

A SEQUENTIAL ANALYSIS OF THERAPIST AND CHILD SOCIAL BEHAVIOR
FOLLOWING A CONDITIONED REINFORCEMENT PROCEDURE

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We conducted a contingency analysis to evaluate if a sequential relation between social initiations and positive social responses increased for both therapists and children with autism following a conditioned reinforcement procedure. Participants included child-therapist dyads, which were previously identified as having low rapport. These dyads were observed prior to and following an intervention designed to establish therapists' social behavior as a reinforcer. Sessions consisted of unstructured play between the therapist and child. Results from a Yule's Q analysis show that both the child and adult positive responding to the others' social initiations increased following the intervention. Findings highlight the reciprocal effects of therapist-child interactions as well as the effectiveness of establishing social attention as a reinforcer via an operant discrimination training procedure.

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CHAPTER 1

INTRODUCTION

Individuals with autism spectrum disorder (ASD) have a deficit in social skills (American Psychiatric Association, 2013). Social deficits are expressed in different forms, which can functionally limit a person's ability to effectively play with others, ask questions, express empathy, and engage in social exchanges. For example, Mundy, Sigman, Ungerer, and Sherman (1986) compared social behavior amongst children with ASD, typically-developing children, and children with intellectual disabilities. One category of social behaviors Mundy and colleagues specifically focused on involved social interactions, which was comprised of initiations and responses. Results showed that children with ASD displayed poor social interaction behaviors, in particular, they demonstrated low rates of responding compared to the other groups.

Previous research that focused on improving social behavior for children and individuals with autism, typically focused on teaching social skills, such as how to respond to social bids from others (Haring & Breen, 1992; Oke & Schreibman, 1990; Strain & Timm, 1974). Through the use of reinforcement, Oke and Schreibman taught a child with autism to initiate a social interaction. As a result, the child increased the amount of emitted initiations during continuous social interactions with a peer. Studies commonly observe the behavior of one of the individuals, here, an individual with autism, instead of capturing the entire interaction between both participants and the potential bidirectional influence for each participant.

These examples from the literature highlight two important considerations. First, it may be important to consider the stimulus conditions and reinforcement history for individuals with

autism during social exchanges in order to increase social responding for individuals with autism (Odom & Strain, 1986). Second, it may be important to consider how improvements in responding to social bids would likely change the behavior of the social partner.

Again, it is a given that social interactions require the involvement of at least two people, therefore, understanding the bidirectionality of social interactions may be of particular benefit in improving social relationships for individuals with ASD. Holmberg (1980) described bidirectionality as the “flow of the interchange [being] a joint endeavor with both persons in the interchange potentially contributing to its continuation” (p. 448). Bidirectional relationships include ongoing processes of responding where responses act as a stimulus change for other interactions (Bell, 1971). There is limited research on the investigation of bidirectional relationships between therapists and children. However, one notable exception is the research on parent-child interaction therapy, or PCIT, which focuses on improving the relationship between the parent and child by examining how child behavior influences parent behavior and how parent behavior influences child behavior (Herschell, Calzada, Eyberg, & McNeil, 2002; Solomon, Ono, Timmer, & Jones, 2008). Through a focus on the interaction patterns, parents gain skills to implement techniques which increases positive social behaviors for the child, which in turn reinforce the parents’ implementation of these techniques. While there is very little literature on the bidirectional influences during social interactions, PCIT highlights the importance of observing all the contributing factors in a relationship. The dynamic structure of an interaction demands one of the individuals respond to the behavior of the other person; this response will likely influence the behavior of the person who initiated the social interaction.

Rapport describes the influences of both people within a social interaction, requiring the analysis of both person's behavior. To understand rapport, it is essential to look at the entire context of the situation. Tickle-Degnen and Rosenthal (1990) provided a theoretical framework for what they considered rapport. Rapport was regarded as the development of a relationship between two people. Mutual attentiveness, positivity present in the interaction, and coordination between the participants were highlighted as three essential components for rapport. The combination of each component described the structure of rapport they deemed necessary to have a cohesive interaction.

Lapin, Toussaint, and Ingvarsson (2014) established a method to increase rapport between therapist-child dyads that were identified as having low rapport. 3 children with ASD and 6 different therapists were chosen as participants. Participants were grouped into high and low rapport pairs based on questionnaires and preference assessments. First, behavioral components of rapport were identified (approaches, body orientation, eye contact, physical contact, and smiles). Then, these measures of rapport were collected during unstructured play sessions which occurred prior to and following an intervention. Dyads previously identified as having low rapport, both by the child and the therapist, went through an operant discrimination procedure. The intervention conditioned and established social attention from the therapist to function as a reinforcer for the child. As a generalized outcome, these behaviors increased for child and therapist participants during free-play sessions. Since the intervention was designed to specifically target child behavior, the degree of increase reported in the therapist's behavior was somewhat unexpected. This research demonstrated that the relationship quality between therapist and individuals can be improved. However, it is unclear whether the improvements in

relationship quality were a result of improved responsiveness on the part of the child, the therapist, or a dynamic interaction between the dyad.

More information involving social interactions and rapport can support the idea that positive behaviors can reinforce responding for both persons involved. Our current analysis will explore the relationship between the participants used in the Lapin et al. (2014) study to examine possible contingencies that may have caused the change in behavior. Given that social interactions depend on the behavior of multiple people, we will examine if therapist's bids for social interaction increased child responsiveness and the therapist responses to child initiations.

In Lapin, Toussaint, and Ingvarsson (2014), all sessions were conducted in the natural environment. The only instructions provided to the therapists was to "have fun" and to "not place any demands on the child". These conditions set the occasion for both participants to react to the natural contingencies in their surroundings. Thus, creating a descriptive situation in which a pattern may be detected in participant responding during social interactions. Bakeman (1978) described interactions as a behavior that is sequential in process, requiring observational measurement. Social interactions between the therapist and child create a continuous record of behavior, which is necessary when utilizing a sequential analysis technique (Bakeman & Gottman, 1997).

Social interactions require at least two people and involve an action and reaction. Initiations (action) and responses (reaction) are behaviors individuals will engage in while involved in an interaction which the term rapport, suggests are important features. These two events are temporal in nature, one behavior follows the other. Due to the linear nature of this behavior, a sequential analysis can be used determine the relation between the two events.

Sequential analysis is one technique that has been used to identify sequential dependencies between events of interest in naturally occurring social interactions (McComas, Johnson, & Symons, 2005).

