BREAKING THE LINK: AN ANALYSIS OF PROCEDURES TO DECREASE INAPPROPRIATE BEHAVIOR WHEN IT IS A LINK IN A RESPONSE CHAIN

DISSERTATION

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ABSTRACT

The current study examined the effectiveness of a strategy to disrupt behavior chains, consisting of an inappropriate behavior followed by an appropriate behavior of 3 children with moderate to severe disabilities. A baseline measure was collected of each response in the chain: response one (R1) and response two (R2). Conditional probabilities were calculated to provide evidence that the two responses occurred in a predictable sequence and may therefore constitute a chain. The subsequent intervention consisted of providing the appropriate discriminative stimulus that occasioned R2 on a fixed schedule and reinforcing the appropriate response (R2) regardless of when it occurred (i.e., within the chain or alone). The results of a multiple baseline across participants analysis demonstrated that the intervention was effective in disrupting the response chains and in decreasing the inappropriate response for all 3 participants. In addition, the intervention was effective in increasing the appropriate response in 2 of the 3 participants. These results have implications for use of the disruption procedure in applied settings in which challenging behavior is a member of a response chain.
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CHAPTER 1

INTRODUCTION

Applied behavior analysts are concerned with changing behaviors, and in doing so must often look at responses that occur in a sequence as members of a response chain. Response chains are sometimes referred to as behavior chains. The term “response chain” will be used throughout this paper to emphasize the components of the chain as discrete behaviors. A response chain is composed of multiple responses that occur in a particular sequence; each response within the chain produces a change in the environment that then acts as a conditioned reinforcer for the response that produced it and as a discriminative stimulus signaling the next response (Cooper, Heron, & Heward, 2007). The terminal reinforcer that is produced at the end of the chain maintains the effectiveness of the functions for each stimulus in the chain.

In other words, each response creates an outcome that acts as both a reinforcer for the preceding response and as a discriminative stimulus for the next response in the chain. The first response is typically evoked by an establishing operation (i.e., an environmental event that momentarily alters the reinforcing effectiveness of a stimulus and evokes behavior that has led to those reinforcing events in the past) such as a physiological state or an operandum (Malott, Malott, & Trojan, 2000). The last response in a chain produces
the reinforcement that maintains the entire sequence of responding. For instance, eating pizza is an example of a response chain. Pizza may be ordered and eaten to satisfy an establishing operation of food deprivation. The sight of pizza (i.e., a discriminative stimulus) may evoke the response of cutting a slice, which then produces an environmental event (i.e., a cut slice) that may reinforce the cutting behavior and signal the availability of the reinforcement of picking up a slice of pizza. The slice of pizza in the hand may reinforce the picking up behavior and occasion the response of moving the slice toward the mouth. The proximity of the pizza slice to the mouth reinforces the closer movement and signals the availability of the reinforcement of taking a bite. The taste of the pizza reinforces the biting and so on until the slice of pizza has been eaten.

Response chains can consist of multiple appropriate behaviors, multiple inappropriate behaviors, or a combination of appropriate and inappropriate behaviors. For example, teaching a student to unlock a door using a key so that he can then enter a room can be considered a response chain of appropriate behaviors. Consider another example in which a child has been successful in receiving attention when he screams. Over time, this response may lose its effectiveness to gain a caregiver’s attention, unless the child also throws his toys against a wall to make a loud noise. This could be one way a chain involving a sequence of two inappropriate behaviors that gain attention (i.e., screaming and then throwing toys) is inadvertently established. Inappropriate and appropriate behaviors can be linked together in a response chain as in the following example. A child obtains her mother’s attention by screaming in the car. Once the child has the mother’s attention, she then politely asks for a favorite song to be played on the car stereo. In this
example, the inappropriate behavior (screaming) and the appropriate behavior (asking politely), have been chained together to produce auditory reinforcement.

Multiple behaviors can be linked together through deliberate chaining procedures using differential reinforcement, or response chains involving inappropriate behavior can be inadvertently shaped by the environment (Cooper et al., 2007). Many procedures have been used to establish response chains including forward chaining, backward chaining, total task presentation, time delay procedures, least-to-most prompting, and observational learning. There have also been reports of inadvertent shaping of response chains consisting of inappropriate behaviors. For example inadvertent shaping of inappropriate responses can occur when prompt procedures are used to teach new behaviors and prompt dependency results (e.g., Glat, Gould, Stoddard, & Sidman, 1998; Mirenda & Dattilo, 2008). Prompt dependency occurs when responding is controlled by the prompt and stimulus control fails to transfer from that prompt to the proper discriminative stimulus. Prompt dependency is a common result when prompts are not faded or delayed during instruction of a skill (Green, 2001). This could be considered a response chain of an inappropriate (any response other than the target response) followed by an appropriate response (the target response). Examples of response chains containing inappropriate responses can also be found in the literature when alternative communicative responses are taught to replace challenging behaviors (e.g., Fisher, Piazza, Cataldo, Harrell, Jefferson, & Conner, 1993; Shirley, Iwata, SungWoo, Mazaleski, & Lerman, 1997). Response chains containing an inappropriate response may be established in a number of other ways, such as the mother reinforcing the screaming by providing her attention in
the example above. This inadvertent chaining may cause a number of response chains that occur in the natural environment. Conceptualizing them as response chains may help in the discovery of ways to decrease the challenging behavior that occurs within them.

Studies in the basic research literature have addressed the disruption of response chains; however, the results have not been consistent in how each response within the response chain is affected. For example, Mansfield and Rachlin (1970) established a two-response chain in pigeons and found that satiation, extinction, and punishment disrupted the response chain by simultaneously decreasing both response one (R1) and response two (R2). Fantino (1965) found that R1 continued while R2 decreased when extinction (withholding the terminal reinforcer for the chain) was implemented with a two-response chain taught to pigeons. Becker (1970) found similar results in that R1 had a higher response strength and continued to be emitted even when R2 decreased after extinction was implemented. The results of a study by Catlin and Gleitman (1973) differed in that when extinction was implemented, the first response (R1) decreased more quickly and was therefore disrupted more easily than R2.

In the basic literature, these types of studies are most commonly conducted using chained schedules of reinforcement (Catania, 2007) to shape response chains consisting of topographically similar responses in nonhumans (e.g., pigeons and rats); however, there are few if any studies involving the types of heterogeneous chains (i.e., chains consisting of responses that are topographically and/or functionally different) found in the natural environment. There are other difficulties with addressing response chains occurring in the natural environment such as establishing that behavior sequences are
response chains and determining the variables that maintain the responses. For example, in order to identify a response sequence as a chain and all the variables maintaining that chain, one would have to determine (a) the stimulus that is produced by R1 that acts as a conditioned reinforcer for R1, (b) that the same stimulus also occasions (i.e., acts as a discriminative stimulus for) R2, and (c) the terminal reinforcer that maintains the entire chain. In addition, basic studies often involve response chains that are shaped by the experimenter and intermittently reinforced using very specific schedules of reinforcement. In the natural environment, response chains containing inappropriate behavior are more likely to have been established inadvertently and may be continuously reinforced or reinforced on a more inconsistent schedule (Contrucci-Kuhn, Lerman, Vorndran, & Addison, 2006).

There have been only a few applied studies on the disruption of response chains. For example, Hagopian, Paclawskyj, and Contrucci-Kuhn (2005) conceptualized problem behavior of an individual with disabilities as a response chain and used this to inform the treatment they implemented to decrease the challenging behavior. They used a conditional probability analysis to determine that self-injurious behavior most frequently followed stereotypy and therefore that these two responses may have constituted a response chain. They then implemented an intervention to decrease the first response and this resulted in a decrease of the second response.

Contrucci-Kuhn and colleagues (2006) applied procedures used in the basic research on disrupting response chains with a two-response chain taught to five participants with disabilities. First they taught the participants to emit a manual sign
that resulted in the opening of a box displaying an edible item. Once the box was opened and the participants emitted another manual sign (eat), the edible item was delivered to them for consumption. Similar to Hagopian et al. (2005), conditional probabilities showing that R2 most frequently followed R1 provided support that the responses formed a response chain. Contrucci-Kuhn et al. (2006) then found that satiation and extinction of the terminal reinforcer (food) each produced decreases in both R1 and R2, with R2 decreasing more rapidly than R1 for most participants. In addition, they implemented one of the procedures suggested by Michael (2000). This procedure, called unchaining by Contrucci-Kuhn and colleagues, involved reinforcing R2 (i.e., delivering the edible reinforcer) regardless of whether it occurred alone or following R1 (in the context of the chain). Michael predicted that this unchaining procedure would result in a decrease in R1 and an increase in R2.

When the unchaining procedure was implemented by Contrucci-Kuhn et al. (2006) with three of the original participants, R1 decreased and R2 increased for one of the three participants. One participant, who did not initially show any chain disruption, showed a decrease in R1 when a manipulation was made with the discriminative stimulus produced by R1. This manipulation involved presenting the discriminative stimulus produced by R1 that occasioned R2 (i.e., the edible reinforcer was made visible continuously). When this procedure was implemented R1 decreased rapidly for that participant. Support for the conclusion that the response chains had been disrupted was obtained by again calculating conditional probabilities, which showed that R2 no longer consistently followed R1. Therefore, the unchaining procedure described by Michael may
be enhanced by also delivering the discriminative stimulus produced by R1 on a noncontingent schedule.

This unchaining procedure may be very useful for clinicians who want to decrease the first response in a response chain while maintaining or increasing the second response, as in the case of a chain consisting of an inappropriate followed by an appropriate behavior (e.g., the screaming and polite requesting example above). This study sought to extend the research on disruption of response chains by examining the effects of the unchaining procedure with three participants with developmental disabilities who exhibited a response chain consisting of an inappropriate response followed by an appropriate response.

The specific research questions addressed were: (a) Will an unchaining procedure, consisting of delivering the discriminative stimulus for the appropriate response and then reinforcing the appropriate response whenever it occurs, disrupt a behavior chain consisting of an inappropriate followed by an appropriate response by decreasing probability that R2 will follow R1? (b) What effect, if any, will this unchaining procedure have on the frequency of the inappropriate response in the chain? (c) What effect, if any, will this unchaining procedure have on the frequency of the appropriate response in the chain?
CHAPTER 2

LITERATURE REVIEW

The purpose of this literature review will be to summarize the relevant literature on how and why response chains that contain an inappropriate behavior occur and how they can be addressed as a clinical problem. Specifically, conceptual literature on disrupting response chains and basic literature on acquiring and disrupting response chains will be discussed in turn. The literature most relevant to disrupting response chains in the applied field is reviewed. Examples of the procedures used to establish response chains in the applied field and examples of response chains that contain inappropriate behaviors that have been inadvertently established in applied studies are then examined. Each of these areas of research are important to review because there are very few applied studies that have investigated the disruption of response chains, especially chains with a combination of inappropriate and appropriate behavior. The research is discussed in terms of the limitations of the literature and the focus of the current study. Specifically, the presented research will be examined to address the following question: What has past research shown that will enable researchers and practitioners to develop procedures that will effectively disrupt response chains consisting of inappropriate followed by appropriate behaviors?
Conceptual Literature on Response Chains

This section contains an overview of definitions and basic information in the behavior analytic literature on response chains containing inappropriate behavior. This includes basic concepts regarding response chains that have been investigated as well as procedures that have been suggested to break response chains, though not thoroughly tested empirically.

Martin and Pear (2003) define response chains as a sequence of discriminative stimuli and responses in which each response produces the discriminative stimulus for the next response, except the last response, which is followed by a reinforcer. They acknowledge that unintentional or inappropriate chains can be established in many common ways. Chains can be established unintentionally through adventitious reinforcement. These are chains that include a response that is not necessary for reinforcement. Response chains can be adventitiously established when delayed reinforcement is implemented (Stromer, McComas, & Rehfeldt, 2000). In order to prevent the development of a response chain consisting of an appropriate and an inappropriate behavior when using delayed reinforcement, a DRO schedule can be implemented during the delay. The most common inappropriate chain is one that includes an inappropriate response followed by an appropriate response (Martin & Pear, 2003). The appropriate response is reinforced and thus both responses are strengthened, maintaining the response chain (e.g., saying “um” before each point in public speaking).

