MANIPULATING REFLEXIVE ESTABLISHING OPERATIONS IN YOUNG CHILDREN WITH PERVASIVE DEVELOPMENTAL DISABILITIES

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MANIPULATING REFLEXIVE ESTABLISHING OPERATIONS IN YOUNG CHILDREN WITH PERVASIVE DEVELOPMENTAL DISABILITIES

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CHILDREN WITH PERVASIVE DEVELOPMENTAL DISABILITIES

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Miriam Alice Shillingsburg is the daughter of Miriam Jones and Peter Shillingsburg of Starkville, Mississippi. She is the granddaughter of Elvin and Miriam Jones of Belmont, North Carolina and William and Florence Shillingsburg of Starkville, Mississippi. She was born on June 28, 1976 in Starkville, Mississippi. She graduated from Starkville High School in 1994. She entered Mississippi State University in August, 1994 and graduated magna cum laude with a Bachelor of Science degree in Psychology in May 1998. She began graduate school in Child Clinical Psychology at Auburn University in September, 1999 and received a Master of Science degree in 2003.

DISSERTATION ABSTRACT

MANIPULATING REFLEXIVE ESTABLISHING OPERATIONS IN YOUNG CHILDREN WITH PERVASIVE DEVELOPMENTAL DISABILITIES

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Previous research has demonstrated the effects of manipulating establishing operations (EO) on problem behavior, task compliance, and the effectiveness of items as reinforcers. Much research on EO focuses on deprivation and satiation effects, whereas little research has been conducted on the manipulation of reflexive EO. The present study examined the manipulation of reflexive EO on in-seat behavior and other maladaptive behaviors during instructional tasks given to children with PDD.

Two children with PDD were administered tasks during 10-minute demand sessions. Following the demand phase, one therapist removed demands and paired the teaching environment with the child's preferred activities while a second non-pairing therapist continued to conduct demand sessions. Following the pairing phase, both therapists conducted demand sessions similar to the initial demand phase.

It was hypothesized that pairing the teaching environment with the child's preferred activities was considered to create a reflexive EO that establishes interacting with the therapist as a valuable reinforcer and would evoke behaviors from the child that prolong interaction. Thus, it was expected that each participant would display a higher percentage of in-seat behavior and lower levels of inappropriate behavior with the pairing therapist relative to the non-pairing therapist and relative to baseline conditions. In-seat behavior during post-pairing demand sessions was higher and aberrant behavior was lower relative to pre-pairing demand sessions and relative to the non-pairing therapist for both participants.

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INTRODUCTION

Autism is a developmental disorder characterized by significant impairments in communication, social interactions, and restricted, repetitive, and stereotypical patterns of motor movements and interests. The Diagnostic and Statistical Manual of Mental Disorders (4^{th} ed., DSM-IV; American Psychiatric Association [APA], 1994) stipulates that to receive a diagnosis of the disorder, impairment in one of the above three domains must have its onset before age 3 and that impairment in all three domains must be present. Impairments in communication typically involve a delay or total lack of communicative speech, inability to initiate or sustain a conversation, repetitive speech, and/or echolalia. Impairments in social interaction include problematic nonverbal behaviors such as poor eye contact and/or odd body postures. There is also a failure to develop social relationships and a lack of sharing interests. Restricted, repetitive behaviors include preoccupation with interests or parts of objects, rigid adherence to rituals and routines, and/or stereotyped motor movements such as hand flapping, rocking, and spinning in circles.

Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) is a diagnosis given to children who display similar pervasive impairments but who do not fully meet the criteria of autistic disorder (Newsom, 1998), or display what some authors refer to as atypical autism (Volkmar, Cook, Pomeroy, Realmuto, & Tanguay, 1999). Children who do not meet the full criteria for autistic disorder may display impairments in two of the three primary domains. Therefore, a child who has impairments in social interactions and language development but does not display significant amounts of restricted or stereotyped behaviors may be given a diagnosis of PDD-NOS as opposed to autistic disorder.

In addition to the three impaired domains, cognitive and intellectual disabilities are commonly comorbid with a diagnosis of autistic disorder. There are also several associated features of autism that are not part of the core symptoms, including self-injurious behavior (SIB), such as head banging and self-biting, aggression toward others, hyperactivity, non-compliance, and poor sustained attention (APA, 1994). Often these associated features interfere with attempts to teach adaptive behaviors to children with PDD and autism. In addition, the way in which teachers and therapists attempt to intervene with children with PDD can result in the expression of some of these associated features. For example, children with PDD may not display maladaptive behaviors until a teacher places demands on the child. When demands are presented, the child may engage in aggression, self-injury, or tantrums, which result in considerable instructional challenges. Children often display these maladaptive behaviors in order to terminate the demand and end the interaction with the teacher.

Although there exist numerous purported interventions for children with autism, many are not supported in the literature as being effective. However, many interventions based on behavioral principles are empirically supported. The purpose of the present study is to examine a component of a behavioral intervention for children with PDD that is aimed at reducing many of the associated features of PDD often accompanying a teaching situation. Although much research has been conducted investigating behavioral treatments involving the manipulation of consequent events, less has been undertaken investigating antecedent events. Given that many children continue to resist instruction, refuse to sit in a structured setting, and display significant inattention during teaching when treatment primarily focuses on consequent events, the manipulation of antecedent events, such as establishing operations, may be beneficial. Thus, the intervention investigated in the present study involved pairing the teacher and teaching environment with the child's preferred items in order to create a reflexive establishing operation that establishes interacting with the teacher as a valuable reinforcer and evokes behaviors from the child that will prolong that interaction rather than terminate it.

History and Etiology of Autism and Other PDD

Although autistic disorder was first described by Kanner in 1943, there are reports of children resembling those with autism as early as the 1800s (Newsom, 1998). Kanner (1943) originally presented 11 case studies describing children with many of the symptoms of what is now called autism. He described the primary features as self-isolation, deviant language, echolalia, pronoun reversal, and inflexible adherence to sameness (Klinger, Dawson, & Renner, 2003). In the following year, Asperger depicted a similar disorder in a group of four children. However, Asperger described children who had acquired proficient language skills by the time they entered school. Although Kanner's description of autism was very narrow, its scope soon widened and autism began to be considered as a form of childhood schizophrenia (Wolff, 2004). Clinicians began diagnosing autism too broadly to include any childhood condition that was odd (Graziano, 2002). In the 1980s autism began to be distinguished from other similar disorders and the Autism Spectrum Disorders were first described (Wolff, 2004).

In 1996, it was estimated that the prevalence of PDD was approximately 15 in 10,000 people (Dawson & Osterling, 1997). In 2003, Yeargin-Allsop and colleagues reported the prevalence of autism to be 3.4 per 1000. Researchers have indicated that the prevalence of autism has been increasing over the last few decades (Croen, Grether, Hoogstrate, & Selvin, 2002) citing an increase from 5.8 per 10,000 in 1987 to 14.9 per 10,000 in 1994. Although no agreed upon reason for the increase in prevalence of autism has been elucidated, it is likely that better assessment techniques and widespread education of health professionals may be partly responsible.

Currently, autism is viewed as a neurological impairment with a genetic component. The first causal explanation of autism was based in psychoanalysis and blamed parents for being cold and rejecting (Klinger et al., 2003). This explanation has since been dismissed due to lack of empirical support (Dumas & Nilsen, 2003). Researchers have also speculated over the years as to the association between the Measles, Mumps, Rubella (MMR) vaccination and autism. However, results of epidemiological studies have not supported this link (Chen, Landau, Sham, & Fombonne, 2004; Madsen et al., 2002; Smeeth et al., 2004).

Genetic factors have also been asserted in the etiology of autism. Prevalence rates in siblings of those with autism has been estimated at 15-30 times greater than in the general population (Klinger et al., 2003) and approximately 3-5% of siblings of children with autism also are diagnosed (Newsom, 1998). Concordance rates for monozygotic twins are substantially greater than the concordance rates for dyzygotic twins (Klinger et al., 2003; Newsom, 1998).

Treatments of PDD

A variety of interventions exist to treat children with PDD. Common interventions for children with PDD include occupational therapy, speech and language pathology, vitamin therapy, dietary restrictions, and interventions based in Applied Behavior Analysis. The empirical support for these interventions range from nonexistent and modest to strong, based on well controlled experimental comparisons of treatments.

Sensory-Motor Interventions. Occupational therapy is a commonly applied intervention for children with PDD due to the unusual sensory reactions seen in children with PDD, such as hypersensitivity to sound and touch. Procedures include sensory integration, sensory stimulation, auditory integration, and visual therapies. Sensory integration therapy is aimed at helping the nervous system modulate better and organize sensory information better through vestibular activities, such as brushing the skin, joint compressions, and weighted vests. Authors (Baranek, 2002; Dawson & Watling, 2000) have concluded that no sound empirical evidence is available to support sensory or auditory integration or visual therapies as treatments for autism.

Biological Interventions. Vitamin therapy is another intervention that is often recommended to parents of children with autism. Several well controlled, double-blind studies have been conducted with varying results. The primary vitamins that have received the most support are B6, magnesium, and a combination of the two. The view is mixed as to the efficacy of these vitamins, given methodological concerns and the finding that many of the studies rely on parental report without direct observations of behavior (Smith, 1998). The potential negative side effects of high doses of vitamin B6 include nerve damage resulting in weak muscles and numbness (Smith, 1998).

In addition to vitamin supplements, parents often apply dietary restrictions for their child with autism. Several specialized diets have been prescribed to children with autism on the basis of a limited number of poorly designed studies (Smith, 1998). Although a few studies exist purporting improvement in a small percentage of children on dietary restrictions (Evangeliou et al., 2003; Knivsberg, Reichelt, Hoien, & Nodland, 2003), these studies rely on ratings by professionals. No studies on dietary restriction have included direct behavioral observation as a means of measuring behavioral change. The few studies that have been conducted have problems including the presence of confounding treatments and a lack of valid outcome measures (Levy & Hyman, 2002).

It has also been suggested that children with autistic behaviors have an overgrowth of yeast in the gut leading many parents to treat their children with an antibiotic such as vancomycin (Levy & Hyman, 2002). No controlled studies of this antibiotic's effectiveness have been conducted and serious side effects often result from its use. Due to the unsubstantiated claim that mercury is related to the development of autistic features, Chelation therapy is another common alternative treatment. Chelation entails ingesting a chemical that is intended to bind to heavy metals such as iron, mercury, and lead in order to remove them from the body. No controlled studies have supported the use of Chelation and the chemicals have not been approved by the FDA for use with children with autism (Levy & Hyman, 2002). In addition, serious side effects such as liver and kidney toxicity and electrolyte imbalances are possible.

Pharmacological Interventions. Due the posited biological etiology of PDD, many professionals have looked to pharmacological interventions to treat the disorder (Smith, 1998). However, it is noted that medications are not used to treat core features of the disorder, but rather, to treat associated symptoms such as aggression and self injurious behavior (Volkmar et al., 1999). Much of the pharmacological research conducted with autistic samples was done so with adults; therefore, less is known about the use of psychotropic medications with children with autistic disorder (Palermo & Curatolo, 2004; Volkmar et al., 1999). The most commonly used and studied medications are neuroleptics, such as haloperidol, and have been shown to be effective in reducing aggression, irritability, overactivity, stereotypy (Palermo & Curatolo, 2004; Smith, 1998; Volkmar et al., 1999). However, these drugs can have severe side effects, including involuntary movement (i.e., tardive dyskinesia) and sedation.

Selective serotonin reuptake inhibitors and tricyclic anti-depressants have also been studied. Both fluoxetine and clomipramine have been shown to reduce self-injury, ritualistic behavior (Smith, 1998; Volkmar et al., 1999), and aggression (Palermo & Curatolo, 2004). However, side effects of fluoxetine include seizures, insomnia, hyperactivity, agitation, and decreased appetite. Side effects of clomipramine include an increased likelihood of seizures. Given that little controlled research has been conducted with children with autism, the use of medications should be approached with caution (Volkmar et al., 1999).

Educational Programs. In addition to the biological and sensory interventions, educational programs have also been developed for children with autism and other PDD. Special education programs vary in terms of the range of services offered. One program, Project TEACCH (Treatment and Education of Autistic and Related Communication-Handicapped Children), is a well known program that has been implemented in special education classrooms across the state of North Carolina (Smith, 1998). The TEACCH program has been widely disseminated and is now seen in classrooms around the world (Sasaki, 2000).

There are four primary components of a structured TEACCH program (Schopler, Mesibov, & Hearsey, 1995). The first focuses on the physical organization of the classroom and emphasizes clear visual boundaries between areas that are associated with specific activities. The second component involves developing classroom and individualized schedules for the child. The schedules are displayed pictorially and show the child engaged in certain activities in a chronological order so as to aid the child in transitions between activities. The third component is the work system. Children are taught to work at "work stations" independently at a repetitive, often visual task such as sorting and matching (Smith, 1998). The child learns how to initiate and complete tasks independently. The fourth component is task organization (Schopler et al., 1995). The emphasis of this component is to provide the child with visual information on what task is to be done and what the final outcome will be. These include visual prompts indicating what steps the child needs to follow in order to complete the work. Behavioral techniques are used primarily for managing disruptive behaviors and teaching self-care skills (Smith, 1998).

Very few articles have examined the efficacy of the TEACCH method. The authors of a recent study (Van Bourgondien, Reichle, & Schopler, 2003) examined its use with autistic adults and concluded that the families of participants were generally satisfied with the TEACCH program and over time behavioral difficulties decreased. However, no changes in skill acquisition occurred. Given that behavioral techniques are used in the TEACCH program only to address behavioral difficulties and not skill acquisition, the decrease in behavioral difficulties is expected. However, the TEACCH method was not useful in teaching new skills.

Applied Behavior Analysis. Although it is clear that a variety of interventions exist to treat children with developmental disorders, the most effective interventions rely on behavioral techniques (Lovaas, Calouri, & Jada, 1989; Lovaas & Smith, 1989; Sigman & Capps, 1997). Unlike the previously discussed interventions, those based in Applied Behavior Analysis have received a substantial amount of empirical support over the past several decades (Parrish, Kern, & Dowrick, 1996). The field of Applied Behavior Analysis has grown out of operant research with animals. The goal of behavior analysis is to detect the particular environmental circumstances under which certain behaviors occur so that behavior can be maintained or modified by altering those environmental circumstances (Parrish et al., 1996). The primary tenet of behavior analysis is that all behaviors occur in the context of antecedent variables and are followed by consequences. By understanding and controlling the antecedents to and consequences of a behavior, one can modify that behavior.

The first to show the applicability of learning theory to the treatment of autism was Ferster (1961). In a series of studies, Ferster and DeMyer (1961) demonstrated that children with autism could learn very simple behaviors such as matching and pulling levers when such behaviors were followed by reinforcement. These first experiments showed that the simple behavior of children with autism is lawfully related to events in the environment. Following Ferster's work, several studies demonstrated that interventions based in learning theory could be used to teach more socially valid behaviors to children with developmental disorders (Lovaas & Smith, 1989).

Many behavioral terms and strategies are associated with Applied Behavior Analysis. Positive reinforcement is the process by which a behavior is increased due to the application of consequences following that behavior. Negative reinforcement refers to the process by which a behavior is increased due to the removal of something following that behavior. In addition to reinforcement, procedures and phenomena associated with Applied Behavior Analysis include extinction, shaping, prompting, fading and generalization (Wicks-Nelson & Israel, 1997).