McComas, Moore, Dahl, et al. (2009) evaluated different probability methods of analyzing events with important sequential relations of descriptive data. Simple, conditional, and transitional probabilities were compared for quantifying two events of a social interaction between child-teacher dyads. They found that simple probabilities were insufficient when describing a sequential relationship as the resultant information describes how often a sequence occurs, but there is no information about the sequence relative to any other events. For example, a simple probability may describe that a child engages in a positive social response 10% of the time following an adult social bid; however, we would not know how many bids the adult initiated. Transitional probabilities provide information about the overall occurrence of the antecedent (or initiations) and behavior, but they do not provide information about the overall occurrence of the behavior of interest. To return to the previous example, a child may engage in positive social responses on 10% of all intervals, irrespective of adult social initiations. Thus, use of the transitional probability may not be appropriate when used by itself, because the results can be affected by the simple probability of the target behavior. However, a conditional probability takes these limitations into account. Specifically, the Yule's Q provides a strength of association measure for two time based variables. Findings from McComas et al. (2009) concluded that results of social interactions between children and adults data computed from Yule's Q, was "a viable index of sequential association" to quantify the magnitude of correlation between the two events of interest.

The purpose of this study is to explore the correlation between therapist initiations and child positive responding, as well as the correlation between child initiations and therapist positive responding, before and after an intervention designed to condition attention as a reinforcer for children with autism. We used a timed event sequential analysis using the Yule's Q formula to examine the aforementioned relationship between social initiations and positive responses for three child-therapist dyads.

CHAPTER 2

METHOD

Participants and Setting

All sessions from the Lapin, Toussaint, and Ingvarsson (2014) study took place at an university-based autism center. Sessions were conducted in a room nominated as a preferred location for each child participant to create a natural environment for social interactions. All sessions were three minutes. Sessions were recorded using a hand-held video camera and reviewed for our analysis.

Lapin et al. (2014) used a combination of objective and subjective measures to identify high and low rapport dyads (see study for full methodological details). We re-analyze the three dyads, consisting of a child with autism and a therapist, previously identified as having low rapport. All child participants were diagnosed with autistic disorder and received early intensive behavioral intervention services ranging from 2 to 5 days a week, with a minimum of sixteen hours per week. Cole, an 8-year-old male, communicated using four to five word sentences. Reports from staff noted that Cole engaged in parallel play with preferred items. All sessions for Cole took place in a therapy room (3.65m by 3.65m) containing a table, two chairs, and several leisure items including his preferred toys. Zane, a 6-year-old male, communicated using four to five word sentences. Zane's interactions with others included reciprocal play in the form of tag, building blocks, multiplayer video games, and riding scooters. Sessions for Zane were conducted either in the motor lab (7m by 9m) or gym (18m by 11m). The motor lab was equipped with a table, four chairs, trampoline, swing, and several toys; while a Wii, trampoline, bicycles, scooters, and a tunnel were located in the gym. Tommy, a 2-year-old male,

communicated using one to two word sentences. Tommy's social interactions typically involved play with leisure items such as cars, music, the swing, and a tricycle. Tommy's preferred locations included a classroom, gym, and motor lab. The gym and motor lab were the locations used during Zane's sessions, which contained the same materials. The classroom (8m by 9m) included several tables, chairs, and cubbies/shelves with numerous age-appropriate toys (e.g., cars, train set, music, dolls, blocks, etc.).

Jan was a female therapist who worked directly with Cole, providing him with behavioral services. Raquel was a female supervisor who developed Zane's programs, sometimes administering direct therapeutic services to him. Katie was a case manager for Tommy, most of her interactions with him were limited to observations.

Measurement

Transcription of videos. All videos were transcribed by an observer. The transcriber recorded participants' speech verbatim, including sound effects and laughs, and observable body movements each second. Instances of vocal speech were recorded as one event, until there was a break in speech and the pause occurred across seconds. For example, if a question occurred at second 5 and lasted into second 6, followed by a pause, the vocal would be counted as one event occurring from second 5-6. Vocalizations that were difficult to decipher were reviewed a minimum of three times. Following several attempts, the uninterpretable utterances were recorded as a "mumble".

Transcripts also contained a description of the participant's non-vocal behavior. A system was developed using key words to describe all non-vocal behavior, which created a common language for transcribers. The recording system included terms to describe observable

behaviors such as: watching, handing, touching, moving, and manipulating. See Appendix A for a complete list of the recording system with examples. Transcribers utilized the recording system and provided additional information when necessary. In addition, transcribers recorded the child's eye contact. Eye contact was scored if the child gazed toward the adult or an item the adult was in contact with at that time. All other instances of eye gazes were scored as "none" and the transcriber noted where the child was looking during that time.

Intertranscriber agreement. In order to check for accuracy of transcriptions, a second, independent observer transcribed 10% of all videos across participants. The second rater was previously trained by the primary rater. Sessions were divided into 10-s intervals. Agreement was calculated by dividing the percentage of agreements plus disagreements by the total number of intervals and multiplied by 100. For vocalizations, an agreement was scored if the two observers recorded the same event a.) within two seconds of each other and b.) the transcription contained at least 80% of the same wording. Mean agreement across participants was 100% for the child's timing on vocals, 100% for the therapist's timing on vocals, 91.7% for the child's mutual vocals, and 96.6% for the therapist's mutual vocals. Agreement for non-vocal behavior was scored if the behavior was a.) within two seconds of the primary raters and b.) described the same item involved during the event. Mean agreement across participants was 93.8% for the child's timing on non-vocal behavior, 98.6% for the therapist's timing on non-vocal behavior, 97% for the child's mutual non-vocal behavior, and 96.5% for the therapist's mutual non-vocal behavior. Agreement for eye contact was scored if both transcribers determined the event occurred a.) within two seconds of the primary raters and b.) consisted of eye contact. Mean

agreement across participants was 99.1% for timing on eye contact and 91.7% on existing eye contact.

Dependent Variables. Independent observers reviewed the transcripts and coded social initiations, social responses, and other social behaviors. Behaviors were mutually exclusive. Initiations were operationally defined as any vocal or non-vocal behavior directed towards another person that attempted to elicit a social response. Eight categories of behaviors were classified as an initiation, further defining “attempts to elicit a social response”. Appendix B provides examples and definitions of the various types of the target behavior.

