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Jonathan Tarbox
FirstSteps for Kids

Denis O'Hora
National University of Ireland,…

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TEACHING CHILDREN WITH AUTISM A BASIC COMPONENT SKILL OF PERSPECTIVE-TAKING

Evelyn Gould[1], Jonathan Tarbox[2*], Denis O'Hora[3], Steve Noone[1] and Ryan Bergstrom[2]
[1]Bangor University, Wales, Gwynedd, UK
[2]Center for Autism and Related Disorders, Tarzana, CA, USA
[3]National University of Ireland, Galway, Ireland

Perspective-taking is an area of human functioning that is rarely studied by behavior analysts but likely entails a complex repertoire of verbal and relational behavior. Perspective-taking is generally acknowledged to be an important skill for successful social functioning and a significant amount of research has documented deficits in these skills in individuals with autism. However, little previous research has examined behavioral intervention procedures for remediating these deficits. The current study evaluated the effectiveness of a multiple exemplar training procedure for teaching three children with autism to identify what other people can see, a simple component skill of perspective-taking. All participants demonstrated generalization to novel table-top tasks but generalization to natural environment probes was less consistent. Results are discussed in terms of the behavioral history required to develop perspective-taking repertoires, as well as for the development of effective interventions. Descriptors: Perspective-taking, autism, Theory of Mind, conditional discrimination, and multiple exemplar training.

Cognitive and developmental psychologists commonly agree that the ability to take the perspective of another person greatly contributes to an individual's success in social situations, and involves a critical and complex set of skills (Barnes-Holmes, Barnes-Holmes, & McHugh, 2004). Perspective-taking involves inferring another person's desires and beliefs, in order to interpret their behavior and predict what they will do next (Howlin, Baron-Cohen, & Hadwin, 1999; Sigman & Capps, 1997). Common human activities that are believed to involve perspective-taking include deception, empathy, self-consciousness, self-reflection, persuasion, and pretence, as well as being essential for effective communication (Howlin et al., 1999).

Typically developing children begin to show signs of perspective-taking from early infancy (Carpenter, Nagell, & Tomasello, 1998) and by around the age of five, clearly

*Correspondence to: Jonathan Tarbox, Director of Research and Development, Center for Autism and Related Disorders, 19019 Ventura Blvd, 3rd Floor, Tarzana, CA 91356, USA. E-mail: j.tarbox@centerforautism.com

demonstrate increasing ability to understand others' minds (Howlin et al., 1999). In contrast, children with autism spectrum disorders (ASD) show severe deficits in their ability to understand others' mental states and how these are said to be related to overt behavior (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen, Tager-Flusberg, & Cohen, 2000; Leekam & Perner, 1991; Ozonoff & Miller, 1995). Studies have shown that the vast majority of children with ASD do significantly worse on tests of even basic levels of perspective-taking, compared to both typically developing children and children with other disabilities such as Down's Syndrome (e.g., Baron-Cohen et al., 1985; LeBlanc, Coates, Daneshvar, Charlop-Christy, Morris, & Lancaster, 2003; Philips, Baron-Cohen, & Rutter, 1992; Reed & Peterson, 1990). It is therefore commonly believed that deficits in perspective-taking lie at the core of the social, communicative, and imaginative difficulties seen in children with autism (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Hadwin, Baron-Cohen, Howlin, & Hill, 1997; Kleinman, Marciano, & Ault, 2001; Leekam & Perner, 1991; Reed & Peterson, 1990).

Despite well-documented perspective-taking deficits, research into effective interventions for children with ASD has remained limited. Most of the existing literature on perspective-taking in children with ASD has taken the cognitive approach deemed "Theory of Mind" (ToM). ToM is a term for a set of complex cognitive processes, enabled by a system of cognitive mechanisms, which result in "the ability to infer the mental states of others (e.g., their knowledge, intentions, beliefs, and desires)" (Ozonoff & Miller, 1995, p. 417). A complete analysis of the conceptual basis of ToM is beyond the scope of this article. For a detailed description, see Howlin et al. (1999). Ozonoff and Miller (1995) conducted a key ToM study that attempted to develop perspective-taking in nine adolescents with ASD in the context of a social skills training program. Five children in the treatment condition received specific instruction in perspective-taking strategies, while the remaining four (control group) received regular social skills training only. Groups were closely matched for cognitive ability and receptive and expressive language levels. A variety of techniques were employed to teach perspective-taking skills, including role-play and video feedback. At the end of the study, 80% of the intervention group improved their ToM composite score (a summary of performance on several ToM tests), whereas only 25% of the control group did, but no effect was seen on parent and teacher ratings of participant social skills.