Behavioral techniques can be executed in many ways when working with children with developmental disorders. Discrete-trial training (DTT) is a highly structured behavioral intervention that consists of three distinct parts (Harris & Delmolino, 2002). The first component is the instruction, referred to as the discriminative stimulus, given by the therapist or teacher. The second component is the response from the child, and the final component is a consequence for the behavior (Newsom, 1998). When the instruction is given, the child may follow the direction and perform the correct behavior, which is then followed by reinforcement. If the child does not respond correctly to the instruction, he or she may then be prompted by the therapist or told "no" as a consequence for the incorrect response (Anderson, Taras, & O'Malley Cannon, 1996). This scenario constitutes one discrete trial (Harris & Delmolino, 2002).

When teaching, several discrete trials are repeated throughout the session. Most programs that use discrete-trial training use intensive one-to-one instruction that focuses on teaching desirable behaviors and reducing undesirable behaviors (Dawson & Osterling, 1997). Typically, basic compliance and attention must be taught prior to teaching more complex behaviors (Newsom, 1998). Therefore, attention and compliance are typically targeted first. Skills targeted later include language acquisition, receptive skills, gross and fine motor development and imitation, and adaptive skills such as dressing and toileting. The general empirical finding in studies involving discrete-trials is that young children who receive this intensive intervention make significant developmental gains in several areas, including language development, and significant decreases in aggressive behaviors and autistic symptomatology (Newsom, 1998).

The UCLA Early Intervention Project (Lovaas, 1987) was one of the first well controlled studies examining the effects of discrete-trial training on children with autism. In this study, three groups of children with similar age and IQ were compared. The experimental group received at least 40 hours per week of intensive one-on-one discrete-trial training intervention. Control 1 group received special education services and 10 hours per week of intensive one-on-one discrete-trial training intervention. Control 2 group received only special education services through a preschool. Two years later the groups were reassessed. Only the Experimental group made significant academic gains. Intensive discrete-trial interventions have also been shown to demonstrate long term effectiveness (McEachin, Smith, & Lovaas, 1993) and effectiveness with children with mental retardation and PDD (Smith, Eikeseth, Klevstrand, & Lovaas, 1997).

Although the direct benefits of discrete-trial training are well established, others have found that spontaneous use in the natural environment of skills taught via DTT is lacking (Fovel, 2002; Koegel, 2000). Thus, another type of intervention based on techniques of Applied Behavior Analysis, referred to as natural environment teaching or incidental teaching, is often proposed (Harris & Delmolino, 2002; Newsom, 1998). Natural environment teaching is less structured than discrete-trial training and is focused on the child's motivation. The intervention takes advantage of teaching opportunities as they arise and is aimed at teaching language skills, such as requesting. For example, the teacher follows the child in the classroom until the child shows interest in an item or activity. Once the teacher sees the child showing interest in something, the teacher prompts the child to ask for the item, thereby promoting language.

Some studies have found that natural environment teaching is superior to discrete-trial training in that more spontaneous language often emerges and skills generalize more readily to other settings and individuals (Delprato, 2001). However, it may be that natural environment teaching is effective when teaching requesting skills but may not be sufficient for teaching other types of language skills such as labeling objects (Carr & Kologinsky, 1983). Some children with autism and other PDD have very limited motivations and may choose self-stimulatory behavior over other alternatives. Therefore, an approach that combines these two types of interventions has been suggested by Sundberg and Partington (1998).

Sundberg and Partingtion (1998) have developed an intervention program based on Skinner's analysis in *Verbal Behavior* (1957). The benefits of Skinner's analysis of verbal behavior to children with autism are clearly explained in an article by Sundberg and Michael (2001). Skinner's analysis of verbal behavior describes a functional analysis of language. A Verbal Behavior program incorporates incidental teaching, discrete-trial teaching and a functional analysis of language. However, Sundberg and Partington described particular teaching methods used during discrete-trial teaching that result in a more cooperative learner and better language acquisition.

Discrete-trial teaching often begins with the presentation of demands in order to achieve compliance with instruction. By requiring the child to come to the table and sit down, the teaching environment becomes paired with demands and the child may begin to avoid the teaching environment and the teacher, which results in an uncooperative learner and negative behaviors motivated by the child's desire to escape. Although compliance may eventually be achieved, many children continue to verbally and physically resist instruction, refuse to sit for longer than a few minutes, and display significant inattention throughout the teaching session (Anderson et al., 1996; Fovel, 2002). In contrast to this approach, Sundberg and Partington (1998) suggested that intensive teaching should start by pairing the learning environment with preferred items and activities prior to the presentation of demands.

Pairing the teaching environment with preferred items avoids the problem of creating an aversive learning environment and, therefore, avoids problems associated with escape such as inattention, aggression, and leaving the table. Because the teaching environment is not paired with demands, there is little to no motivation for escape. In fact, the child becomes motivated to be around the teacher because the teacher and the teaching environment are only paired with preferred items and activities.

This theory of pairing is based on much basic research that shows animals engaging in behaviors that result in escape from environments that have been paired with aversives and engaging in behaviors that lead to approaching environments that have been paired with reinforcement. However, no research has studied the pairing process in children with autism. From the behavioral sciences perspective, the procedure referred to by Sundberg and Partington as pairing, may best be discussed as creating a reflexive establishing operation.

The Establishing Operation

The term establishing operation (EO) was first used by Keller and Schoenfeld (1950) as a means of describing the effects of deprivation and stimulation on drives. Skinner also discussed the concept of drive with respect to the behavioral effects of satiation and deprivation (cited in McGill, 1999; Michael, 1982, 1993, 2000). The term *establishing operation* and its utility in discussing motivation did not, however, become readily used until reintroduced by Michael (1982, 1993) who suggested that understanding EOs is important because an individual's behavior is reliant upon both the *ability* and the *motivation* to perform it. If motivation is overlooked or discounted, the relevant variables responsible for both adaptive and maladaptive behaviors will not be fully understood, thus limiting one's ability to manipulate and change that behavior.

According to Michael's definition, an EO is an environmental event that has two functions (McGill, 1999; Michael, 1982, 1993, 2000). First, an EO changes the reinforcing effectiveness of other events or stimuli: it is an event that increases or decreases the value of stimuli as reinforcers or punishers and is referred to as the *reinforcer establishing* effect. Second, an EO changes the frequency of the occurrence of behaviors associated with these reinforcers or punishers: it increases or decreases the occurrence of certain behaviors that have led to those reinforcers or avoided those punishers. This increase or decrease in behaviors is the *evocative* effect. Any event or stimulus that alters the effectiveness of another stimulus as a reinforcer and alters the frequency of behaviors relevant to that reinforcer is an EO.

Conditions of deprivation and satiation are prime examples of establishing operations. For example, thirst (i.e., water deprivation) increases the value of water as a reinforcer and increases the frequency of behavior associated with obtaining water (e.g., requesting water). The first effect of thirst is the change in the value of water as a reinforcer. The second effect of thirst is the change in the frequency of behaviors that have led to water in the past. Therefore, thirst is an EO. EOs typically occur in pairs, in which one event acts as an establishing operation while another acts as an abolishing operation. Satiation is an example of an EO that acts as an abolishing operation. For example, when an organism is satiated on water, the value of water as a reinforcer is weakened and the behaviors that lead to water are less likely to occur.

Deprivation and satiation comprise only a fraction of what can be considered EOs. Just as thirst is an EO that increases the effectiveness of water as a reinforcer and evokes behaviors associated with obtaining water, so is consumption of salty foods or vigorous exercise. Eating salty foods and engaging in exercise increase the value of water as a reinforcer and evoke behaviors that lead to water consumption. Although these events are quite different, they have similar reinforcer establishing and evocative effects and, therefore, both are EOs.

Types of Establishing Operations

Several different types of EOs have been described and each has implications for the development and treatment of behavioral problems. Michael (1993) suggested that unconditioned establishing operations (UEO) are those in which the effect of the reinforcer is unlearned. Deprivation of food and water are considered UEOs because food and water will reinforce behavior regardless of the organism’s learning history.

Although the behaviors used to obtain the reinforcer may have been learned, the effect of the reinforcer is unlearned.

Another example of a UEO is restricted attention from another person (Michael, 2000). Michael argued that attention is a type of unconditioned reinforcement and the deprivation of attention is the establishing operation that increases the value of attention and increases the frequency of behaviors that has led to attention in the past. If undesirable behaviors have led to attention in the past, these behaviors will be evoked by deprivation of attention. If attention deprivation is evoking attention-maintained undesirable behaviors, one way to reduce those negative behaviors is to abolish the establishing operation by increasing the overall level of attention that the individual is experiencing (Michael, 2000). This intervention has often been called noncontingent reinforcement or attention (Wilder & Carr, 1998). Noncontingent reinforcement has been effective in the reduction of attention-maintained destructive behaviors (Hagopian, Fisher, & Legacy, 1994) and aggression (Hagopian, Crockett, Stone, DeLeon, & Bowman, 2000). Many researchers maintain that it is the attenuation of the deprivation state (i.e., abolishing the EO) that is responsible for the behavior change (Wilder & Carr, 1998).

Conditioned establishing operations (CEO) are those in which the effect of the reinforcer has been learned in some way. Having little or no money may increase the effectiveness of money as a reinforcer and may evoke behaviors that have been associated with obtaining money in the past. Money is a reinforcer that has been conditioned and, thus, the deprivation of money is considered a CEO.

Three types of conditioned establishing operations (CEO) have been identified—surrogate CEOs, transitive CEOs, and reflexive CEOs. UEOs can also be reflexive. For the purposes of this study, only reflexive CEOs will be described in relation to pairing. Reflexive UEOs and CEOs are stimuli that alter their own function (McGill, 1999). Reflexive UEOs are events or stimuli that establish their own termination or prolongation as a reinforcer and evoke behaviors that have been associated with termination or prolongation of the event in the past. For example, experiencing pain is an event that is a reflexive UEO because it establishes its own termination as reinforcing and evokes behaviors to obtain reduction in pain. Experiencing a headache is a UEO in that it establishes its own termination as reinforcing and evokes behaviors (e.g., lying down, eating, or taking medicine) that have been associated with pain reduction in the past. Although the behaviors that are evoked may be learned, the reinforcing effect of pain reduction is unlearned.

Reflexive CEOs are similar except that the reinforcing effect is learned. Reflexive CEOs are previously neutral events that have been repeatedly followed by a worsening or improving set of conditions. Through this repeated pairing of the neutral stimuli with a worsening of conditions, the neutral stimuli begin to take on the properties of the worsening conditions and establish their own termination as a reinforcer (McGill, 1999). An example from basic research is the signaled shock-avoidance paradigm. A rat is presented with a tone followed by shock. The rat learns to press a lever to terminate shock, or, if the lever is pressed during the tone, it avoids shock. In this case, the termination of shock is an unlearned reinforcer and the termination of the tone is a learned reinforcer. The tone is a reflexive CEO because it has established its own termination as a reinforcer and, therefore, those behaviors that have terminated the tone in the past will be evoked.

The reflexive CEO is also seen in human behavior. For example, a teacher presents academic materials to a child. The presentation of the materials represents a worsening of conditions. The child engages in disruptive behavior and the teacher removes the academic material. With repeated interactions with the teacher, the teacher begins to act as a signal that academic demands will be made. The child may engage in these same disruptive behaviors at the sight of the teacher to terminate the interaction and avoid task demands. Sight of, or interaction with, the teacher is a reflexive CEO that establishes the termination of the interaction as its own reinforcer and evokes behaviors that have been successful in the past.

Some studies examining factors that affect the value of reinforcers suggest that satiation and deprivation are important variables (Vollmer & Iwata, 1991). Deprivation and satiation levels are often reported in the method sections of animal research, although not referred to as manipulations of establishing operations. The relevance of establishing operations to the treatment of individuals with developmental disabilities has rarely been studied. Gewirtz and Baer (1958) conducted a study in which children were exposed to a presession phase either with or without social praise. Following the presession phase, the participants were given a marble-dropping task in which social praise was used as a consequence. The researchers found that responding was better following social deprivation and decided that the deprivation increased the reinforcing value of social praise.

In a more recent study, Vollmer and Iwata (1991) investigated satiation and deprivation levels of food items, music, and social praise and the subsequent effect on responding to motor tasks in adults with developmental disabilities. In general, these items functioned as reinforcers with varying degrees of effectiveness depending on the condition. This study demonstrated the use of manipulating establishing operations in order to alter the effectiveness of an item as a reinforcer, resulting in better performance by the individuals. McComas, Thompson, and Johnson (2003) demonstrated the effects of deprivation and satiation of attention. In this study, individuals with attention-maintained problem behaviors showed less problem behavior following a presession period of attention compared to those who were not exposed to presession attention. No studies, however, have investigated the manipulation of reflexive establishing operations in individuals with developmental disabilities.

The purpose of the present study was to examine the use of reflexive establishing operations as the initial stage of an intervention for children with PDD. When managing undesirable behaviors and promoting desirable behaviors from a behavioral perspective, most research and practical applications rely on techniques that use specific behavioral consequences (Wilder & Carr, 1998). Given that it is the consequences of behaviors that affect the future likelihood of the occurrence of that behavior, this emphasis is not unexpected (Smith & Iwata, 1997). However, antecedent events, particularly establishing operations, are rarely studied, even in the field of behavior analysis (Iwata, Smith, & Michael, 2000; Wilder & Carr, 1998). Manipulating antecedent events such as reflexive establishing operations may be beneficial, given that many children continue to verbally and physically resist instruction, refuse to sit in a structured setting, and display significant inattention throughout the teaching session when treatment primarily focuses on consequent events.

The goal of the present study is to demonstrate that manipulating reflexive establishing operations results in less resistance to instruction and a structured teaching environment and more cooperative behavior from the child. By pairing the teacher and teaching environment with the child's preferred activities and items, the teacher/therapist is creating a reflexive establishing operation that establishes interacting with the teacher as a valuable reinforcer and evokes behaviors from the child that prolongs that interaction. It is expected that, through this process the child will engage in behaviors that promote interaction with the therapist. Therefore, it is expected that the child will sit at the table with the therapist for longer time periods and that maladaptive behaviors that result in ignoring from the therapist will decrease.

METHOD

Participants

Two male children, one diagnosed with autism (Dan) and one diagnosed with PDD-NOS (Bill) participated in the study. These participants were selected for the study based on the following criteria: age between two and six years; diagnosis of autism or PDD, NOS; and disruptive behavior in a structured teaching environment. Both participants were enrolled at the ABC Child Development Center (East Alabama Mental Health).

Dan was 3 years 7 months at the start of the study. His disruptive behavior consisted of climbing on and under furniture, running away from adults, trying to leave the room, throwing objects, and self-stimulatory behaviors such as hand flapping and jumping up and down. In addition, Dan displayed aggressive behavior such as pinching, scratching, biting, and hitting. Dan was also completely nonverbal but frequently engaged in vocal noisemaking during sessions.

Bill was 2 years 9 months when the study began. His disruptive behavior consisted of climbing on and under furniture, throwing objects, trying to leave the room, flopping on the floor, and crying/whining. Bill did not exhibit aggressive behavior. Bill was able to use one and two word phrases to indicate interests, desires, and labels of item (e.g., cookie, cow). However, at the start of his participation, the frequency of his vocalizations was low.

Setting and Apparatus

Each session was conducted and videotaped in a playroom adjacent to the main preschool room at the ABC Child Development Center. Sessions were scheduled two to five days per week; however, sessions were occasionally canceled due to illness and other circumstances. Only the participant, the research assistant conducting the session, and the individual taping the session were in the therapy room during each session. The therapy room contained three tables and chairs, an observation window, a sink, several toys and bookshelves, and four exits.