Although this evaluation focused on social interactions starting with an initiation, we scored other social behaviors to evaluate if the target behavior (a positive response) occurred in the absence of an initiation. Other social behaviors were operationally defined as any vocal or non-vocal behavior directed towards another person that does not attempt to elicit a social response. Other social behaviors were identified as comments or instructions, taking an item from the other person, general physical touches, and non-engaging touches to an item the other person is in contact with (see Appendix B). These categories captured all emitted behaviors across participants.

Following an initiation or other social behavior, the other person could engage in a response or no response at all. A response was operationally defined as any change in vocal or non-vocal behavior following the start of an initiation or other social behavior for up to three seconds or before the next initiation or other social behavior occurred. No response was scored if there was no change in vocal or non-vocal behavior following the start of an initiation or other social behavior for up to three seconds or before the next initiation or other social behavior

occurred. Responses are mutually exclusive and were rated as either positive, neutral, or negative. Examples of positive responses included laughs, engaging with the other person, imitating behaviors, on-topic vocal responses, and eye gazes toward the person. Any change in vocal or non-vocal behaviors that were not relevant to the initiation or other social behavior were rated as neutral. When the response was previously scored as an initiation, it was considered a neutral response. Negative responses consisted of behaviors such as crying, moving away from the person, and removing existing eye contact.

Responses were scored after initiations and other social behaviors were coded. To determine the probability that a positive response followed an initiation, raters observed behaviors 1 second following the start of the initiation or other social behavior and no more than 3 seconds following the end of, or prior to the next, initiation or other social behavior. The initial change in eye contact, vocal, and non-vocal behavior was scored during that time period. For example, if the therapist asked the child a question (initiation) and then the child shifted his eye gaze towards the therapist, the rater would score the change in eye contact as a response. Furthermore, that response would be coded as a positive response to the initiation. When more than one change across behaviors occurred at the same time, the recorder would go back and review the video to determine which event transpired first. The first behavior change was scored and coded. Raters used the operational definitions and examples to score the occurrence of initiations, other social behaviors, and the type of response or no response throughout the entire session.

Interobserver agreement. Two trained data collectors independently scored the ongoing occurrences transcribed from the videos for a minimum of 33% of sessions across conditions and

participants. Every session was divided into consecutive 10-s intervals. Partial-interval agreement was calculated by dividing the percentage of agreements plus disagreements by the total number of intervals and multiplied by 100. Agreements were defined if raters agreed behaviors were a.) initiations or another social behavior and b.) no response or a positive, neutral, or negative response. Mean interobserver agreement across participants was 96.5% for child initiations and other social behavior, 92.2% for therapist initiations and other social behaviors, 90.9% for child responses, and 94.9% for therapist responses.

Experimental Design

A sequential analysis was used to determine the correlation between two time related events. When using the Yule's Q method, variables are classified as an antecedent and target event. For our purposes, the antecedent was a social initiation and the target behavior was a positive response. Yule's Q arranges the frequency of each event within a 2 x 2 contingency table and then a score is derived, the Yule's Q coefficient, which provides a measure of the strength of the association between the antecedent and target behavior. Similar to other correlation coefficients, Yule's Q scores range from -1 to 1. A score of 1 (positive and negative), denotes a strong relationship between the events. A positive value represents an association between the targeted behaviors. Results with a negative sign represent the relationship between the two low categories, or the misses. A Yule's Q value of zero means there is no correlation between the two events. Knoke, Bohrnstedt, and Mee (2002) provide a set of guidelines that can be applied when interpreting Yule's Q values. Virtually no relationship is represented by the values between .00 and .24. The intervals continue to describe the values as having a weak relationship (.25 to .49), moderate relationship (.50 to .74), or a strong relationship (.75 to 1.00).

In this evaluation, each quadrant in the 2 x 2 contingency table was identified by a letter: A, B, C, or D. Cell “A” represented the number of times child or therapists positive responses (target) were preceded by therapist or child initiations (antecedent). Next, “B” was the number of times therapist or child initiations (antecedent) were not followed by positive child or therapist responses (target). “C” represented the occurrences of child or therapist positive responses (target) in the absence of therapist or child initiations (antecedent). Cell “D” contained the occurrences of initiations and responses not included in the antecedent and target behavioral definitions. An example of the matrix including the antecedent (rows) and target behavior (columns) used during this study is found in Table 1.

CHAPTER 3

RESULTS

Figures 1 – 6 display the results from the analysis of social interactions between therapist and child. We measured child and therapist initiations and other social behaviors followed by the type of response or no response from the other person. The total average of positive responses emitted in the presence of an initiation by the child and therapist are shown in Figures 1 and 2. Averages were computed by adding together the total frequency of positive responses per session and divided by the total number of sessions per condition. Cole's data for the target behavior during all pre and post-intervention sessions are depicted in Figure 1. Cole's responses averaged at 8.7 during the pre-intervention sessions rising to an average of 17 per session. Cole's therapist, Jan, began with an average of 0 positive responses, increasing to an average of 3 per session (see Figure 2). The average target response per session for Zane was 11.3 before intervention and 15.7 afterwards. Raquel's averages for positive responses to Zane's initiations are shown in Figure 2 (from 4 to 7.7). Tommy (see Figure 1) and Katie's (see Figure 2) average number of target responses grew across conditions. Tommy went from an average of 4 to 13.3 positive responses per session. His therapist, Katie, positively responded to initiations an average of 0.8 times prior to the intervention followed by an average of 5 after the intervention.

Figures 3 and 4 show the results of the sequential analysis (Yule's Q) calculated by $(\text{hits} \times \text{hits}) - (\text{misses} \times \text{misses}) / (\text{hits} \times \text{hits}) + (\text{misses} \times \text{misses})$ or $AD - BC / AD + BC$. Hits included initiations followed by a positive response (A) and other social behaviors followed by either a neutral, negative, or no response (D). Misses were comprised of other social behaviors followed by a positive response (C) or initiations followed by a neutral, negative, or no response

(B). Frequency of each set of events were tallied for each session and the formula was used to determine the value of the Yule's Q.

