Teaching Children with Asperger’s Syndrome to Respond to I-You, Here-There, and Now-Then Perspectives-taking Frames

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ABSTRACT

Perspective-taking, the ability to respond based on information about oneself and others, is an important part of social interactions. Children who are diagnosed with an autism spectrum disorder (ASD) often lack perspective-taking, and this deficit can detrimentally impact the quality of their social interactions. In recent years, a behavioral account of language and cognition, *Relational Frame Theory*, has taught various levels of perspective-taking complexity. Simple, reversed, and double reversed relations, through targeting, I-You, Here-There, and Now-Then relations have been established using the Barnes-Holmes protocol. To date, the training protocol has been evaluated using typically developing individuals and has yet to be used for individuals with perspective-taking deficits. The current study extends pervious research by teaching children with ASD perspective-taking relations, evaluating the influence of teaching on generalized responding, and briefly evaluating the impact of individualized training on perspective-taking acquisition, using the Barnes-Holmes protocol. Participants included three boys ranging from nine to ten years old, diagnosed with Asperger’s. Findings indicated that only one participant was able to master simple, reversed, and double reversed perspective-taking relations using the training protocol. Additionally, acquiring simple, reversed, and double reversed perspective-taking relations did not consistently result in acquisition of untrained responses across participants. Finally, preliminary findings indicate individualization of training protocols may be necessary for promoting acquisition of perspective-taking relations.
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CHAPTER I

INTRODUCTION

In daily life, successful social interactions and social relationships are often taken for granted, yet social skills comprise one of the most challenging set of skills for people with autism spectrum disorders (ASD) to master (Frea, 1995). Successful social interactions require understanding of many smaller skills and components (e.g., greeting another person) that lead to more complex social behavior (e.g., carrying on a reciprocal conversation), and all together lead to more appropriate social interactions. Therefore, throughout the past several years, research has been dedicated to understanding and remediating the multiple social skills that are critical to achieving social success in children with ASD (Matson, Matson, & Rivet, 2007; Scattone, 2007). Some of the social skills target in the literature include holding a conversation, understanding and relating to the perspectives of others, pretend play, using appropriate facial affect, and understanding personal space (Matson et al., 2007; White, Keonig, & Scahill, 2007). While there are many skills relevant to achieving social success, perspective-taking has been identified as one of the most critical skills (Dawson & Fernald, 1987; Heagle & Rehfeldt, 2006). In general, children with high-functioning autism are less able than typically developing children to assume the role or perspective of others (Yirmiya, Sigman, Kasari, & Mundy, 1992), and targeting perspective-taking deficits may be one of the most effective ways to help remediate social deficits in children with ASD. This would support current research that passing perspective-taking tasks is an indicator of enhanced social skills (Frith, Happé, & Siddons, 1994).
In order to extend the current literature on interventions which can remediate perspective-taking deficits in children with ASD, the current study tested the utility of using *Relational Frame Theory*, and specifically the Barnes-Holmes protocol, rather than the traditional perspective known as *Theory of Mind*, to teach perspective-taking relations to children with Asperger’s. Chapter 1 provides a statement of purpose, rationale for the current study, and a list of research questions. Chapter 2 provides a more detailed discussion about the perspective-taking deficits associated with ASD and a discussion about the effectiveness of current interventions for perspective-taking. Chapter 3 describes the study participants and outlines the settings, materials, and procedures used within the current study. Chapter 4 lists the findings that were obtained from the three research questions addressed within the study. Lastly, Chapter 5 provides a summary of the important findings and addresses both limitations of the current study, as well as implications for future research.

**Statement of Purpose**

Given that a diagnosis of high-functioning autism or Asperger’s Syndrome indicates clinically significant deficits in the area of social interaction, a significant amount of resources have been dedicated to the study of perspective-taking in persons with autism. Primarily, the study of perspective-taking has been dominated by the rubric *Theory of Mind* (ToM), which focuses on teaching the informational states identified as necessary for perspective-taking (Baron-Cohen, Leslie, & Frith, 1985; Howlin, Barnon-Cohen, & Hadwin, 1999). Recently the behavioral perspective, *Relation Frame Theory* (RFT), has developed an alternative form of perspective-taking intervention, which targets the relational counterparts (individual and other events), termed relational frames,
necessary for perspective-taking and may offer an effective alternative in teaching perspective-taking to children with ASD (Hayes, Barnes-Holmes, & Roche, 2001; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004a). The purpose of the current study is to first, evaluate the use of a perspective-taking intervention, which utilizes reinforcement contingencies as a means to alter perspective between I-You, Here-There, and Now-Then relational frames in children with Asperger’s Syndrome. Secondly, the current study will assess whether acquisition of responses will generalize to novel responses.

**Rationale for Current Study**

Within the literature, the relationship between social success and perspective-taking has been high-lighted and noted as a potential reason for social dysfunction in individuals with ASD (Hadwin, Baron-Cohen, Howlin, & Hill, 1997; Heagle & Rehfeldt, 2006; Yirmiya et al., 1992). Over the years, many social skills programs have sought to remediate social skills deficits, including those in perspective-taking, with mixed results (Charlop-Christy & Daneshvar, 2003; Hadwin, Baron-Cohen, Howlin, & Hill, 1996; Hadwin et al., 1997; Heagle & Rehfeldt, 2006; LeBlanc, Coates, Danesvar, Charlop-Christy, Morris, & Lancaster, 2003; Ozonoff & Miller, 1995; Rehfeldt, Dillen, Ziomek, & Kowalchuk, 2007; Swettenham, 1996). A key feature that sets an effective program apart from an ineffective program is one which targets key aspects of social understanding rather than one which concentrates on specific impairments. By targeting a broader class of behaviors that encompass perspective-taking, it is believed that more widespread behavior change will occur (Howlin et al., 1999). In order to affect change on social behavior, the literature focuses on two components, the need for skill acquisition and the need for generalization of learned skills.
There are two theories which have dedicated resources to developing interventions which target aspects of perspective-taking behavior: the well established developmental perspective, *Theory of Mind* (ToM), and more recent behavioral perspective, *Relational Frame Theory* (RFT). Both the developmental and behavioral traditions are invested in developing interventions to establish and improve perspective-taking deficits, particularly in children with ASD. While the same goal is shared, both camps propose the use of different types of interventions. Through ToM, children are taught informational states across various levels of understanding. Meaning multiple scenarios are provided in which a person is taught an informational state, such as two people may see the same object differently. Within the existing ToM literature, many successful belief or false belief interventions which target perspective-taking have been identified and include strategies such as: training tasks using pictures, video modeling, or computer animations (Charlop-Christy & Daneshvar, 2003; Hadwin et al., 1996; Hadwin et al., 1997; Ozonoff & Miller, 1995; Swettenham, 1996). Each of these studies has demonstrated that perspective-taking can be taught to children with ASD, although only a few have shown some generalization to novel tasks or natural settings (Charlop-Christy & Daneshvar, 2003; Feng, Lo, Tsai, & Cartledge, 2008).

RFT, on the other hand, uses a process termed arbitrary applicable relational responding which requires and individual to respond to one event in relation to another event. The pattern of arbitrary applicable relational responding, also called relational frames, identified for perspective-taking are termed deictic relations and consist of: I-You, Here-There, and Now-Then (Hayes et al., 2001). Overall, there is agreement between ToM and RFT. Specifically, ToM tasks involve the relational frames listed
above, although in ToM tasks relational frames are not targeted directly. By targeting relational frames directly through intervention, learning may be more efficient (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001; McHugh et al., 2004a). This notion led to the development of the Barnes-Holmes protocol. The Barnes-Holmes protocol targets each of these relational frames across three levels of relational complexity, simple (8 trials), reversed (36 trials), and double reversed (12 trials) relations. Within each trial the protocol targets the deictic relations and a level of complexity by requiring an individual to use a piece of contextual information (e.g., “If have a red brick and you have a green brick”) to answer two questions (e.g., “Which brick do I have?” and “Which brick do you have?”), with two response options for each question (e.g., red and green). By using multiple exemplar training targeting the relational frames, a child learns to talk about their perspectives in relation to others. For instance, initially an individual can learn that what “I” see “Here” is different from what “You” see “There” (a simple relation). Next, an individual moves to a more complex level, for instance learning how their perspective would change if “I” were “You” and “You” were “me” (a reversed relation). To date, a pair of studies (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007) have demonstrated the utility of using the Barnes-Holmes protocol to train the perspective-taking relational frames to typically developing children. Due to the initial success noted with typically developing children, the proposed benefits of RFT for children with ASD have been discussed (Rehfeldt et al, 2007). Yet, a demonstration of its effectiveness with other populations, including children with ASD, is necessary.

Beyond simply teaching a single set of perspective-taking trials, it is important to consider whether the perspective-taking skills have generalized beyond the learning
context (Stokes & Baer, 1977) and become a functional repertoire of behavior. Often communication and social skills programs, including many developed under ToM, have had initial success in increasing responding to targeted behavior, but are not always able to demonstrate generalization beyond the learning context (Hadwin et al., 1996; Howlin et al., 1999; Ozonoff & Miller, 1995; Swettenham et al., 1996). This is problematic, because perspective-taking is a skill which requires a child to continually respond across various novel circumstances. RFT may be an option for increasing generalization, because the RFT intervention targets perspective-taking by focusing on the relational frames. By training relations using multiple exemplars, it may be possible to set the stage for generalization to novel responses. Preliminary findings with typically developing children indicated that the training used by Heagle and Rehfeldt (2006) utilizing RFT, led to both stimulus and response generalization across all participants. Although using training that simultaneously programs for generalization is promising, this finding requires extension to children with ASD. Specifically, in future research the effect of teaching on generalization to more contextually relevant responses, such as face-to-face social interaction, is important for individuals with ASD. Observing the impact of training on socially relevant behavior is important, because children with high-functioning autism have, (1) greater difficulty with conversational understanding (Yirmiya et al., 1992), and (2) difficulty generalizing beyond the contexts that are targeted within intervention (Hadwin et al., 1996). Generalization of responding to more naturalistic settings following training would help demonstrate acquisition of more contextually relevant perspective-taking ability.
The evolution of the perspective-taking literature demonstrates initial gains in teaching perspective-taking to children with ASD. While the majority of this research has been focused on ToM, the interventions which have targeted these developmental levels of understanding have had limited success in producing generalized responding. Specifically, there has been limited success in producing generalization outside the context targeted within intervention. The emergence of a new perspective, RFT, has identified a new approach to targeting perspective-taking and promoting generalization which may offer a promising alternative to ToM. While RFT has demonstrated potential efficacy with typically developing children, additional research is required to address the utility of these methods with children that have ASD. Specifically, the impact of RFT on children with Asperger’s would be of interest, since many have average intellectual and communicative abilities, but have profound deficits with social interactions.

Research Questions

1. Can children with Asperger’s learn to respond to the relational frames I-You, Here-There, and Now-Then through reinforcement contingencies?

2. If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past?

3. If children with Asperger’s fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?

Definitions of Key Terms
Teaching perspective-taking relational frames: Teaching perspective-taking responses across each level of relational complexity: simple, reversed, and double reversed, which incorporate the perspective-taking relational frames, I-You, Here-There, Now-Then, as noted in the Barnes-Holmes protocol.

Mastery of perspective-taking or response generalization: Defined as reaching the stated criterion performance on a perspective-taking or response generalization protocol, at a given level of complexity, as established by Heagle and Rehfeldt (2006) and Rehfeldt and colleagues (2007).

Trial: Consists of contextual information, two questions, and two response choices for each question. Correct trial responses require a participant to respond correctly to both questions.

Frequently Used Acronyms

Relational Frame Theory: RFT

Theory of Mind: ToM

Autism Spectrum Disorders: ASD
CHAPTER II
LITERATURE REVIEW

The ability to take the perspective of another person is critical to human interaction. Through typical development, social norms and interactions are observed and learned through experiences within a child’s environment (Hurley-Geffner, 1995). Conversely, a child that is diagnosed with an autism spectrum disorder (ASD), does not develop in the same way as a typically developing child (Dawson, 1984). The communication and social distinctions between children with ASD and typically developing children can be vast; even the communicative abilities of children diagnosed along the autism spectrum can be dynamically different (Siegel, Goldstein, & Minshew, 1996). Children who are diagnosed with high-functioning autism or Asperger’s, present with communication deficits which include difficulty using pragmatic or social aspects of language. These deficits in social communication and their impact on social functioning are complex, and if untreated can result in a loss of learning opportunities associated with positive peer relationships (Frea, 1995).

The extent to which communicative deficits can impact the social functioning of a child with ASD, makes social dysfunction one of the most critical defining features of autism. Social dysfunction appears in many forms, such as difficulty appropriately engaging in reciprocal conversation, trouble noticing and interpreting social and emotional cues (Clark, Winkielman, & McIntosh, 2008; Tardif, Laine, Rodriguez, & Gepner, 2007), being over-literal in interpreting a conversational partner, or perseverating on topics of interest regardless of the conversational partner’s interests. These deficits can compound to create problems forming and keeping relationships (Kelly, Garnett,
Attwood, & Peterson, 2008). Unlike a typically developing child who may pick-up intricacies of social interaction through observation and interaction within his or her environment, a child diagnosed with ASD may fail to naturally observe and imitate appropriate social interactions. Instead these children may require more teaching to acquire the same behaviors. Overall, a child with ASD often fails to understand and relate to other people’s points of view. Instead, he may appear to be highly self-centered and unresponsive to other people’s perspectives. This failure to reciprocally relate to others has lead to the belief that perspective-taking may be one of the key features responsible for successful social interactions (Rehfeldt et al., 2007).

Remediating Perspective-taking Deficits

In order to help children with ASD to be more socially successful, a large volume of research has been dedicated to understanding and remediating perspective-taking deficits. Theory of Mind (ToM) comprises the largest portion of perspective-taking research, although other theories, such as Relational Frame Theory (RFT), have also begun to pursue the study of perspective-taking in children with ASD. The objectives of these two theories are similar; however their approaches to perspective-taking remediation are distinct. ToM follows a developmental profile, which outlines the levels of understanding that are believed to be required for perspective-taking. Teaching programs aimed at increasing ToM target the informational states identified as relevant to the developmental profile of perspective-taking (Charlop-Christy & Daneshvar, 2003; Hadwin et al., 1996; Hadwin et al., 1997; Ozonoff & Miller, 1995; Swettenham, 1996). RFT has taken a different approach, maintaining that perspective-taking emerges based on a person’s learning history, and can be targeted by directly teaching relational frames
necessary for perspective-taking (I-You, Here-There, and Now-Then) (Hayes, Fox, Gifford, & Wilson, 2001; Rehfeldt et al., 2007). For example, rather than teaching an informational state, such as a single object may appear different to others, RFT teaches the specific relations themselves, such as what “I” see “here” may be different from what “you” see “there.” Using questions which target the perspective-taking relational frames, an individual is required to change perspective between different references of person (I-You), place (Here-There), and time (Now-Then), with the relational properties remaining the same even if the exact words (such as, “I” or “here”) are substituted for equivalents (e.g., “Sarah” or “the yard”) (Barnes-Holmes, McHugh, Barnes-Holmes, 2004; Heagle & Rehfeldt, 2006). Therefore, through RFT, ToM tasks (described in more detail below) provide opportunities to directly train perspective-taking relational frames, and a person can learn to respond to perspectives of themselves and others across novel situations (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004b). This relationship between ToM and RFT is better illustrated in the following example provided by Barnes-Holmes and colleagues (2004). There are two children sitting across from each other at a table with a picture of a cat between them (a level 2 Theory of Mind task). In this scenario, one child will see the cat right side up; the other child will see the cat upside down. Through this task, ToM is targeting the informational state that objects may appear differently to others. RFT on the other hand, targets the relations frames necessary for perspective-taking; in this case, teaching that if, “I” am “here” the cat is right side up, but to “you,” sitting over “there,” the cat is upside down. In other words, RFT directly targets the relational properties so children can begin to understand their own perspective in relation to others even when presented with novel situations. In the following sections, a more
detailed description of the theories is provided along with a developmental timeline for the emergence of perspective-taking, which further validates the potential utility of RFT in the study of perspective-taking.