Self-control problems, like overeating, can be response chains that are remedied by inserting delays into the behavioral sequence. Another self control example of an
undesirable chain is getting up from the couch at a commercial, fixing a snack in the kitchen, and returning to the television (Martin & Pear, 2003). The return of the television program and the consumption of the food reinforces getting the snack (and may result in obesity if the response chain increases to clinically significant levels).

Cooper, Heron, and Heward (2002) suggest that a response chain containing inappropriate behavior can be broken by substituting the initial discriminative stimulus with a discriminative stimulus for an alternative and appropriate behavior or by extending the chain and inserting time delays between the components of a response chain. The rationale for these procedures is as follows. The first discriminative stimulus in a response chain initiates the remaining responses; therefore, if that discriminative stimulus occurs less often, the entire chain will likely occur less often. In addition, substituting a new discriminative stimulus may result in emitting an alternative response chain. For example, distracting stimuli in a vocational environment (e.g., multiple loads of un-sorted laundry to be machine washed) may set the occasion for emitting laundry washing responses out of order. However, if a chart of the order of the washing steps or a verbal command to sort laundry is added to the situation, these may develop stimulus control over the appropriate washing behavior. This would create an alternative stimulus, instead of multiple loads of laundry, acting as the main discriminative stimulus for the inappropriate chain. A second procedure, inserting time delays into a response chain, may make the chain more acceptable or even desirable. For example, requiring a child to emit 35 chewing responses before swallowing a bite of food may insert a time delay thereby
making an undesirable response chain (e.g., eating too fast or frequent choking) less likely.

McGill (1999) emphasized the importance of considering establishing operations when treating problem behaviors, including response chains. He suggested that modifying common descriptive and experimental methods to more effectively detect the role that conditioned establishing operations play in maintaining inappropriate behaviors would make interventions addressing those behaviors more effective. Michael (2000) discussed possible procedures for disrupting response chains in the context of transitive conditioned establishing operations. He posited that there are three major ways to reduce the frequency of behavior evoked by a transitive conditioned establishing operation (CEO) as in the case of a two-response response chain: satiation, extinction, and unpairing. Satiation involves exposing the individual to unrestricted access to the terminal reinforcer. Presumably this will reduce the frequency of the first response (R1) in the chain by decreasing the reinforcing effectiveness of the reinforcer for R1, which is a conditioned reinforcer that has been paired with the terminal reinforcer. In addition, because the frequency of R1 will decrease, it will decrease the probability of initiating the entire chain. Thus, the frequency of the second response (R2) will decrease as well. Extinction would involve withholding the reinforcer for R1 after that response is emitted and this is predicted to reduce the likelihood of future occurrences of R1 and the rest of the chain (R2).

The third procedure involves what Michael (2000) calls “unpairing,” and involves two types. The first unpairing procedure involves allowing R1 to produce its reinforcer
but then withholding the reinforcer for R2 once both responses are emitted. This will extinguish R2 and thus reduce the effectiveness of R1 as it is no longer paired with the terminal reinforcer that occurs after R2. The second unpairing procedure involves allowing R2 to produce the terminal reinforcer regardless of whether it occurs following R1. This again reduces the effectiveness of the reinforcer for R1 and thus may decrease R1 while maintaining or increasing the frequency of R2. This procedure was termed “unchaining” by Contrucci-Kuhn et al. (2006) and was used in their investigation of the effects of several procedures on a two-response chain, described below.

There are other procedures that could be implemented in the applied setting to disrupt response chains. For example, investigators could arrange the environment such that R1 does not produce the discriminative stimulus for R2. However this would not occasion the occurrence of R2 which, in chains comprised of inappropriate followed by appropriate responses, would not be preferable as it may cause a decrease in the appropriate response. An investigator could also arrange for the reinforcer for R2 to be delivered noncontingently. This may increase the occurrence of appropriate response (R2), but may not decrease the occurrence of the inappropriate response (R1). Therefore the procedure that would most likely maintain or increase R2 and decrease R1 in a two response chain comprised of an inappropriate response followed by an appropriate response would be the unchaining procedure (reinforcing the appropriate response regardless of when it occurred) used by Contrucci-Kuhn et al. (2006).
Basic Literature on Response Chain Learning and Disruption

This section examines the basic literature on the acquisition and disruption of response chains. Although the response chain literature overall is small, many of the concepts regarding response chains were established through basic empirical studies many decades ago.

A variety of procedures have been used to establish response chains in the laboratory. For example, Talkington (1971) studied the effects of reward, reward plus punishment, and punishment alone on acquiring a four-step response chain, consisting of activating a series of switches, in 64 teenagers with disabilities. Participants earned or lost tokens (that could be exchanged for money) as feedback for switch performance in a forward chaining procedure until they were able to emit the entire four-response chain. Participants who received only punishment (tokens removed for incorrect responses) or punishment and reward (tokens removed for incorrect responses and received for correct responses) required fewer trials to acquire the response chain than participants who received only reward. Participants who earned or lost tokens as feedback for correct or incorrect responding required fewer trials to acquire the response chain than did participants who received only a light for correct responses. These findings suggest that punishment, whether combined with reinforcement or alone, may result in faster acquisition of response chains. Talkington argues that these results could be due to the tendency of avoidance motivation to be more significant in individuals with a history of repeated failure. He also suggests that this research may be applicable in examining the establishment of response chains in individuals with developmental disabilities because
these individuals may have a history consisting of multiple errors that do not produce reinforcement. Due to this reinforcement history, these individuals may require punishment techniques alone or in combination with reinforcement procedures to prevent the inclusion of inappropriate behaviors in a response chain.

Boren and Devine (1968) examined the effects of various intervals of a time out condition following incorrect responding on the acquisition of four-member response chains (a sequence of lever presses) in several rhesus monkeys. The manipulations in this study occurred after the first response chain had been acquired with a small time out for errors. The investigators found that when the monkeys received a time out condition consisting of a blackened experimental chamber as feedback after making an error, they acquired the new chains faster and with fewer errors than when they were not given the time out at all. This result was found regardless of the length of the time out interval (up to 240 sec), suggesting that the time out periods functioned as a punisher for incorrect responses within a chain. This result could also have been due to the tendency of the time out conditions to prevent the establishment of an unnecessarily long response chain. For example, when a monkey made an incorrect response at the beginning of the chain, the time out would have immediately signaled an incorrect response and would shape only the correct response chain. However, if no timeout was given and the monkey made additional responses before or after the chain, reinforcement was still delivered for the emission of the chain, regardless of the surrounding responses. Thus, the immediate feedback on incorrect responses prevented the superstitious chaining of unnecessary responses.
In another experiment in this same study, Boren and Devine (1968) found that when establishing response chains in monkeys, adding an instructional cue signaling which response within each link of the chain would be reinforced resulted in shaping lever pressing in the presence of the cue. However, the monkeys did not emit the chained sequence without the cue. This suggests that excessive prompting or cueing before each response within the chain may aid in the acquisition of the chain, but only when responding occurs in the presence of prompts (i.e., prompt dependency).

Several laboratory studies have examined procedures to disrupt response chains, including extinction, or withholding the terminal reinforcer, after establishing a response chain. In the early literature, Fantino (1965) found that when the terminal reinforcer (food) was withheld from pigeons taught to emit a two-link behavioral chain, responding in the first link continued while responding in the second link decreased. Fantino described this as occurring because the stimuli associated with the second response continued to act as a conditioned reinforcer for the first response, but its capacity as a discriminative stimulus to elicit the second response diminished. Thus, the values of the discriminative stimulus and the conditioned reinforcer are not interdependent. A stimulus can continue to act as a conditioned reinforcer while ceasing to act as a discriminative stimulus (and possibly as a discriminative stimulus while ceasing to act as a conditioned reinforcer).

Similarly, Becker (1970) found that during extinction conditions with rats, responses furthest from the goal (terminal reinforcer) in a response chain producing access to water, had greater resistance to extinction. Becker describes the results in terms
of two concepts developed by two previous researchers. First, Becker cites Hull’s (1932) idea that a response closer to a goal will be learned more effectively than one further away due to the immediacy of the reinforcement. Second, Becker (1970) describes the results in terms of Spence’s (1956) idea that responses further from the goal may be more difficult to establish because of possible acquisition of competing responses that interfere with the goal-directed responses, and stimulus generalization between stimuli close and far from the goal.

Catlin and Gleitman (1973) found that the pattern of responding in the first response component in a two-response chain established in pigeons was more easily disrupted than the second response when extinction conditions were implemented. This was not the case in a fixed ratio (FR) 14 tandem control group in which a chain was not established before extinction was implemented.

Fischer and Fantino (1968) evaluated the effects of deprivation and satiation on the responses in a two-response response chain in pigeons. They found that the frequency of both links in the chain decreased simultaneously across four different deprivation levels (although, depending on method of analysis, satiation affected responding in the initial link slightly more rapidly than in the second link). This finding suggests that the discriminative stimulus function of the stimulus associated with the second response in the chain is more resistant to the effects of satiation than the conditioned reinforcing function early in satiation training. However as satiation training persists, both functions are affected simultaneously.
Mansfield and Rachlin (1970) drew a parallel between certain behavioral chains and nervous system reflexes by describing reflexive chains. These are response chains that, when interrupted, are not resumed at the point of interruption (e.g., as in finishing building a chair after a pause or lunch break); instead, responding begins again at the first response in the chain. In these chains the stimuli for the responses are available for a limited amount of time. If the response is not made during that time, the chain is broken and the responses are not made. Interruptions in the reflexive chains result in aborting responses instead of simply resuming the rest of the chain after a pause in responding, as would occur in a more one-directional chain.

Mansfield and Rachlin (1970) established a two-response chain in pigeons and then observed the effects on responding in that chain after exposing the pigeons to satiation, punishment, and extinction. They found that satiation, punishment, and extinction all had similar effects of decreasing the rate of the completed response chain. They also found that the first and last responses in the chain decreased simultaneously. In addition, pausing between the first and last element in the chain increased in duration as the rate of responding decreased.

Mandell (1980) conducted a series of experiments comparing the relative value or strength of responses during various chained schedules of reinforcement in pigeons. One experiment suggested that differences in schedules of reinforcement could cause differences in resistance to extinction and satiation in either the initial or the terminal link of the chain. In addition, fixed interval (FI) and variable interval (VI) schedules with the same average reinforcement rate were valued equally in terms of response strength.
Implications can be drawn between this and the applied literature because oftentimes in applied settings schedules of reinforcement for inappropriate behavior are intermittent and cannot be easily controlled. This research can remind applied researchers to take schedules of reinforcement into consideration when applying procedures to disrupt undesirable response chains.

Basic research has done much to inform applied research in the area of response chains. However, basic researchers have the advantage of being able to more easily over control and manipulate all relevant variables. Specifically, it is easier for basic researchers to determine with more certainty the reinforcers that affect behavior and to arrange conditions such as satiation, deprivation, and extinction. Although basic research often has applied implications, there remains a need to empirically determine whether procedures demonstrated in the laboratory are effective in natural environments.

Specifically, most of the basic literature on response chains has been conducted with homogeneous response chains (i.e., response chains consisting of topographically similar responses). Most commonly these have been studies involving chained schedules of reinforcement with responses of the same topography (e.g., key pecks, lever presses, etc.). Chained schedules involve a schedule in which “reinforcers are produced by successive completions of two or more component schedules, each operating during a different stimulus” (Catania, 2007, p. 380). There is a paucity of research on heterogeneous chains (i.e., response chains consisting of topographically dissimilar responses that are established under continuous reinforcement). There is a need to examine these types of chains because they frequently occur in applied settings. In
addition, the chained responses in basic studies have been reinforced on a systematic intermittent schedule as opposed to the continuous reinforcement sometimes seen in applied heterogeneous response chains (Contrucci-Kuhn, Lerman, Vorndran, & Addison, 2006). Therefore, there is a need for basic and applied researchers to study not only heterogeneous response chains, but heterogeneous chains maintained by continuous reinforcement.