Procedure

Research assistants (RA). All RAs previously worked for at least one semester for 5 hours per week with the Developmental Disabilities Clinic, which is housed within the Auburn University Psychological Services Center. While working with the Developmental Disabilities Clinic, each student learned basic behavioral intervention strategies as part of a 1 hour per week class. These skills included reinforcement of positive behaviors, ignoring undesirable behaviors, prompting, fading, and shaping techniques. Each RA passed a written quiz consisting of questions pertinent to the present study (i.e., knowledge of behavioral intervention techniques, description of phases) and role played each phase of the study with the principal investigator (PI). In addition, RAs who coded videotaped sessions passed a quiz of behavioral definitions and each RA obtained interobserver agreement of at least 80% with the PI on practice codings.

Experimental Design. A within-subjects design was utilized to assess each participant's response to the intervention phase. Specifically, a multiple-schedule design, more generally referred to as a multi-element design (Sulzer-Azaroff & Mayer, 1991), with a reversal was used. A multiple-schedule design allows for the comparison of two or more differing intervention methods or an intervention method and a baseline condition presented during the same treatment phase with an individual participant (Kazdin, 1978). Although similar to a simultaneous-treatment design, the multiple-schedule design incorporates two conditions that are consistently associated with a particular stimulus condition. Compared to other designs, this design minimizes difficulties, such as sequence effects, that arise when using other designs and it permits a direct comparison between treatments. However, multiple-treatment interference is a concern when using this design (Kazdin, 1982). Multiple-treatment interference refers to carry over effects from one intervention condition to next when switching between two intervention conditions.

The multiple-schedule design begins with a baseline phase after which two or more interventions are employed. Although the interventions are implemented concurrently, each intervention is associated with its own stimulus conditions. Following the intervention phase, the most effective treatment may be continued or the interventions can be removed to determine if the individual's behavior reverts back to baseline levels (Kazdin & Geesey, 1977). Control is shown primarily in the changes in behaviors from baseline to the treatment phase associated with each of the interventions (Gelfand & Hartmann, 1984).

In the present study, a variation of the multiple-schedule design was applied, using three phases. Each participant was assigned to two research assistants, RA1 and RA2, who conducted either the baseline or intervention condition. Each day, one session was conducted by RA1 and one session was conducted by RA2. RA1 and RA 2 alternated as to who conducted the first session. During the first phase of the study (baseline), both RA1 and RA2 conducted Demand Situation Baseline Phase sessions. During the second phase of the study (intervention), RA1 conducted Pairing Phase sessions, while RA2 continued to conduct Demand Situation Baseline sessions. During the final phase (return to baseline), RA2 continued to conduct Demand Situation Baseline sessions and RA1 returned to the Demand Situation Baseline Phase.

Demand Situation Baseline Phase. This first phase was conducted with each child by RA1 and RA2 to determine his current levels of compliance and maladaptive behaviors, the child's initial amount of interaction with the RAs, and time spent at the teaching table when presented with developmentally appropriate demands. In this phase, each child was presented with a demand task such as sorting, completing several single-inset puzzles, putting snap beads together, or imitating simple motor movements. These items were selected from the Assessment of Basic Language and Learning Skills (ABLLS; Partington & Sundberg, 1998).

Four types of tasks were presented. The first was a sorting task with three items, each presented a total of three times. Two single-inset puzzles were presented one time each. Ten motor imitation items were presented, three times each. Five of the motor imitation items involved the manipulation of objects such as ringing a bell and pushing a car. The other five motor imitation items consisted of imitating simple gross motor movements. The final type of task, presented once, involved pulling a set of four snap beads apart. The demand items presented during each Demand Situation session were listed on a prompt sheet (see Appendix 1) to aid in administration. Each RA tried to present materials at the teaching table; however, if the participant would not sit, the RA presented materials to him at other locations in the therapy room.

Vocal praise was given contingent upon compliant behavior, which mimicks a typical classroom interaction between a teacher and child. Mild maladaptive behaviors such as crying, whining, and mild tantrums were ignored and the RA continued to present tasks. Each Demand Situation Baseline session lasted approximately 10 minutes. During this phase, the participants had one Demand Situation session with RA1 and one Demand Situation session with RA2.

Pairing Phase. Following the Demand Situation Baseline Phase, each participant went through the Pairing intervention phase with RA1 while continuing Demand Situation sessions with RA2. It was during this phase that the REO was manipulated. During the Pairing Phase, RA1 interacted with the child in a low-demand, high density reinforcement session. RA1 presented the child with preferred items and activities frequently throughout the session and eliminated commands from the interaction. The items presented to each participant were idiosyncratic and based on a list of items provided by the child's parent/guardian. In addition, novel items were made available and used if the participant showed an interest in the object or snack. The participants were not required to participate in any activity and were permitted to refuse any offered items. All maladaptive behaviors that were emitted by the child were ignored unless deemed dangerous. If the participant attempted to leave the room, RA1 attempted to promote interest in a toy or activity.

Each pairing session with RA1 lasted approximately 20 minutes. Ten Pairing sessions were conducted with Bill and 12 sessions with Dan. Given that no other studies have investigated the manipulation of REOs, the length of the Pairing Phase was based on the clinical experience of the PI. Thus, a minimum of five Pairing sessions in which appropriate in-seat behavior was at or above 70% were needed before returning to the Demand Baseline phase.

Demand Situation Phase. Following the Intervention Phase with RA1, the participants returned to the Demand Situation Phase. These sessions were conducted just as the initial Demand Situation Baseline sessions. During this final phase, both RA1 and RA2 conducted Demand Situation sessions with the participants.

Data Collection

Each session was videotaped and later coded by trained research assistants. Both frequency and duration were coded for specific behaviors. The behaviors coded for each participant and behavioral definitions are included in Table 1.

Interobserver Agreement

A second independent observer also coded behavior to provide interobserver reliability for at least 18% of the selected sessions. Interobserver reliability percentages for frequency counts were calculated by dividing the number of agreements by the number of disagreements plus the agreements, and multiplying by 100%. Interobserver agreement (IOA) for duration was calculated by dividing the duration recorded by the first observer by the duration recorded by the second observer and multiplying by 100%.

RESULTS

Interobserver Agreement

IOA was obtained for each coded category for Dan and Bill. Sessions were randomly selected for interobserver agreement coding. IOA ranged from 93.34% to 100% for Dan and from 87.5% to 100% for Bill. The percentage of sessions coded and results are presented in Table 2.

For each relevant behavior, a graph depicting responses during each session is presented followed by a graph depicting the mean of all responses during each phase of the study. Thus, changes from session to session as well as the overall change during each phase can be examined and discussed.

Dan

The behavioral data for Dan are presented first. Figure 1 presents the percent of session time that Dan sat appropriately during baseline, intervention, and return to baseline (RTB) phases with RA1 (pairing) and RA2 (nonpairing). Responses during sessions with RA1, the therapist who conducted Pairing sessions, are depicted by the closed circles. Responses during sessions with RA2, the therapist who conducted only Demand Situation Baseline sessions, are depicted by the open squares.

During the Baseline condition Dan's appropriate in-seat behavior occurred for a small percent of each session with both RA1 and RA2. With the initiation of the intervention phase, Dan's appropriate in-seat behavior rose after only three sessions and remained consistently high with RA1, while his appropriate in-seat behavior remained low during sessions with RA2. During the first session of the RTB phase there was a decrease in Dan's appropriate in-seat behavior with RA1. However, the following three sessions show consistently high percentages relative to both baseline and RA2. Dan's appropriate in-seat behavior with RA2 during the RTB phase continued to be low.

Figure 2 depicts the mean appropriate in-seat behavior during each phase for RA1 and RA2. Although Dan's percent of appropriate in-seat behavior increases slightly over time with RA2, there is a clear increase with RA1 that persists through the RTB phase.

Figure 3 presents the latency in seconds to the first voluntary sit once Dan entered the therapy room. During the baseline phase the latency to first sit was variable across sessions with both RA1 and RA2. A point at 600 seconds indicates that Dan never sat down during the session. During some sessions in the baseline phase, Dan quickly came to the teaching table and sat down, while during others he came to the table after several minutes or not at all. Once the intervention phase was initiated, Dan began coming to the teaching table with RA1 much more quickly after only two sessions. In addition, the latency to first sit with RA1 was consistently low with the exception of session 29 and continued to be low through the RTB phase. With RA2, Dan's latency to first sit remained variable with only a few sessions in which the latency was comparable to that with RA1. The variability in latency with RA2 was seen throughout all phases.

Figure 4 depicts the mean latency to first sit for each therapist during each phase. During the baseline phase, Dan's mean latency to first sit was 251 and 331.5 seconds for RA1 and RA2, respectively. Although Dan's latency to first sit decreased over time with both RA1 and RA2, a much more pronounced decrease was seen with RA1 to a mean latency of 20.5 seconds compared to 175.75 seconds with RA2 during the RTB phase.

Figure 5 depicts the responses per minute of Dan's attempts to leave the therapy room (i.e., elopement). Dan attempted to leave the therapy room at a minimum rate of 0.1 each session except the last session during the baseline phase. With the initiation of the intervention phase, a decrease in attempts was initially seen with both RA1 and RA2. However, this decrease persisted only during sessions with RA1. Dan's attempts to leave the room, although variable, increased with RA2 and persisted through the RTB phase. His attempts to leave the room with RA1 eventually stopped during intervention and throughout the RTB phase.

Figure 6 shows the mean rate of Dan's attempts to leave the therapy room during each phase with RA1 and RA2. During the baseline phase, Dan attempted to leave the therapy room at an average rate of 0.5 per minute per session with RA2 and 0.3 per minute per session with RA1. During the intervention phase, Dan's attempts to leave reduced with both RA1 and RA2. During the RTB phase, Dan's attempts to leave terminated. His attempts to leave during the RTB phase with RA2 increased to an average of .4 per minute and were comparable to his behavior during baseline.

Figure 7 shows the rate of Dan's combined inappropriate behaviors (i.e., CIs) per minute during each session. Dan's combined inappropriate behavior included aggression and elopement. During baseline sessions, Dan exhibited inappropriate behavior with both RA1 and RA2. With the initiation of intervention sessions, inappropriate behavior remained consistently low with RA1. However, with repeated Demand sessions with

RA2, Dan's inappropriate behavior increased for several sessions. During RTB, Dan's inappropriate behavior was similar to baseline levels with both RA1 and RA2.

Figure 8 shows the mean rate of Dan's combined inappropriate behaviors across phases with RA1 and RA2. Similar mean rates were seen with both RA1 and RA2 during the baseline phase. During the intervention phase, the mean rate of CIs with RA2 was much higher compared to both RA1 and baseline rates. During RTB, Dan's mean rate of CIs remained lower with RA1 relative to RA2, although a decrease in CIs was also seen with RA2.

Bill

Figure 9 shows the percent of each session that Bill spent seated appropriately with RA1 and RA2 during baseline, intervention, and RTB phases. During the baseline phase, Bill's appropriate in-seat behavior with RA1 ranged from approximately 25 to 62 percent of the session. His appropriate in-seat behavior with RA2 ranged from approximately 10 to 45 percent of the session. With the initiation of the intervention phase, Bill's appropriate in-seat behavior showed a marked increase with RA1 (pairing) ranging from approximately 45 to 95 percent of the session. Bill's percent of appropriate in-seat behavior with RA2 (nonpairing) showed an increasing trend, ranging from approximately 20 to 77 percent of the session, but remained distinctly lower than with RA1. During the RTB phase, Bill's percent of appropriate in-seat behavior stayed consistently high, ranging from approximately 65 to 97 percent of the session with RA1. During the final phase there was more variability in Bill's appropriate in-seat behavior with RA2. Although Bill's appropriate in-seat behavior reached a level comparable to that seen in sessions with RA1 in one session, the majority of the sessions with RA2 showed a lower percentage of appropriate in-seat behavior. With RA2, Bill's appropriate in-seat behavior ranged from approximately 8 to 95 percent of the session.

Figure 10 shows the mean percent of appropriate in-seat behavior during baseline, intervention, and RTB phases with RA1 and RA2. During the baseline phase, Bill's mean appropriate in-seat behavior for both RA1 and RA2 was below 60 percent. Throughout the intervention and RTB phases, Bill's mean appropriate in-seat behavior remained below 60 percent with RA2. With RA1, Bill's mean appropriate in-seat behavior during the intervention phase approached 75 percent and approached 90 percent during the RTB phase. However, an increasing trend is seen across phases with both RA1 and RA2.

Figure 11 shows the rate of Bill's crying/whining per minute for each session during the three phases with RA1 and RA2. During baseline, Bill exhibited crying/whining in all sessions with RA1 and RA2. With RA1, Bill's rate of crying/whining ranged from approximately .6 to approximately 1.7 occurrences per minute. With RA2, Bill's rate of crying/whining ranged from approximately .6 to approximately 1.3 occurrences per minute. With the initiation of the intervention phase, the rate of Bill's crying/whining during sessions with RA1 decreased and stayed consistently lower relative to baseline. The rate of Bill's crying/whining with RA2 remained consistently higher than that seen with RA1. During RTB there was an initial increase in Bill's rate of crying/whining with RA1. However, his crying/whining returned to low levels. Bill's crying/whining with RA2 also decreased during RTB.

Figure 12 shows the mean rate of Bill's crying/whining during baseline, intervention, and RTB phases with RA1 and RA2. Bill's mean rate of crying/whining decreased markedly between baseline and intervention with RA1. With RA2, Bill's mean rate of crying/whining initially increased from baseline to intervention and decreased from intervention to RTB. However, baseline and RTB levels of crying/whining for RA2 were more similar than those seen with RA1.

Figure 13 shows the rate of Bill's attempts to leave the therapy room (i.e., elopement) per minute during each session. During Baseline, Bill attempted to leave the therapy room at least once in all sessions except the first session with RA2. With the initiation of the intervention phase, Bill's attempts to leave the room stopped for the remainder of the phase with RA1. Bill continued to attempt consistently to leave the therapy room with RA2 throughout the intervention phase. During the RTB phase, there was an initial increase in Bill's attempts to leave the therapy with the initiation of demands from RA1. However, his attempts did not persist and he did not attempt to leave the room during any subsequent sessions with RA1. During the RTB phase with RA2, Bill's attempts to leave the room also decreased with attempts occurring in only two of the sessions.

Figure 14 shows the mean rate of Bill's attempts to leave the therapy room during baseline, intervention, and RTB phases with RA1 and RA2. Bill's mean rate of attempting to leave remained stable from baseline to intervention with RA2 while it decreased dramatically with RA1. During the final phase, the mean rate of Bill's attempts to leave with RA1 and RA2 was identical.

Figure 15 shows the rate of Bill's flopping to the ground per minute during each session. During the baseline phase, Bill flopped to ground during every session with both RA1 and RA2. With the initiation of the intervention phase, Bill's flopping to the ground stopped. With RA2, Bill's rate of flopping was variable but continued to occur during most sessions. During RTB, Bill's flopping continued to occur with RA2. With RA1, Bill's flopping was absent with the exception of the first session of RTB.

Figure 16 shows the mean rate of Bill's flopping per minute during each session. Differences in the rate of Bill's flopping with RA1 and RA2 were seen during the baseline phase. A decrease in Bill's mean rate of flopping was seen with both RAs; however, his mean rate of flopping remained higher during all three phases with RA2. With RA1 there was a dramatic decrease in rate of flopping from baseline to intervention and RTB.

