Teaching Perspective Taking to Adults with Traumatic Brain Injury

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Teaching Perspective Taking to Adults with Traumatic Brain Injury

by

Jacqueline Cohen

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts
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Abstract

Approximately 1.7 million people sustain a traumatic brain injury each year in the United States. Perspective taking is a repertoire known to be severely affected following a traumatic brain injury. The ability to take the perspective of another greatly contributes to social interactions and involves a complex set of skills. A small number of studies have attempted to train perspective taking skills in populations lacking the ability, but none with individuals diagnosed with TBI. This study aimed to teach perspective taking skills to adults with TBI through established protocols which teach deictic relational frames. Three adult males with traumatic brain injuries were exposed to the deictic relational training protocol. Each participant was tested on traditional theory of mind tasks prior to and following mastery of deictic training. All three participants achieved mastery of the relational training protocol and showed some improvement on theory of mind tasks following training and at follow-up.
Chapter One: Introduction

Approximately 1.7 million people sustain a traumatic brain injury (TBI) each year in the United States, and of those, about 52,000 die, 275,000 are hospitalized, and 1.365 million are treated and released from an emergency department. Around 511,000 TBIs occur among children ages 0 to 14 years, but adults ages 75 and older have the highest rates of TBI-related hospitalization and death. Falls are the leading cause of TBI and result in the highest number of hospitalizations (especially for children under 5 years of age and adults over 65 years of age) but motor vehicle traffic is the leading cause of TBI-related death (Faul, Xu, Wald, & Coronado, 2010). Brain injury is the third leading cause of long-term disability among Americans after major depressive disorders and intellectual disabilities (Heinike & Carr, 2014).

Several factors contribute to potential outcomes for people with TBI related disabilities: the age at which the person sustained the injury, amount of time since the injury occurred, and the severity of the injury (Taylor & Alden, 1997). Behavior analytic approaches to TBI recovery generally include basic behavior change principles, reduction of problem behaviors, and skill acquisition (Heinike & Carr, 2014). Taylor and Alden (1997) concluded that although in some cases, children with brain injuries develop in a relatively normal manner, long-term consequences for infants and young children who sustain a brain injury are generally worse than for school-age children and adults. This may mean that training individuals who acquired a brain injury when of adult age can result in better outcomes. In general, it appears that only an environmental approach such as that seen in behavior analysis, occupational therapy, or speech
therapy, may have a beneficial impact on behavioral improvements with individuals with acquired/traumatic brain injury.

Interestingly, a more recent development in the conceptualization of brain functioning involves the redistribution of functioning to areas of the brain that would not otherwise participate in behavioral outcomes. This ability, neuroplasticity, assumes that certain areas of the brain can compensate for loss or damage in other areas (Taylor & Alden, 1997). This effect necessarily requires environmental stimulation to promote plasticity across brain regions. An analogy to better understand plasticity may be one of explicit practice writing with a non-dominant hand as a result of loss of motor function in the dominant hand.

One behavioral area that shows resistance to acquisition with traumatic brain injury is in perspective taking. The ability to take the perspective of another, or infer their mental states, greatly contributes to social interactions and involves a complex set of skills (Barnes-Holmes, Barnes-Holmes, & McHugh, 2004). Perspective taking is a skill set which typically developing people use every day to make contact with the experiences of those around them. For example, in order to best understand a friend’s story about his or her weekend vacation, the ability to assume the friend’s perspective brings the story to the here and now for the listener. While this ability is typically seen in children over six years of age (Baron-Cohen, Leslie, & Frith, 1985), there are several populations in which perspective-taking is substantially delayed. Children without siblings generally take longer to develop perspective-taking abilities, as do children who are blind, deaf, or have been diagnosed with autism (Spradlin & Brady, 2008). Many researchers have also hypothesized that similar deficits would be seen in individuals who have suffered a traumatic brain injury (Bivona et al., 2014; Geraci, Surian, Ferraro, & Cantagallo, 2010;
McDonald et al., 2014; Snodgrass & Knott, 2006; & Walz, Yeates, Taylor, Stancin, & Wade, 2009).

Theory of Mind

In cognitive psychology, perspective taking is termed “theory of mind” and is defined as the ability to infer mental states in others, as well as the knowledge that other people know, want, or believe things about the world around them (Baron-Cohen et al., 1985). There are five levels of theory of mind or perspective taking ability, but the most commonly studied levels are the third, fourth, and fifth (Barnes-Holmes, McHugh, & Barnes-Holmes, 2004). The levels of theory of mind ability and the tests used to measure them are discussed in greater detail in Appendix I. The different levels of theory of mind tasks correspond to and act as tests for observable levels of perspective taking skills.

Theory of mind and perspective taking deficits have been shown in young children (e.g. Barnes-Holmes, McHugh, et al., 2004; Weil, Hayes, & Capurro, 2011), children with autism (e.g. Baron-Cohen et al., 1985), people diagnosed with schizophrenia (O’Neil & Weil, 2014), and, minimally, children with TBI (e.g. McDonald et al., 2014).

Perspective taking functions are thought to take place in the frontal lobe and prefrontal cortex of the brain, and as such, most studies involving TBI patients have compared subjects with frontal lobe injuries to control subjects (e.g. Geraci et al., 2010 & Snodgrass & Knott, 2006). Studies involving people with TBI and perspective taking are generally restricted to assessment of participants’ abilities/deficits and not on remediation of those skills. Snodgrass and Knott (2006) compared 12 subjects with TBI (aged 6-12 years) to 20 control subjects (also aged 6-12 years) on three theory of mind tasks, two control tasks, and an attention and memory screening. The authors found that the children with TBI performed similarly to the control
subjects on the control tests, the Sally-Anne task (see Appendix I, Level 5), and a deception task, but the TBI subjects performed significantly worse on a sabotage task and the eyes task.

Geraci, Surian, Ferraro, and Cantagallo (2010) tested 18 adult (20-56 years old) TBI patients with prefrontal cortex injuries against 20 control participants (21-50 years old) on two theory of mind tasks (the eyes task and the faux-pas test) and an executive functioning test. The TBI patients were also split into groups based on whether their injuries were mainly in the center of the prefrontal cortex or more towards the left or right hemisphere. Geraci et al. (2010) found that all of the TBI subjects performed worse on the eyes task than the control group and the group of TBI subjects with central injuries performed worse in the faux-pas test than both other groups. The authors also found that executive functioning scores correlated with the eyes task scores, but not faux-pas test scores.

McDonald et al. (2014) tested 25 adults (22-66 years old) with TBI and a control group of 28 adults (22-67 years old) on executive functioning versus theory of mind ability. The authors found that both executive functioning and theory of mind deficits contribute to poor expressive language, or the ability to put thoughts into words in a way that makes sense, in people with TBI. These findings point toward the need for training perspective-taking skills in people with TBI.

