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Using Differential Attention and Stimulus Control  
to Decrease Child Elopement  
And Increase Engagement during Play

Emory Bruno

A thesis submitted to the Graduate Faculty of

JAMES MADISON UNIVERSITY

In

Partial Fulfillment of the Requirements

for the degree of

Master of Arts

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## Abstract

The purpose of this study was to use a specialized form of differential attention to increase the length of time a child is able to remain within close proximity of an adult during play. The therapist used two sets of skills in the context of play, one for when the child was within close proximity, and the other for when the child was not. The close proximity skills were adapted from Parent-Child Interaction Therapy, an evidence-based therapy designed to create and maintain positive interactions between parent and child. The second skill set consisted of positive play statements and descriptive play statements. The therapist used these skills to provide attention differentially during play, emphasizing the attention and anecdotal fun available within close proximity of the adult. The goal was for the therapist to establish stimulus control, acting as a symbolic “magnet” for the child’s return to the play area, without providing attention when the child was not in close proximity. Data collection was terminated before the study was concluded because of the COVID-19 pandemic of 2020.

## Introduction

### **Applied Behavior Analysis & Reinforcement**

Reinforcement is a procedure in which the presentation or removal of a stimulus immediately following a behavior increases the likelihood that the behavior will occur again, in the future (Cooper, Heron, & Heward, 2007). The alternative to which, is punishment. If the presentation or removal of a stimulus directly follows a response, and decreases the likelihood that response will occur again in the future, punishment has occurred (Cooper *et al.*, 2007). This procedure is commonly used in the field of applied behavior analysis, the conceptual foundation of which is increasing socially significant behaviors in individuals through the systematic application of interventions (Baer, Wolf, & Risley, 1968). Generally, a behavior, along with what happens immediately before and after that behavior, are all identified. The event taking place immediately before the behavior is emitted is referred to as the antecedent of the behavior (Cooper *et al.*, 2007). The event immediately following the behavior is identified as the consequence, which maintains the behavior having occurred prior to the consequence (Cooper *et al.*, 2007). Once the function of the behavior has been determined, an intervention can be put in place to provide the individual with an alternative method of achieving the recognized function in a way that is no longer deemed problematic.

Behavior Analysts must abide by *the Professional and Ethical Compliance Code for Behavior Analysts (2014)*, developed by the BACB (Behavior Analysis Certification Board). This code exists as a safeguard, for both behavior analysts and their clients, to set and maintain clear expectations of ethical practices. A wide range of topics relevant to behavioral analytic practices are included in the code. Code 4.08 identifies ethical

guidelines for both the consideration and implementation of punishment procedures.

There are four subparts to this code, the first of which states that reinforcement should be used in preference to punishment whenever possible. The term ‘preference’ tends to hold a subjective connotation, however, when the statement, “reinforcement is preferred over punishment in the field of applied behavior analysis” is made, it is not open to interpretation. The sole interpretation of the statement, and that code itself is that reinforcement procedures are deemed more ethically sound, therefore should consistently be the first choice to employ before punishment when developing an intervention. It is inevitable, however that there will be occasional times where the addition of punishment may be needed to yield desired results. Another safeguard by the BACB’s ethics code is the recommendation that when punishment procedures are deemed necessary, a reinforcement procedure must be included in the intervention to support an alternative behavior.

### **Differential Reinforcement**

Differential reinforcement is a procedure in which reinforcement is delivered contingent upon engagement in a designated response classes, and withheld during engagement in an alternative response class (Cooper *et al.*, 2007). Differential reinforcement is a unique procedure because it simultaneously increases a behavioral response class, while decreasing another. The reduction in behavior is done through a process called extinction. A behavior is considered to be put on extinction when the reinforcer maintaining the behavior is discontinued (Cooper *et al.*, 2007). This “undoing” of reinforcement results in the reduction of the likelihood the behavior will occur again in the future. Rather than undoing, differential reinforcement essentially

reverses the contingency by taking the discontinued reinforcer from the behavior targeted for extinction, and delivering it in the absence of that previously reinforced behavior (Thompson, Iwata, Conners, Roscoe, 1999). This helps to counteract the effects of systematically decreasing a behavior with multiple opportunities for reinforcement. It is an evening out the behavioral effects so to speak, because unlike in an extinction procedure where reinforcement is withheld entirely, differential reinforcement ensured there are multiple opportunities for reinforcement. Which, per the Ethical Code of Behavior Analysts, is absolutely necessary.

For example, in a study conducted by Jeffries, Crosland, and Miltenberger (2016), therapists reported three children on the Autism Spectrum, with excellent verbal repertoires, frequently did not make eye contact while manding for items. Jeffries *et al.* (2016) first attempted to increase eye contact through the implementation of a tablet application that was designed to do so. Unfortunately, the tablet application failed to increase eye contact from baseline in any of the participants. Jeffries *et al.* (2016) then implemented a differential reinforcement procedure for making eye contact while manding for items. Prior to the study, the children received items they manded for regardless of whether or not eye contact was made. This consistent access to reinforcers following mands with the absence of eye contact is positive reinforcement in action, and differential reinforcement is most relevant when the target behavior is maintained by positive reinforcement (Vollmer, Iwata, Zarcone, Smith, Mazaleski, 1993). Making eye contact with the therapist while verbally manding for an item was identified as the replacement behavior for manding for an item without eye contact, which is the target

behavior to decrease (Jeffries *et al.*, 2016). An array of five toys and edibles selected by the child were laid out in front of them. If the child made eye contact with the therapist while vocally manding for an item, they were given praise by the therapist for their eye contact, as well as the toy or edible for which they manded. This reinforced the replacement behavior of eye contact while manding, thus increasing the likelihood it would occur again in the future. If the child manded for an item without making eye contact, the therapist simply waited until the child manded with eye contact, upon which occasion the child would receive both the praise and item. Contrary to the contingency in the past, the child now no longer received the item when no eye contact was made. The combination of this reinforcement withholding and consistent, contingent reinforcement for manding with eye contact, was what categorized this intervention as a differential reinforcement procedure. Results showed that Jeffries *et al.*'s (2016) differential reinforcement intervention substantially increased eye contact while manding for all three of the participants.

### **Types of Differential Reinforcement**

There are three primary types of differential reinforcement procedures: differential reinforcement of other behaviors (DRO), differential reinforcement of alternative behaviors (DRA), and differential reinforcement of incompatible behaviors (DRI). All three types share the commonality of withholding reinforcement when the behavior targeted to decrease is emitted. The differences lie within what is done with that removed reinforcement; the reinforcement withheld for one behavior is made up for by applying it to a replacement behavior. Rather than removing a reinforcer entirely from a

child's array of consequences, differential reinforcement procedures ensure that the discontinued reinforcement pattern is made up elsewhere by dispersing it systematically.

Jeffries *et al.* (2016) used a DRI procedure. A behavior was deemed incompatible if it was not possible to engage in the target behavior simultaneously, which in this case is making eye contact and not making eye contact. The benefit of using an incompatible behavior was that if the individual was engaging in the incompatible behavior, they definitely aren't engaging in the target behavior. Prior to the DRI, manding for an item without eye contact was maintained by access to the item manded for (Jeffries *et al.*, 2016). Upon the implementation of the DRI, that reinforcement pattern was no longer available and a new one, access to items contingent on mand paired with eye contact, was implemented.

Differential reinforcement of alternative behaviors, as with DRI, involves the selection of an alternate behavior, but in a DRA the behavior does not have to be incompatible. Athens and Vollmer (2010) used DRA with seven children with aggression, each with their own replacement behavior. Exchanging a picture card, sign language, and vocal requests are three examples of replacement behaviors used (Athens & Vollmer, 2010). Notice that it is very much possible to evoke aggression while also engaging in the replacement behaviors. The same principles of differential reinforcement, however, still apply. The aggression was always ignored, regardless of the context it was happening in, and the replacement behavior was consistently reinforced.

