

Teaching Perspective-Taking Skills to Typically Developing Children Through Derived Relational Responding

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Abstract

Perspective-taking is an ability that requires a child to emit a selection response of informational states in himself or herself and in others. This study used an extended version of the Barnes-Holmes protocol developed in a series of studies by McHugh, Barnes-Holmes, and Barnes-Holmes (2004) to teach typically developing children between the ages of 6-11 perspective-taking skills. The present demonstrational study used a multiple probe design to evaluate the participants' abilities to demonstrate a number of simple and complex relations, and examined both relation type and relational complexity. We also tested for generalization of perspective taking to new stimuli and real-world conversational topics. Results demonstrate that the capacity to alter perspectives can be established by means of a history of reinforced relational responding.

Keywords: Perspective-taking, Relational Frame Theory, Theory of Mind, stimulus generalization, response generalization.

Perspective-taking is a phenomenon described in the developmental literature that requires a child to display knowledge of informational states in himself or herself and in others (Barnes-Holmes, Hayes, Dymond, & O'Hara, 2001). A simple example of a child taking another's perspective occurs when, for instance, a child discriminates that when sitting in a different chair from which he is sitting in now, an object will look different from that different viewpoint. Perspective-taking skills are said by developmental psychologists to benefit children in their complex reasoning abilities. In addition, having the ability to take another person's perspective is an important social skill that children need in order to make and sustain friendships.

There have been a multitude of studies conducted concerning perspective-taking skills in children. The majority of these studies have focused on the age at which children develop these skills. For example, Newcombe and Huttenlocher (1992) discussed the developmental psychologist Piaget's view on perspective taking. Piaget did not believe that these skills are developed in children before the age of 9-10 because of children's tendency to be egocentric, meaning that children have problems realizing that other people see things in different ways than themselves. Specifically, Piaget believed that children couldn't develop perspective-taking skills because they code spatial location differently from adults. For example, Piaget thought that children use a topographical system of spatial representation. Children code relationships through touching or proximity, whereas adults use metric coding of distance, such as coding the position of objects as being in the vicinity of landmarks. Huttenlocher and Presson (1979), however, argued that this lack of perspective-taking in children is not due to the children's difficulty with coding spatial locations, but rather conflict between actual and imagined frames of reference. Instead of relying on these frames of reference as in Piaget's studies, these authors asked preschoolers what object occupied a specified location with respect to a hypothetical observer, and this led to improved performance. The Newcombe and Huttenlocher (1992) study extended the results of the Huttenlocher and Presson study. The results clearly showed that the preschool children in their study could indicate locations relative to another person. Surprisingly, although young children still made egocentric errors, it is still quite notable that 3-year old performance was considerably above chance.

Other studies conducted on perspective taking focused on the different aspects of this skill. Dixon and Moore (1990) for example, examined the difference between the two situations in which perspective taking can be seen. The authors labeled these two situations as Information effect—when the subject and the other person have contrasting information, and the Weighting effect—when the subject and the other person have the same information but use that information differently when deciding their

own separate judgments. Therefore, the aim of this study was to observe the development of these two types of perspective-taking skills. The results of this study showed that the development of these skills progresses with age, but that there are also individual variations. In both preschool, second, and fifth grade, participants completed the task at different levels of capability.

Two important studies in this area that focused on the different aspects of perspective-taking skills are studies conducted by Jacobsen and Waters (1985) and Rosser and Lane (1993). These studies examined the visual and spatial perspective-taking skills of young children. In the Jacobsen and Waters study, 40 children, composed of 6, 8, and 10-year olds were presented with a stimulus display and were told that the display could look different to a puppet (Big Bird) depending on where the puppet was placed. The child's task was explained as building an equivalent display "to show me what Big Bird is seeing from here," while the experimenter pointed to one of the four positions around the display which Big Bird could occupy. For all three problems, a perspective construction was modeled at 90 degrees to the left of the subject, 90 degrees to the right, and 180 degrees opposite the subject. Results show that the 4-year old children failed to perform the perspective-taking problems successfully even though they were able to correctly replicate the stimulus displays when taking the perspective of another person's view was not necessary. Ten-year olds were successful on all positions of perspective-taking predictions, while the 6-8 year olds had mixed success.

Rosser and Lane (1993) also focused on the spatial and dimensional perspective-taking skills of second and fourth grade children (ages 6, 8, and 10). In this study, a cylinder object in nine positions on a square 3 X 3 grid was presented to children from the 90, 180 and 270° positions. The results showed that when the object was placed differently from the child's view in the left-right and near-far dimensions, the participants produced more errors in taking that perspective. When the object was transformed in only one dimension, there were fewer errors produced, however, error rates decreased with age, and egocentric responding was high for both ages. In summary, the above studies follow the developmental theory approach to perspective taking and provide evidence that perspective-taking abilities vary with age.

The major cited theory in the area of perspective-taking is the developmental perspective, or the Theory of Mind approach, while an alternate behavioral approach that is somewhat new to this area of concern is the Relational Frame Theory approach. These two theories' views differ concerning exactly how these perspective-taking skills are established and what is the most effective and efficient way to develop interventions to teach these capabilities to children who are missing them.

Developmental psychologists have focused on perspective taking for several years, especially in the area of perspective-taking problems found in children diagnosed with autism spectrum disorders. "Developing perspective-taking skills in children with these deficits is necessary because of the dire importance of being able to infer other people's mental states (thoughts, beliefs, desires, etc.), and the ability to use this information to interpret what they say, make sense of their behavior and predict what they will do next" (Howlin, Baron-Cohen, & Hadwin, 1999, pg. 2). In the life of a child with autism, these skills become a concern when the child is faced with the task of communicating and sustaining relationships with his/her peers. The majority of research has focused on the concepts of the "Theory of Mind" (TOM) approach (Howlin et al., 1999). This theory focuses on five levels of understanding of informational states involved in teaching children diagnosed with autism perspective-taking skills. These levels of perspective taking and the methods, by which they might be established, are as follows. Level 1 is simple visual perspective taking. This is the understanding that different people can see different things. At this level the child can judge what the experimenter can see or not see. To train this level, a child is presented with a two-sided card with a ball on one side and an airplane on the other, for example. The child is then asked, "What can I see and what can you see?" If the child responds incorrectly, corrective feedback is provided until correct responding is established (Howlin et al., 1999, Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001). Level 2 is complex visual perspective taking. This involves

discriminating between not only what people see and how it appears to them. This level requires the child to judge both what another person can see and how it appears to that person. This level is trained as follows. A child is presented with a card on which a character (e.g., a horse) is depicted the right way up on one side and upside down on the other. The child is asked, "When you or I look at this picture, is the horse the right-way-up or upside-down?" Correct responding again is established through corrective feedback (Howlin et al., 1999, Barnes-Holmes et al., 2001). Level 3 involves the principle that seeing leads to knowing. This is the ability to understand that people only know things that they have experienced (directly or indirectly). This level is established as follows: a child is asked to close his/her eyes, and the experimenter hides an object in a box. The child is asked, "Do you know what is in the box? Why don't you?" The child is then shown inside the box, and asked again, "Do you know what is inside the box?" and she is then asked, "How do you know?" The correct answers in this scenario are basically "I know because I have seen, and I do not know because I have not seen." A similar scenario is then enacted for the child from the perspective of a doll, for example, and the same questions are asked regarding the doll's perspective (Howlin et al., Barnes-Holmes et al.). Level 4 involves the principle that you can predict actions on the basis of knowledge. Level 4 tests the child's understanding of true belief. Here, children are required to predict a person's actions on the basis of where that person believes an object to be. A training task would utilize four toys: two identical trucks, one train, and one bus. One truck is placed next to the train and the other truck next to the bus. A child is then supplied with the following true belief story. "This morning, you saw the truck next to the train but you did not see the truck next to the bus." The child is then asked, "Where do you think the truck is? Why do you think it is near the train? Where will you go to get the truck? Why will you go to the train?" The same story is then enacted with a doll and the same questions are asked concerning the doll's perspective. The correct responses from these questions involve the knowledge that one will only know what one has seen (Howlin et al., 1999, Barnes-Holmes, et al., 2001). Level 5 includes the theory that you can predict actions on the basis of false belief, the standard approach to theory of mind reasoning. Here children are required to predict a person's actions on the basis of where that person falsely believes an object to be. This level might be established as follows. A child is shown a purse and asked, "What do you think is inside the purse?" The child is unaware that the purse does not contain money, but instead contains a hairbrush. The child is then shown inside the purse, and asked, "Before we opened the purse, what did you think was inside? And what is really inside?" A similar scenario is then acted out from the perspective of another (e.g., a doll), and the same questions are asked regarding this different perspective. Therefore, according to the Theory of Mind approach, taking the perspective of another may be trained across progressively more complex levels of informational states that evolve from simple visual perspective-taking to acting on the basis of false belief (Howlin et al., 1999, Barnes-Holmes et al., 2001).

A variety of studies have been conducted using this Theory of Mind approach. The majority of these studies focus on the last two levels of understanding that children develop concerning perspective-taking ability determined by this theory — true and false belief. A primary study in this area, conducted by Wellman and Bartsch (1988) examined children's early understanding of belief in an attempt to provide an account of when and if children as young as the age of 3-4 years develop true and false belief tasks.

The study's results revealed that children as young as 3 conceive of people as thinking and not thinking, knowing and not knowing, desiring and not-desiring. The authors hypothesize that:

"Children fail false-belief tasks because from the perspective of the 3-year old, false-belief tasks present a conflict between desire reasoning (Sam wants the object and it is at Location 2: Sam will look at Location 2) and belief reasoning (Sam believes the object is at Location 1: Sam will look at Location 1). In such situations, 3-year olds predict on the basis of desire. They do so not because they have no conception of belief but because for them belief and desire are in conflict and they weight desire over belief in arriving at a prediction" (Wellman & Bartsch, 1988, pg. 273).

