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## Assessing and enhancing the value of social interactions for individuals diagnosed with an autism spectrum disorder

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### Abstract

Autism spectrum disorders are characterized by social deficits. These social deficits are pronounced and include responding abnormally to social stimuli, such as smiles, eyes and faces. This study sought to examine responsiveness to social stimuli during free choice between social interaction and solitary play. Two persons diagnosed with ASD who displayed social deficits participated in this study. During the free choice assessment, two sets of identical play materials were available, one set on each side of the room. On the social side, an adult who interacted with the participant was present. On the non-social side, an adult was present but she did not interact with the participant. Preference for social interaction was obtained as was the quality of social behavior emitted by the participant. Then a free-operant social preference assessment was used to identify social reinforcers. Prompt fading and a script was used to train social interactions with an adult. The preferred social stimuli were used as reinforcers during this training. Pre assessment sessions indicated that the participants did not engage in complex social interactions and there was a variety of preference for social interactions. Post-assessment sessions indicated the emergence of social skills that were not previously present and the emergence of a preference for social interactions in one of the participants.

Assessing and Enhancing the Value of Social Interactions for Individuals Diagnosed with an  
Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) has been described as a complex neurological disorder that has strong genetic roots though prenatal environment may also play a role in the development of the disorder (Bailey, Le Couteur, Gottesman, Bolton, Simonoff, Yuzda, & Rutter, 1995). There is variation in severity, time of onset (typically before 12 months of age) and behavioral deficits across affected individuals. The *Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition* (DSM-IV, 1994) has described ASD as the presence of abnormal or impaired development in social interactions, communication, and restricted repertoires of activities and interests. ASD is generally characterized as consisting of Asperger's Disorder, Rett's Disorder (females only), Autism, and Childhood Disintegrative Disorder. ASD is a spectrum disorder, meaning that there are many different levels of abilities, deficits, and excesses across affected persons. Higher scores on IQ tests, communicative speech, and appropriate play are considered to be prognostic of better outcome (Helt, Kelley, Kinsbourne, Pandey, Boorstien, Herbert, & Fein 2008). It has also been demonstrated that children who are diagnosed and treated at an early age will make greater gains than other children who are diagnosed and enter treatment at an older age (Eikeseth, Smith, Jahr, & Eldevik, 2007).

There are many deficits and excesses associated with ASD including delays in communicative vocalizations, decreased interest in social interactions with others, atypical body posture, failure to imitate, inconsistent or no eye contact; poor joint attention skills (reciprocal communicating), poor play skills, repetitive behaviors, and cognitive delays. In some more severe cases, spoken language may never develop and the ability to maintain a conversation may not emerge (Kanner, 1943). Also, children with autism sometimes exhibit extreme isolation and

preservation of sameness. These children are also less likely to respond when being spoken to. Another study showed that fifty percent of children diagnosed with an autism spectrum disorder lack functional speech and therefore require instruction to acquire communication skills (Tsiour & Greer, 2003).

Many studies have revealed a number of social deficits. For example, Dawson, Meltzoff, Osterling, Rinalidi, and Brown (1998) stated that children with ASD typically do not orient toward speech sounds, social stimuli or point cues give by others. This was verified by Charman, Swettenham, Baron-Cohen, Baird, and Drew (1997), when they placed a mechanical toy with a child with autism and found that the child would interact with the toy but did not gaze shift between the toy and the presence of the adult. Because these deficits and excesses are so profound, it is important to teach these foundational skills (e.g., imitation, communication, play, and other forms of social behavior). There is a particular impetus to teach these skills because these responses may be predictors of a child's responsiveness to intervention (Charman, 2003). Once an individual is diagnosed with an ASD, it is important to start targeting the core deficits, especially social interactions. Joint-attention skills may be a particularly important target when the individual enters treatment.

Mundy, Sigman, and Ungerer (1986) described joint attention as the coordination of attention between interactive social partners with respect to objects or events in order to share an awareness of the objects or events. This includes responding to social interactions, initiating social interactions, responding to gestures or cues, initiating gestures or cues, responding to a request and initiating a request. Dube, MacDonald, Mansfield, Holcomb, and Ahearn (2004) conceptually analyzed joint attention from a behavior-analytic perspective. They suggested that the contingencies of reinforcement that establish and maintain joint attention include reinforcers

and evocative effects of antecedent objects or events. They explain that joint attention is established by consequences that are delivered by an adult. This happens when an interesting event occurs and the adult shifts their gaze towards that event and comments (or emits other behavior) to allow the child to share that event. This then sets the occasion for the child to engage in social behavior (such as pointing or commenting on the event) which would be reinforced or punished by the adult.

Dube et al. (2004) stated that joint attention is behavior relative to an interesting event that occurs in a social environment. There is a gaze shift from an interesting event to someone, and then the consequence that follows is the behavior of another individual. The gaze shift provides a discriminative stimulus for additional responding. For example, a gaze shift sets the occasion for a comment about the interesting event, which is a socially mediated consequence for the gaze shift. It is possible that children with ASD do not develop a preference for social stimuli, such as smiles or verbal praise or a preference for social environments. Some forms of social stimuli and environments may have some reinforcing value, but there is likely variation in the properties of those stimuli that are salient. The authors noted that it is important to target joint-attention deficits in persons with ASD and teach these skills across a variety of settings.

Typical children engage in social interactions before they begin to talk. They smile, they make eye contact and they point to objects. Bakeman and Adamson (1984) conducted a longitudinal study to look at joint-attention skills between mothers and typically-developing children. They coded these observations using coordinated joint-attention, object engagement, and passive joint-engagement as relevant response classes for classifying the quality of social behavior. They concluded that the mothers were the ones who supported the social interactions with the youngest children but as the children aged and learning occurred, children demonstrated

more complex social behavior and became more reciprocally interactive partners in the interactions. Children who engage in social interactions at an early age acquire language faster (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010). Therefore, social interaction is an important target for children who have joint attention deficits. Many children diagnosed with an ASD show deficits in joint attention behaviors and each child presents individual differences determined by the severity of autistic symptoms, cognitive abilities and temperament (Naber, Bakersman-Kranenburg, Van Ijzendoorn, Dietz, van Daalen, Swinkels, Buitelaar, & van Engeland 2008). These deficits are also one of the earliest signs of autism (Carpenter, Pennington, & Roger, 2002). As early as 9-12 months of age, deficits in nonverbal joint attention may be noticed in atypically developing children, (Bakeman & Adamson, 1984). More complex forms of joint attention, such as responding to and initiating interactions also do not emerge for children with ASDs during this period of development (Siebert, Hogan, & Mundy, 1984).

One method for determining the extent to which a person values social interactions was described by Mundy et al. (1986). They describe three levels of scoring the quality of social interactions where in Level one, there is only eye contact. Level two is more complex where there is eye contact, reaching for an item, engagement with another person, and distal pointing. Level three is the most complex level and it includes turn taking, initiating play with others, eye contact, distal pointing and cues, showing, smiling, imitation, reciprocating verbal behavior, and gestures. They found that children with ASD exhibited significant social deficits and joint attention deficits when compared to their typically functioning peers. Kasari, Gulsrud, Wong, Kwon, Locke (2010) define engagement in four levels where each level is more complex than the one before. *Unengaged* or other engagement is when the child is unengaged or there is very little engagement with objects and people in the environment. *Object engagement* is when a

child is actively involved with objects in the environment but there is very little involvement with people in the environment. Finally, joint attention is when the child and adult are involved actively with the same object or event. In this level, the adult-supported joint-attention, or coordinated joint-attention and language, must be present in this level of engagement. *Supported joint-attention* is when the participant and therapist are actively involved with the same object, but the participant is not actively acknowledging the therapist's participation. *Coordinated joint-attention* is when the participant and therapist are actively involved with the same event, and the participant is actively initiating and repeatedly acknowledging the therapist's participation as well as the environment, likely by visually referencing the therapist. They used these codes to teach parents how to interact with their children and they found that after teaching, the parents who used the intervention with a high degree of fidelity increased their children's levels of joint attention engagement.

Applied Behavior Analysts often teach social skills to children with ASD by using direct and intensive instruction that systematically teaches specific response classes (Ahearn & Tiger, in press). One form of teaching consists of discrete-trial training with prompt fading. Another form of teaching that is also effective is incidental teaching where teaching occurs in the natural environment. The authors recommend that social skills should be practiced in a controlled environment and then those skills should be generalized to the natural environment. In addition, prerequisite skills such as attention, eye contact and vocal imitation should be taught before more advanced joint attention skills (Ahearn & Tiger, in press).

Risley and Wolf (1967) increased the eye contact of children with ASD by holding a preferred edible in front of the therapist's face. Typically, the children would look at the food item and then at the therapist's face directly behind the item. Once eye contact was made, the

child was presented with the food item. The food item was systematically moved away from the therapist's face and the children continued to maintain eye contact with the therapist. Because there is a typically lack of gaze shifting, Whalen and Schriebman (2003) conducted a study where they trained children diagnosed with autism to engage in gaze shifting. The training consisted of cueing, distal cueing, distal pointing, eye contact, and auditory cues. Four of the five participants successfully completed the training.

Imitation is another important skill prerequisite because it is correlated with an increase in joint attention. Ingersoll and Schriebman (2006) taught children with ASD to imitate motor skills. They then evaluated the degree to which those skills generalized to novel environments. They used a multiple-baseline design across participants to evaluate naturalistic teaching of object imitation skills. After training, there was an increase not only in imitation skills but also in social interactions, communication, play and joint attention skills. One way to enhance the reinforcing value of social interactions is to systematically assess children's preference for different forms of social stimuli while increasing social interactions. Using social reinforcement (negative or positive) while teaching social skills may improve these skills and, because it is a natural occurring component of social interactions, may enhance generalization of the trained skills (Ahearn & Tiger, in press).