**Applied Literature on Disrupting Response Chains**

This section reviews the empirical literature on procedures to disrupt behavior chains in an applied setting. These studies were found through electronic searches of empirical literature containing the words “response chains” or “behavior chains.” Studies found were selected for review if the study sought to disrupt behavior chains outside of the laboratory.

Some of the earliest applied literature on disrupting undesirable response chains involved behaviors that were once thought to be unaffected by operant procedures. For example, by conceptualizing seizures as a terminal link in a chain of behaviors, reliable pre-seizure behavior can be targeted for differential consequences that may affect the frequency of seizure behavior. Zlutnick, Mayville, and Moffat (1975) examined contingent interruption and reinforcement of incompatible behavior in the treatment of seizures in 5 patients with seizure disorders. These researchers were able to identify behaviors that reliably preceded minor motor seizure climaxes for each of the patients. An interruption procedure was implemented, consisting of a parent or other caregiver shouting “No!” and shaking the participant’s shoulders, contingent on the identified pre-
seizure behavior. The procedure was shown to effectively reduce the frequency of seizures in 3 of the 4 participants. A differential reinforcement procedure was implemented with the fifth participant in which a behavior (keeping arms lowered) incompatible with the pre-seizure behavior (raising arms) was reinforced. This procedure was found to be effective in lowering the frequency of seizures in this participant. The method through which this “startle and shake” procedure is effective is unknown. One explanation may be that the intervention had a punishing effect on the seizure behavior and therefore may have different effects depending on variables such as the intensity of the punishment, the degree of seizure predictability, etc. In addition, the participant may have been avoiding the aversive stimuli of shouting and shaking while continuing to exhibit the seizure behaviors in the absence of the person implementing the intervention. The type of seizures with which these procedures are most effective is unclear; however, this study provided evidence that both procedures can be effective with the motor seizures exhibited by these participants and can be effective when implemented by the parents of the participants.

Similarly, Kohlenberg (1970) conceptualized the persistent post-meal vomiting of an adult with mental retardation as being the last response in a response chain. Kohlenberg identified stomach tensions as an earlier response in the chain due to the correlation between the two responses. He implemented a punishment procedure in which a shock was delivered immediately contingent on stomach tensions. This aversive contingency resulted in an eventual decrease in stomach tensions, vomiting, and emitted vomitus. Kohlenberg also found that this procedure resulted in a weight gain in the
severely underweight participant and only occasional shocks were required to maintain the decrease in vomiting. These results suggest that vomiting may be one response in a response chain and when earlier responses in the chain are targeted, both responses may decrease and remain low with occasional maintenance shocks.

Horner, Wuerch, and Boomer (1981) studied disruption in response chains; however, the response chains did not include an inappropriate behavior. These researchers examined the effects of extinction on the time required for participants to complete a response chain and to complete each step in the response chain. In their study, 3 participants with severe mental retardation were taught a nine-step vocational response chain using forward chaining. Once this chain was established the terminal reinforcer was withheld for several sessions and then reinstated. The investigators found that performances were variable and the response chain was emitted more slowly when the terminal reinforcer was withheld than when it was delivered. They also found an increase in the time taken to perform the first step in the response chain during extinction. Other steps in the chain were performed more slowly only after 14 extinction sessions and even then these steps were early in the chain. The authors discuss how extinction affects performance rate, and that these effects are seen more in the first steps in the chain. The authors suggest that extinction most likely caused the increased variability and changes in response topography in this vocational response chain. They also suggest implications for maintaining terminal and possibly intra-chain reinforcers in applied settings to increase and maintain responding.
Foxx (2003) implemented a relaxation training procedure to disrupt the dangerous aggressive behavior of an adult with developmental disabilities. The relaxation procedure was implemented at the beginning of the aggressive episode. The purpose of the relaxation was to interrupt the escalating response chain of aggression and increase the likelihood of a behavior that was incompatible with aggression. Conclusions about the effectiveness of using relaxation to disrupt a response chain are difficult because this intervention was used in combination with another intervention in a case study format. Regardless, it is interesting that the individual reportedly used the relaxation procedure independently during stressful times after treatment was complete.

Fisher, Lindauer, Alterson, and Thompson (1998) examined a response chain consisting of two inappropriate behaviors. These researchers found that the destructive behavior of two boys with mental retardation was maintained by the automatic reinforcement of the stereotypic responses emitted involving the pieces of the destroyed objects. The authors also found that when toys that matched the stimulation similar to that provided by their stereotypy were provided, levels of property destruction and stereotypy decreased below baseline levels. The stereotypy decreased more when matched toys were present than when highly preferred unmatched toys were made available. In addition, appropriate toy manipulation increased in the matched toy condition and further decreases in property destruction and increases in appropriate toy manipulation resulted when attempts to destroy toys were blocked. The investigators discussed these results in terms of supporting the hypothesis that both property destruction and stereotypy were members of a response chain. They suggest that these
responses were maintained by automatic reinforcement for several reasons. First, both responses maintained in the absence of social contingencies. Second, stereotypy alone persisted when destroyed pieces of items were available. Third, matched toys produced larger decreases in property destruction. In addition the first response was necessary to obtain the consequences produced by the second response, stereotypy, suggesting the two responses occurred in a behavioral chain. However, without an analysis of the probability of the responses occurring in a specific sequence, it is not clear that these two responses were a response chain. The analysis would have to demonstrate that property destruction increased when it produced broken material for stereotypy and extinguished when it did not (e.g., attempted destruction with an unbreakable toy). The analysis must also demonstrate that both responses decreased when the sensory consequences were not produced following the second consequence.

The previous study described demonstrates an important issue to consider when conducting applied experiments involving response chains. That issue involves the difficulty in determining if an existing sequence of behaviors is a response chain. Hagopian, Paclawskyj, and Contrucci-Kuhn (2005) used a conditional probability analysis to support the hypothesis that a sequence of responses involving stereotypic finger waving followed by eye poking was a response chain. They demonstrated this support sequence was a response chain by comparing the conditional probability of eye poking given the occurrence of finger waving to the conditional probability of eye poking in the absence of finger waving. By comparing the probability that the responses occurred in a predictable sequence to the overall probabilities of each behavior alone, they
determined that the behaviors were most likely to occur within a chain sequence. They then found that when a procedure to block the stereotypic behavior of finger waving was added to the procedure of blocking eye poking, both responses decreased. However, in order to definitively determine that this response sequence was a chain, the researchers would have had to determine the discriminative stimulus produced by the finger waving that occasioned the eye poking. The finger waving most likely produced automatic reinforcement that in some way may or may not have made the eye poking more likely, and this is very difficult to determine experimentally.

Contrucci-Kuhn et al. (2006) used a conditional probability analysis to establish that a two-responses they taught five participants with disabilities was a response chain. They investigated the effects of three procedures to disrupt the responses in the two-response chain: extinction, satiation, and unchaining. The participants were taught to emit an “open” sign (R1), which resulted in a box containing a desired food item being opened by the experimenter. The participant was then required to emit an “eat” or specific food item sign (R2) in order to receive the terminal reinforcer (the food contained in the box). The investigators found that when the participants were given open access to the terminal reinforcer prior to the experimental session (satiation), both responses were suppressed during the session. In addition, when satiation conditions were implemented, the frequency of R2 decreased slightly more than R1. They also found that when the terminal reinforcer was withheld following the emission of R2 and preceded by R1 (extinction), both responses were suppressed and the frequency of R2 decreased more rapidly than R1 in half of the participants.
Finally, the investigators found that when the terminal reinforcer was delivered contingent on R2, regardless of whether it followed R1 (unchaining), participants typically allocated their responding to R2. When this condition was implemented, the frequency of R1 decreased more rapidly in one of the three participants. The other two participants either continued to emit R1 or continued to emit R1 and R2. One of these participants showed a decrease in the rate of R1 once a discriminative stimulus manipulation was conducted. This discriminative stimulus manipulation involved making the discriminative stimulus that was typically produced by R1 (i.e., the sight of food) continuously available in the absence of R1.

Results of the conditional probability analysis indicated that after each of these three procedures, the probability that R2 followed R1 decreased as compared to baseline. This suggests that the responses no longer occurred in a predictable sequence and therefore could have no longer been a chain. However, given the inconsistent results in the unchaining condition, further research is needed to determine if providing reinforcement for the second response in a chain, regardless of whether it follows the first response, may successfully decrease only the first response. Further research may also be needed to determine when multiple responses constitute a response chain and when they constitute a response sequence and how these procedures affect sequences and chains differently.

These studies provide evidence of promising techniques to use in applied settings when it is necessary to disrupt a response chain. However, direct experimentation on the specific procedures discussed here could contribute to the literature on disrupting
response chains. Although there is little applied research on disrupting response chains, there are many studies examining procedures used to establish response chains.

**Applied Literature on Establishing Response Chains**

Response chains are important in learning complex behavior because many complex behaviors consist of several responses chained together (e.g., making the bed, making coffee, washing the dishes, etc.). Behavioral chaining instruction has even been used to teach independent walking skills to individuals with disabilities in order to maintain education in the public school system (Colozzi & Pollow, 1984). Thus, procedures for establishing response chains for complex behaviors (e.g., self help skills, vocational skills, recreational skills, etc.) have been widely studied. These types of behaviors are essential in increasing independence of individuals with disabilities. Teaching functional behavioral chains that increase independence may enable an individual to be educated in a less restrictive environment than if he or she did not exhibit the chain.

Researchers have successfully used forward chaining (e.g., McWilliams, Nietupski, & Hamre-Nietupski, 1990), backward chaining (e.g., Hagopian, Farrell, & Amari, 1996), and total task presentation (e.g., Miltenberger, 2001); however, there has been no consistent evidence to suggest which chaining method is consistently more effective (Kazdin, 2001). During all types of chaining instruction, the first step in instruction is to create a task analysis breaking the entire task into smaller responses. Forward chaining consists of teaching the first response in the task analysis until acquisition and then teaching each subsequent response in the order in which the
responses are to be exhibited. For example, in teaching shoe tying using forward chaining, the instructor may teach the individual to first grasp one shoelace in each hand. Once this is acquired, reinforcement will be withheld until the individual performs the first response (grasping one shoe lace in each hand) and the second response (crossing the right shoe lace over the left shoe lace). This instruction would continue until the entire task is completed in sequence.

Backward chaining consists of teaching the last step in the chain first and teaching the steps in the reverse order until all steps are acquired. Using the shoe tying example, backward chaining may involve giving an individual a shoe tied in a loose bow and teaching the individual to tighten the bow (the last step in the sequence) first. Once the last step is acquired, the student would receive trials of shoes tied up to the point of instruction (progressively less and less completely tied), requiring the individual to emit the responses left in the sequence. Total task presentation instruction of response chains involves presenting the entire task to the student and prompting each response that cannot be performed independently until the entire task is completed before beginning a new trial.

Many researchers have examined various aspects of and techniques involved in establishing response chains. For example, Macduff, Krantz, and McClannahan (1993) successfully used graduated prompting to teach 4 boys with disabilities to follow photographic activity schedules containing leisure activities and homework assignments. Once these children remained on-task and were found to be on-schedule (engaging in the correct activity at the appropriate time), prompting was faded. All 4 boys then
demonstrated increases in on-task and on-schedule behavior during maintenance sessions. They were also able to follow schedules when the order of the activities was rearranged, and when some of the activities on the schedule were replaced by new activities.

Teaching this skill enabled the students to engage in activities containing complex response chains and to sustain engagement by frequently moving and changing tasks with no prompting. In addition, the completion of response chains may be beneficial to the acquisition and maintenance of complex behavior because it can help to signal delayed reinforcement (Stromer, McComas, & Rehfeldt, 2000). Each response in the schedule can produce stimuli that acquire conditioned reinforcing properties and help to sustain responding during the delay to the terminal reinforcer. This maintains the responding of each link in the response chain; however, it is not clear how long a chain can become and still be maintained by this relationship. Stromer et al. suggest establishing schedule-following to maintain responding during times when reinforcement must be delayed by reasonable periods. However, too many responses in a chain can be detrimental. For example, Duncan and Fantino (1972) found that the greater the number of stimuli presented during a delay, the less likely an individual is to choose a delayed reinforcement condition over a no reinforcement condition.