**Training Perspective-Taking**

A number of studies have attempted to train theory of mind or perspective taking abilities from differing approaches in children with and without autism (e.g. Hadwin, Baron-Cohen, Howlin, & Hill, 1997; MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009; Swettenham, 1996), though none have satisfactorily produced generalized results.
Hadwin, Baron-Cohen, Howlin, and Hill (1997) and Wellman et al. (2002) attempted to improve theory of mind abilities by teaching children about mental states and emotions and found no statistical differences between groups after training. Wellman et al. (2002) used thought bubbles to walk children through the Sally-Anne task after which the participants were tested on a bears task (similar to Sally-Anne but with bears), Smarties task, and a Seeing Leads to Knowing task. Most subjects did significantly better on the Sally-Anne task and bears task after training, but still failed the Smarties and Seeing Leads to Knowing tasks. Some subjects passed all six stages of training without showing much improvement, and some other subjects only finished two or three stages and passed all or most of the post tests showing that the training protocol did not have any particular bearing on participants’ acquiring the desired skills.

Ozonoff and Miller (1995) used a social skills training group with embedded theory of mind training to improve theory of mind task performance. The group which received the social skills and theory of mind training performed significantly better on the theory of mind post-tests than the pre-tests and significantly better than the group which received no treatment. However, on the teacher and parent measures of social skills, both groups showed no change from pre- to post-test. This study showed that the ability to pass theory of mind tasks can be trained, but that it does not necessarily generalize to real life social skills.

Swettenham (1996) taught children with autism, children with Down’s syndrome, and typically developing children to pass the Sally-Anne task via a computer game. After training, children from all three groups passed the close transfer tasks (a Sally-Anne task on the computer without the instructional text and a Sally-Anne task with dolls), but none of the children with autism passed the distant transfer tasks (the Smarties task, the false breakfast task which is similar to the Smarties task but with cereal, and the Tom task where a character has true and
false beliefs about the time of day and the weather). Again, participants learned to pass theory of mind tasks, but showed no generalization to untrained tasks or everyday social skills.

Knoll and Charman (2000) trained 11 out of 22 typically developing children (the other 11 acted as a control group and were not trained) on theory of mind tasks by first explaining the scenarios presented and then predicting what the protagonist would do next. Nine of the 11 children trained passed the close transfer tasks, whereas none of the untrained children did.

Video modeling has been utilized in several studies to teach theory of mind tasks and pretend play to children with autism (Charlop-Christy & Daneshvar, 2003; LeBlanc, Coates, Daneshvar, Charlop-Christy, & Morris, 2003; MacDonald, et al., 2009). Charlop-Christy and Daneshvar (2003) successfully trained two out of three children to pass five types of first-order attribution tasks as well as two similar variations of each to show generalization. LeBlanc, Coates, Daneshvar, Charlop-Christy, and Morris (2003) used a similar method to the previously mentioned study, but included reinforcement for correct answers in the training procedure and showed better outcomes as far as generalization to theory of mind tasks, but not necessarily to real life. MacDonald, Sacramone, Mansfield, Wiltz, and Ahearn (2009) attempted to teach pretend play using scripted video models to two pairs of children (one typically developing child and one with autism per pair) but in effect, taught the children to repeat lines from the video with no generalization in pretend play.

While some of these training methods produced minor success in teaching theory of mind or perspective taking skills and some programmed for limited generalization, they still failed to produce any socially significant gains (Ozonoff & Miller, 1995). The shortcomings of these previous methods have lead behavioral scientists to search for new answers and new methods for training the skills needed to acquire theory of mind or perspective taking abilities. That search
has lead, mainly, to the use of deictic frames to teach perspective-taking (Barnes-Holmes, Barnes-Holmes, & Murphy, 2004; Barnes-Holmes, McHugh, et al., 2004; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004a; McHugh, Barnes-Holmes, & Barnes-Holmes, 2004b; McHugh, Barnes-Holmes, Barnes-Holmes, Stewart, 2006; Rehfeldt, Dillen, Ziomek, & Kowalchuk, 2007; Weil et al., 2011).

Training Deictic Relations

Deictic frames are those which seem to be involved in perspective taking as they specify stimulus relations in terms of the perspective of the speaker (McHugh et al., 2004a). The three main deictic frames are I-You, Here-There, and Now-Then (Barnes-Holmes, Barnes-Holmes, & Murphy, 2004) and are usually used to teach perspective-taking to populations lacking in that area. McHugh, Barnes-Holmes, and Barnes-Holmes (2004a) found similar differences among five different age groups when responding to questions on deictic frames as seen in responding to theory of mind tasks.

Few studies assess how training deictic relations may aid in improving theory of mind or perspective taking abilities, but some of those which have tend to show that not only is teaching deictic relations possible, it can increase theory of mind task performance (Weil et al., 2011; O’Neil & Weil, 2014). Rehfeldt, Dillen, Ziomek, and Kowalchuk (2007) trained two typically developing participants, who had not scored above 80% on any tested relations, using a computer program similar to the original testing apparatus. Both participants mastered the deictic training protocol showing that a history of reinforced relational responding can enhance the ability to change perspective across deictic frames (Rehfeldt et al., 2007), although performance on theory of mind tasks was not measured.
Weil, Hayes, and Capurro (2011) followed a similar training protocol with three young, typically developing children (4 and 5 years old), but used a one-on-one method with an experimenter reading from cards and more systematic methods of reinforcement as opposed to computer-based training. Weil et al. (2011) also tested levels 3, 4, and 5 theory of mind tasks as a pre-test, after reversed relations were mastered, and as a post-test after double-reversed relations were mastered. Weil et al. (2011) found that the three participants increased their accuracy in deictic relational responding which “generalized across stimuli, suggesting the acquisition of an operant class” (p.385). These studies together show that training in deictic frames may increase performance on theory of mind tasks.

In a more recent study, Jackson, Mendoza, and Adams (2014) trained children with autism in deictic relations using the McHugh protocol, but found that the children were unable to pass traditional theory of mind tasks after training. Gilroy, Lorah, Dodge, and Fiorello (2015) also trained children with autism using the Barnes-Holmes protocol and found that the participants all reached mastery at each level of relational complexity and showed generalization to novel adults in the absence of error correction and reinforcement contingencies. However, Gilroy et al. (2015) did not test participants on theory of mind tasks before or after deictic training.

Research thus far has focused on perspective taking with a few populations, but little has been conducted that teaches perspective taking skills to people with traumatic brain injuries (Bivona et al., 2014; Geraci et al., 2010; Snodgrass & Knott, 2006). The present study aimed to extend the application of the established protocols (Rehfeldt et al., 2007; Weil et al., 2011) to teach perspective taking abilities to individuals who are diagnosed with traumatic brain injury.
Chapter Two: Methods

Participants and Setting

The participants in this study were three adult males diagnosed with traumatic brain injury. Participants were recruited from a residential brain injury rehabilitation center in a suburban area. Several potential participants were recruited, consented, and pretested, but after passing the pretests were dropped from the study due evidence of a perspective taking repertoire. Once recruited, consent was obtained from the participants and/or their respective guardians. Pre-tests, training, and post-tests took place in common areas of the brain injury rehabilitation center (cafeteria, outdoor areas, living rooms, etc.) where the participant and primary investigator were still visible to the staff (for safety purposes), but distanced enough to ensure privacy.

Dale. Dale was a 47-year-old male who sustained a traumatic brain injury in a car accident in February of 1996. Dale’s injuries consisted of a subarachnoid hemorrhage and a right zygomatic bone fracture which resulted in a 23 day coma. He remained in the hospital for two months following his accident and has resided in his current neuro-rehabilitation center since 2007. Dale lived in an apartment style room at the facility with a roommate. He generally made use of a wheelchair for ambulation, but could walk short distances. Dale spent most days in the cafeteria among several staff members, watching TV and completing simple crossword puzzles with staff assistance.

