Training Deictic Relational Responding in
People Diagnosed with Schizophrenia

by

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TABLE OF CONTENTS

List of Figures

Abstract

The purpose of this study was to replicate and extend recent findings in the functional contextual literature by 1) establishing complex deictic relational responding skills in 3 persons diagnosed with Schizophrenia and mild-moderate Mental Retardation and 2) assessing generalization through pre and post-instructional measures of Social Anhedonia and Theory of Mind functioning. Results suggest that increasingly complex levels of deictic relational responses were acquired and mastered by all 3 participants and that generalization extended to the *Deceptive Container Task* (ToM levels 4 & 5) and *Hinting Task*. Support is provided for the notion that perspective taking skills might be shaped through operant conditioning of deictic frames and that acquisition of these skills may generalize to novel stimuli and settings.

Introduction

According to the National Institute of Mental Health (2009), Schizophrenia is a brain disorder that occurs in approximately 1% of the general population and is associated with several genes and environmental influences. A DSM IV-TR diagnosis of Schizophrenia may occur when 6 criterion are met: A) presentation of two or more characteristic symptoms (delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, negative symptoms) for a significant portion of time during a 1-month period, B) social/occupational dysfunction, C) duration of at least 6 months D) Schizoaffective and Mood Disorder exclusion, E) substance/general medical condition exclusion, and F) exclusion of a relationship to a Pervasive Developmental Disorder. (American Psychiatric Association, 2000).

Social disinterest, a Criterion A negative symptom, is considered a defining dimension of Schizophrenia (American Psychiatric Association; World Health Organization, 1992). Corcoran, Mercer, and Frith (1995) found that those with negative symptoms as well as those with paranoid delusions and related positive symptoms scored significantly lower than controls when inferring the mental states of others. In fact, social anhedonia is thought to be a main factor in the prediction of onset in Schizophrenia research, even when it is not associated with other dimensions of schizotypy (Gooding, Tallent, & Matts, 2005). Others have suggested that inaccurate social perceptions persist during remission phases and may well contribute to reemergence of psychotic symptoms (Hyronemus, Penn, Corrigan, & Martin, 1998). In a prospective investigation, Schiffman

et al. (2004) observed that children who scored low on perspective taking measures were at a higher risk of developing a Schizophrenia Spectrum Disorder than those who attained high scores. This topic has received considerable attention from cognitive and developmental psychologists in recent decades, leading to a nativist theory which examines age as the dependent variable in the acquisition of perspective taking skills.

Theory of Mind

Theory of Mind (ToM) refers to the ability to attribute beliefs, intentions, or emotions (i.e., mental states) to the self or to others in order to predict or explain their behavior (Premack & Woodruff, 1978) and therefore plays an important role in everyday activities that require an accurate understanding of another person's perspective. ToM, as put forth in the neurodevelopmental literature, postulates 5 levels (Howlin, Baron-Cohen, & Hadwin, 1999) in understanding perspective and takes a nativist developmental approach in explaining the acquisition of perspective taking skills via maturation (i.e., the passage of time as the independent variable).

Levels of Theory of Mind

There are five general levels in the development of ToM ability that range from simple visual perspective taking to predicting actions on the basis of true and false belief (Howlin et al., 1999). As the levels represent increasing complexity, each level is dependent on adequate performance on all previous levels. In addition, there are at least two abilities seen to be foundational to all aspects of theory of mind; the first, *mental-physical distinction*, includes the ability to identify what someone is able to do physically (e.g., actually pet a dog) as opposed to a thought (e.g. imagining someone petting a dog). The second basic ability is to identify distinctions between *appearance and reality* (e.g., a

candle that is in the shape of an apple). Following from this foundation are the five levels of ToM ability.

Level 1 simple visual perspective taking. People are said to act on the principle that different individuals can have different views of the same situation or object. For example, with a two-sided card placed between two individuals, one person can see only one side while the other person can only see the other side. Each side of the card has a different picture on it (e.g., ace of spades & decorative design).

Level 2 complex visual perspective taking. This is based on the principle that people can see the same thing differently. For example, if an item is placed between two individuals sitting opposite one another, one person will see the front of the item and the other will see the reverse. In the language of ToM, these first two levels are collectively referred to as *first-order* because they involve the simple attribution of a mental state to another person (Baron-Cohen, 2004).

Second Order

Levels 3-5 in the development of ToM may be collectively referred to as *second-order* because they involve the more complex understanding that a person can have mental states about another person's mental states (Baron-Cohen, Tager-Flusberg, & Cohen, 2004).

Level 3 seeing leads to knowing. Seeing leads to knowing is based on the principle that people only know things that they have seen (Taylor, 1988). Therefore, an individual who cannot track what another person may or may not know is unlikely to engage in continued social interaction, or have the ability to determine whether the other

person is being truthful or dishonest. At level 3, a true belief is established through the delivery of information from another source.

Level 4 true belief. This aspect extends the level 3 attribution of seeing leads to knowing by predicting the actions of another based on the information provided by another. The ability to engage in true belief tasks based on the rules of access (seeing or not) are also believed to be important pre-requisites to the attribution of false belief. Whether or not true belief as a prerequisite to false belief is actually necessary is unclear.

Level 5 false belief. False belief involves the principle that you can predict actions on the basis of another's false belief and can become aware that previous beliefs may have been false (Howlin et al., 1999). In instances in which representations or beliefs are discriminated as incorrect or false (e.g., events may have occurred without a person's knowledge) the individual can alter the belief about these events. In other words, given additional information about events not experienced, individuals are able to modify their belief such that it is in line with what has occurred. Moreover, the individual can recognize that prior to acquiring the new information he/she was behaving on the basis of a false belief.

ToM Applications in Perspective Taking and Schizophrenia

ToM literature suggests that people diagnosed with Schizophrenia have difficulties in sequencing false-belief stories (Langdon et al., 1997), understanding metaphors in proverbs (Brüne & Bodenstein, 2005), as well as ironic and metaphorical statements (Langdon, Davies, & Coltheart, 2002; Mo, Su, Chan, & Liu, 2008), understanding humorous pictures (Corcoran, Cahill, & Frith, 1997), and inferring intentions (Corcoran etal., 1995; Sarfati & Hardy- Baylé, 1999). Overall, ToM research

has suggested that people diagnosed with Schizophrenia have deficits in inferring mental states such as the beliefs, desires, and intentions of others (perspective taking). Some authors have considered that difficulties in perspective taking skills constitute the core element of mental states attribution deficits in Schizophrenia (Langdon & Coltheart, 2001; Langdon, Coltheart, Ward, & Catts, 2001) and a recent meta-analysis of ToM literature suggested that deficits may well persist during remission phases (Bora, Yucel, & Pantelis, 2009). While the majority of research performed in this area has been undertaken from a neurodevelopmental standpoint, recent developments in the field of Behavior Analysis have led to inquiry from a functional contextual approach to perspective taking (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004; Villatte, Monestès, McHugh, Freixa i Baqué, & Loas, 2010a; Weil, Hayes, & Capurro, 2011).

Relational Frame Theory

Relational Frame Theory (RFT) is a functional contextual account of human language and cognition based on the operant scientific system put forth by B.F. Skinner. This view approaches all behavior as being influenced by a history of antecedent and consequential environmental stimuli which comes to bear on the current context. Cognitive and developmental psychologists, language pathologists, and other non-behavioral scientific fields have attempted to account for verbal behavior with mentalist models, such as ToM, that do not serve to predict or control verbal behavior but rather, in the end, might "allay curiosity and bring inquiry to a stop" (Skinner, 1974). Skinner defined verbal behavior as behavior that is reinforced through the mediation of another who is specifically trained to do so (Skinner, 1957).

The definition of verbal behavior provided by RFT differs from that of Skinner by requiring, in addition to Skinner's criterion, that in order to be considered verbal, a behavior must participate in a relational frame (Hayes, Barnes-Holmes, & Roche, 2001). A relational frame is defined by Hayes et al. (2001, p. 33) as:

> *"A specific class of arbitrarily applicable relational responding that shows the contextually controlled qualities of mutual entailment, combinatorial mutual entailment, and transformation of stimulus functions; is due to a history of relational responding relevant to the contextual cues involved; and is not solely based on direct non-relational training with regard to other particular stimuli of interest, nor solely to nonarbitrary characteristics of either the stimuli or the relation between them."*

Although the development of language and cognition are phenomena which are not yet satisfactorily understood, RFT provides the tools necessary for an empirical evaluation of complex cognitive constructs such as perspective taking.

Mutual Entailment

Relational framing begins with direct contingencies for neutral stimuli and can be trained via operant conditioning (Törneke, 2010). That is, a neutral stimulus (B) can be trained as functionally equivalent to another stimulus (A) by reinforcing the desired response to a question such as "Stimulus A is the same as?" When presented with stimulus A and asked this question in the presence of stimuli B/C/D, the participant will choose stimulus B. What we find in addition, is that the reverse selection will also occur. When presented with stimulus B and asked to choose its equivalent from stimuli A/C/D, the participant will choose stimulus A although this relation has never been directly trained. The relation from B-A is derived through mutual entailment and if we introduce a third stimulus (C) and again train equivalence to stimulus A, we will find the same results with A-C as we do with stimulus A-B.

Combinatorial Mutual Entailment.

In addition to the two relations that have been trained (A-B, A-C) and the complementary relations, which, are in turn derived through mutual entailment (B-A, C-A), a process known as combinatorial mutual entailment establishes a derived equivalence relationship between stimulus B-C and C-B. In order for this to occur, one must be able to take the position of stimulus B in order to understand it's relation to stimulus A and likewise, take the position of stimulus C in order to understand it's relation to stimulus A. Through combinatorial mutual entailment, if stimulus B is equivalent to stimulus A and stimulus C is also equivalent to stimulus A, then stimulus B and C acquire a derived equivalence relationship. Combining previously learned relations is thought to be the basis for the development of complex human language behavior such as metaphor and sarcasm because these processes require that a person is able to take different perspectives (Hayes et al., 2001).
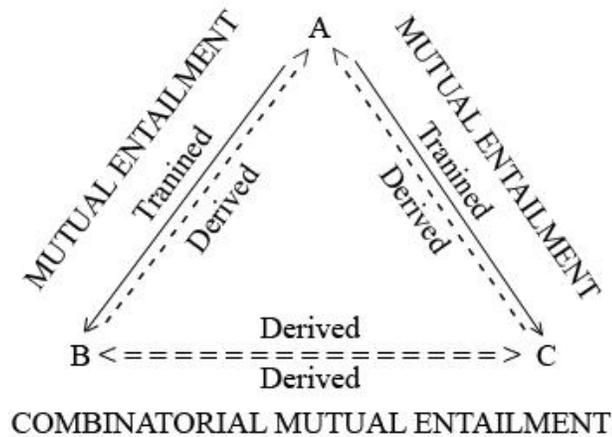
Figure 1. Components of a Relational Frame.