A number of studies have investigated time delay procedures (i.e., inserting a delay between the instructional question and the instructional prompt during instruction) with a variety of chained tasks like first aid skills, cooking, self-feeding, hygiene, and others (e.g., Collins, Gast, Wolery, Holcombe, & Leatherby, 1991; Gast, Winterling, Wolery, & Farmer, 1992; Griffen, Wolery, & Schuster, 1992; Hall, Schuster, Wolery,
Gast, & Doyle, 1992; McDonnell, 1987; Schuster, Gast, Wolery, & Guiltinan, 1988; Schuster & Griffen, 1991; Snell, 1982; Stonecipher, Schuster, Collins, & Grisham-Brown, 1999; Wall & Gast, 1999; Walls, Haught, & Dowler, 1982; Winterling, Gast, Wolery, & Farmer, 1992; Wolery, Ault, Gast, Doyle, & Griffen, 1990; Wolery, Ault, Gast, Doyle, & Griffen, 1991; Zhang, Gast, Horvat, & Dattilo, 1995). Time delay instruction can involve progressive time delays (i.e., increasingly larger time intervals between the instruction and the prompt) or constant time delays (i.e., inserting a specified and fixed time interval between the instruction and the prompt). Both procedures have been effective; however, constant time delay may be preferable because it consists of delivering fewer types of prompts (i.e., one fixed interval as opposed to a hierarchy of intervals) and therefore, less decision making is required by the implementer.

Both time delay procedures have also been found to be more effective when compared to other teaching strategies, such as least to most prompting (e.g., McDonnell, 1987; Miller & Test, 1989; Schoen & Sivil, 1989; Wolery, et al., 1990). For example, Wolery et al. (1990) taught four students with moderate mental retardation three chained tasks with the system of least prompts and three skills with constant time delay. They found that both procedures were effective in producing acquisition of tasks, however, constant time delay was a more efficient teaching procedure (fewer sessions to criterion, lower percentage of errors, and fewer minutes of direct instructional time to criterion).

Researchers have taken advantage of observational learning by using peer modeling and group instruction to establish response chains. For example, Wolery et al. (1991) used constant time delay to teach half a domestic skill to one participant within a
dyad and the remaining half of the task to the other participant. They found that participants acquired the pieces of the chained task that they were taught and the pieces they only observed. Griffen et al. (1992) found this same observational learning when food preparation skills were taught in small groups (i.e., triads instead of dyads) and members of the group reinforced one another’s correct responding with tokens. Similarly, Werts et al. (1996) found that three students with disabilities were able to learn response chains (e.g., playing a tape, adding using a calculator, sharpening a pencil, etc.) simply by observing peers in their general education classroom model the task while describing each step. Visual cues and minimal modifications in tasks were needed before the participants accurately completed the task. After the tasks were acquired, all students demonstrated generalized responding to new materials or began to ask for help in completing the new task.

Wall and Gast (1999) taught vocational skills to 12 high school students using constant time delay procedures. In addition to acquiring the response chain directly trained, the participants also retained a variety of other information. Participants retained over half of the “incidental” information given embedded in the positive feedback delivered by the instructors. For example, when a participant correctly placed a carton of milk in a bag when learning to bag groceries, the instructor added a nutritional task to the positive feedback (e.g., “Good job bagging the milk! Mild contains vitamin D for strong bones.”). In addition, while observing peers complete the vocational skills being targeted, participants retained over half of the incidental information embedded in the feedback to the peer that they were observing.
In a small group format Stonecipher et al. (1999) taught a vocational skill that consisted of a behavioral chain. Using constant time delay, the researchers taught four students to wrap gifts and it is likely that observational learning may have enhanced performances. These skills generalized to home settings for all of the students that participated.

Video modeling and prompting have also been used to establish response chains. This procedure can often be preferable to other methods in that video modeling can be easily implemented by clinicians and does not require a live model. Rehfeldt, Dahman, Young, Cherry, and Davis (2003) effectively taught adults with mental retardation to prepare meals using video modeling and verbal praise. This study is interesting in that the model in the video was a peer that was also diagnosed with a disability. Participants in this study demonstrated maintenance and generalization to new settings. Murzynski and Bourrett (2007) found that their participants acquired functional response chains (e.g., sandwich making, shirt folding, etc.) faster when least-to-most prompting was combined with video modeling, than when least-to-most prompting was used alone. However, both methods of instruction were effective in producing acquisition of the response chains. The authors cautioned that when using video modeling, video clips of response chains may need to be faded gradually in order for the student to continue to exhibit the complete response chain without prompting.

Sigafoos et al. (2007) taught a behavioral chain of dish washing in three adults with disabilities using video prompting and then successfully faded the video clips so that the participants were completing the response chains more independently. Their
participants watched a video clip of a teacher completing each step in a 10-step task analysis involving washing a cup, plate, and spoon. After watching the clip, the participants were told, “Now you do it.” This continued for each step in the task analysis until all were acquired. Once acquired, the behavioral chain of dishwashing did not maintain in the absence of prompts until the video clips were faded by combining the steps into clips of larger and larger segments of the dishwashing task. This was done until the participants were accurately performing the task after watching one video clip containing all the steps of dishwashing. Watching one entire clip of a task, allowed for the establishment of a more continuous and durable behavioral chain, because the participants did not have to re-orient to the video in between steps of the task.

Hagopian, Farrell, and Amari (1996) used fading along with backward chaining to shape increasing amounts of liquid drinking in a participant with a long history of feeding disorders and emesis. They first reinforced prompted swallowing and then reinforced swallowing after an empty syringe was depressed in the participant’s mouth. Next they reinforced swallowing increasing amounts of water placed in the participant’s mouth from the syringe. The participant was then required to bring a cup containing increasingly larger amounts of water to his mouth, accept, and finally swallow the water. In generalization sessions, the participant was able to accept even larger amounts of water than explicitly trained.

Patel, Piazza, Martinez, Volkert, and Santana (2002) evaluated the effects of differentially reinforcing the first response versus differentially reinforcing the terminal response in a three-response chain to determine if all steps must be reinforced.
individually. The response chain consisted of eating and drinking (i.e., response chains consisting of accepting, swallowing, and retaining substances) in three children exhibiting total food refusal. These investigators found that when they reinforced the first response in the chain (accepting) or the last response (presenting a clean mouth), consumption of the food or drink did not increase. In fact, consumption did not increase for any of the children until attempts to escape eating and drinking were placed on extinction. When this extinction component was added to the reinforcement contingencies, consumption levels maintained high, independent of whether the first or last responses were targeted for reinforcement. These results suggest that differential reinforcement of eating responses alone may not be successful with individuals with pediatric feeding disorders who exhibit total food refusal. The addition of escape extinction may be necessary in treating these types of feeding disorders. These findings may be exclusive to properties only found in feeding disorders and not all response chains, however, further research is needed in this area.

Applied Literature on Establishing Response Chains Containing Inappropriate Behaviors

Ethical considerations prevent research on establishing chains that contain inappropriate behaviors; however there has been anecdotal documentation of such chains reported in the literature. The literature contains studies that report inadvertently establishing prompt dependency, especially in the literature on teaching communication with individuals with developmental disabilities (e.g., Mirenda & Dattilo, 2008). For example, in a study conducted by Mirenda and Dattilo (2008) participants did not increase their spontaneous use of a pictorial communication device with a “prompt-free
training” (a shaping procedure) and one participant increased usage when a visual prompt was provided. Therefore the participants remained prompt dependent by exhibiting a response chain of waiting (inappropriate response) until a prompt was delivered and then emitting the target response (appropriate response).

Instructional procedures today frequently include prompt fading or delayed cuing techniques to prevent prompt dependency (e.g., Sigafoos et al., 2007; Shabani, Katz, Wilder, Beauchamp, Taylor, & Fischer, 2002; Clark & Green, 2004; Brown & Mirenda, 2006) Delayed cue prompting (in which the prompt is presented over gradually longer and longer delays), however, has not been full proof in preventing prompt dependency. In a replication of an original delayed-cue procedure, Oppenheimer, Saunders, and Spradlin (1993) used the procedure and found that many participants continued to wait for the prompt to be delivered over increasing time periods, instead of exhibiting a transfer of stimulus control from the prompt to the discriminative stimulus. A similar example is found in a study conducted by Glat, Gould, Stoddard, and Sidman (1998). They found a delayed cue procedure to be initially unsuccessful in that the participant waited for the cue before responding in virtually every trial on an auditory to visual matching task. When the participant was required to repeat the auditory sample, emitting a differential response, the participant began responding before the delay-cue prompt was delivered and maintained this responding when no longer required to repeat the verbal stimulus. Therefore, prompt dependency remains a problem in applied examples of instruction and can be conceptualized as a response chain of inappropriate followed by appropriate behavior.
This type of prompt dependency occurs frequently in children with developmental disabilities given that instructional procedures often use prompting procedures (Odom, Chandler, Ostrosky, McConnell, & Reaney, 1992; Hilton & Seal, 2007; Green, 2001). The majority of these examples of prompt dependency involve inadvertently training an individual to wait for a prompt. Responses involving waiting and non-responding are difficult to define behaviorally, as they are often defined by the absence of a behavior (i.e., anything other than the correct response) and may include a large response class of waiting behaviors (e.g., sitting, crossing arms, avoiding eye contact, etc.). There are also many examples of instruction that inadvertently establishes a response chain that involves a specific incorrect or inappropriate response. This incorrect response provides access to a prompt or corrective procedure, which then elicits the appropriate response. The incorrect response that would be chained to the correct response may be easier to study in that the incorrect responses may be easier to define and therefore collect data on than a response class of waiting behaviors.

One example of such inadvertent training of an incorrect response to gain access to a prompt is found in a study by Olenick and Pear (1980). Olenick and Pear inadvertently established an undesirable chain when teaching students to label objects. During teaching trials, if a student emitted an incorrect answer, he or she was given an imitation trial in which the instructor verbally repeated the question and then modeled the answer. The echoics produced by the student following this trial were then reinforced, establishing a chain of the incorrect answer reinforced by the imitation trial. This was thought to have occurred because in the imitation trials the easier response (the echoic)
was reinforced, so the participants were more likely to emit the easier response than an entirely independent response. The authors disrupted this chain by reducing the reinforcement rate for correct responses on imitation trials while maintaining a high rate of reinforcement for independent correct responses.

There have been several anecdotal reports of undesirable response chains becoming established during Functional Communication Training. Functional Communication Training (FCT) has been used to decrease problem behaviors and involves two important components: functional assessment and alternative response training. Implementers begin by conducting a functional assessment to determine the consequences maintaining the problem behavior. The individual is then taught a more appropriate, alternative response to access those consequent reinforcers. In this way, individuals can produce their own conditioned reinforcers by emitting functional communication during delayed reinforcement conditions (Stromer et al., 2000). Fisher, Piazza, Cataldo, Harrell, Jefferson, and Conner (1993) investigated the effectiveness of using functional communication training alone, with extinction, or with punishment to reduce destructive behaviors in four patients with severe disabilities. They found that only one of the three patients emitted reduced levels of destructive behavior after FCT was implemented by itself or in combination with extinction. In addition, this effect was specific to only one living environment. It was not until FCT was combined with punishment that decreases in the destructive behavior were found along with increases in appropriate communication. These authors noted several reasons why reinforcement of appropriate communicative responses alone may not have reduced the destructive
behaviors. One possibility is that the communicative response and the destructive behavior may have formed a response chain. This chain could be established because communication is consistently reinforced during conditions when problem behavior is likely to occur. This reinforcement then increases the probability of problem behavior occurring after communication. Although attempts at any behavior other than the appropriate response were blocked to avoid establishing a chain, this was difficult and may not be possible in all situations.