This prediction suggests that young children have yet to understand difficulties concerning belief-desire reasoning rather than that they are unsuccessful in participating in such mentalistic reasoning at all.

Bennett and Galpert (1992) took the Wellman and Bartsch study to the next level by investigating complex belief-desire reasoning skills in young children. These authors examined whether children would recognize that someone might resist acting upon a desire, even if they desired to do it. This complex version of belief-desire reasoning holds that “when an actor desires a particular end and believes that a particular action will achieve that end, and when it is believed that there are no co-occurring outcomes of that action whose avoidance is desired more highly than is the originally conceived end, then the actor will undertake the action which will satisfy the original desire” (Bennett & Galpert, 1992, pg. 202).

This study was conducted with participants who were ages 4, 5, and 7-years-old. They were presented with similar stories as described above with the actor in the story either having a true or false belief concerning undesirable outcomes associated with the pursuit of a desired end. Children of all age groups scored fairly well on the complex belief-desire reasoning tasks; however, there was a great improvement with the 7-years-old participants compared to the 4-years-old age group when dealing with tasks concerning false beliefs. These results are predictable, since the ability to predict action on the basis of false belief is just appearing at this young age (Perner, Leekam, & Wimmer, 1987) and these complex belief-desire reasoning skills may not yet be fully emerged in the 4-year-old’s repertoire.

There is some controversy about what exact age children begin to show evidence that they understand false belief tasks. Wimmer and Perner (1983) argue that children as young as 3-years-old cannot correctly assign a false belief to a deceived actor. There is also controversy about why in fact children of this age cannot attribute false belief. Zaitchik (1990) examined three major hypotheses that guess as to why young children do not understand false belief tasks. The first hypothesis explains that children cannot understand false belief because children of this age attribute seeing to knowing. For example, if the child knows that the actor saw that the doll was in the dollhouse, the child will believe that the actor, when asked where the doll is, will say that he/she knows where the doll is because he/she saw it in the dollhouse. Hypothesis 2 supports that notion that children have difficulties with false belief because the belief was once true and changing the truth is hard for children of this young age to understand. Finally, hypothesis 3 states that it does not matter whether the actor’s false belief was founded visually or verbally through testimony, but what is most important is that the child will believe that if he/she saw the objects true location, there is no way that anyone could think the object would be anywhere else. Through puppet skits, this experiment tested these hypotheses by contrasting the standard false belief task with two testimony conditions; the ‘seen’ condition, in which the participant saw the object’s actual location, and the ‘unseen’ condition, in which the participant was verbally told the object’s real location. In both conditions the false belief was predetermined as false from the start (the deceiver made known that he was going to tell a lie). Results from this study revealed that the 3-year-olds in the ‘unseen’ condition effectively recognized a false belief, while 3-year-olds in the two other conditions did not. These results support the third hypothesis because only the subjects in the ‘unseen’ testimony condition did not actually see the object’s true location (Zaitchik, 1990). This provides evidence that young children are unable to recognize a belief that is inconsistent with his or her direct observation. The child holds the belief that the object is in its true location; therefore he or she cannot understand that anyone could believe that the object is anywhere else. However, because children in the ‘unseen’ condition did successfully attribute a false belief, as long as they were only told and not shown the accurate location of the object, this study offers evidence that, under some conditions, even 3-year-olds can understand false belief and its effects on human action (Zaitchik, 1990). Hence, the above studies report that even children as young as preschool age have the ability to take the perspective of another.

However, the field of behavior analysis has taken an alternative approach to understanding and teaching perspective-taking skills. Unlike the Theory of Mind proponents who view these simple and complex perspective-taking skills as specific stages of development that emerge through the course of childhood, behavior analysis labels perspective-taking as a form of generalized operant responding as supported by a behavioral account of human language and cognition known as Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001).

Skinner offered a behavioral definition of “self-awareness as discrimination of one’s own behavior” (Barnes-Holmes, Hayes, & Dymond, 2001, pg. 120). However, Relational Frame Theory provides a view of self-awareness as “not simply behaving with regard to his [a child’s] own behavior, but [the child] is also behaving verbally with regard to his [non verbal] behavior” (Hayes and Wilson, 1993, pg. 297). This provides a clear functional distinction between verbal and nonverbal self-discrimination. However, a more complete RFT analysis of self requires the addition of the theory of perspective taking in the verbal construction of self.

RFT provides three perspective-taking frames. These frames are termed “deictic” relations, have no physical properties, and can only be abstracted through relational frames (Barnes-Holmes et al., 2001). The three frames of importance are the frames of “I and You,” “Here and There,” and “Now and Then.” Examples of such frames are, “What are you doing now?” “What did I do then?” “What are you doing here?” and “What will I do there?” These questions require the speaker to change perspective between different references of person (i.e., I versus you), place (i.e., here versus there) and time (i.e., now versus then). When one of these deictic questions is asked, the relational frames of I versus You, Here versus There, and Now versus Then are the only constants, while the physical environment will always be different (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001). In order for an individual to abstract his or her perspective on the world, as well as others’ perspectives, a strong relational repertoire and a history of multiple exemplar training is required. In other words, over the course of development children are reinforced by caregivers for appropriately responding to questions such as those mentioned above. After being reinforced multiple times for responding to these “I-You” questions, the child’s responding may generalize to simple “Here-There” and “Then-Now” questions, as well as to more complex combinations of each.

Barnes-Holmes, Hayes, and Dymond (2001) note that daily interactions present frequent occasions for a child to change perspective, as in responding to the questions, “what would you do if *you* were *me*,” “what am I doing *now*,” and “what will you do once you are *there*?” A child who does not change perspective between I-and-you, here-and-there, and now-and-then will be faced with social difficulties. The capacity to vary perspectives does more than allow a child to participate successfully in conversation; it also contributes to several additional complex skills. Perspective taking is involved in planning one’s course of action, in showing empathy towards others, and in one’s conceptualization of self (Barnes-Holmes et al., 2001).

Although Relational Frame Theory and its Theory of Mind proponents differ on their views of perspective-taking, both theories are concerned with developing effective and efficient methods for teaching perspective-taking in individuals in which these skills are lacking. However, while the TOM training programs are concerned with establishing these skills by teaching children to understand complex informational states: RFT attempts to teach perspective-taking skills by targeting the relational frames directly (Barnes-Holmes, McHugh, & Barnes-Holmes, 2004; McHugh, Barnes-Holmes, Barnes-Holmes, 2004). To date, little research has been conducted in this area.

LeBlanc et al. (2003) provided a behavior analytic approach to teaching perspective-taking skills to 3 children with autism, ages 7-13 years. Three common measures of perspective-taking skills and stimulus variations of each were taught, including the Sally-Anne task, the “Smarties” task conducted

with M&M's as a substitute candy, and the Hide and Seek task. The Sally-Anne task acted as the pre-and post test, while the M&M and Hide and Seek task were trained via video modeling and reinforcement. During video modeling, each participant watched an adult on the video correctly completing each task. The video tape was then stopped and the participant was asked to answer perspective-taking questions. Correct answers to these questions resulted in praise and preferred edibles or stickers. An incorrect response resulted in a replay of the video and prompts to pay attention to the model completing the task correctly. Results revealed that video modeling and reinforcement was an effective teaching method for the perspective-taking tasks. However, only two of the three children passed an untrained task, demonstrating a failure of these newly taught skills to generalize to novel tasks. The author's comment that the intervention used in this study could be an effective strategy for teaching perspective-taking skills if researchers continue to develop methods for enhancing or programming generalization of these skills.

Another preliminary study that was derived from a behavioral account of perspective taking described the use of the Barnes-Holmes protocol. This study analyzed perspective-taking abilities in terms of the three deictic relational frames mentioned previously. McHugh et al. (2004) used this Barnes-Holmes protocol in their study to evaluate the perspective-taking skills of 64 typically developing participants, ranging in age from early childhood to adulthood. This assessment evaluated the participants' ability to show a number of simple and complex relations, examining both relation type (I-you, here-there, and now-then) and relational complexity (i.e., simple, reversed, and double reversed). For example, a simple I-you relation was composed as follows: "I have a red brick and you have a green brick. Which brick do I have? Which brick do you have? While an example of a reversed here-there relation was composed as, "I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here, where would you be sitting? Where would I be sitting?" Finally, a double reversed here-there/now-then relation was composed as, "Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here and if now was then and then was now. Where would I be sitting then? Where would I be sitting now?"

The procedure was administered in conversational format with the experimenter. The experimenter asked the questions listed above, and the participant was to answer in the absence of any feedback. The results revealed that there was a significant difference between age groups. In general, errors decreased as a function of age. Adults produced the lowest number of errors, while the early childhood (ages 3-5) group produced the highest number of errors. The middle (ages 6-8) and late (ages 9-11) childhood groups showed no significant difference in their number of errors produced.

This finding was important because the Theory of Mind literature argues that children's performance should improve on simple Theory of Mind tasks by the age of 5. The results of this study further support this claim because the performances of children in their middle childhood more closely resembled those in the adolescent and adult participants than did the performances of the children in the early childhood group, implying that RFT is consistent with the traditional and Theory of Mind research, showing that "relational perspective-taking is an important feature of normal cognitive development" (McHugh et al., 2004, pg. 143). More importantly, this study demonstrated that behavior analysis can identify responses that involve perspective-taking and that these responses may be defined as relational operants. In addition, Relational Frame Theory can assist in the analysis of these events, and this analysis can inform our science of what maintains a repertoire of perspective-taking. These conclusions have implications in terms of application in that by utilizing a behavioral approach to perspective-taking, effective interventions can be designed to establish these repertoires in both typically developing and developmentally disabled children in which these skills may not yet exist (McHugh et al., 2004).