Noteworthy differences between pre and post-intervention sessions for all 6 participants were reported using the Yule's Q method. An example of the equation is shown with Cole's data from sessions preceding the intervention equaling $(26*34) - (110*3) / (26*34) + (110*3) = .46$ and post-intervention data equating to $(51*58) - (81*7) / (51*58) + (81*7) = 1$. Figure 3 shows sessions prior to intervention for Zane (*M* Yule's Q = .14), and Tommy (*M* Yule's Q = .14) verses Zane's (*M* Yule's Q = .53) and Tommy's (*M* Yule's Q = .52) post-intervention sessions. Results for therapist responses to child initiations were comparable to the child participants (see Figure 4). Pre-intervention data for the therapists working with Cole, Zane, and Tommy were -.1 (Jan), .3 (Raquel), and .09 (Katie) respectively. Post-intervention sessions show a stronger positive correlation with Jan (*M* Yule's Q = 1), Raquel (*M* Yule's Q = .57) and Katie's (*M* Yule's Q = .72) data. Results suggest a strong negative association between social initiations and positive social responses prior to intervention for both therapist and child participants. However, after the intervention, there is a moderate to strong positive correlation between the two events for every participant.

Figures 5 and 6 depict participant's average initiations per condition. Averages were calculated by adding together the total frequency of initiations per session and divided by the total number of sessions per condition. Data shows an increase in frequency of overall initiations following intervention for all 3 children (see Figure 5). Cole (0.33), Zane (9.3), and Tommy (2.3) began with low average occurrences of initiations, which increased following intervention to 6, 14.3, and 7.7. Figure 6 illustrates the increase in Raquel and Katie's initiations when

interacting with Zane and Tommy. Raquel increased the average amount of initiations from 26.8 to 32.7. Katie emitted an average of 20.2 initiations during the first condition increasing to an average of 35.7 following the intervention. For Jan, the therapist paired with Cole, the average frequency of initiations remained constant from pre to post-intervention sessions (45.3 to 44.7).

There was an overall increase in the number of initiations and positive responses from participants across conditions. Aggregated data from the child participants show a 22.1% increase in positively responding to initiations. The average occurrence of child emitted initiations increased across conditions by 16.1%. Together, all 3 therapists increased their initiations by 20.8% and positive responses to child initiations by 10.9% from pre to post-intervention sessions.

A summary of participant behaviors occurring across conditions can be viewed in Tables 2 and 3. Table 2 displays the average count of initiations, percentage of positive responses to therapists, and the Yule's Q sequential index. Additionally, data using those 3 measures, is reiterated in Table 3 for therapist participants. Percentages were calculated per session by dividing positive responses which followed initiations by the total number of opportunities to respond to an initiation and multiplied by 100. 6 out of 6 participant's data showed an increase in positive responses after the intervention. Results from the Yule's Q equates a moderate to strong positive association between the antecedent and target measures during the second condition for all participants.

In summary, findings indicate that following intervention, both therapist and child participants were more likely to initiate social interactions and respond positively to a social

initiation bid. Overall, each participant was influenced by the other's bid for social interaction illustrated by the increase in initiations and positive responses following intervention.

CHAPTER 4

DISCUSSION

Previous research has demonstrated that an operant discrimination training (ODT) procedure produced increases in certain behaviors (e.g., eye contact, body orientation, etc.) for both child and therapist (Lapin, Toussaint, & Ingvarsson, 2014). In the current evaluation, we were interested in examining if we could quantify the magnitude of association between social initiations and responses between a therapist and child with ASD prior to and following an ODT procedure. The purpose of the ODT procedure was to establish therapist attention as a reinforcer for children with ASD. However, we also speculated that if children began to respond positively to therapists' initiations as a generalized outcome of the ODT procedure, then positive social responses may in turn function as a reinforcer for therapist behavior. In other words, the ODT procedure may result in improvements within the entire social context, not just increasing child social behavior.

The Yule's Q measure of association provides information on the strength of a relationship between two time-related variables. As measures for participants increased in strength between the target behaviors (hits), the undesired behaviors, or misses, occurred less frequently. All child participants Yule's Q scores increased by two "degrees of magnitude" according to the labels provided by Knoke, Bohrnstedt, and Mee (2002). Prior to intervention, there was a weak relationship between initiations and positive responses for Cole; following the ODT procedure, the relationship between initiations and positive responses increased and is characterized as a strong, positive association. For Zane and Tommy, there was no to minimal relationship between the therapist initiations and child positive social responses prior to

treatment. After the ODT procedure, Zane and Tommy's values were representative of a moderately strong positive relationship between the events

Improvements in the strength of correlation between the target behaviors was also noted for therapists. For example, Jan's pre-intervention sessions scored a -1 and post-intervention sessions yield a result of 1. Meaning, there was a strong association between initiations followed by a neutral, negative, or no response, as well as other social behaviors followed by a positive response prior to treatment. In other words, there was a strong association between the two low events (misses). Jan's score of a positive 1 during post-intervention sessions represent a strong relationship between the target behaviors. Raquel and Katie's pre-intervention scores indicated there was virtually no relationship between the two events. Scores increased to .57 (Raquel) and .72 (Katie), falling into the category of exhibiting moderate positive strength between the antecedent and target behavior.

Data from the sequential analysis provides additional information about the participants used in the Lapin, Toussaint, and Ingvarsson (2014) study. Lapin et al. showed an increase in the measures of rapport behaviors for both the therapist and child during post intervention sessions. However, our analysis provides more information than the overall number of emitted behaviors. Results from the analysis shows participants behavior proportional to the other person's behavior.

Results showed a smaller difference between the rates of therapist's initiations compared to the rate of the child participants. This may be because therapists trained to work with children with autism are behaving under certain rule-governed contingencies (e.g., trained to respond positively to all initiations) and they also have training and some history of reinforcement from

other staff for presenting the child with as many learning opportunities as possible. However, the data still suggest therapist behavior is sensitive to child behavior as the combined frequency of therapist provided initiations increased following intervention. Based on the results, we can assume positive responding from the child, served as a reinforcer for therapists. This suggests that despite the level of training (undergraduate to doctorate level), therapists will increase the amount of initiations and opportunities for children to respond under conditions in which the child is more engaging. This supports the initial idea behind the importance of rapport between the therapist and child (Lapin, Toussaint, & Ingvarsson, 2014). As rapport-like behaviors increase between the child and others, responsiveness during social interactions increase.

Results from the analysis indicate the child participants were more likely to engage with a therapist initiating a social interaction after treatment, by emitting a positive social response. For example, when a therapist would offer the child a toy, the child was more likely to take the toy or attend to the adult. Each child participant increased the amount of initiations towards adults and their responsiveness to bids for interaction. Positive responding and self-initiations exhibited by the child participants during the last condition represent an improvement in social interactions with the therapist. Children with autism benefit in numerous ways by improving their social skills (Rogers, 2000). For instance, peers may be more likely to engage in social interactions with children with ASD if the potential for reinforcers (responsiveness) are present. Children in need of social skills programs, may benefit from understanding the implications of this analysis.