Shirley, Iwata, SungWoo, Mazaleski, and Lerman (1997) taught a functional communicative response to replace self-injurious behavior exhibited by three adults with developmental disabilities. They found that the participants did not successfully acquire the alternative response (a manual sign) until reinforcement was withheld for the self-injurious behavior. In one of their participants, learning a sign to request a favorite shirt when it was removed during self-care routines resulted in a response chain including self-injurious behavior followed by a manual sign. Both responses were extinguished, and the manual sign was then prompted during every opportunity in which it did not occur independently. This resulted in an increase in the signing alone without the self-injurious behavior. This increase maintained even when self-injurious behavior was again reinforced.

Wacker et al. (1990) examined the components within FCT that are necessary to increase appropriate communication and decrease problem behaviors. They found that when the appropriate communicative response and the problem behavior were functionally equivalent, the FCT intervention was most effective if implemented with a
component to address the inappropriate behavior (e.g., extinction or graduated guidance).
Through a reversal design, they found that when the contingency for the problem behavior was removed, even when appropriate communication was being reinforced, the problem behavior increased and the appropriate communication decreased. For example, one participant began to emit the problem behavior (biting) followed by the appropriate communicative response in the FCT alone condition, signaling the presence of a possible response chain. It was not until the FCT was combined with graduated guidance for the inappropriate behavior that decreases in biting were observed. Had graduated guidance not been added to the treatment package, a behavioral chain (including demand, bite, sign, receive reinforcement) most likely would have been trained. These findings suggest that FCT alone may not be sufficient to eliminate problem behavior and increase appropriate communication. FCT may be more efficient and prevent undesirable response chains when a contingency to address the problem behavior is included into the package intervention.

Mildon, Moore, and Dixon (2004) attempted to prevent the possible chaining of the challenging behavior and the alternative response in FCT by implementing noncontingent reinforcement (escape). The noncontingent escape was implemented to decrease the challenging behavior and then FCT was used to replace the challenging behavior. This procedure successfully decreased the frequency of the undesirable behavior and allowed an opportunity to teach the functional response and increase compliance to demands.
McGill (1999) comments on the tendency of FCT to be effective only when combined with other treatment procedures (e.g., extinction). McGill encourages the consideration of establishing operations when treating inappropriate behavior to prevent the establishment of inappropriate response chains. Regarding FCT, it is possible that when alternative communicative responses are reinforced, the evoking establishing operation is only temporarily modified by changing the response (i.e., producing the reinforcer contingent on alternative communication instead of the problem behavior). Instances in which FCT is more successful may be due to other procedures (e.g., antecedent procedures like enriching the environment). For example, McGill recommends using any functionally equivalent response, not just communication, especially self-mediated control of the environment. Such procedures may prevent inadvertently creating chains of FCT and inappropriate behavior.

Implications and Future Research

As noted earlier, many of the complex behaviors that practitioners desire to establish in individuals with disabilities are response chains (e.g., washing dishes, getting dressed, etc.). Many studies have been described above (e.g., Murzynski & Bourrett, 2007; Stonecipher et al., 1999; Werts et al., 1996; etc.) and many more have been completed that are excellent examples of successful procedures to teach these types of response chains. Although research is needed on how certain procedures (e.g., satiation, deprivation, extinction, DRO) affect the maintenance of these applied response chains, this is not often successfully accomplished. The most likely reason for this is that once a desirable response chain is established, it is ethically undesirable to implement...
procedures that may decrease or disrupt the responses within the chain. To avoid this ethical dilemma, researchers can teach arbitrary response chains and then examine the effects these procedures have on the responses within that chain. This is precisely how Contrucci-Kuhn and colleagues (2006) went about examining three procedures on a response chain they had taught their participants. Specifically they examined satiation, extinction, and unchaining procedures and their effects on both responses in a two-part response chain.

However, these chains are desirable or arbitrary response chains, and there has been very little research examining the effects of similar procedures (i.e., satiation, extinction, and unchaining) on previously established response chains containing undesirable behavior (an exception being Fisher et al., 1998). This may be due to various difficulties in conducting such research. For example it would be unethical to establish a response chain containing an undesirable or inappropriate behavior and it is difficult to determine if a series of responses already established is a response chain (i.e., an order of responses in which a discriminative stimulus produced by each response occasion the next response) or a response sequence (responses that occur in a predictable order). This distinction (i.e., response chain vs. response sequence) is important because procedures may have very different effects depending on the classification of the responses. Procedures that affect multiple responses within a chain may affect only the response that is targeted in a response sequence.

The studies completed by Contrucci-Kuhn and colleagues (2006) were an important first step in examining the effects of common laboratory procedures (i.e.,
satiation, extinction, and unchaining) on newly established response chains in the applied literature. Extinction and satiation effectively decreased both responses in the established chain. However, the third procedure, unchaining, has unique applied implications because one response in the chain maintains or increases, while another response in the chain decreases. This procedure could be useful with response chains that include an appropriate and an inappropriate behavior in an applied context. Although satiation and extinction could be used to decrease the inappropriate behavior, it would also most likely decrease the appropriate behavior as well. However, if it was desirable to decrease the inappropriate behavior while increasing or maintaining an appropriate behavior, the unchaining procedure may prove to be a useful intervention.

Consider the earlier example in which a child screams to get her mother’s attention in the car. After attention is acquired, the child asks politely for her favorite song to be played. In this example, it is most likely that the mother would want to decrease the frequency of screaming, but maintain the polite asking behavior. If the unchaining procedure were to be implemented in this situation, perhaps it would look similar to the following. The mother may reinforce the second response, polite asking, regardless of when it occurred (i.e., following screaming, preceding screaming, or alone) and possibly provide more noncontingent attention that may occasion the polite asking. It would be expected that this procedure would maintain the polite asking behavior and decrease the screaming. If this prediction is correct, there may be many parents, teachers, and therapists who desire a protocol of this procedure for a variety of inappropriate-appropriate response chains.
However, before this protocol is suggested for practitioner use, it needs to be empirically demonstrated to be effective, practical to implement, efficient, and socially valid. Therefore, one important area of research with increasing applied value would be to demonstrate the effectiveness of the unchaining procedure on existing response chains that include an appropriate and an inappropriate behavior. In addition to the unchaining procedure described above, there may be other procedures that effectively “unchain” or maintain the appropriate response while decreasing the inappropriate response. For example, suppose the mother in the current example is weary of reinforcing polite asking when it occurs within the chain, reasoning that she doesn’t want to reinforce the screaming and thereby increase screaming instead of unlinking the chain making the procedure longer than necessary. After all, Conrucci-Kuhn and colleagues (2006) found that the unchaining procedure consistently took longer to disrupt the chain than satiation and extinction.

Perhaps the effects of another procedure, consisting of reinforcing the appropriate behavior only when it occurs alone (i.e., not following screaming), may be more readily received by the mother. If this procedure is more socially accepted than the unchaining procedure, it too should be researched to determine its effectiveness. Or it may be possible that both procedures (i.e., reinforcing the appropriate behavior regardless of when it occurs or only when it occurs outside the chain) may need to be implemented for a long period of time before disrupting the chain. If this is the case, it may be more efficient to first disrupt both responses in the chain, possibly through satiation or
extinction. Then the appropriate response could be shaped back to baseline levels and reinforced until it reaches the desired frequency.

These three general procedures (i.e., satiation, extinction, and unchaining) require empirical support before they can be recommended for implementation in applied settings. However, another problem still remains: how to determine an existing sequence of behavior is a response chain. In other words, the issue may lie in discriminating between behavioral sequences in which one response occasions the stimulus setting for the next response and those in which responses do not depend on previous responses but do occur in a specified order (Catania, 2007). Both response sequences and chains contain responses that occur in a predictable sequence. The difference between response sequences and response chains are that only response chains are comprised of responses that are a function of the stimuli that are produced by responses they follow and are reinforced by the stimuli they produce. Specifically, responses in a chain must occur in a sequence and the first response produces a change in the environment that reinforces the first response and functions as a discriminative stimulus that occasions the second response.

Research in this area can benefit from the conditional probability analysis completed by Hagopian et al. (2005) described earlier. For example, a sequence of behaviors including an appropriate and an inappropriate behavior could be selected in the existing repertoire of an individual. A conditional probability analysis would determine the likelihood that the responses occur in the response chain order (i.e., appropriate response and then inappropriate response). If the conditional probability analysis
confirms that the first response (i.e., appropriate behavior) is most frequently followed by
the second response (i.e., inappropriate behavior) and the second response most
frequently follows the first response, then it is possible that the sequence of responses is a
chain. It would then be possible to implement one of the procedures suggested above to
maintain the appropriate behavior while decreasing the inappropriate behavior. Other
procedures could also be developed to determine if the sequence is a chain by
determining that each response produces a change in the environment that acts as a
discriminative stimulus for the following response.

Perhaps, if any of these interventions is empirically demonstrated to be effective,
research could be done to compare them. For example, the unchaining procedure and the
unchaining plus extinction procedure (reinforce the appropriate behavior only when it is
exhibited outside of the response chain) could be compared in a multiple baseline design
across response chains or across participants. Or, a reversal design could be used to
compare these strategies and an extinction or satiation procedure. The strategies could be
compared to determine which is the most efficient in terms of reducing the inappropriate
behavior and increasing the appropriate behavior. Regardless of the methodology used,
research in specific strategies to break these types of chains should determine the
contexts under which each strategy is most and least effective.

Future research in this area could add to the conceptual literature on response
chains and to the applied literature on breaking these common types of response chains
while maintaining appropriate behavior. In addition, this type of research may inform
basic research, especially questions that can be answered regarding heterogeneous
response chains. Although basic and applied researchers have made great strides in the area of response chains, there are still questions to be answered before many applied problems can be solved.

The purpose of the current study is to contribute to the literature on disrupting response chains by using unchaining procedures to unlink the behaviors in an already established response chain involving an inappropriate behavior followed by an appropriate behavior. The responses that comprise the response chain were observed and analyzed using a conditional probability analysis to determine the likelihood that the responses occurred in the chained sequence. Unchaining procedures were implemented and the frequency of both responses within the chain were recorded to determine what effect the unchaining procedures had on both the inappropriate and the appropriate responses.

The specific research questions addressed in this study are as follows:

1. Will the unchaining procedure, consisting of delivering the discriminative stimulus for the appropriate response and then reinforcing it whenever it occurs, disrupt a behavior chain consisting of an inappropriate followed by an appropriate response by affecting the conditional probability that R2 will follow R1?

2. What effect if any will this unchaining procedure have on the frequency of the inappropriate response in the chain?

3. What effect if any will this unchaining procedure have on the frequency of the appropriate response in the chain?
CHAPTER 3

METHOD

Participants

The participants were three school age children with developmental disabilities attending a state funded school that serves children with developmental disabilities. These students were referred to Buckeye Behavior Analysis Services (BBAS) for problem behaviors. BBAS is a project that represents a partnership between the Special Education faculty and graduate students and the local public and county schools serving students with developmental disabilities. The purpose of this partnership is to use behavior analytic interventions to address problem behavior and academic deficits exhibited by children with developmental disabilities. Participants were selected for the study after initial intake observations done by BBAS staff suggested that one of the primary behaviors for which the student was referred might occur within a response chain. The response chain had to be comprised of an inappropriate behavior followed by an appropriate behavior. Research was conducted under the institutional review board (IRB) approval obtained by BBAS to conduct research on challenging behavior exhibited by the students served by the BBAS project.
All participants were referred to BBAS for one or more challenging behaviors before the start of the study. After initial observations were conducted by BBAS staff, these three students were referred to the investigator as potential participants because their challenging behavior appeared to occur within a response chain. Upon this referral the investigator conducted observations to determine if there was evidence that the challenging behavior occurred in a response chain. These observations consisted of data collection (described below) on the frequency of each response in the response chain and the potential establishing operations and reinforcers maintaining those responses. A conditional probability analysis (as described below) determined the probability that the second response (i.e., the appropriate behavior) occurred following the first response (i.e., the inappropriate behavior) more frequently than in any other sequence, or alone. Although this does not definitively establish that the response sequence is a chain, it is the most practical procedure developed to date to support the hypothesis that two specific responses comprise a response chain.