Rehfeldt, Dillen, Ziomek, and Kowalchuk (submitted) were the first to use the behavioral account of perspective-taking to conduct an empirical investigation on relational learning deficits in perspective-taking with the autistic population. This study utilized a version of the Barnes-Holmes automated

protocol, and investigated in two experiments whether children with autism spectrum disorder demonstrated relational learning deficits in a perspective-taking task as compared to their age-matched typically-developing peers. They also investigated whether accuracy in perspective-taking correlated with scores on standardized instruments commonly used in the assessment of autism spectrum disorder, and whether relational responding in perspective-taking improved following a history of reinforcement for such responding. The results of Experiment 1 demonstrated statistically significant differences in errors as a function of relational complexity. The results also showed that participants with autism spectrum disorder made more errors than typically developing children on two of the three types of relations examined. Results of Experiment 2 illustrated that a history of reinforced relational responding improved performance on the perspective-taking task.

The present study set out to build on the findings of the McHugh et al. (2004) study and apply the Barnes-Holmes protocol in a computerized format with typically developing children. This study utilized the computer program developed by Rehfeldt et al. (submitted). Through the utilization of the computerized version, fewer experimenter cues were necessary, and a higher standard of procedural reliability was obtained (i.e., the investigators provided procedural reliability). The aim of the present study was to use an extended version of the Barnes-Holmes protocol (Barnes-Holmes, Barnes-Holmes, & McHugh, 2004; Barnes-Holmes, McHugh, & Barnes-Holmes, 2004) to teach typically developing children between the ages of 6-11 perspective-taking skills through training the simple, reversed and double-reversed, I-you, here-there, and now-then relations as described in the original protocol. Furthermore, this is the only study to date that has assessed these learned perspective-taking skills and tested for generalization of perspective-taking to a real-world conversation. To test for this generalization, the experimenter assessed both pre- and post training to decipher if these novel skills transferred into day-to-day conversations with the experimenter. During the generalization assessment, the experimenter asked the child the same form of questions as previously discussed; however, the questions now involved more day-to-day topics that the child would encounter in a real-world setting conversational context. Moreover, we also tested for stimulus generalization. To test for this specific generalization, each participant was given pre-and post assessments of the exact questions composed of the three types of relations and complexities, however, this time with novel stimuli. We hypothesized that after training the simple, reversed and double reversed relations, participants' post assessment scores would be significantly higher than the pretest scores for each relation. We also hypothesized that the perspective-taking skills learned throughout the training portion of the study would in fact generalize to more real-world topics of the same format, and would also generalize to more questions of the same format with different stimuli. Such findings would show that the relations were truly derived and regardless of the stimuli involved, children may display relational skills in perspective taking with unique stimuli, in different situational contexts.

METHOD

Participants

Three typically developing children with no known disabilities participated in this study. All three participants were recruited via personal contacts. Parents and children were financially compensated for their time and travel. JH was a male of eleven years and 4 months (late childhood) at the time of his participation. DH was a male of 8 years and 1 month (middle childhood) at the time of his participation. WH was a female of 6 years and 9 months (middle childhood) at the time of her participation. Before each participant's first session, the participant's reading ability was screened by having each participant read a sample simple relation question out loud in the presence of the experimenter. This sample relation question was not presented in the actual experiment. All of the children in this study were reported by their parents to read at grade level and displayed no reading comprehension problems. Throughout the remainder of the study, each participant was periodically asked to read randomly selected trials out loud as he/she completed various portions of the experiment. This

precaution was taken to ensure that the child was not misreading questions that could affect his or her ability to answer the perspective-taking questions to the best of his or her ability.

Setting and Apparatus

Experimental sessions were conducted in a quiet, secluded room in the Rehabilitation Institute at Southern Illinois University. The perspective-taking tasks were presented on a laptop PC, and were created in Microsoft® PowerPoint® with program macros controlled by Microsoft Visual Basic Editor® and were programmed by both authors. The perspective-taking and stimulus generalization programs were automated, while the response generalization questions were presented by the experimenter to each participant through a conversational context. A script for these response generalization questions was created and procedural reliability was also recorded during this portion of the experiment to avoid any procedural errors on the part of the experimenter. Participants were allowed brief breaks from the tasks at any time, during which they engaged in a fun activity with the experimenter (e.g., playing a computer game, playing with modeling clay). Participants were also compensated for their participation after each session with small tangible items (i.e., candy, small toys, etc.). Finally, parents and children were financially compensated for their time and travel. If the participant attended all scheduled sessions for the entire week, the participant was awarded \$10 for that week. Each participant in the current study attended every scheduled session and was compensated accordingly.

Procedure

All participants were exposed to the same procedure which consisted of a modified automated version of the Barnes-Holmes protocol (Barnes-Holmes, Barnes-Holmes, & McHugh, 2004; Barnes-Holmes, McHugh, & Barnes-Holmes, 2004), as reported by McHugh et al. (2004). The protocol used in this study was the same protocol used in the Rehfeldt et al. study (submitted) and consisted of 57 total trials. Each trial consisted of two questions (e.g., “where am I sitting?” “Where are you sitting?”). The participant had to answer both questions correctly in order for the trial to be scored as correct. If the participant answered one of the two questions wrong, or answered both questions incorrectly, the trial was scored as incorrect. If the participant asked the experimenter a question during a task, the experimenter reminded the participant to answer the question as best as he/she could and that the experimenter was not allowed to help the participant. There was no time limit on each trial for a response to occur. Three types of relations varying in complexity were presented in the protocol including simple relations, reversed relations, and double reversed relations. Within each of these three types of relations were trials that assessed responding to three different perspective-taking frames (I-You, Here-There, and Now-Then). The simple relation protocol consisted of eight trials that included 2 I-You, 2 Here-There, and 4 Now-Then trial types. The reversed relation protocol consisted of thirty-six trials, including 8 I-You, 12 Here-There, and 16 Now-Then relations. The double reversed relation protocol consisted of thirteen trials, including 4, I-You/Here-There and 9, Here-There/Now-then trial types. The number of trials for each relation and each trial type followed closely the procedure used by McHugh et al. (2004) and were identical to those used by Rehfeldt et al.

Table 1 shows the questions that were presented for each of the three relations and for each of the trial types within each relation tested. In order for the participant to receive a correct score on test trials for the simple relations, the participant had to choose the answer that was identical to the arrangements specified in the question. Correct answers to test trials for the reversed relations required the participant to reverse the I-You, Now-Then, or Here-There arrangements specified in the question. In order for the participant to receive a correct score on test trials for the double reversed relations, the participant had to simultaneously reverse the I-You and Here-There or Here-There and Now-then arrangements specified in the question. The stimulus generalization program was identical to the perspective-taking program (57 total trials) except the relation questions included different stimuli (e.g., instead of “I have a red brick and you have a green brick”, the stimuli was now changed to “I have a yellow pencil and you have an orange pencil”, etc.). Examples of stimulus generalization questions are shown in Table 2. The response

generalization questions consisted of 8 questions of each relation (simple, reversed, and double reversed) and also tested for all three perspective-taking frames (I-You, Now-Then, Here-There), however the questions were presented in a conversational format and consisted of real world topics, for example, "I am eating here at McDonald's and you are eating there at Wendy's. If I were you and you were me, where would I be eating? Where would you be eating?" Examples of response generalization questions and corresponding correct answers are shown in Table 3.

Table 1

The Perspective-Taking Protocol. (The correct response for each question is shown in parentheses. The reader is also referred to McHugh et al., 2004.)

SIMPLE RELATIONS:

Simple I-YOU:

I have a red brick can you have a green brick.

Which brick do I have? (Red)

Which brick do YOU have? (Green)

I have a green brick and you have a red brick.

Which brick do YOU have? (Red)

Which brick do I have? (Green)

Simple HERE-THERE:

I am sitting here on the blue chair and you are sitting there on the black chair.

Where am I sitting? (Blue)

Where are YOU sitting? (Black)

I am sitting here on the black chair and you are sitting here on the blue chair.

Where are YOU sitting? (Blue)

Where am I sitting? (Black)

Simple NOW-THEN:

Yesterday I was watching television, today I am reading.

What am I doing now? (Reading)

What was I doing then? (Television)

Yesterday I was reading, today I am watching television.

What was I doing then? (Reading)

What am I doing now? (Television)

Yesterday you were reading, today you are watching television.

What are YOU doing now? (Television)

What were YOU doing then? (Reading)

Yesterday you were watching television, today you are reading.

What were YOU doing then? (Television)

What are YOU doing now? (Reading)

REVERSED RELATIONS

Reversed I-YOU:

I have a red brick and you have a green brick. If I was you and you were me.

Which brick would I have? (Green)

Which brick would YOU have? (Red)

I have a green brick and you have a red brick. If I was you and you were me

Which brick would YOU have? (Green)

Which brick would I have? (Red)

I have a red brick and you have a green brick. If I was you and you were me.

Which brick would YOU have? (Red)

Which brick would I have? (Green)

I have a green brick and you have a red brick. If I was you and you were me.

Which brick would I have? (Red)

Which brick would YOU have? (Green)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me.

Where would YOU be sitting? (Black)

Where would I be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me.

Where would I be sitting? (Blue)

Where would YOU be sitting? (Black)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me.

Where would I be sitting? (Black)

Where would YOU be sitting? (Blue)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me.

Where would YOU be sitting? (Blue)

Where would I be sitting? (Black)

Reversed HERE-THERE:

I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here.

Where would YOU be sitting? (Blue)

Where would I be sitting? (Black)

I am sitting here on the black chair and you are sitting there on the blue chair. If here was there and there was here.

Where would I be sitting? (Blue)

Where would YOU be sitting? (Black)

I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here.

Where would I be sitting? (Black)

Where would YOU be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If here was there and there was here.

Where would YOU be sitting? (Black)

Where would I be sitting? (Blue)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here.

Where would I be sitting now? (Blue)

Where was I sitting then? (Black)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here.