**Theory of Mind**

Theory of Mind, the position which historically dominates the study of perspective-taking, is described as the ability to acknowledge and interpret other people’s thoughts, feelings and desires, and to use that information to understand and respond to others in social contexts (Howlin et al., 1999). The initial idea of ToM originated from the Piagetian belief that during early development children are cognitively egocentric, meaning they fail to understand perspectives beyond their own. The term “theory of mind” was introduced in 1978 by Premack and Woodruff in their study of chimpanzees (Flavell, 2004). Not until the early 1980’s did Heinz Wimmer and Josef Perner introduce the first research that led to the modern day *Theory of Mind*. In their 1983 study, Wimmer and Perner used the “unexpected transfer” technique to test children’s understanding of false beliefs (in other words, how a person’s belief about a situation affects their response in that situation), and demonstrated that performance on false beliefs tasks improves with age. In the years to follow, ToM researchers outlined the levels of understanding of informational states that must be learned in order to demonstrate perspective-taking, documented the developmental profile of ToM, and began to test teaching techniques.

**Five levels of understanding**

Howlin et al. (1999) outlined the five levels of understanding children are reported to gain as they move through development: simple visual, complex visual, seeing-leads-to-knowing, actions can be predicted based on knowledge, and actions can
be predicted based on false beliefs. Each of these levels of understanding become increasingly more complex and have been described as the building blocks to perspective-taking. Specifically, these levels reflect the assumption made by ToM researchers that before children can begin to understand that people have different beliefs (the highest level of understanding) they need to understand more basic perspective-taking concepts, such as people may see things differently and that people could have different perceptions of a single object (Hadwin et al., 1996). The developmental progression of these levels of understanding has been documented in typically developing children, and in situations where deficiencies in ToM have been demonstrated, notably in children with ASD, the levels of understanding have been targeted for intervention.

(1) Simple visual perspective-taking. Simple visual perspective-taking is the understanding that different people see things differently. A child’s simple visual understanding emerges between 2 ½ and 3 ½ years of age (Flavell, Shipstead, & Croft, 1978; Flavell, Abrahams Everett, Croft, & Flavell, 1981; Flavell, Flavell, Green, & Wilcox, 1981), and typically has been assessed by having two children sit across from each other. A two-sided card is held up between them and there is a different picture on each side of the card. In this basic level of understanding, a child who has simple visual perspective-taking is able to relay both what he or she can see and what the other child can see.

(2) Complex visual understanding. A slightly more difficult level of perspective-taking is termed complex visual understanding and is the ability to understand that a single object may appear different to others. By age 4 ½ to 5 ½, typically developing children are able to understand that a single object viewed by two different people who
are sitting at different vantage points, will appear different to each person (Flavell et al., 1981).

(3) *Seeing-leads-to-knowing.* Seeing-leads-to-knowing, means that a child understands that access to information leads to understanding, and in typically developing children emerges between 3 and 4 years old (Pratt & Bryant, 1990). In order to demonstrate this level of understanding, a child must be able to recognize that when presented with something like a closed box, he does not know what is inside, but another child who saw what was in the box will know what is in the box.

(4) *Understanding that knowledge can lead to predictions about actions.* Level four, understanding that knowledge can lead to predictions about actions, further extends on the informational state of seeing-leads-to-knowing. In this slightly more complex level, when given a scenario where an object is located in two places, a typically developing child around 3 to 4 years of age (Wellman & Bartsch, 1988) is able to understand that a person searching for an object will seek it out in the location they last saw it. In other words a person’s previous knowledge about an object’s location affects the person’s actions.

(5) *Knowledge and actions can be predicted based on false beliefs.* The highest level of understanding, knowledge and actions can be predicted based on false belief, is believed to be the final critical component to understanding. This level of understanding requires that children recognize that prior knowledge can lead to true beliefs or false beliefs and develops between 4 and 6 years of age (Perner, Leekam, & Wimmer, 1987; Wellman, Cross, & Watson, 2001; Wimmer & Perner, 1983). Overall, a typical assessment for understanding of belief is an unexpected contents task, where the child is
presented with a toolbox and asked to guess what is inside. Children will often guess tools, however the box may be filled with fishing tackle and without looking first, his or her false belief about what is in the toolbox dictates their response.

While typically developing children often follow the developmental profile outlined above, with the most significant growth occurring in the preschool years (Wellman et al., 2001), children with ASD often fail to acquire some or all levels of ToM and therefore have difficulty socially relating to others (Baron-Cohen et al., 1985; Baron-Cohen, 1991). To remediate perspective-taking understanding that has not occurred along a typical developmental timeline, ToM researchers have tested teaching techniques to target these specific levels of understanding. Hadwin and colleagues, in both their 1996 and 1997 studies attempted to teach belief understanding to children with ASD using a brief intervention. Each child’s current level of understanding was assessed (ranging from level one to level five) and intervention began at the first level where errors occurred (with the majority of participants beginning teaching at level 2, complex visual understanding). The intervention consisted of using a question-answer procedure to teach each level, which consisted first of asking a question, targeting the level being assessed (e.g., placing a card in front of the child and asking, “What can you see?”, “What can I see?”). Next, if an error occurred, feedback was provided (e.g., “You can see the pen, can't you? The pen is on your side of the card… But look! What is on my side of the card? What can I see?...”), and finally, a statement was made by the teacher concerning the general principle being targeted (e.g., “people do not always see the same things…”). Results indicated that children with autism were able to pass higher levels of understanding than were present at initial pretest, both immediately following teaching
and at a two month follow-up. Despite the learning that occurred following teaching, responding did not generalize. Specifically, neither spontaneous play behaviors (Hadwin et al., 1996) nor social communication (Hadwin et al., 1997) increased in children with autism following teaching.

Within ToM, perspective-taking is only said to have developed when mastery occurs across all five levels (Hadwin et al., 1996; Hadwin et al., 1997). The lack of generalization to tasks that were not contextually similar to the teaching has resulted in speculation within the researchers themselves, that actual acquisition of the perspective-taking concepts by children with ASD has not occurred. While ToM researchers continue to work on issues of generalization, an emerging research base using RFT is developing that offers an alternative behavioral account of perspective-taking. RFT intervenes to remediate perspective-taking deficits by targeting the relational frames associated with understanding. By focusing on the components of perspective-taking that are present across environmental situations and tasks, RFT may offer a more effective way to teach perspective-taking and promote generalization.

*Relational Frame Theory*

Researchers within behavior analysis have become increasingly interested in the topic of perspective-taking (Hayes et al., 2001; Heagle & Rehfeldt, 2006; McHugh et al., 2004; Rehfeldt et al., 2007). Although ToM research follows a developmental profile, the study of perspective-taking within a behavior-analytic framework was first derived from the study of stimulus equivalence (Hayes et al., 2001). Within a typical stimulus equivalence framework, derived relational responding refers to the stimulus relation which is not explicitly trained but is instead, derived based on other acquired stimulus
relations (Sidman, 1990). For example, if a child is taught that the word “peace” can be matched to a peace sign (]byte and simultaneously learns that that the word “peace” and holding up your pointer finger and middle finger are also equivalent, then without further training the child should derive that the peace sign and holding up your pointer finger and middle finger are also the same. In recent years, researchers have taken the concept of derived relational responding and applied it to the exploration of language and cognition (Hayes et al., 2001). Relational Frame Theory (RFT), described by Hayes and colleagues as modern behavioral account of human language and cognition (2001), is the direct result of this movement.

Within RFT, the term *relational frame* was coined to refer to particular types of relational responding which have moved beyond the terms reflexivity, symmetry, and transitivity used to describe equivalence relations. Instead, stimulus equivalence is considered a relational frame of coordination (Barnes-Holmes, Barnes-Holmes, Smeets, Cullinan, & Leader, 2004). Hence, two new terms were created to describe the complex relationships within relational frames: mutual entailment and combinatorial entailment (Barnes-Holmes et al., 2004; Hayes et al., 2001). First, mutual entailment refers to both symmetrical (e.g., A=B and B=A) and nonsymmetrical responding (e.g., A>B and B<A) and secondly, combinatorial entailment refers to transitive (e.g., A=B, B=C, C=A) and nontransitive responding (e.g., A is opposite of B, B is opposite of C, and A and C are the same). Thus far, RFT has identified multiple relational frames to describe particular patterns of arbitrarily applicable relational responding, such as coordination, opposition, distinction, comparison, hierarchy, and perspective-taking (Hayes et al., 2001). Under current review are the three relational frames which have been associated with
perspective-taking and they are termed deictic relations. A deictic relation is one that specifies the relation in terms of the perspective of the speaker, and they consist of: I-You, Here-There, and Now-Then relations. Deictic relations are unique to other families of relations since the physical or formal features of the environment are unimportant. Instead, deictic relations emerge due to the history of responding where only the relational counterparts are consistent (Hayes et al., 2001; McHugh et al., 2007). Therefore, RFT has the potential to be helpful for a child with ASD, because if you can teach him or her the relational counterparts of an interaction, his or her responding should maintain and occur in the presence of novel stimuli.

In order to reach the point where a person can deduce the perspectives of one self and others, “a strong relational repertoire and a history of multiple exemplar training is necessary” (Heagle & Rehfeldt, 2006). Training can occur naturally through a child’s development, where children are reinforced in their natural environment for responding to questions such as, “What would you do if you were me?” For children with ASD, these associations do not come naturally and may require remediation. RFT promotes targeting these frames directly as a means to more effectively establish perspective-taking (Barnes-Homes, Barnes-Holmes, & McHugh, 2004). These investigators have attempted to target these relations by using multiple exemplars that utilize the three perspective-taking frames (McHugh et al., 2004a; Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007).

**Barnes-Holmes Protocol**

In order to analyze perspective-taking performance in reference to the three relational frames, I-You, Here-There, and Now-Then, Yvonne Barnes-Holmes developed a tool termed the Barnes-Holmes protocol. The original protocol was lengthy and
contained 256 trials. Modifications were made to the protocol by McHugh and colleagues (2004a), by shortening the length of the protocol, in order to make the measure accessible to both adults and children. The modified version of the Barnes-Holmes protocol contains 62 trials based on the three perspective-taking frames, as well as three levels of complexity: simple, reversed, and double reversed relations.

**Simple relations.** The first level of complexity, simple relations, is comprised of three trial types (simple I-You, simple Here-There, and simple Now-Then). Each of the trials tests the relation between each of the trial types. For example, in a simple I-You relation a person would be told, “I have a red brick and you have a green brick.” Next, he or she would be asked, “Which brick do I have?” and “Which brick do you have?” Similar types of trials are presented which assess Here-There and Now-Then simple relations using the same format (examples of each type of simple relation can be found in Table 1).

**Reversed relations.** Reversed relations also test the relation between three trial types (reversed I-You, reversed Here-There, and reversed Now-Then). For example, in a reversed I-You relation a person would be told, “I have a red brick and you have a green brick. If I were you and you were me, “Which brick would I have?” and “Which brick would you have?” with the correct responses being, “Green” and “Red” respectively. Reversed relations require that a person actually take the perspective of another person and often result in greater difficulty and thus lower performance than simple relations (McHugh et al., 2004a).

**Double reversed relations.** Within double reversed relations, only two trial types are present (I-You/Here-There double reversals and Here-There/Now-Then double
reversals). For example, a person would be told, “I am sitting here on the blue chair and
you are sitting there on the black chair. If I were you and you were me and if here was
there and there was here.” Next, they would be asked, “Where would I be sitting?” and
“Where would you be sitting?” In this case, a correct response would be, “blue chair’ and
“black chair” respectively, thus each person ends up being where they started.

With all of these relational trials (for simple, reversed and double reversed
relations) a persons’ answers are only correct if they are able to answer both questions
within the trial accurately. As a whole, RFT views perspective-taking as a generalized
response class through which derived relational responding plays an integral role
(Barnes-Holmes et al., 2004; Hayes, Barnes-Holmes, & Roche, 2001). In other words by
teaching specific types of contextual relations (e.g., I have a red brick and you have a
green brick; Which brick do I have?; Which brick do you have?) novel untaught
responses have been demonstrated to emerge (Heagle & Rehfeldt, 2006).

This protocol has been evaluated and modified across multiple studies and
frequently administered to typically developing individuals (Heagle & Rehfeldt, 2006;
McHugh et al., 2004a; Rehfeldt et al., 2007). Performance by typically developing
children on relational responding tasks appears to corroborate the existing ToM research
on the emergence of perspective-taking. McHugh and colleagues (2004a) used the
Barnes-Holmes protocol (primarily targeting skills associated with levels one through
three of traditional ToM tasks) delivered in a conversational format to typically
developing children in three different age ranges: 3-5, 6-8, and 9-11 years old. Results
indicated that a significant difference was present across age groups. Children that were
3-5 years old had the highest number of errors, children between the ages of 6-8 and 9-11
had no significant difference in number of errors. These results help confirm that the responses targeted in RFT tasks are indeed targeting aspects of perspective-taking, and in typically developing children appear to follow the same developmental profile established by ToM. Additional preliminary research also indicates that RFT tasks which target the fourth and fifth levels of understanding, as well as deception, follow a similar developmental profile to ToM, where the number of errors decreases as a function of age (McHugh et al., 2004b; McHugh, Barnes-Holmes, Barnes-Holmes, Stewart, & Dymond, 2007).

Researchers have only begun to use the Barnes-Holmes protocol, an automated version, as a training protocol. Heagle and Rehfeldt administered the protocol to typically developing children between the ages of 6 and 11 to teach simple, reversed, and double reversed relations. Results indicated that the protocol was able to alter perspective-taking frames through contact with reinforcement contingencies, across all levels of complexity (2006). Additionally, Rehfeldt and colleagues (2007) administered the automated Barnes-Holmes protocol to a 9 year old boy and a 10 years old girl. Results were consistent with the previous study, and indicated that training was able to increase performance to criterion levels. While positive outcomes have been witnessed in typically developing children, the protocol has yet to be used with populations that require remediation of perspective-taking abilities, such as children with ASD.

Evaluating Perspective-taking in Children with ASD

Rehfeldt and colleagues examined whether children with ASD exhibited greater relational learning deficits than typically developing matched peers. Results indicated that children between the ages of 6 and 14, who were matched on age, demonstrated
relational learning differences with the largest discrepancy occurring with reversed relations. Participants with ASD had much higher error rates on reversed relations than typically developing participants (2007). The perspective-taking deficit still present in children with ASD between 6 and 14 years old, also reiterates the need for remediation of perspective-taking skills generally established by age 6 in most typically developing children.

*Effect of Motivation on Skill Acquisition in Children with ASD*

Interventions that successfully teach children with ASD are often highly specialized and incorporate motivational variables specific to the individual child. Interventions that are not specialized and use generic rewards or components may fail to induce high levels of on task behavior, high frequency of responses, or high levels of accurate responding. Use of generic rewards may also lead to a failure to minimize disruptive behaviors that can get in the way of learning (Newman, Needelman, Reinecke, & Robek, 2002). While skill acquisition is extremely important and is the primary focus in the perspective-taking literature, research has demonstrated that motivation plays an integral role in both skill acquisition and the emission of behavior in children with ASD. In general, children with ASD often appear highly unmotivated or seek to avoid complex social and task stimuli (Koegel, Koegel, & McNerney, 2001; Koegel, Dyer, & Bell, 1987) and a number of antecedent variables have been demonstrated to increase responding. The antecedent variables include but are not limited to providing choice, task variation, reinforcing an attempt at appropriate behavior, and using direct and natural reinforcers.

Some studies also support the use of obsessive behaviors or interests as rewards
for emitting appropriate behavior (Baker, 2000; Baker, Koegel, & Koegel, 1998). Using obsessive behaviors or interests as reinforcers helps ensure that high quality reinforcers are being used, and does not increase the frequency of obsessive behaviors. In children with Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS), using circumscribed interests (CI, defined as, “interests or preoccupations of individuals with ASD that become unusual in their intensity and/or focus”) resulted in a higher percentage of social interactions than using less preferred items (Boyd, Conroy, Mancil, Nakao & Alter, 2007). Additionally, in children with high-functioning autism, access to CI has also been noted to substantially influence both independent interactions as well as interactions with family, peers, and other adults (Klin, Danovitch, Merz, & Volkmar, 2007).

The manipulation of motivational variables has been demonstrated to increase performance on targeted tasks (Koegel, O’Dell, & Koegel, 1987) as well as to promote generalization and maintenance of high levels of responding (Koegel & Egel, 1979). This is important because, “…it is not simply the acquisition of multiple skills that we seek, but rather the harder to obtain social motivation that transforms skills into human attachment” (Carr, 2007). Due to the influence that motivational variables can play on responding and acquisition of skills, it is important to take them into consideration when planning for intervention. Specifically, when working with children with ASD, individualization of motivational variables may be the key between a successful and an unsuccessful intervention.