Brennan. Brennan was a 61-year-old male who sustained a traumatic brain injury in a motor vehicle accident in August of 1984 which resulted in a three month long coma. Brennan has lived in his current neuro-rehabilitation center since 2002. At the beginning of the study,
Brennan lived in a group home on the facility’s campus. He was later moved to an apartment style room (similar to Dale) then back to a group home setting again. Brennan completed chores around the facility (sweeping, mopping, etc.) to earn money.

Derek. Derek was also a 61-year-old male who sustained a traumatic brain injury due to a suspected car accident in August of 1999 where he was found comatose on the side of the road with no vehicle nearby. HIs injuries consisted of a basilar skull fracture and a right-sided subdural hematoma. Derek has resided in his current neuro-rehabilitation center since October of 1999. Derek lived in two different campus group homes throughout the study, both with similar supervision. He moved with the help of a wheeled walker, but could walk short distances without it.

**Dependent Variables and Measures**

The main dependent variable measured was correct answers to questions on deictic frames. Responses were measured as correct responses divided by total number of trials to calculate percentage of correct answers. Dependent variables also included performance on theory of mind tasks before and after deictic training, as well as at a 10-12 day follow up, and were recorded as percentage correct.

**Interobserver Agreement and Treatment Integrity**

All sessions were videotaped and scored by trained research assistants on treatment integrity (see Appendix II) by the primary investigator and interobserver agreement on participant responses. A random sampling of videos across participants and phases were scored for interobserver agreement (IOA) and treatment integrity. IOA was evaluated for 33% of all sessions and calculated by dividing the total number of agreements by agreements + disagreements on participants’ answers. Treatment integrity data was also collected for 33% of
sessions. Interobserver agreement ranged from 83-100% agreement for all three participants. Average IOA was 95% for Dale, 98% for Brennan, and 95% for Derek. Treatment integrity was 100% across participants and phases.

**Design**

The design of this study was a multiple-probe design across levels of relational complexity (simple, reversed, and double reversed). Baseline probes occurred prior to introduction of training at each level of complexity. After baseline for simple relations, the duration of each phase was dependent upon how quickly each participant acquired the skills.
Chapter Three: Procedures

Preference Assessment

Participants’ preferences were assessed using an interview from Blair and Fox (2011) which asked questions about favorite foods, movies, music, and activities. Items from this interview were used to identify reinforcers throughout the study, in the form of gift cards to preferred restaurants or movie theaters and edible reinforcers. During training participants mainly worked for praise for correct answers. At the end of each session, participants received smaller edible reinforcers (Dale: chocolate bars and granola bars; Brennan: chocolate milkshakes; Derek: French fries and cheese-it crackers). Dale and Derek also required small edible reinforcers following correct responses toward the end of training in order to increase the likelihood of emitting correct responses in the future. Upon completion of the full training protocol, participants were asked to choose a larger reinforcer based on results from their individual preference assessments.

Theory of Mind Pre- and Post-Tests

Weil et al. (2011) found that in administering theory of mind tests three separate times, participants’ scores improved slightly at the second testing, but the skills did not appear to fully come on board until the third testing. Considering most people trained in deictic relational frames do not show improvement on theory of mind tasks until after deictic training is completed, participants in this study were only tested before and immediately following deictic mastery, as well as at a 10-12 day follow up. Participants were asked basic true and false belief hidden contents questions regarding themselves and others, similar to those used in O’Neil and
Weil (2014) (see Appendix III). They were also asked to complete a revised strange stories task (White, Hill, Happe, & Frith, 2009). The strange stories task consists of eight vignettes (four different types of stories with two variations of each type) which can be found in Appendix IV.

**Deictic Relational Training**

The deictic training protocol was similar to that used in Weil et al. (2011). Participants were trained and tested on three levels of complexity or category of relations (simple, reversed, and double reversed) across three deictic relations (I-You, Here-There, and Now-Then). Training consisted of three phases per category of relation: pre-instructional probes, relational training, and post-instructional probes. During the pre-instructional probes, all untrained complexity levels were tested and no feedback was delivered for correct or incorrect answers. In the relational training, participants received feedback on whether or not they had answered correctly. One level of complexity was trained at a time. Post-instructional probes consisted of all previously trained relations without error correction or reinforcement contingencies.

**Pre-instructional baseline probes.** Pre-instructional probes acted as a baseline for each level of complexity and consisted of exemplars which had not been trained. Before simple relations were trained, the pre-instructional probes consisted of 18 trials (six per complexity level). These 18 trials were a mix of all three complexity levels and all three deictic relational frames. Pre-instructional probes at the reversed level consisted of 12 trials (six reversed and six double reversed) and a randomized mix of relations. Finally, the pre-instructional probes before the double reversed level of training consisted of six trials of untrained double reversed relations. There was no mastery criterion for pre-instructional probes. Participants did not receive any feedback during this phase.
**Relational training.** Each training session included 12 trials at each respective complexity level (simple, reversed, or double reversed). The 12 trials contained an equal mix of I-You, Here-There, and Now-Then relations. The tested relations can be found in Appendix V. The protocol created by McHugh, et al. (2004a) utilized a limited number of scenarios with two questions per scenario. The scenarios also tended to be very similar, often using the same stimuli in different orders. Vilardaga, Esteves, Levin, and Hayes (2012) used trials which were all unique from one another and only based one question on each scenario to keep participants from becoming distracted by repeated similar wording. Vilardaga et al. (2012) used this protocol with typically developing adults, so it is reasonable to assume that adults with TBI could also become distracted by similar scenarios. This study utilized unique scenarios containing varied stimuli with only one question per scenario/trial.

During training, participants received feedback and praise for correct responding. If a participant answered incorrectly, he was told “I’m sorry, the correct answer is ...” The participant was then reread the same scenario, asked the same question again, and given the opportunity to answer correctly. Mastery criteria during training consisted of two consecutive trials blocks with at least 92% correct responding (at least 11 out of 12 trials correct). After achieving mastery at each level of complexity, the participants moved on to the post-instructional probes.

**Antecedent and consequent manipulations.** Dale and Brennan required mass trials of a subset of six and four trials, respectively, during training at the reversed level, to strengthen responding to those scenarios. The six scenarios were repeated twice to maintain a full set of 12 for Dale. The four scenarios were repeated three times to maintain a full set of 12 for Brennan. Dale required visual prompts for all reversed trials and for five double reversed scenarios. Visual prompts consisted of slips of paper with the names or times and situations written on them. The
parts of the scenario which were to be reversed could be manipulated and rearranged to form the correct answer. Dale also required a token board to signal whether he had answered correctly or incorrectly and to indicate when the mid-session break would occur. The length of the mid-session break was contingent on how many scenarios Dale had answered correctly (one minute of break for each correct answer). Brennan required similar visual prompts for the subset of four mass trialed reversed scenarios. Derek required mass trials of Now-Then relations at the reversed level in order to achieve mastery of that level. Prior to training at the double reversed level, all three participants were provided a visual prime (similar to the visual prompts) to show how the double reversed relations worked as compared to previous relations. The prime consisted of four manipulable slips of paper with two names and two objects. The participant was walked through a scenario involving the four stimuli in a double reversed scenario and the researcher moved the papers and pointed to the correct answer. Dale and Derek also required small edible reinforcers (M&Ms) following correct responses to enhance the likelihood of future correct responding.