Smaby, MacDonald, Ahearn, and Dube (2007) developed a protocol to identify social reinforcers for children with autism. They used a multiple schedule, alternating reinforcement and extinction components, to identify social interactions that served as reinforcers. This assessment produced a hierarchical ranking of social consequences. For every arbitrary response (passing a poker chip), the participant received a form of social interaction (e.g., tickle, head rubs, and verbal praise) during the social-reinforcer conditions, and no interaction during the

extinction conditions. They found that this assessment identified some social stimuli as reinforcers while the children were relatively indifferent to other social stimuli. This is a useful technique that can identify how an individual will respond to social stimuli in one environmental condition with a single response. If these social stimuli actually function as reinforcers, then these stimuli can be used as social reinforcers for teaching social skills such as joint attention.

Harding, Wacker, Berg, Cooper, Asmus, Mlela and Muller (1999) developed a method to determine preference for different social environments by using a concurrent-operant assessment, also known as a split-room assessment, to evaluate whether the participants preferred social or nonsocial environments. They divided the parent's living room in half and each side of the room was associated with specific social conditions. A parent acted as the social therapist and toys were present during the sessions and they found that the children preferred to be on the side of the room where their parent was located provided that no demands were being placed on them. Harding et al., (1999) as well as Smaby et al., (2007) gave a basis for assessing preference for (or against) social interactions.

More recently, Dube and colleagues (in preparation), used methods similar to Harding et al. (1999) to assess preference for adult attention in play conditions. They divided a room in half with masking tape, and placed similar sets of toys on the floor. An adult sat on each side of the room with the toys. However, only one adult would interact with the child participant. Before the assessment began, they conducted an exposure phase that was 2 mins in duration. During each of two exposure trials lasting 1 min, only 1 adult and 1 set of toys were present in the room. The social adult would interact with the child throughout the minute. The adult did not place demands on the participant, but made comments about the items in the room or actions of the child. The adult either interacted in this manner every 5 s or maintained a conversation with the

child. In the non-social exposure trial, the other adult and a set of toys were present in the room. This adult was engaged with a book and did not make eye contact with the participant and ignored all social interactions made by the participant throughout the 1 min. Following the exposure trials, they arranged a 4 min choice phase. During this phase, both adults and both sets of toys were present in the room. The child was led into the middle of the room by another adult and was allowed to move freely about the room. When the child was on the side with the social adult, the adult interacted with the child as described previously. When the child was on the side of the nonsocial adult, neither adult interacted or made eye contact with the child.

In this study, 6 typically-developing children and 13 children with diagnosed autism participated. It was found that the typically-developing children preferred the social side of the room whereas the children with autism either preferred the social side of the room less often than their typical peers, or preferred the non-social side of the room. All 6 of the typically developing children preferred to be on the side of the room with the social adult, however only half of the participants engaged in social interaction for more than 50% of the session time. Five of the 13 children with autism preferred to be with the social adult, but only 2 engaged in social interaction for more than 50% of the session time. For 9 of the 13 children with autism, the preferred location was variable and social interactions were low. The remaining 4 children spent a low percentage of time on the social side, and did not engage in social interactions. These data show that children with ASD vary widely in their preference for social environments and the degree to which they interact with an adult. It is also important to note that all of these children were receiving treatment at the time of the assessment.

Because there was such a range of preferences and quality of social interactions in Dube et al.'s study, the present study attempted to replicate and extend the results of their study by

assessing preference for social interaction using the split-room technique and then teaching social interactions to individuals who exhibit social-skill deficits. The present study had 3 components: 1) the measurement of an autistic individual's choice between social environments and non-social environments; 2) the identification of types of social interactions that function as reinforcers for those individuals; 3) the teaching of specific social skills using a script, social reinforcers, and prompt fading.

## **METHOD**

### **Participants**

Two male individuals diagnosed with ASD participated in the study. Walker, a 9-year old student received 30 hours per week of teaching at a school that specialized in ASD, and communicated using vocal approximations in 1-3 word utterances. River was a 34-year-old resident at the same facility and communicated using short sentences.

### **Setting and Materials**

Sessions were conducted at the participants' school. Social-environment preference-assessment sessions were conducted in a research room that was evenly divided with masking tape. Materials included two identical sets of leisure items (e.g., toys & books), a camcorder, and a stop watch. Reinforcer-assessment sessions were conducted in different research rooms accessible to the participants. Materials used in these session included a camcorder, poker chips, colored construction-paper, paper plates, table, chairs, and a stop watch. All training sessions were conducted in a quiet room. Materials needed for these sessions included a camcorder, one set of toys, script data-sheets, and a stop-watch. All sessions were videotaped.

### **Response Measurement & Reliability**

*Preference assessments pre- and post training.* The dependent variable was the percentage of time that a participant spent on the social side of the room, and the percentage of time he engaged with the therapist coded in terms of 4 types of social engagement. Interobserver agreement (IOA) was calculated by dividing the number of agreement intervals (second by second) by the total number of intervals (240 s) and multiplying by 100. IOA was collected by trained observers on 33% of sessions for Walker with a mean score of 97.5% and a range of 90-100%. IOA was collected on 37% of sessions for River with a mean score of 99% and a range of 98-100%.

*Reinforcer Assessment.* The dependent variable during the reinforcer assessment was the rate of passing poker chips. Interobserver agreement (IOA) was calculated by dividing the number of agreement intervals by the total number of responses per session and multiplying by 100. IOA was calculated on 50% of sessions for Walker with a mean score of 100%. IOA was collected on 100% of sessions for River with a mean score of 99% and a range of 98-100%. Sessions were conducted 2 to 5 days a week with 1 to 2 sessions run each day.

*Training Social Interaction.* During the training phase, the dependent variable was the average number of independent joint-attention responses in a 10-trial teaching session. "Eye contact" was defined as the participant's eyes oriented toward the therapist's eyes for at least two seconds. "Initiation" was defined as the participant making a related comment or asking a question after making eye contact with the therapist. "Reciprocating" was defined as the participant responding to a question or a comment made by the therapist. IOA was collected on 53% of sessions for Walker with a mean score of 93% and a range of 70% to 100%, and on 34% of sessions for River with a mean score of 96% and a range of 86-100%.

## Procedures

*Phase 1: Pre-training Preference Assessment.* The purpose of this assessment was to measure a participant's preference for reinforcers that are either socially mediated over those that are non-socially mediated, or vice versa, using a concurrent choice procedure. Prior to the concurrent choice phase, an exposure trial was conducted. During the social exposure-trial, the participant was brought into the assessment room by a therapist and led to the social side of the room where another therapist was seated on the floor surrounded by a set of leisure items. The therapist delivering the participant then immediately left the room. The social therapist immediately engaged the participant with preferred toys by maintaining positive non-demanding social interactions. Every 5 s, the social therapist initiated positive interactions if there were no reciprocal responses from the participant. The social therapist continued with these interactions even if the participant was not responding. The social therapist remained within an arm's length of the participant and the interactions continued if the participant moved onto the non-social side of the room. The exposure trial was 1 min in duration. At the end of the 1 min, another therapist entered the room and escorted the child out of the assessment room.

During the non-social exposure-trial, the participant was brought into the assessment room by a therapist and placed on the non-social side of the room where a third therapist was seated on the floor and surrounded by the same set of leisure items used in the social exposure-trial. This therapist – called the *non-social therapist* – read a magazine and completely ignored the participant. The participant could move freely about the room and could manipulate any of the leisure items. The exposure trial was also 1 min in duration. At the end of 1 min, a therapist entered the room and escorted the child out of the assessment room.

During the choice phase of a trial, both the social and non-social therapists were present in the room, each with the same set of leisure items. The participant was escorted into the assessment room by a therapist and placed in the middle of the room, on the dividing line. After the participant was positioned on the line, the therapist left the assessment room. The participant was free to move about the room and free to manipulate with any leisure items and/or interact with either therapist. When the participant was on the social side, the social therapist interacted with the participant as described above. When the participant was on the non-social side, neither the social nor the non-social therapist interacted with the participant. This choice phase lasted for 4 mins. If the participant did not move to either side of the room after 3 minutes, then the choice phase was stopped, exposure trials were conducted again, and another choice phase was presented.

The social therapist was the therapist who decided whether the participant was on the social or the non-social side of the room. If the participant returned to the center of the room, or it was unclear which side he was on, then his choice was scored as selection of the non-social side. If the participant was standing or kneeling on the dividing line, the side of the room with the participant's head and one foot across the line was scored as the side selected. If the participant was lying flat over the dividing line, the side with the participant's head was scored as selected. If the participant moved out of the frame of the camera, then that time of the session was scored as out-of-frame and no data were collected.

Across successive sessions involving this procedure, the social and non-social therapist remained the same for each participant but the social and non-social side alternated. The social therapist redirected any aberrant behavior and ended the session if participant-specific criteria were met. Sessions were run until stability was achieved. Stability was the participant choosing

one side of the room for 3 consecutive sessions or variability in responding for 4 sessions. A minimum of 6 sessions were run before determining stability.