Figure 17 shows the rate of Bill's combined inappropriate behavior (i.e., CIs) per minute in each session during all three phases with RA1 and RA2. CIs included counts of climbing on and under furniture, throwing objects, attempting to leave, crying/whining, and flopping to the floor. During baseline, Bill displayed inappropriate behavior with both RA1 and RA2 in all sessions. With the initiation of the intervention phase there was a decrease in the inappropriate behavior exhibited by Bill with RA1 that persisted throughout the intervention phase. The inappropriate behavior exhibited with RA2 during the intervention phase was higher than with RA1 and consistent with levels seen at baseline. During the RTB, phase there was a slight increase in Bill's inappropriate behavior during the first session with RA1 but it remained consistently low in all subsequent sessions. With RA2, Bill's inappropriate behavior was more variable. Bill's inappropriate behavior exhibited in two of the sessions was comparable to that exhibited by RA1. However, his inappropriate behavior in all other sessions during the final phase was higher than that seen in sessions with RA1 and consistent with levels seen during baseline and intervention sessions.

Figure 18 shows the mean rate of Bill's CIs. A reduction in inappropriate behavior from baseline to intervention and return to baseline was seen with RA1. Although there was a slight reduction in inappropriate behavior across phases with RA2, the reduction was not as pronounced as that seen with RA1 and his CIs during RTB were clearly more frequent with RA2 than with RA1.

DISCUSSION

The purpose of the present study was to examine the manipulation of a reflexive establishing operation as a component of an intervention with children with PDDs. During the Baseline phase, both RA1 and RA2 consistently and repeatedly presented demands in a structured teaching environment. Through this repeated pairing of the therapist with a worsening of conditions (i.e., demands), escape from demands and the therapist was established as effective reinforcement and evoked behavior that resulted in escape. Thus, during the Baseline phase, leaving the teaching table and attempting to leave the therapy room occurred frequently.

During the intervention phase, RA1 paired herself and the teaching table with the presentation of preferred items and activities, while RA2 continued to pair with the presentation of demands. Through this repeated pairing of the therapist (i.e., RA1) with an improving set of conditions (i.e., preferred items, absence of demands), prolonged interaction with the therapist was established as effective reinforcement and evoked behavior that resulted in prolonged interaction. Thus, during the intervention phase sitting at the teaching table increased and attempting to leave the therapy room decreased.

During the RTB phase, both RA1 and RA2 presented demands similar to the Baseline phase. Generally, both participants displayed less maladaptive behavior and stayed seated at the table with RA1, the pairing therapist, compared to RA2 and compared to Baseline. Therefore, the hypothesis that each participant would sit for longer periods of time at the teaching table with the pairing therapist, RA1, relative to the nonpairing therapist, RA2, and relative to pre-pairing (baseline) sessions was generally supported. However, the results also indicate that some disruptive behaviors may persist despite the pairing procedure.

In-seat Behavior

In order to teach many skills a child must be able to sit during a structured teaching session, often at a teaching table. Many children with developmental disabilities resist sitting during structured teaching and often leave the table or refuse to come to the table when instructed (Anderson, Taras &O'Malley Cannon, 1996; Fovel, 2002). Both Dan and Bill exhibited resistance to sitting with the therapist at the teaching table during baseline. Both participants showed an increase in appropriate in-seat behavior with the initiation of the intervention phase with RA1, the pairing therapist. In addition, both Dan and Bill continued to sit appropriately for a higher percentage of sessions during RTB compared to sessions during baseline and sessions with RA2, indicating that they were more willing to sit during demands following a pairing procedure. These results suggest that the pairing procedure established interacting with RA1 as effective reinforcement and evoked behaviors (i.e., sitting at the table) that led to that interaction. These results also suggest that a reflexive establishing operation was manipulated.

Both Dan and Bill were more likely to continue that interaction during a demanding situation during RTB. Interestingly, during RTB, both Dan and Bill exhibited an initial increase in appropriate in-seat behavior with RA2, the nonpairing therapist. It is possible that carry over effects from sessions with RA1 were responsible for the initial increase since sessions with RA1 and RA2 were conducted similarly in RTB phase.

Carry over effects, also called multiple treatment interference (Richards, Taylor, Ramasamy, & Richards, 1999), refers to instances when one treatment condition affects behavior in another treatment condition. Thus, the more distinguishable two conditions are, the less likely there are to be carry over effects. The Demand Situation condition and the Pairing condition were distinct, resulting in discrimination between the conditions. During RTB, both RAs implemented almost identical conditions, resulting in less discrimination. Therefore, the behavior of the participants may have been affected by carry over between conditions. One disadvantage to using a multiple-schedule design is the possibility of carry over effects due to rapidly switching conditions/therapists.

Latency to first voluntary sit data are available for only one participant. Dan began voluntarily sitting at the teaching table much more quickly with the therapist who conducted pairing sessions and continued to come to the teaching table very quickly through RTB. His latency to first voluntary sit remained variable with the nonpairing therapist, however, Dan came to the teaching table quickly on several occasions. This behavior may also be due to carry over effects from sessions with RA1.

Elopement

Elopement from a structured teaching activity may occur to escape demands and a demanding interaction with a teacher or therapist (Olmi, Sevier, & Nastasi, 1997; Piazza, Hanley, & Bowman, 1997). Both Dan and Bill exhibited elopement during baseline with RA1 and RA2. With the initiation of pairing, both Bill and Dan showed an immediate reduction in rates of elopement with RA1, the pairing therapist. Dan, however, also showed a reduction initially with RA2.

The reduction in rates of elopement with both therapists may partially be explained by extinction effects in that all classroom doors were locked. If the doors were unlocked, then attempts to leave the classroom would have resulted in an opened door and option to leave the room. Because the doors were locked, attempts to leave the classroom were never reinforced; thus, the behavior may have been extinguished. However, if extinction were the only behavior change mechanism at work, a decrease to rates of zero would be expected to be consistent with both therapists. Rates of elopement during sessions with RA2 re-emerged, however, indicating that repeated presentation of demands established escape as effective reinforcement and evoked behavior (i.e., elopement) that in the past had led to escape. Bill's elopement eventually decreased with RA2 during the RTB phase. This reduction may also be explained by possible carry over effects from sessions with RA1 since sessions with RA1 and RA2 become more similar during this phase.

Crying/Whining

Children often engage in maladaptive behavior such as crying/whining when presented with demands due to a history of the removal of demands following crying/whining (Marcus, Swanson, & Vollmer, 2001). Only one participant exhibited significant and consistent rates of crying/whining during baseline sessions with RA1 and RA2. With the initiation of intervention, Bill's rates of crying/whining decreased relative to baseline sessions and sessions with RA2. If this reduction in crying/whining were explained only by the removal of all demands, one would expect re-emergence of crying/whining with the re-presentation of demands during RTB by RA1. This did not occur. Bill's rate of crying/whining remained at near zero rates throughout RTB with

RA1. With the initiation of RTB, rates of crying/whining also decreased during sessions with RA2. Again, this decrease may be explained due to carry over from sessions with RA1 given that sessions become more similar during the RTB phase.

Flopping

Flopping to the ground may occur as another form of escape from demands and therapist (Marcus, Swanson, & Vollmer, 2001). Bill exhibited significant and consistent rates of flopping to the ground during baseline sessions with RA1 and RA2. With the initiation of intervention, Bill's flopping decreased to low levels with the exception of one session with RA1. With RA2, flopping continued to occur. These results suggest that repeated presentation of demands established escape as reinforcement and evoked flopping to the ground. In contrast, pairing with RA1 eliminated the establishing operation that established escape as reinforcement and, thus, resulted in a decrease in escape behaviors such as flopping to the ground. During RTB, an initial decrease in flopping is also seen with RA2, which may be explained by carry over effects from sessions with RA1.

Combined Inappropriate Behaviors

Both Dan and Bill exhibited CIs with RA1 and RA2 during baseline sessions. With the initiation of intervention, both participants showed a clear and consistent reduction in CIs relative during sessions with RA2 and sessions in baseline. Both participants also showed continued low rates of CIs throughout RTB. Interestingly, both participants also showed a decrease in CIs during RTB with RA2. This reduction may best be explained as carry over effects from sessions with RA1.

Limitations and Future Directions

The results of the present study provide promising support for pairing the therapist and teaching environment with an improving set of conditions prior to implementing structured teaching sessions with children with developmental disabilities who are resistant to structured teaching. Following the Pairing procedure an increase in in-seat behavior as well a decrease in maladaptive behavior was observed. Despite these positive results, there are limitations to the present study.

First, the present study included only two participants. Although four participants were originally included in the study, two were excluded due to a lack of difficulties when presented with demands. More research involving a greater number of participants is needed in order to generalize the treatment effects demonstrated in the present study.

Second, due to time constraints, the RTB phase lasted only four and five sessions with Dan and Bill, respectively. In order to understand fully the effects of the EO manipulation, it would have been ideal to extend RTB sessions. By lengthening the RTB phase, the stability of the effects of the intervention could be determined. It is possible that with repeated pairings of the pairing therapist with demands during RTB, the effects of the intervention would eventually break down. Future studies should allow time for continued RTB sessions.

In addition, future studies should examine procedures aimed at extending the effects of pairing such as the use of booster pairing sessions or demand/instructional fading. Many studies have examined the utility of instructional fading (Pace, Iwata, Cowdery, Adree, & McIntyre, 1993; Piazza, Moes, & Fisher, 1996; Ringdahl et al., 2002) in decreasing maladaptive behavior during academic and vocational tasks. Instructional fading consists of gradually increasing the frequency at which instructions are presented. For example, one study (Ringdahl et al.) described an instructional fading procedure in which one instruction was given every 15 minutes. Additional instructions were added every 15 minutes following 45 minutes without problem behavior. Thus, the frequency of instruction presentation was gradually increased.

Although instructional fading involves the gradual increase in demand presentation, the period between demand presentation is typically described as a break from instruction (Ringdahl et al., 2002): there is minimal interaction between the therapist and participant between demand presentation. It would be interesting to examine instructional fading in the context of a pairing procedure where the therapist pairs herself with preferred items and activities during periods between demands.

Also due to time constraints, phase changes were not always conducted at ideal times. For example, Bill's percent of appropriate in-seat behavior was different during baseline sessions with RA1 and RA2. Ideally, baseline sessions should have been continued until more similar percentages were observed with both therapists (Johnston & Pennypacker, 1993). However, due to the frequency of his absences and the time constraints of the academic semester, the phase change to intervention had to be implemented. Often a difficulty that arises when conducting research in applied settings is that of time constraints making prolonged baselines problematic (Kazdin, 1982).

In addition, Bill's appropriate in-seat behavior within sessions with RA1 were already on an upward trend when the phase change from baseline to intervention occurred. Ideally, phase changes should not be made when trends are present (Johnston & Pennypacker). However, the presence of trends during a phase change when using a multiple-schedule design compared to other designs is less egregious. Although other experimental designs require a stable baseline prior to the initiation of the intervention phase, the multiple-schedule design does not (Kazdin, 1982; Sulzer-Azaroff, & Mayer, 1991). Because this design depends on comparing changes in behavior associated with the different treatments or a treatment versus an extended baseline, changes can still be revealed when trends are present in the data (Kazdin, 1982).

Another limitation related to phase change decisions exists in the present study. The decision to reverse back to baseline was based entirely on the behavior of each participant with the pairing therapist. Therefore, the reversal back to baseline was made once Bill met criteria with RA1 (i.e., at least five sessions in which appropriate in-seat behavior was at or above 70%). However, Bill's appropriate in-seat behavior showed a high point in the last session during the intervention phase with RA2. It would have been better to extend the intervention phase until a low point was observed with RA2.

Although some observed maladaptive behaviors decreased with the initiation of the intervention phase and remained low through RTB, others such as climbing on furniture (for Bill) and throwing objects (for Dan) remained present and variable throughout all phases. The continued occurrence of these behaviors may be due to the differing functions that the behaviors serve. For example, elopement may serve an escape function, whereas, climbing on furniture may be attention-maintained. Similarly, flopping to the ground may be escape-maintained, whereas, throwing objects may be automatically reinforced and, thus, unaffected by social consequences.

Another limitation of the present study is the lack of a functional analysis prior to the initiation of baseline. A functional analysis of behavior is an assessment method used to assess the functional relationships between target behaviors and specific environmental stimuli (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994). The results of a functional analysis of a particular behavior can aid in the selection of a suitable treatment. Understanding the functions of the maladaptive behaviors may add incremental understanding as to which behaviors are likely to change as a result of a pairing procedure and which may need other additional intervention. Future research should include a functional analysis of maladaptive behaviors and in-seat behavior prior to baseline.

Previous research involving the manipulation of EOs has primarily focused on satiation and deprivation of items, activities, and attention (Gewirtz & Baer, 1958; McComas, Thompson, & Johnson, 2003; Vollmer & Iwata, 1991). Results have indicated that manipulating EOs can facilitate or hinder treatment effects. Research investigating reflexive EOs has not previously been conducted. Overall the results of the present study support the use of a pairing procedure prior to the implementation of a structured teaching situation and suggest that manipulating reflexive establishing operations may result in higher percentages of in-seat behavior and a reduction in some maladaptive behaviors when presenting demands to children with PDDs.

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APPENDIX 1

Demand Prompt Sheet

Child's Name_______________________________

Researcher Name____________________________

Date________________ Time_________________

Sorting	Trial 1	Trial 2	Trial 3
Object 1 _________________			
Object 2 _________________			
Object 3 _________________			

Inset Puzzle	Trial 1
Puzzle 1	
Puzzle 2	

Motor Imitation	Trial 1	Trial 2	Trial 3
Clap Hands			
Tap Head			
Tap Table			
Tap Tummy			
Slap Thighs			
Block in Bucket			
Ring Bell			
Shake Rattle			
Build Tower with 4 Blocks			
Push the Car			

Snap Beads	Trial 1
Pull 4 apart	

Table 1
Behavioral definitions for "Dan" and "Bill"

		Behaviors Coded	
Behavior (Frequency)	Definition	"Dan"	"Bill"
Physical Aggression	Completed or attempted behavior aimed at the RA including hitting, kicking, biting, scratching, pinching, or throwing objects at the RA.	X	
Climbs on Furniture	Two-thirds of the participant's body is on a piece of furniture, excluding appropriate sitting.	X	X
Under Furniture	Any part of the participant's body is under a piece of furniture, excluding appropriate sitting.	X	X
Throws Objects	Any time the participant throws or drops an object excluding when an item accidentally falls from the participant's hand.	X	X
Attempts to Leave Room	Any attempt to leave the room as indicated by touching or pulling any door handle.	X	X
Flopping	Two thirds of the participant's body is on the floor.		X
Crying and Whining	Any behavior that resembles crying or whining and includes screaming and tantrum behavior.		X
Combined Inappropriate Behavior	Sum of the frequency count of all inappropriate behavior codes (except throwing for Dan).	X	X
(Duration)			
Crying and Whining	Any behavior that resembles crying or whining and includes screaming and tantrum behavior.		X
Appropriate Sitting	Length of time participant is seated on his bottom in his chair without crying or whining or pushing away further than an arm's length from the table.	X	X
Latency to First Sit	The amount of time that elapsed between entering the therapy room and the participant voluntarily sitting in his chair.	X	

Table 2

Interobserver Agreement (IOA)

	"Dan"		"Bill"	
Behavior	Percent of Sessions Coded	IOA	Percent of Sessions Coded	IOA
Physical Aggression	22.7	93.34	NA	NA
Climbs on Furniture	22.7	100	25	95.68
Under Furniture	22.7	100	20	87.5
Throws Objects	18.2	93.9	20	94.39
Attempts to Leave Room	22.7	100	20	100
Flopping	NA	NA	20	93.75
Frequency Crying/Whining	NA	NA	20	87.6
Duration Crying/Whining	NA	NA	20	94.78
Duration Appropriate Sitting	18.2	99.15	20	97.33
Latency to Sit	18.2	98.1	NA	NA