Where was I sitting then? (Blue)

Where would I be sitting now? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here.

Where was I sitting then? (Black)

Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here.

Where would I be sitting now? (Black)

Where was I sitting then? (Blue)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here.

Where would you be sitting now? (Blue)

Where were you sitting then? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here.

Where were you sitting then? (Black)

Where would you be sitting now? (Blue)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If here was there and there was here.

Where would you be sitting now? (Black)

Where were you sitting then? (Blue)

Yesterday you were sitting here on the black chair, today you are sitting there on the blue chair. If here was there and there was here.

Where were you sitting then? (Blue)

Where would you be sitting now? (Black)

Reversed NOW-THEN:

Yesterday I was watching television, today I am reading. If now was then and then was now.

What was I doing then? (Reading)

What would I be doing now? (Television)

Yesterday I was reading, today I am watching television. If now was then and then was now.

What would I be doing now? (Reading)

What was I doing then? (Television)

Yesterday I was watching television, today I am reading. If now was then and then was now.

What was I doing now? (Television)

What would I be doing then? (Reading)

Yesterday I was reading, today I am watching television. If now was then and then was now.

What was I doing then? (Television)

What would I be doing now? (Reading)

Yesterday you were watching television, today you are reading. If now was then and then was now.

What were you doing then? (Reading)

What would you be doing now? (Television)

Yesterday you were reading, today you are watching television. If now was then and then was now.

What were you doing then? (Television)

What would you be doing now? (Reading)

Yesterday you were watching television, today you are reading. If now was then and then was now.

What would you be doing now? (Television)

What were you doing then? (Reading)

Yesterday you were reading, today you are watching television. If now was then and then was now.

What would you be doing now? (Reading)

What were you doing then? (Television)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If now was then and then was now.

Where would I be sitting now? (Blue)

Where was I sitting then? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If now was then and then was now.

Where was I sitting then? (Black)

Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If now was then and then was now.

Where would I be sitting now? (Black)

Where was I sitting then? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If now was then and then was now.

Where was I sitting then? (Blue)

Where would I be sitting now? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now.

Where were you sitting then? (Black)

Where would you be sitting now? (Blue)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now.

Where would you be sitting now? (Blue)

Where were you sitting then? (Black)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If now was then and then was now.

Where were you sitting then? (Blue)

Where would you be sitting now? (Black)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If now was then and then was now.

Where would you be sitting now? (Black)

Where were you sitting then? (Blue)

DOUBLE REVERSED RELATIONS:

I-YOU/HERE-THERE:

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me and if here was there and there was here.

Where would I be sitting? (Blue)

Where would YOU be sitting? (Black)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me and if here was there and there was here.

Where would I be sitting? (Black)

Where would YOU be sitting? (Blue)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me and if here was there and there was here.

Where YOU be sitting? (Black)

Where would I be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me and if here was there and there was here.

Where would YOU be sitting? (Blue)

Where would I be sitting? (Black)

HERE-THERE/NOW-THEN:

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here and If now was then and then was now.

Where would I be sitting then? (Blue)

Where would I be sitting now? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here and If now was then and then was now.

Where would I be sitting now? (Black)

Where would I be sitting then? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here and If now was then and then was now.

Where would I be sitting then? (Black)

Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here and If now was then and then was now.

Where would I be sitting now? (Blue)

Where would I be sitting then? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here and If now was then and then was now.

Where would you be sitting then? (Blue)

Where would you be sitting now? (Black)

Yesterday you were sitting here on the blue chair, today you are sitting here on the black chair. If here was there and there was here and If now was then and then was now.

Where would you be sitting now? (Black)

Where would you be sitting then? (Blue)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If here was there and there was here and If now was then and then was now.

Where would you be sitting then? (Black)

Where would you be sitting now? (Blue)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If here was there and there was here and If now was then and then was now.

Where would you be sitting now? (Blue)

Where would you be sitting then? (Black)

Table 2

Stimulus Generalization Perspective Taking protocol.

SIMPLE RELATIONS:

Simple I-YOU:

I have an orange pencil and you have a yellow pencil.

Which pencil do I have? (Orange)

Which pencil do YOU have? (Yellow)

I have a yellow pencil and you have an orange pencil.

Which pencil do YOU have? (Orange)

Which pencil do I have? (Yellow)

Simple HERE-THERE:

I am sitting here on the pink couch and you are sitting there on the purple couch.

Where am I sitting? (Pink)

Where are YOU sitting? (Purple)

I am sitting here on the purple couch and you are sitting here on the pink couch.

Where are YOU sitting? (Pink)

Where am I sitting? (Purple)

Simple NOW-THEN:

Yesterday I was playing video games, today I am listening to music.

What am I doing now? (Listening to music)

What was I doing then? (Video games)

Yesterday I was listening to music, today I am playing video games.

What was I doing then? (Listening to music)

What am I doing now? (Video games)

Yesterday you were listening to music, today you are playing video games.

What are YOU doing now? (Video games)

What were YOU doing then? (Listening to music)

Yesterday you were playing video games, today you are listening to music.

What were YOU doing then? (Video games)

What are YOU doing now? (Listening to music)

REVERSED RELATIONS:

Reversed I-YOU:

I have an orange pencil and you have a yellow pencil. If I was you and you were me.

Which pencil would I have? (Yellow)

Which pencil would YOU have? (Orange)

I have a yellow pencil and you have an orange pencil. If I was you and you were me

Which pencil would YOU have? (Yellow)

Which pencil would I have? (Orange)

I have an orange pencil and you have a yellow pencil. If I was you and you were me.

Which pencil would YOU have? (Orange)

Which pencil would I have? (Yellow)

I have a yellow pencil and you have an orange pencil. If I was you and you were me

Which pencil would I have? (Orange)

Which pencil would YOU have? (Yellow)

I am sitting here on the purple couch and you are sitting there on the pink couch. If I was you and you were me.

Where would YOU be sitting? (Purple)

Where would I be sitting? (Pink)

I am sitting here on the purple couch and you are sitting there on the pink couch. If I was you and you were me.

Where would I be sitting? (Pink)

Where would YOU be sitting? (Purple)

I am sitting here on the pink couch and you are sitting there on the purple couch. If I was you and you were me.

Where would I be sitting? (Purple)

Where would YOU be sitting? (Pink)

I am sitting here on the pink couch and you are sitting there on the purple couch. If I was you and you were me.

Where would YOU be sitting? (Pink)

Where would I be sitting? (Purple)

Reversed HERE-THERE:

I am sitting here on the pink couch and you are sitting there on the purple couch. If here was there and there was here.

Where would YOU be sitting? (Pink)

Where would I be sitting? (Purple)

I am sitting here on the purple couch and you are sitting there on the pink couch. If here was there and there was here.

Where would I be sitting? (Pink)

Where would YOU be sitting? (Purple)

I am sitting here on the pink couch and you are sitting there on the purple couch. If here was there and there was here.

Where would I be sitting? (Purple)

Where would YOU be sitting? (Pink)

I am sitting here on the purple couch and you are sitting there on the pink couch. If here was there and there was here.

Where would YOU be sitting? (Purple)

Where would I be sitting? (Pink)

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If here was there and there was here.

Where would I be sitting now? (Pink)

Where was I sitting then? (Purple)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If here was there and there was here.

Where was I sitting then? (Pink)

Where would I be sitting now? (Purple)

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If here was there and there was here.

Where was I sitting then? (Purple)

Where would I be sitting now? (Pink)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If here was there and there was here.

Where would I be sitting now? (Purple)

Where was I sitting then? (Pink)

Yesterday you were sitting there on the pink couch, today you are sitting here on the purple couch. If here was there and there was here.

Where would you be sitting now? (Pink)

Where were you sitting then? (Purple)

Yesterday you were sitting there on the pink couch, today you are sitting here on the purple couch. If here was there and there was here.

Where were you sitting then? (Purple)

Where would you be sitting now? (Pink)

Yesterday you were sitting there on the purple couch, today you are sitting here on the pink couch. If here was there and there was here.

Where would you be sitting now? (Purple)

Where were you sitting then? (Pink)

Yesterday you were sitting here on the purple couch, today you are sitting there on the pink couch. If here was there and there was here.

Where were you sitting then? (Pink)

Where would you be sitting now? (Purple)

Reversed NOW-THEN:

Yesterday I was playing video games, today I am listening to music. If now was then and then was now.

What was I doing then? (Listening to music)

What would I be doing now? (Video games)

Yesterday I was listening to music, today I am playing video games. If now was then and then was now.

What would I be doing now? (Listening to music)

What was I doing then? (Video games)

Yesterday I was playing video games, today I am listening to music. If now was then and then was now.

What was I doing now? (Video games)

What would I be doing then? (Listening to music)

Yesterday I was listening to music, today I am playing video games. If now was then and then was now.

What was I doing then? (Video games)

What would I be doing now? (Listening to music)

Yesterday you were playing video games, today you are listening to music. If now was then and then was now.

What were you doing then? (Listening to music)

What would you be doing now? (Video games)

Yesterday you were listening to music, today you are playing video games. If now was then and then was now.

What were you doing then? (Video games)

What would you be doing now? (Listening to music)

Yesterday you were playing video games, today you are listening to music. If now was then and then was now.

What would you be doing now? (Video games)

What were you doing then? (Listening to music)

Yesterday you were listening to music, today you are playing video games. If now was then and then was now.

What would you be doing now? (Listening to music)

What were you doing then? (Video games)

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If now was then and then was now.

Where would I be sitting now? (Pink)

Where was I sitting then? (Purple)

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If now was then and then was now.

Where was I sitting then? (Purple)

Where would I be sitting now? (Pink)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If now was then and then was now.

Where would I be sitting now? (Purple)

Where was I sitting then? (Pink)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If now was then and then was now.

Where was I sitting then? (Pink)

Where would I be sitting now? (Purple)

Yesterday you were sitting there on the pink couch, today you are sitting here on the purple couch. If now was then and then was now.