Differential reinforcement of other behaviors is one of the most widely used differential reinforcement procedures (Vollmer *et al.*, 1993). Reinforcement is withheld upon engagement in the undesired behavior, and provided upon absence of engagement

in the undesired behavior (Cooper *et al.*, 2007). Part of the appeal of using DRO comes from the wide range of behaviors holding the potential to be reinforced. Instead of a specific alternative behavior chosen to reinforce, any behavior other than the target behavior has the potential to be reinforced. The focus in DROs is more directed to the reduction of the problem behavior, rather than the simultaneous reinforcement of a specific behavior. Reinforcement is still prevalent of course, just more dispersed across behaviors.

Cowdery, Iwata, and Pace (1990) conducted a study in which a DRO intervention was used to decrease the self-injurious behaviors of a nine year old boy, given the pseudonym Jerry. The general topography of Jerry's self-injurious behavior was rubbing and scratching his body. As a reference for level of severity, Jerry's body was consistently covered in lesions with bandages often wrapped around the majority of his body. These self-injurious behaviors became prevalent at six years old, and Jerry had spent a majority of his time since then in a hospital. This study was conducted in an inpatient unit with a one-way observation window. An ABAB reversal design was used, where A was baseline and B was a DRO intervention. An experimenter began the sessions by telling Jerry that she needed to leave the room for a while, and asked that he not scratch during her absence. During the treatment phase, the experimenter additionally notified Jerry that if didn't engage in the self-injurious behavior, he would receive a penny. The one-way mirror allowed observation to determine if Jerry had engaged in the undesired behavior. When Jerry did not engage in the scratching behavior, he received a penny upon the experimenter's return. When Jerry did engage in the self-injurious behavior while the experimenter was gone, Jerry was told that because he had scratched

himself, he did not earn the penny. Cowdery *et al.* (1990) also stated that the experimenter did so in a manner that was not aversive.

In the Cowdery *et al.* (1990) study, Jerry's self-injurious behavior was the target behavior. The absence of this target behavior allowed Jerry to access reinforcement, in the form of a penny. Regardless of the behaviors that Jerry engaged in during a session, he would receive a reinforcer as long as the self-injurious behavior was not one of them. Using a DRO schedule in this context helped to target the self-injurious behavior directly, by making reinforcement access solely contingent upon its absence. Differential reinforcement is a great alternative to punishment when dealing with self-injurious behaviors. Punishment procedures, especially of the physical variety, were unfortunately very common in interventions for self-injurious behavior in the early stages of developing behavioral plans to address these behaviors. In a 1969 study, painful shocks were delivered to each participant after any and every engagement in self-injurious behavior (Lovaas & Simmons, 1969). In a 1975 study, crushed ammonia tablets were forcefully pushed into the nose of a twenty-year-old woman with autism every time she slapped herself in the face (Tanner & Zeiler, 1975). DRO interventions, such as Cowdery *et al.*'s (1990) offer the same reduction of behavior, in a much more ethical manner and without an individual inflicting physical pain or harming the patients.

While the general rise in differential reinforcement procedures included its use with self-injurious behaviors, it is now used more often for a wide variety of behaviors. Daddario, Anhalt, and Barton (2007) conducted a study in which a class-wide DRO procedure was implemented as a means of decreasing disruptive behavior in a preschool classroom. The participants in this study were seven preschool students with ages ranging

from two years to three years old. All students were typically developing with no identified disabilities. It was noted that even though a class-wide approach was used, one student engaged in a majority of the disruptive behaviors. Daddario *et al.* (2007) defined disruptive behavior as touching a peer or teacher in inappropriate ways such as kicking, poking, or tackling.

During circle time, a timer was set to sound every minute (Daddario *et al.*, 2007). The timer was used to ensure consistent and accurate implementation of the DRO. When the timer went off, the teacher gave an M&M to a student randomly selected from those who were not engaging in disruptive behavior at that time. M&M's were chosen to be the reinforcer based on teacher and student preference reports. Using a reinforcer that was consistent across all students helped to eliminate potential extraneous variables stemming from variations in size, quantity, or reinforcement level. Labeled specific praise from the teacher was also given to students not engaging in disruptive behavior, delivered intermittently throughout circle time. Only in the absence of the disruptive behavior did the students have the potential to access a reinforcer, thus making the intervention the differential reinforcement of other behaviors. The results showed a strong decrease in the rates of disruptive behavior at the conclusion of the study, as well as follow-up conducted showing a rate of 0% negative behaviors per minute (Daddario *et al.*, 2007).

### **Differential Attention**

When a differential reinforcement procedure is used with attention as the reinforcer, the procedure is referred to as differential attention. Attention is withheld when the child engages in the target behavior, and delivered when the child is not. The attention is used systematically to increase behaviors it follows. While the first exemplar

of attention tends to be eye contact, attention can actually take on many forms (Kodak, Northup, & Kelley, 2007). Furthermore, the reinforcement levels for each types of attention may vary across individuals. Kodak *et al.* (2007) conducted an extended version of a functional analysis, during which he analyzed the effects different types of attention had on the problem behaviors of two participants. For one participant, reprimands and tickles were the two forms of attention out of the six analyzed that produced the highest rate of problem behavior. Meanwhile, unrelated comments and reprimands produced the highest rates of problem behaviors for the second participant. The data for the attention evaluation were graphically represented in a line graph showing the rate of problem behaviors across twenty five sessions, with a line for each attention type. Though at varying levels, each attention type showed a relatively stable trend, showing that there was a consistency with the rate of problem behaviors emitted across the sessions (Kodak *et al.*, 2007). From graphical interpretation, a distinction can be made between the levels of reinforcement delivered for each attention type.

Harris, Wolf, and Baer (1964) found interventions based on contingent adult attention to be effective in reducing the problem behaviors of nursery school children across five studies. Adult attention in general has proven to be a strong reinforcer for children. In one of the studies, contingent teacher attention effectively increased walking rates in a three-year-old girl who had regressed back to crawling. The teacher provided direct attention to the child, typically in the form of social play or tickles, when the child was walking, standing, or running. If the child crawled or crouched, the teacher redirected her attention to a different child. The crawling behaviors decreased after a week of implementation of the contingency, and the child's walking patterns improved.

This demonstrated that the walking and crawling skills of a three-year-old were changed by the intentional delivery of teacher attention is a great example of how powerful attention from an adult can be for a preschool-aged child. Harris *et al.* (1964) noted that when a teacher withdrew their attention from a child, it was done in a concrete and flat-affect manner. No look of disapproval or rejection was paired with the withdrawal of attention. Withdrawing attention from the child had been proven to be effective enough on its own, and pairing it with negative physical expressions risked strongly upsetting the child (Harris *et al.*, 1964).