**Post-instructional mastery probes.** Post-instructional probes acted as a post-test for relational training. The probes consisted only of categories of relations which had been trained. Post-instructional probes consisted of an even mix of exemplars used in pre-instructional probes, exemplars used in training, and novel exemplars (two of each per level of complexity). These different exemplars were used to test for maintenance of trained exemplars and generalization to novel stimuli. After training at the simple level, the post-instructional probe consisted of six trials at only the simple level. After training at the reversed level, the post-instructional probe consisted of 12 trials (six simple and six reversed). After double reversed training, the post-instructional probe consisted of 18 trials (six per level). Participants needed achieve 80% or higher (five out of six trials per level) on post-instructional probes to move on to the next level of
complexity or to complete training. Participants were allowed up to three attempts at the post-instructional probes to achieve mastery.
Chapter Four: Results

Dale

**Deictic probes and training.** Probe and training data for Dale is shown in Figure 1. During baseline probes of deictic performance, Dale performed 100% and 67% at the simple level, 17% and 67% correct responding at the reversed level, and at 33% and 17% correct responding at the double reversed level. For Dale, training at the simple level functioned as an introduction to the protocol and process, rather than an actual training phase, as Dale showed some proficiency at this level during baseline probes. Dale achieved mastery criteria at the simple level in three sessions and achieved 100% correct responding in a post-instructional probe with no feedback and novel scenarios.

Following training at the simple level, Dale performed at 17% and 33% correct responding in the next pre-instructional probe consisting of reversed and double reversed relational complexities. Training began at the reversed level and after the first five sessions, visual prompts were added for all trials. In the 36th training session, a token board was added. In the 58th reversed training session, after several unsuccessful attempts to fade the visual prompts, six scenarios were pulled out of the full training set and mass trialed for more practice. Twelve training sessions were conducted of the six scenarios aforementioned before reintroducing all twelve scenarios (a more difficult context for discrimination). Prompts were faded spatially (stimuli moved farther apart from each other and from Dale) across 10 sessions resulting in mastery of reversed relations. Three post-instructional probes followed reversed training; Dale scored 83%, 100% and 100% on the simple relations and 50%, 67%, and 100% on the reversed
relations, respectively, with no feedback or visual prompts. Throughout reversed training, Dale maintained scores above mastery criteria in simple relations and below mastery criteria in double reversed relations.

Dale scored 33% on the final pre-instructional probe for double reversed relations. In the 12th double reversed training session, a small edible reinforcer was added following each correct response. In the 15th double reversed training session, visual prompts were added for five previously missed scenarios. Dale reached mastery of double reversed relations three sessions after the visual prompts were added. Dale scored 100% for both sessions of simple relations, 33% and 83% on reversed relations, and 50% and 83% for double reversed relations in two full post-instructional probes. It is important to note that visual prompts were not fully faded in either reversed or double reversed training, but that no visual prompts were used during post-instructional probes.

**Theory of mind probes.** Dale’s theory of mind task performance is shown in Figure 2. Dale’s baseline performance on the theory of mind tasks indicated that he had limited perspective taking ability overall. During baseline probes, Dale responded incorrectly to all four strange stories scenarios. Following deictic relational training, Dale answered one of the four vignettes correctly, and at a 12 day follow-up he answered two of four vignettes correctly. Dale maintained 100% correct responding to true belief hidden contents scenarios regarding the self and others throughout all three testings. At baseline, Dale responded correctly to 17% of false belief hidden contents tasks regarding the self and others, respectively. Following training, Dale improved to 42% correct responding on the same two individual tasks. At the 12 day follow up, Dale scored 58% correct on false belief to the self and 50% on false belief to others.
Figure 1: Results of deictic relational training for Dale. Asterisks represent pre-and post-instructional probes, closed squares represent training sessions, and open squares represent a subset of six previously missed scenarios.
Figure 2: Dale’s scores on theory of mind tasks. The blue bar represents baseline scores, the red bar represents scores after deictic training, and the green bar represents scores at a 12 day follow-up.
Brennan

**Deictic probes and training.** Brennan’s probe and training data are displayed in Figure 3. In three baseline pre-instructional probes, Brennan scored below mastery criteria in all three complexity levels. As with Dale, the simple level also functioned as an introduction to the training protocol and process for Brennan due to relatively strong performance on the baseline probes. Brennan achieved mastery criteria at the simple level after six training sessions with feedback. Brennan maintained 100% correct responding in all simple post-instructional probes following mastery.

Brennan remained below mastery criteria in a final pre-instructional probe at the reversed level and continued on to training. Brennan showed variable responding to scenarios at the reversed level of complexity and it was determined that he was struggling with a subset of four trials. The four trials were then broken out and mass trialed. Visual prompts were added seven sessions in to these mass trials. Brennan achieved mastery of the subset of four trials and received training again on all 12 scenarios. He then mastered the full training set in only two sessions. Visual prompts were included for the four previously missed scenarios when the full training set was reintroduced. In a post-instructional probe of combined simple and reversed level scenarios with no feedback or visual prompts, Brennan achieved 100% correct responding across both complexity levels.

Brennan performed at 50% correct responding in the last double reversed probe. Brennan achieved mastery of relations at the double reversed complexity level in five sessions with no additional supports. Brennan maintained 100% correct responding in the simple and double reversed levels, but dipped slightly in performance (83% correct) at the reversed level in a full post-instructional probe of all three complexity levels.
**Theory of mind probes.** Brennan’s theory of mind task performance is shown in Figure 4. Brennan performed at 58% correct responding in the hidden contents task regarding true belief of both self and other prior to deictic relational training. He scored 92% correct regarding false belief of self and 67% for false belief of others. He also answered zero of four strange stories vignettes correctly at baseline. Brennan scored 67% correct responding in both sets of true belief tasks (self and others), 92% correct regarding false belief of self, and 83% correct regarding false belief of others following deictic relational training. He answered two of four strange stories vignettes correctly after training. Brennan remained at 67% correct responding to hidden contents tasks regarding true belief of self, achieved 75% correct responding regarding true belief of others, maintained 92% correct responding regarding false belief of self, and 92% correct regarding false belief of others at a 10 day follow-up. He also answered the same two strange stories correctly at follow-up.
Figure 3: Results of deictic relational training for Brennan. Asterisks represent pre-and post-instructional probes, closed squares represent training sessions, and open squares represent a subset of four previously missed scenarios.
Figure 4: Brennan’s scores on theory of mind tasks. The blue bar represents baseline scores, the red bar represents scores after deictic training, and the green bar represents scores at a 10 day follow-up.
Derek

**Deictic probes and training.** Probe and training data for Derek is shown in Figure 5. Derek remained below mastery criteria in all three levels of relational complexity during baseline pre-instructional probes. Derek mastered training at the simple level following eight sessions with feedback. Derek achieved 83% correct responding in the first post-instructional probe at the simple level and 100% correct responding in a second probe. He maintained 100% correct responding from the fourth post-instructional probe onwards.