Further studies have also shown that children with ASD can be taught to pass ToM tests said to be indicative of perspective-taking (e.g., Fisher & Happé, 2005; Hadwin et al., 1997; Swettenham, 1996). However, whether training generalizes to other non-trained tasks or to real life social situations is less clear (Fisher & Happé, 2005). Some studies find limited generalization (e.g., Swettenham, Baron-Cohen, Gomez, & Walsh, 1996) and others have found no improvement on measures of real world social

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functioning (Ozonoff & Miller, 1995). In the Ozonoff and Miller study (1995), only one participant (in the intervention group) passed all ToM tests post-intervention, which was said to be indicative of possessing ToM. Generalization of participants' skills outside of the clinic and improvement in overall social skills functioning also did not appear to be significant. Ozonoff & Miller (1995) suggest that rather than truly teaching children the ToM cognitive concepts, interventions may simply teach children a "strategy" to "hack out" a solution to tests.

In contrast to the large amount of published cognitive research on ToM, perspective-taking has received relatively little attention in the behavioral research literature. Only two studies, of which we are aware, have used a behavioral approach to teach perspective-taking to children with autism. These were two experiments conducted by Charlop-Christy and colleagues on the use of video-modeling (Charlop-Christy & Daneshvar, 2003; LeBlanc et al., 2003). In both studies, video-modeling was used to teach children with autism to pass the Sally-Anne Task, a task that is common in research on perspective-taking and is said to be a test of ToM (Baron-Cohen et al., 1985). Both studies demonstrated some degree of stimulus and response generalization. These studies represent an important first step toward a behavioral analysis and intervention for perspective-taking deficits, however more research is still needed that identifies the specific component skills involved in perspective-taking and teaches them to children who do not yet posses them in their repertoires. Accurate performance on the Sally-Anne Task may be an estimate of an individual's overall perspective-taking ability but, as Charlop-Christy and colleagues point out, it does not specify the particular behavior/environment relations involved. An understanding of the basic functional processes involved in perspective-taking, and the best way to establish and maintain these skills, continues to be limited (Frith, 2003; McHugh, Barnes-Holmes, & Barnes-Holmes, 2009).

An alternative to cognitive conceptual accounts of perspective-taking, such as ToM, is to treat perspective-taking as simply something that people do (i.e., behavior). A behavioral conceptual analysis of perspective-taking has been proposed by Relational Frame Theory (RFT) researchers (Barnes-Holmes, McHugh, & Barnes-Holmes, 2004). A full RFT conceptual account of perspective-taking is beyond the scope of this article (see Hayes, Barnes-Holmes, & Roche, 2001; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004; McHugh et al., 2009). However, the basic thrust of the analysis is that perspective-taking is generalized operant behavior, under the antecedent control of the relation between oneself and someone else. Furthermore, as generalized operant behavior, perspective-taking is thought to be learned via multiple exemplar training. As a part of typical child development, children are often encouraged to talk about their own perspectives (e.g., emotions, physical states, thoughts, etc.) and to talk about the perspectives of others. For example, "How do you think you made Jimmy feel when you hit him? How would you feel if someone hit you?" Such interactions likely consist of

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caregivers prompting and reinforcing (albeit unintentionally) verbal responses which describe one's own and other's perspectives. Initially, each learning opportunity of this kind may establish a particular response under a particular source of stimulus control, but over the course of many such responses being reinforced, a generalized operant class of perspective-taking emerges.

The question of whether perspective-taking can be established via multiple exemplar training should be addressed empirically, rather than being assumed. To date, few studies have examined this possibility, however, two recent studies provide initial data that appear promising. These studies used multiple exemplar training to teach basic perspective-taking skills to typically developing children (Heagle & Rehfeldt, 2006; Rehfeldt, Dillen, Ziomek, & Kowalchuk, 2007). Specifically, children were presented with vocal questions that required the child to identify features of the environment, based on someone else's perspective, as opposed to their own. For example, "I'm sitting in a black chair. You are sitting in a blue chair. If I were you and you were me and here were there and there were here, what chair would you be sitting in? What chair would I be sitting in?" Multiple exemplar training was successfully used to teach children how to answer these questions correctly, and the effects of training generalized to novel stimuli and novel responses.