The analysis illustrates the bidirectional nature of social interactions between the therapist and child. Adult behavior was directly influenced by the child, which can be seen by their increase in initiations. As the children began responding in a positive manner, the

therapist's behavior was reinforced. Likewise, the child's frequency of initiations peaked as therapists positive responses increased. These data highlight the reciprocal effects of therapist-child interactions, as well as the effectiveness of establishing social attention as a reinforcer via an operant discrimination training procedure. Overall results indicate that the therapist-child relationship is dynamic and reciprocal; each individual's response serves as a stimulus for the other.

Some limitations of the analysis involve the method of data collection. In order to accurately code continuous streams of behaviors, transcripts of all of the session were developed. It may be possible, that observers made errors during the transcribing process, directly affecting rater's ability to score behaviors. Unstructured sessions created conditions where participants were very mobile, constantly moving about the room. Videotaped recordings attempted to capture the participants for the entire duration of the session. However, with two participants per session, there were instances where participants were in different areas of the room and momentarily absent from the recording. This created a challenge for observers recording non-vocal behaviors for both participants. The same difficulties were true while recording eye contact for the child, since direct sight of the child's face may not have been consistently present on the tapes. Interobserver agreement proved reliability between scorers for the transcripts and scoring target behaviors based on the transcripts, which may indicate it did not have a large effect on the data.

The instructions and presence of an observer recording the session, may have produced an observer effect, which may be another potential limitation. Therapists were provided with little direction during sessions, however, they were instructed to have fun. Therapists may have

acted differently in the presence of the observer than they would have under normal circumstances. Information from the script may have lead therapists to engage socially with the child more often than they normally would. Therefore, it is possible the frequency of therapist's initiations were higher under these conditions. This may be irrelevant, since the same script and the presence of an observer occurred throughout all the sessions (pre and post-intervention). Still, capturing therapists and children's social interactions remotely may achieve a more realistic picture of what typically occurs.

Future research may compare the correlation between social initiations and positive social responses with non-clinical populations (e.g. preschool teacher and child). With typically developing children, we may expect for the differences in the effect size to be lower compared to children with ASD. As we saw with Zane's results, the rate of responding was higher in his pre-intervention sessions compared to the other child participants. Zane's communication skills were more developed, possibly making it easier for Zane to engage in several different behaviors that could be categorized as initiations and responses compared to his peers. However, all the child participants followed the same increasing trend, regardless of their skill level. The evaluation of non-clinical teachers and children may further validate the findings from this study.

In conclusion, data supports the findings that, through the operant discrimination training to increase rapport children and therapists increased their social interaction behaviors. Children were more likely to participate in interactions by initiating social attention and responding to others in a positive manner. Overall, therapists responded to the children's increase in targeted behaviors by initiating and responding at higher rates. Results demonstrate therapist behavior affects the child's behavior and vice versa.

Table 1

Index of Variables Observed and Recorded During Sessions

<i>Target Behavior</i>		
<i>Antecedent</i>	<p>A</p> <p>Y, Y</p> <p>Initiation; Positive Response</p>	<p>B</p> <p>Y, N</p> <p>Initiation; Neutral, Negative, or No Response</p>
	<p>C</p> <p>N, Y</p> <p>Other Social Behavior; Positive Response</p>	<p>D</p> <p>N, N</p> <p>Other Social Behavior; Neutral, Negative, or No Response</p>

Note. Matrix of antecedent behaviors (initiations or other social behavior) and the behaviors that follow for both the therapist and child are presented. Antecedent behaviors are listed in the rows and the target behavior (positive response) is listed in the columns. These behaviors were tallied and computed for sequential relations. Y= yes and N= No which refer to the occurrence of the antecedent and target behaviors. (Yes the antecedent behavior occurred and then yes the target behavior occurred).

Table 2

Summary of Child Participant's Results Across Conditions

Participant	Pre Intervention			Post Intervention		
	Average Initiations	% of Positive Responses	Yule's Q	Average Initiations	% of Positive Responses	Yule's Q
Cole	.33	19%	0.46	6	38%	1
Zane	9.3	22%	0.14	14	33%	0.53
Tommy	2.3	25%	0.14	7.7	65%	0.52

Table 3

Summary of Therapist Participant's Results Across Conditions

Participant	Pre Intervention			Post Intervention		
	Average Initiations	% of Positive Responses	Yule's Q	Average Initiations	% of Positive Responses	Yule's Q
Jan	45.3	0%	-1	44.7	50%	1
Raquel	26.8	41%	0.3	32.7	58%	0.57
Katie	20.2	44%	0.09	35.7	65%	0.72