Generalization of Acquired Skills

Generalization of acquired skills to novel stimuli or contexts is essential to maximize learning. Over the past several decades the importance of planning for and
measuring generalization, stressed by Stokes and Baer (1977), has been widely accepted. Nonetheless, successful generalization still plagues researchers today. Many studies which have targeted various social skills, including perspective-taking, have failed to generalize acquired behavior to novel settings, people, or responses. RFT targets perspective-taking skills through training relational frames using multiple exemplars. Following an extensive history of responding to such exemplars, a person is said to learn how to abstract their perspective and the perspective of others (Hayes et al., 1999). While perspective-taking may include the specific words that are similar to the relational frames being targeted (e.g., “I”, “You”, “Here”, etc), RFT suggests that the properties needed for perspective-taking are present even in the presence of functionally equivalent words (e.g., pronouns such as, “Tom” or “her” could replace “I” or “You” and specified locations like “the gym” or “classroom” could replace “Here” or “There”). For example, “you were there and I was here” can be replaced with substitute words that serve the same contextual function, “Fred was at the house and I was in the yard.” Overall, RFT stresses the importance of generalized relational activity rather than the words themselves (McHugh et al., 2004b).

To date, the applied research indicating the quantity and type of exemplars needed to train for generalization of skills is minimal. Heagle and Rehfeldt (2006) were the first to test for generalization and observed both stimulus and response generalization across each of their three participants. Multiple exemplar training was presented using the Barnes-Holmes protocol described above, which presented all possible combinations of the three types of perspective-taking relational frames across three levels of complexity. While Heagle and Rehfeldt (2006) provided preliminary results that indicted success in
generalization with typically developing children, further research is needed to determine if the training would be equally successful for children with ASD.

Research Implications

The struggle to identify effective interventions to remediate the profound social deficits in children with ASD has been the focus of research for many years. Without appropriate interventions, children with ASD may have difficulty functioning in daily life. Specifically, children with high-functioning autism or Asperger’s syndrome may present with more subtle deficits, yet problems such as failure to understand the perspective of others can greatly impact their ability to make and keep relationships, thus affecting them throughout their lifetime.

Historically, the study and treatment of perspective-taking deficits has fallen to the developmental perspective, Theory of Mind. While the levels of perspective-taking understanding outlined under ToM mind has offered insight into the increasingly complex levels of perspective-taking, there is a new approach which appears promising. Preliminary findings suggest that the behavioral based perspective, RFT, may offer new insights into the development of a perspective-taking repertoire of behavior by directly targeting the relations necessary for perspective-taking.

Only recently has RFT sought to use the Barnes-Holmes protocol as a means to train perspective-taking relations. To date, the treatment protocol has only been administered to typically developing children, although many RFT researchers have touted the proposed benefits in the remediation of perspective-taking deficits, specifically for children with ASD. Currently, research is needed to extend the current findings beyond typically developing children to those with identified perspective-taking deficits.
Specifically, the potential utility of using the existing Barnes-Holmes protocol to teach perspective-taking to children with ASD, needs to be evaluated.

Research Questions

1. Can children with Asperger’s learn to respond to the relational frames I-You, Here-There, Now-Then through reinforcement contingencies?

2. If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past?

3. If children with Asperger’s fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?
CHAPTER III

METHODS

The current study used the methods described below to address the following research questions, 1) Can children with Asperger’s learn to respond to the relational frames I-You, Here-There, Now-Then through reinforcement contingencies, 2) If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past, 3) If children with Asperger’s fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?

Participants

Five children, all diagnosed with Asperger’s by a medical or psychological professional, were consented to participate in the current study. The project was promoted in a flyer that was emailed and provided on site to parents whose children were between the ages of eight and ten years old, and who participated in programming at a private center for children with autism in the Midwest. No compensation was provided for participation in the study. Each of the participants recruited was a Caucasian male, and at the time of recruitment: Manuel was 9 years 11 months old, Curtis was 10 years 2 months, Cole was 9 years 10 months old, James was 10 years 1 months, and Connor was 10 years 7 months.

Screening

Each of the consented participants were required to complete five prescreening measures before qualifying for participation: (1) a diagnosis of Asperger’s by medical or
psychology professional, (2) parental report that their child minimally read at an eight year old or second grade level, (3) scores on the passage comprehension and oral comprehension subtests for the Woodcock-Johnson® III, Test of Achievement, reached normal range or above for age eight, (4) an ability to read and respond to practice trials, and (5) a score of 60% accuracy or less on the reversed relations pretest.

Screening confirmed that all five participants had obtained a medical diagnosis of Asperger’s and could minimally read at an eight year old or second grade level (as confirmed by parent or guardian). Each participant completed the passage comprehension and oral comprehension subtests of the WJ-III. Table 2 contains scores for each of the participants. All participants reached inclusion criteria on both the passage and oral subsets (meaning scores on the passage comprehension were greater than or equal to 25 and scores on oral comprehension were greater than or equal to 15 correct responses). Results indicated each participant could comprehend written and oral passages at or above their age level with average passage comprehension equaling 32.2 and average oral comprehension equaling 24.6.

Three computerized practice trials were administered to verify each participant’s ability to read and understand the tasks that were required of them. All five participants were able to complete the practice trials with 100% accuracy and only one participant (Manuel) required the error correction procedure. Additional detail concerning content and administration of practice trials can be found in the following sections.

The final inclusionary criterion was a score less than or equal to 60% accuracy on the reversed relations pretest. Participants who scored with greater than 60% accuracy on the reversed relations perspective-taking pretest were excluded from the remainder of the
study. Therefore, following pretesting for reversed relations both James and Connor were dismissed from the study by scoring 91 and 89%, respectively. Following all prescreening measures, only three of the five consented participants (Manuel, Curtis, and Cole) were eligible for participation.

Setting and Apparatus

All sessions were conducted in a quiet curriculum room, separated from other programmed activities, located at a private center for children with autism. Each room contained a table and chairs where the participant and experimenter(s) completed each activity.

Screening for reading and oral language comprehension

Participants’ reading comprehension and oral comprehension were evaluated using the Woodcock-Johnson® III, Test of Achievement (WJ-III). The WJ-III is a comprehensive set of norm-referenced tests used to measure general intellectual and academic ability across multiple skill sets.

Experimental protocols for perspective-taking and response generalization

The revised version of the Barnes-Holmes perspective-taking protocol (McHugh et al, 2004; Heagle & Rehfeldt, 2006; Rehfeldt et al, 2007) was used in this study in conjunction with the response generalization protocol developed by Heagle and Rehfeldt (2006). The Barnes-Holmes perspective-taking and training protocol consists of 56 total trials and the questions for the perspective-taking protocol are listed in Table 1. The response generalization protocol contains 24 total trials consisting of real world conversational topics (Table 3) for example, “I have a hamburger and you have a grilled
cheese.” For a detailed explanation of the number and types of trials within each protocol see Table 4.

*Perspective-taking pretest, probe and posttest trials.* A laptop computer controlled trial presentation and recorded participant responses for the perspective-taking protocols using Microsoft® PowerPoint® macros controlled by Microsoft® Visual Basic Editor® (Heagle & Rehfeldt, 2006; Rehfeldt et al, 2007). The three levels of perspective-taking complexity (simple, reversed, and double reversed relations) were each assessed separately using computer presentation. Throughout the computer program, the text location remained the same across simple, reversed, and double reversed sessions, but the background color on the slides varied between grey, green, and blue, respectively. At the start of each session, regardless of level, a screen was presented with a single grey box in the center of the screen. The grey box contained the word “Click to Start” in black letters. The researcher clicked the center button, entered participant ID, and tipped the laptop screen downward. The laptop was then placed in front of the participant and he was told to open the screen when he was ready to begin. Upon opening the screen, the participant was presented with the first of the trials, on either the simple, reversed, or double reversed perspective-taking protocol (8 simple trials, 36 reversed trials, 12 double reversed trials). The trials within each of the three protocols were consistent with those found in the Barnes-Holmes protocol, but were randomly ordered. Each trial page consisted of a full sized color background, consistent with the level being assessed (grey, green or blue) and a statement containing relational information typed in black at the top of the screen. Below the text containing relational information were two white boxes in the middle of the screen, one stacked on top of the other. The upper box was labeled
Question 1, and the lower box was labeled Question 2. Within each white box were questions printed in black ink and below each question were two grey button boxes, side by side, that contained possible answers to the question above. All trials throughout the experiment followed this format and contained a statement, two questions, and four possible response choices (two choices for each question). An example of a trial page at each level of complexity can be seen in Figure 1.

At the presentation of a trial page, both question one and question two were visible. Once the participant responded to the second question, the program automatically progressed to the next trial page. The participant continued through each trial page until all of the trials within the given protocol were complete. Following the final trial page, a full color screen immediately appeared containing a large blue box with yellow stars in the center that read, ”Great Job! You are finished.”

Additionally, a binomial expansion was used to calculate the 95% confidence interval for chance performance on the simple, reversed, and double reversed perspective-taking protocols. The 95% confidence interval for chance performance for the perspective-taking protocols were: simple (8 trials) included performance from 13% correct to 88% correct, reversed (36 trials) with performance from 36% correct to 64% correct, and double reversed (12 trials) including performance from 25% correct to 75% correct.

*Response generalization pretest, probe and posttest trials.* The principal investigator used a script to deliver the three levels (simple, reversed, and double reversed) of the response generalization protocol in a conversational format with the participant (the protocols can be found in Table 3 and the script can be found in
APPENDIX A). All relational statements and questions follow the same format as the perspective-taking trials, but the response generalization trials contained more socially relevant content and were delivered orally rather than on the computer.

A binomial expansion was also used to calculate the 95% confidence interval for chance performance on the simple, reversed, and double reversed response generalization protocols. The 95% confidence interval for chance performance on the 8 trial response generalization protocols (simple, reversed, and double reversed) included performance from 13% correct to 88% correct.

*Modified perspective-taking and response generalization posttests.* Modified versions of the perspective-taking and response generalization posttests were also administered. The protocol content remained the same, both for the modified perspective-taking and response generalization posttest. Only a performance contingency, scoring seven out of eight correct, was added to the posttests. Reaching the performance contingency resulted in earning a break before the next task.

*Perspective-taking training trials.* Training trials consisted of an automated presentation of each level within the perspective-taking protocol in a format similar to the one used for the perspective-taking pretest, probe, and posttest trials. While both the visual appearance and content of the protocol remained the same, the distinguishing feature of training trials was an additional screen presented after correct and incorrect trial responses. Following a participant’s correct trial response, a 3-sec animated clip was automatically presented. The clip acted simply as reward for answering correctly and carried no explicit feedback about the correct answer. If a participant completed a trial incorrectly (i.e., one or both questions within a trial were answered incorrectly), a screen
appeared which read, “Try Again” and the trial was repeated until the correct answers were selected. Following the final trial page, a full color screen immediately appeared, containing a large blue box with yellow stars in the center that read, ”Great Job! You are finished.”

*Modified perspective-taking training trials.* Two individualized modifications were made to the training protocol. The first training modification, contingent reward, consisted of altering the perspective-taking training program so the 3-sec automated clips were only available if the participant answered the two questions with a trial correctly on the first attempt. If the participant failed to answer both questions within a trial correctly on the first attempt, they were presented with a screen that read, “Try Again” and the trial page was presented repeatedly until the correct responses were made. At the point when correct responses were selected, the program immediately progressed to the next trial rather than presenting an animated clip. The program continued through each trial until the final trial page was completed, at which point a full color screen immediately appeared containing a large blue box with yellow stars in the center that read, ”Great Job! You are finished.”

The second training modification, oral presentation, consisted of delivering the perspective-taking training orally rather than on the computer. Therefore, the content of oral presentation training was consistent with the previous training; the only distinction was that content delivery and response feedback was done orally by the experimenter rather than on the computer.

*Procedures*

*Breaks and rewards during screening and experimental protocols*
Following each activity during pre-screening and experimental sessions, participants were allowed to select from the following: 1) a small prize, such as piece of candy or a small toy (e.g., starburst, pen, matchbox car, etc.), 2) complete part of an activity sheet (e.g., word find, hidden picture, etc.), or 3) play a portion of a game with the experimenter, which lasted a minute or two (e.g., a few turns in a war card game, Monopoly®, etc.). The duration of break time or amount of reward did not vary upon length of activity, although upon completion of an entire work session, the participant did have access to a higher quality reward such as a Pokémon® or Yu-Gi-Oh® trading card or a longer activity time. Also, as both feedback and a reward during computerized perspective-taking training, a variety of 3-sec animated clips were used, with one 3-sec animated clip being presented following each correct trial response.

These breaks and rewards were sufficient to maintain responding for all but one participant (Manuel). The contingencies within the training program (e.g., 3-sec animated clips), as well as standard breaks or rewards for completing each session, did not maintain on-task behavior for Manuel. In the presence of the original contingencies, high levels of complaints (e.g., “this is pointless”, sighing, and laying his head on the table), as well as termination of sessions occurred. Based on anecdotal observations and a conversation with Manuel, additional contingencies were added during training for reversed relations, following an escalation in problem behavior. The additional contingencies consisted of 1) providing a choice between a short break now or longer break later (breaks consisted of taking a designated number of turns in an ongoing game of Monopoly®), and 2) higher quality reinforcers for task competition (receiving 1 Yu-Gi-
trading card per completed activity, and an additional card for working the entire session). The new contingencies successfully decreased complaining and work termination.

**Practice trials**

Three computerized practice trials were administered to verify each participant’s understanding of the tasks that were required of them. Practice trials were presented in an identical format to the computerized perspective-taking trials within the study, but the content was not repeated within the study. For example, in the practice trial, the text at the top of the screen read, “If the sky is yellow and the sun is blue,” the two boxes labeled Question 1 and Question 2 read, “What color is the sky?” and “What color is the sun?” respectively. Beneath each question were two grey button boxes, side by side, which read “yellow” and “blue.” The order of these button boxes was random. During the practice trials, the experimenter instructed the participants that when a screen was presented, they should first read the information at the top of the screen and use that information to answer the two questions below. Participants were told that to answer the questions, they should click one of the two boxes below each question, but they should always answer question one before question two. Next, the experimenter opened the first practice trial for the participant and oriented him to the text, questions, and available answers. For each of the practice trials, participants were required to read the text, questions, and selected answers aloud to the experimenter. A trial was scored as correct across practice trials, and all other trials within the study, when both questions within the trial were answered correctly. For example, in reference to the practice question above, the trial would be marked correct if the participant was able to correctly answer, both
“What color is the sun?” and “What color is the sky?” A trial was scored as incorrect when either of the questions within a given trial was answered incorrectly. Any participant unable to read through the practice trials accurately would have been dismissed from the study immediately, although that was not an issue in the current study. A participant who was unable to answer both questions correctly within any of the three practice trials was prompted through a paper pencil question using an error correction procedure (the question and procedure can be found in Appendix A). Once the error correction procedure was completed, the participant was again presented with the computerized practice trials. If the participant completed all three trials correctly, they moved on to the next task (pretesting across simple, reversed and double reversed relations); if they were unable to complete the practice trials accurately following error correction they were dismissed from the study. All participants were able to complete the practice trials.

Pre-test procedures for perspective-taking and response generalization

Perspective-taking and response generalization pretests were conducted sequentially on the three relational complexities (simple, reversed and double reversed) and procedures closely followed those used by Heagle and Rehfeldt (2006) and Rehfeldt et al. (2007).

Simple perspective-taking and response generalization pretests. First, participants were assessed on simple relations (a visual representation of the entire simple relations testing procedure can be found in Figure 2). The simple relations pretests consisted of completing the perspective-taking and response generalization protocols described above. Each protocol was administered one at a time, and took approximately three minutes and
five minutes, respectively. Participants were allowed to work through each protocol without time constraints, so completion rates varied.

During perspective-taking pretesting, participants were seated at a table in a small curriculum room in front of a laptop computer. Prior to beginning assessment, the experimenter explained that all the information necessary to do the activity would be available on the screen, and that the participant should simply follow the instructions. The experimenter clarified that assistance could be requested if necessary throughout the activity, but the experimenter would be unable to answer any specific question within the activity for the participant. If the participant asked a specific question during the activity, the experimenter simply replied, “Answer the question the best you can.”