A strength of the RFT approach to perspective-taking – and indeed, behavioral approaches to any area of functioning – is that they are systematically built upon decades of research on basic behavioral principles of learning and motivation. Thus, if perspective-taking is behavior, then what we already know about behavior from decades of prior research should apply and should guide future research and practice in a systematic manner. In particular, one of the more practical implications of an RFT analysis of perspective-taking is that it should be trainable using basic behavioral procedures, such as prompting and reinforcement, in the context of multiple exemplar training. The two studies by the Rehfeldt group described above, although preliminary, provide evidence supporting this.

Children with autism often show deficits in their ability to follow another's gaze (Leekam, Lopez, & Moore, 2000) and research suggests that gaze-following is a critical component of perspective-taking, and one of the earliest precursors to the development of broader perspective-taking skills (Baron-Cohen et al., 1997; Dube, MacDonald, Mansfield, Holcomb, & Ahearn, 2004; Sigman, Mundy, Ungerer, & Sherman, 1986; Tomasello, 1995; Whalen & Schreibman, 2003). In addition, the ability to identify what others can see is critical to everyday conversational and social interactions. For example, it would be inappropriate to ask someone to tell you about something that they cannot possibly see. Similarly, before children develop perspective-taking skills, they often make conversational errors based on the absence of the skill, such as the common occurrence of young children expecting a person on the other end of a telephone call to be aware of the visual properties of something they

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are holding in their hand. Many other conversational behaviors also depend on responding to whether or not someone else saw something. For example, if one's friend was present yesterday when one bought a puppy, it would not be appropriate to report that it occurred (e.g., "Guess what, I bought a puppy yesterday"). That is, the person was there and saw it, so one does not need to tell them.

Responding to the eye-gaze and/or facial orientation of others is one component skill of perspective-taking that behavioral researchers have not yet attempted to teach. The purpose of the current study was to conduct an initial investigation on the use of a behavioral approach to isolating and teaching the skill of identifying what another person can see. Multiple exemplar training, in the context of conditional discrimination training procedures, was used to teach children to identify what another person can see, by following their facial orientation and eye-gaze. Generalization to untrained stimuli and to the natural environment was assessed.

METHODS

Participants and Setting

Three children participated in the study; Aaron, Cormac, and Hannah, aged 4 years 9 months, 5 years 1 month, and 3 years 10 months, respectively. All three were receiving intensive home-based behavioral intervention programs at the time of the study. Participants had received a diagnosis on the autism spectrum from an independent professional (e.g., pediatrician), as defined by DSM-IV (American Psychiatric Association, 1994) and were deemed by clinical staff as being most in need of training in the area of perspective-taking. Each child had received between 11 and 18 months of 1:1 therapy for a minimum of 20 h/week, plus weekly clinical supervision from a case consultant. Children continued to receive their typical levels of intervention and supervision throughout the study. Participants were required to possess the following pre-requisite skills: (1) ability to sit and work at the table, (2) ability to visually discriminate between and tact all experimental photographs, and (3) a history of successfully responding to visual prompts in the form of arrows. All participants had a previous history of exposure to table-top, match-to-sample, and conditional discrimination procedures as a part of their day-to-day therapy programs. None had any prior exposure to ToM or perspective-taking training.

All sessions were conducted in participants' homes, as a part of their regularly scheduled therapy programs. All procedures were conducted by the participants' regular behavioral therapists. Therapist and child were seated adjacent to each other at a table, on which the therapist placed the appropriate materials. A selection of potential reinforcers was also readily available to the therapist (hidden from

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participant's sight). Only the therapist and child were present in the room except for sessions being videotaped for interobserver agreement (IOA) and during generalization probes, when an additional person was present. Generalization probes were carried out in the therapy room and other rooms around the participants' homes. Sessions were conducted two-to-six times per day, 5 days/week.

Therapists were three females aged between 22 and 36 years who had a history of working 1:1 with participants at least twice a week for 4 months or longer. Therapists were given a written protocol, instructions, sample stimuli, and data sheets and were then trained through 1 h of one-to-one training, including role-playing, with the primary investigator. Therapists were then supplied with video models of each procedure to review prior to sessions. Therapists were instructed to role-play procedures with another person in preparation for an assessment of competence a week later by the primary investigator, in which she directly observed the therapists role-play the procedure with one another.