In review, by training two equivalence relations (A-B, A-C), four derived equivalence relations are established (B-A, C-A, B-C, C-B). Two derived relations are

established via mutual entailment (B-A, C-A) and two derived relations are established via combinatorial mutual entailment (B-C, C-B). A total of six equivalence relations develop as a result of only two directly trained equivalence relations (figure 1).

Three types of relational frames that seem to be important in the development of language are *coordination:* as described in the previous equivalence example. *Opposition:* the simplest relation in which some derived relations differ from the original trained relations. If stimulus A is opposite to stimulus B and stimulus A is opposite to stimulus C, then we can derive two relations of opposition via mutual entailment (B-A, C-A) but also two relations of equivalence via combinatorial mutual entailment (B-C, C-B). *Distinction*: the simplest form of relational frame in which some relations go unspecified. If stimulus A is different than stimulus B and stimulus A is also different than stimulus C, then two relations (B-A, C-A) are derived via mutual entailment but we are unable to derive the remaining relations (B-C, C-B) via combinatorial mutual entailment because the relationship between stimulus B and C remains ambiguous.

Other relational frames that might be established through derived relations are: distinction (Roche & Barnes, 1996), comparison (Dymond & Barnes, 1995; O'Hora, Roche, Barnes-Holmes, & Smeets, 2002), hierarchy (Griffee & Dougher, 2002), analogy (Barnes, Hegarty, & Smeets, 1997; Lipkens & Hayes, 2009; Stewart, Barnes-Holmes, & Roche, 2004), temporality (O'Hora, Barnes-Holmes, Roche, & Smeets, 2004; O'Hora et al., 2002), and perspective, or deictic relational responding as it is referred to in RFT literature (McHugh et., 2004).

Contextual cues help to predict reinforcement for particular relational responses and there are two types of contextual cues referred to in RFT. The first is a relational cue

or C_{rel} (pronounced "see real"). This is a type of contextual cue that specifies the relation between stimuli and the type of relational response that is likely to receive reinforcement. Some examples of C_{rel} are "equal to", "greater than", and "less than". C_{func} (pronounced "see funk") is a type of contextual cue that specifies the stimulus functions to be transformed in a relational frame. For example, if we say that "He is a rock", then "is a rock" serves as a C_{func} for the person's stimulus functions to transform and take on certain stimulus functions that are often paired with rocks (i.e. hard or not easily changed). Known as metaphor, statements like this are just one example of how arbitrarily applicable relational responding can account for complex and novel human language extensions originally described by Skinner.

Transfer of Stimulus Functions

Using the equivalence (a frame of coordination) relation described previously as an example, it is now possible to alter the function of each stimulus in the frame by introducing a fourth stimulus with a different function (ex. anxiety producing) to stimuli A, B, and C. When stimulus D, having an aversive property, is introduced and trained as equivalent to say, stimulus B, the result is a trained aversive equivalence function transferred from stimulus D-B and a derived aversive equivalence function between stimuli B-D. As a result, when stimulus B again comes in contact with stimulus A or C, the aversive function will transfer to both remaining stimuli through derived relations (Törneke, 2010).

A Relational Frame Account of the Self and Perspective taking

In behavioral terms, the self has been described by Lattal (2012) as 1) the collective repertoire of behavior resulting from a unique genetic and behavioral history.

2) A specific behavioral repertoire under stimulus control, such that multiple selves may be described. 3) A verbal response describing aspects of one's behavioral repertoire. 4) A dependent variable: the outcome of contingencies of reinforcement and punishment. 5) An independent variable: a potential source of control over an individual's behavior. Perspective taking ability is thought to be critical to the development of the self.

In RFT, perspective taking is argued to emerge from deictic relational frames (Barnes-Holmes, Barnes-Holmes, & Cullinan, 2001; McHugh et al., 2004). Deictic frames are established by demonstration and cannot be traced to formal dimensions of the environment because they are relative to the speaker (McHugh et al., 2004). That is to say, whereas bigger/smaller relations have formal counterparts in the environment and learning histories most likely involve a reliance on formal dimensions initially; deictic relations do not. The primary dimensions involved are spatial, temporal, and perspective in relation to the speaker. Each is said to emerge due to a history of asking and responding to questions such as "What am I doing?" and "Where were you yesterday?" While the formal characteristics of questions like these may be consistent across many different situations, inevitably the situations themselves will vary. What is consistent across different events are the relational properties of I-You (allocentric), Here-There (egocentric), and Now-Then (egocentric) (McHugh et al., 2004).

These particular relational frames participate in all levels of ToM complexity. For instance, levels 1 and 2 involve simple and complex visual perspective taking. During relational training the principle of different people see different things is targeted. As such, contextual control of the I-You relational frame is being established. That is, given

a statement regarding some visual stimuli, the correct response is evoked by the contextual cues of I and You in the statement.

Level 3 involves training on the principle of seeing leads to knowing. The relational protocol involves continued training with the I-You relational frame to increase the flexibility of the relational class, and indirectly targets the temporal relations of Now-Then. For example, when discussing the location of an object, references to time and personal indicators are often used as in, "I saw the key this morning (Then) so I know (Now) where it is." or "You did not see the key (Then) so (You) do not know (Now) where it is."

Relational training at level 4 involves the acquisition of contextual control of the deictic frames. A common exemplar for true belief involves a scenario where a car is placed beside a boat, and in another scene, an identical car is placed beside a plane. A child is then provided with the following true belief story: "This morning, you saw the car next to the boat but you did not see the car next to the plane". The child is then asked, "Where do you think the car is? Why do you think it is near the boat? Where will you go to get the car? Why will you go to the boat?" The correct conclusions from this scenario involve the knowledge that one will only know what one has seen, and will act on this basis. Although Levels 3 and 4 of understanding informational states appear to cover the attribution of true belief to the self and others, these abilities are also believed to be important pre-requisites to the attribution of false belief (Howlin et al., 1999).

Level 5 involves further training on the complexity and flexibility of deictic relational frames involving false belief tasks. The principle covered here involves predicting actions on the basis of false belief as well as becoming aware that previous

beliefs may have been false and thus providing the context to alter the previous response to a true belief. Accomplishment of these tasks requires an appreciation that observation from a specified perspective may change when seen from another perspective. As previously mentioned, all require observations made from a specified perspective or point of view, defined by person, place, and time. From an RFT point of view, that sense of perspective is the result of deictic frames along those three dimensions (I-You, Here-There, Now-Then).

Relational Frame Applications in Perspective Taking

Based on the Barnes-Holmes et al. (2001) perspective taking protocol, McHugh et al. (2004) developed a shortened protocol in order to assess the acquisition of skills via the deictic relations of I-You, Here-There and Now-Then. Relations were assessed in simple, reversed, and double reversed tasks across 56 (originally 256) total trials. The study determined that accuracy on deictic perspective taking tasks increased as a function of age (3-5 years (early childhood); 6-8 years (middle childhood); 9-11 years (late childhood); 12-14 years (adolescence); and 18–30 years (adulthood)) and that levels of accuracy appeared to decrease as a function of relational complexity. Overall, participants performed with higher levels of accuracy in simple deictic trials when compared to reversed trials. The findings from this and subsequent studies support ToM literature which designates age as the independent variable in the acquisition of perspective taking skills, acting on the basis of true/false belief (McHugh, Barnes-Holmes, & Barnes-Holmes, 2003b), and acting for the purpose of deception (McHugh, Barnes-Holmes, & Barnes-Holmes, 2003c).

Proponents of RFT have since developed deictic relational responding training that has been shown to accelerate the development of these repertoires in typically developing children (McHugh, Barnes-Holmes, & Barnes-Holmes, 2003a). Rehfeldt, Dillen, Ziomek, and Kowalchuk (2007) also suggested that two typically functioning children ages 9 and 10 acquired perspective taking skills through reinforced multiple exemplars. A limitation to the study was that the researchers did not assess external validity in generalizing to novel tasks. The study was also the first to show that children with high-functioning Autism Spectrum Disorders scored lower on each level of deictic perspective taking through an automated Barnes-Holmes protocol. Heagle and Rehfeldt (2006), utilized an extended and automated version of the Barnes-Holmes protocol to reinforce three normal functioning children of ages 6, 8, and 11 years to generalize simple, reversed, and double-reversed perspective taking to real world stimuli and responses. In addition, Weil et al. (2011) demonstrated that deictic relational frames can be shaped as operant behavior in typically functioning children age 4-5 years and that reversed and double-reversed perspective taking acquisition correlated with increases in scoring on the ToM false-belief *Deceptive Container Task*. This was the first relational frame study to asses ToM task performance as a pre/post-training measure.

The literature suggests that when deficits in deictic perspective taking tasks are found, acquisition may be facilitated through reinforced multiple exemplar training. Moreover, these findings have encouraged research in the area of Schizophrenia by suggesting that perspective taking skills might be remediated in the same fashion.

Deictic Relations and Schizophrenia

In a series of studies performed by Villatte et al. (2008, 2010a, 2010b), the McHugh et al. (2004) protocol was employed to determine if persons with high levels of Social Anhedonia and Schizophrenia exhibit deficits in deictic perspective taking tasks.

Villatte et al. (2008) utilized an automated version of the McHugh et al. (2004) protocol to assess relational responding in 30 nonclinical young adults (age 18-21) with high levels of Social Anhedonia. The protocol included 62 trials, each of which differed from the others depending on the deictic relation it addressed (I-You, Here-There or Now-Then) and the level of relational complexity assigned (8 simple, 36 reversed, and 18 double reversed) for a total of eight trial-types (simple I-You, simple Here-There, simple Now-Then, reversed I-You, reversed Here-There, reversed Now-Then, double reversed I-You/Here-There, double reversed Here-There/Now-Then). Villatte et al. found that socially anhedonic participants scored lower than a control group on the more complex (double-reversed) relational responding tasks which involved the deictic relation of I-You and that performance on the deictic relational responding protocol predicted accuracy on an established ToM exercise which involves identifying the intent of indirect speech known as the *Hinting Task* (see Corcoran et al., 1995).

Villatte et al. (2010a), study 1, employed a protocol consisting of 48 true/false ToM trials in order to assess deficits in attributing a belief to the self or to another (12 true-belief for self, 12 false-belief for self, 12 true-belief for another, 12 false-belief for another) in 30 first-year Psychology students with Social Anhedonia. The study found that those with scores at or above two standard deviations on the Revised Social Anhedonia Scale (RSAS) (Eckblad, Chapman, Chapman, & Mishlove, 1982) performed

more poorly than controls on relational responding tasks that involved reversing the I-You frame when attributing a belief (true or false) to another. Overall, experimental participants produced 75% more errors on true-belief (ToM level 4) tasks and 300% more errors on false-belief tasks (ToM level 5). No differences were found between groups on tasks that involved attribution of a belief to the self. These findings support those of Villatte et al. (2008) in that participants with high levels of Social Anhedonia appeared to exhibit deficits in taking the perspective of another during complex deictic relational responding tasks.