At the beginning of the study, the experimenter provided more explicit instructions. The instructions given are consistent with procedures designed by McHugh et al. (2004) and were delivered as follows:

“Each computer screen presents a task. Your job is to read the information at the top of each screen and try to answer the questions using the choices available to you on the screen. You should use the mouse to click on what you think is the correct choice for question 1, and then click on what you think is the correct choice for question 2. Always make sure to answer question 1 before you answer question 2. After you answer question 2 the computer will present the next task immediately. Do your very best to answer each question correctly and the computer will let you know when all the tasks are done. You can ask questions if you have them, but I will not be able to answer specific questions for you. If I cannot help you with your question just answer the best you can. If you get tired while you are working let me know and we will take a short break. Do you understand what I am asking you to do? Do you have any questions?”

Following the instructions, the experimenter verified the participant was ready to begin the task, and requested that when he was ready he should open the computer screen and begin working through the questions. The experimenter sat on a chair located in the
room a few feet away from the participant and directed her attention toward an alternative activity. The first screen the participant saw contained the first trial within the simple relations perspective-taking protocol. Periodically throughout the activity, in order to ensure that the participant could read each of the trials, the experimenter asked the participant to read a trial out loud. After the participant completed the final trial a “Thank You” screen appeared. Then, the participant then received a short break or chose a small prize. Each participant worked for no more than 50 minutes and based on the time remaining, the experimenter either asked the participant to complete another activity or the participant was dismissed for the day. In the event that a participant requested to end a task prematurely, he was first asked if he would like to finish the current task so he could earn an activity or prize for completing the entire task. If a participant again confirmed he would like to end the task, the participant was allowed to stop, and the session was terminated until the next scheduled meeting. Within the study a session was ended early but, the participant completed the task before ending the work session.

Following the simple perspective-taking pretest, participants completed the simple relations response generalization pretest with the experimenter. The participant and experimenter sat in chairs at the table. The response generalization pretest was delivered in a conversational format in which the experimenter read each trial a loud and the participant responded verbally to the experimenter. The experimenter provided no feedback regarding response accuracy but noncontingent praise, unrelated to the trials, was delivered (e.g., “You are really staying focused, I am so impressed.”). After the simple response generalization pretest was complete, the participant chose a reward. Depending on the time available, either the experimenter asked the participant to
complete another activity or the participant was dismissed for the day. In the event that a participant requested to end a task, he was reminded that he must finish the activity to earn his reward, and if the desire for session termination was confirmed, the session was ended until the next scheduled meeting. None of the participants ever terminated a session in the middle of a task, although on one occasion a session was terminated early.

Reversed perspective-taking and response generalization pretests. Following the simple relations pretests (perspective-taking and response generalization), the participants were given the reversed perspective-taking (12 min) and response generalization (5 min) pretests using the same procedures described above (a visual representation of the entire reversed relations testing procedure can be found in Figure 3). First, the reversed perspective-taking pretest was delivered. Participants who completed the reversed perspective-taking pretest with less than 60% accuracy were given a choice of reward, then presented with the reversed response generalization pretest, and subsequently continued through the duration of the study. Participants who scored with greater than 60% accuracy on the reversed relations perspective-taking pretest were excluded from the remainder of the study, as previously described.

Double reversed perspective-taking and response generalization pretests. Following completion of the simple and reversed relations pretests, the double reversed relations pretests were administered. The double reversed perspective-taking and response generalization measures each took approximately five minutes to complete and were administered following the procedures described above (Figure 3 also outlines the entire double reversed testing procedure).

Mastery of each level of perspective-taking complexity
After pretesting was completed across all levels of complexity (simple, reversed, and double reversed relations), each level of relational complexity was evaluated to determine if mastery had been reached or if training was required. Previous research has established that 88 percent accuracy can be interpreted as mastery of simple relations and 90 percent accuracy can be interpreted as mastery of reversed and double reversed relations (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007). To remain consistent with previous research these mastery criterion were retained, therefore a participant who reached 88 percent accuracy on the simple relations perspective-taking pretest (7/8 correct), or 90 percent accurate on reversed (33/36 correct) or double reversed (11/12 correct) perspective-taking pretests were considered to have mastered the respective level of relational complexity. A participant that did not reach mastery level following pretesting would complete one or more training sessions. When calculating percent accuracy, a single trial was marked correct only when both questions within the trial were answered correctly.

In training, the mastery criterion associated with the level of complexity being targeted (either 88 percent for simple relations or 90 percent for reversed and double reversed relations, established by Heagle and Rehfeldt (2006) and Rehfeldt and colleagues (2007), was used to indicate when to administer probes or posttests. For example, if a participant scored with 90 percent accuracy on a single simple relations training session, then the simple relations posttest would be administered. During posttesting, if the participant again scored greater than 88 percent, they were considered to have mastered simple perspective-taking. The exception to the training mastery rule was if two or more consecutive training sessions occurred in which the participant did not
meet criteria or failed to increase accuracy of performance, then treatment effectiveness was evaluated before continuing training. The additional criterion was intended to minimize exposure to unnecessary trials, which were not leading to increased acquisition of perspective-taking relations. Treatment effectiveness was evaluated by calculating the percentage of non-overlapping data (PND) of a given level of complexity. PND refers to the percentage of treatment data that did not overlap with baseline data points, and values can range from 0 to 100 percent. Research has noted that a PND greater than 90 percent indicates a highly effective treatment; a PND between 70 and 90 percent indicates a fair treatment; and, a PND less than 50 percent indicates an ineffective or unstable treatment (Herzinger & Campbell, 2007). If treatment at a given level of complexity was identified as ineffective (a PND value of 50 percent or less), training was terminated and the posttests were administered. Rather than returning to training, the participant was moved on to the next level of complexity as described below.

Criterion performance was also used to indicate whether mastery of perspective-taking relational frames at a given level of complexity would lead to response generalization at the same level of complexity. For simple, reversed, and double reversed relations, a score of 88% accuracy (7/8 correct), as established by Heagle and Rehfeldt (2006), was indicative of a participant’s generalization to untrained responses at a given level.

*Perspective-taking training*

Participants received training for each level of complexity that was not mastered during pretesting, and training procedures were carried out sequentially, moving from least (simple) to most complex (double reversed). For example, a participant who failed
to reach criterion on all three levels of perspective-taking during pretesting would first receive simple relations training, then the procedure would continue until he completed training for reversed, and then double reversed perspective-taking. Training consisted of participants completing the automated versions of the perspective-taking protocols (e.g., simple, reversed, or double reversed perspective-taking) and receiving feedback following correct and incorrect responses. A correct response resulted in a 3-s animated clip and an incorrect response resulted in a screen that said, “Try Again.” If a participant answered a question incorrectly within a trial, the same trial was presented repeatedly until the appropriate answers were selected.

*Probe and posttest procedures for perspective-taking and response generalization*

Throughout training, response generalization for the level being targeted, as well as perspective-taking and response generalization for the other levels of complexity, were monitored using probes. The probes consisted of re-administering the pretest protocols to evaluate any influence the training may have had on other levels of complexity. Based on previous research (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007), typically developing children on average reach mastery of simple relations following one simple relations training session; they master reversed relations following four reversed training sessions; and they master double reversed relations following two double reversed training sessions. Therefore, in the current study probes (perspective-taking and response generalization) were administered consistent with the average mastery levels for typically developing children. For example, a participant who did not reach mastery of simple relations following one simple training session would be probed prior to completing the next simple training session. Specifically, in this case, the participant would be probed on
the simple response generalization protocol, and on the perspective-taking and response generalization protocols for reversed and double reversed relations. The same would be consistent if mastery was not reached for either reversed or double reversed training, except probes would be administered after every fourth reversed training session, and after every third double reversed training session. The probes were delivered in a random sequence throughout the duration of the study. Training sessions (and probes) were repeated until the participant reached mastery for the targeted level of complexity or until PND was calculated and indicated training sessions were ineffective.

Posttesting. After mastery criterion was reached or the treatment was identified as ineffective by calculating PND, the posttests were administered. The posttests consisted of re-administering the pretests, both perspective-taking and response generalization, at each level of complexity. Following posttesting, a participant who reached criterion on the perspective-taking posttest for the level of complexity being targeted was considered to have mastered that level of perspective-taking. Whereas, if a participant did not reach criterion at the targeted level posttest, the training was reinstated following the procedures above, unless the intervention had been demonstrated to be ineffective prior to posttesting (PND less than or equal to 50 percent). Following administration of a final posttest for a given level, the training, probing, and posttesting procedures were continued for the next level of complexity, if necessary.

Modified procedures for non-responders to the training protocol

Participants who completed the perspective-taking training and were unable to master simple, reversed, or double reversed relations were briefly exposed to modified individualized training trials. Only one level of complexity was targeted for each
participant and was identified by selecting the first level of complexity that did not result in mastery using the previous training.

*Modified training.* Each participant’s individual performance was considered in identifying appropriate training modifications, and both Curtis and Cole required individualized modifications. The first training modification, contingent reward, used for both Curtis and Cole, consisted of altering the computerized perspective-taking training programs (simple and reversed respectively), so the 3-sec automated clips were only available if both questions within a trial were answered correctly on the first attempt. If both questions within a trial were not answered correctly on their first attempt, the trial page was presented repeatedly until the correct responses were selected; then following the correct responses, the program automatically progressed to the next trial. This pattern continued until all trials within the targeted protocol (simple or reversed) had been completed.

The second training modification, oral presentation, identified for Cole, consisted of delivering the reversed relations training orally rather than on the computer. The content and procedural delivery was consistent with the original training, as described previously, except the delivery was done orally by the researcher rather than on the computer.

*Modified perspective-taking and response generalization posttests.* Modifications of the posttest contingencies were also considered, on an individual basis. The content and procedures for administering the posttests were not altered; a performance contingency was simply added to the targeted posttest. Cole received no modification of posttesting procedures. Curtis’s performance on the modified training with contingent
reward, led to the application of a performance contingency to the simple relations posttests. The contingency consisted of informing Curtis that in order to earn a break after each posttest (both perspective-taking and response generalization), he would be required to answer at least seven out of eight trials correctly. If Curtis failed to reach the criterion, he was immediately given the next activity within the sequence, or if all activities had been completed, he was allowed to leave for the day. If Curtis met the performance criterion, he was allowed to earn his break or tangible item before moving on to the next activity or leaving for the day.

*Inter-observer Agreement and Fidelity*

From July to November, the primary observer recorded data. In addition, one of three secondary observers collected procedural fidelity on 18 of 62 perspective-taking trials (29%), 22 of 72 response generalization trials (31%), all four modified perspective-taking and response generalization trials (100%), 21 of 48 perspective-taking training trials (44%), and 4 of 8 modified training trials (50%). Reliability was also gathered across participants on trial responses for 22 of 72 response generalization sessions (31%) and all four modified oral training sessions (100%). Reliability was not gathered for perspective-taking and computerized training trials, since the computer scored responses as correct or incorrect independent of the experimenter. Inter-observer agreement (IOA) was calculated by totaling the number of agreements, dividing the total agreements by the number of agreements plus disagreements, and then multiplying by 100 \(\frac{A}{A+D}*100\) within each protocol. An agreement was recorded when each observer agreed on both the response to question one and question two within a given trial. A disagreement was recorded when the observers disagreed on either or both of the responses within a given
trial. The IOA was high across all protocols averaging 99% for response generalization protocols, 94% on modified response generalization protocols, and 100% on modified oral training.

An independent observer recorded procedural fidelity by responding “yes” or “no” to six questions concerning the fidelity of protocol implementation for the perspective-taking probe and training (Appendix B) and the response generalization protocols (Appendix C). Fidelity was calculated by dividing the number of “yes” responses by the number of “yes” plus “no” responses, and then multiplying by 100 \([\frac{Y}{Y+N} \times 100]\). Overall, procedural fidelity was high, reaching 100% for: perspective-taking protocols, response generalization protocols, all perspective-taking training, and modified perspective-taking and response generalization protocols.

**Design**

A multiple-baseline across levels of complexity design was used to assess the effects of the perspective-taking training protocol on the percentage of correct perspective-taking responses on simple, reversed and double reversed relations in three children with Asperger’s. Within each level of complexity, beginning with simple relations, pretest, training, probing and posttests were administered. Training, probing and posttest trials were repeated across each level of complexity until the participant reached the training and posttest criterions (88% accuracy for simple relations and 90% accuracy for reversed and double reversed relations, or until 2 or more data points indicated the intervention was not effective as determined by \(PND \leq .5\)).

Additionally, performance was evaluated on modified training and posttesting procedures for Curtis and Cole. Curtis’s performance on simple perspective-taking
training was evaluated by assessing the impact of contingency changes within the training procedure (A-B-A). Initially, the training was implemented (A), next a modified training, contingent reward, was implemented (B), and subsequently there was a return to the original training (A). Additionally, a performance contingency was added to the simple perspective-taking and response generalization posttests (A-B) to evaluate the addition of performance contingencies on Curtis’s responding. During the first phase, the perspective-taking and response generalization posttests were delivered (A). In the second phase, a performance contingency was added to both the perspective-taking and response generalization posttests (B). Finally, Cole’s performance across the training as compared to two modified training programs, contingent response and oral presentation, was evaluated (A-B-C).
CHAPTER IV

RESULTS

A combination of criteria performance validated via effect size calculations in the form of percentage nonoverlapping data (PND) were used to evaluate the following research questions: 1) Can children with Asperger’s learn to respond to the relational frames I-You, Here-There, Now-Then through reinforcement contingencies, 2) If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past, 3) If children with Asperger’s fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?

Perspective-taking Training

Question 1: Can children with Asperger’s learn to respond to the relational frames I-You, Here-There, Now-Then through reinforcement contingencies?

In the following section, participants’ perspective-taking performance is evaluated individually and as a whole across level of complexity. Figures 4-6 display performance on the perspective-taking trials (open triangle), as well as the perspective-taking training trials (closed triangle) across all levels of relational complexity (simple, reversed and double reversed). Mastery of each level of perspective-taking was based on scores of 88 percent for simple relations and 90 percent for reversed and double reversed relations at final posttest. Additionally, a comparison between participants across each level of responding can be found in Table 5.

Manuel (Figure 4)
Simple relations. At baseline, Manuel demonstrated mastery of simple perspective-taking, reaching 100% accuracy. Given that the criterion for simple relations was met during baseline, no simple relations training was implemented. With continued probing of simple relations throughout training for reversed relations, Manuel maintained 100% accuracy on simple perspective-taking with all responding remaining above chance levels.

Reversed relations. Manuel’s baseline reversed perspective-taking scores equaled 57%, so training for reversed relations was implemented. Following his first two reversed relations training sessions where performance averaged 79% and remained at chance levels, the performance contingencies were modified as noted within the methods section and Manuel was provided longer breaks with a choice component and higher quality rewards. Subsequently, the third training session resulted in 94% accuracy (above chance) and posttesting was administered. The posttest for reversed perspective-taking did not meet criterion, reaching only 83%. Training was reinstated and following two training sessions, Manuel reached or exceeded criterion. Due to a significant lag between sessions, training was administered for a third time upon Manuel’s return to ensure an accurate measure of performance prior to posttesting. His performance on the third training session remained above criterion, 92%, and the posttests were subsequently administered. Upon posttest, Manuel reached criterion on reversed perspective-taking (100%) and maintained performance above chance levels.

Double-reversed relations. While Manuel performed below criterion on double reversed relations at baseline, 83%, a double reversed probe indicated he mastered double reversed relations after the first three reversed training sessions and was responding
above chance. An additional double reversed probe was administered following completion of the reversed relations training. Results indicated he maintained mastery of double reversed relations. The emergence of double reversed responding through training for reversed relations resulted in completion of double reversed relations with no need to implement double reversed training.

*Curtis* (Figure 5)

**Simple relations.** At baseline, Curtis scored only 63% on simple perspective-taking, so simple relations training was initiated. Following seven simple relations training sessions below criterion, which averaged 68%, PND (the percentage of non-overlapping data between performance on simple relations pretest and training) was calculated to determine if termination of simple relations training was appropriate. PND equaled 0.429, indicating the training was ineffective, so simple relations training was terminated and posttests were administered. Posttests for simple perspective-taking remained below criterion, at 63%. Continued probing for simple relations during both reversed and double reversed relations training indicated no increase in accuracy of responding due to reversed or double reversed training. Throughout baseline, training, and posttesting Curtis’s performance remained at chance levels for simple relations.