Materials

Twenty-four stimulus cards were created for training and generalization testing. Each stimulus card contained pictures printed on white sheets of laminated paper, 21.6 cm $\times$ 27.9 cm. On each card, the conditional stimulus consisted of a picture of the head and shoulders of a person and was printed in the center of the page. Four discriminative stimuli were printed around it: one above, below, to the right, and to the left of the person depicted (see Figure 1). The correct stimuli on any particular card consisted of four pictures of animals, vehicles, or colors. A total of eight pictures of each of the three categories were used, making up a total of 24 stimulus cards. On each stimulus card, the person in the center had either their eyes or their entire heads oriented to the left or the right stimulus. That is, each card depicted a person looking either at the right or left picture. The conditional stimulus never depicted a person looking up or down, the pictures in these positions were included as distracters only. In the multiple exemplar training condition, the stimulus cards included visual prompts in the form of red dotted arrows pointing from the person's eyes to the stimulus they were looking at, i.e., the correct picture for participants to name (Figure 1).

Response Measurement and Interobserver Agreement

The target behavior was a conditional discrimination, whereby the participant was required to name the correct discriminative stimulus, indicated by the direction of the person's eye-gaze (the conditional stimulus), when provided with the verbal instruction "what does he/she see?" During natural environment probes, the target

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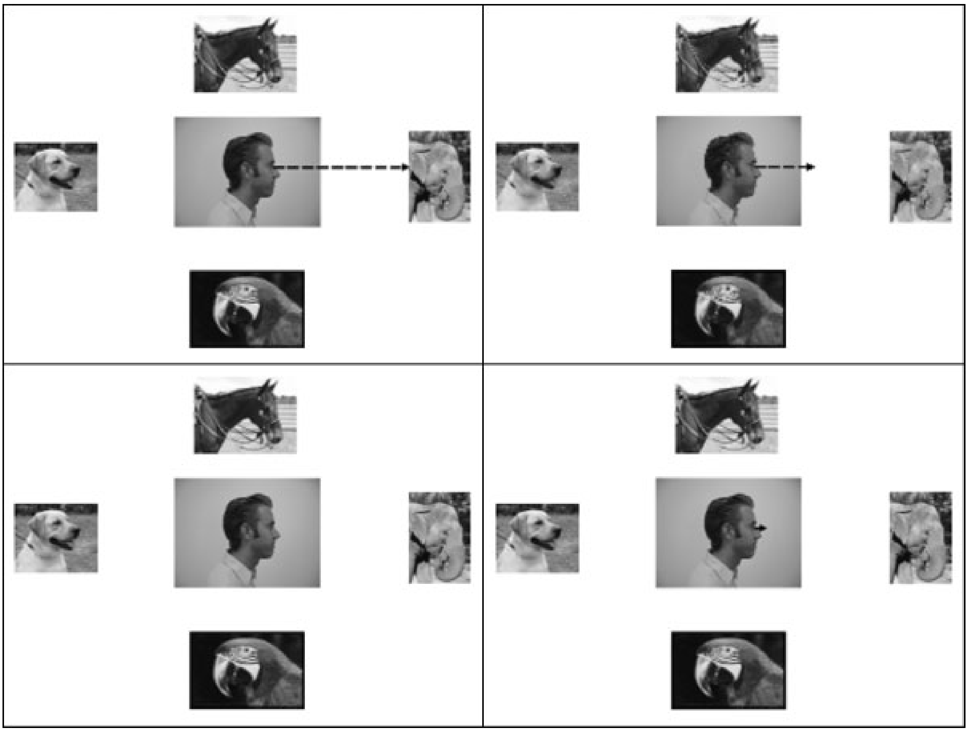

Figure 1. Sample stimulus cards, with an example of a card with no visual prompt used during baseline and probing (lower left), and examples of cards including the visual arrow prompt being faded out (upper left to lower right).

behavior was also a conditional discrimination, whereby the participant was required to name an object in a real person's field of vision (indicated by the direction of their eye-gaze) when provided with the verbal instruction ''what does he/she see?'' During all sessions, data were collected and summarized as the percentage of correct responses.

Twenty percent of baseline and intervention sessions were videotaped and scored for IOA. For these sessions, a second, independent observer collected data from the videotapes at a later time. An agreement was defined as both the primary investigator and the therapist recording the occurrence or non-occurrence of the target response as defined above. A disagreement was defined as one observer scoring a response as having occurred, and the other observer scoring the response as not having occurred. IOA was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100. Primary and secondary data collectors scored exactly the same data across all sessions in which IOA was assessed, yielding 100% IOA for all participants.