Reduction in rate of isolate play was the goal in two studies presented by Harris *et al.* (1964). Once a high rate of solitary play was noticed by the teacher, systematic observations were conducted to explore the behavior further. Through these observations it was found that the consequence of the child engaging in isolate play was a teacher approaching them to play, or maintaining their attention throughout the play. When children were playing with one another, however, a teacher rarely approached the children who were interacting in that play. This means that in order to get the most attention, the child would play on their own. Given this data collection and hypothesis, an intervention was developed to use teacher attention to decrease the rate of isolate play. Given that the child started out as not playing with other children at all, shaping was used to slowly build their social play repertoire and reach the end goal of voluntarily engaging fully in play with another child (Harris *et al.*, 1964). First the child was reinforced for simply standing by and showing interest in the play of other children, then for parallel play, and then for fully engaging with another child. Two forms of attention were delivered by the teacher as reinforcers within this contingency. One form was a statement

acknowledging group play, making eye contact and a direct play statement made toward the group. Providing attention to the participant and the group he was interacting with helped serve as a signal that teacher attention was provided toward groups, therefore in order to receive that method, the participant needed to be playing in a group. The second form of attention was presenting the participant with an item relevant to the materials he is playing with in group play. This form of attention holds two forms of reinforcement in one: attention and access to tangibles. The example Harris *et al.* (1964) gave was providing an extra plate for children having a tea party. An addition in play materials also added an opportunity for an expansion in play.

### **Elopement**

Elopement has often been identified as multiple attempts or successes of leaving a designated area without permission and / or supervision (Lang, Davis, O'Reilly, Machalicek, Rispoli, Sigafos, & Regehr, 2010; Piazza, Hanley, Bowman, Ruyter, Lindauer, & Saiontz, 2010). Each study then tends to individualize the definition further, such as in Call, Pabico, Findley, and Valentino's (2011) study on elopement and blocking, where he categorized elopement as escape to another room. Their participant, Johnny, was a five-year-old boy with autism, a history of eloping toward water, and an inability to swim. The intervention included a phase of blocking paired with DRO procedure, as well as the DRO and blocking individually. Given safety concerns, blocking was understandably necessary for Johnny. This study was conducted in rooms within a building, and the hallways were monitored. Creating a safe space for escapes allowed the blocking component to be investigated further (Call *et al.*, 2011).

The results showed blocking in combination with a DRO schedule to be most

successful at decreasing rates of elopement, but Call *et al.* (2011) recognized that in some situations blocking was not possible or ideal. While blocking would physically keep the child from escaping, it also has the potential of simultaneously serving as an opportunity for reinforcement to a child seeking attention and physical touch. As noted by Harris *et al.* (1964), adult attention was found to be a major reinforcer for children's behaviors. Though blocking an elopement may not be first considered as attention, it is important to note that attention takes on many forms, and per Kodak *et al.*'s (2007) attention assessment, affect different children differently.

### **Stimulus Control**

Tiger and Hanley (2004) used stimulus control to condition various colored leis to serve as signals for the manding of preschool students. The study was conducted in a five meter by five meter room set up as a mock classroom, with an individual desk for each of the two children participants and the experimenter sitting across from them (Tiger & Hanley, 2004). Simulating a classroom during the experiment was intended to increase the likelihood that the behavioral contingencies would generalize to the students' legitimate classroom setting. Generalization is important, because in order to be an effective intervention, it must be applicable to the intended antecedent the behaviors are desired to occur, expanding beyond an experimental setting. Efforts to generalize should be made prior to study implementation (Stokes & Baer, 1977; Stokes & Osnes, 1989), something done well in this study.

When the experimenter was wearing a red lei, only child 1 was able to receive attention, while wearing the blue lei was a stimulus for the availability of attention for only child 2. There was also a white lei which when worn by the experimenter, served as

a stimulus for the absence of availability of attention for either child. Teacher attention was given in the form of body orientation, eye contact, and verbal communication. Attention was provided entirely contingent on the lei color that represented which child was to receive it at that time. When the white lei was worn, the teacher oriented away from both children altogether. Direct instructions were given to the children to notify them of the contingencies corresponding to the colors of the lei (Tiger & Hanley, 2004).

### **Parent-Child Interactions**

Eyberg created an evidence-based intervention called Parent-Child Interaction Therapy (PCIT), which is divided into two phases: CDI (Child-Directed Interaction) and PDI (Parent-Directed Interactions) (Lieneman, Brabson, Highlander, Wallace, & McNeil, 2017). In CDI the parent is taught foundational play skills that focus on establishing a positive relationship with their child. The skills introduced are coined the term PRIDE skills, an acronym for praise, reflect, imitate, describe, and enjoy (Eyberg & Funderburk, 2011). When these positive skills are used during interactions with a child, the social interaction itself becomes more potent as a reinforcer. The focus of CDI is to build a relationship foundation between the parent and child. From the perspective of applied behavior analysis, these procedures of CDI increase the salience and power of adult attention as a reinforcing consequence for child behavior. During CDI, the child leads the play and the parent follows the child's lead while implementing their newly learned PRIDE skills. These skills are taught to the parent via coaching through a discrete earpiece system (bug in the ear), while the parent and child interact on the other side of a one-way mirror (Lieneman *et al.*, 2017). The criterion for meeting mastery during CDI is delivering ten behavior descriptions, ten labeled praises, ten verbal reflections, and no

more than three commands, questions, or negative talk, cumulatively (Eyberg & Funderburk, 2011). This criteria has to be met during a five minute observation.

Once the parent has met mastery criterion for the CDI phase, the transition to PDI is made. During this phase, the locus of control shifts from the child to parent. The parent continues to expand their PRIDE skills repertoire in order to maintain a positive interaction. Additionally, the parent is taught how give commands and manage the child's compliance. Consequences such as various forms of timeout are provided as response costs for noncompliance to clearly stated commands. The foundation of those CDI skills set the dyad up for success, with a positive parent-child relationship and the ability to maintain therapeutic social management. PCIT has been shown to decrease child defiance and negative parenting in several studies (Lieneman *et al.*, 2017).

### **Current Study**

The current study integrates CDI skills into a differential attention procedure that was used by an adult to increase the amount of time a child with a history of elopement remained within close proximity to the adult during play. The attention of the therapist was used as a reinforcer for the child's close proximity, delivered through praise, reflections, and behavior descriptions. As recognized by Harris, Wolf, and Baer (1964), adult attention can be a powerful reinforcer for children and effective at decreasing the rate of problem behaviors when used systematically. Clearly defining the topography of the attention delivered by the therapist in this study ensured that the type of attention delivered remained consistent.

To the knowledge of the author, there has not been much research on the application of differential reinforcement of incompatible behavior. The three Target

Areas in this study were defined in a way that made it impossible for the child to be in two different locations simultaneously. The child was either deemed as being within close proximity or they were not. Even though the therapist's verbal attention did not always directly address that the child was sitting in close proximity, the researcher identified the intervention as a DRI given that the verbal attention and interaction was only provided when the child was within closer proximity to them. The child received no access to attention when they were not within close proximity of the therapist.

The intervention used in this study consisted of a treatment package broken down into two skill sets, one for when the child was within close proximity and one for when they were not. When the child was within close proximity of the researcher, the evidence-based CDI skills were used (Eyberg & Funderburk, 2011). Only producing the CDI skills when the child was within close proximity showed the child that the way to obtain access to CDI-based reinforcers was to remain near the therapist.

The therapist's use of these CDI skills ceased when the child left the Target Area where the therapist was sitting, and they withdrew their attention to the child. Rather than sitting alone in silence waiting for the child to return, the therapist used positive play statements and descriptive play statements to emphasize their own independent play. The positive play statements and descriptive play statements were essentially adapted versions of two CDI skills. The adaptation was that the skills define the therapist's own play, not the play of the child, as in the original CDI skills. These skills were paired with a simultaneous withdrawal of attention to the child. The combination represented the clear contingency that the child be in the same Target Area as the therapist to receive attention and engagement in play.