*Phase 2: Social-Reinforcer Assessment.* The purpose of this assessment was to determine the reinforcing efficacy of three types of social interaction. These interactions were chosen because they are naturally occurring interactions for this participant's age group. This procedure is similar to Smaby et al. (2007). The target response was placing colored poker-chips into the therapist's hand (Walker) or target touching (River). Data were collected using frequency of responses per session. Extinction components were 10 min in duration and only the last minute of the session was scored if responding persisted for the duration of the session, or the session ended if there was 1 min of no responding within the session. All reinforcer conditions were 1 min in duration and the entire minute was scored. Sessions were stopped if the participant's specific criteria were met. Each condition was correlated with a colored piece of construction paper that was placed on the table as a discriminative stimulus. At the beginning of the components, the therapist stated the name of the color and manually guided 5 responses and delivered the specific consequence for each response as well. If the participant passed more than one poker chip at a time, it was recorded as one response. If the poker chip was not placed onto the therapist's hand, the response was not scored or if the target was not completely touched. The order of the conditions was as follows: extinction, Reinforcer 1, extinction, Reinforcer 2, extinction, Reinforcer 3.

During the extinction components, the participant was allowed to respond throughout the 10 minutes and the therapist did not deliver any social consequences. During the Reinforcer 1 component, the participant was allowed to respond throughout the 1 min session and for every response, the therapist delivered a high five. During the Reinforcer 2 component, the participant

was allowed to respond throughout the 1 min session and for every response, the therapist delivered verbal praise. During the Reinforcer 3 component, the participant was allowed to respond throughout the 1 min session and for every response, the therapist delivered a head rub. This sequence was continued until there was stable responding across all of the components.

*Phase 3: Training Social Interaction.* The leisure items used in this phase were the same as those used in Phase 1. During each session, one set of leisure items was present in a room along with the social therapist from Phase 1. At the beginning of each trial in the baseline phase, a timer was started for 2 minutes while the participant was led into the treatment room by an adult and placed at a table with the social therapist. The social therapist waited 5 s for eye contact to occur. If eye contact was made or 5 s elapsed, the therapist handed over the leisure items while looking at the participant with an expectant look. During each trial, if the participant emitted a verbal response, the therapist would respond accordingly to the initiation. These verbal initiations were not explicitly reinforced, but acknowledged by the therapist. If the participant did not emit a verbal response, the therapist would continue to look at the participant with an expectant look. All other behavior was ignored unless participant specific criteria were met to end the session. The target behaviors being scored in these sessions were eye contact, initiation of exchange while making eye contact (e.g., “Hi, can I play?”), and reciprocating a comment while making eye contact (e.g., “I like these beads.”). The therapist recorded a correct response if the participant independently emitted the target response within 5 s of the previous response in the chain. The therapist recorded an incorrect response if the participant did not emit the correct response within 5 s of the previous response or if the participant did not respond at all. Baseline sessions were conducted until there were stable rates of all defined responses.

During each training session, one set of leisure items was present in a room along with the social therapist from Phase 1. At the beginning of each training trial, a timer was started for 2 minutes while the participant was led into the treatment room by an adult and placed at a table with the social therapist. The therapist then prompted the participant through each step of the chain using a most-to-least prompting hierarchy. The chain consisted of making initial eye contact, initiating a greeting and requesting items, answering a question, and then commenting on an item. The prompting hierarchy for eye contact consisted of the therapist bringing one hand to guide the participant's head and eyes towards the therapist, fading the hand away from the participant, a 2-s delay, then a gesture 5 inches away from therapist's eyes, a 2-s delay, then a gesture to therapist's eyes, then no prompt. The prompting hierarchy for the vocal responses consisted of a complete full verbal model, a 2-s delay then a partial verbal model, and then no prompts. The correction procedure used if errors occurred or the participant did not respond within 5 s, was the therapist delivering the most intrusive prompt for the training step and for both eye contact and vocal responses. If the participant responded correctly on the training step, the therapist delivered any of the social reinforcers identified from the social-reinforcer assessment. The criterion to advance to the next prompt level was 9/10 correct responses during one session. The criterion to decrease a prompt level was two consecutive errors within one session. The criterion to advance to the next step in the chain was 2 consecutive sessions with 9/10 independent responses. One session consisted of 10 trials. All aberrant behaviors were ignored and no contingent consequences were delivered. When the last step of the chain was mastered, the training sessions ended.

*Phase 4: Post-Training Preference Assessment.* The purpose of this assessment was to measure the preference for reinforcers that were either socially mediated or non-socially mediated. The procedure for this phase was identical to Phase 1.

## Results

Figure 1 shows the results of the pre-training preference assessment for Walker. The percentage of time spent on the social side of the room is represented on this graph for each session. During the first 2 sessions, there was no clear preference for the social versus the non-social side of the room, but during the third through the sixth session, Walker reliably chose the social side of the room and stayed on the social side of the room for the majority of the 4-min period. Figure 2 shows the results of the pre-training preference assessment for River. During the first 4 sessions, River preferred the social side of the room, but beginning with the fifth session through the ninth session, River reliably chose the non-social side of the room and stayed on the non-social side of the room for the entire 4-min period in 4 of these 5 sessions.

Figure 3 shows the results of analyzing the quality of social interactions during the pre-training assessment for Walker. He did not engage in coordinated joint-attention, but instead spent most of his time disengaged in object interactions. He spent little of his time unengaged and during the last 4 sessions, he engaged in more supported joint-attention than before.

Figure 4 shows the results of analyzing the quality of social interactions during the pre-training assessment for River. River never engaged in coordinated joint-attention and he engaged in very little supported joint-attention. He spent most of his time engaging in object interactions and very little time unengaged.

Figure 5 shows the results of the social reinforcer assessment for Walker. The response rates are shown for each of the components. Extinction components continued for the full 10 mins with Walker and data from only the final minute is represented on the graph. Response rates from each session are shown in left to right and the components were conducted in the same order every session until stability was achieved. The response rates for Walker were consistently at zero levels in the extinction conditions. Responding was consistently higher in the social-consequence conditions when compared to extinction, even though within each consequence, responding varied or did not occur (High-five mean 3/min, verbal-praise mean 4.5/min, head-tickles mean 1.5/min).

Figure 6 shows the results of the social reinforcer assessment for River. Response rates from each session are shown separately with Session 1 on the top and Session 2 below. The response rates for River were consistently zero in the extinction conditions across both sessions. Responding was consistently higher in the social-consequence conditions when compared to extinction, even though within each consequence, responding was slightly variable (High-five mean 10/min., verbal-praise mean 17/min., hand-shakes mean 9.5/min.).

Figure 7 shows the results of the social-skills training for Walker. The percentages of correct responses per session are represented on this graph. Across sessions, the participant's social interactions systematically increased and enhanced with the therapist, as well as decreased the amount of prompts required to appropriately interact with the therapist. Walker required 84 sessions to complete a 4-part social interaction accurately and independently.

Figure 8 shows the results of the social-skills training for River. Across sessions, the participant's social interactions systematically increased and enhanced with the therapist, as well

as decreased the amount of prompts required to appropriately interact with the therapist. Walker required 56 sessions to complete a four-part social interaction accurately and independently.

Figure 9 shows the results of the post-training preference assessments for Walker. The percentage of time spent on the social side of the room is represented on this graph for each 4-min choice period defining a session. Walker reliably chose the social side of the room and stayed on the social side of the room throughout each session.

Figure 10 shows the results of the post-training preference assessments for River. The percentage of time spent on the social side of the room is represented on this graph for each session. River reliably chose the social side of the room and stayed on the social side of the room throughout each session.

Figure 11 shows the results of analyzing the quality of social interactions during the post-training assessment for Walker. Walker was never unengaged during these sessions. He spent most of his time engaging in coordinated joint-attention with the therapist. When he was not engaging in coordinated joint-attention, he was engaging in object engagement and sometimes he engaged in supported joint-attention.

Figure 12 shows the results of analyzing the social interactions during the post-assessment for River. River spent most of his time engaged in coordinated joint attention. He also engaged in object engagement and he spent little time engaging in supported joint-attention.

## **Discussion**

The purpose of this study was to evaluate procedures to increase the reinforcing efficacy of social interactions for individuals with ASD. To this end, we first identified whether 2

individuals diagnosed with ASD preferred social environments, then we identified stimuli that functioned as reinforcers, and finally, we taught them specific social skills and to engage in joint attention. The results of the post-training assessment indicated the emergence of more complex social skills that were not previously present as well as an emergence of a preference for social environments in one of the 2 participants. One of the most important findings of this study was the demonstration of generalization. Specifically, social skills taught in one environment generalized to a novel environment where programmed reinforcement was not available and prompting was not delivered.

The results obtained from this study imply several findings. First, the results of the pre-training assessments for Walker indicated that, although he preferred social interaction over no interaction, he did not engage in appropriate social interactions. Similar results were obtained with River in the fact that he also did not engage in appropriate social interactions but he preferred to be in non-social environments. Second, for both participants, the reinforcer assessment indicated that social interactions could function as reinforcers. Third, following social-skills training, both participants initiated a conversation with an adult while making eye contact. As these skills were mastered and maintained, a more complex conversation was taught. Finally, following social-skills training, both participants showed an increase in preference for social-interaction over no interaction, and an increase in time spent interacting with an adult. These findings are important because of the large body of literature suggesting that social-skills deficits are prevalent in persons with autism. In this study, a systematic technology for identifying, teaching and testing for generalization of social skills and joint attention was developed for individuals diagnosed with ASD.

Replicating this study with more participants would increase the generality of the results. In addition, this study tested for generalization to only one novel setting using the same therapists. Future research could assess (and train if necessary) the generalization of social skills to more settings and different therapists. Also, future research could focus on social interactions with peers instead of social interactions with adults only. Another limitation is that procedural integrity data were not collected.