**Reversed relations.** At baseline Curtis’s performance on reversed relations perspective-taking was 47%. Prior to implementing training for reversed relations, Curtis’s performance on perspective-taking probes for reversed and double reversed relations were evaluated. The probes remained consistent with pretesting values, so it was determined the simple relations training did not impact the two higher levels of relational complexity. A total of 12 reversed relations training sessions were administered,
performance on reversed training was below criterion and averaged 38% accuracy with PND = 0. Posttesting resulted in a slight increase in reversed perspective-taking with accuracy increasing from 47% at baseline, to 64% at posttest, but mastery was not reached. Performance on reversed relations was continually probed throughout double reversed training, but it did not lead to a change in performance on reversed relations. The majority of Curtis’ responding for reversed relations remained within chance levels with 4 training sessions and 3 probes dropping below chance responding.

**Double-reversed relations.** Curtis scored below criterion at baseline for double reversed perspective-taking, 58%, indicating a need for double reversed training. Prior to double reversed training, a comparison was done between the double reversed probe taken at the initial pretest and the probes taken during simple and reversed training. There appeared to be no increase in the average perspective-taking performance during training for simple and reversed relations. Next, double reversed training was implemented and, following three sessions, Curtis reached criterion with a score of 100% accuracy. At posttest, double reversed perspective-taking dropped back to 25%, resulting in a return to training. Double reversed training was continued for six more sessions, and average performance dropped to 50% with PND=-.111, so double reversed training was terminated. The final double reversed posttest resulted in a perspective-taking score of 25%. Curtis’s responding on double reversed relations was consistent with simple and reversed relations, where responding was primarily at chance levels with only one probe dropping below chance levels.

*Cole* (Figure 6)
Simple relations. At baseline, Cole reached criterion for simple relations, scoring 88%, therefore training for simple relations was not administered. During continued probing, simple perspective-taking decreased from 88% to an average of 50% during training for reversed relations, and down to 25% accurate during training for double reversed relations. Further evaluation indicated that Cole’s performance was mostly at chance levels with only the final posttest dropping below chance.

Reversed relations. Cole scored only 53% on reversed perspective taking at baseline. Initially, Cole required only two reversed training sessions to reach mastery for reversed relations, with performance above chance levels. When the posttests were administered, performance on reversed perspective-taking dropped to 78%. Training was reinstated and following eight training sessions, accuracy decreased, with performance averaging 53%. Due to a sustained drop in performance, training was terminated. The posttest for reversed relations resulted in perspective-taking at 39% accuracy. During double reversed training performance fell further to an average of 26% accurate. Performance during the second round of training and during posttesting remained within chance levels.

Double-reversed relations. Cole accurately responded to only 8% of perspective-taking double reversed relations at the first baseline probe (performing below chance), although his performance on double reversed relations increased throughout simple and reversed training sessions and resulted in a final probe of 58% accuracy. Four double reversed training sessions were administered with an average performance of 48% with PND=.000, resulting in termination of double reversed training. His performance throughout simple, reversed, double reversed training remained within chance levels of
responding, with the exception of the posttests for double reversed perspective-taking (17% accuracy) which is below chance levels.

**Perspective-taking training summary**

Manuel was the only participant able to master all levels of perspective-taking complexity (Table 5), although he only contacted training for reversed relations. Both Curtis and Cole failed to master the perspective-taking relational frames using the training protocol with the majority of their responding falling within chance levels. Cole demonstrated mastery of simple relations at baseline, but his performance did not maintain through the duration of the study.

**Question 2: If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past?**

Each participant’s results are depicted within a multiple baseline design (Figures 7-9), comparing performance on the perspective-taking trials (open triangle) and perspective-taking training trials (closed triangle) to performance on the response generalization trials (open circle), across all levels of relational complexity (simple, reversed and double reversed). Participant’s ability to generalize to untrained responses was indicated by a score of 88% or higher, consistent with the criterion set by Heagle and Rehfeldt (2006), on the response generalization protocols.

**Manuel (Figure 7)**

*Simple relations.* Manuel demonstrated mastery of simple perspective-taking, as well as simple response generalization protocol, 88%, without training and all responses were at or above chance levels.
Reversed relations. Manuel was able to demonstrate mastery of reversed perspective-taking, but at posttest he did not demonstrate generalization to responses that were not directly reinforced (75%), with all responding on the response generalization protocol occurring within chance levels.

Double-reversed relations. Initially, at baseline, Manuel’s performance fell below criterion for double reversed perspective-taking, but he scored 100% accuracy on the double reversed response generalization protocol. Following two more baseline probes, both perspective-taking and response generalization (100%) reached criterion levels, and were above chance.

Curtis (Figure 8)

Curtis failed to master simple, reversed, and double reversed perspective-taking relations, nor was he able to generalize to simple, reversed, or double reversed responses that had not been directly reinforced. The initial simple, reversed, and double reversed response generalization probes equaled 75%, 75%, and 25% with final response generalization probes equaling 50%, 75%, and 38%, respectively. Additionally, all of Curtis’s responding on the response generalization protocols occurred at chance levels.

Cole (Figure 9)

Simple relations. At baseline, Cole initially demonstrated mastery of simple relations, although he was unable to reach criterion on the simple response generalization protocol, scoring only 75%. During training for reversed and double reversed relations, simple perspective-taking fell to an average of 40%, but his score on the response generalization protocol was above criterion (averaging 93%) and he had two points that went above chance levels.
Reversed relations. At baseline, Cole did not reach criterion for reversed perspective-taking, although he did reach criterion on the reversed response generalization protocol (88%). Cole’s performance on reversed response generalization probes fluctuated during training for reversed relations, averaging 71%, although values reached 100% during training for double reversed relations, moving above chance levels.

Double-reversed relations. At baseline, Cole did not reach criterion on double reversed perspective-taking or the response generalization protocol, 50%. However, Cole’s performance on double reversed relations probed throughout simple and reversed training sessions resulted in an increase in both perspective-taking, averaging 47%, and the response generalization protocol, averaging 79% with one point reaching 88%.

During double reversed training, perspective-taking scores remained low, but response generalization increased to 82% with one score reaching 88%. Mastery of double reversed perspective-taking was never reached and response generalization scores failed to remain at criterion levels and fluctuated within chance levels.

Standard training summary

Manuel was the only participant to master simple, reversed, and double reversed relations (Table 5). He also reached criterion on both simple and double reversed response generalization protocols, although it occurred prior to relational training. Also, despite Manuel acquiring reversed relations, he did not generalize to reversed responses that were not previously reinforced. Cole also initially demonstrated mastery of simple relations, and while he did not maintain criterion performance, Cole did reach and maintain criterion performance on simple response generalization.

Modified Training
Question 3: If children with Asperger's fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?

Both Curtis and Cole failed to master all levels of perspective taking complexity, so modified training procedures were identified and administered. The effectiveness of the initial training versus modified training procedures for both Curtis and Cole are described in detail within the following section (Figure 10 & 11).

Curtis

Figure 10 depicts Curtis’s performance across: 1) two types of training (closed triangles) consisting of perspective-taking training and contingent reward, where a 3-sec animated clip is presented contingent upon answering a trial correctly the first time, and 2) perspective-taking (open triangle) and response generalization (open circle) probes both without and with a performance contingency.

In phase one, Curtis’s performance on the initial perspective-taking training averaged 68% and remained within the level of chance responding. Subsequently, the modified training, contingent reward, was implemented and increased performance above chance levels to 100% accurate. Upon returning to the initial perspective-taking training, Curtis’s performance remained high, averaging 94%, dropping just below criterion during the final training session.

Throughout all types of training, Curtis’s performance on simple perspective-taking and response generalization probes remained at chance levels and were low with scores averaging 45 and 48%, respectively. In the final phase, a performance contingency was added to the probes. Adding a performance contingency to the probes increased
simple perspective-taking above chance to 100%, although performance on untrained responses remained at 50%.

Cole

Cole’s performance on reversed perspective-taking training and two modified reversed training procedures, contingent reward and oral presentation, can be found in Figure 11. In phase one, Cole averaged only 38% accuracy across the twelve initial perspective-taking training sessions, with performance varying at or below chance levels. Contingent reward was added to the training procedure and Cole’s average performance across the four training sessions increased slightly, to 51% accuracy, with no scores going above 52%. Next, a more individualized oral training procedure was introduced. Four oral training sessions resulted in an average performance of 62%, with the highest level of accuracy reaching 72%, before dropping back to 50% accuracy during the final training session. Introducing the oral training procedure also resulted in one training session moving above chance responding.
CHAPTER V
DISCUSSION

Perspective-taking has been identified as one of the pivotal social skills that leads to social success. In children who lack a perspective-taking repertoire of behavior, teaching perspective-taking is critical to ensure successful social interactions. While perspective-taking has been approached using multiple theories, relational frame theory has sought to target the aspects of perspective-taking by using reinforcement contingencies to teach perspective-taking relational frames across various levels of complexity. Previous applications of the Barnes-Holmes protocol to target the perspective-taking relational frames have generated positive outcomes for typically developing children. The positive effects using the perspective-taking training techniques observed with typically developing children are important, although it does not speak to the effectiveness of these procedures with other populations who present with perspective-taking deficits, such as children with ASD. The current study provides preliminary evidence concerning the effectiveness of the Barnes-Holmes protocol to teach perspective-taking relational frames to children with Asperger’s, as well as the impact of training on skill generalization, and briefly touches on the potential role that individualization can play in intervention effectiveness. The current chapter begins with a discussion of the findings across the three research questions, and continues with a discussion of the studies limitations and directions for future research.

Discussion of Findings

Question 1: Can children with Asperger’s learn to respond to the relational frames I-You, Here-There and Now-Then through reinforcement contingencies?
The results of the current study failed to replicate performance on the Barnes-Holmes perspective-taking training protocol that was witnessed in previous research with typically developing children (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007). While the current study used the same perspective-taking training protocol and computerized delivery method used in previous studies, there were three key differences that distinguished the current study from previous research. These differences may illuminate the reason for performance differences across studies.

First, unlike the previous investigations, the population tested within the current study focused on children with Asperger’s. It would be expected that differences in performance would appear across diverse populations. In the current study, the perspective-taking training protocol did not consistently result in acquisition of perspective-taking relational frames as it did in typically developing children in earlier investigations, where all participants (n=5) were able to reach criterion on trained simple, reversed, and double reversed perspective-taking relations (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007). While one participant (Manuel) in the current study was able to reach criterion on each level of perspective-taking complexity, it is important to note that performance did not reach criterion until additional contingencies were added for on task behavior and he only received training for reversed relations. These contingencies were added as a result of high levels of work refusal and work termination and did not involve modifications to the reinforcement contingences within the training protocol. Therefore, none of the participants in the current study were able to reach criterion on perspective-taking relations without some modifications to the original procedures.
Interestingly, while performance outcomes following intervention differed between children with Asperger’s and typically developing children, performance at baseline for both populations was similar. For instance, in both the current and in previous studies, participants that met criterion at baseline were 66% (2 of 3) and 60% (3 of 5), respectfully, for simple relations, 0% for reversed relations, and 33% (1 of 3) and 40% (2 of 5), respectfully, for double reversed relations. This comparison of baseline performance and consideration of results suggests that, although training may be required for both populations, the Barnes-Holmes training protocol, in its current form, may not be as effective for children with Asperger’s as typically developing children.

The second difference between past and current research, was that performance at the two levels of perspective-taking complexity not being targeted for intervention were continuously probed. The reprobing procedure provided an opportunity to monitor the influence of training at different levels on each level of complexity. The continuous probing procedure helps to provide a more detailed picture of the emergence of perspective taking relational frames. For instance, an increase in performance on double reversed perspective-taking, beyond chance levels, was witnessed for Manuel while training was in place for reversed relations. In fact, Manuel reached criterion performance on double reversed relations during training for reversed relations. This provides a broader view of the emergence of perspective-taking behavior. Specifically, it suggests that teaching levels of perspective-taking has the potential to influences more complex levels that have yet to be targeted for intervention.

The third modification made in the current study, was that training was not repeated continuously until mastery was reached. Instead, a decision rule was established
(PND ≤ .5) to determine the effectiveness of the training procedure. For instance, by assessing the PND value, it was determined if the training procedure was increasing performance and should therefore be continued, or to deem the intervention ineffective, thus it should be terminated. While it is possible that adding a decision rule, to alter the number of training sessions delivered to each participant, could have impacted acquisition of perspective-taking relational frames, it appears to be unlikely. When training was carried out with typically developing children, multiple training sessions were administered with patterns of increased performance (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007). The patterns of acquisition in the current study with children with Asperger’s did not consistently result in performance increasing over time, rather performance often leveled off, requiring a rule for termination of intervention. These differences in performance indicate that while it is possible that having a criterion for termination of intervention impacted acquisition of perspective-taking relations, it is more likely that differences in performance on the perspective-taking protocol were based on differences between the populations (children with Asperger’s verses typically developing children), rather than differences in methodology.

Overall, these results highlight the differences that appear in mastery of perspective-taking relations during training between typically developing children and children with Asperger’s. The findings provide initial evidence that the existing training protocol may be insufficient to teach perspective-taking relational frames to children with Asperger’s.
Question 2: If children with Asperger’s master the perspective-taking relational frames, does this result in acquisition of responses that have not been directly reinforced in the past?

Within the current study, learning to respond accurately to trained perspective-taking relations did not necessarily lead to accurately responding to untrained relational responses. These findings are not consistent with previous research (Heagle & Rehfeldt, 2006), where all typically developing participants (n=3) were able to reach criterion on untrained simple, reversed, and double reversed relations. A methodological difference does exist between Heagle and Rehfeldt’s work and the current study. Heagle and Rehfeldt (2006) continued to administer training and posttesting at the targeted level of complexity until criterion performance was reached for both perspective-taking and generalization responses. In the current study, mastery was based solely on reaching criterion performance on perspective-taking, while response generalization was continuously probed throughout. This methodological difference should be noted, but is not likely the cause for differences in performance between typically developing children and children with Asperger’s. As was discussed previously in the first research question, the performance on the perspective-taking protocols alone was lower in children with Asperger’s, resulting in failure to meet the previously established mastery criterion. Their performance on response generalization protocols was also different when compared to typically developing children and did not appear to systematically emerge following perspective-taking training. Due to these differences, which will be discussed below, it was decided that continuing to present the response generalization probes without modifications, was not likely to increase their performance to criterion levels.
While the current study was not able to consistently demonstrate that the emergence of perspective-taking leads to accuracy in responding to untrained responses, two other opposing outcomes were observed. First, Manuel, the only participant to master all levels of perspective-taking, did not always generalize to novel responses. For instance, following training, Manuel reached criterion for reversed relations, although he was never able to generalize to untaught reversed responses. Interestingly, the opposite situation occurred with Cole, where he reached criterion on the reversed response generalization protocol, but did not reach criterion on the perspective-taking protocol. Cole also never reached criterion on double reversed perspective-taking, but he did reach criterion on untaught double reversed relations.

These differences in performance on the response generalization protocol will need to be investigated further to assess the specific variables affecting acquisition of response generalization. The lack of generalization to novel response following training could have been due to multiple factors including but not limited to: insufficient number of exemplars within training, insufficient mastery of current exemplars, or perhaps training using more contextually relevant exemplars would be more appropriate. Conversely, perhaps for some children, the ability to perform better on response generalization protocols could be due to the fact that exemplars targeted within training (e.g., “I have a red brick and you have a green brick.”), were not as contextually relevant as the exemplars used in the response generalization probes (e.g., “Yesterday I was playing X-Box, today I am watching the Incredibles.”). While it is difficult to pin point the exact cause of the performance differences between the perspective-taking and
response generalization protocols in children with Asperger’s, there is no doubt the acquisition of these skills is distinct from that of typically developing children.

Interestingly, at baseline, a similar pattern of responding on the response generalization protocol between children with Asperger’s and typically developing children was also identified. In the current study and in previous studies, the proportions of participants that met criterion at baseline, were both 66% (2 of 3) for simple relations, 33% (1 of 3) and 0% respectively for reversed relations, and were both 33% (1 of 3) for double reversed relations. This continued pattern of similar performance at baseline between the two populations, with lower generalization for children with Asperger’s, further validates the need to modify the current protocol for children with Asperger’s to help generalize to novel perspective-taking responses.