Where were you sitting then? (Purple)

Where would you be sitting now? (Pink)

Yesterday you were sitting there on the pink couch, today you are sitting here on the purple couch. If now was then and then was now.

Where would you be sitting now? (Pink)

Where were you sitting then? (Purple)

Yesterday you were sitting there on the purple couch, today you are sitting here on the pink couch. If now was then and then was now.

Where were you sitting then? (Pink)

Where would you be sitting now? (Purple)

Yesterday you were sitting there on the purple couch, today you are sitting here on the pink couch. If now was then and then was now.

Where would you be sitting now? (Purple)

Where were you sitting then? (Pink)

DOUBLE REVERSED RELATIONS:

I-YOU/HERE-THERE:

I am sitting here on the pink couch and you are sitting there on the purple couch. If I was you and you were me and if here was there and there was here.

Where would I be sitting? (Pink)

Where would YOU be sitting? (Purple)

I am sitting here on the purple couch and you are sitting there on the pink couch. If I was you and you were me and if here was there and there was here.

Where would I be sitting? (Purple)

Where would YOU be sitting? (Pink)

I am sitting here on the pink couch and you are sitting there on the purple couch. If I was you and you were me and if here was there and there was here.

Where YOU be sitting? (Purple)

Where would I be sitting? (Pink)

I am sitting here on the purple couch and you are sitting there on the pink couch. If I was you and you were me and if here was there and there was here.

Where would YOU be sitting? (Pink)

Where would I be sitting? (Purple)

HERE-THERE/NOW-THEN:

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If here was there and there was here and If now was then and then was now.

Where would I be sitting then? (Pink)

Where would I be sitting now? (Purple)

Yesterday I was sitting there on the pink couch, today I am sitting here on the purple couch. If here was there and there was here and If now was then and then was now.

Where would I be sitting now? (Purple)

Where would I be sitting then? (Pink)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If here was there and there was here and If now was then and then was now.

Where would I be sitting then? (Purple)

Where would I be sitting now? (Pink)

Yesterday I was sitting there on the purple couch, today I am sitting here on the pink couch. If here was there and there was here and If now was then and then was now.

Where would I be sitting now? (Pink)

Where would I be sitting then? (Purple)

Yesterday you were sitting there on the pink couch, today you are sitting here on the purple couch. If here was there and there was here and If now was then and then was now.

Where would you be sitting then? (Pink)

Where would you be sitting now? (Purple)

Yesterday you were sitting here on the pink couch, today you are sitting here on the purple couch. If here was there and there was here and If now was then and then was now.

Where would you be sitting now? (Purple)

Where would you be sitting then? (Pink)

Yesterday you were sitting there on the purple couch, today you are sitting here on the pink couch. If here was there and there was here and If now was then and then was now.

Where would you be sitting then? (Purple)

Where would you be sitting now? (Pink)

Yesterday you were sitting there on the purple couch, today you are sitting here on the pink couch. If here was there and there was here and If now was then and then was now.

Where would you be sitting now? (Pink)

Where would you be sitting then? (Purple)

Table 3

Response Generalization Questions.

SIMPLE RELATIONS:

I have the hamburger and you have the grilled cheese

Which sandwich do I have? (Hamburger)

Which sandwich do you have? (Grilled cheese)

You have the hamburger and I have the grilled cheese.

Which sandwich do you have? (Hamburger)

Which sandwich do I have? (Grilled cheese)

If I'm standing in the classroom, and you're standing on the playground.

Where are you standing? (Playground)

Where am I standing? (Classroom)

If you're standing in the classroom, and I'm standing on the playground.

Where am I standing? (Playground)

Where are you standing? (Classroom)

Yesterday I was playing X-Box, today I am watching "The Incredibles."

What was I doing then? (X-Box)

What am I doing now? ("The Incredibles")

Today you are watching "The Incredibles," yesterday you were playing X-Box.

What are you doing now? ("The Incredibles")

What were you doing then? (X-Box)

Yesterday you were reading comic books, today you are talking on the phone.

What are you doing now? (Phone)

What were you doing then? (Comic books)

Today I am talking on the phone, yesterday I was reading comic books.

What was I doing then? (Comic books)

What am I doing now? (Phone)

REVERSED RELATIONS:

I am holding the puppy and you are holding the kitten, if I was you and you were me.

Which animal am I holding? (Kitten)

Which animal are you holding? (Puppy)

You are holding the puppy and I am holding the kitten, if I was you and you were me.

Which animal are you holding? (Kitten)

Which animal am I holding? (Puppy)

Yesterday I was swimming there in the pool, today I am swimming here in the lake, if here was there and there was here.

Where was I swimming then? (Lake)

Where am I swimming now? (Pool)

Today you are swimming here in the lake, yesterday you were swimming there in the pool, if here was there and there was here.

Where are you swimming now? (Pool)

Where were you swimming then? (Lake)

Yesterday I was doing my homework; today I am taking a nap. If now was then and then was now.

What would I be doing now? (Homework)

What was I doing then? (Nap)

Today you are doing your homework; yesterday you were taking a nap. If now was then and then was now.

What were you doing then? (Homework)

What would you be doing now? (Nap)

Yesterday you were playing soccer, today you are playing basketball. If now was then and then was now.

What were you doing then? (Basketball)

What would you be doing now? (Soccer)

Today I am playing soccer, yesterday I was playing basketball. If now was then and then was now.

What would I be doing now? (Basketball)

What was I doing then? (Soccer)

DOUBLE REVERSED RELATIONS:

I am sleeping here in the bedroom and you are sleeping there in the living room. If I was you and you were me and if here was there and there was here.

Where would I be sleeping? (Bedroom)

Where would you be sleeping? (Living room)

You are sleeping here in the living room, and I am sleeping there in the bedroom.

If I was you and you were me and if here was there and there was here.

Where would you be sleeping? (Living room)

Where would I be sleeping? (Bedroom)

I am eating here at McDonalds and you are eating there at Wendy's. If I was you and you were me and if here was there and there was here.

Where would you be eating? (Wendy's)

Where would I be eating? (McDonalds)

You are eating here at Wendy's and I am eating there at McDonalds. If I was you and you were me and if here was there and there was here.

Where would I be eating? (McDonalds)

Where would you be eating? (Wendy's)

Yesterday I was shopping there at the mall; today I am shopping here at the grocery store. If here was there and there was here and if now was then and then was now.

Where would I be shopping then? (Mall)

Where would I be shopping now? (Grocery store)

Today you are shopping here at the mall; yesterday you were shopping there at the grocery store. If here was there and there was here and if now was then and then was now.

Where would you be shopping now? (Mall)
Where would you be shopping then? (Grocery store)

Yesterday you were running there in the park; today you are running here in gym class. If here was there and there was here and if now was then and then was now.

Where would you be running now? (Gym class)
Where would you be running then? (Park)

Today I am running here in the park; yesterday I was running there in gym class. If here was there and there was here and if now was then and then was now.

Where would I be running then? (Gym class)
Where would I be running now? (Park)

Figure 1 shows on-screen representations of a simple I-You trial, a reversed Now-Then trial, and a double reversed Here-There/Now-Then trial. Participants were required to click the computer mouse on one of the two command buttons presented for each question in order to designate their answer. Once the participant responded to one of the two command boxes presented for the second question, they were advanced to the next trial. The left-right position of the correct and incorrect command boxes was randomly established across all trials.

Participants were first given three pretests for the simple relation. These pretests consisted of the simple relation pretest, the stimulus generalization pretest and the response generalization pretest. If the participant did not receive an 88% (7/8 correct) on all three pretests, training of the simple relations was introduced. If the participant did not meet criterion on the simple relations training, the participant repeated training until a criterion of at least 88% was reached. Once a mastery criterion of 88% was reached on the simple relations training, the three post-tests (simple relation, stimulus generalization and response generalization) were given. If the participant met the criterion for inferring the emergence of the simple relations on the simple relations post-test and showed generalization (criterion of 88%) on the two generalization post tests, pre-testing of the reversed relations was introduced. If the participant did not meet criterion for inferring the emergence of the simple relations or showing generalization on the two generalization post tests, training of the simple relations was repeated until a criterion of 88% mastery criterion was reached, and the simple relations post tests were repeated once the relations and generalization were again shown to be mastered. This process was then repeated for the reversed and double reversed relations. A mastery criterion of at least 88% correct on the simple relations pre-and post tests (7/8 test trials correct for the simple relations), and 90% correct on the reversed and double reversed pre-and post tests (33/36 correct for the reversed relations, and 12/13 correct for the double reversed relations) was taken as indicative of the emergence of the particular relations.