During the social-skills-training phase of this study, a single script was used to teach initiating and conversation skills. This script was designed for the specific environment in which the participants were being assessed. In future research, more general scripts that could generalize to more environments and social contexts could be taught. Future research could also use matrix training to increase the variability of responding. During the pre- and post-training assessments as well as the training sessions, the social therapist interacted with the participant. Because there was a large amount of time between these assessments, it is possible that the therapist was interacting with the participant more or less in the post-training assessment than in the pre-training assessment. Future studies could ensure equality in this interaction rate by yoking conditions so that the therapist would only engage with a participant on a fixed-interval schedule. Certain stimuli used in the pre-training assessments, post-training assessments, and training sessions could aid in facilitating greater degrees of social interaction. For example, more joint attention and conversation can be initiated with a book or magazine than with a simple toy because there are pictures and words that can set the occasion for spontaneous speech. Future studies could focus on basing the sessions with leisure items that encourage more complex joint-attention skills.

In conclusion, this study demonstrated the effectiveness of social-skills training for enhancing social interactions and inducing a preference for social-interaction over no-interaction conditions in individuals diagnosed with ASD. More complex joint-attention skills also emerged once teaching was completed. These skills are important to the participants in their daily lives and this study also adds to the literature on social interactions in people with ASD.

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### Figure Captions

Figure 1. Percentage of time located on the social side of the room for Walker. Each bar represents a four minute session during the pre-training assessment.

Figure 2. Percentage of time located on the social side of the room for River. Each bar represents each four minute session during the pre-assessment.

Figure 3. Percent of time engaging with the social therapist for Walker. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the pre-assessment.

Figure 4. Percent of time engaging with the social therapist for River. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the pre-assessment.

Figure 5. Response rates for passing a poker chip in Social Consequence condition for Walker. Each plot shows the conditions in the order in which they were conducted. Extinction bars represent the final minute of the Extinction condition and in the Social Consequence conditions.

Figure 6. Response rates for target touching in Social Consequence condition for River. Each plot shows the conditions in the order in which they were conducted. Extinction bars represent the final minute of the Extinction condition and in the Social Consequence conditions.

Figure 7. Average of independent responses using a social script for Walker. Each data point represents a session consisting of 10 trials per session.

Figure 8. Average of independent responses using a social script for River. Each data point represents a session consisting of 10 trials per session.

Figure 9. Percentage of time located on the social side of the room during the post assessment, as compared to the pre assessment for Walker. Each bar represents each four minute session during the post-assessment.

Figure 10. Percentage of time located on the social side of the room during the post assessment, as compared to the pre assessment for River. Each bar represents each four minute session during the post-assessment.

Figure 11. Percent of time engaging with the social therapist during the post assessment, as compared to the pre assessment for Walker. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the post-assessment.

Figure 12. Percent of time engaging with the social therapist during the post assessment, as compared to the pre assessment for River. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the post-assessment.

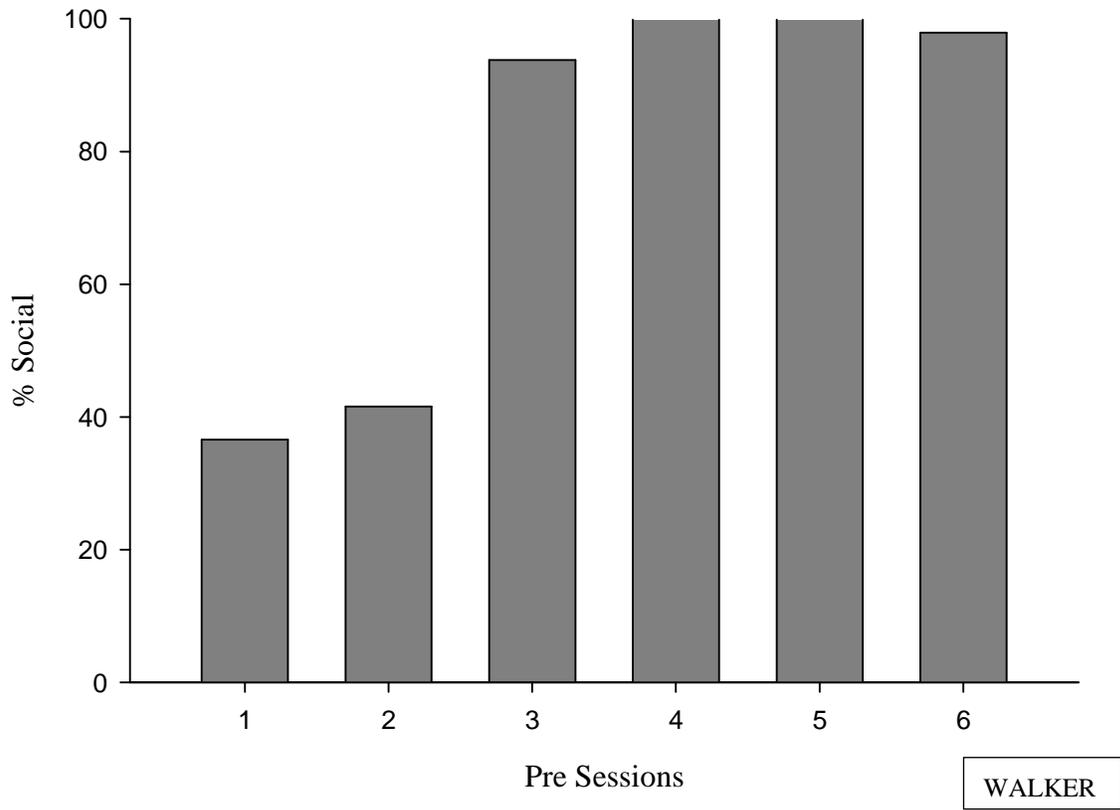


Figure 1. Percentage of time located on the social side of the room for Walker. Each bar represents each four minute session during the pre-assessment.

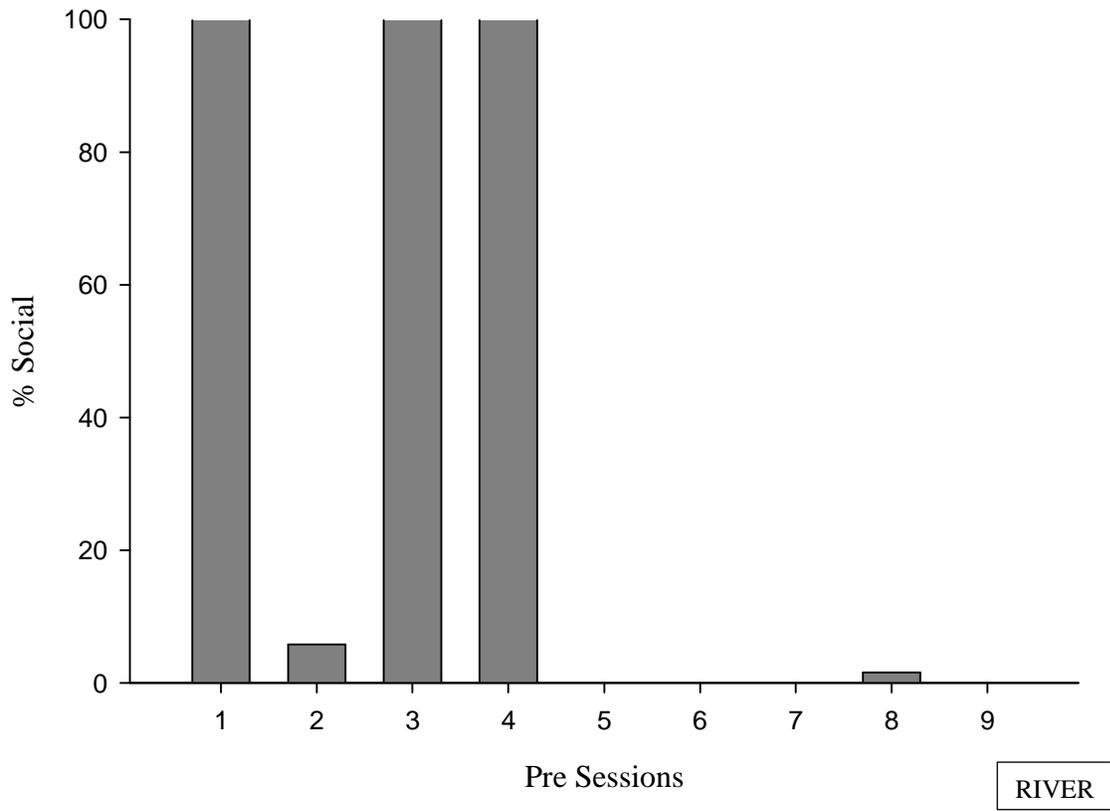


Figure 2. Percentage of time located on the social side of the room for River. Each bar represents each four minute session during the pre-assessment.