Villatte et al. (2010a), study 2, compared performance, on the same tasks as study 1, by 15 patients (ages 22-53) diagnosed with Schizophrenia according to ICD-10 (World Health Organization, 1992). The number of tasks was reduced by half as compared to study 1 due to hospitalization constraints and resulted in 24 true/false trials for the purpose of assessing deficits in attributing a belief to another or to the self (6 true-belief for self, 6 false-belief for self, 6 true-belief for another, 6 false-belief for another). The study reported that experimental participants scored lower than controls in tasks that required attributing belief to another (reversal of I-You frame) and were less accurate in attribution of a false-belief (as compared to true-belief) to the self or another (supporting ToM reports by Brune, 2005 & Sprong, Schothorst, Vos, Hox, & Van Engeland, 2007). In contrast, accuracy of controls did not differ across trial-types. Response latencies were also assessed and resulted in the finding that subjects with high levels of Social Anhedonia were as fast in responding to the tasks as control subjects. This finding suggests that impulsivity, often exhibited by people with Schizophrenia, is unlikely to account for increased levels of error on perspective taking tasks in this population. This

also suggests that neuroleptic medication side effects did not have a significant effect on subject's performance in perspective taking. It is also unlikely that memory deficits account for increased errors on longer tasks because tasks were left on screen for as long as participants needed. These findings lend further support to the hypothesis that high levels of Social Anhedonia lead to less practice in perspective taking and thus, deficits emerge. It is also quite possible that Social Anhedonia is reinforced by its consequences, thus exacerbating the condition. While Villatte et al. found that deficits in attributing a false belief to the self were present in patients with Schizophrenia (study 2), the same did not apply to those with Social Anhedonia alone (study 1). This finding suggests that low levels of social interaction can be implicated in the impairment of understanding another's point of view but perhaps not in the understanding that people can act on the basis of a false-belief.

In a study published the same year, Villatte et al. (2010b) assessed relational responding in 15 patients (ages 22-53) diagnosed with Schizophrenia, according to ICD-10 (World Health Organization, 1992). The protocol included 42 trials, each of which again differed from the others depending on the deictic relation it addressed and the level of relational complexity (8 simple, 20 reversed, and 14 double reversed) assigned. This study found that the experimental group scored significantly lower than the control group on all reversed trial types (I-You, Here-There, Now-Then). While the experimental group also scored lower on double-reversed trials, the deficit fell short of significance, although, it was hypothesized that significance would have been reached with a larger sample size. Similar to the findings of Villatte et al. (2008) performance on the deictic relational responding protocol again predicted accuracy on the ToM *Hinting Task*.

The current study trained deictic relational responding in 3 people diagnosed with Schizophrenia and mild-moderate Mental Retardation and the study took place at a local behavioral services company in Tampa, Florida. Once consent had been obtained, participants completed the Revised Social Anhedonia Scale and then tested for deficits in deictic relational responding and an attempt to remediate these skills then occurred through reinforced multiple exemplar training. The *Deceptive Container Task* (levels 4 and 5) and the *Hinting Task* were employed as baseline ToM probes as well as post-training probes for skill remediation. This study is the first in the deictic relational responding literature to utilize a single-subject analysis to attempt remediation of perspective taking skills in Schizophrenia and also the first to address such deficits in a population of clients with mild-moderate Mental Retardation.

Method

Participants

Screening confirmed that each of the 3 participants selected for the study met the following inclusion criteria: 1) a current diagnosis of Schizophrenia, 2) a diagnosis of mild-moderate Mental Retardation, 3) high scores on the Revised Social Anhedonia Scale, 4) deficits on the ToM tasks, and 5) deficits in deictic relational responding.

Participant #1 was a 66 year old male who had diagnoses of Schizophrenia, Bipolar manic with psychotic features, and Mental Retardation. Prescription drugs related to these diagnoses were Abilify (atypical antipsychotic) and Carbamazepine (anticonvulsant/mood stabilizing). He had a long history of engaging in inappropriate sexual behavior towards children and vulnerable adults. Participant #2 was a 49 year old male diagnosed with Schizophrenia with auditory hallucinations and Mental Retardation.

Prescription drugs related to these diagnoses were Zyprexia and Risperdal (atypical antipsychotics). He had a history of engaging in inappropriate sexual behavior toward adult females. Participant #3 was a 47 year old male diagnosed with Schizophrenia with bizarre vocalizations and Mental Retardation. Prescription drugs related to these diagnoses were Zyprexia (atypical antipsychotic), Haldol (typical antipsychotic), Luvox (SSRI), and Depakote (anticonvulsant/mood stabilizing). He had a history of engaging in inappropriate sexual verbalizations toward adult females.

Following screening, an explanation of the relational responding protocol was provided to each potential participant in language appropriate for functioning level and a review period of 24 hours was allowed before obtaining written informed consent from each. Ongoing assessment of consent was performed before the onset of each study session and participants were made aware that they may opt out of the study at any time and that this choice would have no affect on their regular treatment. Participants did not receive any form of monetary compensation.

Setting

Study sessions were conducted in private closed-door rooms at each of the client's homes or Adult Day Training (ADT) facility. The rooms varied in size across client homes but contained at least two chairs and one table. Participants sat facing the experimenter in order to facilitate training and every attempt was made to avoid interruptions.

Design

A within-subject multiple probe design was combined with a multiple baseline across behaviors design which allowed for evaluation of acquisition across levels of deictic relational complexity (Simple, Reversed, and Double Reversed relations).

Data Collection

Sessions were approximately 10 minutes in duration, attempted twice daily, and were typically conducted on Mondays, Wednesdays, and Fridays. Study duration ranged from 8-10 weeks per participant. Data were reported as the percentage of correct responses per session and were calculated by dividing correct trials by total trials and multiplying by 100. Interobserver Agreement (IOA) was conducted by a master's level graduate student via audio recordings of sessions. IOA percentage was calculated on a trial by trial basis by dividing the number of trials with agreement by the number of trials with agreement plus disagreement, then multiplying by 100. IOA was calculated across 33.1% of all sessions (including 33.3% of post-training probes) and resulted in 95.8% agreement.

Procedures

Testing and Training

Each participant was exposed to the same order of testing and training. The general course and sequence of the study progressed from baseline assessments to intervention training with post-training probes conducted before advancing to higher complexity tasks:

1. Baseline probes
   - Revised Social Anhedonia Scale
   - ToM (*Deceptive Container* & *Hinting Tasks*)
   - RFT (All deictic complexity levels)

2. Deictic training (Simple level)
  ▪ Post deictic training probes
    • Mastery (Simple)
    • Baseline (Reversed and Double Reversed)
3. Deictic training (Reversed level)
  ▪ Post deictic training probes
    • Mastery (Simple and Reversed)
    • Baseline (Double Reversed)
    • 1st post-training ToM probes (*Deceptive Container & Hinting Tasks*)
    • Revised Social Anhedonia Scale
4. Deictic training (Double Reversed level)
  ▪ Post deictic training probe
    • Mastery (All complexity levels)
    • 2nd post-training (*Deceptive Container & Hinting Tasks*)
    • Revised Social Anhedonia Scale

Theory of Mind testing. Levels four and five theory of mind testing consisted of 32 scenarios with accompanying true/false questions. These scenarios were read to participants from note cards in random order. Scenarios were modeled around the ToM *Deceptive Container Task* used by Villatte et al. (2010a) and were divided equally into 4 categories: true belief attribution to oneself, false belief attribution to oneself, true belief attribution to another, and finally, false belief attribution to another. An equal number of true and false answers for each type of attribution were maintained. Three object sets appeared in the scenarios: a cigarette pack and crayons, a crayon box and cigarettes, and a chalk box and pencils. These items were selected in order to allow for false belief (level 5) questions because one would normally expect to find cigarettes in a cigarette box, crayons in a crayon box, and chalk in a chalk box. For example, the following scenario was read to participants from a note card:

> *"If I put the pencils in a chalk box and you are not here,*
> *you would think the chalk box contains chalk"*

Participants then received a prompt to answer "true" or "false".

The preceding example is one of false belief attribution to oneself because, being absent from the setting, the participant would normally expect to find chalk in a chalk box and so the correct answer to the question is true. Answering this question correctly requires knowing that one can act in accordance with false beliefs.

The ToM *Hinting Task* was modeled on that employed by Corcoran et al. (1995) and Villatte et al. (2010b) to assess ToM impairments in Schizophrenia. Ten short scenes were read to each participant. Each scene described an interaction between two characters in a socially relevant everyday situation and the participant was then asked to clarify what he believed the character meant by what was said in each interaction. For example:

> *"Stephanie says to her friend Nicole: 'I can't afford the repairs of my car. Could you lend me some money?' Nicole answers: 'I have to have my car repaired too.'"*

The participant was then asked:

> *"What does Nicole really mean when she says this?"*

A second hint was then provided regardless of the answer to the first hint:

> *"Nicole then says: The repairs to my car are going to be very expensive."*

The participant was again asked:

> *"What does Nicole really mean when she says this?"*

Participants were able to score a maximum of 3 points per scenario (2 points for a correct first answer, 1 point for a correct second answer, and 0 points for an incorrect answer).

The previously mentioned studies employed this cue and second opportunity to answer in an attempt to avoid a floor effect in participants who find the task difficult. Participants in the Villatte et al. (2010b) study produced correct answers after the first question on 63% of trials (77% after the cue and 2nd question) and therefore, a floor effect

was not anticipated in this study. In addition, previous control and experimental participants benefited equally from this supplemental information. Despite these data, the current study also incorporated a cue and an additional question in order to maintain uniformity.

Deictic relational testing and training. The protocol used in the current study consisted of the shortened perspective taking protocol employed in the developmental profile of perspective taking reported by McHugh et al. (2004). The protocol consisted of fifty six perspective taking tasks that target responding in accordance with the three perspective taking frames of I-You, Here-There and Now-Then across three levels of complexity (Simple, Reversed, & Double Reversed). Specifics of baseline probes, instructional probes and post reinforcement probes are discussed below.

This experiment made use of a table top procedure that necessarily included a limited set of stimuli. The importance of utilizing a limited set of stimuli was to ensure acquisition in a timely fashion and to evaluate whether limited multiple exemplars would promote generality of complex relational responding. That is, utilizing small samples of stimuli in each type of relational frame should function to establish a relational operant. Each of the specific statements was presented by the researcher and read from an index-sized card. The correct answer was in parenthesis and printed at 20% grayscale to minimize the chance that the participant was able to see it.

Pre-instructional testing procedures. All pre-instructional probes (baseline) contained a random presentation of all three deictic relational frames across all three complexity levels. A total of 18 trials (6 per complexity level) were included. The testing procedure was conducted without feedback and in the absence of reinforcement. As the

design employed in this study was a multiple probe baseline design across levels of complexity, baseline testing sessions were conducted throughout on complexity levels that were not yet involved in training. Whenever this occurred, only deictic relational frames from those complexity levels not yet involved in training were evaluated. For example, given that training was in progress at the simple complexity level and a baseline probe was conducted—that baseline probe included trials comprised of deictic relational frames from the Reversed and Double Reversed levels of complexity only (total of 12 trials).