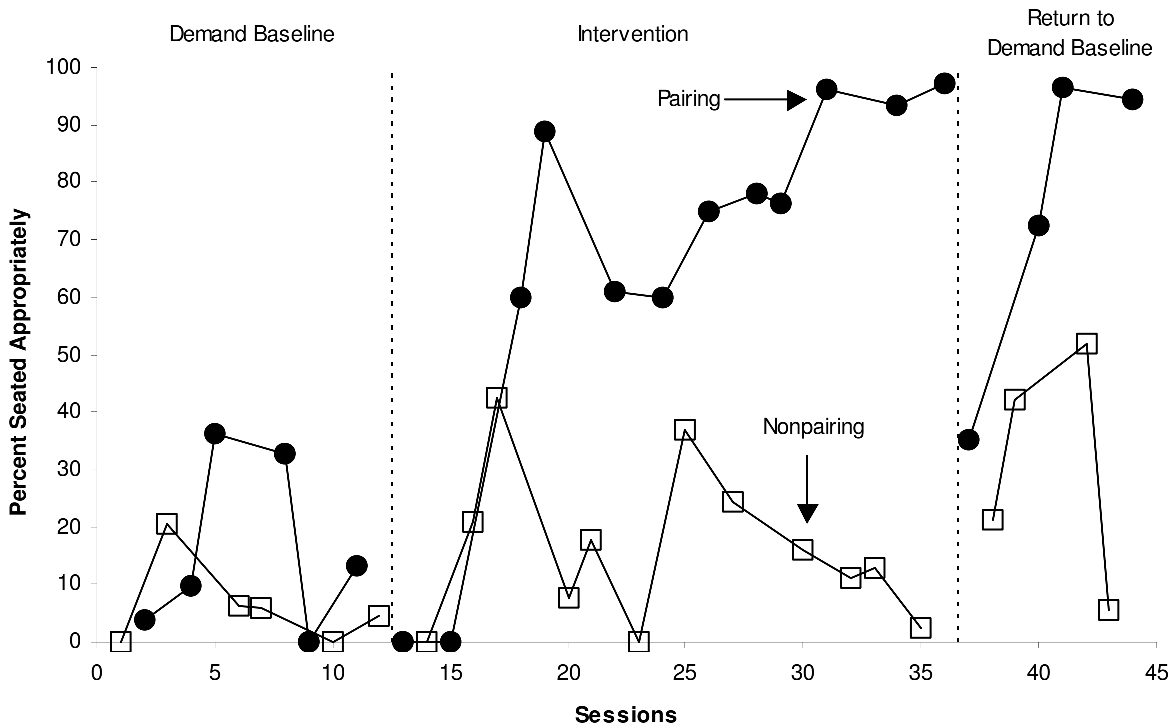

Figure 1. This graph depicts Dan's percent of appropriate in-seat behavior per session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

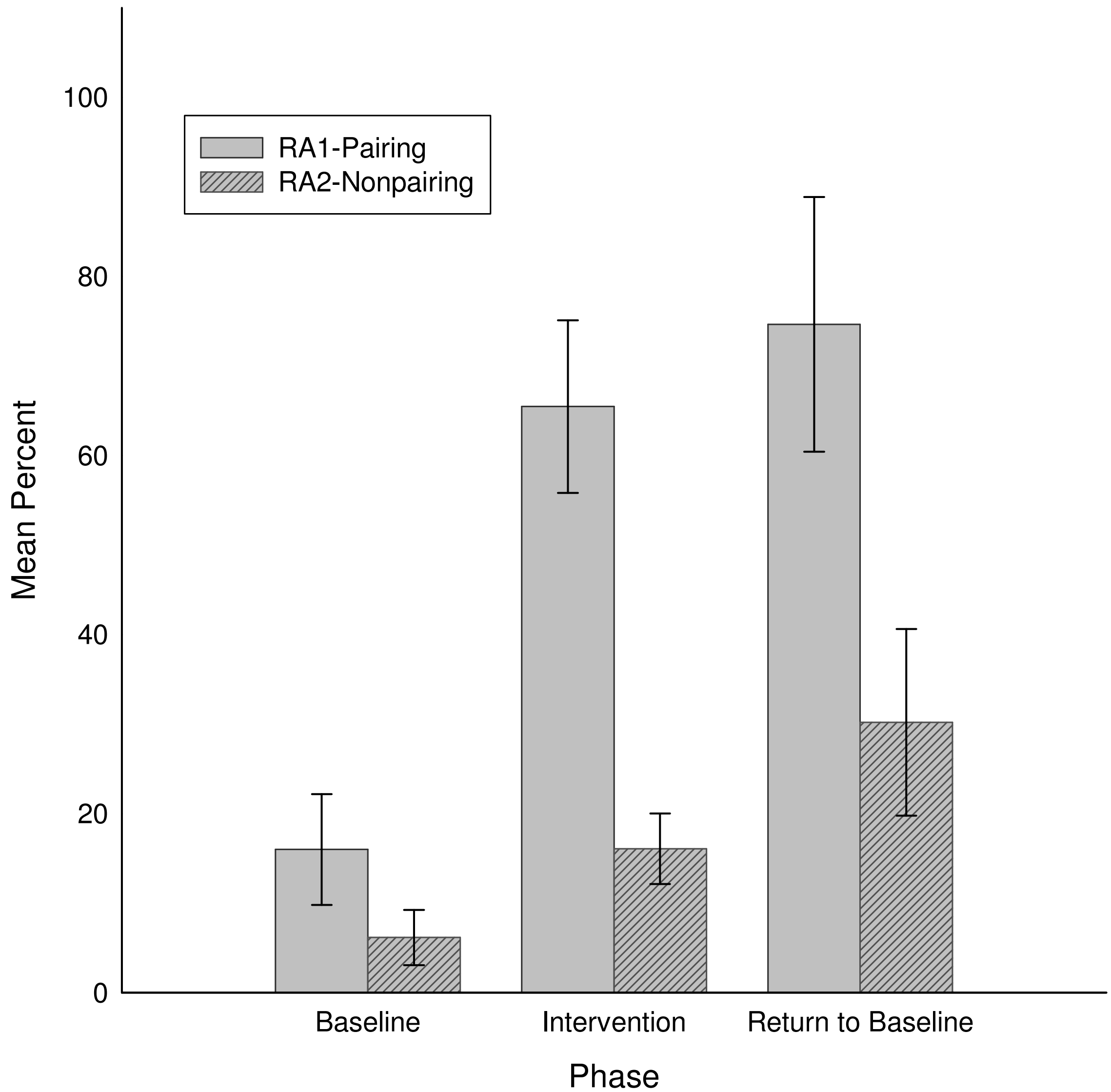

Figure 2. This graph shows the mean percent of appropriate in-seat behavior for Dan during the baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing). Error bars represent +/- standard error of the mean in all bar graphs.

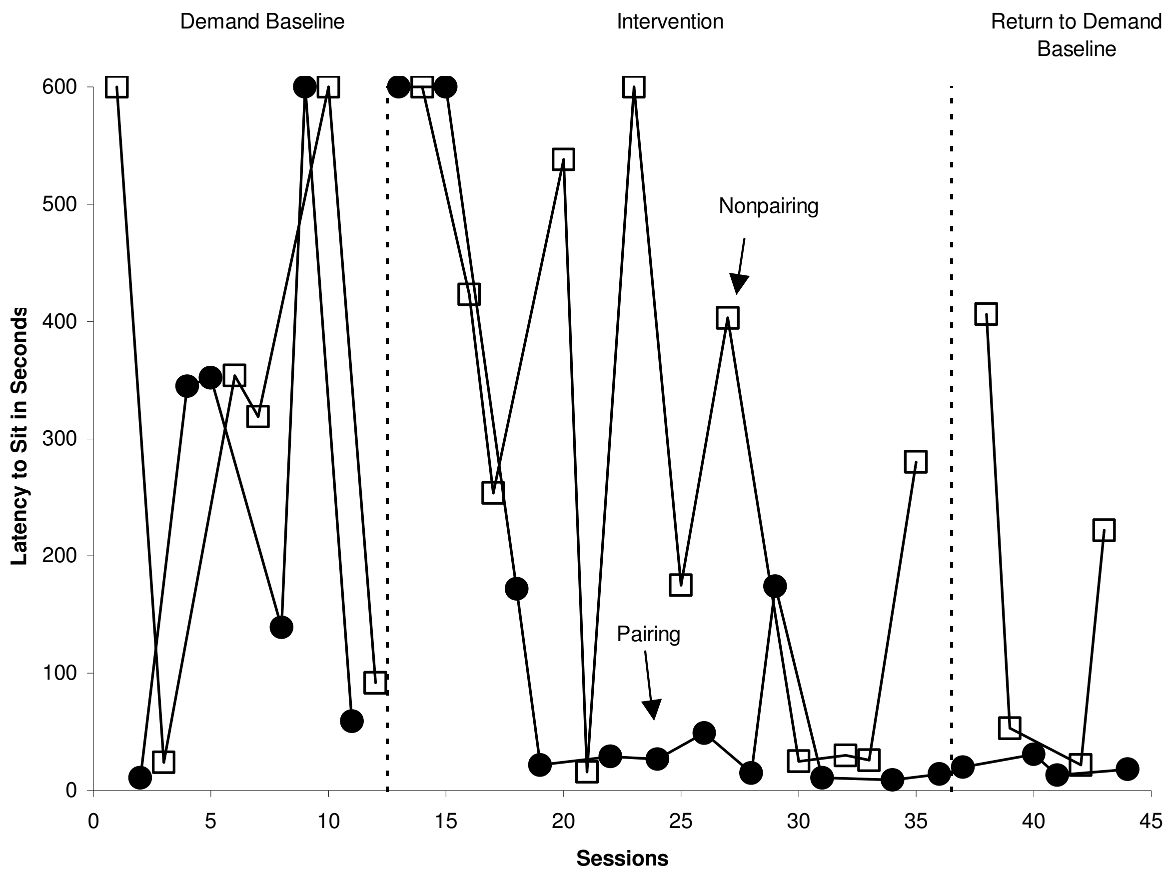

Figure 3. This graph shows Dan’s latency to first voluntary sit per session during the baseline, intervention, and RTB phases for RA1 (pairing) and RA2 (nonpairing).

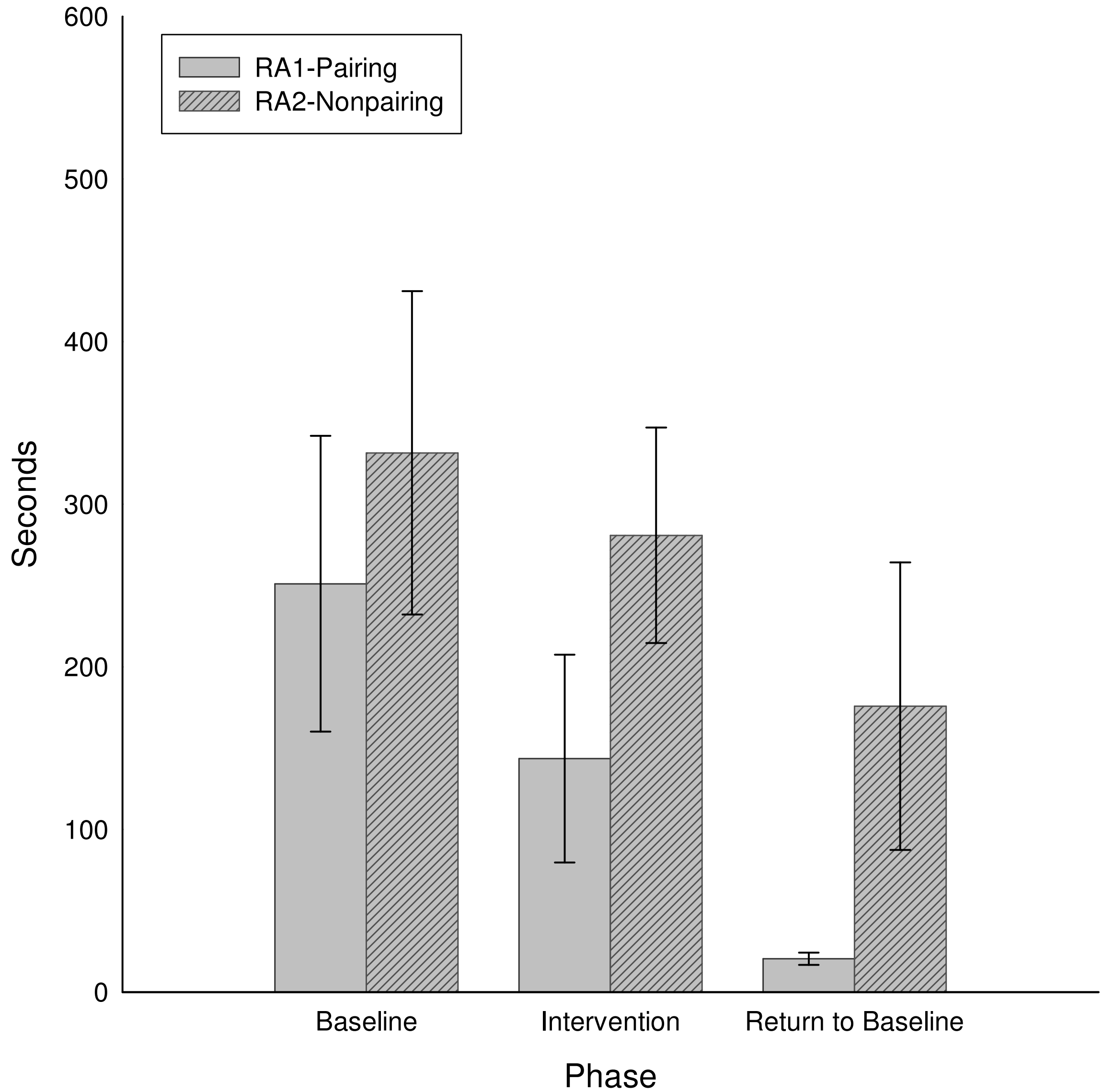

Figure 4. This graph shows the mean latency to first voluntary sit for Dan during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