Derek scored 100% on a pre-instructional probe at the reversed level after training of simple relations. This score seemed out of the ordinary based on previous pre-instructional probes, and another probe was delivered on which he scored 17%. Derek began training of reversed relational complexity following this return to below mastery levels. After 23 sessions of training, during which a cyclical pattern of responding developed, it was determined that Derek was mainly erring on the Now-Then relational frames. The Now-Then relational frames were mass trialed for 19 sessions, and while mastery was not achieved, there was an improvement in Derek’s scores. From the fourth session of only Now-Then scenarios through the end of the training protocol, a small edible reinforcer was delivered following correct responses in addition to praise. Derek mastered training at the reversed level in four sessions when all three relational types were integrated and trained together again. Derek scored 100% on simple relations and 83% on reversed relations in a post-instructional probe of combined simple and reversed relational complexities.

All scores for pre-instructional probes at the double reversed level of complexity remained below mastery criteria. Derek mastered training at the double reversed level following nine sessions with edible reinforcers and praise as feedback for correct responses. Derek scored
100% correct on relations at the simple and reversed levels and 83% correct on relations at the double reversed level in a final post-instructional probe.

**Theory of mind probes.** Derek’s theory of mind task performance is shown in Figure 6. Derek scored 83% on a hidden contents task regarding true belief of the self, 100% on true belief of others, 0% on false belief of self, and 42% on false belief of others at baseline. He scored 92% on true belief of self, 100% on true belief of others, 33% on false belief of self, and 25% on false belief of others after deictic relational training. Interestingly, at a 10 day follow-up, Derek scored 100% on both areas of true belief, but performed worse in both areas of false belief (17% self and 0% other). Derek answered one of three strange stories vignettes correctly across all three testings.
Figure 5: Results of deictic relational training for Derek. Asterisks represent pre-and post-instructional probes, closed squares represent training sessions, and closed triangles represent mass trials of only Now-Then scenarios.
Figure 6: Derek’s scores on theory of mind tasks. The blue bar represents baseline scores, the red bar represents scores after deictic training, and the green bar represents scores at a 10 day follow-up.
Chapter Five: Discussion

Several studies have attempted to train perspective taking abilities in various populations via traditional psychological means, behavior analytic methods, and deictic relational training. The present study is the first to apply a deictic relational training protocol (or any perspective taking training) to adults who have sustained a traumatic brain injury. All three participants in this study showed clear improvements in deictic relational responding but mixed results on improvement in theory of mind task scores.

Rehfeldt et al. (2007) laid the groundwork for studies such as this by showing that deictic relational framing can be taught. The two participants who were taught to respond relationally to questions on deictic frames were taught using a computerized training. Based on the 55 sessions it took the second participant to master the training protocol, she may have benefitted more from a one-on-one approach. Perspective taking is a social skill and would reasonably be learned more quickly in a social environment, as opposed to in front of a computer screen. All three participants in this study required more than 55 sessions to achieve mastery, but none of these three were typically developing children.

The participants in Weil et al. (2011) completed the training protocol in 16-65 sessions, whereas the participants in this study took 63-118 sessions to achieve full mastery. While this seems like a drastic difference, one could argue that the participants in the former study were predisposed to acquire the skillset being taught and those in the latter study were not. Perspective taking skills are generally seen in typically developing children over six years of age (Baron-Cohen et al., 1985) without explicit training. Adults who have suffered a traumatic brain injury
most likely had a fully developed perspective taking repertoire prior to their injuries, but following trauma, display deficits. Post-traumatic brain injury perspective taking deficits can be understood in the same way we understand an inability to walk following a substantial brain injury. Just as a person can learn to walk again, he or she can learn to take perspective again.

Jackson et al. (2014) was one of the first to use the McHugh protocol to train deictic relational responding in children with autism, but found little generalization to theory of mind task performance. It may be that mastery criteria in that study was not indicative of a fully acquired skill. None of the three participants achieved higher than 85% correct responding at the reversed level and only one of the three achieved higher than 85% correct responding at the double reversed level. While mastery criteria is rarely a specific cutoff known to indicate full acquisition, it is possible that achieving scores above 90% correct responding in two consecutive sessions (as in the current study) provides a better indication that one session above 80% correct.

O’Neil and Weil (2014) used a similar mastery criteria to Jackson et al. (2014) but found that participants’ theory of mind task performance improved. Participants in the former study generally began with higher theory of mind scores than the children in the latter. The current study also employed more antecedent manipulations (visual prompts, mass trials of subsets of scenarios) than either of the previously noted studies. The inclusion of antecedent manipulations may have led to better outcomes for participants in this study.

These data add to the body of research supporting the McHugh deictic relational training protocol and open up the possibility of this protocol helping even more populations than those typically worked with in the field of applied behavior analysis (e.g. children with autism). This study also adds to the theory of neuroplasticity, in that a skill which had likely been lost following a traumatic brain injury may be retaught with behavioral approaches.
While overall, the goals of the study were achieved, several limitations were noted. The first limitation in this study involved initially finding participants. Participant recruitment was very difficult due to stringent inclusion criteria (specific area of brain injured and failure on all pre-tests). Two potential candidates were screened, but passed all of the pre-tests and were not included in training. Several more potential candidates were approached but they or their respective legal guardians declined.

Scheduling sessions became problematic once all three of the final participants were consented and screened. Each of the three participants lived in a different area of the facility with different schedules, making it difficult to coordinate times to meet for sessions. Additionally, staff members often took patients at the rehabilitation facility on unplanned outings, resulting in several missed sessions. Participants had regular doctor’s appointments which conflicted with planned sessions as well. These conflicts often led to long gaps between training sessions, particularly Dale and Derek who experienced up to two weeks without any training sessions on a few occasions. Also, at the beginning of the protocol, Dale was only receiving training sessions two times per week, whereas by the end of the study all three participants were receiving four to eight sessions per week across four days. Future research should aim to have set schedules for meeting with participants to ensure minimal time between training days.

Another issue encountered was that all three participants tended to struggle with the same scenarios. The wording of several scenarios had to be changed throughout the course of the training protocol. All of the scenarios used were created specifically for this study and had not been tested prior. Future studies should test scenarios in a focus group of typically developing adults to ensure that wording is clear and unnecessary words are removed.
It is also important to take into account the sheer number of antecedent and consequent manipulations utilized in this study. All manipulations were included following data-based decisions (i.e., Dale was consistently answering six reversed scenarios wrong, so we worked on only those six scenarios for a time) and future studies should maintain this practice. While the overall generalized protocol is helpful and necessary, not all learners will benefit from basic practices alone and may require additional supports. In particular, populations with known learning deficits (children with autism or people with TBI) will likely require trainers and researchers to assess all possible tactics to promote learning.

In the future, it may be valuable to observe whether this training has any impact on problem behavior such as aggression or unusual statements. Future studies should also investigate a comparison between the scenarios used in the original McHugh protocol versus the more conversational scenarios used in Vilardaga et al. (2012) and the current study. It could also be interesting to take data on more subjective measures to determine if caregivers or relatives notice a change in social skills following deictic training. Future research should conduct follow-up sessions to test for maintenance of deictic relations and theory of mind task performance farther out (one month, six months, etc.). Future directions could also examine fluency training and generalization to other therapists or relatives/caregivers. Future studies should also conduct a pre-screening to rule out severe memory deficits. If deficits are identified, then a fluency based format would be recommended due to the benefits of performing with speed and accuracy as opposed to just accuracy.