While elopement is often referred to as leaving a large area or room (Lang *et al.*, 2010), in this study elopement was defined as leaving a 1m by 1m Target Area in which the therapist interacting with the child was sitting. The study was conducted in an enclosed 2.75m by 3.75m room, so the child did not have the opportunity of eloping a long distance. This form of social elopement inhibits a child's ability to learn and obtain appropriate play skills needed for social development. It can also hinder academic skill development if the child is unable to remain within close proximity of a teacher, therapist, or parent working with them on academic tasks. Although the researcher acted as the adult in this study to maintain procedural control of the experiment, the long-term goal is for the intervention to be used by parents who report extreme difficulty in keeping their child within close proximity for productive behavior development and safety.

## **Method**

### **Participant**

There was one participant in this study, who will be referred to by the pseudonym Nathan. Nathan was a five-year-old male diagnosed with global developmental delays. He also had deficits in remaining within close proximity of an adult during social interactions, quantified during baseline as remaining within close proximity of an adult an average of 20% of the time. The criterion for eligibility as a participant in this study was to remain within close proximity of the researcher no more than 25% of the time. Informed consent was obtained according to a protocol approved by the JMU IRB.

### **Setting**

All sessions of this study were conducted in the Alvin V. Baird Attention and Learning Disabilities Center at James Madison University. Two clinic rooms, both

approximately 2.75m wide and 3.75m long, share a wall consisting of a large one-way mirror (3m by 2m). The therapist-child interactions took place on the mirrored side while data collectors observed through the one-way mirror, or by review of videotapes of the session. Not having data collectors in the same room as the therapeutic interactions aided experimental control by accounting for the potential of the observer effect for both therapist and child.

Two 1m by 1m boxes were outlined on the carpeted floor in blue tape on opposite corners of the room. A couch was situated against the wall and strategically placed so that it was equal distances between the two outlined floor squares.

### **Independent Variables**

Two sets of therapist skills made up the independent variables of this study: three close proximity skills, and two magnet skills. The therapist engaged close proximity skills when the child was within close proximity to them i.e., within the designated 1m by 1m space. When the child was not within close proximity, the therapist utilized magnet skills.

**Close Proximity Skills.** The following skills were based on those identified by Eyberg (2004) in the DPICS-IV protocol.

1. Praise: A positive statement made directly following appropriate child behaviors. An example of which might be “Thank you for playing with me!”; “Good job stacking those blocks!”; or “I love how straight the lines of the square you drew are!”
2. Reflection: A phrase or statement that has the same meaning as the preceding child verbalization. The reflection may paraphrase or elaborate

on the child's initial verbalization but may not change the meaning or interpret unstated child ideas. An example is if the child says, "I am sleepy" and the therapist then says, "you are sleepy". Another example is if the child says, "And you're the dog" and the therapist then says, "You want me to be the dog"

3. Behavior Description: A non-evaluative, declarative statement or phrase where the researcher describes an appropriate behavior of the child. For example, if the child is stacking blocks the researcher might say, "You are stacking the blocks!"; "You rolled the car fast!"; or "You're clapping your hands"

### **Magnet Skills**

1. Positive Play Statement: Any instance in which the researcher positively verbalized about their independent play when the dyad was not engaging in a close proximity interaction.

An example scenario: The child is on the other side of the room and the therapist is playing with legos. The adult says, "I love building with these legos".

A second example scenario: The child is on the other side of the room and the therapist is playing with toy cars. The adult says, "These cars can go so fast!"

A third example scenario: The child is on the other side of the room and the therapist is playing with a toy piggy bank that make sounds

when toy coins are put inside of it. The adult says, “When the coins go in it sings a nice song”

2. Descriptive Play Statement: Any instance in which the therapist verbally described their independent play, when the dyad was not engaging in a close proximity interaction. A verb relevant to the action she is engaging in must be included in the statement.

An example scenario: The child is on the opposite side of the room to the adult, and the adult is playing with legos. The adult says, “I’m stacking the blocks”

A second example scenario: The child is on the opposite side of the room. The therapist is playing with toy cars and says, “I’m making the cars roll back and forth”

A third example scenario: The child is on the other side of the room. The therapist is playing with a toy piggy bank and says, “I’m putting the coins in the pig!”

### **Dependent Variables**

1. Target Area A: Any instance when any part of the child’s body was touching or inside of the blue tape outlining the square the therapist sat in during baseline.
2. Middle Area: Any instance in which no part of the child’s body was touching or inside of the blue tape that outlines the two squares.
3. Target Area B: Any instance when any part of the child’s body was touching or inside of the blue tape that outlined the square the therapist was not sitting in during baseline.

## **Data Collection**

Data were collected for the child as well as the therapist. Child data were the data of focus in this study. Therapist data were also collected, as a measure of procedural fidelity. Tracking the therapist's systematic use of the therapist skills allowed us to see both sides of the story. There were two primary data collectors in the study, one for child data and the other for the therapist data. A third data collector served to collect IOA for all forms of data collection. The primary data collectors were both first year graduate students in the Psychological Sciences Master's program, with a concentration in Applied Behavior Analysis. The IOA data collector was a second-year graduate student from the same program. All three data collectors had experience in the field of ABA, including data collection. Data collectors were trained on the procedures before the study commenced.

Child data on Target Area A, Middle Area, and Target B were collected using partial interval recording with intervals of five seconds in length. A behavior was scored as having occurred if it occurred at any point, for any length of time, within the designated interval (Johnston & Pennypacker, 2009). Observations for data collection were ten minutes in length. There were three observations within each session. The first two minutes of each session was used for the child to adjust and adapt to the environment. Then data observation periods began, each separated by a one-minute break to allow the data collectors to reorganize materials and reset interval timers.

Data on the therapist skills were collected using a frequency within interval recording system. The intervals were fifteen seconds in length, and each observation period was ten minutes in length. If a target skill vocalization was made across two

intervals, it was recorded as having occurred in the interval in which the vocalization ended. For example, if the therapist said, “Thank you so much for playing with me!” spread across two intervals, the skill was recorded as having occurred in that second interval. It is important that the dimension of data collection is brought back to the focus of the frequency of skills used. If the skill was recorded as having occurred in both the intervals, the frequency data would be inaccurate because it will make it seem as if the two skills were used in isolation.

An interval timer that produced an audible beep at the conclusion of each interval served as a signal to the data collector to move to the next interval. This method allowed the data collector to focus fully on the observation, without needing to watch a timer or restart intervals. This was done to decrease the potential of confounds related to inaccurate data on the basis of missed opportunities to see behavior. Because the two methods of data collection vary in interval lengths, two different interval timers were set, and the data collectors had one earbud to hear the interval schedule they are using. This ensured the data collector using ten second interval doesn't mistake a five second interval with a ten second one.

A computer software entitled Video Audio Learning Tool (VALT) was used to record all sessions. Recording sessions allowed the researcher the opportunity to refer back to previous sessions, if needed. Two cameras and microphones were in the interaction room, the feeds of which were transmitted to a computer in the observation room. This computer has no internet access, and the computer, VALT software, and videos themselves, are encrypted and password protected.

### **Reliability IOA**

IOA (Inter-observer Agreement) was used for both child and therapist data. IOA was taken on child data for 33% of the observations in baseline, 22% of observations in the first intervention condition, and 33% of the observations in the second intervention condition. IOA for therapist data were taken for 33% of the observations in baseline, 11% of observations in the first intervention condition, and 67% of the observations in the second intervention condition.

IOA for therapist behavior data was calculated using exact tally agreement within intervals, a form of IOA used when observations are divided into intervals in which the frequency of occurrences are recorded within each interval. This is a very stringent form of IOA. An interval is only counted an agreement if both data collectors scored the same frequency within the same interval. The number of intervals in which agreement was achieved is then divided by the total number of intervals.

Percentages of agreement for close proximity skills used when the child was in Target Area A were 92.5% in baseline, 85% in the first intervention condition, and 100% in the second intervention condition. Percentages of agreement for the use of close proximity skills when the child was in the middle area was 81.7% in baseline, 97.5% in the first intervention condition, and 100% in the second intervention condition.