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Experimental Design

A concurrent multiple probe (Kazdin, 1982) design across participants was implemented to evaluate the effectiveness of the intervention. Follow-up probes were carried out post-intervention, to test for skill maintenance. Pre- and post-intervention natural environment probes were also carried out to test for generalization of the trained skill to real life people and objects (versus pictures which were used during training).

Procedures

Baseline

Initial baseline sessions consisted of 24 trials (one per stimulus card) presented in a random order. Participants received no prompting or feedback for correct or incorrect responding. In an attempt to maintain attending to and compliance with the task, every three experimental trials were interspersed with one trial targeting an already mastered skill (e.g., receptive object labels or non-verbal imitation) and correct responding on trials of mastered tasks produced the child's regularly programmed reinforcer (determined via a brief modified multiple stimulus preference assessment prior to a block of trials). After the initial baseline session, further baseline sessions were conducted approximately twice per week on nine randomly selected stimulus cards, using the same procedures outlined above.

Training

Training sessions included 8–12 trials. During training trials, the presentation of stimulus cards and therapist instructions (e.g., ''What does he/she see?'') were identical to baseline. However, as described in the Materials Section, stimulus cards contained visual prompts in the form of red dotted arrows, drawn from the person's eyes to the picture they were looking at. A most-to-least prompt fading procedure was used to fade out the visual prompts, by shortening the length of the arrows, thereby increasing the distance from the head of the arrow to the picture the person was looking at (see Figure 1). The following four levels of prompting were used: (1) Full arrow: 7.2 cm, (2) 3.3 cm arrow, (3) 0.5 cm arrow, and (4) no visual prompt. Prompt level was decreased contingent on two consecutive sessions at 100% correct. Correct responding on training trials produced brief access to the participant's regularly programmed reinforcer. If the participant responded incorrectly, the therapist moved onto the next trial without giving feedback or administering reinforcement. Four stimulus cards were trained concurrently at any given time. Once the mastery criterion was met without prompting for all four stimulus cards, a generalization probe was

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conducted (see below). If responding on a generalization probe was 80% correct or higher, intervention was introduced to the next participant in the multiple baseline. If correct responding was lower than 80%, the training condition was reinitiated with another set of four stimulus cards. After mastery criteria were again achieved with those four stimulus cards, another generalization probe was conducted. This sequence was continued until a participant met the generalization criterion or no stimulus cards remained to teach (which never occurred). Once correct responding was 80% or higher during a generalization probe, a natural environment probe was conducted (see below).

Error Correction

An error correction procedure was added in cases where the training procedure alone did not produce a favorable trend of acquisition (Hannah only). When an incorrect response occurred, instead of moving onto the next trial, the therapist stated "No, try again," and immediately prompted the correct answer by providing hand-over-hand guidance to follow the person's line of vision from their eyes to the item they were looking at, and modeling the correct vocal response (e.g., "He sees an elephant"). The next trial was then initiated.

Generalization Probes

Generalization probes were conducted in order to test for generalization to untrained stimuli. Generalization probes were identical to baseline sessions. That is, they contained one trial of each of the 24 stimulus cards, including the ones that had been directly trained and the ones which had not, and reinforcement was not delivered for correct responding. Generalization was assessed by analyzing data on the untrained cards only. Criterion for generalization was set at 80% correct or higher.

Natural Environment Probes

Natural environment probes were carried out to test whether the training procedure produced generalization to natural situations involving familiar people, rooms around the house, and familiar objects. As in baseline and generalization probe sessions, no feedback or reinforcement was given. The first probe was carried out the day before the initial baseline session was conducted. The second was carried out once a participant responded at 80% correct or better in a generalization probe. A final natural environment probe (Aaron and Cormac only) was carried out approximately 3 and 2 weeks post-final training sessions, for Aaron and Cormac, respectively.

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The procedure for natural environment probes was as follows: A second person familiar to the child (e.g., mother or grandparent) was invited into the therapy room and asked to look in one particular direction; either to the left, to the right, or at the floor in front of the participant. The therapist then asked the child ‘‘What does he/she see?’’ A correct response was something directly in the person’s line of vision. If the child named something present in every direction, and therefore did not rule out that they were just naming whatever he himself could see, the therapist asked ‘‘What *else* can he/she see?’’ until the child named something that was in the person’s line of vision only, or until three trials occurred. The second person was then required to rotate so that they were facing a different direction. Different directions were targeted in a random order and the process was repeated until all three directions were targeted once. Further probes were then carried out in the same way with another adult, and then in at least one other room of the house, for a total of nine trials per session.