Based on the current data, it seems reasonable to assume that if perspective taking ability is lost or impaired following a traumatic brain injury, the skill set may be relearned using a deictic relational training protocol. This study stands as further evidence in support of deictic
relational training to teach an operant skill which also allows for some generalization to more traditional theory of mind tasks.
References


Appendix I:

Theory of Mind Tasks

Level 1: Simple visual perspective taking. The test for level one involves a card with a different picture on either side. In order to pass this level, the person must identify that he or she sees a different image than a person looking at the opposite side of the card (Barnes-Holmes, McHugh, et al., 2004).

Level 2: Complex visual perspective taking. The test for this level involves a card with the same picture is placed between two people so that it is facing the right way for one person and upside-down for the other. Passing this level requires the person being tested to acknowledge that he or she is looking at the same image as the other person, but from a different angle or perspective (Barnes-Holmes, McHugh, et al., 2004).

Level 3: Seeing Leads to Knowing/Hidden Contents. The test for this level requires the person being tested to indicate that he or she is unable to say for sure what is inside a box without seeing its contents. This may also be done with dolls so that the person being tested must identify that a doll which has not “looked” inside a box does not “know” what is inside of it (McHugh et al., 2004b; Wellman et al., 2002).
Level 4: True belief. This level usually tests about where objects are placed from the perspective of the person being asked and a doll (Colle, Baron-Cohen & Hill, 2007; McHugh, Barnes-Holmes, Barnes-Holmes, & Stewart, 2006; Weil et al., 2011).

Level 5: False belief. First order false belief tasks generally involve doll models (usually Sally and Anne) (Baron-Cohen et al., 1985; Charlop-Christy & Daneshvar, 2003; Holroyd & Baron-Cohen, 1993; Knoll & Charman, 2000; LeBlanc et al., 2003; Ozonoff & Miller, 1995; Swettenham, 1996). One doll (Sally) places an object in a certain location and then leaves the room. Following Sally’s exit, the other doll (Anne) moves the object to a different location. When Sally returns, the experimenter asks the child where Sally thinks the object is and where she will look for the object. In order to answer these questions correctly, the child must indicate that the doll thinks that the object is where it was originally placed and will look there for the object.

A second-order attribution test involves a toy village with two houses, a church, a park area, an ice cream van and four dolls and tests the ability to “think about another person’s thoughts about a third person’s thoughts or beliefs about an object or event” (Baron-Cohen, 1989, p. 288). The characters in this test were John, Mary, John’s mother, and an ice cream man. John and Mary are in the park when the ice cream man arrives. John does not have money so the ice cream man tells John that he will wait in the park while John goes home. After John leaves, the ice cream man decides to sell ice cream at the church instead and tells Mary this. On his way to the church, the ice cream man passes John and tells John where he is going. Mary decides to go to John’s house and tell him that the ice cream man has moved, not knowing that the two had already spoken. When Mary gets to John’s house, John’s mother tells Mary that John had already
left to get ice cream. The main test question for this task is “Where does Mary think John has gone to buy ice cream?” (Baron-Cohen, 1989).

Another type of false belief task, which is usually called the Smarties or M&M task (LeBlanc et al., 2003; Wellman et al., 2002), involves placing an unlikely item in a box (a crayon in a Smarties candy box) and asking the participant what he or she thinks is in the box. The child should respond that he or she thinks that there is Smarties candy in the box. After giving an incorrect answer, the child is shown what is actually in the box and then asked what a friend who has never seen that particular candy box would think it contained (Wellman et al., 2002).

Higher order tasks: Eyes task and faux-pas test. Baron-Cohen, Jolliffe, Mortimore, and Robertson (1997) describe the “eyes task”, which they term a more advanced theory of mind task. The eyes task requires subjects to choose one of two mental state terms which best describes what a picture of a person is thinking or feeling based only on the eye region of the picture. The faux-pas test involves stories where a character says something awkward and the person being tested must identify whether something was said which shouldn’t have been, who said the strange thing, why it should not have been said, and why it was said (Geraci et al., 2010).
Appendix II:

Treatment Integrity Checklist

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<th>Training Sessions</th>
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<td>PI allows participant 3-5 seconds to answer</td>
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<td>If incorrect: PI repeats trial scenario</td>
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<td>If incorrect: PI allows participant to answer again, correctly</td>
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<td>PI delivers no consequence for participant answers (Praise or correction procedure)</td>
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Appendix III:

Hidden Contents True and False Belief Task

True Belief to Self

1. If I put the pencils in the toy box and you are not here, you would think the toy box contains toys. (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 tools in the tool box and you are not here, you would think the tool box contains tools. (True)
4. If I put the shoes in the shoes box and you are here, you would think the shoe box contains shoes. (True)
5. If I put the cake in the shoe box and you are not here, you would think the shoe box contains shoes. (True)
6. If I put the candy in the cigarette box and you are here, you would think the cigarette box contains candy. (True)
7. If I put the cigarettes in the cigarette box and you are not here, you would think the cigarette box contains cigarettes. (True)
8. If I put the cigarettes in the cigarette box and you are here, you would think the cigarette box contains cigarettes. (True)
9. If I put the tools in the toy box and you are not here, you would think the toy box contains toys. (True)
10. If I put the cigarettes in the candy box and you are here, you would think the candy box contains cigarettes. (True)

11. If I put the crayons in the crayon box and you are not here, you would think the crayon box contains crayons. (True)

12. If I put the juice in the juice box and you are here, you would think the juice box contains juice. (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 candy in the candy box and I am not here, I would think the candy box contains candy. (True)

4. If you put the cake in the cake box and I am here, I would think the cake box contains cake. (True)

5. If you put the crayons in the cigarette box and I am not here, I would think the cigarette box contains cigarettes. (True)

6. If you put the soda in the water bottle and I am here, I would think the water bottle contains soda. (True)

7. If you put the cigarettes in the cigarette box and I am not here, I would think the cigarette box contains cigarettes. (True)

8. If you put the cards in the card box and I am here, I would think the card box contains cards. (True)
9. If you put the water in the soda bottle and I am not here, I would think the soda bottle contains soda. (True)

10. If you put the shoes in the cake box and I am here, I would think the cake box contains shoes. (True)

11. If you put the toys in the toy box and I am not here, I would think the toy box contains toys. (True)

12. If you put the crayons in the crayon box and I am here, I would think the crayon 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 candy in the apple box and you are not here, you would think the apple box contains candy. (False)

3. If I put the tools in the tool box and you are not here, you would think the tool box contains pencils. (False)

4. If I put the candy in the candy box and you are here, you would think the candy box contains pencils. (False)

5. If I put the crayons in the cigarette box and you are here, you would think the cigarette box contains cigarettes. (False)

6. If I put the crayons in the cigarette box and you are not here, you would think the cigarettes box contains crayons. (False)

7. If I put the cigarettes in the cigarette box and you are not here, you would think the cigarette box contains crayons. (False)
8. If I put the apples in the apple box and you are here, you would think the apple box contains crayons. (False)

9. If I put the apples in the candy box and you are here, you would think the candy box contains candy. (False)

10. If I put the cigarettes in the crayon box and you are not here, you would think the crayon box contains cigarettes. (False)

11. If I put the crayons in the crayon box and you are not here, you would think the crayon box contains cigarettes. (False)