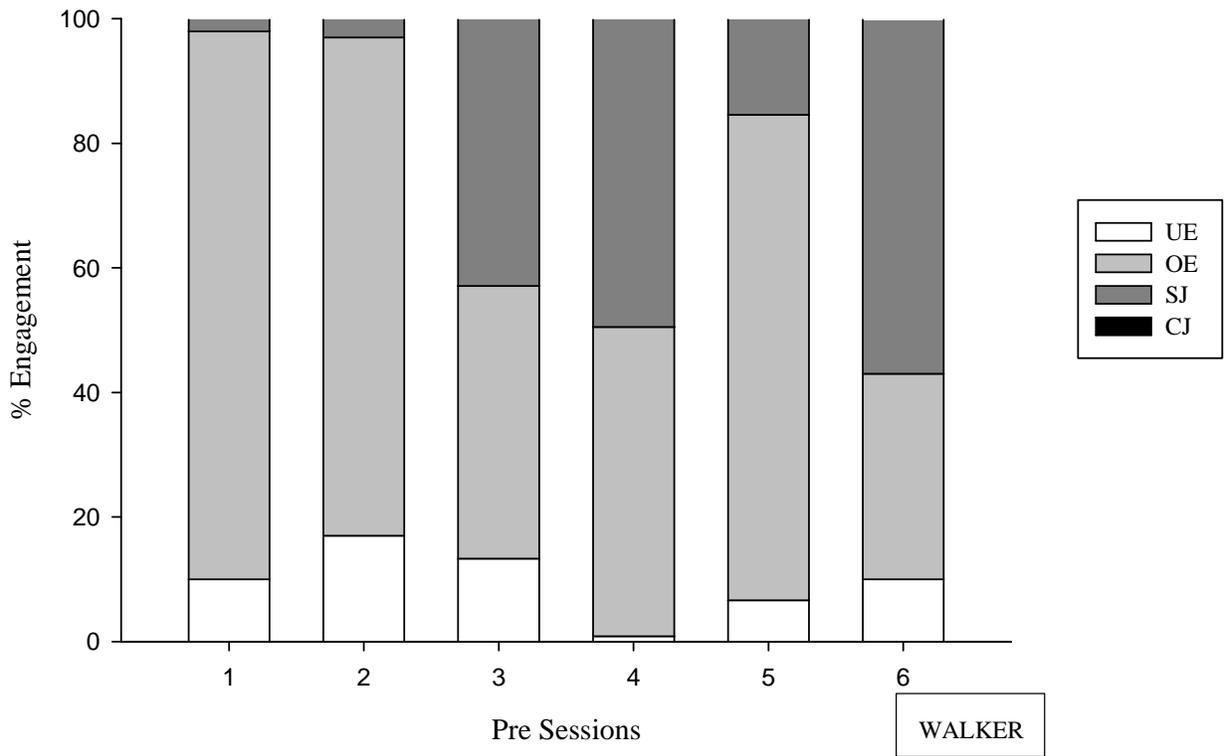


Figure 3. Percent of time engaging with the social therapist for Walker. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the pre-assessment.

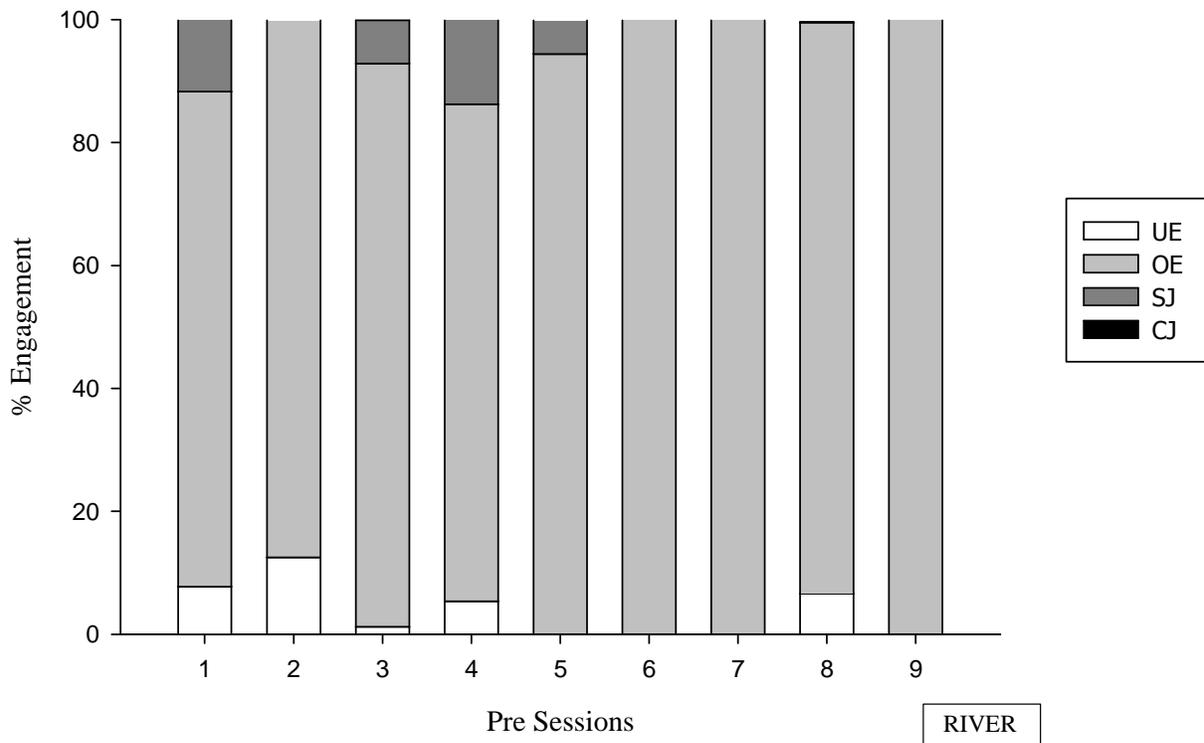


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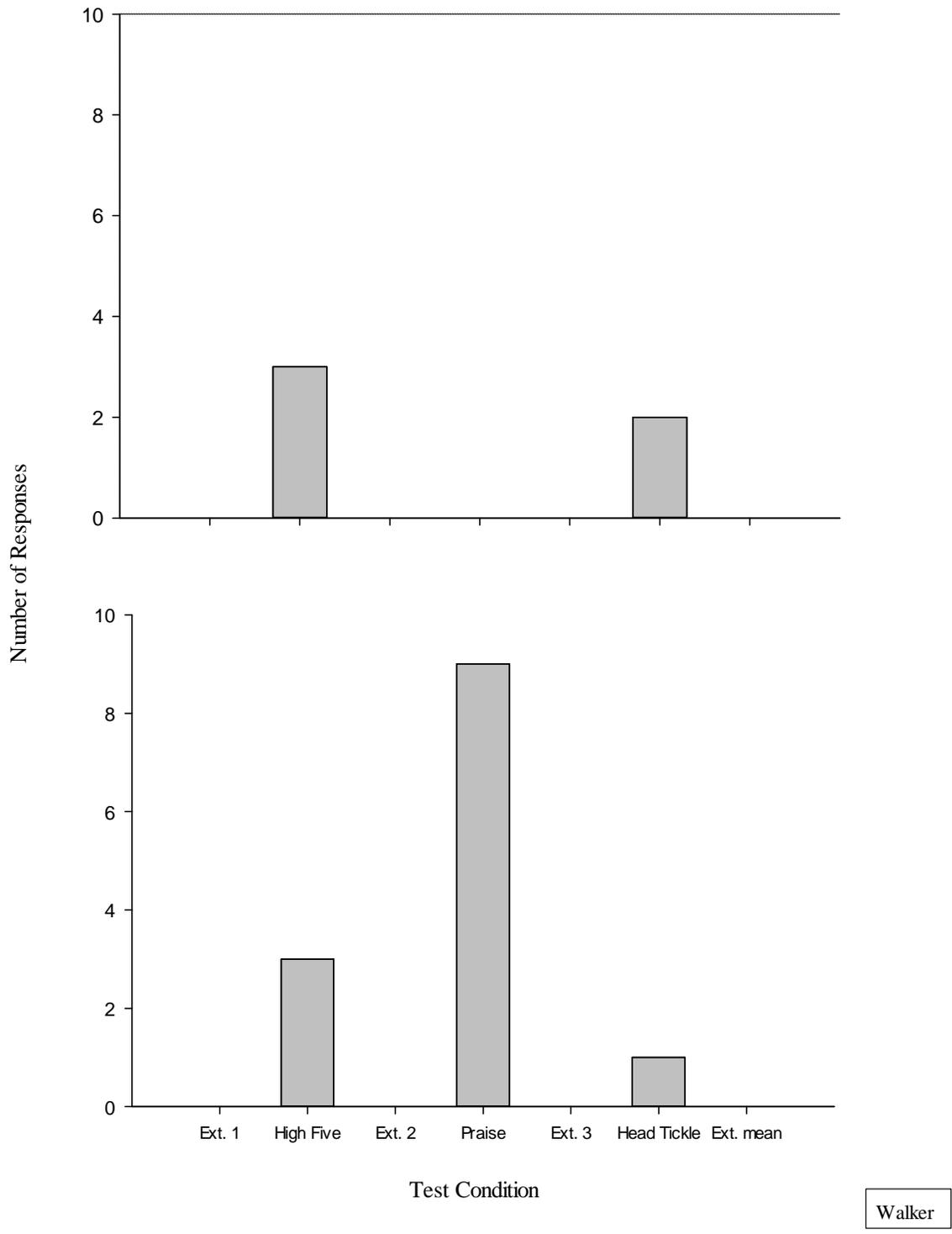


Figure 5. Response rates for passing a poker chip in Social Consequence condition for Walker. Each plot shows the conditions in the order in which they were conducted. Extinction bars represent the final minute of the Extinction condition and in the Social Consequence conditions.