Maintenance

Maintenance sessions for Aaron and Cormac, consisting of 12 trials of randomly selected stimulus cards, were carried out once or twice per week until the study’s conclusion. Prompting was not included in maintenance sessions and correct responding resulted in brief therapist praise only. Hannah was not available for participation in the maintenance phase.

RESULTS

Figure 2 depicts the percentage of correct responding across all phases for all participants. Steps in prompt-fading are depicted by breaks in the data path. During baseline, all participants demonstrated low percentages of correct responding, with means of 13, 16.5, and 0%, for Aaron, Cormac, and Hannah, respectively. When training was initiated with the first set of stimulus cards with Aaron, his correct responding increased rapidly. Each time prompts were faded a step, Aaron’s correct responding decreased initially, followed by an increasing trend, resulting in attainment of the mastery criterion. After the first set of stimulus cards were mastered for Aaron, a generalization probe was conducted across the remaining stimulus cards and Aaron responded at 68% correct, thus failing to meet the criterion for generalization. Another set of stimulus cards was subsequently trained (indicated in Figure 2 by a change from square to circular symbols in the data path), after which time Aaron scored 86% correct on a generalization probe. A natural environment probe was then conducted with Aaron and he responded at 55% correct. This was an increase from the natural environment probe conducted during the baseline phase, in

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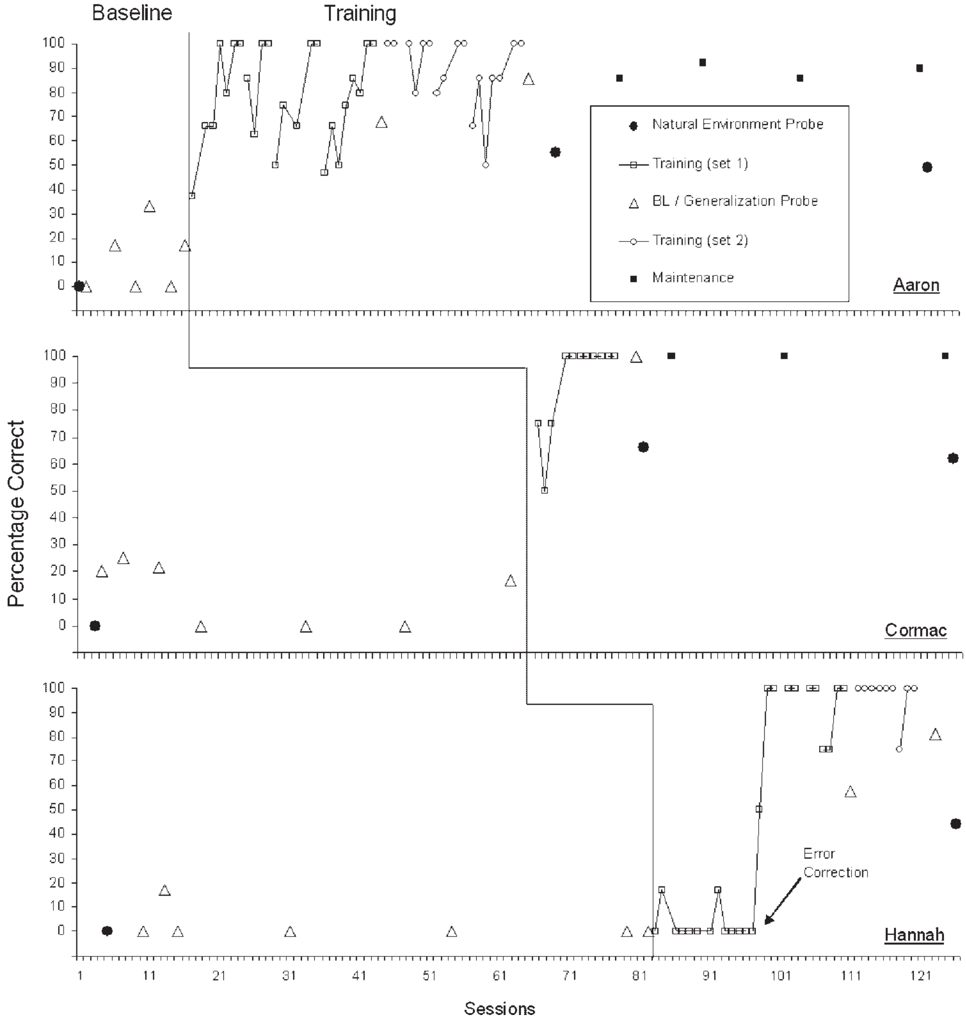