Percentage of agreement for the use of close proximity skills when the child was in Target Area B were 94.1% in baseline, 100% in the first intervention condition, and 71.3% in the second intervention condition. Percentage of agreement for magnet skills was 100% across all phases when the child was in Target Area A and Target Area B. Percentage of agreement for magnet skills used when the child was in the Middle Area

was 100% during baseline, 92.5% during the first intervention condition, and 96.5% during the second intervention condition.

Interval-by-interval IOA was used to calculate IOA for each child behavior, in each phase. The percentage represents the number of intervals the two observers scored the same out of all intervals of scoring. Percentage of agreement for when the child was in Target Area A was 98.9% during baseline, 98.8% during the first intervention condition, and 95.8% during the second intervention condition. Percentage of agreement for the child being in the Middle Area was 95.8% during baseline, 97.1% in the first intervention condition, and 81.7% for the second intervention condition. Percentage of agreement for the child being in Target Area B was 97.2% during baseline, 100% during the first condition, and 89.2% for the second intervention condition.

### **Baseline**

All procedures were implemented by a second-year graduate student in studying ABA who has four years of experience in the Baird Center clinic. She held certification as a Registered Behavior Technician (RBT). She was supervised by a Virginia Licensed Behavior Analyst.

Three toys were in the room for each session, one in Target Area A, one in Target Area B, and one in the exact middle of room. The same three toys were used across all sessions, but their location was systematically randomized across sessions, according to a random number generator. The therapist remained in Target A for the entirety of each session during baseline. Once the therapist was sitting in Target A, a research assistant brought the child into the room. This eliminated any confounds that might have occurred in regard to the therapist leading the child into the room. The child might have followed

the therapist simply as part of the transition, and remained with the therapist longer during the beginning as a result of this initial proximity.

Magnet skills were not used during this phase, and close proximity skills were used, but not contingent on the child's location. Using close proximity skills during baseline controls for the effects these skills alone could have on the proximity of the child. Exposing the child to the reinforcing play skills from the beginning controls for any effects the exposure to close proximity skills might have on the child's proximity. This allows the researcher to isolate the contingencies as a point of investigation.

### **Intervention**

The therapist sat in Target Area A as she did in baseline. When the child was in Target Area A, the therapist used close proximity skills. When the child was in Target Area B or the Middle Area, the therapist engaged in magnet skills. The magnet skills were incorporated slowly. During the first few sessions the therapist used shaping to gradually bring the child closer to the therapist. In order to do so, the therapist would periodically use close proximity skills when the child was closer to the therapist than the center of the room. A small piece of blue tape was put on the floor in the center of the room as a position cue for the therapist. If the therapist was using the close proximity skills while the child was in the Middle Area, she did so when the child was on the side of the room between the central marker and the therapist. The close proximity skills used during those scenarios were often in regard to the child coming over to or closer to the therapist.

After three sessions, the therapist sat in Target Area B for the entirety of the fourth session of intervention. This is referred to as a second phase of intervention,

because the same contingencies were used, but the location of the therapist changed in order to assess the stimulus control demonstrated by the therapist.

## Results

### Child Behavior

Results indicated that an adult's systematic implementation of magnet and close proximity skills was effective at increasing the amount of time a child remains within close proximity to the adult. As presented in Figure 1, Nathan spent a mean of 19.8% of a session in Target Area A during baseline. Percentage of a session spent in Target Area A showed slight variability at a low level with no trend. During the first intervention condition, the percentage of a session spent in Target Area A increased to a mean of 38.9%. The level of percentage of a session spent in Target Area A increased from the lower level during baseline, to a middle level. The percentage of a session spent in Target Area A showed slight variability with no trend during the first intervention condition. In the second intervention condition, the mean percentage of a session spent in Target Area A promptly decreased to 1.6%, a very low level. Trend and variability could not be evaluated across sessions for the second intervention condition, because only one session was spent in this condition prior to the untimely conclusion of the study.

Nathan spent a mean of 68.5% of a session in Middle Area during baseline, with slight variability at a mid-high level and no trend. In the first intervention condition he spent a mean of 58.3% of a session in Middle Area. Percentage of a session spent in Middle Area during the first condition showed no trend, with slight variability, at the mid-level. Nathan spent a mean of 50.8% of a session in Middle Area, at a middle level. Overall, the level of percentage of time spent in Middle Area decreased across phase

changes. Trend and variability of the percentage of a session spent in the Middle Area could not be evaluated, due to only one session being spent in the second intervention condition.

Nathan spent a mean of 10.8% of a session in Target Area B during baseline, a low level with variability and a slight decreasing trend. During the first intervention condition, this mean percentage decreased to 2.8%. Percentage of time spent in Target Area B during this first intervention condition showed little variability and a slight decreasing trend, but less of a trend than was seen during baseline. During the second intervention, mean percentage of a session spent in Target Area B increased significantly to 47.5%. Mean percentage of a session spent in Target Area B during this second intervention condition was at a middle level. Trend and variability for mean percentage of a session spent in Target Area B could not be evaluated, because only one session was spent in this condition.

### **Therapist Behavior**

As presented in Figure 2, during baseline, the therapist used 26.8% of their close proximity skills when Nathan was in Target Area A, 63.75% of them when Nathan was in Middle Area, and 16.1% when Nathan was in Target Area B. During the first intervention, the therapist used an average of 86.2% of the of the close proximity skills when Nathan was in Target Area A, 13.8% when Nathan was in Middle Area, and 0% when Nathan was in Target Area B. During the second intervention condition, the therapist used 0% of their close proximity skills when Nathan was in Target Area A, 4.3% when Nathan was in Middle Area, and 95.7% when Nathan was in Target Area B.

The therapist did not use any magnet skills during baseline. During the first intervention condition, the therapist used 5.3% of magnet skills when Nathan was in Target Area A, 88.9% when Nathan was in Middle Area, and 5.7% when Nathan was in Target Area B. During the second intervention condition, 3.7% of the therapist's magnet skills were used when Nathan was in Target Area A, 96.3% were used when Nathan was in Middle Area, and 0% were used when Nathan was in Target Area B.

Table 1

*Mean Frequency of Attention Delivered Across Conditions*

	Baseline	Magnet Target A	Magnet Target B
Close Proximity Skills	151	100	125
Magnet Skills	0	87	52
Total Skills	151	187 (range 159-226)	177

### **Discussion**

Across all three phases, the difference between percentages of time spent in each Target Area increased as each area was targeted sequentially within the experimental design. The child showed an increase in sequential discriminate stimulus control as the contingencies varied over time. During baseline, when magnet skills were not used, Nathan spent nine percentage points more of his time in Target Area A than in Target Area B. By the fourth session of intervention, the difference in percentages of time spent between Target Areas was 46 percentage points. These data provided promising evidence that when Nathan was far from the therapist, the therapist's use of magnet skills served as a discriminative stimulus for Nathan's return to the area occupied by the therapist.

The same contingencies for the therapist's implementation of skill sets in relevance to the child's proximity were applied in both intervention conditions. Attention was applied differentially, contingent on Nathan's location. When the child was in the same Target Area as the therapist, the therapist used close proximity skills. When the child was not in the same Target Area as the therapist, the therapist used magnet skills as a means of recruiting the child back to their area without providing attention to the child directly. The only procedural difference between these intervention conditions was the location of the therapist. Moving to a different part of the room served as a method for the researcher to demonstrate that stimulus control had been achieved in relevance to the therapist, rather than just the corner of a room. This is synonymous with changing the color of lei in the study conducted by Tiger and Hanley (2004). For the first intervention condition, the desired child behavior was to be in Target Area A. The desired child behavior for the second intervention condition was to be in Target Area B. From the first intervention condition to the second intervention condition, the percentage of a session Nathan spent in Target Area A decreased by 37 percentage points while the percentage of a session spent in Target Area B increased by 45 percentage points simultaneously. This significant switch in time spent in each Target Area validates not only the level of stimulus control, but the ability to generalize that stimulus control across different locations within the same room.