12. If I put the toys in the toy box and you are here, you would think the toy box contains toys. (False)

**False Belief to Another**

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

2. If you put the cards in the tool box and I am not here, I would think the tool box contains cards. (False)

3. If you put the toys in the toy box and I am not here, I would think the toy box contains tools. (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 cigarette box and I am here, I would think the cigarette box contains cigarettes. (False)

6. If you put the soda in the water bottle and I am not here, I would think the water bottle contains soda. (False)
7. If you put the cigarettes in the cigarette box and I am not here, I would think the cigarette box contains crayons. (False)

8. If you put the cigarettes in the cigarette box and I am here, I would think the cigarette box contains crayons. (False)

9. If you put the pencils in the crayon box and I am here, I would think the crayon box contains crayons. (False)

10. If you put the tools in the toy box and I am not here, I would think the toy box contains tools. (False)

11. If you put the crayons in the crayon box and I am not here, I would think the crayon box contains cigarettes. (False)

12. If you put the apples in the apple box and I am here, I would think the apple box contains candy. (False)
Appendix IV:
Strange Stories Task

Double Bluff

1. Jim knows that his brother, Simon, is a big liar. Yesterday Simon stole Jim’s cigarettes. Jim knows that the cigarettes are hidden either under Simon’s bed or in his closet. When Jim asks Simon where the cigarettes are, Simon says they are under his bed.
   a. Why will Jim look in the closet for his cigarettes? (Answer should include “Jim knows Simon is lying”)

2. During the war, the Red army captures a member of the Blue army. The Red army wants to know where the Blue army’s tanks are, but they know the prisoner will lie to protect his army. The tanks are either in the mountains or by the beach. The prisoner is very smart and knows that the Red army will expect him to lie. The tanks are really in the mountains so the prisoner tells the Red army that the tanks are in the mountains.
   a. Why did the prisoner say that? (Answer should include “The prisoner knows the army will expect him to lie”)

Deception/Persuasion

1. Brian is always hungry and very greedy. Today at school it is his favorite lunch – pizza. He wants extra pizza even though his mom is making a special dinner tonight. Everyone is allowed only two slices of pizza. When it is Brian’s turn to be served, he says “Can I please have four slices? I won’t be having any dinner when I get home.”
a. Why does Brian say this? (Answer should include “Brian is greedy” or “Brian is lying”)

2. Jill wanted to buy a kitten so she went to see Mrs. Smith. Mrs. Smith had a lot of kittens that she didn’t want. Mrs. Smith loved the kittens and wouldn’t do anything to hurt them, but she couldn’t keep them all. Jill wasn’t sure if she wanted one of Mrs. Smith’s kittens because they were all males and she wanted a female. Mrs. Smith said “If no one buys the kittens, I’ll have to drown them!”

   a. Why does Mrs. Smith say this? (Answer should include “Mrs. Smith lied to get Jill to buy a kitten”)

White Lie

1. Helen waited all year for Christmas because she knew she could ask her parents for a puppy. She wanted a puppy more than anything. Finally, on Christmas Day, she rushed to unwrap the big box from her parents, thinking there would be a puppy inside. But when she opened the box, it was full of clothes. When Helen’s parents asked how she liked her present she said “It’s great, thank you, just what I wanted”.

   a. Why did Helen say that? (Answer should include “She didn’t want to hurt their feelings”)

2. Peter’s girlfriend came over one day in a new outfit. Peter didn’t really like the outfit on her and thought it made her look kind of fat. But when Peter’s girlfriend asked if he liked the outfit, he said she looked great.

   a. Why did Peter say that? (Answer should include “He didn’t want to hurt her feelings”)

50
Misunderstanding

1. Late one night, old Mrs. Peabody is walking home. She is very nervous and doesn’t like walking alone in the dark because she thinks she will be mugged. A man taps her from behind to ask her what time it is. She jumps and says “Take my purse, just please don’t hurt me!”
   a. Why does Mrs. Peabody say that? (Answer should include “She thought she was being robbed”)

2. A burglar has just robbed a jewelry store and is running home. As he is running, a police officer sees the burglar drop a glove. The officer doesn’t know that the man is a burglar and wants to return the glove. The police officer shouts to the burglar “Hey, you! Stop!” The burglar turns around, sees the police officer, and gives himself up, confessing his crime.
   a. Why did the burglar do that? (Answer should include “He thought that the police caught him stealing”)

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Appendix V:  
Deictic Relations Training Trials

Simple

I-You.

- Jim has a dog and Karen has a cat. What does Jim have? (Dog)
- I have a red car and you have a silver car. What car do you have? (Silver)
- Laura is going bowling and Julie is going fishing. What is Laura going to do? (Bowling)
- Sam collects movies and Henry collects coins. What does Henry collect? (Coins)
- Alicia drives a motorcycle and Marvin drives a truck. What does Marvin drive? (Truck)
- Lisa is a dog walker and Kim is a teacher. What does Lisa do? (Walk dogs)
- James is writing a novel and Tim is writing a newspaper article. What is Tim writing? (Newspaper article)
- Alex’s favorite color is orange and Carol’s favorite color is purple. What is Alex’s favorite color? (Orange)
- Kirk plays the drums and Richard plays the guitar. What does Richard play? (Guitar)
- Jessica rides her bike to work and Mike walks to work. How does Jessica get to work? (Riding a bike)
Here-There.

- Marcia lives in Miami and Gloria lives in Orlando. Where does Marcia live? (Miami)
- Susan is riding the bus and Jerry is at the movie theater. Where is Jerry? (Movie theater)
- Reggie is on vacation in Hawaii and Logan is on vacation in Alaska. Where is Reggie on vacation? (Hawaii)
- Gary works at Walmart and Sean works at Publix. Where does Gary work? (Walmart)
- Emma is from Wisconsin and Jeannette is from Oregon. Where is Jeannette from? (Oregon)
- Ted is at the library and Chis is at the gym. Where is Ted? (Library)
- Wes is at a concert and Scott is at a restaurant. Where is Scott? (Restaurant)
- Dana is studying in her room and Kaitlyn is studying in the cafeteria. Where is Kaitlyn studying? (Cafeteria)
- Jeff is playing golf at the country club and Kevin is playing hockey at the arena. Where is Jeff? (Playing golf)
- Talia is riding a horse on the beach and Arnold is reading a magazine at a café. Where is Arnold? (A café)

Now-Then.

- Now David is eating an apple but three hours ago he was picking the apple off a tree. What was David doing three hours ago? (Picking an apple)
Today Jane is surfing in Hawaii and tomorrow she will be at a business meeting in New York. Where is Jane today? (Hawaii)

Yesterday I was watching TV and today I am reading. What am I doing today? (Reading)

Today Larry is on a date with his girlfriend and tomorrow he will be leaving for a cruise with his family. What is Larry doing tomorrow? (Leaving for a cruise)

Last week Tom was taking a final in school and today he is at the beach with his friends. What was Tom doing last week? (Taking a final)

Today Steve is sleeping late and tomorrow Steve has to wake up early for class. What will Steve be doing tomorrow? (Waking up early)

Last night Wanda was playing video games and tonight she will be running on the treadmill. What was Wanda doing last night? (Playing video games)

This afternoon, Elizabeth had a salad for lunch and tonight she will have a steak for dinner. What will Elizabeth eat tonight? (Steak)

Yesterday Shayla was writing a term paper and today she is going to a pool party. What is Shayla doing today? (Pool party)

Today Stuart is packing his luggage and next week he will be on vacation at the Grand Canyon. What is Stuart doing today? (Packing)

Reversed

I-You.