Students who displayed certain types of specific response chains that may have produced experimental difficulties were not included in the study. For example, students who had behavior chains requiring the acquisition of an appropriate replacement behavior in addition to decreasing the inappropriate behavior were not included as this acquisition process was not the focus of the current study. Therefore students who were considered to require the acquisition of an appropriate replacement behavior (e.g., individuals for whom functional communication training was found to be the most appropriate intervention for decreasing their inappropriate behavior) were not included because those
individuals did not already emit that communicative response. Additional inclusion criteria were parental consent for participation in the study (see Appendix B) and consistent school attendance.

All participants attended a segregated, county-operated and non-graded school that served students with moderate to intensive educational needs in four levels: primary, intermediate, junior, and senior. Reece was a twelve-year-old male who was diagnosed with multiple physical and developmental disabilities. He was being served in an intermediate level classroom in the school and was referred to BBAS for noncompliant behaviors (e.g., placing items in his mouth instead of manipulating them appropriately during work tasks). Spence was a six-year-old male diagnosed with autism spectrum disorder who attended a primary classroom. He was referred to BBAS for aggression that typically occurred in order to access preferred tangible items. Jane was a ten-year-old female being served in a primary classroom and was diagnosed with autism, oppositional defiant disorder, and attention deficit hyperactivity disorder. Jane was referred to BBAS for aggression maintained by escape and attention. She demonstrated little spontaneous communication and the staff reported that a goal was for her to request items. Reece and Jane attended the same school and Spence attended school in another building run by the same county agency.

Setting

Observations and sessions were completed in the participants’ classrooms and in a small room not being used for instruction. Initial observations conducted to complete the descriptive functional assessment (described below) were completed in the student’s
classroom during normal activities. Each student’s response chain was observed to occur in the presence of the investigator outside of the classroom. Therefore, baseline and intervention sessions were conducted in a small room of the school. Reece and Jane’s sessions were conducted in either a small room used by the school’s vision specialist or a small conference room. The room used by the vision specialist contained only one large and one small filing cabinet. The conference room was located in the administrative office suite and contained a large table, several chairs, locked cabinets, and a computer. Spence’s sessions were conducted in a conference room across from his classroom that contained a large table, several chairs, bookcases, and other non-session materials. Sessions were 10 min in length and were conducted once daily, four to five times per week. Toward the end of the study (sessions 11-30 for Reece; sessions 21-22 and 24-30 for Spence; and sessions 23-28 for Jane) sessions were conducted two to three times daily, due to the rapidly approaching end of the school year. On days when multiple sessions were conducted, participants were given at least 5-10 min breaks between sessions. All sessions were videotaped for data collection purposes using a video camcorder attached to a tripod in the corner of the session room.

**Sequence of Procedures**

The study was conducted in three phases: (a) assessment, (b) data collection, and (c) experimental analysis. In the assessment phase, descriptive data were collected to develop an hypothesis regarding the antecedent and consequent events that were maintaining the responses in the target response chain. Next, conditional probabilities were calculated to determine the relative likelihood that the responses selected occurred...
in a specific sequence, one of the criteria for a response chain. In the second phase, baseline data were collected on the frequency of each response in the response chain. The third phase consisted of an experimental evaluation of an unchaining procedure as an intervention to decrease the inappropriate response within the response chain, while maintaining the appropriate response. Preference assessments of potential reinforcers were conducted, as necessary, to determine items that were delivered contingent the appropriate response. A secondary observer collected data on the frequency of both responses within the response chain and the steps of the procedural protocol that were conducted appropriately. These data were used to calculate interobserver agreement and procedural integrity. At the conclusion of the study, social validity questionnaires were distributed, collected, and analyzed to evaluate the acceptability of the goals, procedures, and results of the study.

Assessment Procedures

Descriptive functional assessment. The investigator began the functional assessment by conducting unstructured interviews with the participant’s teacher and teacher’s assistants. From the interviews, hypotheses were created regarding the discriminative stimulus that was created by the first response (R1) and that occasioned the second response (R2) and regarding the terminal reinforcer that maintained the entire chain. Next the investigator conducted three to ten 5 min observations of the participants’ response chains. The number of observations varied depending on how quickly the function of the behavioral responses could be determined by the data collected. If three observation sessions were conducted and the conditional probabilities calculated from the
data collected during these sessions did not reveal a clear pattern of a potential function, then more observation sessions were conducted. During these observations, data were collected on the frequency of each response in the response chains. Operational definitions were created for each response exhibited by each participant (see below). In addition, data were collected on the frequency of the hypothesized discriminative stimulus occasioning the second response and the frequency of delivery of the terminal reinforcer. This information and data were then used in confirming the hypothesis of the discriminative stimulus and consequent events maintaining the response chain. These observations occurred in the participant’s classroom setting or other naturalistic settings during the time the classroom staff reported the response chain was most likely to occur.

To determine the contingencies supporting the maintenance of the response chain in the natural environment, data were collected on possible establishing operations and maintaining consequences as described by Vollmer et al. (2001). Operational definitions similar to those used by Vollmer et al. were used as well. Estimated duration (i.e., partial interval recording) measures were collected on the possible establishing operations occurring in the natural environment including: low attention, instructional demands, and restricted access to preferred items. Low or diverted attention was defined as adult care staff physically turning away from a participant or not interacting (verbally or physically) with the participant for at least 3 s. An instructional demand was defined as any discrete request or demand delivered to a participant by a staff member or any ongoing work activities performed by the participant even if requests were not continuously delivered. For example, if a participant was requested to trace an object with a pencil and this task

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was performed for 2 min with no further requests or prompts, an instructional demand was scored for the entire 2 min. An instructional demand was considered complete when neither requests nor ongoing activity occurred for at least 3 s. Restricted access was defined as removal of a preferred item or positioning of items out of reach of the participant for at least 3 s.

Estimated duration measures (i.e., partial interval recording) were collected on consequences that may have been affecting the response chain including attention, escape from demands, and access to preferred items. Attention was defined as verbal or physical interaction directed toward or about the participant, or being within 3 ft of and oriented toward the participant. Escape was defined as removal of requests, demands, or instructional materials, or the absence of instructions, for at least 3 s following task completion. Access to preferred items was defined as the availability of tangible items, activities, or edible items for interaction or consumption by the participant. These data, in combination with the occurrence of the responses within the response chain and the duration of potential establishing operations, were used to determine any patterns that suggested potential variables maintaining the response chains. Appendix C contains the data sheet used to collect descriptive analysis data.

**Conditional Probability Analysis.** Conditional probabilities were calculated on the frequency of R1 and R2 during the descriptive assessment sessions to support that the responses occurred in a chain. Specifically, two probability calculations were the focus of the study: (a) the probability that the second response in the response chain (R2) occurred given the first response in the chain (R1), or R2 given R1, and (b) the probability of R2
given the absence of R1. These conditional probabilities were compared to each other and if the probability that R2 followed R1 was higher than the probability that R2 occurred in the absence of R1, it suggested that R1 followed by R2 was a reliable response sequence and possibly a response chain.

Response chains in this study were recorded on a trial-by-trial basis in order to calculate the conditional probabilities (see Appendix D for copy of data sheet). Specifically, the occurrence of R1 (i.e., the inappropriate response) constituted the beginning of a trial during baseline. A trial was concluded with the emission of R2, upon the next occurrence of R1, or if 10 s elapsed without an occurrence of R2. Jane often emitted R2 up to 5 s following the emission of R1. Therefore a 10 s criterion was developed to allow for this delay in responding. During intervention sessions, a trial was also recorded as beginning when the discriminative stimulus for R2 was delivered. If an occurrence of either R1 or R2 occurred within 10 s of the discriminative stimulus, it was recorded within the same trial as the discriminative stimulus. If no response occurred within 10 s of the discriminative stimulus, the trial was concluded and a new trial began when either an occurrence of R1 was emitted without following the delivered discriminative stimulus or another discriminative stimulus was delivered. These trial definitions were discussed during observer training and listed on the procedural integrity data sheets for the observer to consult during sessions (see Appendices E and F).

Conditional probabilities were then calculated in the following manner. The probability that R2 occurred in the presence of R1 was calculated by dividing the number of times R2 followed R1 in the same trial by the total number of occurrences of R2. The
probability that R2 occurred in the absence of R1 was calculated by dividing the number of times R2 occurred without R1 in the same trial by the total number of occurrences of R2.

Responses that met the following three criteria were then targeted for exposure to the experimental procedures; (a) responses must have occurred within a response chain (established through these conditional probability calculations), (b) the hypothesized discriminative stimulus ($S^D$) produced by the first response was easily reproducible (e.g., verbal prompts), and (c) the response chain was maintained by an accessible reinforcer (e.g., tangible items). The rate of each response within the chain was calculated and was used as baseline data. Each baseline and intervention session lasted 10 min.

**Experimental Procedures**

Following the collection of baseline rates of R1 and R2, the intervention, an unchaining procedure, was implemented for each response chain. The intervention was a procedure referred to as unpairing by Michael (2000) and as unchaining by Contrucci-Kuhn et al. (2006). Michael describes two types of unpairing and the second type was used and referred to as unchaining by Contrucci-Kuhn et al. and resulted in a decrease of the frequency of R1. In the current study, the procedure used was similar to that used by Contrucci-Kuhn et al. and is referred to here as unchaining to distinguish it from the first unpairing procedure described by Michael (i.e., allowing R1 to produce the discriminative stimulus for R2, but not allowing R2 to produce its reinforcer). The first unpairing procedure described by Michael is predicted to result in a decrease in R1 and R2. This was not a preferable intervention for the response chains in this study involving
an inappropriate behavior (R1) followed by an appropriate behavior (R2), because the targeted outcome for this study was to maintain and not decrease the frequency of R2 while decreasing the frequency of R1. Therefore, the second unpairing procedure described by Michael and used by Contrucci-Kuhn et al. was the focus of this study.

Unchaining

The unchaining procedure involved reinforcing the appropriate behavior regardless of whether it occurred in the chain or outside the chain. Some responses are not be likely to occur by themselves outside of the response chain and therefore do not have adequate opportunities to contact this reinforcement contingency. In order to occasion R2 (i.e., the appropriate response) so that it was more likely to occur outside the chain, the discriminative stimulus associated with the R2 was presented by the experimenter. This discriminative stimulus, usually produced by the R1 in the response chain, was identified during the descriptive assessment. During experimental unchaining sessions, the experimenter presented the $S^D$ at specified time intervals (determined by baseline rates of R1 in the chain) in order to make it more likely that the appropriate response would occur alone.

Once the appropriate response was occasioned by the $S^D$ and emitted by the participant, the reinforcer that maintained the response chain (identified during the descriptive assessment) was delivered, regardless of whether that response occurred immediately following the inappropriate behavior (R1) or occurred alone. In other words, the investigator immediately delivered the reinforcer contingent upon each appropriate response (R2).
In each case, as described below, the $S^D$ was hypothesized to be a stimulus prompt (e.g., a verbal or physical prompt). Therefore the prompting procedure involved a three-prompt least-to-most hierarchy. If the appropriate response was not occurring outside the chain, a verbal prompt was delivered on a fixed time schedule (determined by the frequency of the response chain prior to any intervention). If no response was emitted 5 s following the verbal prompt, a model prompt was delivered. If no response was emitted 5 s following the model prompt, the participant was physically prompted to complete the second response of the chain (i.e., the appropriate response).

**Procedures Specific To Each Participant**

**Reece.** Reece’s response chain (see descriptive results section) occurred during a demand situation that consisted of putting dominoes into a slot cut into a cardboard box (i.e., a daily work task in his classroom). This task was a task developed by the classroom teacher to address a gross motor educational goal. Although it was not seen as functional and beneficial for the student by the investigator, it was the task that Reece’s classroom teacher suggested for a target in the study, as this is when the response chain reliably occurred. The response chain was chosen for inclusion in the study, even though it occurred during a task that did not seem to beneficial, because teaching a new and functional skill was not the focus of the current study.