**Question 3: If children with Asperger’s fail to master the perspective-taking relational frames through the training protocol, can individualized modifications to the training procedures influence the acquisition of perspective-taking relational frames?**

The current study appears to initially validate previous research, which demonstrates that individualization of programs helps bolster positive outcomes for children with ASD (Koegel & Koegel, 1995). Throughout training the feedback following correct and incorrect responses, in the form of brief animated clips for correct responses and a “Try Again” screen for incorrect responses, did not appear to reinforce accurate responding as it did with typically developing children. Specifically, for both Manuel and Curtis, additional contingencies were identified and applied, in order to maintain on-task behavior and increase levels of accuracy. Manuel was able to reach criterion on all levels of relational complexity using the original training protocol,
although he still required modification of contingencies to decrease work refusal. Only after these modifications were in place, did work refusal subside and protocol performance increase. Curtis, on the other hand, initially failed to reach criterion performance at all levels of relational complexity. Only after a performance contingency was systematically added to both simple training and simple perspective-taking probes did performance reach criterion levels for simple relations. This raises the question about the role motivation plays in the emission of behavior. With both Manuel and Curtis, accurate responding increased rapidly after reinforcers were identified and implemented. It is important to recognize the important role that motivation appears to play in this population. Without establishing appropriate motivational variables and contingencies, it is possible that acquisition may not be observed.

Individualized interventions were also put in place for Cole, although no contingency was identified that increased accurate responding on the perspective-taking protocol to criterion levels for reversed relations. As each type of training was introduced, Cole’s average level of performance did increase. For instance, average performance on the perspective-taking training was 38.4%, average performance increased to 50.7% when contingent reward was added, and finally during oral presentation, performance increased to 61.8% and resulted in a point above chance levels. This pattern of responding indicates that modifications to training influenced performance slightly, but did not result in criterion performance. It is possible that if a more powerful motivational variable had been identified, Cole’s performance could have increased to criterion levels, consistent with the other two participants.
Overall, for both Curtis and Cole, only brief demonstrations of the effects of individualized interventions are provided. A more detailed analysis of individualized interventions to teach perspective-taking relational frames to children with Asperger’s is necessary to draw any firm conclusions. Although preliminary, it appears that making individual modifications to the training procedure has the potential to increase accuracy on perspective-taking relations.

Limitations

Several limitations must be considered when interpreting the results of the current study. This is the first study of its kind to use the Barnes-Holmes training protocol to teach perspective-taking relational frames to children with Asperger’s. Replication is required to expand and validate findings beyond the three participants within the current study. The population used in the current study was restrictive and included only children between the ages of eight and ten years old, with a diagnosis of Asperger’s, having higher verbal and oral communication skills, and a maximum of 60% accuracy on reversed relations at baseline. These requirements create a specific group, which both restricts the ability to generalize beyond the current participants and identifies only a segment of the population along the Autism Spectrum that were evaluated. Additionally, restricting participation to those children who performed at 60% accuracy or less on reverse relations at baseline may have resulted in identifying a group of participants who have greater perspective-taking deficits. Further study of populations across the Autism Spectrum will be required to further generalize findings.

The current study also failed to include female participants and therefore, caution should be taken when generalizing these findings across sex. Future research will have to
be conducted to assess the potential role that gender plays on the acquisition of perspective-taking relational frames. Finally, while the Woodcock Johnson was used to screen for both passage and oral comprehension no assessment was used to evaluate the participants ability to make inferences about content. Future research should consider using a comprehension test to evaluated participants abilities to make inferences to further rule out factors that could be influencing performance on the perspective-taking protocols.

**Future Directions**

The current study joins a modest, but growing set of research, which has begun to focus on teaching perspective-taking, using RFT, through the Barnes-Holmes protocol. Additionally, the current study is the first of its kind to use the Barnes-Holmes protocol as a tool to teach perspective-taking to children with ASD. Given that this line of research is in its infancy, there are many opportunities for expansion and future research. Specifically, the following possibilities will be discussed below: modifications to the standardized training procedure, probing performance across levels, the establishment of mastery criterion, the role of response generalization, and the need for direct observation.

*Modifications to the training procedure*

Overall, the training procedure using the Barnes-Holmes protocol can be fine-tuned to provide more efficient intervention. Currently, the trials follow a standard protocol and each trial is administered for both pre and post testing, as well as during training regardless of performance. Therefore, within a level of perspective-taking such as simple relations, if a participant answers one set of trials correctly and another set incorrectly, both sets of trial types are repeatedly trained until criterion performance is
reached. In future research it may be advantageous to tailor training based on individual performance, by targeting the types of trials which need more attention rather than administering the entire protocol (Weil, 2006). By targeting only the types of trials which are being answered incorrectly, it will allow more focused attention on specific deficits and make intervention more efficient.

Also, the existing protocol contains trials which evaluate and teach each combination of deictic relations across each level of relational complexity. Future research may consider more heavily focusing attention on trials targeting I-You relations at the beginning of training, as a means to enhance discrimination before moving or increase the focus on the other relations. Additionally, the implications of using other deictic relations, such as this-that, on the acquisition of perspective-taking could be considered. Training additional deictic relations may further breakdown the steps for perspective-taking.

The current study also identified instances where individualized modifications to the training procedures, in the form of contingency modifications and protocol administration, influenced performance for children with Asperger’s. Individual changes such as those made in the current study are easily identified and appear to influence performance. Future research should expand this line of research to further evaluate the role that individualization and motivation play on acquisition and emission of learned responses.

*Continuous probing at each level of complexity*

Additionally, the current study was the first to continuously probe each level of perspective-taking to monitor the influence of training at each level of complexity. Future
studies should consider implementing the continuous probing procedure at each level, to both identify potential patterns in the emergence of perspective-taking skills, as well as to make training more efficient. If a participant is able to reach criterion on a higher level of complexity while in training at a lower level, it eliminates the time spent on unnecessary training.

*Establishing mastery criterion*

As more research is conducted in this area, additional efforts should be spent on identifying mastery criterion. At present, the mastery levels (for simple, reversed and double reversed perspective-taking and generalization) appear to have been arbitrarily set without prior assessment. Acquisition, generalization, and maintenance of perspective-taking response should be evaluated to identify the most appropriate set of mastery criterion. Specifically, future research should assess the appropriateness of the current mastery levels, identify whether one instance of criterion performance is sufficient or if multiple sessions at criterion levels better constitute mastery, and to determine whether mastery should require only criterion performance on trained perspective-taking trials or both criterion performance on perspective-taking and response generalization trials.

*Generalization*

Within the current training protocol, multiple exemplars are trained with the intent that responding will generalize to untaught responses. The current study demonstrated that in children with Asperger’s, accurate responding to novel untaught responses did not always occur. Future research will need to focus greater attention on the variables that influence response generalization in an effort to increase responding. Specifically, the current study was not able to determine whether failure to generalize to untaught
responses was due to an insufficient number of exemplars within training, insufficient mastery of current exemplars, or problems with the type of exemplars within training. Children with ASD may not be able to generalize from trained responses to novel responses as easily as typically developing children. Often children with autism spectrum disorders have trouble with abstract thinking, therefore the trials used within training may not have been as contextually relevant to their lives. It is possible that children with ASD may respond better when trained with more contextually relevant questions that involved content that is of interest to them (e.g., TV programs, video games, talking on the phone), such as those used within the response generalization questions. Additionally, switching from computer to conversational presentation may have influenced responding for this population. McHugh and colleagues (2004a) determined that the delivery method (one-on-one versus computer presentation) did not influence responding for typically developing individuals, although it is possible that performance difference may be present in individuals with ASD.

Finally, if mastery of perspective-taking relational frames can be demonstrated for individuals with ASD, it is also important to consider the translation of skills to daily interactions. Future research should consider directly observing behavior in context with peers, teachers, or families to assess the impact of the perspective-taking training within the natural environment. Children with ASD, and specifically children with Asperger’s, are often highly intelligent and learn social content quickly, but have difficulty translating learned information into direct application. Once the perspective-taking training procedure is fine-tuned, it would be appropriate to directly observe participants to assess generalization to applied settings. If application of perspective-taking skills in
the natural environment does not occur, further evaluation of the training procedures will be necessary.
BIBLIOGRAPHY


Table 1

The Perspective-taking Protocol. For more information see McHugh et al, 2004; Heagle & Rehfeldt, 2006; and Rehfeldt et al, 2007. (The correct answer is located in parentheses.)

SIMPLE RELATIONS:

Simple I-YOU:
I have a red brick and 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 there 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 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 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 here was there and there was here.
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 black chair, today you are sitting here on the blue chair. If here was there and there was here.
Where were you sitting then? (Black)
Where would you be sitting now? (Blue)

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 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 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)

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 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.

Scores on WJ-III Subtests by Participant

<table>
<thead>
<tr>
<th>Participant</th>
<th>Passage Comprehension</th>
<th>Oral Comprehension</th>
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<tbody>
<tr>
<td>Manuel</td>
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<tr>
<td>Curtis</td>
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</tr>
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<td>James</td>
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<td>27</td>
</tr>
<tr>
<td>Connor</td>
<td>32</td>
<td>24</td>
</tr>
</tbody>
</table>

Note. Qualifying scores = Passage Comprehension ≥ 24 and Oral Comprehension ≥ 15
Table 3

The Response Generalization Protocol, developed by Heagle & Rehfeldt (2006). (The correct answer is located in parentheses.)

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)
### Table 4

Number and Type of Relational Frames Within the Testing Protocols

<table>
<thead>
<tr>
<th>Level of Complexity</th>
<th>Relational Frames</th>
<th>Perspective-taking Protocol</th>
<th>Response Generalization Protocol</th>
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<tr>
<td></td>
<td>I-You</td>
<td>Here-There</td>
<td>Now-Then</td>
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<td>2</td>
<td>4</td>
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<tr>
<td>Reversed</td>
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<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Double Reversed</td>
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<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Note. The number of trials used are consistent with Heagle & Rehfeldt (2006) & Rehfeldt (2007)
Table 5.

Performance for Each Participant During Standardized Training.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Required training</th>
<th>Total training trials</th>
<th>PND</th>
<th>Mastery Reached</th>
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<tr>
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<td>Perspective-taking</td>
</tr>
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<td>no</td>
<td>-</td>
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<td>yes</td>
</tr>
<tr>
<td>Curtis</td>
<td>yes</td>
<td>7</td>
<td>0.429</td>
<td>no</td>
</tr>
<tr>
<td>Cole</td>
<td>no</td>
<td>-</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>Reversed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manuel</td>
<td>yes</td>
<td>6</td>
<td>1</td>
<td>yes</td>
</tr>
<tr>
<td>Curtis</td>
<td>yes</td>
<td>12</td>
<td>0</td>
<td>no</td>
</tr>
<tr>
<td>Cole</td>
<td>yes</td>
<td>10</td>
<td>0.9</td>
<td>no</td>
</tr>
<tr>
<td>Double Reversed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manuel</td>
<td>no</td>
<td>-</td>
<td>-</td>
<td>yes</td>
</tr>
<tr>
<td>Curtis</td>
<td>yes</td>
<td>9</td>
<td>0.111</td>
<td>no</td>
</tr>
<tr>
<td>Cole</td>
<td>yes</td>
<td>4</td>
<td>0</td>
<td>no</td>
</tr>
</tbody>
</table>

Note. Values of Percentage Non-overlapping Data (PND): PND ≥ 0.9 effective, PND from 0.7-0.9 is fairly effective, and PND ≤ 0.5 is ineffective (Herzinger & Johnson, 2007)
Figure Captions

Figure 1. Example of simple, reversed, and double reversed computer screens during respective testing and training trials (Heagle & Rehfeldt, 2006).

Figure 2. Testing sequence and criteria for simple relations.

Figure 3. Testing sequence and criteria for reversed and double reversed relations.

Figure 4. Manuel’s percentage of correct responding on perspective-taking pre and posttests and training, across simple, reversed, and double reversed relations.

Figure 5. Curtis’s percentage of correct responding on perspective-taking pre and posttests and training, across simple, reversed, and double reversed relations.

Figure 6. Cole’s percentage of correct responding on perspective-taking pre and posttests and training, across simple, reversed, and double reversed relations.

Figure 7. Manuel’s percentage of correct responding on response generalization probes compared to perspective-taking performance, across simple, reversed, and double reversed relations.

Figure 8. Curtis’s percentage of correct responding on response generalization probes compared to perspective-taking performance, across simple, reversed, and double reversed relations.

Figure 9. Cole’s percentage of correct responding on response generalization probes compared to perspective-taking performance, across simple, reversed, and double reversed relations.
Figure 10. Curtis’s percentage of correct responding on the perspective-taking training versus training using contingent reward, and percentage of correct responding on pre and posttests with and without a performance contingency.

Figure 11. Cole’s percentage of correct responding on the perspective-taking training versus training using contingent reward and an oral training procedure.
Figure 1. Example of simple, reversed, and double reversed computer screens during respective testing and training trials (Heagle & Rehfeldt, 2006)

<table>
<thead>
<tr>
<th>Simple I-You Relation</th>
<th>Reversed I-You Relation</th>
<th>Double Reversed I-You/Here-There Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a red brick and you have a green brick.</td>
<td>I have a red brick and you have a green brick.</td>
<td>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,</td>
</tr>
<tr>
<td>Question 1: Which brick do I have?</td>
<td>Question 1: Which brick would I have?</td>
<td>Question 1: Where would you be sitting?</td>
</tr>
<tr>
<td>RED</td>
<td>RED</td>
<td>BLUE</td>
</tr>
<tr>
<td>Question 2: Which brick do YOU have?</td>
<td>Question 2: Which brick would YOU have?</td>
<td>Question 2: Where would I be sitting?</td>
</tr>
<tr>
<td>RED</td>
<td>GREEN</td>
<td>BLUE</td>
</tr>
<tr>
<td>GREEN</td>
<td>RED</td>
<td>BLACK</td>
</tr>
</tbody>
</table>
Figure 2. Testing sequence and criteria for simple relations.

**Simple Relations**

- **Pretests:**
  1) Perspective-taking
  2) Response Generalization

- Did the participant meet the criterion of:
  88% accuracy on the perspective-taking protocol or does PND indicate no treatment gains?

  - yes: **Done**
  - no: Introduce training with perspective-taking protocol until criterion of 88% accuracy is met

- **Give Posttests:**
  1) Perspective-taking
  2) Response Generalization
Figure 3. Testing sequence and criteria for reversed and double reversed relations.

**Reversed and Double Reversed Relations**

**Pretests:**
1) Perspective-taking
2) Response Generalization

Did the participant meet the criterion of: 90% accuracy on the perspective-taking protocol or does PND indicate no treatment gains?

- **yes**
  - Done

- **no**
  - Introduce training with perspective-taking protocol until criterion of 90% accuracy is met

**Give Posttests:**
1) Perspective-taking
2) Response Generalization
Figure 4. Manuel’s performance on perspective-taking pre and posttests and training, across simple, reversed, and double reversed perspective-taking.

Note. The astric (*) indicates an additional training session was administered because there was a 6 week lag in assessment. Also, based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the: simple 13-87.5%, reversed 36-64%, and double reversed 25-75% perspective-taking protocols.
Figure 5. Curtis’s performance on perspective-taking pre and posttests and training, across simple, reversed, and double reversed perspective-taking.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the: simple 13-87.5%, reversed 36-64%, and double reversed 25-75% perspective-taking protocols.
Figure 6. Cole’s performance on perspective-taking pre and posttests and training, across simple, reversed, and double reversed perspective-taking.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the: simple 13-87.5%, reversed 36-64%, and double reversed 25-75% perspective-taking protocols.
Figure 7. Manuel’s perspective-taking response generalization across simple, reversed, and double reversed relations.

Note. The asteric (*) indicates an additional training session was administered since there was a 6 week lag in assessment. Also, based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the simple, reversed, and double reversed response generalization protocols 13-87.5%.
Figure 8. Curtis’s perspective-taking response generalization across simple, reversed, and double reversed relations.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the simple, reversed, and double reversed response generalization protocols 13-87.5%.
Figure 9. Cole’s perspective-taking response generalization across simple, reversed, and double reversed relations.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on the simple, reversed, and double reversed response generalization protocols 13-87.5%.
Figure 10. Curtis’s percentage of correct responding on the simple perspective-taking training versus training using contingent reward, and percentage of correct responding on pre and posttests with and without a performance contingency.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation on both the simple perspective-taking and response generalization protocols 13-87.5%. 
Figure 11. Cole’s percentage of correct responding on the reversed perspective-taking training verses training using contingent reward and an oral training procedure.