The frequency of skills used by the therapist remained generally consistent across the three phases, as displayed in Table 1. The number of skills used did not change substantially, but the contingency under which the skills were used did. Keeping this consistent allowed the contingent attention component to be isolated from the frequency

of skills used alone. In a future study, it would be helpful to control more stringently the frequency of skills used in each session. The therapist could wear a bug-in-the-ear while someone behind the one-way mirror gives them updates on how many skills they have used thus far. This would be a cue for the therapist to use more or less skills in general, not of a specific skill category.

The therapist had prior experience working with the participant in a clinic setting, which came with both strengths and limitations. A strength of this prior experience is that reinforcing rapport between child and therapist had already been established prior to the conduction of this study. Part of this pre-established rapport was built with use of CDI skills, from which the skills within the close proximity skill set originate. This was consistent with typical PCIT practice to meet behavior performance frequency targets. The participant had experienced the close proximity skills, non-contingent on their location, during baseline to control for any effects the exposure of close proximity skills alone might have had on the child's proximity to the therapist. Being exposed to the same skills, again non-contingent to the child's proximity, controls further for effects that the skills have on the child's behavior alone. A positive, foundational relationship between the dyad also shows that the child only spending an average of 20% of a session in Target Area A with the therapist is not because of avoidance motivation regarding the therapist.

The therapist's familiarity with the participant allowed her to successfully select toys that were equally highly preferred by the child. It is important that the toys were reinforcing, so that the child was able to access a reinforcing tangible at any location. It was important that the toys were generally equivalent in reinforcement power, so that the child's location was not biased toward an area because a toy there was either much more

or much less reinforcing than the other two. To further control for potential effects of relationships between toy and location, the placement of each toy for each session was systematically randomized.

Nathan had a history of engaging in interfering behaviors such as yelling, hand-biting, putting his hands in his pants, and insertion of his finger into his anus to retrieve feces. For hygiene reasons, the fecal matter behaviors could not be ignored. To handle these matters with appropriate sanitization while also limiting disruption of session procedures, the researcher's supervisor would quickly enter the room, sanitize the child's hands, and leave. He did so silently, with a flat-affect, and without making eye contact with the child, similar to the way the adult withdrew their attention from a child in Harris *et al.* (1964). The one-way mirror allowed him to address the behavior quickly. If the therapist had addressed the behavior, it would serve as a major confound to the study. While having an outside party address the behavior is an excellent alternative, there are still confounds that originate from it. These episodes occurred distributed across experimental conditions.

There were a couple of instances when as soon as researcher's supervisor came in to sanitize the Nathan's hands, Nathan held out his hands and smiled. This behavior suggested that Nathan might have engaged in the fecal matter behavior in order to recruit the attention of an outside person. Here is where prior experience with the child was a limitation in the study. Prior to the study, as well as in baseline, there was a history of Nathan being reinforced by the therapist regardless of his location. The abrupt change in these contingencies led to what seemed like an extinction burst, with Nathan engaging in a higher frequency and magnitude of interfering behaviors.

Operationally defining close proximity engagement in observable and measurable terms proved to be difficult. Clearly marking designated areas with blue tape helped both the therapist and the data collectors identify the child behaviors. For the child to be coded as in a Target Area, any part of his body needed to be touching or inside of the blue tape that marks the 1m by 1m dimensions of the Target Areas. This definition was developed to account for times when the child might spread out, such as laying on their stomach, but was still close enough to the therapist to be able to play with the same toy. There were a few instances during intervention when Nathan's foot was touching the blue tape of the Target Area the therapist was in, but not attending to the therapist. Nathan was counted as being in that Target Area, but anecdotally he was not engaging with the therapist. The use of magnet skills at these times could have brought Nathan in just enough to activate his engagement in play with the therapist. Since he was technically in the same Target Area as the therapist, however, the therapist had to refrain from use of these skills during those times. Developing a definition specific to the child's engagement with the therapist would have helped to capture moments like these.

Along with operationally defining proximity, choosing the quantitative dimension under which to measure the location of the child proved to be difficult. Duration spent in each Target Area would have been ideal, but was not chosen due to the resources it would require. Three data collectors, one for each Target Area, would be needed for child behavior rather than one. Additionally, a stopwatch would have needed to be provided for each data collector. Using five second intervals provided data that was the next closest estimate of the child's behavior.

Target Area A was located next to the one-way mirror, and Target Area B was located next to the door. The child seemed to enjoy looking at their reflection in the one-way mirror, which could have had an impact on the child's proximity to Target Area A. The clinic door was next to Target Area B. During clinic sessions outside of this study, Nathan's clinicians were working on his communication skills. One of which, was requesting that a door be opened by saying, "Dah". There were sessions in which Nathan appropriately made this request, but in order to maintain procedural fidelity the therapist had to ignore the request. This was an antecedent for a spike in his interfering behaviors, due to a behavior typically reinforced with praise and access to the request being ignored. The addition of a couch to the clinic room helped to make the clinic space a more realistic and home-like setting. The placement of the couch was very strategic in order to maintain experimental control of the measurements in the clinic space. The couch was placed against the wall, at equal distances from each of the Target Areas.

The biggest limitation of this study was that it was discontinued due to a pandemic that required social distancing. The intended experimental design of this study was  $AB_{MA}B_{MB}B_{MA}$ . While the study made it to the second intervention condition, only one session was spent in that condition, after which the study was forced to conclude. While the data from that session provides evidence for the prompt effectiveness of the intervention, more than one session needed to be spent in the condition to interpret that condition with experimental control. If time had allotted, sessions would continue in this condition until the researcher identified the child behavior data to be stable through visual analysis. The phase that followed would be a repetition of the intervention condition. This would provide another opportunity to evaluate the level of stimulus control. If the

data during this third intervention condition was at or above the level seen in the first intervention condition, it would extremely enhance the experimental control of the study and provide further evidence that the intervention is effective. It would have also been interesting to incorporate a counter-magnet condition, during which the original contingency would have been reversed. The goal this time would be for the child not to remain within close proximity of the therapist. The intervention would entail using the close proximity skills only when the child was not within close proximity and using magnet skills when the child was within close proximity.

The primary implication of this study is the ability to retrieve a child that has eloped, without moving toward them or providing any direct attention. Due to a worldwide COVID-19 pandemic, the study was brought to an abrupt halt before the desired level of experimental control was achieved. An extension or expanded replication of this study would be highly beneficial contributions to this research. The primary researcher has experience in coaching parents on the conceptual foundation of this procedure. To ease in interpretation of the complex behavior analytic contingencies at play, it is simply referred to as “the magnet approach”. In application of these procedures in the clinic, parents are told to think of themselves as a magnet. The premise being: Do not achieve the desired proximity by going after the child; stay put and allow the child to come to you. Parents are simply instructed to ignore the child’s elopement, and amplify attention toward an alternate activity, a DRI procedure. There is social validity in the effects of this intervention through parent report. Once parents have learned the impacts that their attention can have on their child’s behavior, they report feeling as though they have re-gained control as a parent, increased their competence as a parent, and increased

confidence in their ability to parent as a whole. This study took this observed, anecdotally effective and impactful approach, and investigated it through a behavior analytic approach. Further research could result in a conceptually systematic approach that bridges parent-training and applied behavior analysis.