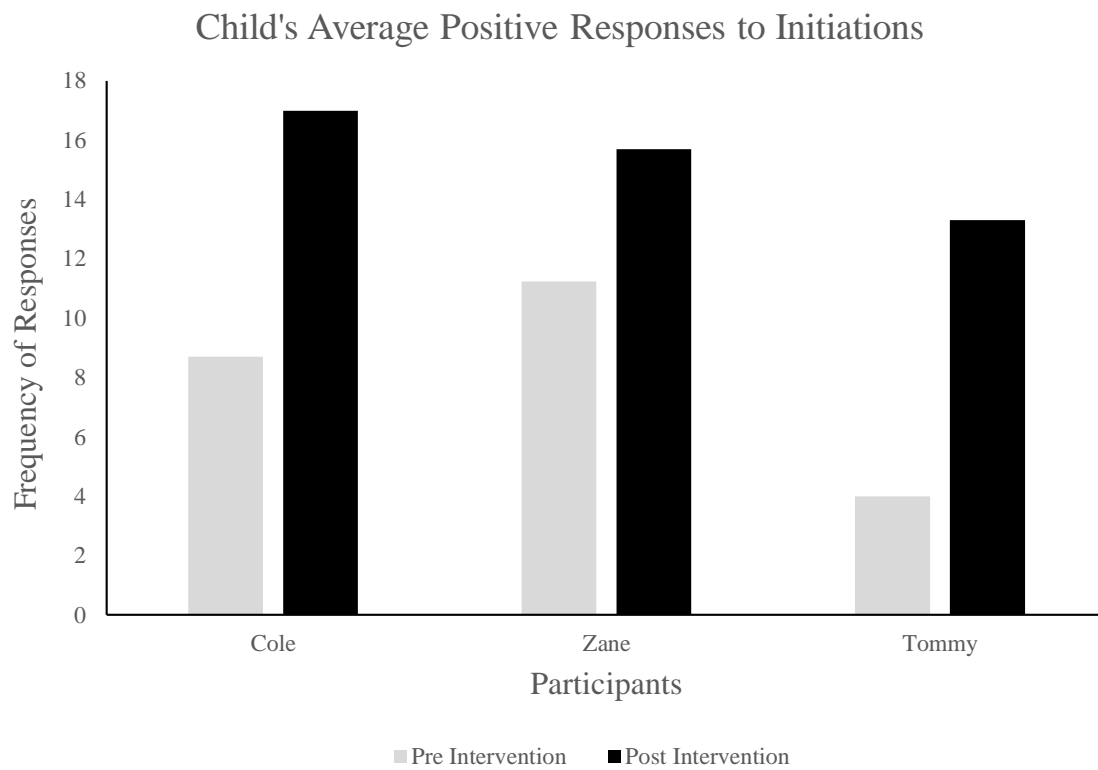


Figure 1. Average number of positive responses to social initiations for child participants before and after intervention.

Therapist's Average Positive Responses to Initiations

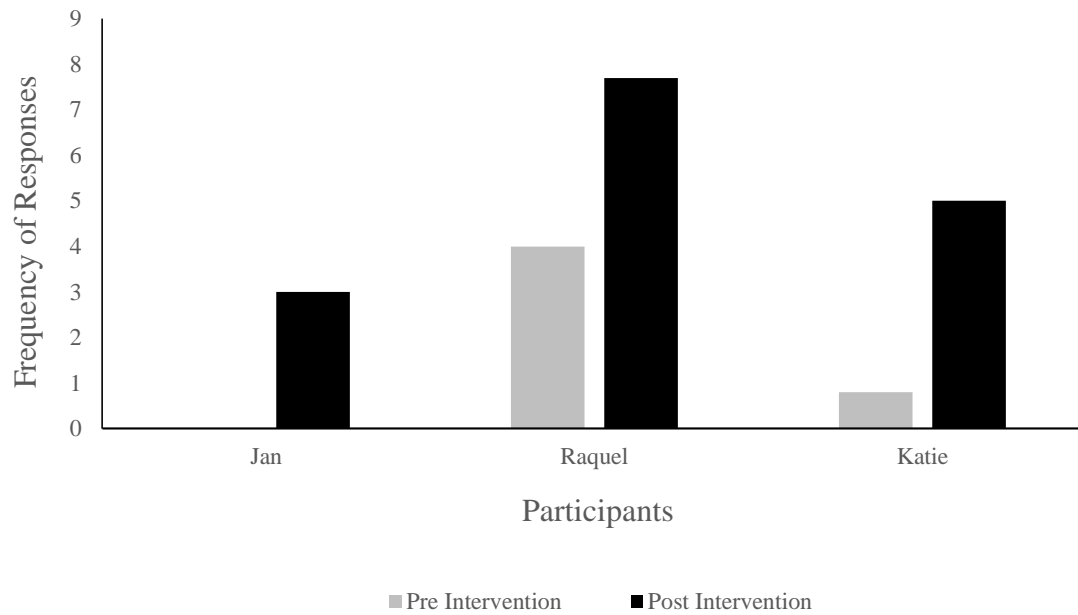


Figure 2. Average number of positive responses to social initiations for therapist participants before and after intervention.

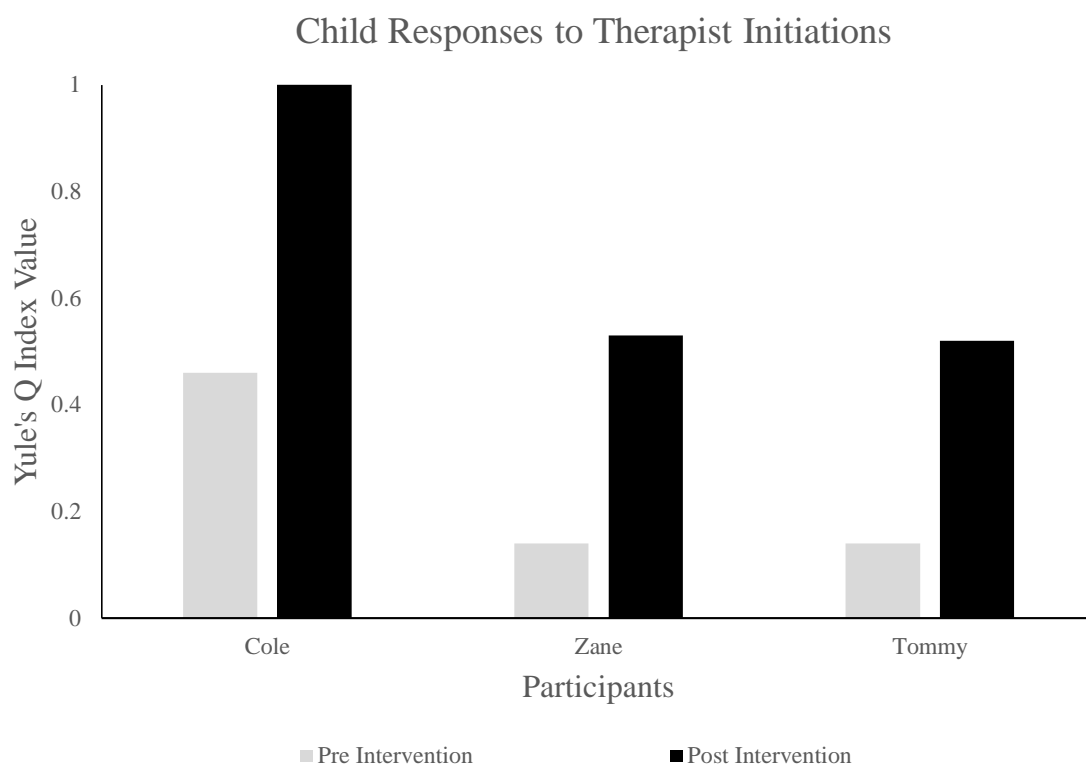


Figure 3. Sequential index of social initiations and positive responses for child participants before and after intervention.