Note. Based on a 95% confidence interval, the grey shading indicates the percentage of responding that could be due to random variation in reversed perspective-taking training 36-64%.
APPENDIX A

Scripts for Practice Trial, Perspective-taking and Response Generalization Protocols,
Perspective-taking Training and Modified Training Protocols.
Practice Trials: Script for Administration

1) Run through practice trials using the script:
“_____________, each computer screen presents a task. Your job is to read the information at the top of each screen and try to answer the questions using the choices available to you on the screen. I want you to read all the words out loud to me while you go through each page. As you go through each page you will use the mouse to click on box you think is the correct choice. First, you will read question 1 out loud and then click on what you think is the correct choice for question one and then read question 2 out loud and click on what you think is the correct choice for question 2. Always make sure to answer question 1 before you answer question 2. After you answer question 2 the computer will present the next task immediately. Do your very best to answer each question correctly and the computer will let you know when all the tasks are done. You can ask questions if you have them but I will not be able to answer specific questions for you. If I cannot help with your question just answer the best you can.”

“Do you understand what I am asking you to do?” and “Do you have any questions?”

Instructor Directions: After reading the instruction- Click start on the first screen. In the pop-up box enter the participant ID before you click “ok” make sure the participant is ready and orient them to the screen. Once the program begins provide NO feedback on accuracy of responding but make sure the participant is reading all the text out loud. If a participant is not reading out loud prompt them to start over. If necessary non-contingent praise may be delivered during the protocol (ex- Nice job staying focused!; Wow you are working really hard to answer the questions!).

2) If the participant gets all trials correct the practice is finished. If the participant gets one or more trials incorrect run through prompting and error correction procedures below using the attached question:

(Have practice trial sheet face down in front of participant) “We are going to practice another task together. Your job is to read the information at the top of the page and try to answer the questions using the choices available to you.” (Turn trial sheet over)

(Point to the top of the page) “Out loud, read the words at the top of this page please.” (wait for participant to read sentence, if necessary re-prompt) “Nice job reading out loud.” (If read incorrectly, correct the error and have them re-read the sentence.)

“Now read question ONE to me” (participant reads question) “Nice job reading the question. The answer to the question WHAT IS HARD is teddy bear. Let’s look where we found the answer.” (Show the participant how to find the answer in the text at the top of the page.) What is the answer to question one? (Wait for participant to respond, restate prompt if necessary and praise for giving the correct response.)
Now remember what we did on the first question, we used the sentence at the top of the page to answer the question. “Now read the 2nd question to me” (participant reads question) “Nice job reading the question. What is the answer to question TWO? (If they answer correctly they are finished. If they answer incorrectly go through full prompting procedure used for question ONE.)

3) Re-administer the practice computerized trials, the directions may be abbreviated for this administration if you feel the participant understand the directions.

If the participant gets 100% they qualify for participation. If they get one or more errors on the practice trials they are excluded from the study.
If the pillow is soft and the teddy bear is hard

Question 1

What is hard?

Pillow   Teddy Bear

Question 2

What is soft?

Pillow   Teddy Bear
Perspective-taking Protocol: Script for Administration  
(Pre and Post test for Simple, Reversed, & Double Reversed)

“Each computer screen presents a task. Your job is to read the information at the top of each screen and try to answer the questions using the choices available to you on the screen. You should use the mouse to click on what you think is the correct choice for question 1 and then click on what you think is the correct choice for question 2. Always make sure to answer question 1 before you answer question 2. After you answer question 2 the computer will present the next task immediately. Do your very best to answer each question correctly and the computer will let you know when all the tasks are done. You can ask questions if you have them but I will not be able to answer specific questions for you. If I cannot help you with your question just answer the best you can. If you get tired while you are working let me know and we will take a short break before you keep working.”

“Do you understand what I am asking you to do?” and “Do you have any questions?”

Instructor Directions: After reading the instruction- Click start on the first screen. In the pop-up box enter the participant ID before you click “ok” make sure the participant is ready and orient them to the screen. Once the program begins provide NO feedback on accuracy of responding. Sit in the room oriented toward an alternative task. If necessary non-contingent praise may be delivered during the protocol (ex- Nice job staying focused!; Wow you are working really hard to answer the questions!). Break: If a break is requested provide approximately one minute break.
Response Generalization Protocol: Script for Administration
(Pre and Post test for Simple, Reversed, & Double Reversed)

“I am going to read some sentences to you and then I will ask you some questions about those sentences. I want you to listen very carefully and do your very best to answer my questions. You can ask questions if you have them but I will be unable to answer specific questions for you. If it is a question I cannot help you with just answer the best you can. If you get tired while you are working let me know and we will take a short break before you keep working. Do you understand what I am asking you to do? Do you have any questions?”

**Instructor Directions:** Within each trial first, read each sentence and then read each question. Wait for a response to the first question prior to reading the second question. It is okay to read the sentence or questions again but once a participant provides an answer to Question 1 you must have participant move on to Question 2. (Do not let participants go back to answer questions they have already provided answers to.) Provide NO feedback on accuracy of responding. Non-contingent praise may be delivered during the protocol (ex- Nice job staying focused!; Wow you are working really hard to answer the questions!)

**Break:** If a break is requested provide approximately one minute break.
Perspective-taking Training Protocol: Script for Administration  
(Training for Simple, Reversed, & Double Reversed)

“Just like before the computer screen will present a task. Your job is to read the information at the top of each screen and try to answer the questions using the choices available to you on the screen. You should use the mouse to click on what you think is the correct choice for question 1 and then click on what you think is the correct choice for question 2. Always make sure to answer question 1 before you answer question 2. This time when you answer the question correctly the computer will show you a moving picture but if you answer incorrectly a screen will appear that says ‘try again’. If you answer correctly and see a moving picture you will get the next questions right away but, if you the questions incorrectly click where it says ‘try again’ and the same question will appear again until you answer correctly. The computer will let you know when the activity is over. You can ask questions if you have them but I will not be able to answer specific questions for you. If I cannot help with your question just answer the best you can. If you get tired while you are working let me know and we will take a short break before we keep working.”

“Do you understand what I am asking you to do?” and “Do you have any questions?”

Instructor Directions: After reading the instruction- Click start on the first screen. In the pop-up box enter the participant ID before you click “ok” make sure the participant is ready and orient them to the screen. Once the program begins provide NO feedback on accuracy of responding. Sit in the room oriented toward an alternative task. If necessary non-contingent praise may be delivered during the protocol (ex- Nice job staying focused!; Wow you are working really hard to answer the questions!).

Break: If a break is requested provide approximately one minute break.
“We are going to do an activity like the one you did on the computer where it let you know if questions were answered correctly or incorrectly but this time I am going to read the questions to you. So instead of opening the screen where you read the information at the top and question 1 then question 2 I will read you information and then ask question 1 and question 2. You can ask me to repeat the information again as long as you haven’t answered the first question. When you answer both the questions correctly I will let you know and we will move onto the next questions. If you answer one or both of the questions incorrectly I will ask you to try again and will re-read the information and questions to you. You can ask questions if you have them but I will not be able to answer specific questions for you. If I cannot help with your question just answer the best you can. If you get tired while you are working let me know and we will take a short break before we keep working.”

“Do you understand what I am asking you to do?” and “Do you have any questions?”

**Instructor Directions:** After providing the instruction- Make sure the participant is ready and then read the first question. Once the participant answers both questions within an item provide feedback on accuracy of responding (ex- correct= “fantastic job”, “nice work” or incorrect= “we will try that one again”). If necessary non-contingent praise may be delivered during the protocol (ex- Nice job staying focused!; Wow you are working really hard to answer the questions!). A participant is allowed to have the information and question one repeated if they have not yet answered a question within the item. **Break:** If a break is requested provide approximately one minute break.
APPENDIX B

Versions of the Perspective-taking Fidelity Sheet (Probe and Treatment) and the Modified Oral Training Scoring Sheet with Corresponding IOA Scoring Sheet
Scoring Sheet for Per-Taking Protocol: ________________ Relations

Subject #: ________________________________
Age: _____       Gender:     M     F
Examiner: ________________________________     Date:       /        /

<table>
<thead>
<tr>
<th>Per-Taking Protocol Fidelity (Probe &amp; Training)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the experimenter follow the script as stated on the response generalization sheet when stating the response generalization instructions to the participant?</td>
<td>yes / no</td>
</tr>
<tr>
<td>Is the experimenter's intermittent reinforcement on the participants' performance truly noncontingent? (i.e.- the reinforcement is randomly emitted throughout the session and not contingent on any correct or incorrect response)</td>
<td>yes / no</td>
</tr>
<tr>
<td>Is the experimenter refraining from giving the participant any verbal ques (i.e.- &quot;good job&quot; or that is incorrect&quot;) in response to the participant's correct or incorrect responses?</td>
<td>yes / no</td>
</tr>
<tr>
<td>Is the experimenter refraining from giving the participant any nonverbal ques (i.e.- approving or disapproving looks, looking away, etc) in response to the participant's correct or incorrect responses?</td>
<td>yes / no</td>
</tr>
<tr>
<td>Did the experimenter state the questions verbatim as written on the response generalization question sheet?</td>
<td>yes / no</td>
</tr>
<tr>
<td>Were the response generalization questions randomized on the response generalization question sheet?</td>
<td>yes / no</td>
</tr>
</tbody>
</table>

# implemented with fidelity :  
Total : 6

\[ \frac{6}{6} = 100\% \]
### Scoring Sheet for Modified Perspective Taking Protocol: Reversed Relations (Training)

**Subject #: ____________________**            **Age: _____**

**Gender:**
- M
- F

**Examiner: ______________________________**  **Date: / /**

* Each time a participant answers a question incorrectly place a tally mark next to 'No', once they have answered correctly circle 'Yes'.

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would YOU be sitting?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td>2</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would you be sitting now?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td></td>
<td>2) Where were you sitting then?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>3</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would YOU be sitting?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>4</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would YOU be sitting?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td>5</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would you be sitting now?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td></td>
<td>2) Where were you sitting then?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td>6</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where were you sitting then?</td>
<td>Yes No</td>
<td>(Black)</td>
</tr>
<tr>
<td></td>
<td>2) Where would you be sitting now?</td>
<td>Yes No</td>
<td>(Blue)</td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Answer 1</td>
<td>Answer 2</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>7</td>
<td>Yesterday you were reading; today you are watching television. If now was then and then was now,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) What would you be doing now?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) What were you doing then?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>8</td>
<td>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,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Where would YOU be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>9</td>
<td>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,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting now?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Where was I sitting then?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>10</td>
<td>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,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Where would YOU be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>11</td>
<td>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,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting now?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Where was I sitting then?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>12</td>
<td>Yesterday I was watching television; today I am reading. If now was then and then was now,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) What was I doing then?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) What would I be doing now?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>13</td>
<td>I have a green brick and you have a red brick. If I was you and you were me,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Which brick would YOU have?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Which brick would I have?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>14</td>
<td>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,</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>1) Where would YOU be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting?</td>
<td><strong>Yes</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td></td>
<td>Scenario</td>
<td>Questions</td>
<td>Answers</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>15</td>
<td>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, 1) Where would you be sitting now? 2) Where were you sitting then?</td>
<td>Yes No (Black)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Yesterday I was watching television; today I am reading. If now was then and then was now, 1) What would I be doing now? 2) What was I doing then?</td>
<td>Yes No (Television)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Yesterday you were sitting there on the blue chair, today you are sitting there on the black chair. If here was there and there was here, 1) Where would you be sitting now? 2) Where were you sitting then?</td>
<td>Yes No (Blue)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Yesterday I was reading; today I am watching television. If now was then and then was now, 1) What would I be doing now? 2) What was I doing then?</td>
<td>Yes No (Reading)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I have a green brick and you have a red brick. If I was you and you were me, 1) Which brick would I have? 2) Which brick would YOU have?</td>
<td>Yes No (Red)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Yesterday I was reading; today I am watching television. If now was then and then was now, 1) What was I doing then? 2) What would I be doing now?</td>
<td>Yes No (Television)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>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, 1) Where were you sitting then? 2) Where would you be sitting now?</td>
<td>Yes No (Blue)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>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, 1) Where was I sitting then? 2) Where would I be sitting now?</td>
<td>Yes No (Blue)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>Answer</td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------------------------</td>
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<td>-----------------------</td>
</tr>
<tr>
<td>23</td>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where was I sitting then?</td>
<td>Yes</td>
<td>2) Where would I be sitting now?</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting now?</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>24</td>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where were you sitting then?</td>
<td>Yes</td>
<td>2) Where would you be sitting now?</td>
</tr>
<tr>
<td></td>
<td>2) Where would you be sitting now?</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>25</td>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting now?</td>
<td>Yes</td>
<td>2) Where was I sitting then?</td>
</tr>
<tr>
<td></td>
<td>2) Where was I sitting then?</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>26</td>
<td>I have a red brick and you have a green brick. If I was you and you were me,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Which brick would I have?</td>
<td>Yes</td>
<td>2) Which brick would YOU have?</td>
</tr>
<tr>
<td></td>
<td>2) Which brick would YOU have?</td>
<td>No</td>
<td>(Green)</td>
</tr>
<tr>
<td>27</td>
<td>Yesterday you were reading; today you are watching television. If now was then and then was now,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) What were you doing then?</td>
<td>Yes</td>
<td>2) What would you be doing now?</td>
</tr>
<tr>
<td></td>
<td>2) What would you be doing now?</td>
<td>No</td>
<td>(Television)</td>
</tr>
<tr>
<td>28</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting?</td>
<td>Yes</td>
<td>2) Where would YOU be sitting?</td>
</tr>
<tr>
<td></td>
<td>2) Where would YOU be sitting?</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>29</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where were you sitting then?</td>
<td>Yes</td>
<td>2) Where would you be sitting now?</td>
</tr>
<tr>
<td></td>
<td>2) Where would you be sitting now?</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>30</td>
<td>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,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where was I sitting then?</td>
<td>Yes</td>
<td>2) Where would I be sitting now?</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting now?</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td>Option</td>
<td>Correct Trials</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>----------------</td>
</tr>
<tr>
<td>31 I have a red brick and you have a green brick. If I was you and you were me,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Which brick would YOU have?</td>
<td>Yes</td>
<td>No</td>
<td>(Red)</td>
</tr>
<tr>
<td>2) Which brick would I have?</td>
<td>Yes</td>
<td>No</td>
<td>(Green)</td>
</tr>
<tr>
<td>32 Yesterday you were watching television; today you are reading.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) What would you be doing now?</td>
<td>Yes</td>
<td>No</td>
<td>(Television)</td>
</tr>
<tr>
<td>2) What were you doing then?</td>
<td>Yes</td>
<td>No</td>
<td>(Reading)</td>
</tr>
<tr>
<td>33 Yesterday I was sitting here on the blue chair, today I am sitting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Where was I sitting then?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>2) Where would I be sitting now?</td>
<td>Yes</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>34 Yesterday you were watching television; today you are reading.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) What were you doing then?</td>
<td>Yes</td>
<td>No</td>
<td>(Reading)</td>
</tr>
<tr>
<td>2) What would you be doing now?</td>
<td>Yes</td>
<td>No</td>
<td>(Television)</td>
</tr>
<tr>
<td>35 Yesterday I was sitting there on the black chair, today I am sitting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Where would I be sitting now?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>2) Where was I sitting then?</td>
<td>Yes</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>36 I am sitting here on the blue chair and you are sitting there on the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Where would I be sitting?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>2) Where would YOU be sitting?</td>
<td>Yes</td>
<td>No</td>
<td>(Blue)</td>
</tr>
</tbody>
</table>

Correct Trials (= both questions answered correctly) : _/

Total Trials : 36
**IOA Scoring Sheet for Modified Perspective Taking Protocol: Reversed Relations (Training)**

**Subject #:**

__________________________

**Age:** _____  
**Gender:** M  F

**Examiner:** _____________________________  
**Date:** / / 

*Each time a participant answers a question incorrectly place a tally mark next to 'No', once they have answered correctly circle 'Yes'*