FIGURE 1, NEXT PAGE

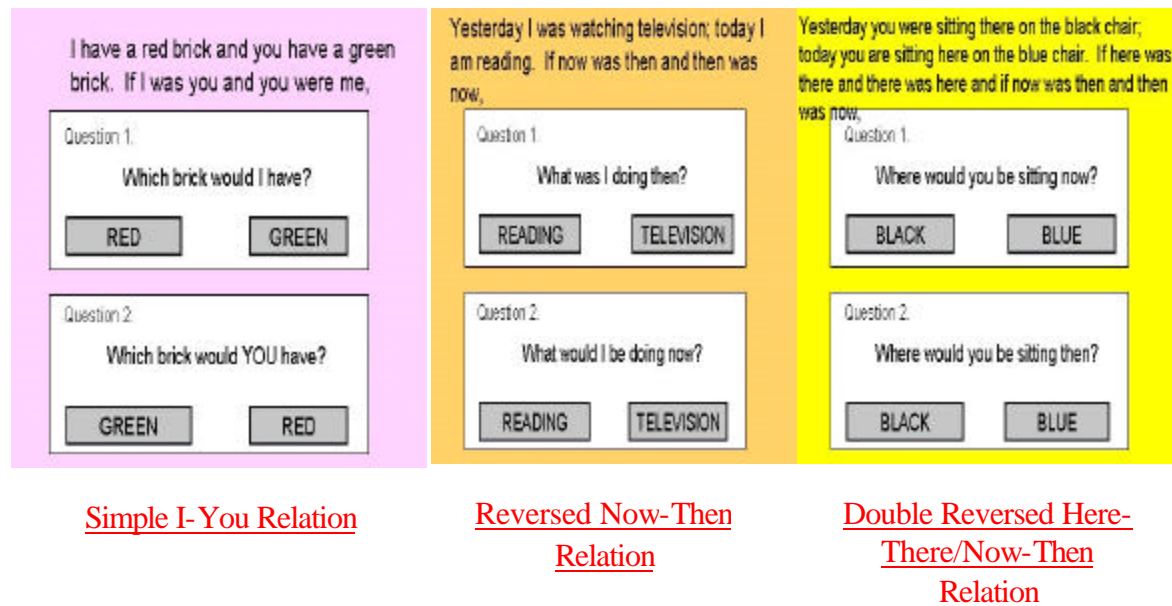


Figure 1. On-screen representation of simple, reversed, and double-reversed relations trials.

No feedback was presented during pre- and post tests. During the response generalization pre- and post tests the experimenter gave noncontingent praise (reinforced attending and responses unrelated to the accuracy of responses to the probes) throughout the protocol (e.g., "Keep up the good work," and "You're doing a great job"). During training for both the perspective-taking and stimulus generalization protocols, a variety of 3 second animation clips were presented as reinforcers following correct trials during training, whereas incorrect trials produced a slide which read, "Try again," and the respective trial was then repeated until the participant answered correctly.

Design

The present experiment utilized a multiple probe design across participants (Horner & Baer, 1978). Three designs were used to train and test each relation (simple, reversed, and double reversed). For the simple relations, all three participants were given all three pre-test probes on the same day. DH was the only participant who needed training. He was then administered the three pre-test probes, in which he reached criterion and completed training on the simple relations. For the reversed relations, once again all three participants were given the pre-test probes on the same day. JH was the first participant to begin training, while the other two participants remained in the baseline period. When visual inspection of the data revealed an ascending trend, DH then began training on the reversed relations while WH remained in baseline. Finally, when visual inspection of DH's training data revealed an ascending trend, WH began training on the reversed relations. Once JH mastered criterion on the reversed relation training, he was administered the reversed relation, stimulus generalization and response generalization post tests. Since he did not reach criterion on all three post-tests, JH then began training a second time for the reversed relations. During this time, DH mastered criterion on the reversed relation training and was administered the three post tests. He did not master the criterion on all three post-tests and began training for a second time on the reversed relations. During this time, WH mastered criterion on the reversed relations training and was administered the three post tests. WH mastered criterion on all three post-tests and this concluded her training for the reversed relations. This process was repeated for

both JH and DH until they met criterion on all three post-test probes. For the double reversed relations, all three participants were given the three pre-test probes on the same day. JH met criterion on the pre-test probes and therefore did not require training. DH was the first to receive training for the double reversed relations. When visual inspection of the data revealed an ascending trend, WH began training on the double reversed relations. The same process described above was repeated for both DH and WH until they met criterion on the double reversed relation, stimulus generalization and response generalization post test probes. Figure 3 and 4 shows that WH was the last participant to be trained in both the reversed and double reversed relations, leaving her in baseline for 7 and 3 sessions respectively after her pre-test probes. Because at least three sessions were administered with each participant each day, three times a week, it was not necessary to administer training probes in baseline for either relation to WH because she was introduced to training in both relations the very next day.

Interobserver Agreement

Because the perspective-taking protocols were administered via an automated computerized format, and data collection was computer controlled, no interobserver agreement was collected on the simple, reversed, and double reversed pre-test, training, and post tests, or the stimulus generalization pre- and post tests. However, IOA was taken independently and simultaneously by a second observer for 100% of the response generalization pre- and post test probes that were administered by the experimenter. Interobserver agreement was assessed using the total number of agreements divided by the number of agreements plus the number of disagreements, multiplied by 100% formula. IOA was 100% across all response generalization pre- and post- tests.

Procedural Reliability

A second observer scored procedural reliability while the experimenter presented the response generalization pre- and post test-probes to ensure that the experimenter was following all aspects of the experimental protocol. A checklist of correct experimenter behaviors was developed and is shown in Table 4. The second observer recorded these behaviors as either occurring or not occurring. Procedural reliability was assessed using the number of experimenter behaviors recorded as occurring divided by the total number of experimenter behaviors listed on the checklist multiplied by 100% formula. Procedural reliability was 100% across all response generalization probes.

Table 4
Procedural Reliability Data Sheet

Phase					
Date					
Experimenter					
Observer					
1. Did the experimenter follow the script as stated on the response generalization sheet when stating the response generalization instructions to the participant?					

- 2. Is the experimenter’s intermittent reinforcement truly noncontingent (i.e., the reinforcement is randomly emitted throughout the session and not contingent on any correct or incorrect response) on the participant’s performance?
- 3. Is the experimenter refraining from giving the participant any verbal cues (i.e., “good job” or “that is incorrect”) in response to the participant’s correct or incorrect responses?
- 4. Is the experimenter refraining from giving the participant any nonverbal cues (i.e., approving or disapproving looks, looking away, etc.) in response to the participant’s correct or incorrect responses?
- 5. Did the experimenter state the questions verbatim as written on the response generalization question sheet?
- 6. Were the response generalization questions randomized on the response generalization question sheet?

Total:				
Percent:				

Results

Simple Relations

Figure 2 portrays all three participants’ performances on the pre-tests, training trials, and post-tests for the simple relations. The pre-and post-tests consisted of the simple relations pre-and post tests, as well as the stimulus and response generalization pre-and post tests. If the participant received a score of 88% or better on all three of the simple relations pre-test probes, training on the simple relations was not administered. Mastery criterion for the simple relations training was 88%. Once the participant met criterion on the simple relations training, the three pre-test probes were introduced. If the participant met the criterion for inferring the emergence of the simple relations on the simple relations post test and showed generalization (criterion of 88%) on the two generalization post-tests, emergence of the simple relations was indicated. Although DH initially did not meet criterion performance on the stimulus generalization pre-test for the simple relations (scoring 100% on the simple relations pre-test, and 75% and 100% on the stimulus and response generalization pre-tests respectively), he required only one training block to master the simple relations, after which he responded with 100% accuracy on the simple relations and stimulus generalization post test and 88% on the response generalization post test.

JH met criterion on the simple relations, stimulus and response generalization pre-tests with a score of 100%, 88%, and 100% respectively. Therefore no training on the simple relations was necessary.

WH also met criterion on all three pre-tests, scoring 88%, 100%, and 88% on the simple relations pre-test, 100% on the stimulus generalization pre-test and 88% on the response generalization pre-test. Therefore, no training was necessary for WH as well.

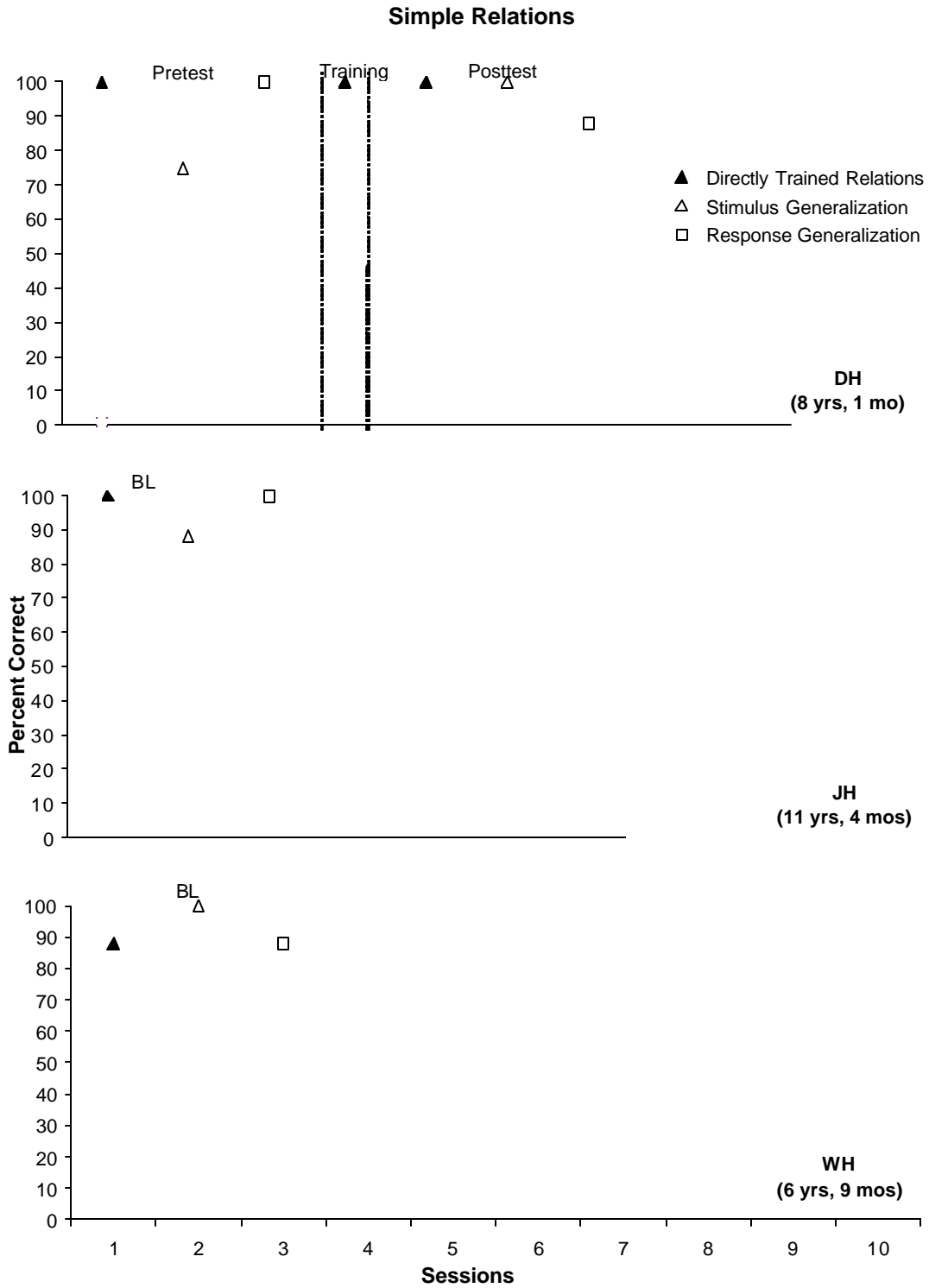


Figure 2. Participants' Performances on the Simple Relations.