The first response in his response chain consisted of placing the domino in his mouth (R1), which typically resulted in a physical prompt given by the classroom teacher to place the domino in the box. Reece would place the domino in the box (R2), but only following R1 and a physical prompt. This pattern of behavior was also observed when
sessions were conducted in the session room with the investigator. Therefore, baseline sessions for Reece consisted of the following. The cardboard box and a basket of dominos were placed on a table directly in front of Reece, seated in his wheelchair. The session timer, set for 10 min, was started and Reece was given one verbal prompt: “Reece, put it in the box.” Reece was given a verbal prompt at least every 10 s throughout the session. If Reece placed the item in his mouth, the therapist provided another verbal prompt and used hand-over-hand guidance to physically prompt Reece to take the domino out of his mouth and place it into the box. This fairly immediate physical prompt was delivered without giving a gestural or model prompt because Reece’s classroom teacher typically used physical prompts only. If Reece put the domino into the box, verbal praise and physical reinforcement (e.g., pats on the back) were delivered. The session was terminated upon the timer signaling the elapse of 10 min.

During intervention sessions, the cardboard box and a basket of dominos were placed on a table directly in front of Reece, seated in his wheelchair. The session timer, set for 10 min, was started and the first trial began when a verbal prompt was delivered simultaneously with a physical prompt. The physical prompt consisted of the investigator picking up Reece’s hand, using hand-over-hand guidance to pick up a domino, and then releasing Reece’s hand directly over the cardboard box. This provided the hypothesized discriminative stimulus (i.e., physical prompt) while still allowing Reece an opportunity to independently emit R1 or R2. This verbal and physical prompt combination was delivered every 4 s (based on the baseline rate of R1) throughout the session. If Reece brought the domino within 2 in of his mouth (see data collection and operational
definitions below), the domino was blocked from entering his mouth, as it was often
difficult to remove the domino from between his teeth once it entered his mouth. The
same prompt combination was then delivered again and the trial was restarted. If Reece
released the domino into the cardboard box, verbal praise and physical reinforcement
(e.g., pats on the back) were delivered and the next trial was started. The session was
terminated upon the timer signaling the elapse of 10 min.

Spence. Spence’s response chain occurred when access to preferred items was
restricted in any way. R1 consisted of Spence pointing at an item and or yelling or
emitting an, “eh, eh,” vocalization. R1 was frequently followed by classroom staff
prompting Spence to produce a manual sign corresponding to the item that he wanted.
The staff prompted using the form of a verbal prompt, “tell me what you want.” Spence
would then produce the appropriate manual sign. This response chain was observed to
occur in the session room with the investigator.

Therefore, baseline sessions consisted of placing an array of at least six highly
preferred items (identified through a preference assessment described below) on the table
in front of Spence, just out of his physical reach. A session timer, set for 10 min, was
started and the investigator said, “If there is something here you want, tell me what you
want.” If Spence emitted R1, the investigator blocked access to the item and gave a
verbal prompt: “Tell me what you want.” If following this prompt, Spence did not
respond or responded with anything other than an appropriate manual sign, the
investigator delivered the verbal prompt again and modeled the manual sign for the item
Spence desired. If it was not evident from Spence’s pointing what item he desired, he
emitted an unknown sign, or he signed for an item that was not on the table, the investigator held up two available items and said, “Do you want [name of item] or [name of item]?” If Spence reached toward one of the items, the investigator prompted the correct manual sign for that item using least to most prompting (i.e., deliver a verbal prompt, wait 3 s, deliver a model prompt, wait 3 s, and then deliver a physical prompt). If Spence continued to point or reach, the investigator repeated a verbal prompt: “Do you want [new item]?” until Spence reached for the item and then the investigator prompted a sign as described above. If Spence emitted a manual sign (R2) for any of the items on the table at any time, he was given 20 s access to that item. At the end of the 20 s interval, the item was removed from Spence’s possession and the investigator said, “It’s my turn.” The session was terminated upon the timer signaling the elapse of 10 min.

During intervention sessions, an array of at least six highly preferred items (identified through a preference assessment described below) was placed on the table in front of Spence, just out of his physical reach. A session timer, set for 10 min, was started and the investigator said, “If there is something here you want, tell me what you want.” This verbal prompt, the hypothesized discriminative stimulus as noted in the descriptive assessment results, was delivered once at least every 24 s (equivalent to the baseline rate of R1). If Spence emitted R1, the investigator blocked access to the item and gave a verbal prompt: “Tell me what you want.” If following this prompt, Spence did not respond or responded with anything other than an appropriate manual sign, the investigator delivered the verbal prompt again and modeled the manual sign for the item Spence desired. If it was not evident from Spence’s pointing what item he desired, he
emitted an unknown sign, or he signed for an item that was not on the table, the investigator held up two available items and said, “Do you want [name of item] or [name of item]?” If Spence reached toward one of the items, the investigator prompted the correct manual sign for that item using least to most prompting (i.e., deliver a verbal prompt, wait 3 s, deliver a model prompt, wait 3 s, and then deliver a physical prompt). If Spence continued to point or reach, the investigator repeated a verbal prompt: “Do you want [new item]?” until Spence reached for the item and then the investigator prompted for a sign, as described above. If Spence emitted a manual sign for any of the items on the table at any time, verbal praise was delivered and he was given 20 s of access to that item. At the end of the 20 s interval, the item was removed from Spence’s possession and the investigator said, “It’s my turn.” The investigator then immediately delivered the verbal prompt/S\text{D}, “Tell me what you want,” to take advantage of the current establishing operation of restricted access and to provide more opportunity for access to the contingency provided for R2. The session was terminated upon the timer signaling the elapse of 10 min.

Jane. Jane’s response chain was very similar to Spence’s in that she would grab or inappropriately ask for an item that was not available to her (R1) and, upon a verbal prompt delivered by staff, say the item she desired (R2). This behavior chain was frequently observed during times when BBAS staff worked with Jane in a session room. Therefore, baseline sessions began by placing an array of at least six highly preferred items (identified through a preference assessment described below) on the table in front of Jane, just out of her physical reach. A session timer, set for 10 min, was started and the
investigator said, “If there is something here you want, tell me what you want.” When Jane grabbed an item or asked inappropriately (see operational definitions below), that item was removed or blocked from Jane’s possession and the investigator delivered a verbal prompt: “What do you want?” If Jane did not respond or did not produce an appropriate request for the item (see operational definition below), the investigator gave an echoic prompt for the item (i.e., “What do you want, say [item name].”). If it was not evident what Jane wanted or if she referred to more than one item, the investigator gave a choice of two items that she often preferred and provided a verbal prompt (i.e., held up two items and said, “Do you want [item name] or [item name]?”). Anytime Jane produced an appropriate request for an item (R2) she was given 20 s of access to that item. At the end of the 20 s interval, the item was removed and the investigator said, “It’s my turn.” The session was terminated upon the timer signaling the elapse of 10 min.

During the intervention phase, sessions began by placing an array of at least six highly preferred items (identified through a preference assessment described below) on the table in front of Jane, just out of her physical reach. A session timer, set for 10 min, was started and the investigator said, “If there is something here you want, tell me what you want.” The investigator repeated this verbal prompt once at least every 25 s (equivalent to the baseline rate of R1). When Jane grabbed an item or asked inappropriately (see operational definitions below), that item was removed or blocked from Jane’s possession and the investigator delivered a verbal prompt: “What do you want?” If Jane did not respond or did not produce an appropriate request for the item (see operational definition below), the investigator gave an echoic prompt for the item (i.e.,
“What do you want, say [item name].”). If it was not evident what Jane wanted or she referred to more than one item the investigator gave a choice of two items that she often preferred and provided a verbal prompt (i.e., held up two items and said, “do you want [item name] or [item name].”). Anytime Jane produced an appropriate request for an item (R2) she was given 20 s of access to that item. At the end of the 20 s interval, the item was removed and the investigator said, “it’s my turn,” and then immediately delivered the verbal prompt as to take advantage of the current establishing operation of restricted access an provide more opportunity for access to the contingency provided for R2. The session was terminated upon the timer signaling a 10 min duration.

Reinforcers

During the unchaining procedure for Spence and Jane, reinforcement in the form of tangible items was delivered following the occurrence of the appropriate behavioral response. This reinforcement was selected based on the descriptive assessment and was selected because the inappropriate responses (R1) for each of these participants was maintained by access to tangible items in the natural environment. Interviews with classroom staff during the descriptive assessment phase identified a few preferred items and then Multiple Stimulus Without Replacement Preference Assessments (MSWO) were conducted to identify highly preferred items (DeLeon & Iwata, 1996). During the MSWO, 5 tangible items that were identified during staff interviews, or items that BBAS staff observed the participant interacting with in the past, were presented in a horizontal line in front of the participant. The participant was asked to pick one of the items. Upon choosing an item, the participant was given 20 s of access to the item before it was
removed from view. The remaining items were presented and the participant was allowed to choose another item until all five had been chosen. This was continued 3-5 times. A hierarchy of preferred items (shown in Figures 4.5 and 4.8 below) was developed by dividing the number of times each item was chosen by the number of times it was presented and multiplying by 100 (see Appendix G for an MSWO data sheet). The six - eight highest preferred items were present on the table in from of Spence and Jane during each of their baseline and intervention sessions.

During classroom observations, the investigator observed classroom staff delivering verbal praise and physical reinforcement (e.g., pats on the back or head rubs) to Reece upon completion of demand tasks. In addition, during baseline sessions, Reece frequently took the investigator’s hand and placed it on his head. Therefore, verbal praise and physical reinforcement were used to reinforce appropriate responses (R2) during baseline and intervention sessions conducted with Reece.

Data Collection

Data were collected using paper data sheets (see Appendix D), a timing device (e.g., stopwatch or timer), and pencils. The primary observer and two secondary data collectors collected data throughout the study. One secondary observer was a graduate student earning her Masters of Arts degree in Applied Behavior Analysis at the university attended by the investigator. The remaining secondary observer was a graduate student in the first year of the doctoral program in Special Education and Applied Behavior Analysis at the same university. Both secondary observers had taken at least one course in behavioral research methods and were graduate students volunteering with BBAS.
Potential establishing operations and consequent events. During the descriptive assessment, partial interval recording was used to collect data on potential establishing operations and consequent events using (see data sheet in Appendix C) to determine the variables that may be maintaining the response chain. Data were collected during 5 min sessions according to the operational definitions of each of the potential establishing operations and consequent events described above.

Frequency of responses within the response chain. During the descriptive analysis, baseline, and unchaining sessions, the frequency of the responses comprising the response chain was recorded on a data sheet (see Appendix D). These frequencies were collected using the operational definitions listed below. In addition, frequency data were collected on the delivery of discriminative stimuli and reinforcers delivered that correspond to each response chain for each participant during baseline and intervention.

Operational Definitions.

Reece. The first response (R1) in the response chain targeted with Reece was defined as Reece moving the domino with his hand or hands to within 2 in of his lips or past his lips. The second response (R2) was defined as Reece releasing the item into the container through the slot cut in the top of the container with or without prompting. An occurrence of the discriminative stimulus was recorded if the investigator or other staff said, “put in,” as a verbal prompt to continue the task or provided any physical assistance to help Reece put the item into container (this was noted with a “V” for verbal and “P” for physical prompt in the SD column on the data sheet). An occurrence of reinforcement
delivery was recorded if verbal praise or physical reinforcement (e.g., head rubs) were delivered.

*Spence.* The first response (R1) in the response chain targeted with Spence was defined as Spence grabbing an item or asking for an item in an inappropriate manner (i.e., pointing, saying “eh, eh,” or, “yah,” or screams). The second response in the chain (R2) was defined as Spence appropriately emitting a manual sign or approximation of a manual sign corresponding to an item present. An occurrence of the discriminative stimulus was defined as the investigator delivering any verbal (i.e., saying, “Tell me what you want.”), model, or physical prompt. An occurrence of reinforcement delivery was recorded if Spence was provided access to the requested item.