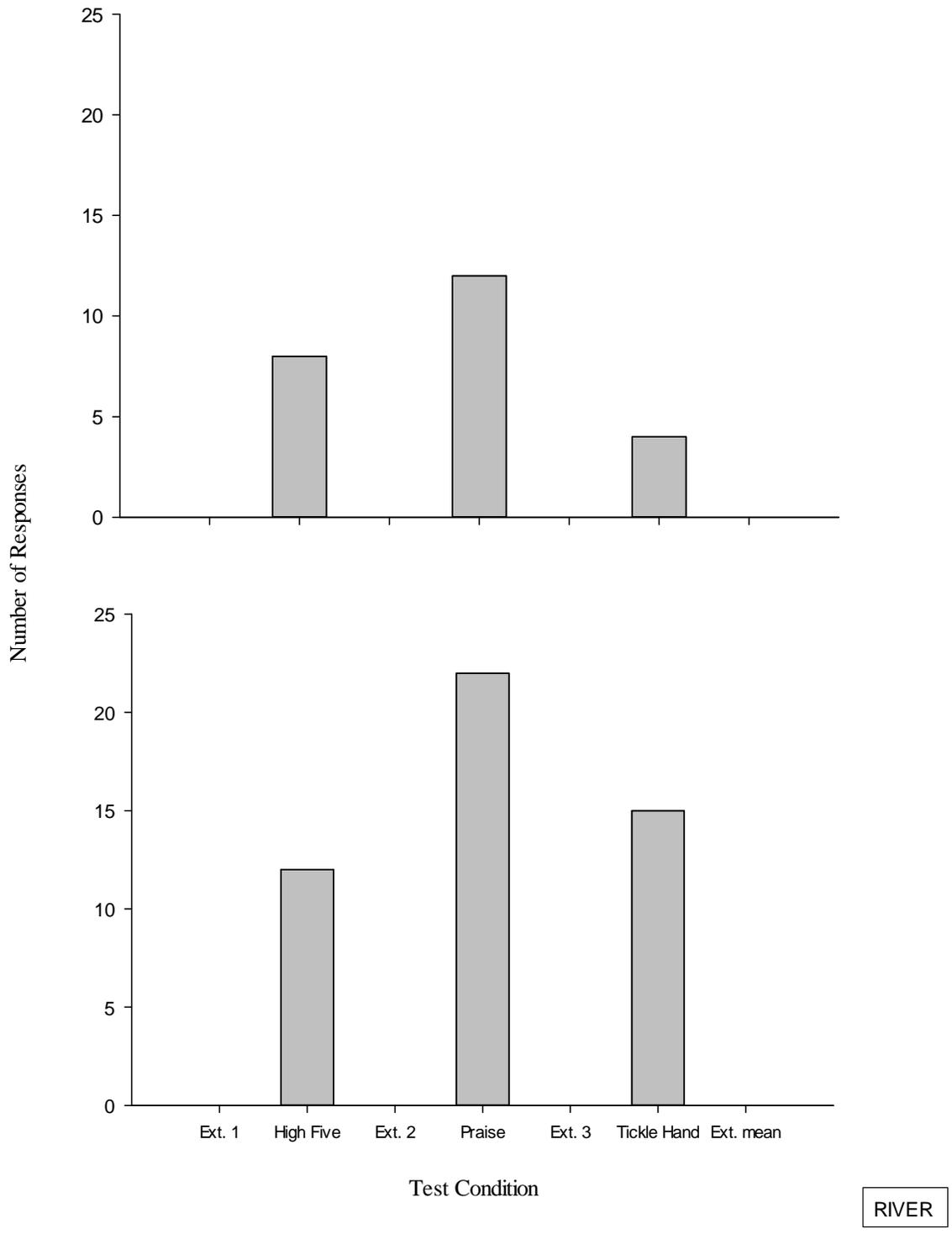


Figure 6. Response rates for target touching in Social Consequence condition for River. Each plot shows the conditions in the order in which they were conducted. Extinction bars represent the final minute of the Extinction condition and in the Social Consequence conditions.

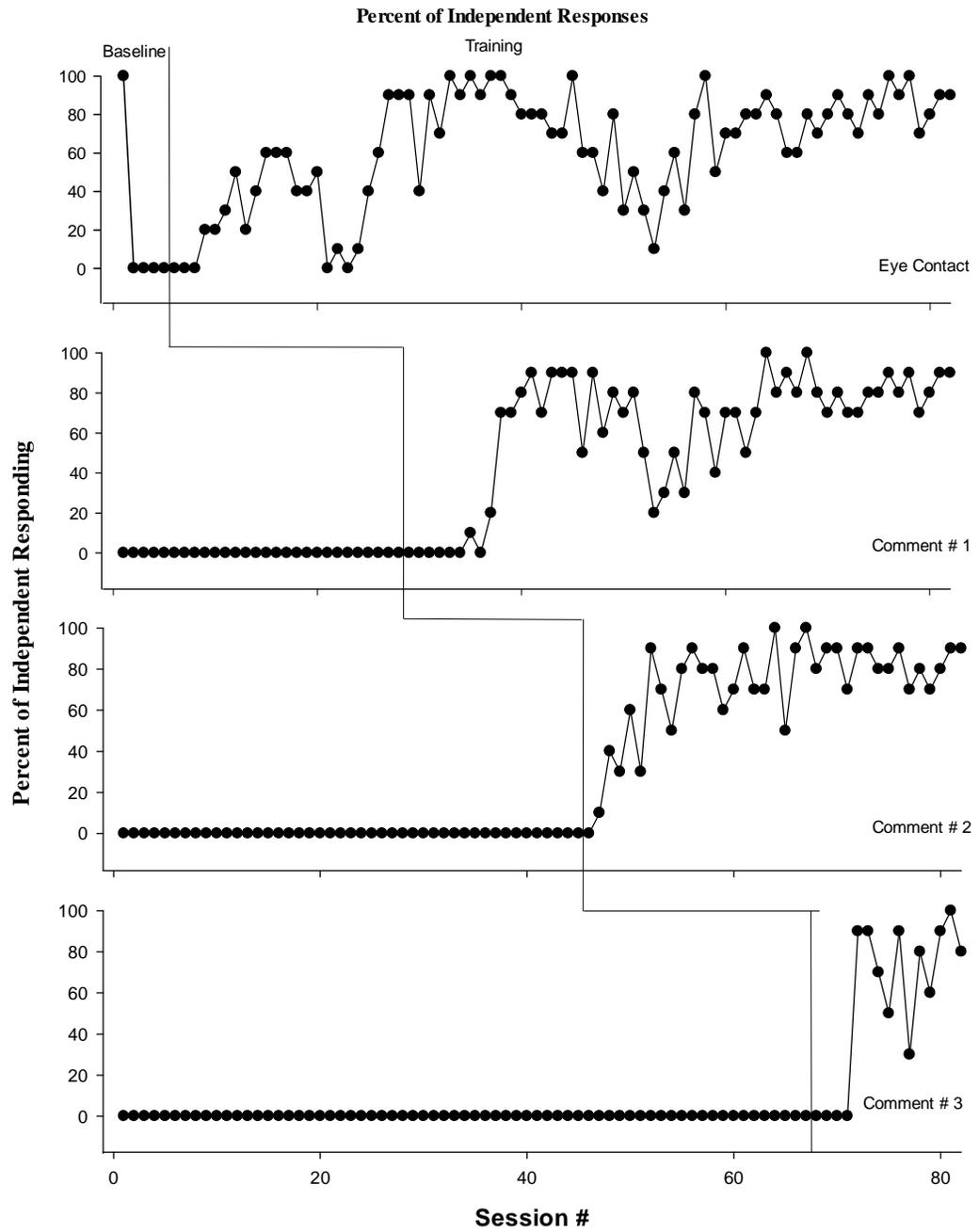


Figure 7. Average of independent responses using a social script for Walker. Each data point represents a session consisting of 10 trials per session.