Training procedures. As previously mentioned, the study employed a table-top procedure that included various questions read from cards (by the experimenter) which made reference to the deictic relational frames involved. All training sessions included 12 trials of the deictic frames at the respective complexity level randomly presented to the participant. Exceptions to this occurred when a participant required training on one specific deictic frame. Responses to these 12 trials produced reinforcement (social positive) or extinction + general feedback ("no, I'm sorry, I would be in the blue chair"). Two sessions were conducted during the vast majority of days with a break in between. Therefore, each day, a maximum of two sessions was implemented. The decision to continue past the first session was left to the participants. Mastery criterion during the training phase for any relational frame was 80%.

During training, the protocol did not include randomized presentations of complexity level, but did include mixed trials involving the three deictic relations at a particular complexity level. Specifically, the training protocol was divided into the three levels of relational complexity (Simple, Reversed and Double Reversed relations), within

which trials took two forms: first, given adequate performance on all deictic relational frames, each session involved 12 trials (4 I-You, 4 Here-There, 4 Now-Then). Second, at any point that it became clear the participant was struggling with one of the deictic relational frames, that frame was mass trialed (e.g., 12 trials of only Now-Then) and recombined with the other deictic relational frames as the participant mastered the material.

Complexity level 1 involved responding in accordance with the perspective taking frames of I-You, Here-There, and Now-Then in simple presentations where the questions were focused on the relational frame as presented. To illustrate, if the trial involved the relational frame of I-You, stimuli were placed on the table and the questions were asked with respect to that particular frame and were presented such as:

"I (Experimenter) have a green brick, and you (participant) have a
red brick".

The participant was then asked:

"Which brick do I have? Which brick do you have?"

The order in which the I-You, Here-There, and Now-Then questions are presented was randomized across all trials in a training block.

Complexity level 2 was procedurally the same as level 1; however, after stating the vignette and prior to asking the questions, the trainer provided a contextual cue which altered the correct response. To use the same example as above:

"I have a green brick, and you have a red brick."
"If I was you and you were me." ⟵———— Contextual Cue
"Which brick would I have? Which brick would you have?

In the statement "If I was you and you were me", the I-You relation is explicitly reversed. Correct responses to these questions were based on this relational reversal and not on the

24

actual possession of the bricks. In other words, the correct answers to the questions are "a red brick" (Experimenter) and "a green brick" (subject), respectively. This reversal was included in each of the relational frames.

Complexity level 3 involved trials of the same type as described in the first two levels of complexity, however, each trial only included two of the three relations and both relations were reversed in each trial. In other words, the two separate trial types in this level consisted of either I-You/Here-There or Here-There/Now-Then combinations. Both of which were reversed by a contextual cue of:

"If I am You and You are Me __and__ If Now was Then and Then was Now."

This resulted in answers to Level 3 questions that were the same as those seen in Level 1 (simple). That is, if you reverse an I-You relation *and* a Here-There relation, the response is the same as if the relations were not reversed at all.

"I am here in the green chair and you are there in the yellow chair."
"And if I am you and you are me and if here is there and there is here."
"What chair are you in? What chair am I in?"

The double reversed level of complexity evaluated 2 combinations of relational frames (I-You/Here-There and Here-There/Now-Then).

Post-instructional testing procedures. Following mastery of the deictic relational frames at any level of complexity, the participant was presented with trials containing deictic relational frames from the level of complexity just mastered randomly rotated with deictic frames from levels that had been previously mastered. That is, given mastery at the reversed level of complexity, a post-instructional probe included relational frames from both the simple (previously mastered) and the reversed levels of complexity. The

participant was presented with 12 trials, randomly rotated that included questions from both the simple and reversed complexity levels; when conducted following acquisition of double reversed relations, the post-instructional probe included 18 randomly rotated trials from all levels of complexity (6 Simple, 6 Reversed, 6 Double-Reversed). Continuation of training into the next level of complexity required that the participant perform at 80% accuracy or better on unprompted, unreinforced probes.

Programmed consequences. Each trial in the relational testing and training protocol included two questions (e.g., "Where am I sitting? Where are you sitting?"). A correct response required that the participant answer <u>both</u> questions correctly. A correct response to the trial (i.e., answering both questions correctly) resulted in the delivery of praise. Participants could earn a preferred reinforcer, as identified through self report, for meeting mastery criteria (80% correct responding). Participants #1 and 2 identified edibles (a box of ice cream bars & large can of ice tea, respectively) and Participant #3 identified tangibles in the form of restrictive clothing (sports gear and rehabilitation braces) as his preferred reinforcer. Incorrect responses resulted in short and concise corrective feedback or 5s extinction for bizarre vocalizations.

Results

Deficits in perspective taking were observed in all 3 participants on baseline ToM *Deceptive Container Tasks* including false belief attribution to oneself, true belief attribution to oneself, false belief attribution to another, true belief attribution to another, and the *Hinting Task*. Deficits were also indicated on all levels of deictic tasks (Simple, Reversed and Double Reversed) at baseline. Reinforced multiple exemplar training occurred for specific deictic relational tasks, at specific levels of complexity, and resulted

in increased accuracy in complex deictic relational responding. Finally, increased accuracy on all ToM tasks was observed across all participants after training at each complexity level of deictic relational responding. ToM task performance increases provide evidence to support the notion that training involving a limited set of stimuli can strengthen deictic relations as generalized operants and that deictic relational responding constitutes the foundation for perspective taking ability.

Participant #1

Baseline scores for Participant #1 were first evaluated and yielded the following aggregate data: 50% (Simple), 50% (Reversed), and 17% (Double-Reversed). A second assessment of baseline performance yielded identical percentages. Training on Simple relations started with session three and continued for 12 sessions. Both I-You and Here-There relations were quickly acquired by Participant #1, however, Now-Then relations were difficult and required mass trial sessions. A post-instructional probe was conducted and resulted in 83% performance across the three Simple deictic relations.

After training for Simple relations, a baseline probe was conducted for both Reversed and Double Reversed relations. There was a decrease in Reversed performance to 33% (2/6). Performance on Double-Reversal trials was shown to increase slightly to 33% (2/6).
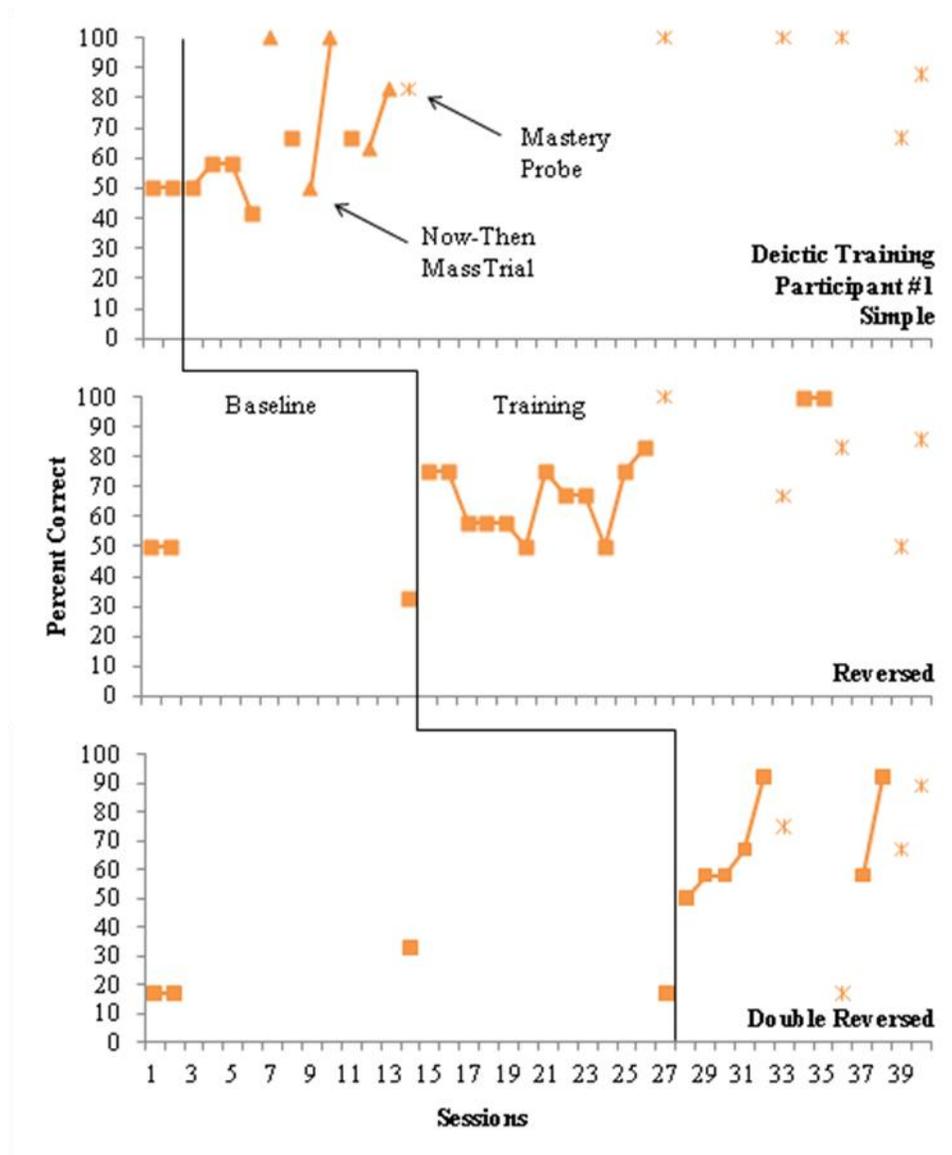
Figure 2. Deictic Training Participant #1

Training at the Reversed level of complexity commenced following the third baseline probe and continued for 12 sessions. As aggregate performance met criteria for 80% or better to be probed, a post-instructional probe was conducted that resulted in 100% correct responding.
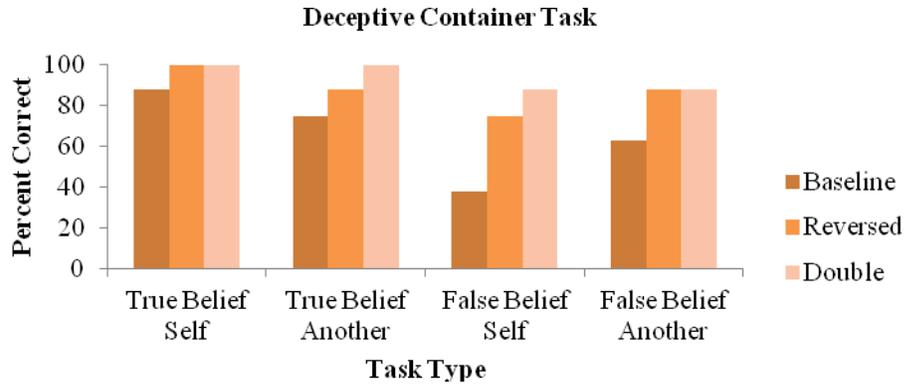
Figure 3. Deceptive Container Task Participant #1

Following this probe, a final baseline was conducted with Double-Reversed relations. Relations at this level tested at 17% accuracy (1/6). Training on these two relations resulted in increased accurate responding at 92% (11/12). A post-instructional probe was conducted and Participant #1 responded at 100% (Simple), 67% (Reversed) and 75% (Double-Reversed). As a result, a return to the Reversed level tasks was deemed appropriate per protocol. Upon two consecutive Reversed level training sessions at 100% accuracy, a post-instructional probe was scored at 100% (Simple), 83% (Reversed), and 17% (Double-Reversed). Figure 2 shows the results of deictic training for participant #1.