Figure 2. Percentage of correct responses across baseline, training, and probing conditions, for Aaron, Cormac, and Hannah.

which his correct responding was at 0%, but was still significantly lower than the 86% correct demonstrated during the generalization probe with picture stimuli. Aaron's correct responding remained high during the four maintenance sessions, with a mean of 89% correct. During the final natural environment probe, Aaron responded with 49% accuracy.

Cormac's data are depicted on the second panel of Figure 2. When training was initiated with the first set of stimulus cards, his correct responding increased to 100%

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within four training sessions. Cormac's correct responding remained at 100% as prompts were faded across phases. After one set of stimulus cards was trained, Cormac scored 100% correct on a probe for generalization across the remaining stimulus cards. A natural environment probe was then conducted with Cormac, who responded at 66% correct, as opposed to the 0% correct responding demonstrated during the natural environment probe during baseline. Cormac's correct responding remained high during the three maintenance sessions, with a mean of 97% correct. The final natural environment probe conducted with Cormac demonstrated 62% accuracy.

The bottom panel of Figure 2 depicts Hannah's results. During baseline Hannah consistently scored at or near 0% correct. There was no significant change in Hannah's behavior during the intervention phase until the error correction procedure was introduced in session 97. Following the introduction of the error correction procedure, immediate changes in accuracy were seen. After the first four items were trained, a generalization probe was conducted across the remaining stimulus cards and Hannah responded at 62% correct, thus failing to meet the criterion for generalization across stimuli. Another set of stimulus cards was subsequently trained, after which time Hannah scored 81% correct on a generalization probe. A natural environment probe was then conducted with Hannah and she responded at 44% correct, as opposed to 0% correct during the natural environment probe during baseline.

DISCUSSION

The results of this study provide an initial demonstration of the effectiveness of a table-top, match-to-sample procedure to teach a basic component skill of perspective-taking to children with autism. During baseline all participants failed to identify what others could see, consistent with previous literature suggesting that without intervention, children with autism show deficits in gaze-following (Ozonoff & McEvoy, 1994; Leekam et al., 2000; Mundy, Sigman, & Kasari, 1990). Two participants readily acquired the table-top conditional discriminations trained. One participant required the introduction of an additional error-correction procedure before rapid gains were seen. Trends in the data indicated rapid learning within each phase of intervention, thus systematic prompt-fading appeared to be an effective and efficient method of teaching gaze-following. Two participants for whom follow-up data were available maintained skills up to 3 weeks post-intervention. Findings support previous literature indicating perspective-taking may be a repertoire that can be taught through behavioral intervention procedures (e.g., Charlop-Christy & Daneshvar, 2003). Furthermore, the current study represents the first published

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attempt to isolate and teach a specific skill which may be a pre-requisite component of a perspective-taking repertoire in children with autism.

The differing degrees of generalization observed across the generalization probes versus the natural environment probes warrants discussion. Specifically, although stimulus generalization was produced across picture cards for all participants, generalization to the natural environment probes was much more limited, ranging from 44 (Hannah) to 66% (Cormac). One potential reason for this limited generalization may be related to the multiple ways in which the two settings were significantly different. For example, the training setting involved two-dimensional stimuli, compared to the three-dimensional stimuli which comprise natural environments. In addition, the *whole* person whose perspective the child was taking was present in the natural environment probes, as opposed to just the head and shoulders, as depicted in the training stimulus cards. Another significant difference was the large variety of ‘‘distracter’’ or competing stimuli that were present around the rooms in the natural environment probe, as opposed to the training stimulus cards, which contained only four stimuli from which to choose. Given the highly controlled, two-dimensional nature of the training stimuli, it is not surprising, then, that generalization to the natural environment was limited.