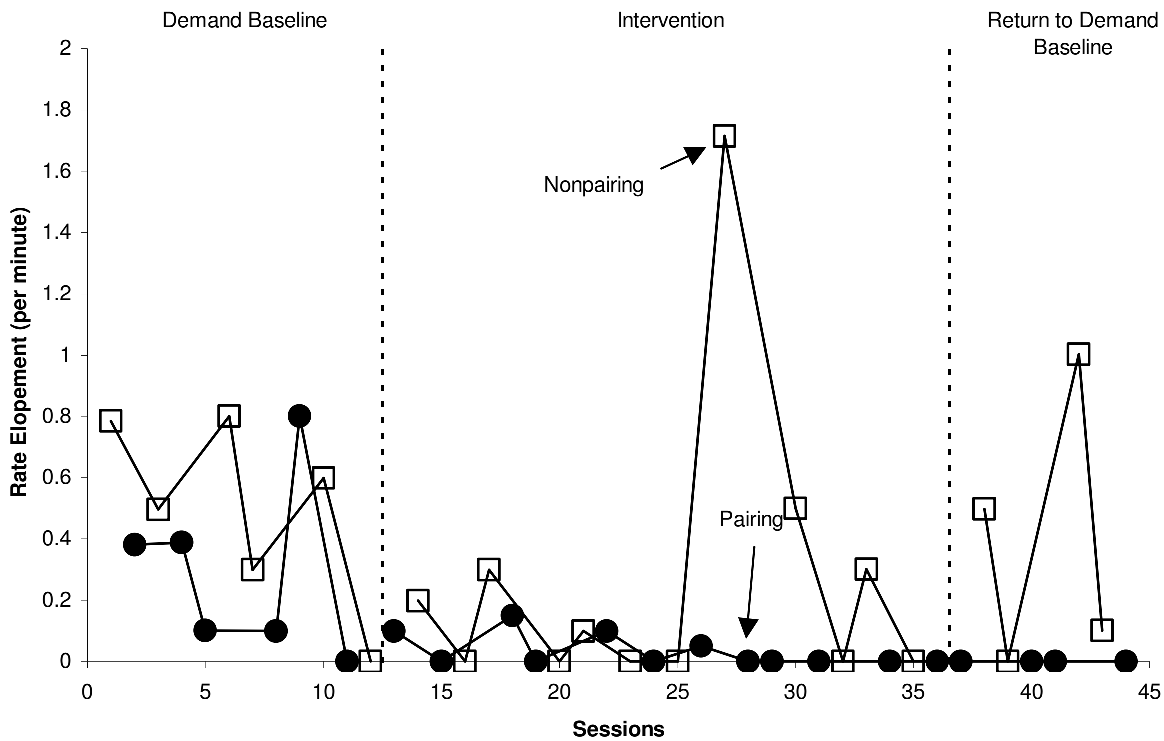

Figure 5. This graph depicts responses per minute of Dan's attempts to leave the therapy room each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

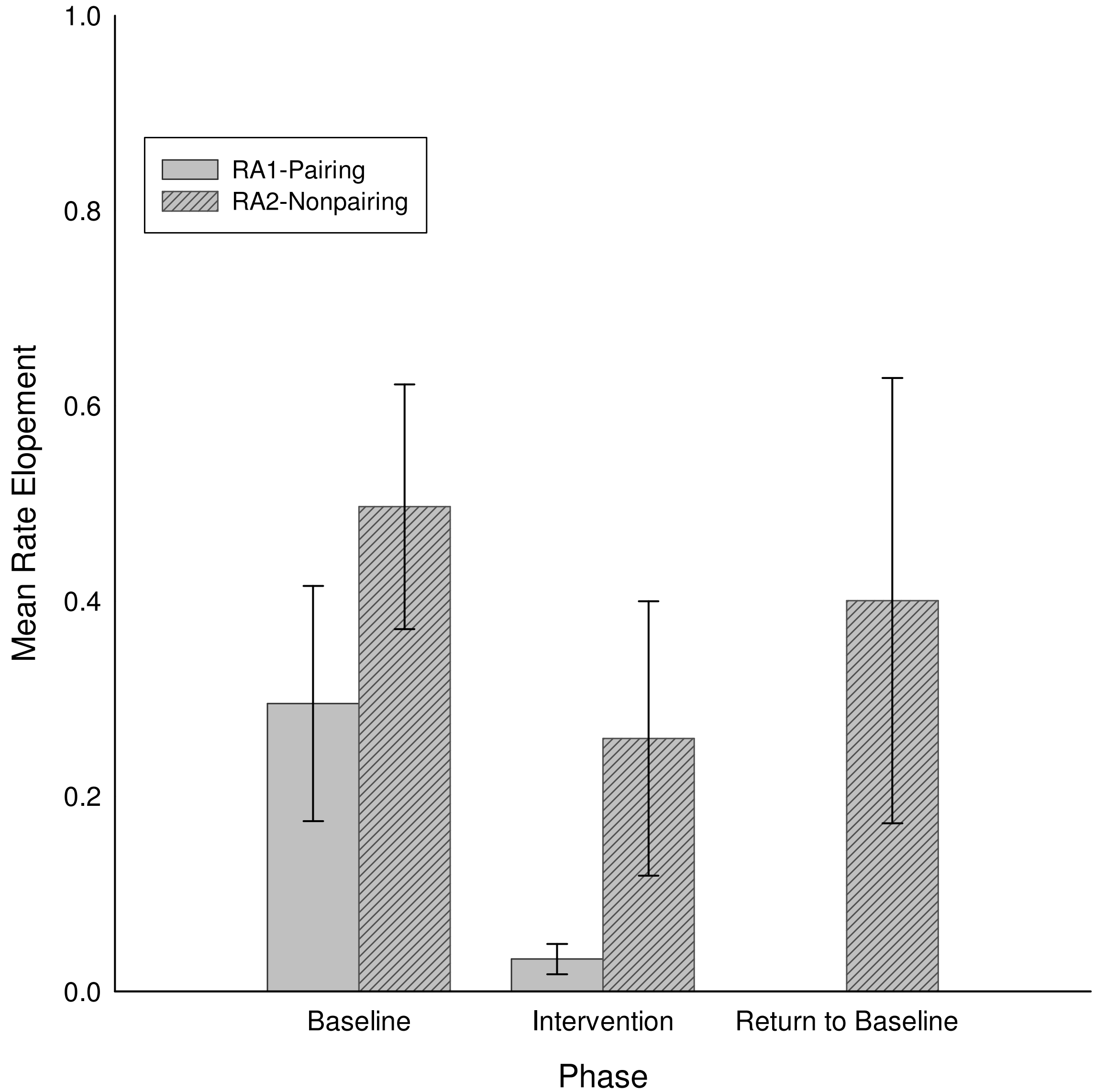

Figure 6. This graph shows the mean rate (per minute) of Dan's attempts to leave the therapy room during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

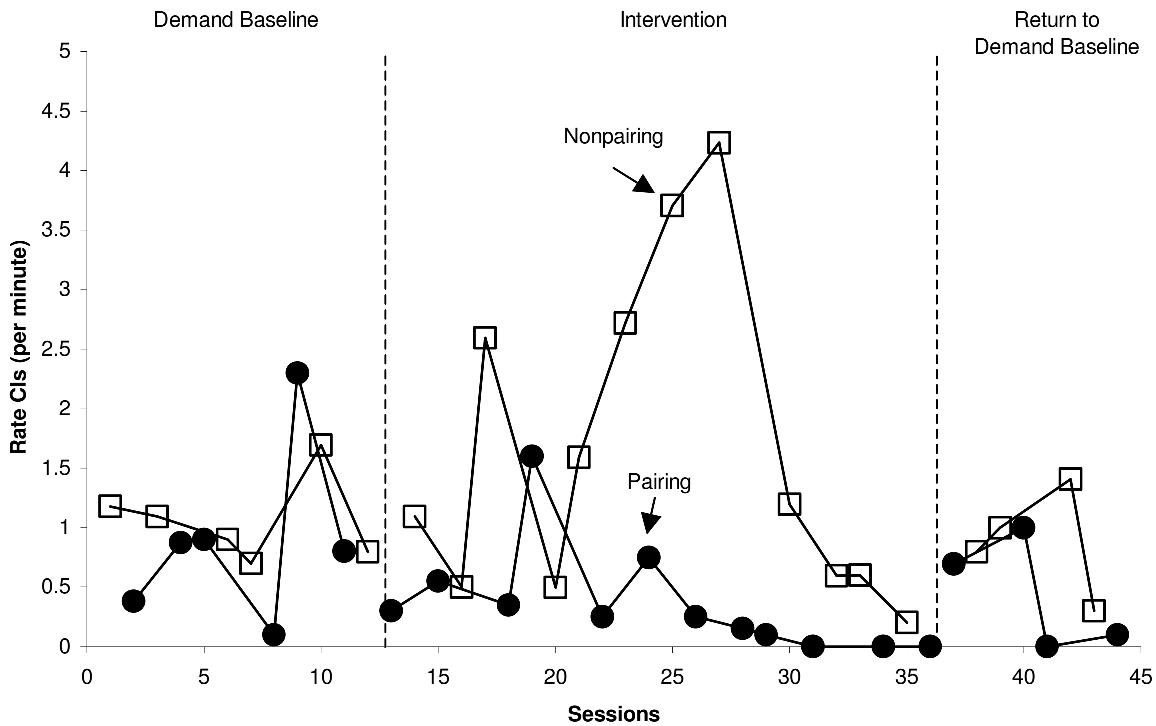

Figure 7. This graph depicts responses per minute of Dan's combined inappropriate behavior each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

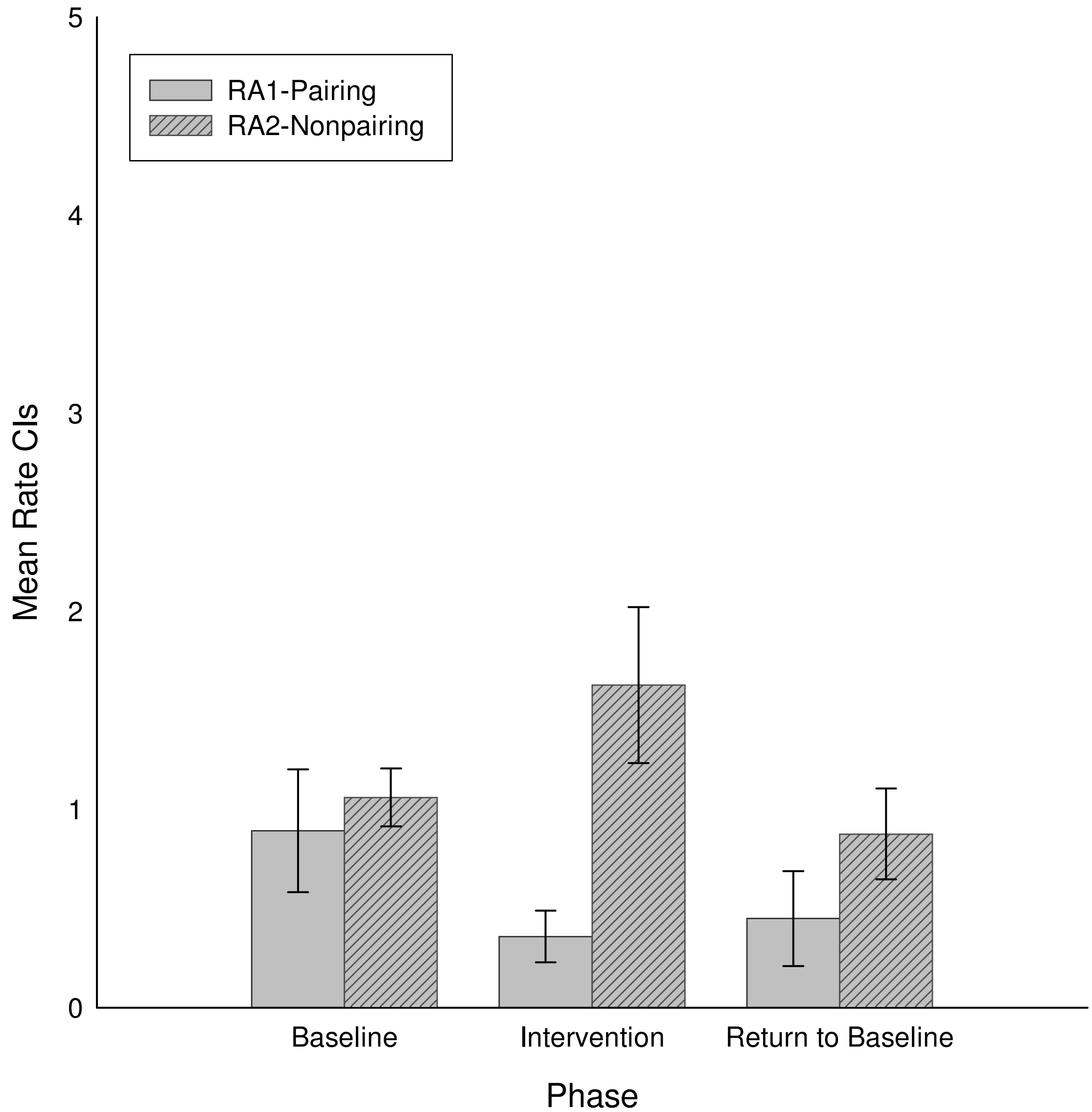

Figure 8. This graph shows the mean rate of Dan's combined inappropriate behavior during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

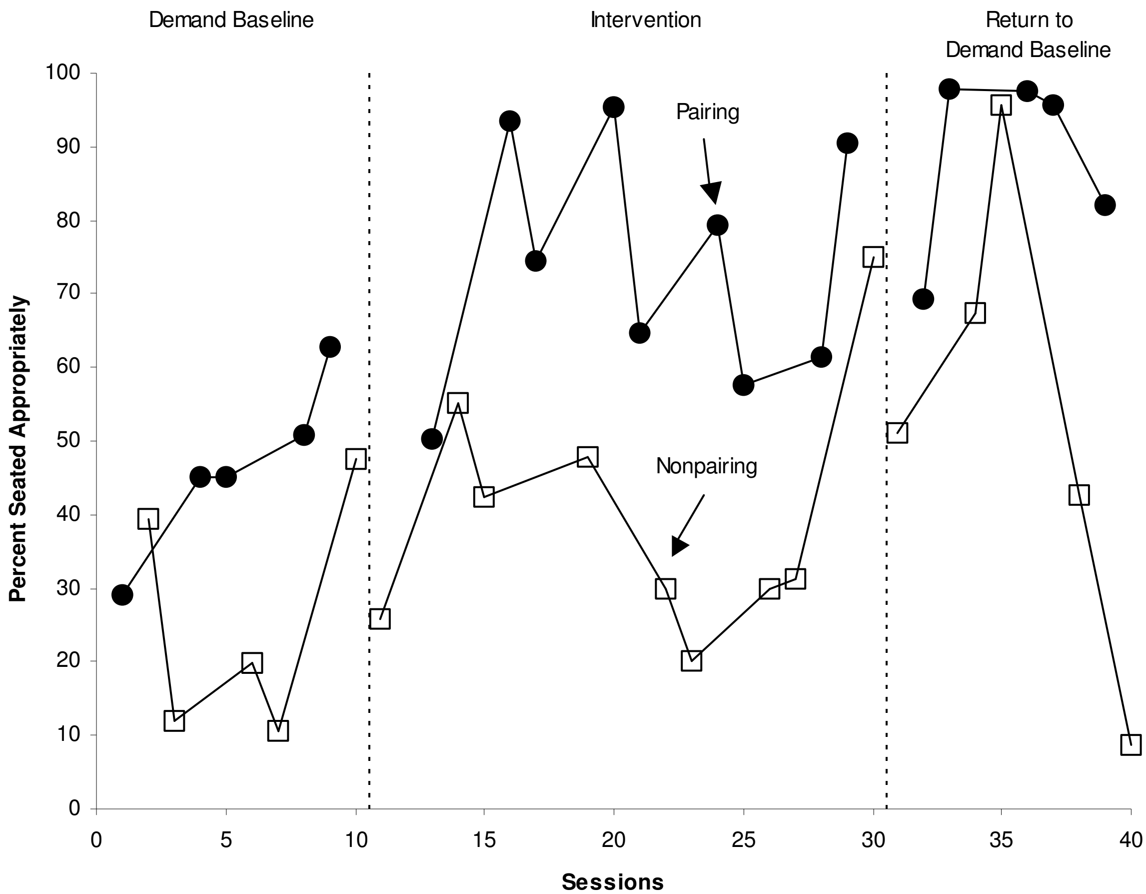

Figure 9. This graph depicts the percent of each session of appropriate in-seat behavior by Bill during baseline, intervention, and RTB sessions with RA1 (pairing) and RA2 (nonpairing).