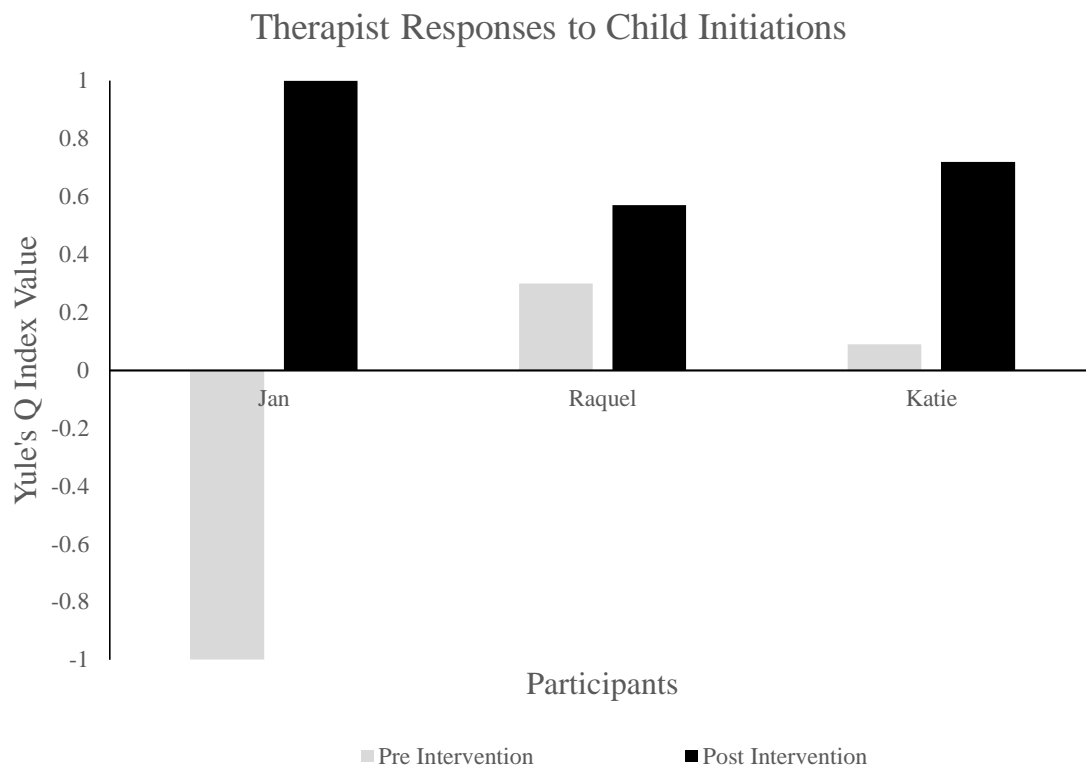


Figure 4. Sequential index of social initiations and positive responses for therapist participants before and after intervention.

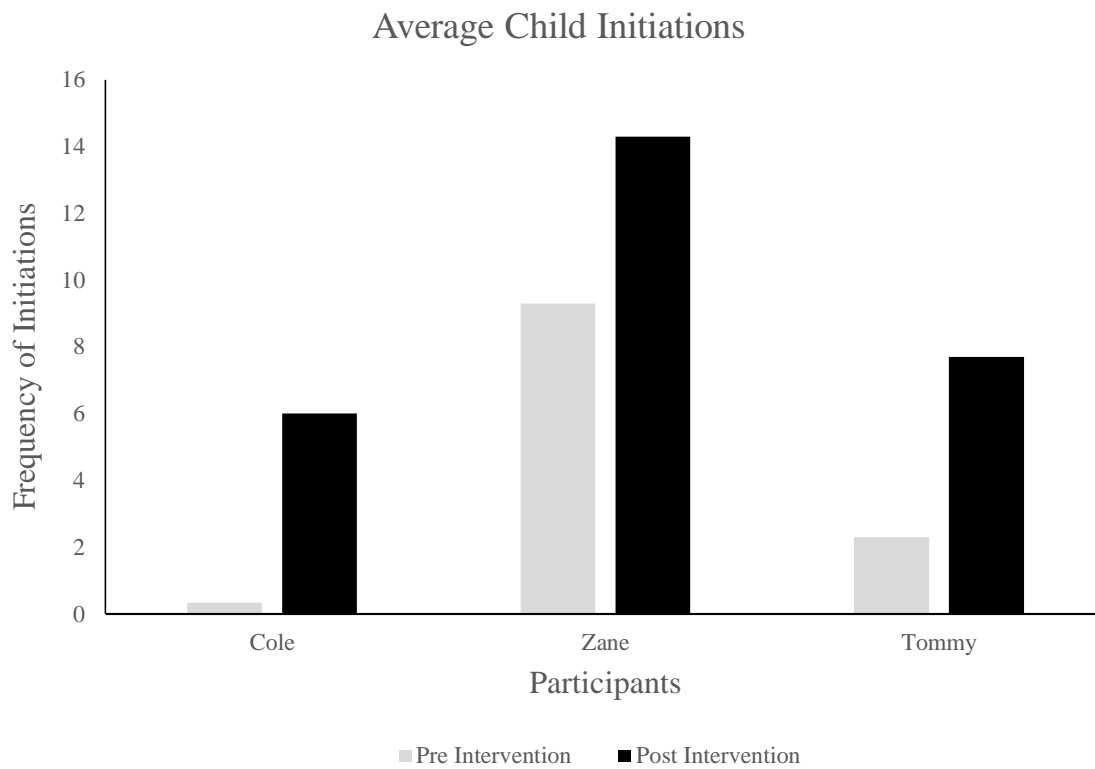


Figure 5. Average frequency of social initiations emitted by child participants before and after intervention.