Future research including table-top materials for teaching perspective-taking behaviors could take several steps to enhance generalization to the natural environment. Fading the differences from the training to the natural setting more slowly and systematically would likely be needed in order for children to generalize from the training setting studied here to real-life social situations. For example, training could progress from controlled table-top settings to more natural settings around the home, across successive trials or sessions. Distractor stimuli could be systematically faded in to the training setting. In addition, a more natural environment or ‘‘incidental teaching’’ (Fenske, Krantz, & McClannahan, 2001) approach could be used to help generalize the effects of training. Further, training parents and therapists to notice and reinforce any instances of the target behavior outside of sessions, creating opportunities for ongoing practice, reinforcement of instances of generalization, and/or the inclusion of peer/sibling training may be beneficial. Despite the low level of generalization observed in the natural environment probes, if we consider baseline scores in natural environment responding (0% correct), the gains seen post-intervention (44–66% correct) might still be relevant, particularly since generalization was not explicitly programmed for and these gains appear to have been maintained at follow-up.

Given the limited generalization obtained from the table-top training setting to the natural environment probes, one might wonder whether it may have been more effective to simply train in the natural environment setting to begin with. However, the table-top training procedure was selected for this study for several reasons. First,

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creating the training stimuli specifically for the purposes of the experiment allowed prompting to be used that likely cued participants directly into the relevant stimuli to which they needed to respond, i.e., red dotted arrows pointing from the eyes of the person whose perspective the participants were to take. Second, when one attempts to identify what another is looking at in the natural environment, there are many possible stimuli to which one could respond and it was judged that this environment may be too complex for initial training. Finally, it was judged that the contrived training setting and stimuli would allow for greater control over therapists' behavior, thereby encouraging a greater degree of procedural integrity. In short, a contrived training preparation was selected in order to allow greater control of the participants' environment, but it appears as though generalization may have suffered because of it. Of course, such possibilities remain purely speculative and future research is needed to evaluate this empirically.

A further potential limitation of the current study is the narrow scope of the skills which were trained. Although identifying what others can see is likely an important component skill to an overall repertoire of perspective-taking, it is by no means considered to be representative of a fully developed perspective-taking repertoire. Future research will need to evaluate behavioral procedures for establishing something that more closely resembles such a repertoire. For example, identifying and responding in a practical way to others' emotions, intentions, preferences, and beliefs, are all activities that typically developing adults engage in on a regular basis and many of these skills may need to be assessed and taught to individuals with ASD.

An additional limitation to the current study is the small number of generalization and maintenance probes which were conducted. Only two natural environment generalization probes were conducted with each participant and only four maintenance sessions were conducted with each (excluding Hannah, who was not available for maintenance sessions). Future research should consider including multiple probes for generalization to the natural environment, conducted across a longer duration of time, in order to further assess for generalization and maintenance.

The pre-requisite skills that may be necessary for the current procedure to be effective remain unknown. The participants in this study did not have data from developmental assessments (e.g., language, IQ, etc.) available for analysis, so it is not known whether their degree of developmental delay influenced the current findings, and it's unclear which individuals would most benefit from this procedure. The inclusion criteria in this study ensured that some of the most basic pre-requisite skills were in place (i.e., following arrow prompts, tacting a variety of stimuli, etc.) but it is possible that other unidentified pre-requisite skills may be needed as well.

The potential role of social motivation in the acquisition and maintenance of perspective-taking skills is also worthy of discussion. Even after perspective-taking

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skills are acquired, children with autism may not be expected to engage in these behaviors as an ongoing part of their day-to-day lives because the social consequences that they mediate may not be reinforcing in the same way that it is for typically developing children. Dube et al., (2004) propose that failure to develop gaze following may be due to failure of adult-attending stimuli to function as a discriminative stimulus or failure of adult-mediated interactions to function as conditioned reinforcers. It may therefore be important to first establish interaction with others as a source of generalized reinforcement, in order to ensure that perspective-taking skills will continue to be displayed outside of the teaching context.

In conclusion, a wealth of research has shown that deficits in perspective-taking may lie at the heart of the social, communicative, and imaginative difficulties seen in children with ASD (Frith, 2003; Howlin et al., 1999). Thus far, few research findings have been clearly translated into effective clinical interventions (Ozonoff & Miller, 1995). This study attempted to bridge the gap between the basic and applied research, by isolating and teaching one potential pre-requisite skill of perspective-taking to children with ASD. Taking a behavioral approach to teaching perspective-taking skills may provide an effective alternative to current cognitive approaches, by offering empirically validated principles and procedures. Although preliminary, the current study represents a step toward the development of more effective perspective-taking interventions for children with autism, as well as progress toward the expansion of behavioral research into the area of perspective-taking, an area that has received little previous research by behavior analysts.

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