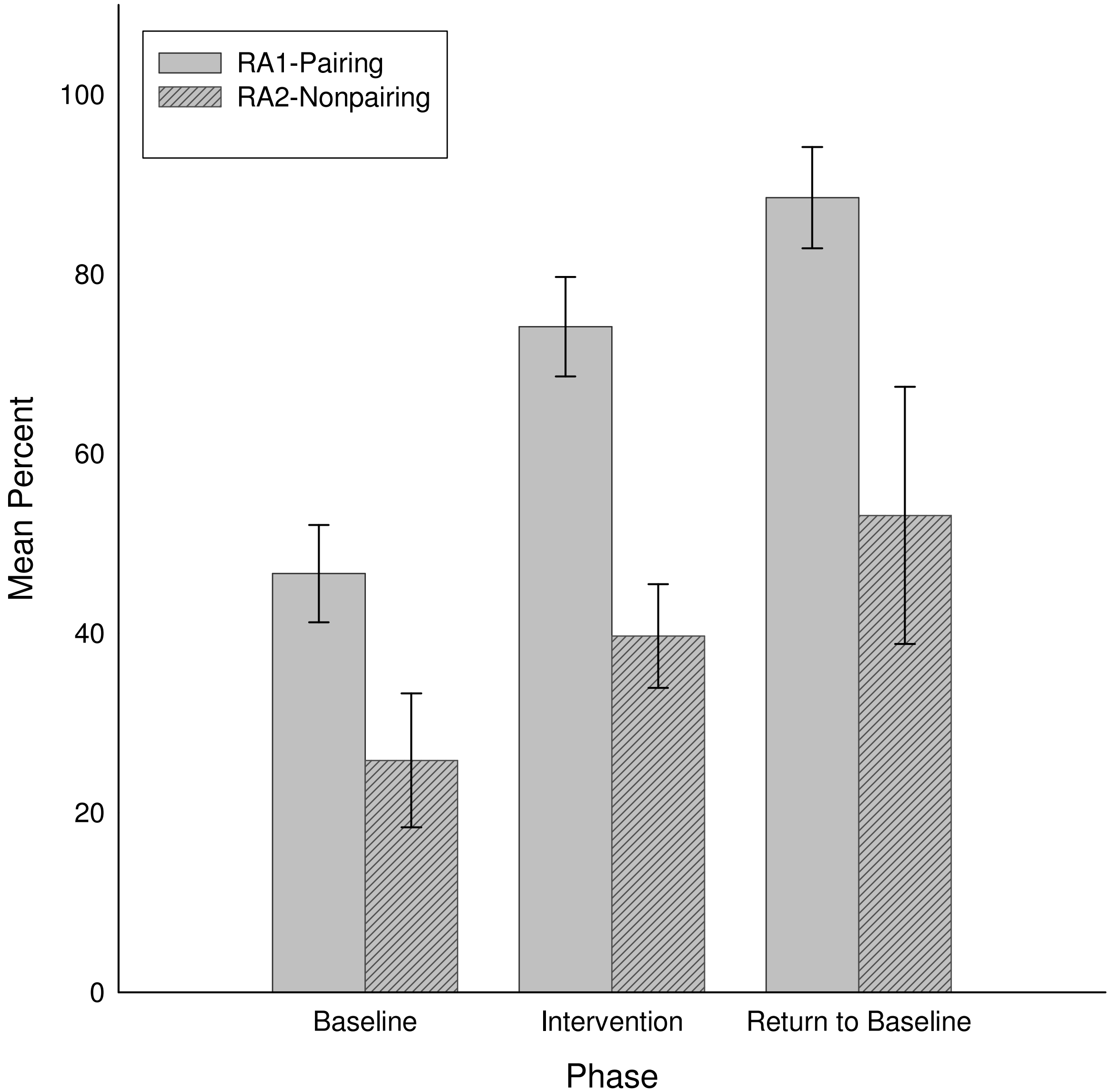

Figure 10. This graph shows Bill's mean percent of appropriate in-seat behavior during baseline, intervention, and return to return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

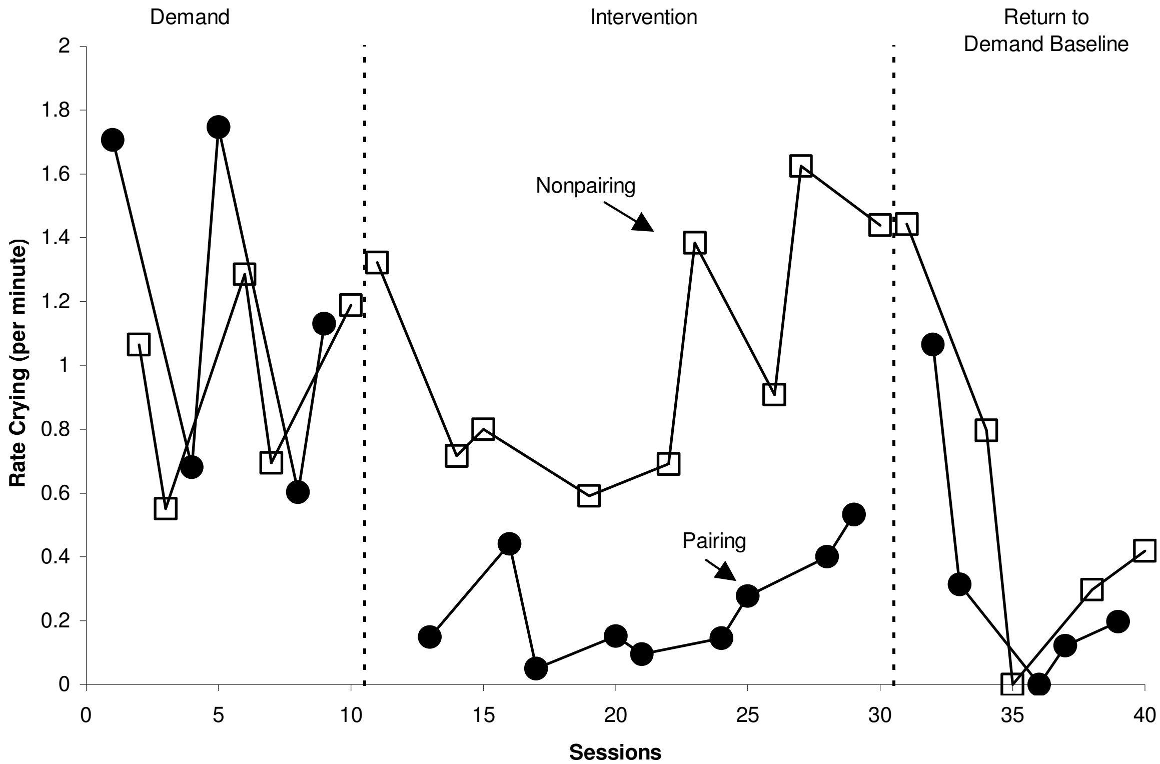

Figure 11. This graph shows responses per minute of Bill's crying/whining for each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

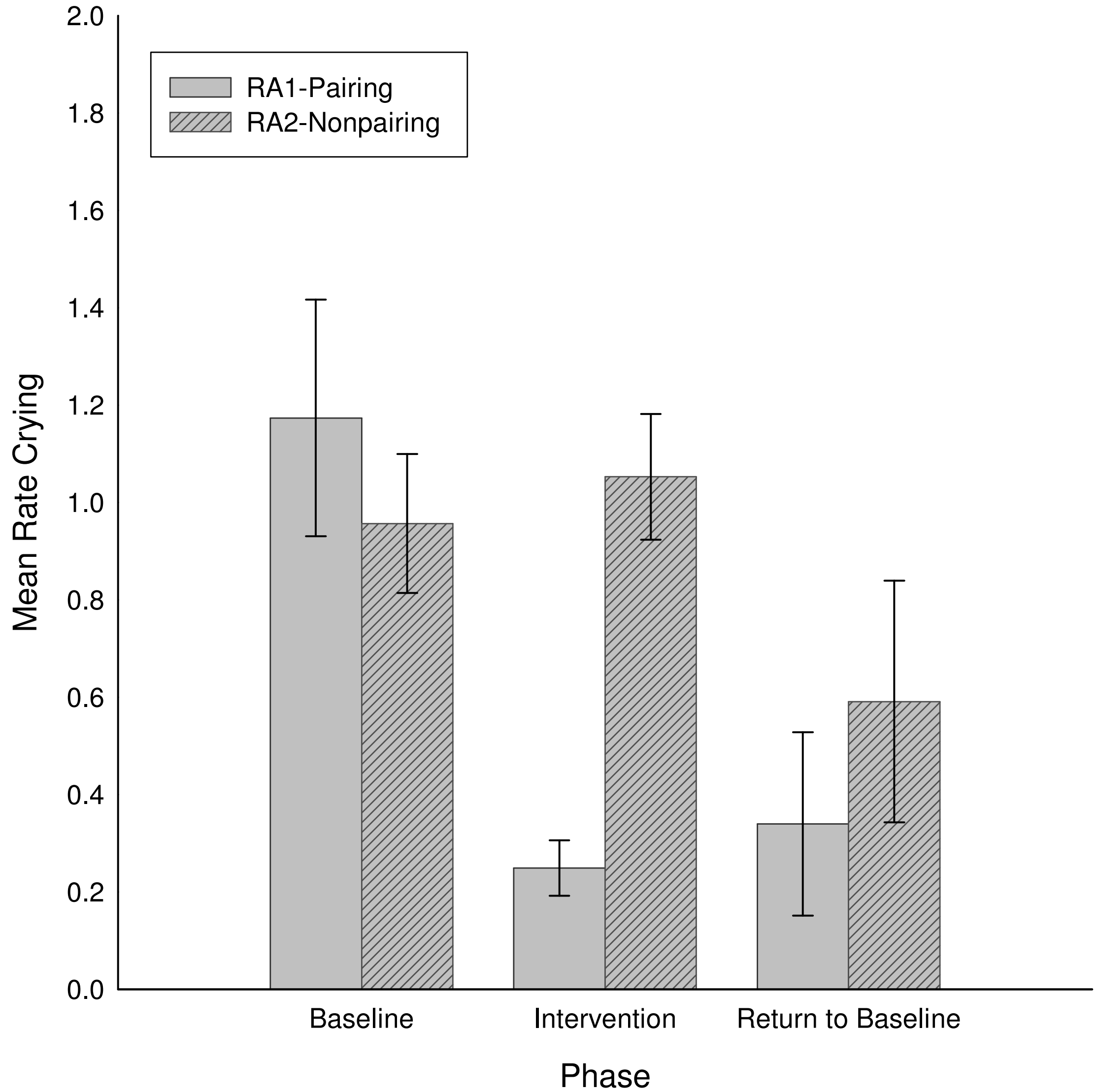

Figure 12. This graph shows the mean rate of crying/whining by Bill during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

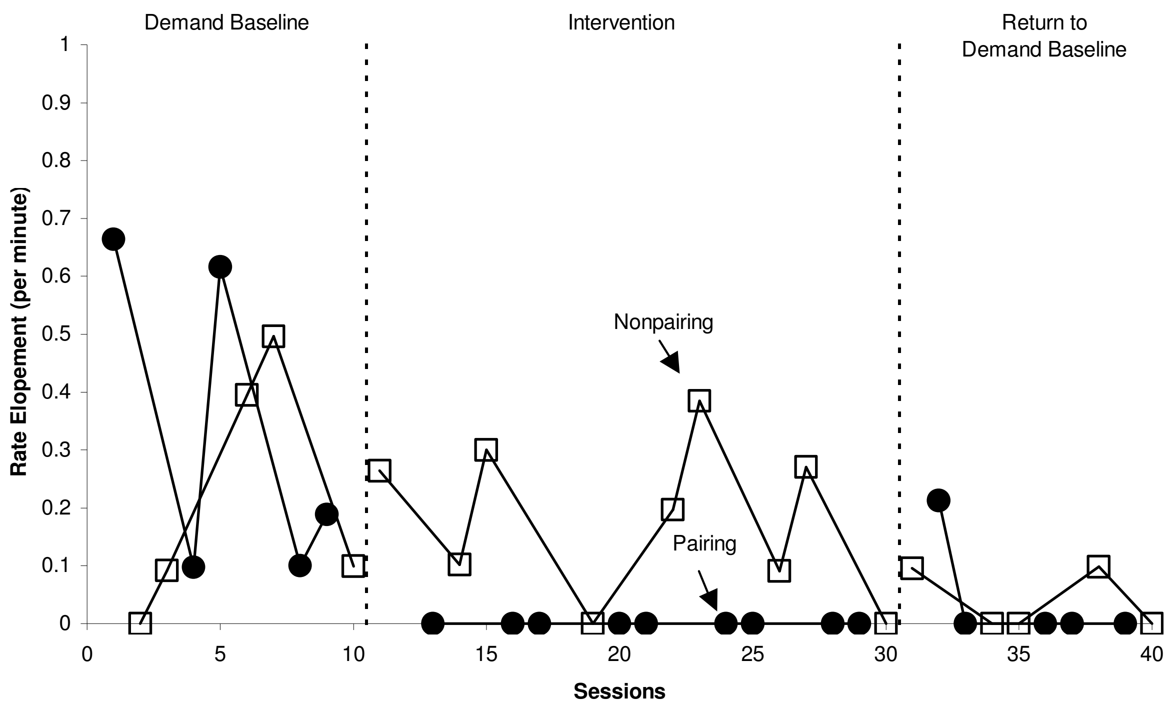

Figure 13. This graph depicts responses per minute of Bill's attempts to leave the therapy room in each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

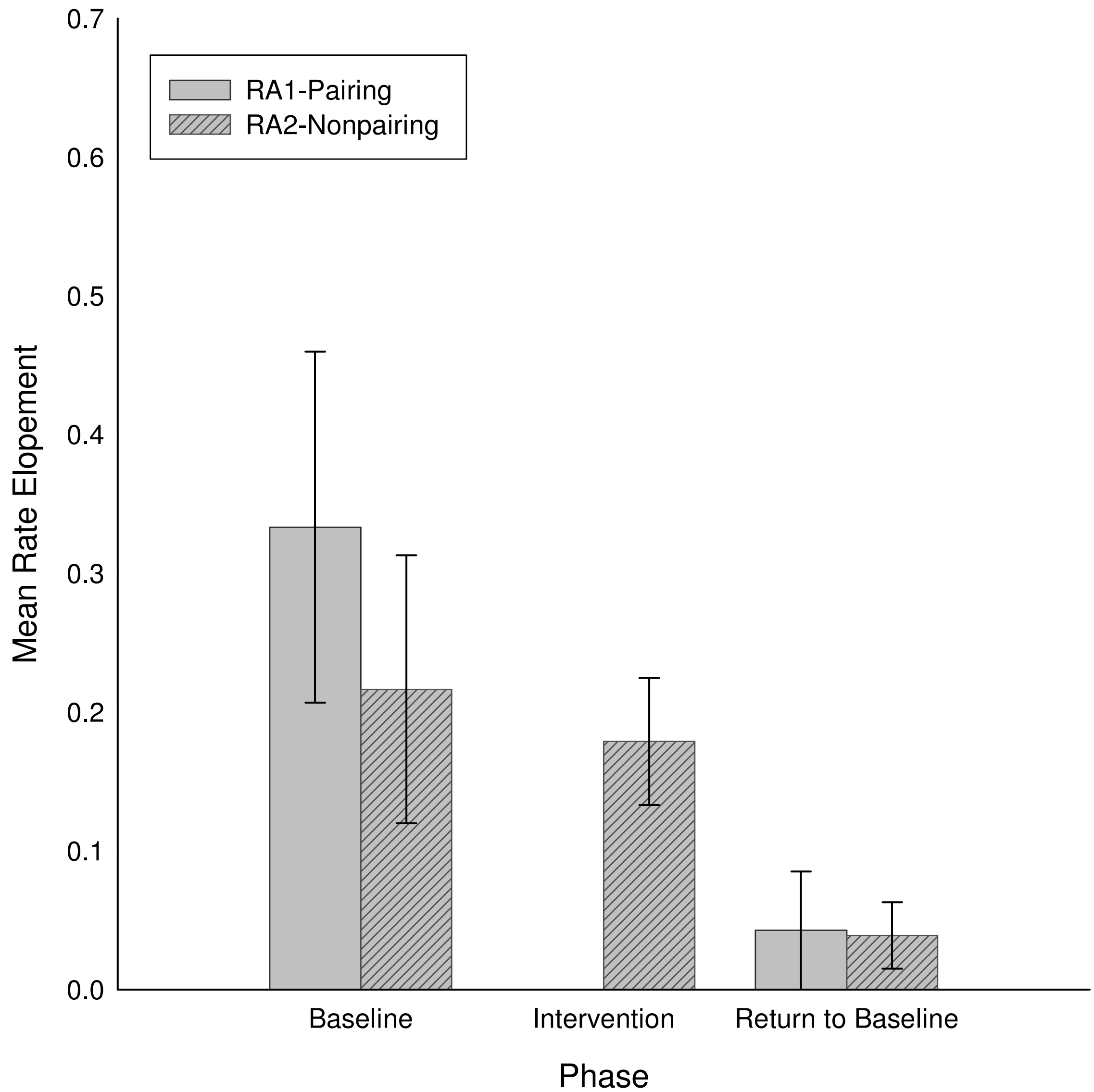

Figure 14. This graph shows the mean rate of Bill's attempts to leave the therapy room during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