Walker

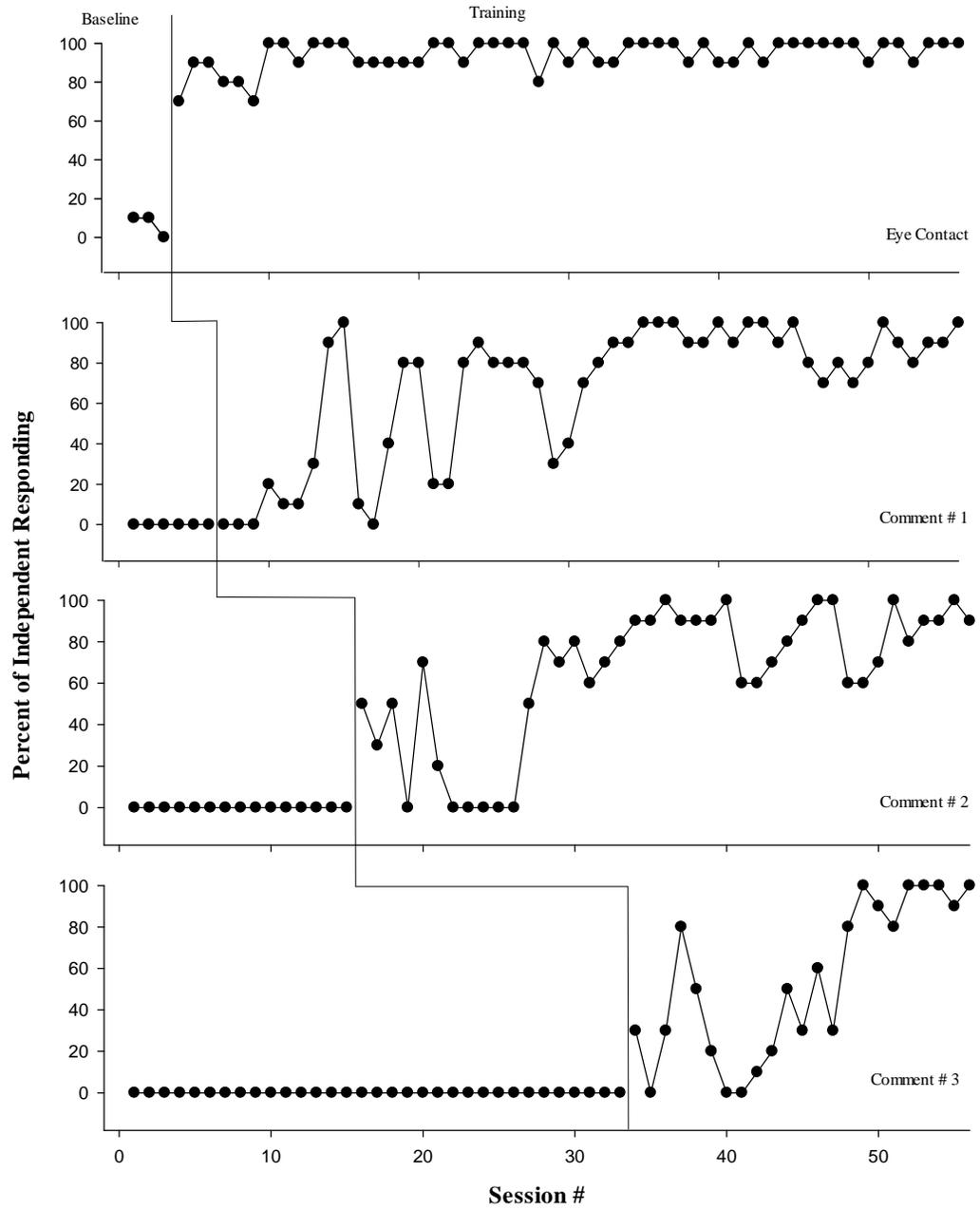


Figure 8. Average of independent responses using a social script for River. Each data point represents a session consisting of 10 trials per session.

RIVER

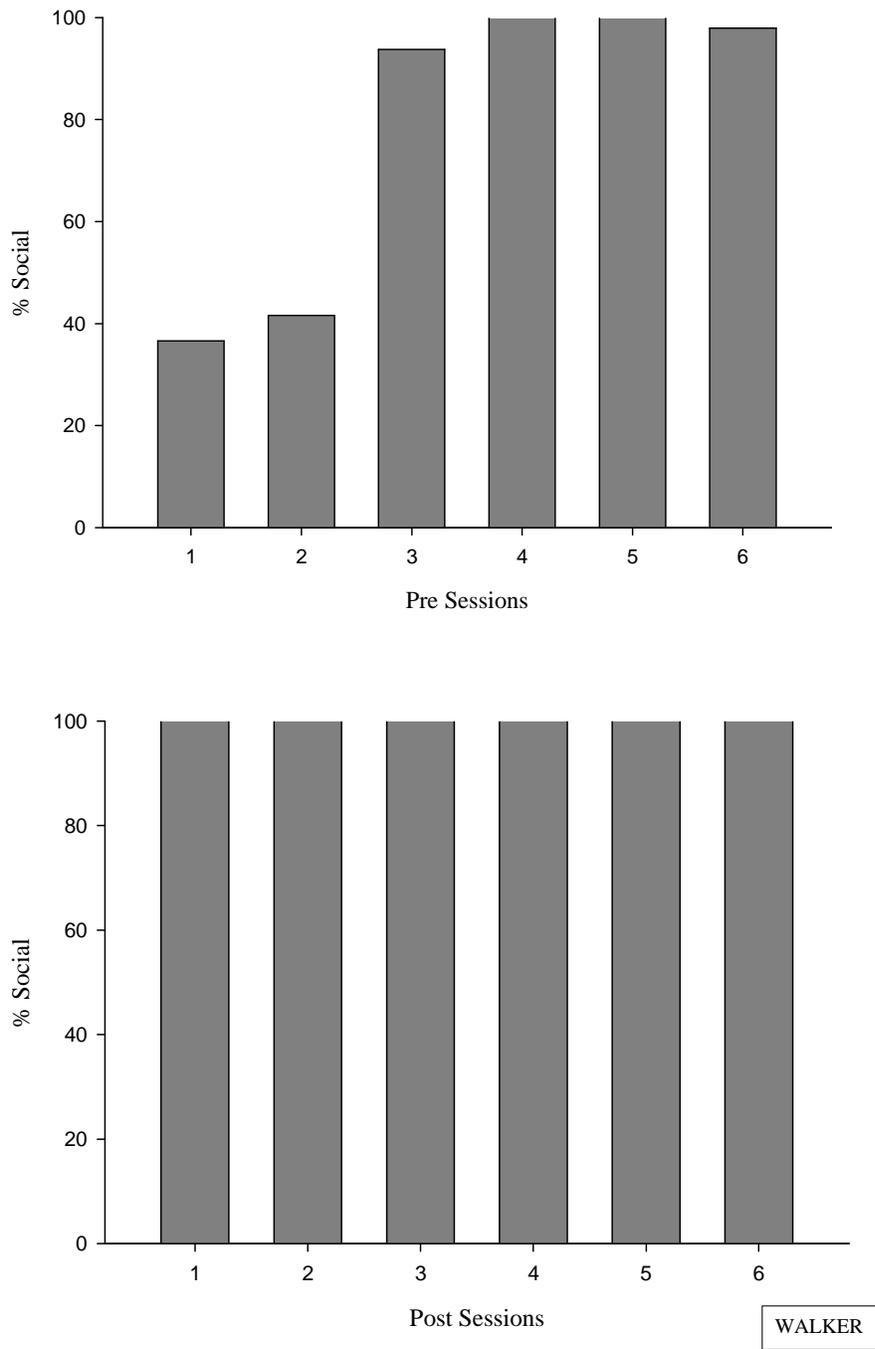


Figure 9. Percentage of time located on the social side of the room during the post assessment, as compared to the pre assessment for Walker. Each bar represents each four minute session during the post-assessment.

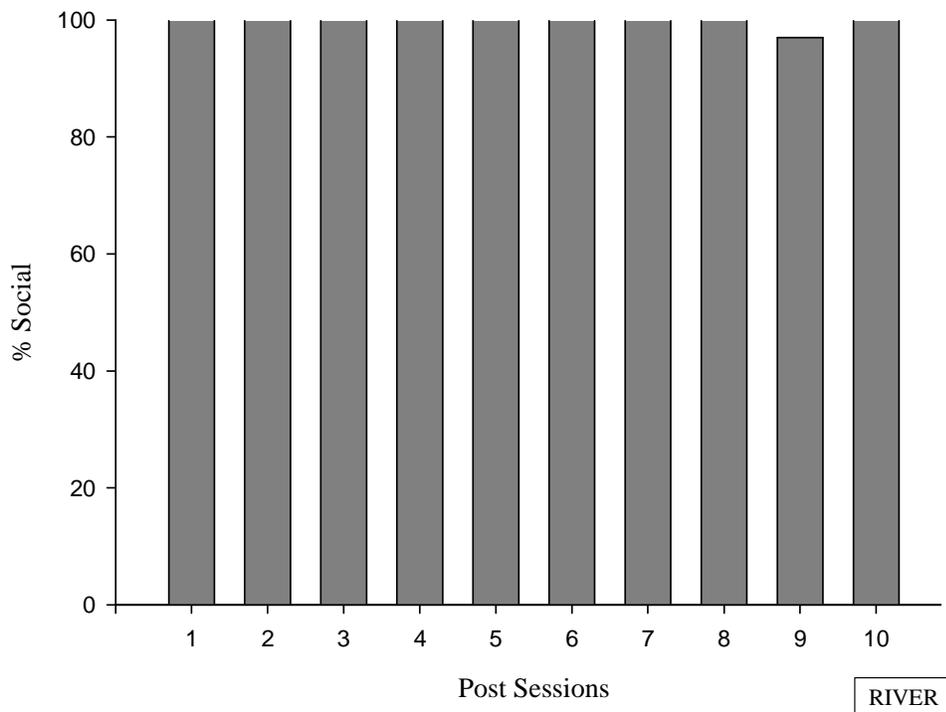
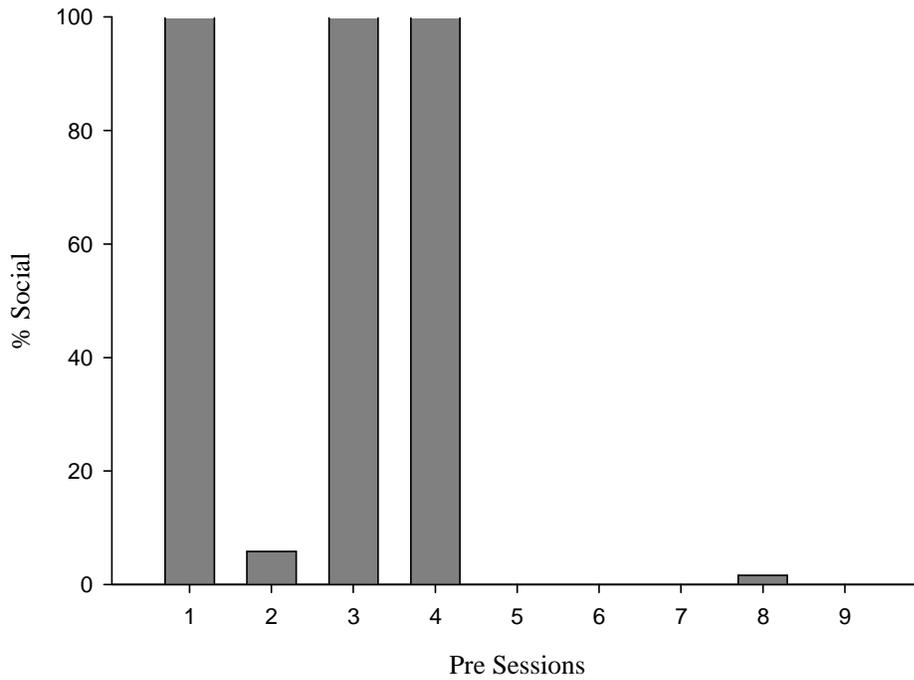


Figure 10. Percentage of time located on the social side of the room during the post assessment, as compared to the pre assessment for River. Each bar represents each four minute session during the post-assessment.