Figure 4. Hinting Task & RSAS Assessments Participant #1

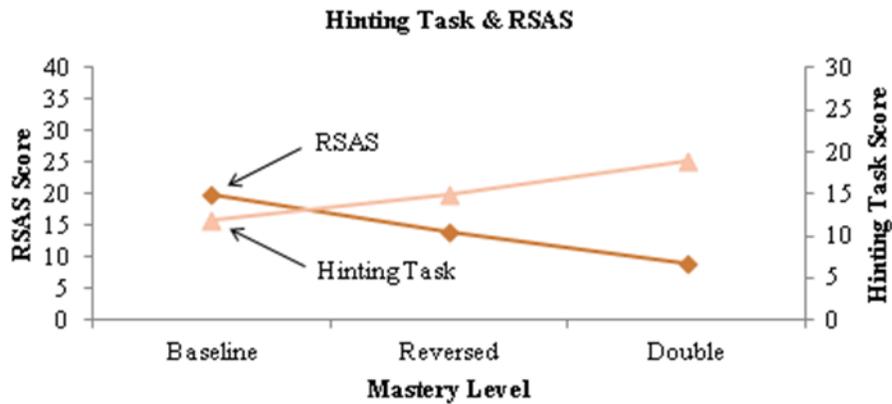Theory of Mind probes were conducted on three occasions (Baseline, Post-Reversed, and Post-Double-Reversed). Evaluation of levels 4 (true belief) and 5 (false belief) were compared by employing the *Deceptive Container Task* and further generalization was assessed by examining performance on the *Hinting Task*. On the first ToM probe, Participant #1's ToM performance was 67% (82% at level 4 and 51% at level 5) across *Deceptive Container Tasks* and 40% on the *Hinting Task*. Following acquisition of Reversed deictic relations a second ToM probe was conducted with ToM accuracy increasing to 88% (94% at level 4 and 82% at level 5) across *Deceptive Container Tasks* and 50% on the *Hinting Task*. A final ToM probe was conducted following the post-instructional mastery probe performance. Participant #1's aggregate ToM accuracy was 94% (100% at level 4 and 88% at level 5) across *Deceptive Container Tasks* and 63% on the *Hinting Task*. Figure 3 shows the results of *Deceptive Container Task* probes for participant #1.

Finally, RSAS probes were also conducted on the same schedule as those performed for ToM and resulted in scores of 20/40 (Baseline), 14/40 (Post-Reversed), and 9/40 (Post-Double-Reversed). Figure 4 shows the results of Hinting Task and RSAS probes for participant #1.

Participant #2

Baseline scores for Participant #2 were first evaluated and yielded the following aggregate data: 33% (Simple), 67% (Reversed), and 33% (Double-Reversed). A second assessment of baseline performance yielded similar percentages: 33% (Simple), 67% (Reversed), and 33% (Double-Reversed). Training on Simple relations started with session three and continued for 6 sessions. Both I-You and Here-There relations were

quickly acquired by Participant #2, however, Now-Then relations were difficult and required a mass trial session. A post-instructional probe was conducted and resulted in 83% performance across the three Simple deictic relations.
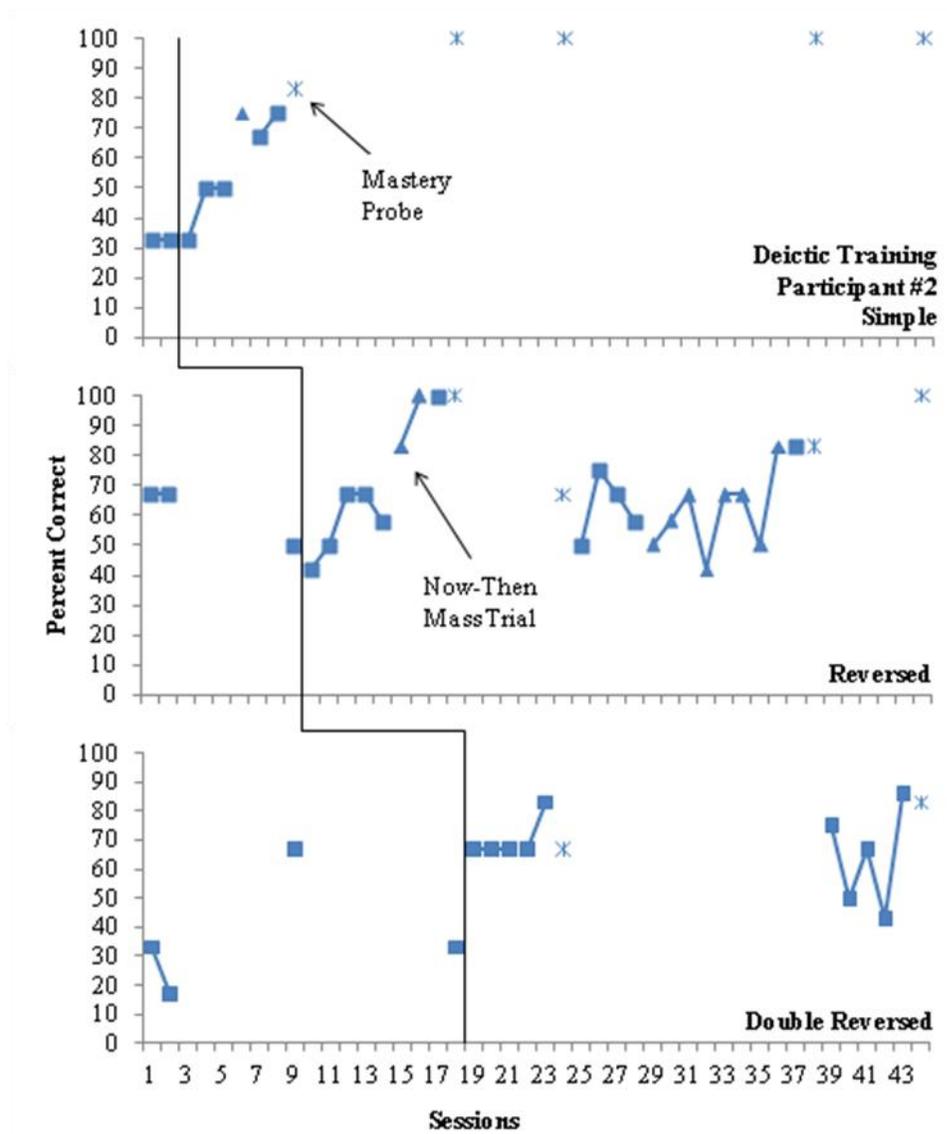

Figure 5. Deictic Training Participant #2

After training for Simple relations, a baseline probe was conducted for both Reversed and Double Reversed relations. There was a decrease in Reversed performance

to 50% (3/6). Performance on Double-Reversal trials was shown to increase slightly to 67% (4/6).
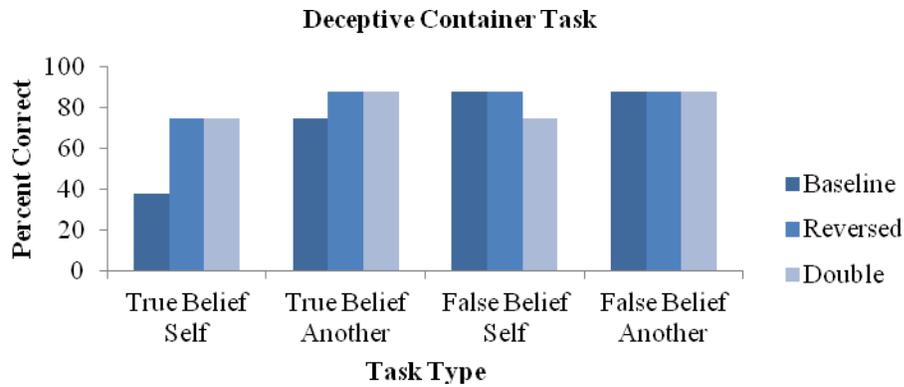
Figure 6. Deceptive Container Task Participant #2

Training at the Reversed level of complexity commenced following the third baseline probe and continued for 8 sessions. As aggregate performance met criteria for 80% or better to be probed, a post-instructional probe was conducted that resulted in 100% correct responding. Figure 5 shows the results of deictic training for participant #2.

Following this probe, a final baseline was conducted with Double-Reversed relations. Relations at this level tested at 17% accuracy (1/6). Training on these relations resulted in increased accurate responding at 83% (10/12). A post-instructional probe was conducted and Participant #2 responded at 100% (Simple), 67% (Reversed) and 67% (Double-Reversed). As a result, a return to the Reversed level tasks was deemed appropriate per protocol. Mass trial training of the Now-Then relation at the Reversed level was conducted until criterion was met. Double-Reversed training again occurred to criterion and a post-instructional probe was scored at 100% (Simple), 100% (Reversed), and 83% (Double-Reversed). Figure 6 shows the results of *Deceptive Container Task* probes for participant #2.
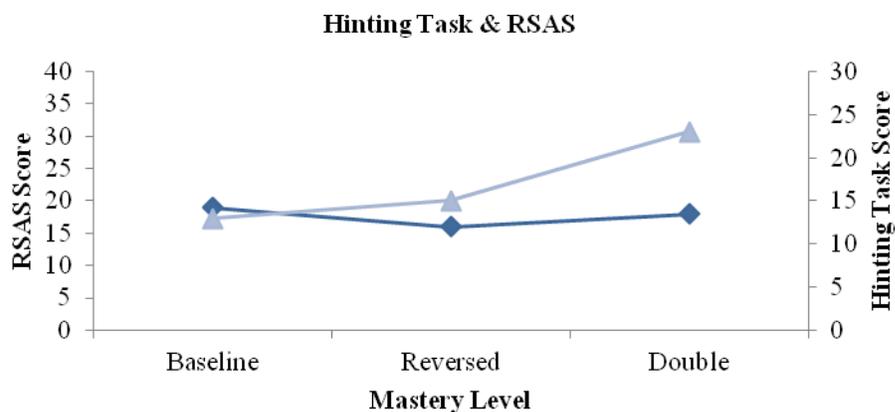
Figure 7. Hinting Task & RSAS Assessments Participant #2

Theory of Mind probes were conducted on three occasions (Baseline, Post-Reversed, and Post-Double-Reversed). Evaluation of levels 4 (true belief) and 5 (false belief) were compared by employing the *Deceptive Container Task* and further generalization was assessed by examining performance on the *Hinting Task*. On the first ToM probe, Participant #2's performance was 73% (57% at level 4 and 88% at level 5) across *Deceptive Container Tasks* and 43% on the *Hinting Task*. Following acquisition of Reversed deictic relations a second ToM probe was conducted with ToM accuracy increasing to 85% (82% at level 4 and 88% at level 5) across *Deceptive Container Tasks* and 50% on the *Hinting Task*. A final ToM probe was conducted following the post-instructional mastery probe performance. Participant #2's aggregate ToM accuracy was 82% (82% at level 4 and 82% at level 5) across *Deceptive Container Tasks* and 77% on the *Hinting Task*.