Reversed Relations

Shown in Figure 3 are all three participants' performances on the pre-tests, training trials, and post tests for the reversed relations. The pre-and post tests consisted of the reversed relations pre-and post tests, as well as the stimulus and response generalization pre-and post tests. If the participant received a score of 90% or better on all three of the reversed relations pre-test probes, training on the reversed relations was not administered. Mastery criterion for the reversed relations training was 90%. Once the participant met criterion on the reversed relations training, the three pre-test probes were administered. If the participant met the criterion for inferring the emergence of the reversed relations on the reversed relations post test and showed generalization (criterion of 90%) on the two generalization post tests, emergence of the reversed relations was indicated. The figure shows that JH performed with 86%, 94%, and 63% accuracy on the reversed relation pre-test, stimulus generalization and response generalization pre-tests respectively, and then mastered the relations in three training blocks. He did not meet criterion performance on the first set of post-test probes (scoring 97%, 100%, and 75% respectively). After two more training blocks, JH again demonstrated mastery of the reversed relations, after which he did not meet criterion performance on the second set of post test probes (scoring 97%, 97%, and 50% respectively). JH was then administered training on the reversed relations for the third time and again demonstrated criterion performance after only one training block. He once again did not meet criterion performance on the third set of post-test probes (scoring 81%, 97%, and 75% respectively). JH then demonstrated mastery of the reversed relations in only one more training block and finally met criterion performance on the fourth set of post test probes (scoring 97%, 94%, and 88% on the reversed relations, stimulus generalization and response generalization post tests respectively).

DH performed with 62%, 39%, and 38% accuracy on the reversed relations pre-test, stimulus generalization and response generalization pre-tests respectively, and then mastered the relations in four training blocks. He did not meet criterion performance on the first set of post tests (scoring 100%, 86%, and 88% respectively), but required only one more training session to do so, after which he demonstrated criterion performance on the three post tests for the reversed relations (scoring 94%, 100%, and 88% respectively).

WH received a score of 28% on the reversed relations pre-test, 32% on the stimulus generalization pre-test, and 50% on the response generalization pre-test. In spite of her low pre-test scores, WH required only one training session to master training, performing with 92% accuracy. She also met criterion performance on the first set of post tests for the reversed relations (scoring 94%, 97%, and 88% respectively).

FIGURE 3, NEXT PAGE

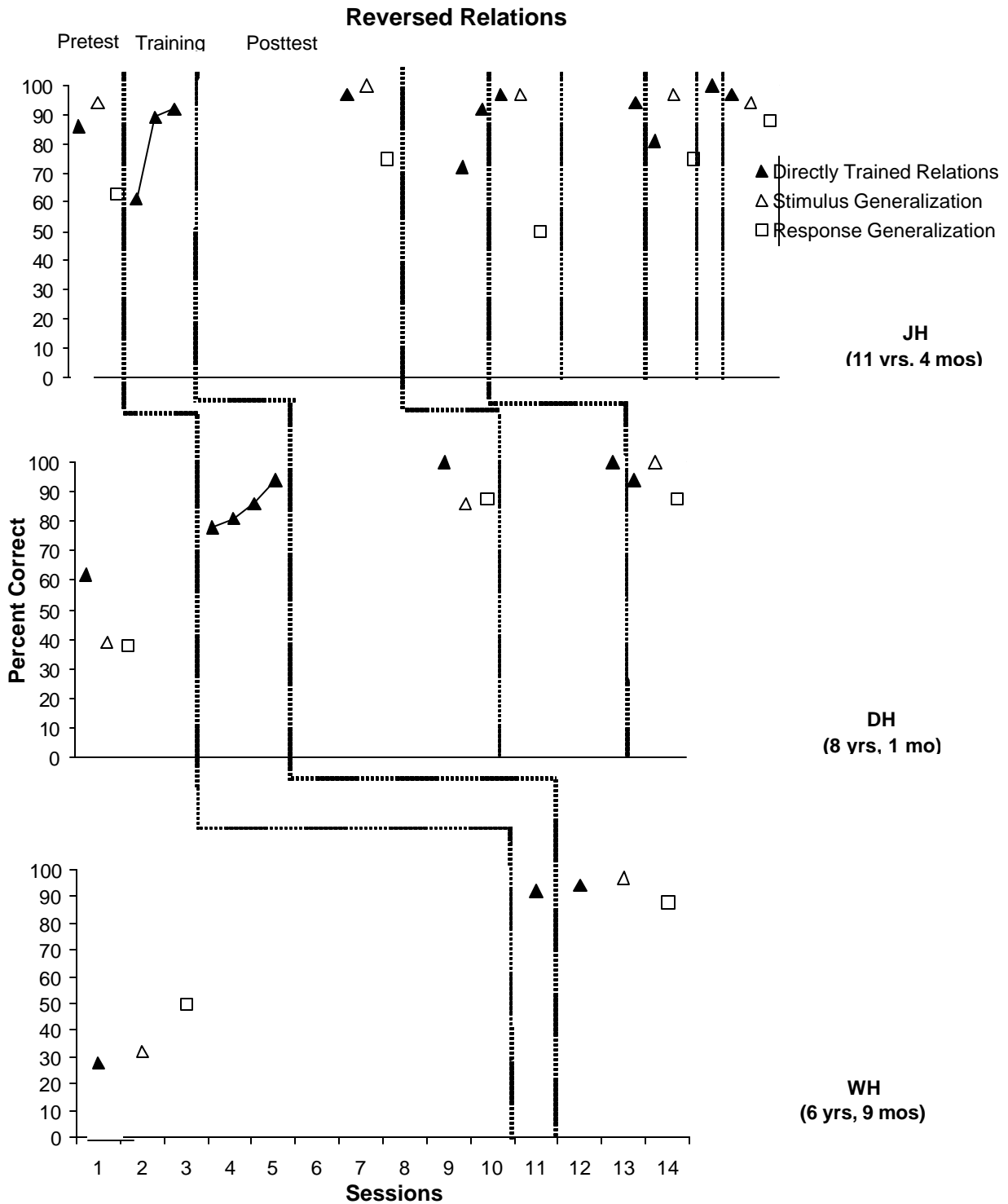


Figure 3. Participants' Performances on the Reversed Relations.

Double Reversed Relations

Shown in Figure 4 are all three participants' performances on the pre-tests, training trials, and post tests for the double reversed relations. The pre-and post tests consisted of the double reversed

relations pre-and post tests, as well as the stimulus and response generalization pre-and post tests. If the participant received a score of 90% or better on all three of the double reversed relations pre-test probes, training on the double reversed relations was not administered. Mastery criterion for the double reversed relations training was 90%. Once the participant met criterion on the double reversed relations, the three post test probes were introduced. If the participant met the criterion for inferring the emergence of the double reversed relations on the double reversed relations post test and showed generalization (criterion of 90%) on the two generalization post tests, emergence of the double reversed relations was indicated. The figure shows that JH performed with 100% accuracy on all three pre-tests. Therefore training was not necessary for this participant.

DH performed with 100%, 85%, and 75% on the double reversed relations pre-test, stimulus generalization and response generalization pre-tests respectively, and then mastered the relations in only one training block. He did not meet criterion performance on the first set of post tests (scoring 92%, 100%, and 50% respectively), but required only one more training session to do so, after which he demonstrated criterion performance on the post tests for the double reversed relations (scoring 100%, 100%, and 88% respectively).

WH scored 8% on the double reversed relations pre-test, 0% on the stimulus generalization pre-test, and 34% on the response generalization pre-test, after which she required two training blocks to master the double reversed relations. Although she did not meet criterion on the first set of post tests (scoring 100%, 85%, and 75% respectively), she required only one more training session to do so. She then demonstrated criterion performance on all three post tests for the double reversed relations (scoring 92%, 100%, and 88% respectively).