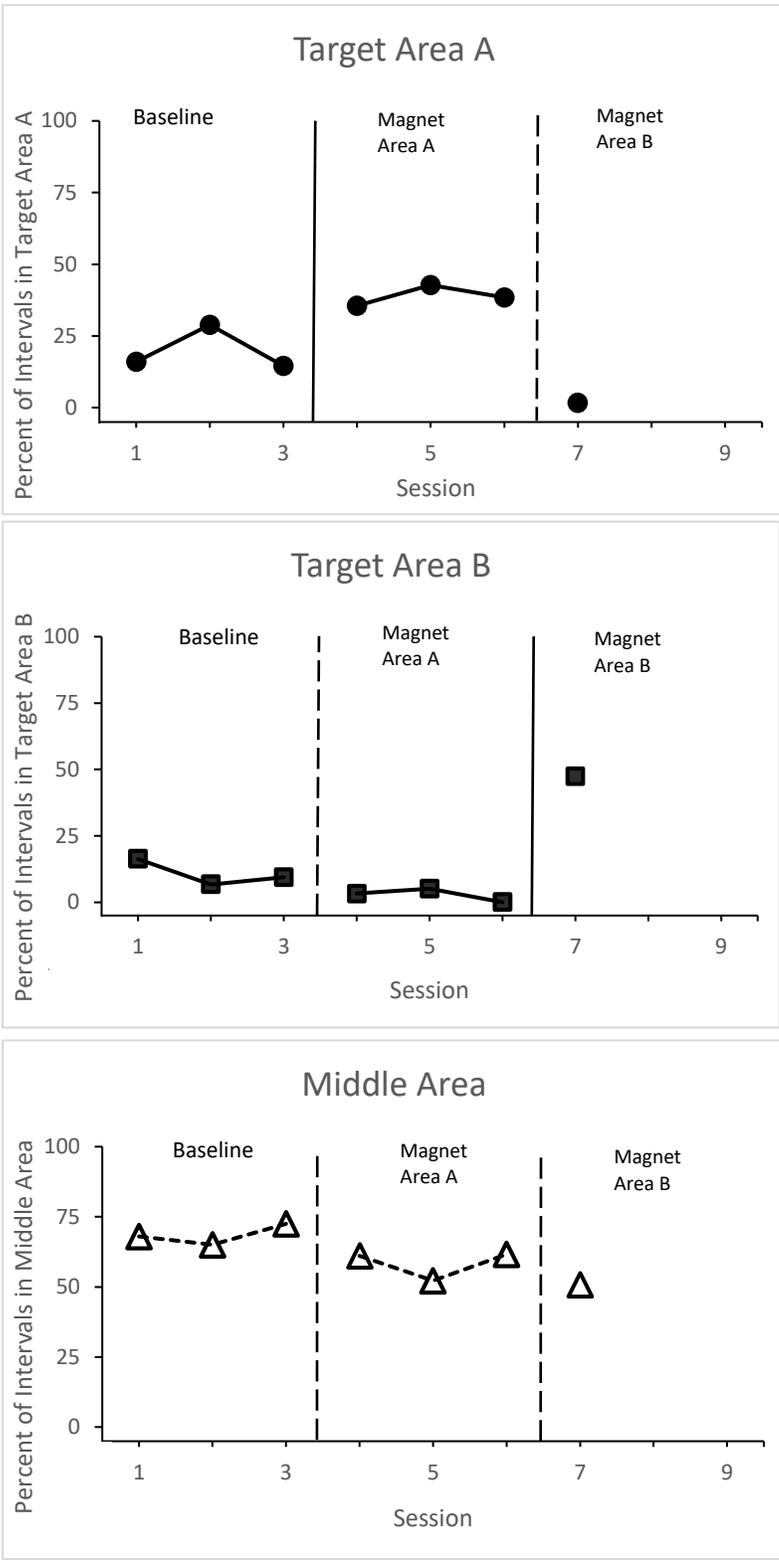


Figure1. The figure displays the percentage of intervals Nathan spent within a specific Target Area, across sessions. Separate graphs were made for each of the Target Areas, stacked in one figure to ease visual analysis.

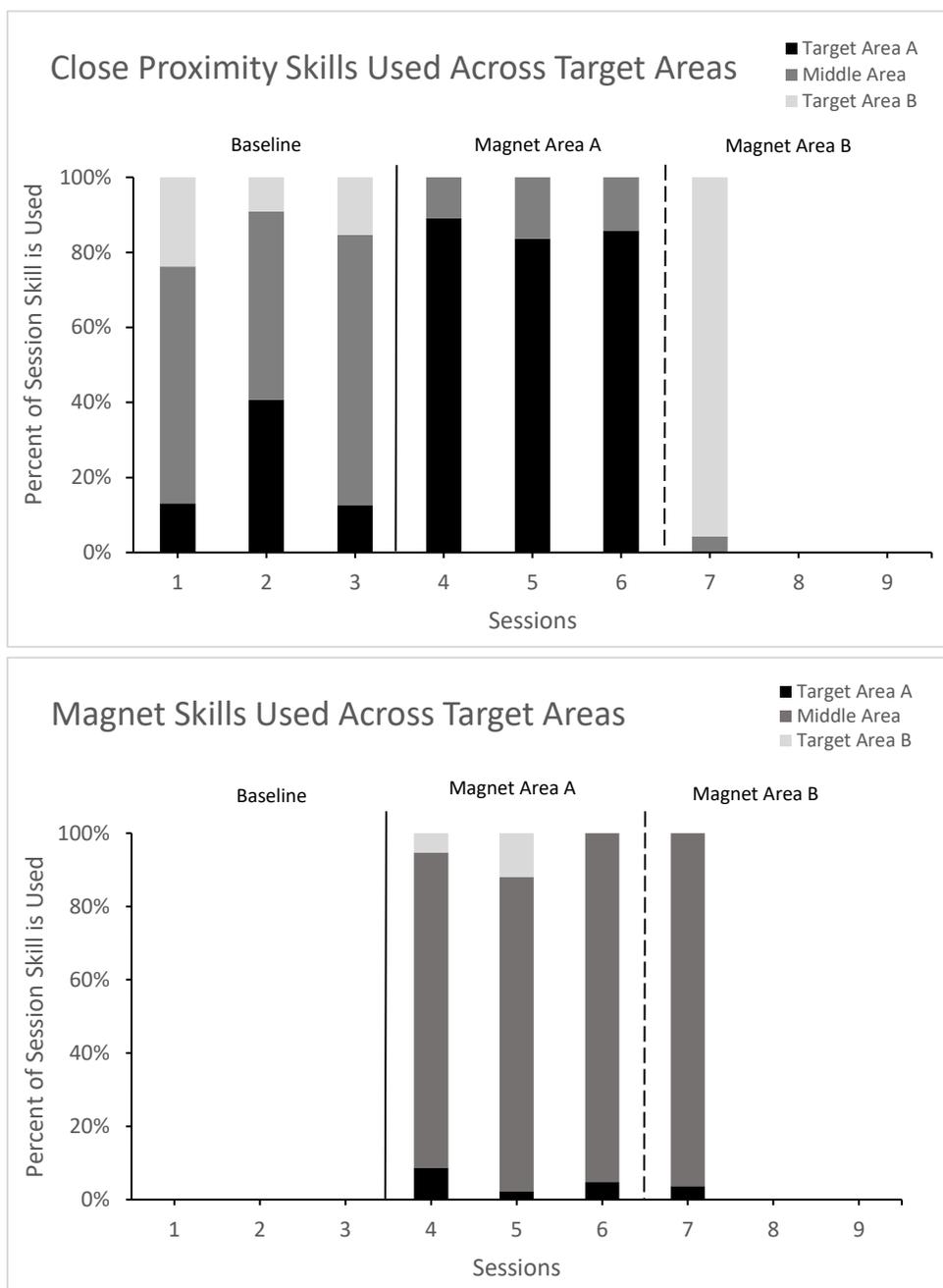


Figure 2. This figure shows where the child was when the therapist engaged in a skill set. The percentage of time spent in each Target Area is represented for each session. The top graph shows this data for the use of Close Proximity Skills, and the bottom graph shows this data for the use of Magnet Skills.