Finally, RSAS probes were also conducted on the same schedule as those performed for ToM and resulted in scores of 19/40 (Baseline), 16/40 (Post-Reversed), and 18/40 (Post-Double-Reversed). Figure 7 shows the results Hinting Task and RSAS probes for participant #2.

33

Participant #3

Baseline scores for Participant #3 were first evaluated and yielded the following aggregate data: 67% (Simple), 17% (Reversed), and 0% (Double-Reversed). A second assessment of baseline performance yielded the following percentages: 0% (Simple), 17% (Reversed), and 17% (Double-Reversed). A third assessment was performed due to the variability between the first and second assessments. The third assessment yielded the following percentages: 17% (Simple), 0% (Reversed), and 0% (Double-Reversed). Training on Simple relations started with session three and continued for 3 sessions. A post-instructional probe was conducted and resulted in 100% performance across the three Simple deictic relations.

After training for Simple relations, a baseline probe was conducted for both Reversed and Double Reversed relations. There was an increase in Reversed performance to 33% (2/6). Performance on Double-Reversal trials was shown to increase to 50% (3/6). Figure 8 shows the results of deictic training for participant #3.

Training at the Reversed level of complexity commenced following the fourth baseline probe and continued for 4 sessions. As aggregate performance met criteria for 80% or better to be probed, a post-instructional probe was conducted that resulted in 0% (Simple) and 67% (Reversed) correct responding. As a result, a return to the Simple level tasks was deemed appropriate per protocol. Criterion was met within one session. Reversed training again occurred to criterion and a post-instructional probe was scored at 100% (Simple) and 100% (Reversed).

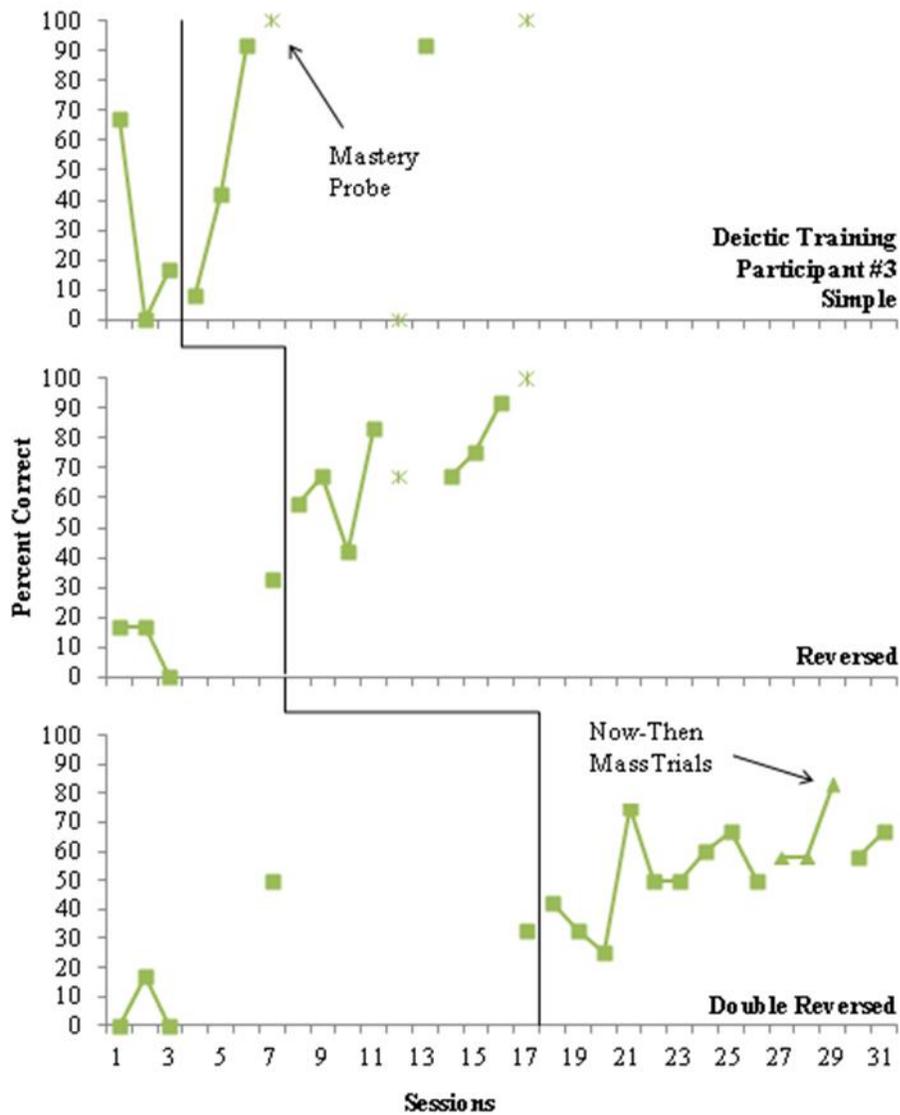Figure 8. Deictic Training Participant #3

Following this probe, a final baseline was conducted with Double-Reversed relations. Relations at this level tested at 33% accuracy (1/6). Training on these relations increased performance to 67% but mastery was not met due to the participant's early withdrawal from the study. Figure 9 shows the results of *Deceptive Container Task* probes for participant #3.

Deceptive Container Task
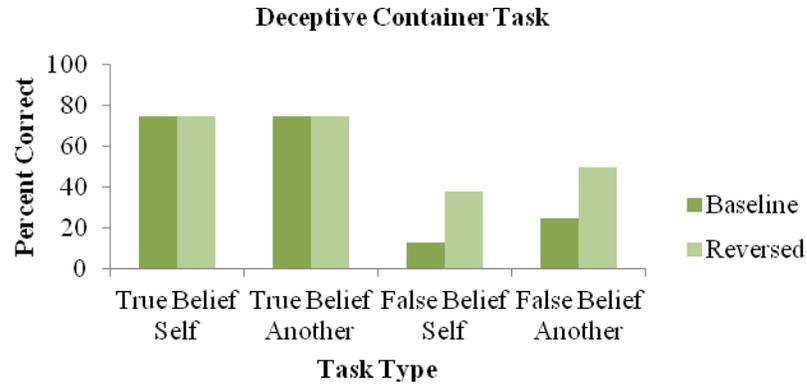
Figure 9. Deceptive Container Task Assessments Participant #3

Theory of Mind probes were conducted on two occasions (Baseline and Post-Reversed). Evaluation of levels 4 (true belief) and 5 (false belief) were compared by employing the *Deceptive Container Task* and further generalization was assessed by examining performance on the *Hinting Task*. On the first ToM probe, Participant #3's performance was 47% (75% at level 4 and 19% at level 5) across *Deceptive Container Tasks* and 23% on the *Hinting Task*. Following acquisition of Reversed deictic relations a second ToM probe was conducted with ToM accuracy increasing to 60% (75% at level 4 and 44% at level 5) across *Deceptive Container Tasks* and 47% on the *Hinting Task*. A final ToM and Hinting task probe could not be conducted due to the participant's early withdrawal from the study.

Finally, RSAS probes were also conducted on the same schedule as those performed for ToM and resulted in scores of 22/40 (Baseline) and 20/40 (Post-Reversed). Figure 10 shows the results of Hinting Task and RSAS probes for participant #3.
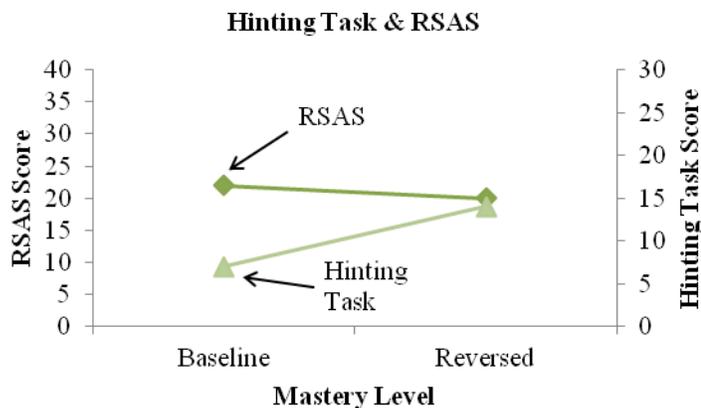
Figure 10. Hinting Task & RSAS Assessments Participant #3

Discussion

Within subject analyses indicated that the deictic relations believed to be the basic units of perspective taking ability can be shaped through operant conditioning to various levels of complexity in 3 males diagnosed with Schizophrenia. Performance by all participants increased when training was implemented.

Post-instructional probes involved stimuli that were not directly trained during the training phases of any level of complexity. These probes were intended to assess for generalization. In the ToM literature, generalization is discussed in terms of near and far generalization. Near generalization refers to generalization across materials and far generalization to that shown across setting/testing style, and materials. The focus of this study was on the hypothesized underlying relational abilities that contribute to far generalization. That is, we were attempting to directly impact perspective taking ability through its hypothesized foundation - deictic relational responding. This was a test of far generalization in that the *Deceptive Container* (ToM levels 4 &5) and *Hinting Tasks* were presented in an entirely different format than that of the multiple exemplar tasks (deictic relations) during training.

All participants showed evidence of improvement on ToM tasks. With the increased flexibility in relational repertoire given mastery at the Reversed level, improvements are seen at level 4 for participants #1 and #2 while improvement was seen at level 5 for participants #1 and #3. Improvements were seen for all 3 participants on the *Hinting Task*. As the participants' relational repertoire expanded through training on Double Reversed relations, participant #1 showed improvement in levels 4 and 5. Participant #2 showed no improvement at level 4 and perhaps a very slight decrease at level 5. Double Reversed probes were not conducted for participant #3 due to early withdrawal from the study. Improvements were seen for participants #1 and #2 on the Hinting Task once again.

A point of interest with regards to particular deictic frames is that, in contrast to the findings of Villatte et al. (2008) none of the participants in this study appeared to exhibit differential deficits on frames involving I-You relations and yet, 2 participants met criteria (a score of 20+ points) on the RSAS, the third falling only 1 point short. In support of the Villatte et al. study, all 3 participants showed *Hinting Task* scores that correlated negatively with RSAS scores as deictic responding met mastery criteria at increasing levels of complexity. An interesting abstraction from the procedure showed that all participants did have difficulty with the temporal (Now-Then) relation. These were the only trials in which the stimuli in the scenario (Today-Yesterday) differed from the stimuli in the questions (Now-Then). 'Now' and 'today' are typically in a frame of coordination as are 'then' and 'yesterday' but it is possible that these frames of coordination were not adequately established in the repertoires of participants prior to the

study. Future studies should consider assessing this prerequisite skill and training their coordination if necessary.