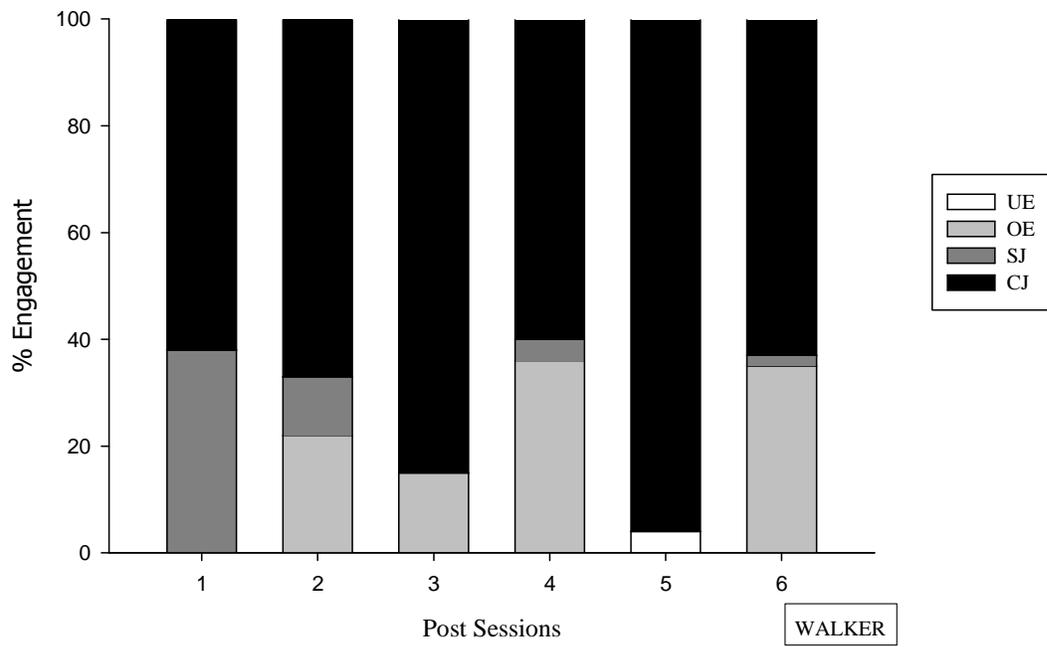
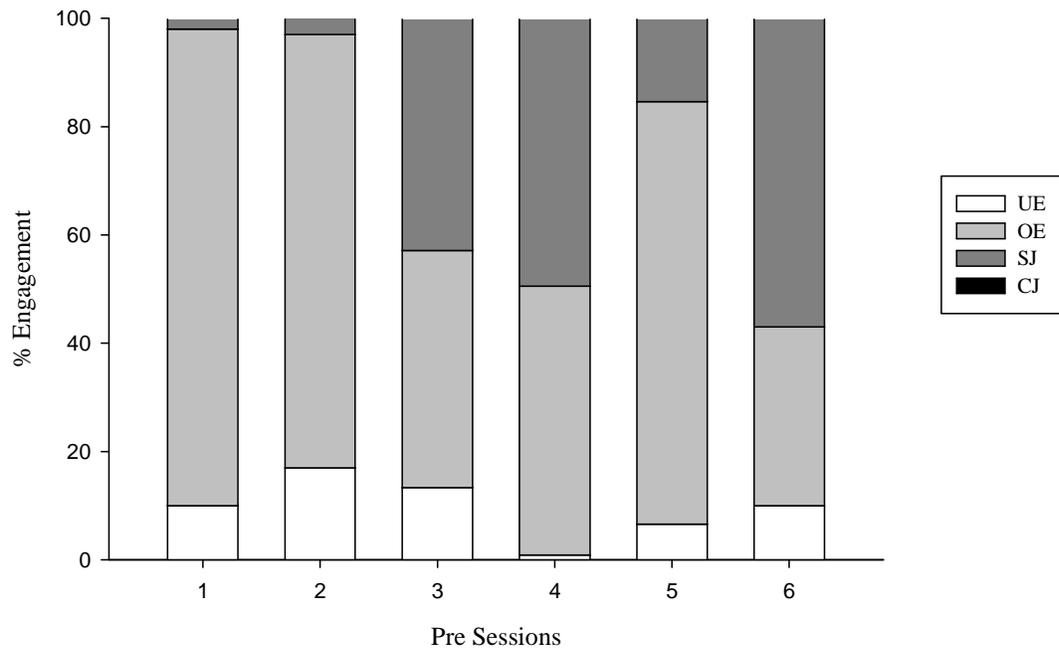


Figure 11. Percent of time engaging with the social therapist during the post assessment, as compared to the pre assessment for Walker. Each bar represents each four minute session as well as the four different states of engagement (unengaged, object engagement, support joint attention, coordinated joint attention) during the post-assessment.

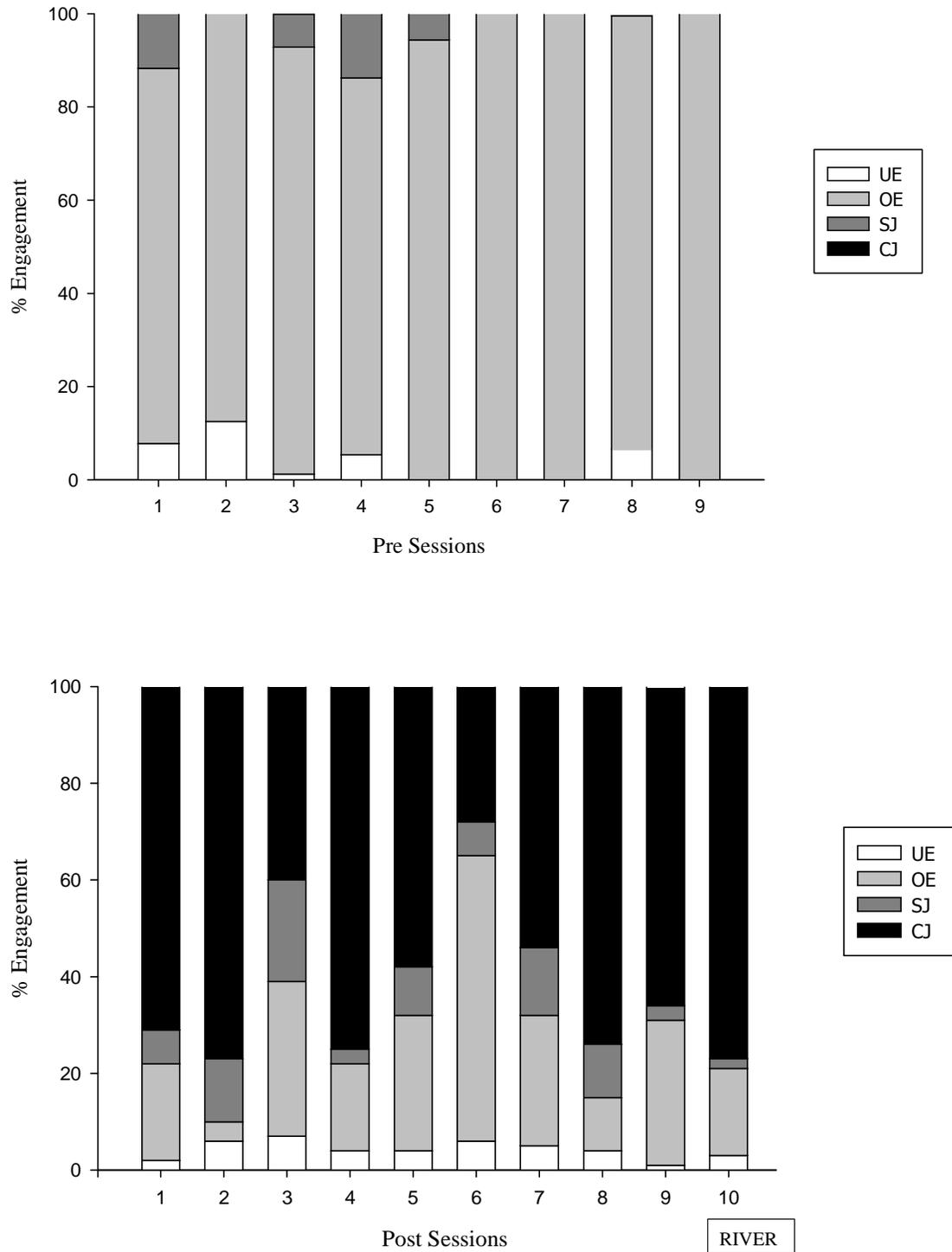


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