I like ham sandwiches and you like turkey sandwiches. If I were you, what would I like? (Turkey sandwiches)
Marge goes to the USF and Luis goes to the UM. If Luis were Marge, where would Luis go? (USF)

Melissa likes to wear all black and Dan likes to wear all red. If Melissa were Dan, what would she wear? (Red)

Sylvia is lifting weights at the gym and Al is running at the park. If Al was Sylvia, what would he be doing? (Lifting weights)

Barbara is listening to music and Nicole is watching a movie. If Barbara was Nicole, what would she be doing? (Watching a movie)

Roy is a nurse and Mia is a journalist. If Mia was Roy, what would she be? (A nurse)

Paul has a parrot and Matt has a pig. If Matt was Paul, what would he have? (Parrot)

Juan works at Publix and Adam works at Winn Dixie. If Juan was Adam, where would he work? (Winn Dixie)

Barney likes dancing and Leslie like singing. If Leslie were Barney, what would she do in her spare time? (Dance)

Wayne plays hockey and Eli plays football. If Wayne was Eli, what sport would Wayne play? (Football)

Here-There.

George lives in Maine and Nathan lives in California. If Maine were California, where would George live? (California)
- Wilfred works at Sears and Emily works at Macy’s. If Sears were Macy’s, where would Wilfred work? (Macy’s)

- Pam is in Ireland and Jim is in Italy. If Italy was Ireland, where would Jim be? (Ireland)

- Amanda is running at the track and Wally is running on the beach. If the track was the beach, where would Amanda be running? (Beach)

- Blaine works at a pool and Mario works at a lake. If the lake was the pool, where would Mario work? (Pool)

- Clark is at a football game and John is at a baseball game. If the football game was the baseball game, where would Clark be? (Baseball game)

- Harry is at the movie theater and Roxanne is at the ice skating rink. If the ice skating rink was the movie theater, where would Roxanne be? (Movie theater)

- Lissette goes to church every Sunday and Francisco goes to the bar every Sunday. If church was the bar, where would Lissette go on Sunday? (Bar)

- Diego is at a tennis match and Blake is at an aquarium. If the aquarium was a tennis match, where would Blake be? (Tennis match)

- Robert is in Seattle and Edward is in Houston. If Seattle was Houston, where would Robert be? (Houston)

**Now-Then.**

- This morning, Luke was sleeping in bed and now he is riding his bike. If now were this morning, what would Luke be doing now? (Sleeping)
Yesterday Jasmine was at a ballet lesson, and today she is shopping at the mall. If yesterday were today, what would be Jasmine be doing yesterday? (Shopping at the mall)

Tomorrow Will is playing in a football game and today he is practicing. If today was tomorrow, what would Will be doing? (Playing)

During the week, Connor works all day and on the weekends, Connor hangs out with friends all day. If the week was the weekend, what would Connor do all day? (Hang out with friends)

Tonight Ben is doing homework and tomorrow Ben will see a play. If tomorrow was tonight, what would ben be doing tonight? (Seeing a play)

Last week Carla ate a lot of junk food and this week Carla is eating more healthy foods. If last week was this week, what would Carla be eating this week? (Junk food)

Yesterday Jake was building a model car and today he is painting the model car. If yesterday was today, what would Jake be doing today? (Building a model car)

Today Aileen is saying goodbye to her friends and tomorrow she is moving to Maryland. If tomorrow was today, what would Aileen be doing tomorrow? (Saying goodbye)

This week Mitch is listening to classical music and next week Mitch will listen to rock and roll music. If this week was next week, what would Mitch listen to this week? (Rock and Roll)
Tonight Angela is having soup for dinner and tomorrow night Angela will have ravioli for dinner. If tomorrow night was tonight, what would Angela eat tomorrow night? (Cereal)

Now, Steve is walking his dog and tonight he is going on a date. If now were tonight, what would he be doing now? (On a date)

Today Neil is playing video games and tomorrow he will be in class all day. If tomorrow was today, what would he be doing tomorrow? (Playing video games)

Yesterday Tom went bowling and today he is going running. If today was yesterday, what would he be doing today? (Bowling)

### Double Reversed

**I-You/Here-There.**

- Sarah is buying a cat at the pet store and Mary is buying food at the grocery store. If Sarah was Mary and the pet store was the grocery store, where would Sarah be? (Pet store)

- Lucy is watching TV at a home and Owen is reading at the library. If Owen was Lucy and the library was home, where would Owen be? (Library)

- Ariana is singing in the shower and Mark is whistling on the street. If Ariana was Mark and the shower was the street, what would Ariana be doing? (Singing in the shower)

- Brittany is traveling to Germany and Ashley is traveling to China. If Ashley was Brittany and China was Germany, where would Ashley be traveling to? (China)
Ruben is cooking at a restaurant and Elisa is cooking at home. If Elisa was Ruben and home was a restaurant, where would Elisa be cooking? (Home)

Whitney is in England and Jennifer is in Spain. If Jennifer was Whitney and Spain was England, where would Whitney be? (England)

Fred likes to build train sets in his garage and Christina likes to build train sets in her bedroom. If Christina was Fred and the bedroom was the garage, where would Christina like to build? (Bedroom)

Debbie is listening to music at a concert and Charles is listening to music in his living room. If Debbie was Charles and the concert was the living room, where would Debbie be listening to music? (Concert)

I live in Jacksonville and you live in Miami. If you were me and Miami was Jacksonville, where would you live? (Miami)

**Here-There/Now-Then.**

Yesterday Wilma was in France and next week she will be in Russia. If yesterday were next week and France was Russia, where was Wilma yesterday? (France)

Today Leroy is at home washing his car and tomorrow he will be in New York. If tomorrow was today and New York was home, where would Leroy be tomorrow? (New York)

This morning Alma was at home taking a shower and now she is at a party. If this morning was now and home was the party, where would Alma be this morning? (Shower)
Last week, Brian was working at a doctor’s office and this week Brian is working at a dentist’s office. If last week was this week and the doctor’s office was the dentist’s office, where did Brian work last week? (Doctor’s office)

Today Lauren is performing in a play in St. Petersburg and tomorrow Lauren will be performing in a play in Clearwater. If tomorrow was today and Clearwater was St. Petersburg, where would Lauren be performing tomorrow? (Clearwater)

This afternoon Janine is going to school and tonight she will be working. If this afternoon was tonight and school was the club, where would Janine be this afternoon? (School)

Yesterday Jack was sailing on a ship and today he is relaxing on the beach. If today was yesterday and the beach was the ship, where would Jack be today? (Beach)

Today Nancy is exercising at the gym and tomorrow she will be in a beauty pageant at the convention center. If tomorrow was today and the convention center was the gym, where would Nancy be tomorrow? (Convention center)

Over the weekend, Olivia was at a yoga convention and today she is at a yoga class. If the weekend was today and the convention was the class, where would Olivia be over the weekend? (Yoga convention)

Now Marilyn is at FSU and next year she will be UM. If next year was now and UM was FSU, where would Marilyn be next year? (UM)