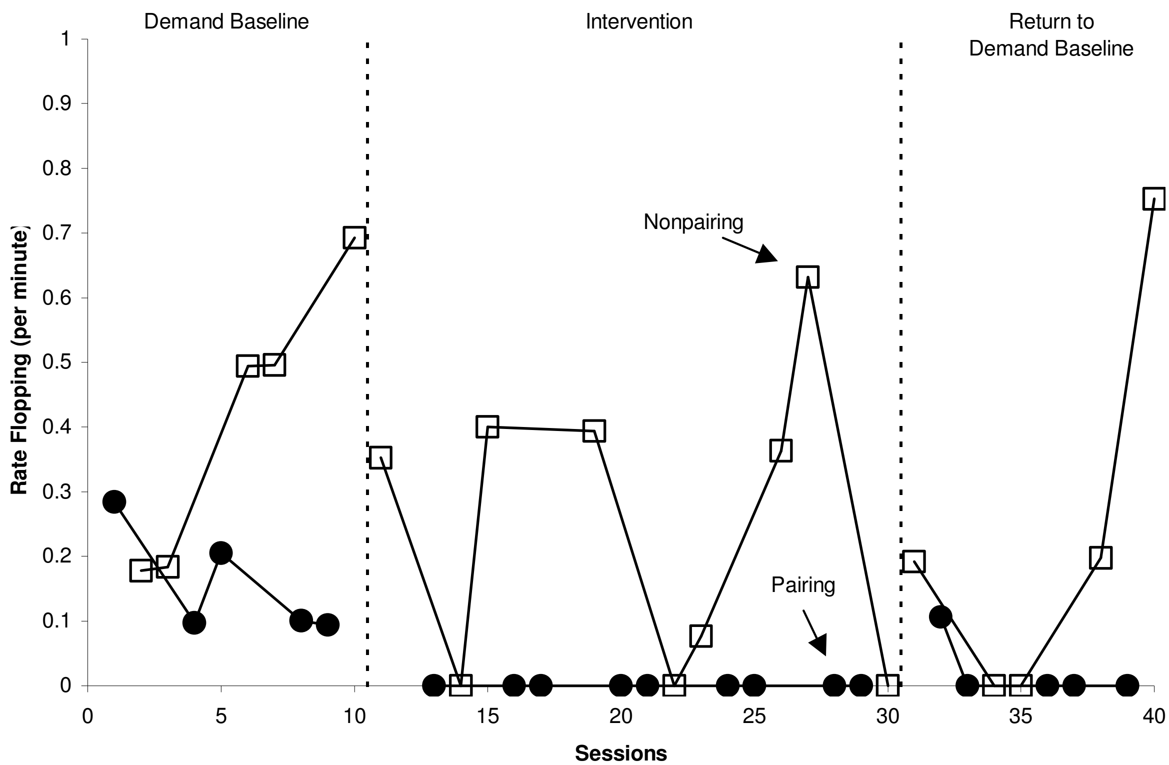

Fig. 15. This figure depicts responses per minute of Bill's flopping to the ground in each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

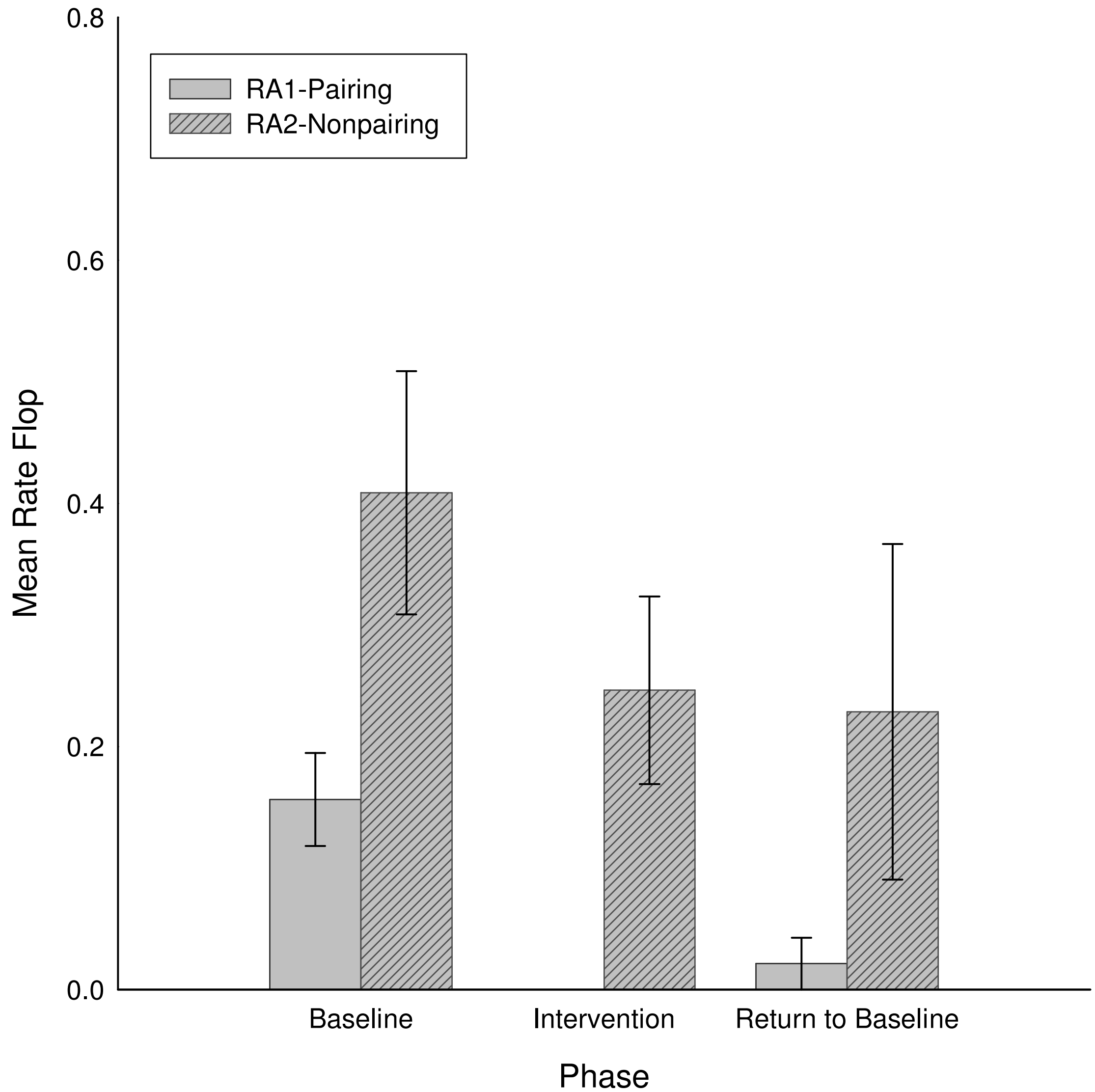

Figure 16. This graph shows the mean rate of Bill's flopping to the ground during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).

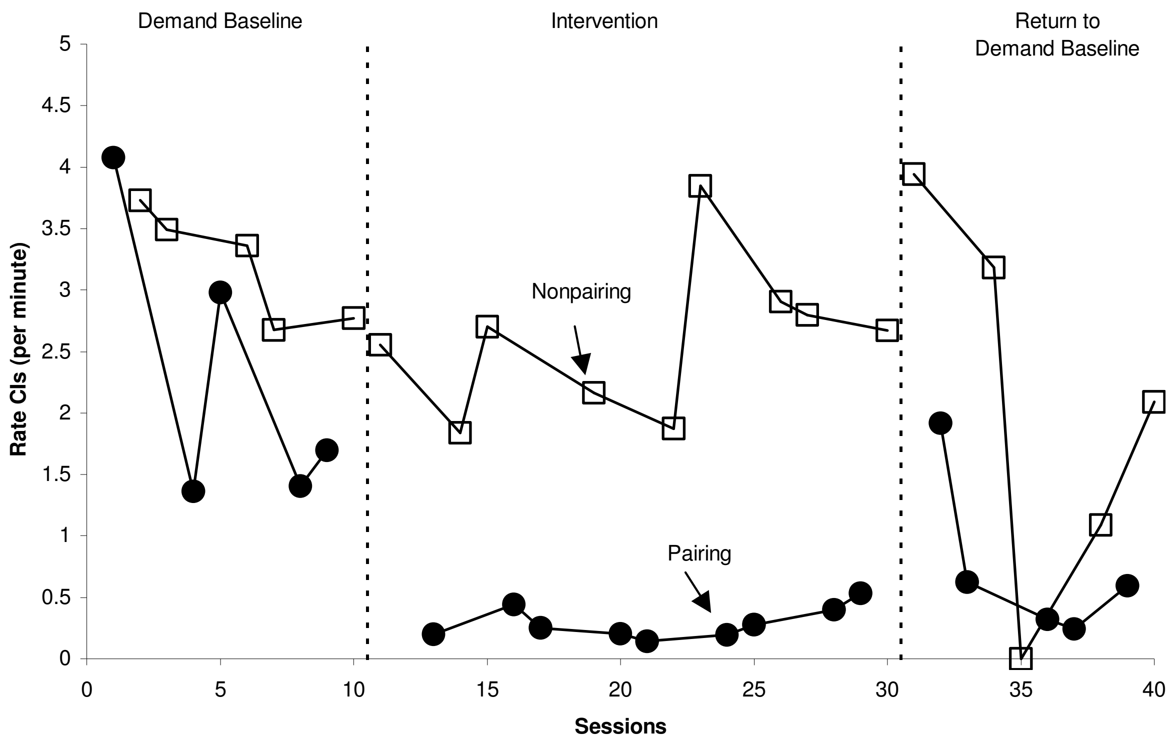

Figure 17. This graph depicts responses per minute of Bill's combined inappropriate behavior in each session during baseline, intervention, and RTB phases with RA1 (pairing) and RA2 (nonpairing).

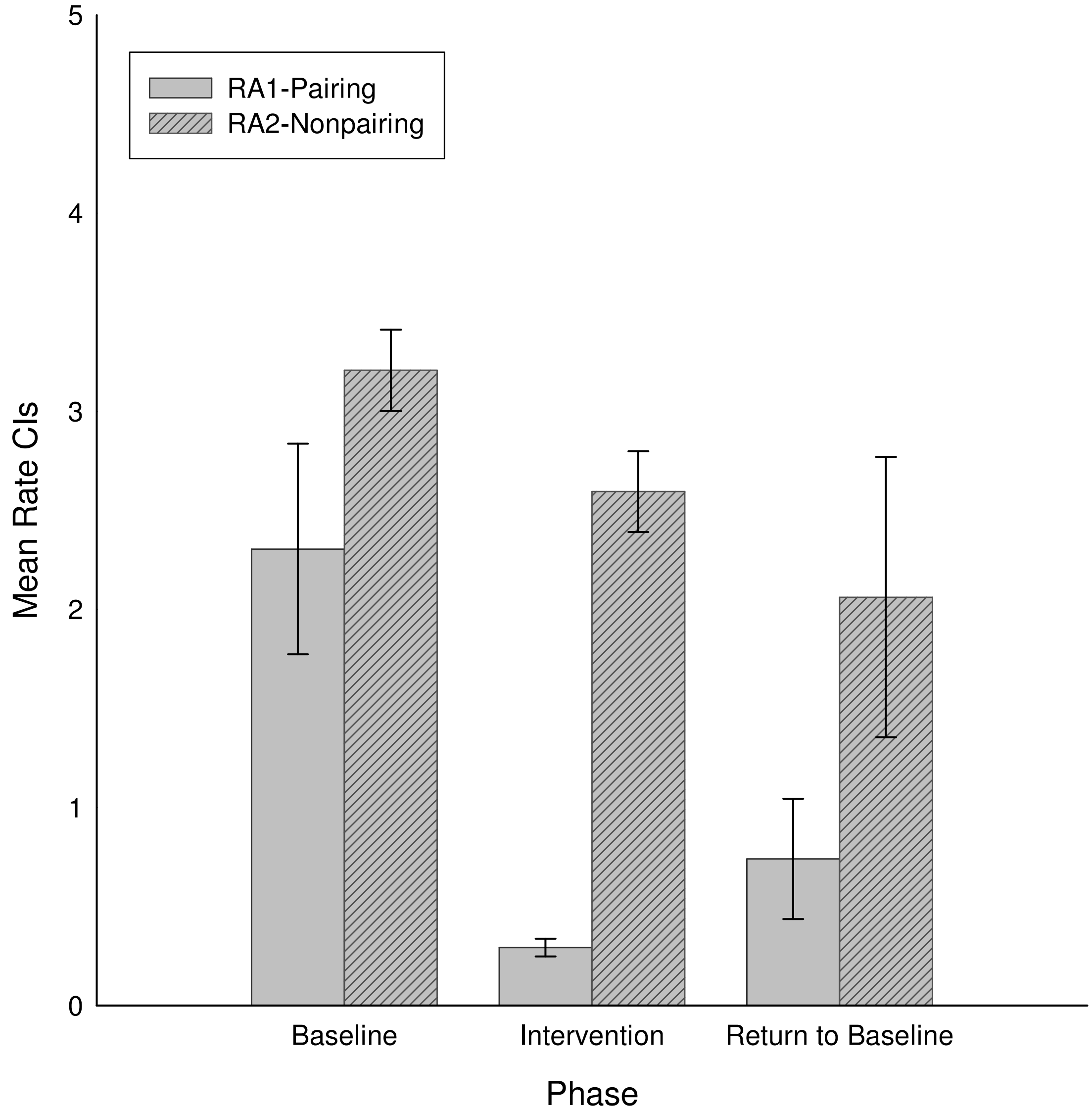

Figure 18. This graph shows the mean rate of combined inappropriate behavior for Bill during baseline, intervention, and return to baseline phases with RA1 (pairing) and RA2 (nonpairing).