In contrast to Villatte et al. (2010a), participant #2 scored higher on false belief (ToM level 5) tasks than on true belief (ToM level 4) tasks. Interestingly, this participant also scored higher on reversed deictic relations than he did on simple relations. Although this phenomenon was recorded for only one subject, these data suggest that the presentation of perspective taking deficits in people with Schizophrenia may differ from other populations such as ASD. Further research with larger sample sizes might consider addressing this hypothesis. The current study lends support to Villatte et al. (2010b) in that performance on the deictic relational protocol predicted performance on the *Hinting Task*. Overall, the findings of this study support the notion that in people diagnosed with Schizophrenia, deictic relational responding is predictive of performance on traditional ToM tasks including the *Deceptive Container Task* and *Hinting Task*.

Limitations

An important variable to consider in a study such as this is maturation. The multiple probe design utilized in this study does so by showing reliable changes in the level and trend of the data following an intervention on one particular behavior or relation (Simple relations) while showing no change, little change, or trending in the opposite direction of the other behaviors/relations of interest (Reversed and Double Reversed relations). Given that probe data for Reversed and Double Reversed relations do not show an intervention effect during baseline, another comparison between data series is possible when the intervention is applied to each subsequent behavior. If the data again respond to the application of the intervention, then there is strong support for functional control.

The data generally provide support for functional control within subjects. It is possible, however, that a test/re-test effect was observed since the ToM tests were identical across three administrations. Appendices III and IV shows examples of the ToM and Hinting Task protocols. Taking the test a second and third time might show improvement as a result of the effect of taking the test previously (Kazdin, 2003). The vignettes were similar across all tests, which could increase this effect. There is also the possibility that, because of the nature of Schizophrenia, participants' responses may have been affected by improved rapport throughout the study. Future studies should consider the effect of test-retest on the ToM measures collected.

Rehfeldt et al. (2007) showed very rapid acquisition of double reversed relations as compared to fairly lengthy training phases for the single reversed relations. It is possible that these results could occur if the participant is not responding relationally but rather simply following a rule. The use of randomly rotated questions from all levels of complexity (only those previously mastered) during post-instructional probes was used as a means to reduce the chance that participants would simply follow a rule or respond to the direct discriminative aspects of the vocal statements and echo them. A second measure was implemented in order to further reduce the chance that participants were following a rule. During Double-Reversed training participants were required to respond correctly at both Simple and Reversed levels before the Double-Reversed level was presented. This process functioned not only to maintain the previously mastered levels of responding but to set the occasion for a second reversal of deictic frames at the Double Reversed level of responding.

A final limitation to this study is that all 3 participants had a dual diagnosis of Schizophrenia and mild-moderate Mental Retardation. The extent to which each of these diagnoses contributed to the perspective taking ability of participants remains unclear. Further research might target participants diagnosed with a Schizophrenia Spectrum Disorder who do not have a concurrent diagnosis of Mental Retardation.

Conclusion

Few studies to date have attempted to operationalize perspective taking in the behavioral literature and only a handful have targeted changes in deictic relational deficits. The only published studies to date that incorporate the McHugh protocol in a training situation (Heagle & Rehfeldt, 2006; Rehfeldt et al., 2007; Weil et al., 2011) have done so with a population of typically developing children (4-11 years). The present study is the first to target these skills in people diagnosed with Schizophrenia and Mental Retardation. Furthermore, previous studies did not conduct assessment of *Hinting Task* performance after deictic training, so the relationship between performance on the *Hinting Task* and improvement in deictic relational responding was unclear. The results of this study suggest that improvements in performance on the *Hinting Task* may have been influenced by training on the deictic relational protocol. That is, these data provide experimental support for the notion that deictic relational frames are a necessary component in the remediation of perspective taking ability in people diagnosed with Schizophrenia.

Finally, future studies should address the role of perspective taking in other behaviors commonly associated with Schizophrenia such as delusions and hallucinations. It is possible that a weak perspective taking ability has some mediating and/or

41

moderating effect on the development of delusions and hallucinations. For example, in the case of auditory hallucinations, a person is unable to accurately identify the source and believability of their own covert verbal behavior. Training on deictic relational responding might be expanded to address this and other behavioral deficits and excesses commonly associated with Schizophrenia Spectrum Disorders. Specific to the participants in this study, it is also possible that long term deictic training may have some effect on sex offenders' understanding of their victim's traumatic experience and may serve as an abolishing operation for inappropriate sexual behaviors. The long term implications of remediation are the eventual reduction or discontinuation of antipsychotic medication regimens and reintegration of people with Schizophrenia as typically functioning members of society.

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Appendix I-Deictic Relational Protocol

The Perspective taking Protocol to be employed in this experiment. The correct response for each question is shown in parentheses. (Adapted from McHugh et al., 2004.)

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 here on the blue chair.
Where are YOU sitting? (Blue)
Where am I sitting? (Black)

Simple NOW-THEN:
Yesterday I was watching television, today I am reading.
What am I doing now? (Reading)
What was I doing then? (Television)

Yesterday I was reading, today I am watching television.
What was I doing then? (Reading)
What am I doing now? (Television)

Yesterday you were reading, today you are watching television.
What are YOU doing now? (Television)
What were YOU doing then? (Reading)

Yesterday you were watching television, today you are reading.
What were YOU doing then? (Television)
What are YOU doing now? (Reading)

REVERSED RELATIONS
Reversed I-YOU:
I have a red brick and you have a green brick. If I was you and you were me.
Which brick would I have? (Green)
Which brick would YOU have? (Red)

I have a green brick and you have a red brick. If I was you and you were me
Which brick would YOU have? (Green)
Which brick would I have? (Red)

I have a red brick and you have a green brick. If I was you and you were me.
Which brick would YOU have? (Red)
Which brick would I have? (Green)

I have a green brick and you have a red brick. If I was you and you were me
Which brick would I have? (Red)
Which brick would YOU have? (Green)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me.
Where would YOU be sitting? (Black)
Where would I be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me.
Where would I be sitting? (Blue)
Where would YOU be sitting? (Black)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me.
Where would I be sitting? (Black)
Where would YOU be sitting? (Blue)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me.
Where would YOU be sitting? (Blue)
Where would I be sitting? (Black)

Reversed HERE-THERE:
I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here.
Where would YOU be sitting? (Blue)
Where would I be sitting? (Black)

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

Where would I be sitting? (Blue)
Where would YOU be sitting? (Black)

I am sitting here on the blue chair and you are sitting there on the black chair. If here was there and there was here.
Where would I be sitting? (Black)
Where would YOU be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If here was there and there was her.
Where would YOU be sitting? (Black)
Where would I be sitting? (Blue)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here.
Where would I be sitting now? (Blue)
Where was I sitting then? (Black)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here.
Where was I sitting then? (Blue)
Where would I be sitting now? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair. If here was there and there was here.
Where was I sitting then? (Black)
Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair. If here was there and there was here.
Where would I be sitting now? (Black)
Where was I sitting then? (Blue)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here.
Where would you be sitting now? (Blue)
Where were you sitting then? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here.
Where were you sitting then? (Black)
Where would you be sitting now? (Blue)

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

Where would you be sitting now? (Black)
Where were you sitting hen? (Blue)

Yesterday you were sitting here on the black chair, today you are sitting there on the blue chair. If here was there and there was here.
Where were you sitting then? (Blue)
Where would you be sitting now? (Black)

Reversed NOW-THEN:
Yesterday I was watching television, today I am reading. If now was then and then was now.
What was I doing then? (Reading)
What would I be doing now? (Television)

Yesterday I was reading, today I am watching television. If now was then and then was now.
What would I be doing now? (Reading)
What was I doing then? (Television)

Yesterday I was watching television, today I am reading. If now was then and then was now.
What was I doing now? (Television)
What would I be doing then? (Reading)

Yesterday I was reading, today I am watching television. If now was then and then was now.
What was I doing then? (Television)
What would I be doing now? (Reading)

Yesterday you were watching television, today you are reading. If now was then and then was now.
What were you doing then? (Reading)
What would you be doing now? (Television)

Yesterday you were reading, today you are watching television. If now was then and then was now.
What were you doing then? (Television)
What would you be doing now? (Reading)

Yesterday you were watching television, today you are reading. If now was then and then was now.
What would you be doing now? (Television)
What were you doing then? (Reading)

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

51

What would you be doing now? (Reading)
What were you doing then? (Television)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair.
If now was then and then was now.
Where would I be sitting now? (Blue)
Where was I sitting then? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair.
If now was then and then was now.
Where was I sitting then? (Black)
Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair.
If now was then and then was now.
Where would I be sitting now? (Black)
Where was I sitting then? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair.
If now was then and then was now.
Where was I sitting then? (Blue)
Where would I be sitting now? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now.
Where were you sitting then? (Black)
Where would you be sitting now? (Blue)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If now was then and then was now.
Where would you be sitting now? (Blue)
Where were you sitting then? (Black)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If now was then and then was now.
Where were you sitting then? (Blue)
Where would you be sitting now? (Black)

Yesterday you were sitting there on the black chair, today you are sitting here on the blue chair. If now was then and then was now.
Where would you be sitting now? (Black)
Where were you sitting then? (Blue)

DOUBLE REVERSED RELATIONS
I-YOU/HERE-THERE:

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me and If here was there and there was here.
Where would I be sitting? (Blue)
Where would YOU be sitting? (Black)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me and If here was there and there was here.
Where would I be sitting? (Black)
Where would YOU be sitting? (Blue)

I am sitting here on the blue chair and you are sitting there on the black chair. If I was you and you were me and If here was there and there was here.
Where YOU be sitting? (Black)
Where would I be sitting? (Blue)

I am sitting here on the black chair and you are sitting there on the blue chair. If I was you and you were me and If here was there and there was here.
Where would YOU be sitting? (Blue)
Where would I be sitting? (Black)

HERE-THERE/NOW-THEN:
Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair.
If here was there and there was here and If now was then and then was now.
Where would I be sitting then? (Blue)
Where would I be sitting now? (Black)

Yesterday I was sitting there on the blue chair, today I am sitting here on the black chair.
If here was there and there was here and If now was then and then was now.
Where would I be sitting now? (Black)
Where would I be sitting then? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair.
If here was there and there was here and If now was then and then was now.
Where would I be sitting then? (Black)
Where would I be sitting now? (Blue)

Yesterday I was sitting there on the black chair, today I am sitting here on the blue chair.
If here was there and there was here and If now was then and then was now.
Where would I be sitting now? (Blue)
Where would I be sitting then? (Black)

Yesterday you were sitting there on the blue chair, today you are sitting here on the black chair. If here was there and there was here and If now was then and then was now.
Where would you be sitting then? (Blue)
Where would you be sitting now? (Black)

Yesterday you were sitting 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 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)

Appendix II-Revised Social Anhedonia Scale

Please answer each item true or false. Please do not skip any items. It is important that you answer every item, even if you are not quite certain which the best answer is. Some items may sound like others, but all of them are slightly different. Answer each item individually, and don't worry about how you answered a somewhat similar previous item.