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
</table>
| 1       | 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,  
1) Where would YOU be sitting?  2) Where would I be sitting? | Yes No (Blue) | Yes No (Black) |
| 2       | 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,  
1) Where would you be sitting now?  2) Where were you sitting then? | Yes No (Black) | Yes No (Blue) |
| 3       | 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,  
1) Where would YOU be sitting?  2) Where would I be sitting? | Yes No (Black) | Yes No (Blue) |
| 4       | 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,  
1) Where would YOU be sitting?  2) Where would I be sitting? | Yes No (Blue) | Yes No (Black) |
| 5       | 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,  
1) Where would you be sitting now?  2) Where were you sitting then? | Yes No (Blue) | Yes No (Black) |
<table>
<thead>
<tr>
<th></th>
<th>Scenario</th>
<th>Yes</th>
<th>No</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>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, 1) Where were you sitting then? 2) Where would you be sitting now?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>7</td>
<td>Yesterday you were reading; today you are watching television. If now was then and then was now, 1) What would you be doing now? 2) What were you doing then?</td>
<td>Yes</td>
<td>No</td>
<td>(Reading)</td>
</tr>
<tr>
<td>8</td>
<td>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, 1) Where would I be sitting? 2) Where would YOU be sitting?</td>
<td>Yes</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>9</td>
<td>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, 1) Where would I be sitting now? 2) Where was I sitting then?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>10</td>
<td>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, 1) Where would I be sitting? 2) Where would YOU be sitting?</td>
<td>Yes</td>
<td>No</td>
<td>(Black)</td>
</tr>
<tr>
<td>11</td>
<td>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, 1) Where would I be sitting now? 2) Where was I sitting then?</td>
<td>Yes</td>
<td>No</td>
<td>(Blue)</td>
</tr>
<tr>
<td>12</td>
<td>Yesterday I was watching television; today I am reading. If now was then and then was now, 1) What was I doing then? 2) What would I be doing now?</td>
<td>Yes</td>
<td>No</td>
<td>(Reading)</td>
</tr>
<tr>
<td>13</td>
<td>I have a green brick and you have a red brick. If I was you and you were me, 1) Which brick would YOU have? 2) Which brick would I have?</td>
<td>Yes</td>
<td>No</td>
<td>(Green)</td>
</tr>
<tr>
<td></td>
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<tr>
<td>---</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 14 | 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,  
1) Where would YOU be sitting?  
2) Where would I be sitting? | Yes No (Black) Yes No (Blue) |
| 15 | 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,  
1) Where would you be sitting now?  
2) Where were you sitting then? | Yes No (Black) Yes No (Blue) |
| 16 | Yesterday I was watching television; today I am reading. If now was then and then was now,  
1) What would I be doing now?  
2) What was I doing then? | Yes No (Television) Yes No (Reading) |
| 17 | Yesterday you were sitting there on the blue chair, today you are sitting there on the black chair. If here was there and there was here,  
1) Where would you be sitting now?  
2) Where were you sitting then? | Yes No (Blue) Yes No (Black) |
| 18 | Yesterday I was reading; today I am watching television. If now was then and then was now,  
1) What would I be doing now?  
2) What was I doing then? | Yes No (Reading) Yes No (Television) |
| 19 | I have a green brick and you have a red brick. If I was you and you were me,  
1) Which brick would I have?  
2) Which brick would YOU have? | Yes No (Red) Yes No (Green) |
| 20 | Yesterday I was reading; today I am watching television. If now was then and then was now,  
1) What was I doing then?  
2) What would I be doing now? | Yes No (Television) Yes No (Reading) |
| 21 | 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,  
1) Where were you sitting then?  
2) Where would you be sitting now? | Yes No (Blue) Yes No (Black) |
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>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,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where was I sitting then?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting now?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>23</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where was I sitting then?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Where would I be sitting now?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>24</td>
<td>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,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where were you sitting then?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Where would you be sitting now?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>25</td>
<td>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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting now?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Where was I sitting then?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>26</td>
<td>I have a red brick and you have a green brick. If I was you and you were me,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Which brick would I have?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Which brick would YOU have?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>27</td>
<td>Yesterday you were reading; today you are watching television. If now was then and then was now,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) What were you doing then?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) What would you be doing now?</td>
<td>Yes  No</td>
</tr>
<tr>
<td>28</td>
<td>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,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1) Where would I be sitting?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td>2) Where would YOU be sitting?</td>
<td>Yes  No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
| 29 | 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,  
1) Where were you sitting then?  
2) Where would you be sitting now? | Yes | No | (Blue) |
| 30 | 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,  
1) Where was I sitting then?  
2) Where would I be sitting now? | Yes | No | (Black) |
| 31 | I have a red brick and you have a green brick. If I was you and you were me,  
1) Which brick would YOU have?  
2) Which brick would I have? | Yes | No | (Red) |
| 32 | Yesterday you were watching television; today you are reading. If now was then and then was now,  
1) What would you be doing now?  
2) What were you doing then? | Yes | No | (Television) |
| 33 | 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  
1) Where was I sitting then?  
2) Where would I be sitting now? | Yes | No | (Black) |
| 34 | Yesterday you were watching television; today you are reading. If now was then and then was now,  
1) What were you doing then?  
2) What would you be doing now? | Yes | No | (Reading) |
| 35 | 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  
1) Where would I be sitting now?  
2) Where was I sitting then? | Yes | No | (Black) |
| 36 | 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, |
|    | 1) Where would I be sitting? Yes No (Black) |
|    | 2) Where would YOU be sitting? Yes No (Blue) |

Correct Trials (= both questions answered correctly) : 
Total Trials : 36

<table>
<thead>
<tr>
<th>Per-Taking Protocol Fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the experimenter follow the script as stated on the modified training sheet when stating the modified training instructions to the participant? yes / no</td>
</tr>
<tr>
<td>Did the experimenter refrain from providing verbal feedback until both questions within the item were answered? yes / no</td>
</tr>
<tr>
<td>Did the experimenter provide verbal feedback (i.e.- &quot;good job&quot; or &quot;try again&quot;) in response to the participant's correct or incorrect response to each item? yes / no</td>
</tr>
<tr>
<td>Is the experimenter refraining from giving the participant any nonverbal ques (i.e.- approving or disapproving looks, looking away, etc) prior to the participant's correct or incorrect responses? yes / no</td>
</tr>
<tr>
<td>Did the experimenter state the questions verbatim as written on the question sheet? yes / no</td>
</tr>
<tr>
<td>Were the questions delivered in the order in which they appear on the question sheet? yes / no</td>
</tr>
</tbody>
</table>

# implemented with fidelity : 
Total : 6 = %
APPENDIX C

Versions of the Response Generalization Scoring Sheets for Each Level of Complexity

with Corresponding IOA Scoring Sheet
### Scoring Sheet for Response Generalization Protocol: Simple Relations

Subject #: ____________________  Age: _____  Gender: M  F
Examiner: ______________________________  Date:  /

<table>
<thead>
<tr>
<th>Trial#</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I have the hamburger and you have the grilled cheese.</td>
<td>1) Which sandwich do I have?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which sandwich do you have?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>You have the hamburger and I have the grilled cheese.</td>
<td>1) Which sandwich do you have?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which sandwich do I have?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>If I’m standing in the classroom, and you’re standing on the playground.</td>
<td>1) Where are you standing?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where am I standing?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>If you’re standing in the classroom, and I’m standing on the playground.</td>
<td>1) Where am I standing?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where are you standing?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Yesterday I was playing X-Box, today I am watching “The Incredibles.”</td>
<td>1) What was I doing then?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What am I doing now?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Today you are watching “The Incredibles,” yesterday you were playing X-Box.</td>
<td>1) What are you doing now?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What were you doing then?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Yesterday you were reading comic books, today you are talking on the phone.</td>
<td>1) What are you doing now?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What were you doing then?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>Today I am talking on the phone, yesterday I was reading comic books.</td>
<td>1) What was I doing then?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What am I doing now?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Correct Trials (= both questions answered correctly): 8

Total Trials: 8
### IOA Scoring Sheet for Response Generalization Protocol: Simple Relations

Subject #: ________________  Age: _____  Gender: M     F  
Examiner: __________________________ Date:       /        /  

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>I have the hamburger and you have the grilled cheese.</td>
<td></td>
<td>(Hamburger)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Which sandwich do I have?</td>
<td>Yes</td>
<td>(Hamburger)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which sandwich do you have?</td>
<td>No</td>
<td>(Grilled cheese)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>You have the hamburger and I have the grilled cheese.</td>
<td></td>
<td>(Hamburger)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Which sandwich do you have?</td>
<td>Yes</td>
<td>(Hamburger)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which sandwich do I have?</td>
<td>No</td>
<td>(Grilled cheese)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>If I’m standing in the classroom, and you’re standing on the playground.</td>
<td></td>
<td>(Classroom)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where are you standing?</td>
<td>Yes</td>
<td>(Playground)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where am I standing?</td>
<td>Yes</td>
<td>(Classroom)</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>If you’re standing in the classroom, and I’m standing on the playground.</td>
<td></td>
<td>(Classroom)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where am I standing?</td>
<td>Yes</td>
<td>(Playground)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where are you standing?</td>
<td>Yes</td>
<td>(Classroom)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Yesterday I was playing X-Box, today I am watching “The Incredibles.”</td>
<td></td>
<td>(X-Box)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What was I doing then?</td>
<td>Yes</td>
<td>(X-Box)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What am I doing now?</td>
<td>Yes</td>
<td>(The Incredibles)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Today you are watching “The Incredibles,” yesterday you were playing X-Box.</td>
<td></td>
<td>(The Incredibles)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What are you doing now?</td>
<td>Yes</td>
<td>(X-Box)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What were you doing then?</td>
<td>Yes</td>
<td>(The Incredibles)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Yesterday you were reading comic books, today you are talking on the phone.</td>
<td></td>
<td>(Comic Books)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What are you doing now?</td>
<td>Yes</td>
<td>(Phone)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What were you doing then?</td>
<td>Yes</td>
<td>(Comic Books)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Today I am talking on the phone, yesterday I was reading comic books.</td>
<td></td>
<td>(Phone)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What was I doing then?</td>
<td>Yes</td>
<td>(Comic Books)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What am I doing now?</td>
<td>Yes</td>
<td>(Phone)</td>
</tr>
</tbody>
</table>

Correct Trials (= both questions answered correctly) : 8  
Total Trials: 8
## Protocol Fidelity

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<tr>
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</tr>
</tbody>
</table>

# implemented with fidelity : 
Total : 6
### Scoring Sheet for Response Generalization Protocol: Reversed Relations

Subject #: ____________________________   Age: ____  Gender:   M    F  
Examiner: ________________________________ Date:       /        /

<table>
<thead>
<tr>
<th>Trial#</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>I am holding the puppy and you are holding the kitten, if I was you and you were me.</td>
<td>Yes    No (Kitten)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Which animal am I holding?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which animal are you holding?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>You are holding the puppy and I am holding the kitten, if I was you and you were me.</td>
<td>Yes    No (Puppy)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Which animal are you holding?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Which animal am I holding?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Yesterday I was swimming there in the pool, if here was there and there was here.</td>
<td>Yes    No (Lake)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where was I swimming then?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where am I swimming now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Today you are swimming here in the lake, if there was there and there was here.</td>
<td>Yes    No (Pool)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where are you swimming now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where were you swimming then?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Yesterday I was doing my homework; today I am taking a nap. If now was then and then was now.</td>
<td>Yes    No (Homework)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What would I be doing now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What was I doing then?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Today you are doing your homework; yesterday you were taking a nap. If now was then and then was now.</td>
<td>Yes    No (Nap)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What were you doing then?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What would you be doing now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Yesterday you were playing soccer, today you are playing basketball. If now was then and then was now.</td>
<td>Yes    No (Basketball)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What were you doing then?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What would you be doing now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>Today I am playing soccer, yesterday I was playing basketball. If now was then and then was now.</td>
<td>Yes    No (Soccer)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) What would I be doing now?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) What was I doing then?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Correct Trials (= both questions answered correctly): 8

Total Trials: 8
### IOA Scoring Sheet for Response Generalization Protocol: Reversed Relations

**Subject #: ___________________ Age: _____**  
Gender: M F  
**Examiner: ________________________ Date: / /**

<table>
<thead>
<tr>
<th>Trial #</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
</table>
| 1       | 1     | I am holding the puppy and you are holding the kitten, if I was you and you were me.  
1) Which animal am I holding? | Yes | (Kitten) |
|         |       | 2) Which animal are you holding? | Yes | (Puppy) |
| 2       | 2     | You are holding the puppy and I am holding the kitten, if I was you and you were me.  
1) Which animal are you holding? | Yes | (Kitten) |
|         |       | 2) Which animal am I holding? | Yes | (Puppy) |
| 3       | 3     | Yesterday I was swimming there in the pool, today I am swimming here in the lake, if here was there and there was here.  
1) Where was I swimming then? | Yes | (Lake) |
|         |       | 2) Where am I swimming now? | Yes | (Pool) |
| 4       | 4     | Today you are swimming here in the lake, yesterday you were swimming there in the pool, if here was there and there was here.  
1) Where are you swimming now? | Yes | (Pool) |
|         |       | 2) Where were you swimming then? | Yes | (Lake) |
| 5       | 5     | Yesterday I was doing my homework; today I am taking a nap. If now was then and then was now.  
1) What would I be doing now? | Yes | (Homework) |
|         |       | 2) What was I doing then? | Yes | (Nap) |
| 6       | 6     | Today you are doing your homework; yesterday you were taking a nap. If now was then and then was now.  
1) What were you doing then? | Yes | (Homework) |
|         |       | 2) What would you be doing now? | Yes | (Nap) |
| 7       | 7     | Yesterday you were playing soccer, today you are playing basketball. If now was then and then was now.  
1) What were you doing then? | Yes | (Basketball) |
|         |       | 2) What would you be doing now? | Yes | (Soccer) |
| 8       | 8     | Today I am playing soccer, yesterday I was playing basketball. If now was then and then was now.  
1) What would I be doing now? | Yes | (Basketball) |
|         |       | 2) What was I doing then? | Yes | (Soccer) |

**Correct Trials (= both questions answered correctly):**

**Total Trials:** 8
<table>
<thead>
<tr>
<th>Protocol Fidelity</th>
<th></th>
</tr>
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<td>Is the experimenter refraining from giving the participant any verbal ques (i.e.- &quot;good job&quot; or that is incorrect”) in response to the participant’s correct or incorrect responses?</td>
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# implemented with fidelity : 
Total : 6
<table>
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<tr>
<th>Trial#</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
</table>
| 1     | 1     | 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.  
1) Where would I be sleeping?  
2) Where would you be sleeping? | Yes No           | (Bedroom)       |
|       | 2     | 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.  
1) Where would you be sleeping?  
2) Where would I be sleeping?   | Yes No           | (Living room)   |
| 2     | 3     | 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.  
1) Where would you be eating?  
2) Where would I be eating?   | Yes No           | (Wendy's)       |
|       | 4     | 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.  
1) Where would I be eating?  
2) Where would you be eating? | Yes No           | (McDonalds)     |
| 3     | 5     | 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.  
1) Where would I be shopping then?  
2) Where would I be shopping now? | Yes No           | (Mall)          |
|       | 6     | 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.  
1) Where would you be shopping now?  
2) Where would you be shopping then? | Yes No           | (Grocery store) |
| 7 | **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.**  
1) Where would you be running now?  
2) Where would you be running then? | Yes | No | *(Gym class)*  
| 8 | **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.**  
1) Where would I be running then?  
2) Where would I be running now? | Yes | No | *(Park)*  

**Correct Trials (= both questions answered correctly):**

**Total Trials:** 8
### IOA Scoring Sheet for Response Generalization Protocol: Double Reversed Relations

**Subject #: _______________**  **Age: _____**  **Gender: M  F**

**Examiner:** ________________________  **Date:**       /        /

<table>
<thead>
<tr>
<th>Trial#</th>
<th>Order</th>
<th>Item</th>
<th>Correct Response?</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would I be sleeping?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would you be sleeping?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would you be sleeping?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would I be sleeping?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would you be eating?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would I be eating?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would I be eating?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would you be eating?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would I be shopping then?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would I be shopping now?</td>
<td>Yes</td>
<td>No</td>
</tr>
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<td>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.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>1) Where would you be shopping now?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2) Where would you be shopping then?</td>
<td>Yes</td>
<td>No</td>
</tr>
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</table>
| 7 | 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.  
1) Where would you be running now?  
2) Where would you be running then? | Yes | No | (Gym class) |
|---|---|---|---|
| 8 | 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.  
1) Where would I be running then?  
2) Where would I be running now? | Yes | No | (Park) |

Correct Trials (= both questions answered correctly): 1) Yes, 2) No

Total Trials: 8

### Protocol Fidelity

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
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