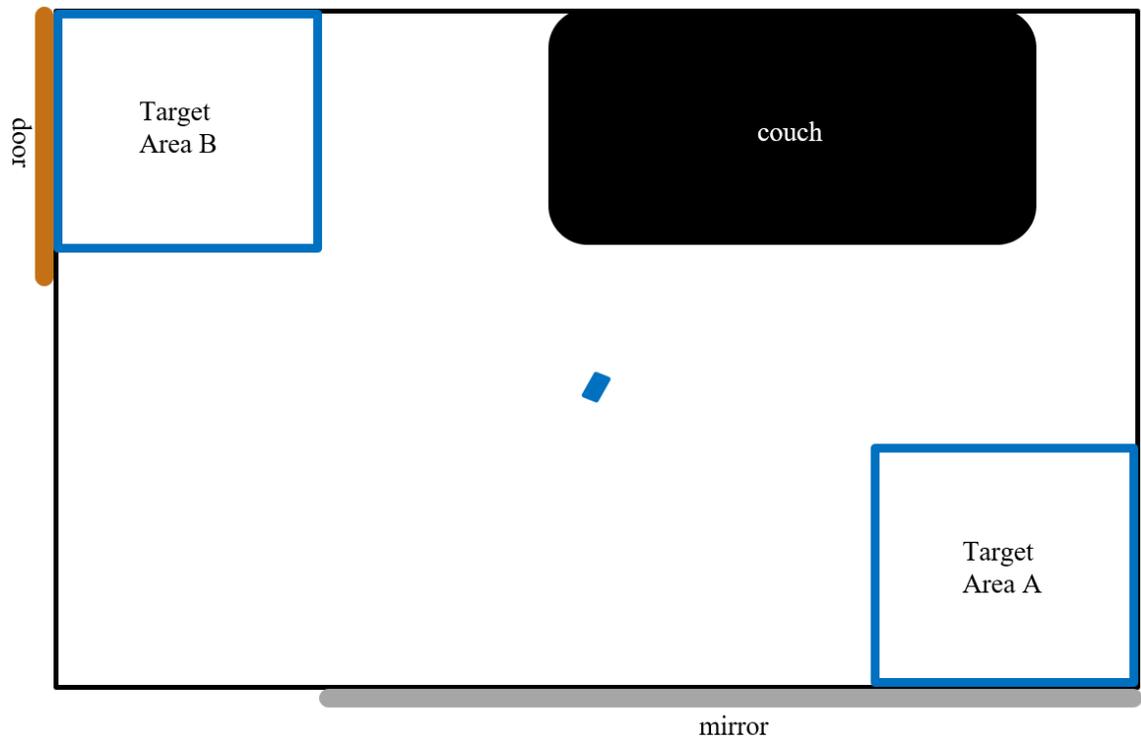


Figure 3. The above figure represents an aerial view of the set up of the clinic room during sessions.

## SKILLS DATA SHEET

(frequency within interval)

Date: \_\_\_\_\_

Client: \_\_\_\_\_

Interval	Close Proximity Skills			Magnet Skills		
	Target A	MA	Target B	Target A	MA	Target B
0:15						
0:30						
0:45						
1:00						
1:15						
1:30						
1:45						
2:00						
2:15						
2:30						
2:45						
3:00						
3:15						
3:30						
3:45						
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7:00						
7:15						
7:30						
7:45						
8:00						
8:15						
8:30						
8:45						
9:00						
9:15						
9:30						
9:45						
10:00						
<b>Total</b>						
<b>%</b>						

**Close Proximity Skills:**

- Praise
- Reflection
- Behavior Description
- Positive Touch

**Magnet Skills:**

- **Positive Play**  
**Statement:** any instance in which the therapist generally positively verbalizes their independent play. (i.e. "this game is so much fun!")
- **Descriptive Play**  
**Statement:** any instance in which the therapist specifically describes their actions during play. The statement must contain a verb. (i.e. "I'm stacking the blocks")

## CLOSE PROXIMITY DATA SHEET

(partial interval recording)

Date:

Client:

Interval	TA	MA	TB	Interval	TA	MA	TB
0.05				2.35			
0.10				2.40			
0.15				2.45			
0.20				2.50			
0.25				2.55			
0.30				<b>3.00</b>			
0.35				3.05			
0.40				3.10			
0.45				3.15			
0.50				3.20			
0.55				3.25			
<b>1.00</b>				3.30			
1.05				3.35			
1.10				3.40			
1.15				3.45			
1.20				3.50			
1.25				3.55			
1.30				<b>4.00</b>			
1.35				4.05			
1.40				4.10			
1.45				4.15			
1.50				4.20			
1.55				4.25			
<b>2.00</b>				4.30			
2.05				4.35			
2.10				4.40			
2.15				4.45			
2.20				4.50			
2.25				4.55			
2.30				<b>5.00</b>			

**TA (Target Area A):** Any instance when any part of the child's body is inside or touching the tape circle designated for close proximity. This is the circle in which the therapist stays in, and the area is referred to as the magnet target.

**MA (Middle Area):** Any instance in which no part of the child's body is in either circle. Although unlikely, if part of the child's body touches both circles at the same time, it will be coded as medium.

**TB (Target Area B):** Any instance when any part of the child's body is touching or inside the taped circle designated as the counter-magnet target. This is the circle that the therapist is not in.

## CLOSE PROXIMITY DATA SHEET

(partial interval recording)

Date:

Client:

Interval	TA	MA	MB	Interval	TA	MA	MB
5:05				7:35			
5:10				7:40			
5:15				7:45			
5:20				7:50			
5:25				7:55			
5:30				8:00			
5:35				8:05			
5:40				8:10			
5:45				8:15			
5:50				8:20			
5:55				8:25			
<b>6:00</b>				8:30			
6:05				8:35			
6:10				8:40			
6:15				8:45			
6:20				8:50			
6:25				8:55			
6:30				<b>9:00</b>			
6:35				9:05			
6:40				9:10			
6:45				9:15			
6:50				9:20			
6:55				9:25			
<b>7:00</b>				9:30			
7:05				9:35			
7:10				9:40			
7:15				9:45			
7:20				9:50			
7:25				9:55			
7:30				<b>10:00</b>			

**TA (Target Area A):** Any instance when any part of the child's body is inside or touching the tape circle designated for close proximity. This is the circle in which the therapist stays in, and the area is referred to as the magnet target.

**MA (Middle Area):** Any instance in which no part of the child's body is in either circle. Although unlikely, if part of the child's body touches both circles at the same time, it will be coded as medium.

**TB (Target Area B):** Any instance when any part of the child's body is touching or inside the taped circle designated as the counter-magnet target. This is the circle that the therapist is not in.

Total Intervals in Target Area A: \_\_\_\_\_ /120 intervals = \_\_\_\_\_ %

Total Intervals in Middle Area: \_\_\_\_\_ /120 intervals = \_\_\_\_\_ %

Total Intervals in Target Area B: \_\_\_\_\_ /120 intervals = \_\_\_\_\_ %

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