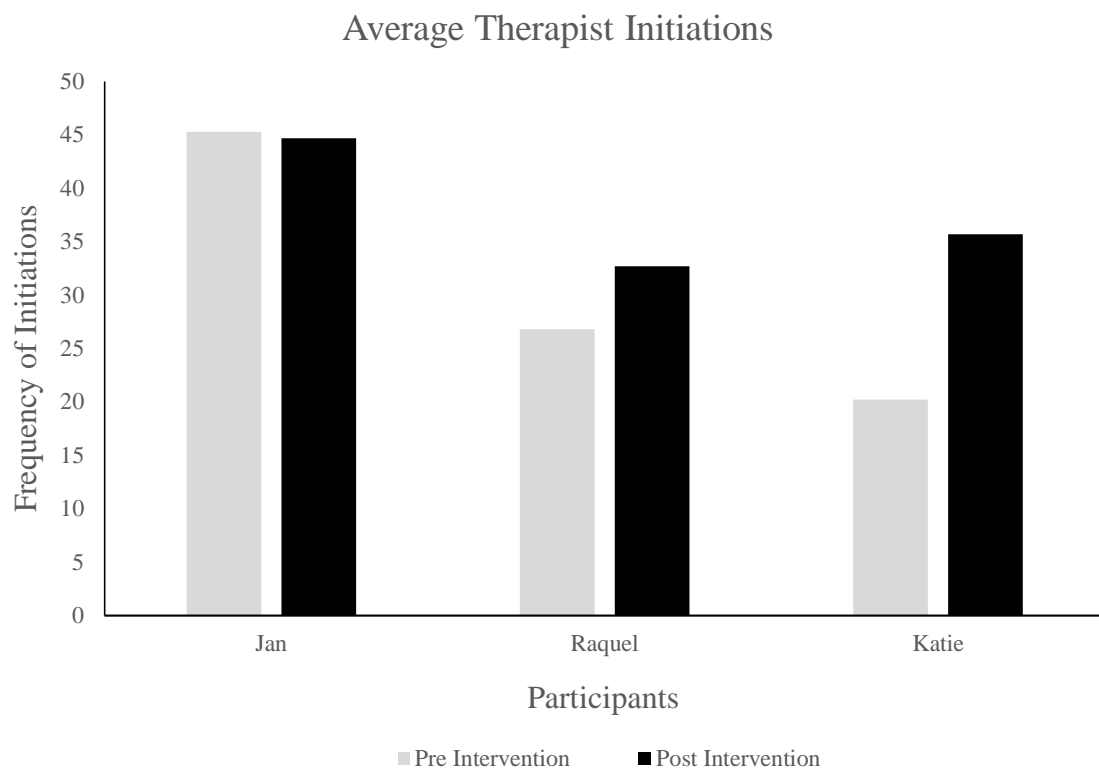


Figure 6. Average frequency of social initiations emitted by therapist participants before and after intervention.

APPENDIX A

RECORDING SYSTEM UTILIZED FOR TRANSCRIBING

Key Term	Brief Description	Included Information	Example(s)
manipulates toy ()	Physically engages with an item- if an item is involved used this description	Note in parenthesis what toy, how they manipulated it, and the people involved.	<i>manipulates toy (ball- bounces it on child)</i> <i>manipulates toy (ball- spins it)</i>
places toy ()	They let go of a toy they were holding	Note in parenthesis what toy and then where it is placed	<i>Places toy (ball) on ground</i> <i>places toy (phone) on child's head</i>
grabs toy ()	Usually happens with the first contact of a new item and then they are holding or manipulating the item.	Note in parenthesis a name of the toy/item.	<i>Grabs toy (ball)</i>
touches child ()	Physical body contact with child	Note in parenthesis how they touch child (e.g., tickle, shakes, etc.).	<i>touches child (lifts them over head)</i> <i>touches child (rubs head)</i>
touches toy () (to child/adult, adult/child has)	If they are just touching a toy- not engaging with it in any way or grabbing it	Note in parenthesis a name of the toy/item.	<i>touches toy (pencil) to child</i> <i>touches toy (pencil) to toy child has</i> <i>touches toy (ball)</i>
holds toy ()	They have a toy in their possession, but they are not manipulating it	Note in parenthesis a name of the toy/item.	<i>holds toy (ball)</i>
hands toy () to child/adult	They are giving a toy to the other person	Note in parenthesis what toy and the person they are handing the toy towards.	<i>Hands toy (ball) to adult</i>
moves () or moves toward/away from child/adult	The person is not engaged with anything or anybody else and is just moving in a certain direction	Note in parenthesis a description of their movement or if they are moving towards or away from the other person.	<i>moves toward child</i> <i>moves (walks)</i>
watches child/adult	They are not engaged with any other stimulus or are not moving around much	Note the person they are looking at.	<i>Watches child.</i>

APPENDIX B

DESCRIPTION AND EXAMPLES OF INITATIONS AND OTHER SOCIAL BEHAVIORS

Initiations		
Category	Brief Description	Example
Posing a question	Includes any vocal behavior classified as a question.	What are you playing with?
Inviting to join or start an activity	Talking about a different activity to engage in together, gesturing towards new activity, or pulling/manipulating other person towards new activity.	“Let’s play with music.”
Offering continuation of an ongoing activity	Stopping or pausing an activity the person is currently engaged with and/or talking about continuing the activity following a pause.	Holding the swing still after pushing it.
Offering an item	Holding a toy/item out toward the other person or talking about offering a toy/item to the other person.	Saying “Here is the ball” as the person holds out an object toward the other person.
Sharing/engaging with the same item	Both people are in contact with the same item as the item is being moved/manipulated by at least one person. Initiation is defined by the person who first initiates the engagement.	Spinning a scooter the other person is on.
Play involving physical touch	Touches to the other person which may elicit a response, physically manipulating the person, or touches to the other person while they are not currently attending to the person/stimuli. Initiation is defined by the person who first initiates the physical touch.	Tickling another person.
Calling person’s attention to a stimulus the person is not already attending to	Talking about an item the person is not already attending to, touches to the person using a stimulus the person is not already attending to, or gestures toward a stimulus the person is not already attending to.	Saying “look” while holding an item.
Calling person’s attention to a different way of interacting with stimulus	Manipulating a stimulus in a different way while attempting to get the other person to attend by making related vocalizations or gestures.	Saying “watch this” while putting a ball on their head.

Other Social Behaviors

Category	Brief Description	Example
Comments or Instructions	A descriptive statement about an item the other person is attending to, instructions for the other person to do something by themselves, or an unrelated comment, excluding utterances or sound effects.	“Your ball is round.” “Touch your nose.”
Taking an item from the other person	Grabbing an item from the other person they are not offering, including attempts.	Person reaches and takes ball out of the other person’s hand while they are bouncing it.
General physical touches	Non-directed (general) touches to other person during existing eye contact/interaction.	Placing a hand on the other person’s shoulder.
Non-engaging touches to an item the other person is in contact with	Touching an item the other person is already attending to or touching the item the other person is in contact with without engaging or playing with it.	One person is riding a bike and the other person touches the handle of the bike for a second.

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