Write down either: True   OR   False

1. Having close friends is not as important as many people say.
2. I attach very little importance to having close friends.
3. I prefer watching television to going out with other people.
4. A car ride is much more enjoyable if someone is with me.
5. I like to make long distance phone calls to friends and relatives.
6. Playing with children is a real chore.
7. I have always enjoyed looking at photographs of friends.
8. Although there are things that I enjoy doing by myself, I usually seem to have more fun when I do things with other people.
9. I sometimes become deeply attached to people I spend a lot of time with.
10. People sometimes think that I am shy when I really just want to be left alone.
11. When things are going really good for my close friends, it makes me feel good too.
12. When someone close to me is depressed, it brings me down also.
13. My emotional responses seem very different from those of other people.
14. When I am alone, I often resent people telephoning me or knocking on my door.
15. Just being with friends can make me feel really good.
16. When things are bothering me, I like to talk to other people about it.
17. I prefer hobbies and leisure activities that do not involve other people.
18. It's fun to sing with other people.
19. Knowing that I have friends who care about me gives me a sense of security.
20. When I move to a new city, I feel a strong need to make new friends.
21. People are usually better off if they stay aloof from emotional involvements with most others.
22. Although I know I should have affection for certain people, I don't really feel it.
23. People often expect me to spend more time talking with them than I would like.
24. I feel pleased and gratified as I learn more and more about the emotional life of my friends.
25. When others try to tell me about their problems and hang-ups, I usually listen with interest and attention.
26. I never had really close friends in high school.

27. I am usually content to just sit alone, thinking and daydreaming.
28. I'm much too independent to really get involved with other people.
29. There are few things more tiring than to have a long, personal discussion with someone.
30. It made me sad to see all my high school friends go their separate ways when high school was over.
31. I have often found it hard to resist talking to a good friend, even when I have other things to do.
32. Making new friends isn't worth the energy it takes.
33. There are things that are more important to me than privacy.
34. People who try to get to know me better usually give up after awhile.
35. I could be happy living all alone in a cabin in the woods or mountains.
36. If given the choice, I would much rather be with others than be alone.
37. I find that people too often assume that their daily activities and opinions will be interesting to me.
38. I don't really feel very close to my friends.
39. My relationships with other people never get very intense.
40. In many ways, I prefer the company of pets to the company of people.

Appendix III-Deceptive Container Task

The following statements are to be read to participants from cards. The participant is then asked if they think the entire statement is true or false. There are 24 true belief tasks (Theory of Mind level 4) and 24 false belief tasks (Theory of Mind level 5) for a total of 48 belief attribution tasks.

True Belief to Self
1. If I put the pencils in the chalk box and you are not here, you would think the chalk box contains chalk. (True)
2. If I put the pencils in the chalk box and you are here, you would think the chalk box contains pencils. (True)
3. If I put the chalk in the chalk box and you are not here, you would think the chalk box contains chalk. (True)
4. If I put the chalk in the chalk box and you are here, you would think the chalk box contains chalk. (True)
5. If I put the crayons in the cigarettes box and you are not here, you would think the cigarettes box contains cigarettes. (True)
6. If I put the crayons in the cigarettes box and you are here, you would think the cigarettes box contains crayons. (True)
7. If I put the cigarettes in the cigarettes box and you are not here, you would think the cigarettes box contains cigarettes. (True)
8. If I put the cigarettes in the cigarettes box and you are here, you would think the cigarettes box contains cigarettes. (True)
9. If I put the cigarettes in the crayons box and you are not here, you would think the crayons box contains crayons. (True)
10. If I put the cigarettes in the crayons box and you are here, you would think the crayons box contains cigarettes. (True)
11. If I put the crayons in the crayons box and you are not here, you would think the crayons box contains crayons. (True)
12. If I put the crayons in the crayons box and you are here, you would think the crayons box contains crayons. (True)

True Belief to Another
1. If you put the pencils in the chalk box and I am not here, I would think the chalk box contains chalk. (True)
2. If you put the pencils in the chalk box and I am here, I would think the chalk box contains pencils. (True)
3. If you put the chalk in the chalk box and I am not here, I would think the chalk box contains chalk. (True)

4. If you put the chalk in the chalk box and I am here, I would think the chalk box contains chalk. (True)
5. If you put the crayons in the cigarettes box and I am not here, I would think the cigarettes box contains cigarettes. (True)
6. If you put the crayons in the cigarettes box and I am here, I would think the cigarettes box contains crayons. (True)
7. If you put the cigarettes in the cigarettes box and I am not here, I would think the cigarettes box contains cigarettes. (True)
8. If you put the cigarettes in the cigarettes box and I am here, I would think the cigarettes box contains cigarettes. (True)
9. If you put the cigarettes in the crayons box and I am not here, I would think the crayons box contains crayons. (True)
10. If you put the cigarettes in the crayons box and I am here, I would think the crayons box contains cigarettes. (True)
11. If you put the crayons in the crayons box and I am not here, I would think the crayons box contains crayons. (True)
12. If you put the crayons in the crayons box and I am here, I would think the crayons box contains crayons. (True)

False Belief to Self

1. If I put the pencils in the chalk box and you are here, you would think the chalk box contains chalk. (False)
2. If I put the pencils in the chalk box and you are not here, you would think the chalk box contains pencils. (False)
3. If I put the chalk in the chalk box and you are not here, you would think the chalk box contains pencils. (False)
4. If I put the chalk in the chalk box and you are here, you would think the chalk box contains pencils. (False)
5. If I put the crayons in the cigarettes box and you are here, you would think the cigarettes box contains cigarettes. (False)
6. If I put the crayons in the cigarettes box and you are not here, you would think the cigarettes box contains crayons. (False)
7. If I put the cigarettes in the cigarettes box and you are not here, you would think the cigarettes box contains crayons. (False)
8. If I put the cigarettes in the cigarettes box and you are here, you would think the cigarettes box contains crayons. (False)
9. If I put the cigarettes in the crayons box and you are here, you would think the crayons box contains crayons. (False)
10. If I put the cigarettes in the crayons box and you are not here, you would think the crayons box contains cigarettes. (False)
11. If I put the crayons in the crayons box and you are not here, you would think the crayons box contains cigarettes. (False)
12. If I put the crayons in the crayons box and you are here, you would think the crayons box contains cigarettes. (False)

False Belief to Another

1. If you put the pencils in the chalk box and I am here, I would think the chalk box contains chalk. (False)

2. If you put the pencils in the chalk box and I am not here, I would think the chalk box contains pencils. (False)
3. If you put the chalk in the chalk box and I am not here, I would think the chalk box contains pencils. (False)
4. If you put the chalk in the chalk box and I am here, I would think the chalk box contains pencils. (False)
5. If you put the crayons in the cigarettes box and I am here, I would think the cigarettes box contains cigarettes. (False)
6. If you put the crayons in the cigarettes box and I am not here, I would think the cigarettes box contains crayons. (False)
7. If you put the cigarettes in the cigarettes box and I am not here, I would think the cigarettes box contains crayons. (False)
8. If you put the cigarettes in the cigarettes box and I am here, I would think the cigarettes box contains crayons. (False)
9. If you put the cigarettes in the crayons box and I am here, I would think the crayons box contains crayons. (False)
10. If you put the cigarettes in the crayons box and I am not here, I would think the crayons box contains cigarettes. (False)
11. If you put the crayons in the crayons box and I am not here, I would think the crayons box contains cigarettes. (False)
12. If you put the crayons in the crayons box and I am here, I would think the crayons box contains cigarettes. (False)

Appendix IV-Hinting Task

The following 10 hinting tasks have been developed for participants based on relevant scenarios in the participant's environment in order to ensure that the task is applicable to daily living. Participants will be able to score a maximum of 3 points per scenario (2 points for a correct first answer, 1 point for a correct second answer, and 0 points for an incorrect answer).

1. *"Paul says to his friend George: 'I can't afford groceries. Could you lend me some money? George answers: I have to buy groceries too."*
   Question 1: *"What does Paul really mean when he says this?"*
   "George then says: The groceries I want are going to be very expensive."
   Question 2: *"What does George want to say to Paul?"*
   Correct response: No, I cannot lend you any money.

2. *"Paul has to go to a job interview and he's running late. While he is cleaning his shoes, he says to his wife, Jane: "I want to wear my blue shirt but it's very creased."*
   Question 1: *"What does Paul really mean when he says this?"*
   "Paul then says: It's in the ironing basket."
   Question 2: *"What does Paul want Jane to do?"*
   Correct response: Paul wants Jane to iron his blue shirt.

3. *"George has been on the phone with his friend for over an hour. George says: My mother ought to call me in few minutes"*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: I could call you back tomorrow."
   Question 2: *"What does George want to do?"*
   Correct response: George wants to hang up the phone.

4. *"Paul is watching his favorite tv show with George. George says: The big game is about to start on channel 13."*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: I'd really like to see the game."
   Question 2: *"What does George want Paul to do?"*
   Correct response: George wants Paul to change the channel.

5. *"Paul is going to the casino tonight and asks George if he would like to go too. George says: I went to the casino last week."*
   Question 1: *"What does George really mean when he says this?"*

"George then says: My paycheck doesn't come in until tomorrow."
Question 2: *"What does George want to say to Paul?"*
Correct response: George wants to say that he doesn't want to go to the casino.

6. *"Paul is listening to music on the van's radio. George says: I have a headache."*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: The music is very loud"
   Question 2: *"What does George want Paul to do?"*
   Correct response: George wants Paul to turn the radio down/off.

7. *"Paul is smoking on the porch. George says to Paul: I ran out of cigarettes."*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: I could really go for a smoke right now"
   Question 2: *"What does George want Paul to do?"*
   Correct response: George wants Paul to give him a cigarette.

8. *"Paul is walking around the yard in the sun. George says to Paul: You've been out there for an hour."*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: The sun is going to burn you're skin"
   Question 2: *"What does George want Paul to do?"*
   Correct response: George wants Paul to go inside.

9. *"Paul is talking to George about personal things in a restaurant. George says to Paul: I think we're bothering people."*
   Question 1: *"What does George really mean when he says this?"*
   "George then says: This is making me uncomfortable"
   Question 2: *"What does George want Paul to do?"*
   Correct response: George wants Paul to stop talking to himself.

10. *"Paul and George are arguing about who is better, the Red Sox or the Rays. George says to Paul: the Red Sox beat the Yankees and the Yankees beat the Rays.*
    Question 1: *"What does George really mean when he says this?"*
    "George then says: The Yankees weren't even at their best when they beat the Rays"
    Question 2: *"What does George want to say to Paul?"*
    Correct response: George wants to tell Paul that the Red Sox will beat the Rays.