FIGURE 4, NEXT PAGE

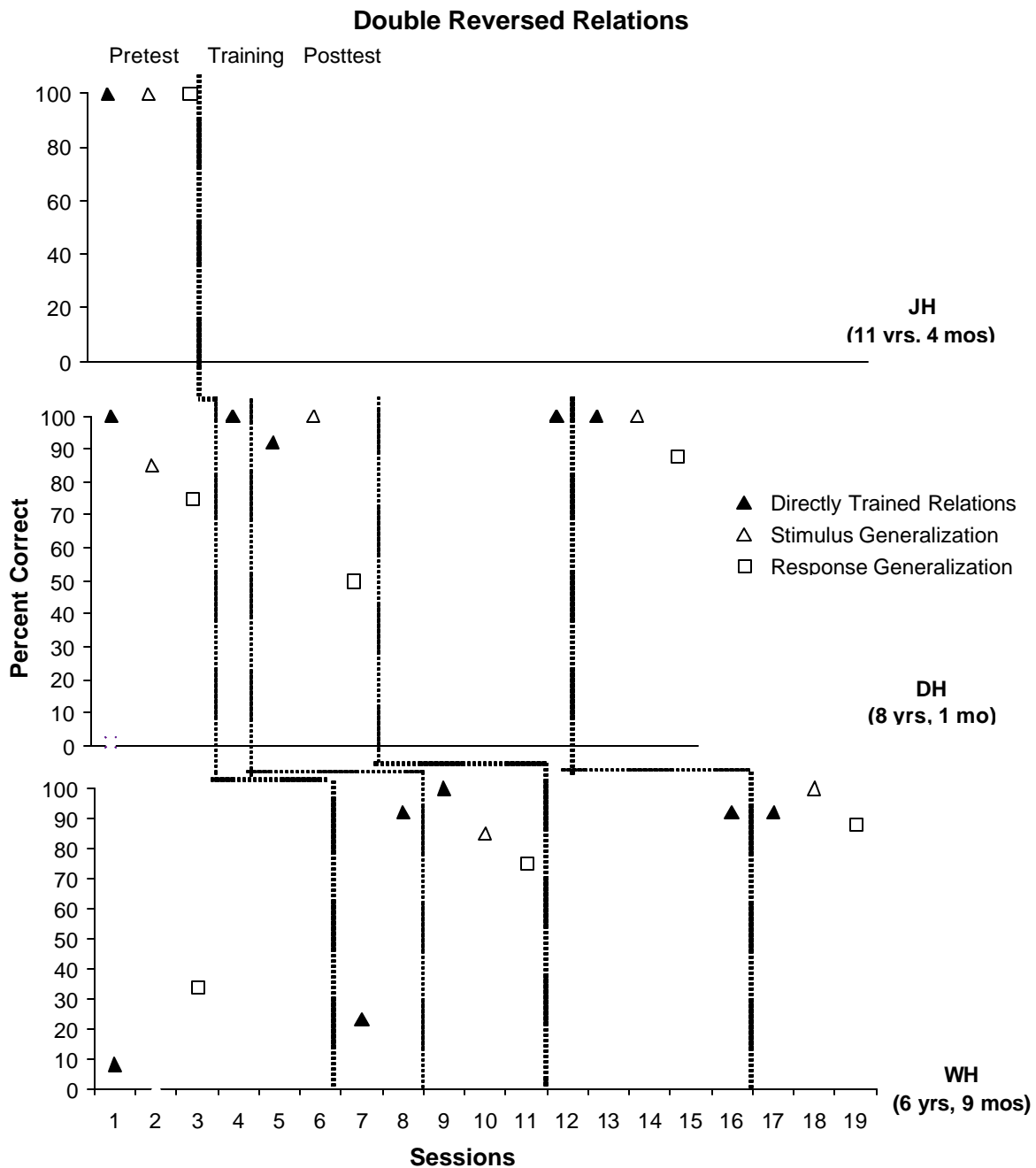


Figure 4. Participants' Performances on the Double Reversed Relations

Discussion

The results of the present experiment demonstrate that the capacity to alter the perspective between I-and-You, Here-and-There, and Now-and-Then can be established by means of a history of reinforced relational responding. All three participants displayed criterion performance on all three post tests for the reversed relations, conducted with no reinforcement, following contact with reinforcement contingencies during the training trials for correct changes in perspective. DH was the only participant

who needed contact with reinforcement contingencies for the simple relations, and DH and WH only needed contact with reinforcement contingencies for the double reversed relations in order to display performance on the three post tests. Thus, the perspective-taking protocol used in the present experiment was effective in establishing I-You, Here-There, and Now-Then frames, which specified the relationship between stimuli in terms of the perspective of the speaker. This experiment was the first to test for response generalization in a real-world social situation that required the speaker to change his or her perspective with regards to different references of person. The present experiment was also the first to test for generalization to novel stimuli, in which questions in the same format as the original perspective-taking protocol were presented with different stimuli (e.g., I have an orange pencil and you have a yellow pencil. Which pencil do I have? Which pencil do you have?). Consequently, the stimulus and response generalization probes revealed that for DH, the simple, reversed, and double reversed relations, for WH the reversed and double reversed relations, and for JH, the reversed relations, were truly learned and regardless of the stimuli involved, the participants displayed perspective-taking skills with unique stimuli, in different situational contexts. Results are consistent with Relational Frame Theory in that perspective-taking is a generalized, overarching response class, with derived relational responding playing an apparent role.

Most predictable was the finding that the simple relations were the easiest for all three participants to master. These results are similar to the results of the McHugh et al. (2004) where children of all age groups produced significantly fewest errors on test trials for the simple relations. What is surprising, however, is that, DH, who was six years, 9 months old, required one training block on the simple relations before mastering criterion on the three post test probes. DH's performance on the simple relations contradicts the results of McHugh et al. (2004), in which errors decreased with age. One possible explanation as to how this may have occurred, concerning the simple relation results, is that while DH scored a 100% on the simple relations pre-test, he scored only a 75% on the stimulus generalization pre-test. These results reveal that while he showed emergence of the simple relations, the simple relations were not able to generalize to new stimuli without further training. As will be discussed later, the generalization probes proved to be most difficult for all three participants.

Another predictable finding that coincided with the results of McHugh et al. (2004), was the fact that the reversed relations required the most training trials. McHugh et al. noted that this was due to the fact that the reversed and double reversed relations required more complex forms of derivation versus the simple relations. What was unexpected is that WH, who was only 6 years, 9 months old, mastered the reversed relations in only one training session, and JH, who was 11 years, 4 months old, mastered the relations in four training sessions. These results do not coincide with the results of the McHugh et al. study. However, there are several possible explanations as to how this may have occurred. Because of the length of the reversed relation trials (36 trials), JH often became discouraged and requested several breaks during the reversed relation sessions. He also became very upset when he found he had not in fact met mastery criterion on the three post tests and would have to go through more training sessions. In addition, WH, while only a first grader, was an excellent reader and was reported by her mother to read at a third grade reading level. She was also highly motivated by the automated reinforcement during the training trials. Furthermore, as shown in Figure 4, JH consistently failed the response generalization post test, requiring further training in the reversed relations. Similar to DH's performance on the simple relation tasks, this demonstrated that while JH showed emergence of the reversed relations, he was not able to generalize these relations to new stimuli without further training.

Another unpredicted finding of the present study is that the double reversed relations did not require as many training trails compared to the reversed relations for the oldest participants, JH and DH to master. These results are not what one would foresee cognitively or developmentally and are unexpected, as the derivation is more complex compared to the simple and reversed relations. These results are similar to those reported by Rehfeldt et al. (submitted), in which participants required fewer training on

the double reversed relations compared to the reversed relations as well. These results may be due to the fact that the double reverse relations protocol consisted of 13 trials, compared to 36 trials in the reversed relations protocol. Participants therefore had fewer questions to answer and were less discouraged due to the shorter length of the sessions. Furthermore, the double reversed relations were the final relations tested and trained in our perspective-taking program. The participants therefore had more experience with the testing context. Lastly, as with the previous relations, the participants often failed to demonstrate mastery criterion on the response generalization post-test probes. Consequently, this required further training in the relation until all three post-test probes were mastered.

As described above, the stimulus and response generalization pre-and post tests were more difficult to show criterion performance than the relations pre-and post tests. Stimulus generalization was shown when the participant mastered criterion on the stimulus generalization questions which were identical to the perspective-taking questions except the relation questions included different stimuli. Response generalization was shown when the participant mastered criterion on the response generalization questions which were presented in a conversational format and consisted of real world topics. The response generalization tests were especially difficult for all three participants. This is due to two factors. First, the participants were introduced to a new testing context in which the response generalization questions were read out loud by the experimenter. Even though the experimenter could repeat the questions an unlimited number of times if necessary to ensure the child understood the questions, the real-world conversational format of the response generalization tasks proved most problematic for the participants. Second, with increased complexity of the relations (reversed and double reversed) the questions increased in length. This made it even harder for participants of this age (middle-late childhood) to sustain attention during the entire time the experimenter read the question. Nevertheless, the results of this study reveal that each participant took no longer than four training sessions to master the stimulus and response generalization post-tests. This demonstrates that after providing children of middle-to-late childhood with a history of reinforced relational responding, simple, reversed, and double reversed relations can in fact generalize to novel stimuli and real-world conversational contexts.

Unlike developmental studies, in which large numbers of participants of specific age groups are typically used, the conclusions drawn from this study cannot speak to particular age groups of children. The results of the present experiment do, nonetheless, have various implications. The perspective-taking protocol used in the present experiment was effective in establishing I-You, Here-There, and Now-Then frames, which specified the relationship between stimuli in terms of the perspective of the speaker. The results also demonstrate that derived relational responding plays an apparent role in perspective-taking. These findings show, in terms of application, that taking the Relational Frame Theory approach to these phenomena provides a means of training and establishing perspective-taking repertoires in typically developing individual children. Understanding the perspective of others is an important skill that benefits children in their complex reasoning abilities that are important in math problems, such as story problems. In addition, having the ability to take another person's perspective is a vital social skill that children need in order to make and sustain friendships. The results of this study also demonstrate that the perspective-taking skills trained in the present experiment also transfer to novel stimuli and real world situations. This finding demonstrates that the skills established in the laboratory can in fact transfer to a more conversational context in which children will face when applying these learned skills in the classroom or other social situations with their peers.

Future studies should be conducted to test whether the perspective-taking protocol developed in this study could also be used to train individuals for whom these repertoires appear to be absent. This would have profound implications for children diagnosed with autism or other spectrum disorders in which perspective-taking skills are lacking. Since this study included children of the middle-to-late childhood age group, further experiments should test for the generalization of perspective-taking skills

with children of the early childhood age group (ages 3-5). Further studies should also focus on training these skills outside of the experimental environment in a more social context to better ensure the generalization of perspective-taking skills in real world settings.

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