*Jane.* The first response (R1) in the response chain targeted with Jane was defined as Jane grabbing an item or asking for an item in an inappropriate manner (e.g., saying, “I want one,” “in my hand,” “eh, eh,” saying “that” while not pointing to an item, or “I want more”). The second response in the chain (R2) was defined as Jane asking appropriately for an item (i.e., saying the name of the item or pointing to one particular item and saying, “that”). An occurrence of the discriminative stimulus was defined as the investigator delivering any verbal (i.e., saying, “What do you want?”) or physical prompt. Reinforcement delivery was recorded if access to the requested item was provided.

*Observer Training.*

Secondary observers participated in two or more role-playing sessions with the experimenter in order to become familiar with the experimental procedures. Then they practiced collecting data until agreement with the primary investigator was above 80%.
Interobserver Agreement

Five types of interobserver agreement (IOA) were calculated: total count, conditional probabilities, trial-by-trial, occurrence, and nonoccurrence. A total count IOA was calculated by dividing the smaller number of occurrences of each response recorded by the larger number of occurrences recorded and then multiplying by 100. IOA for the conditional probabilities was calculated by dividing the smaller proportion by the larger proportion and multiplying by 100 for each probability calculated. Trial-by-trial IOA was calculated by comparing occurrences and nonoccurrences of responses recorded on a trial-by-trial basis and then dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100. Occurrence IOA was calculated by dividing the number of agreements on the occurrence of a response by the number of agreements plus disagreements and multiplying by 100. Nonoccurrence IOA was calculated by dividing the number of agreements on the nonoccurrence of a response by the number of agreements plus disagreements and multiplying by 100. All IOA scores calculated were then averaged across sessions for each participant by study phase. Table 3.2 displays the percentage of sessions in which a secondary observer collected data on the occurrence of the responses within the response chains and the means and ranges of interobserver agreement for each type of agreement calculated during both phases of the study for each participant. An agreement was recorded if both observers recorded an occurrence of a response or both observers recorded the absence of a response during the same trial.
<table>
<thead>
<tr>
<th>% of Sessions</th>
<th>Reece Baseline</th>
<th>Intervention</th>
<th>Spence Baseline</th>
<th>Intervention</th>
<th>Jane Baseline</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Count</td>
<td>20%</td>
<td>24%</td>
<td>25%</td>
<td>29%</td>
<td>30%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>(95.16–96.43)</td>
<td>(85%–100%)</td>
<td>(92.86%–89.06%)</td>
<td>(100%)</td>
<td>(85.16–96.43)</td>
<td>(85.71%–97.37%)</td>
</tr>
<tr>
<td>Trial By Trial</td>
<td>88.51%</td>
<td>93.75%</td>
<td>90.96%</td>
<td>91.79%</td>
<td>100%</td>
<td>84.83%</td>
</tr>
<tr>
<td></td>
<td>(86.27%–91.51%)</td>
<td>(86.75%–100%)</td>
<td>(86.84%–76.32%)</td>
<td>(95.24%)</td>
<td>(69.35%–100%)</td>
<td>(98.44%)</td>
</tr>
<tr>
<td>Occurrence</td>
<td>89.70%</td>
<td>68.94%</td>
<td>94.78%</td>
<td>93.38%</td>
<td>100%</td>
<td>83.02%</td>
</tr>
<tr>
<td></td>
<td>(87.69%–91.94%)</td>
<td>(38.89%–100%)</td>
<td>(92.30%–82.54%)</td>
<td>(96.97%)</td>
<td>(60.53%–100%)</td>
<td>(97.37%)</td>
</tr>
<tr>
<td>Nonoccurrence</td>
<td>86.80%</td>
<td>95.55%</td>
<td>94.72%</td>
<td>88.49%</td>
<td>100%</td>
<td>83.72%</td>
</tr>
<tr>
<td></td>
<td>(83.78%–90.91%)</td>
<td>(93.04%–100%)</td>
<td>(88.89%–58.33%)</td>
<td>(96.97%)</td>
<td>(71.43%–100%)</td>
<td>(100%)</td>
</tr>
<tr>
<td>Conditional</td>
<td>96.82%</td>
<td>92.07%</td>
<td>96.72%</td>
<td>94.26%</td>
<td>100%</td>
<td>85.03%</td>
</tr>
<tr>
<td>Probabilities</td>
<td>(95.54%–99.16%)</td>
<td>(75.1%–100%)</td>
<td>(88.44%–79.19%)</td>
<td>(100%)</td>
<td>(71.08%–100%)</td>
<td>(94.86%)</td>
</tr>
</tbody>
</table>

Table 3.1 Interobserver agreement means and ranges (in parentheses) for each participant during baseline and intervention phases.
**Procedural Integrity**

The secondary observer (described above) also collected data on the fidelity with which the procedures of the study were implemented. During baseline sessions, a secondary observer recorded procedural integrity data during 30% of Reece’s sessions, 25% of Spence’s sessions, and 40% of Jane’s sessions. During intervention sessions, a secondary observer collected procedural integrity during 25% of Reece’s sessions, 29% of Spence’s sessions, and 28% of Jane’s sessions. A procedural integrity checklist (see Appendices E and F) listing the procedural steps that were to be completed during each session was used throughout the baseline and intervention sessions. The secondary observer was required to record the occurrence or nonoccurrence of each procedural step. These data were used to calculate a percent of procedural steps completed, a measure of procedural integrity. Table 3.3 displays the means and ranges of procedural steps completed correctly throughout baseline and intervention sessions for all participants.

<table>
<thead>
<tr>
<th></th>
<th>Reece</th>
<th>Spence</th>
<th>Jane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>98.94%</td>
<td>99.60%</td>
<td>94.73%</td>
</tr>
<tr>
<td></td>
<td>(96.83%–100%)</td>
<td>(98.39%–100%)</td>
<td>(94.23%–95.24%)</td>
</tr>
<tr>
<td>Intervention</td>
<td>100%</td>
<td>97.22%</td>
<td>95.38%</td>
</tr>
<tr>
<td></td>
<td>(93.33%–100%)</td>
<td>(89.90%–99.13%)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2 Mean and ranges (in parentheses) procedural integrity during baseline and intervention phases
Experimental Design

The experimental design was a nonconcurrent multiple baseline across participants design. Baseline sessions were conducted until performance was stable for all participants. This was followed by implementation of the intervention phase, staggered across time and number of sessions for each participant.

Social Validity.

Social validity questionnaires were distributed to the staff and family responsible for the care and education of each participant (see Appendices H and I). The questionnaires contained Likert scale or multiple choice questions regarding the goals, procedures, and results of this study. Specifically, the questionnaires contained a question regarding the importance of having a goal to address disrupting response chains that contain inappropriate behaviors like the response chain addressed with their student or child. There were also questions regarding the importance of having a goal of decreasing the frequency of an inappropriate behavior while maintaining the frequency of an appropriate behavior that occur in a specific sequence. There were questions regarding the practicality of implementing the unchaining procedure used in the study, especially as compared to the intervention that was in place to address the inappropriate behavior prior to the study and the likelihood of the parent or staff implementing or recommending similar procedures in the future. Finally, there were questions regarding the perception of improvement in the participant’s behavior, specifically in the disruption of the response chain, the decrease of the targeted inappropriate behavioral response, and the maintenance or increase in the appropriate behavioral response. Staff and parents were
given a summary of the procedures and results of the study (see Appendix J), including copies and descriptions of the graphs of the response rates of each response in the response chain in order to answer questions on the social validity questionnaire while referring to the procedures and results specific to their student or child.
CHAPTER 4

RESULTS

Descriptive Functional Assessment Results

*Reece.* Interviews conducted with Reece’s teacher suggested that Reece was noncompliant during work tasks, especially tasks involving putting small objects into larger containers. Instead of correctly putting the items into the container, Reece put the item into his mouth. Ten observations were conducted during a daily work task in which Reece was required to put dominos into a slot cut into a cardboard box while a classroom assistant was supervising and prompting him through the task. Data were collected on the frequency of occurrences of Reece putting the domino to his mouth and of putting the domino into the box. Conditional probabilities were then calculated to determine if these responses occurred in a predictable sequence to support the argument that they comprised a response chain. Figure 4.1 displays the average conditional probabilities before and during intervention. The average probability that R2 followed R1 was .88 while the average probability that R2 occurred in the absence of R1 was .12. Therefore although R1 occurred more often than R2, R2 rarely occurred without being preceded by R1. This suggested that the R1 followed by R2 sequence was predictable and possibly a response chain.
Figure 4.1 Average baseline and intervention conditional probabilities for Reece

Figure 4.2 shows the descriptive assessment results from these observations. On average, 97.24% of the occurrences of Reece putting the domino to his mouth (according to the operational definition above) resulted in verbal or physical prompts delivered by the classroom assistant. This suggests that the discriminative stimulus produced by R1 and that occasioned R2 was a stimulus prompt. Regarding the consequences that followed R2, verbal or physical attention was delivered by the assistant an average of only 5.65% of occurrences. However, attention was hypothesized to be the maintaining
consequence for the response chain, or at least an effective reinforcer to be used during intervention. This hypothesis was formed because, anecdotally, Reece frequently looked at the assistant after emitting R2 and frequently reached for the assistant’s hand to place on top of his head, presumably for a head rub. In addition, head rubs were reported by the assistant to be a preferred reinforcer.

Figure 4.2 Descriptive assessment results for Reece

Spence. Interviews with Spence’s teacher and observations by BBAS members suggested that Spence exhibited aggression when denied access to tangible items, and
Spence rarely requested items spontaneously. Pointing and whining and other inappropriate vocalizations (e.g., a “yah, yah” vocalization) often preceded aggression. If prompted during the pointing or inappropriate vocalizations, Spence would emit a manual sign referring to the item he desired. Classroom staff prompted Spence by saying, “Tell me what you want.” Data from three observation sessions suggested that Spence’s response chain consisted of an inappropriate vocalization followed by a prompt from staff, which occasioned a manual sign emitted by Spence.

Conditional probabilities were calculated from the data collected on the frequency of R1 (i.e., inappropriate vocalizations or pointing) and R2 (producing a manual sign). During baseline (depicted in Figure 4.3) the average probability of R2 following R1 was .68 while the average probability that R2 occurred alone was only .30. This suggested that R1 was predictably followed by R2, meeting one of the requirements of a response chain.
Data from the same observations suggested a pattern in the maintaining variables of the responses within the chain. These data are depicted in Figure 4.4. Specifically, 58.10% of the occurrences of R1 emitted by Spence resulted in a prompt, suggesting this was a discriminative stimulus produced by R1 that occasioned R2. In addition, 88.89% of occurrences of R2 resulted in access to a preferred item. This suggests that the terminal reinforcer maintaining the response chain was access to tangible items, produced by R2.
During the MSWO preference assessment, a nail toy, View Master®, and slinky toy were found to be the highest preferred items and were the items most often chosen throughout the intervention phase. Figure 4.5 depict the hierarchy of preferred tangible items suggested by the MSWO and the highest six – eight items were used during the sessions.
Figure 4.5 Preference hierarchy for Spence

*Jane.* Interviews with Jane’s teacher and observations by BBAS members suggested that Jane would request preferred items vocally but only when prompted. Jane frequently grabbed items or requested items using inappropriate vocalizations (e.g., pointing and saying “eh, eh” or saying “I want one,” “more,” or “that” without referring directly to a specific object). If classroom or BBAS staff delivered a verbal prompt (e.g.,
“What do you want?”) following one of these inappropriate responses, Jane would frequently say the name of the preferred item she desired.

Data were collected on the frequency of both inappropriate requesting and grabbing (R1) and appropriate requesting (R2). Conditional probabilities calculated from these data and are depicted in Figure 4.6. During baseline, the average probability of R2 occurring in the presence of (following) R1 was .76 during baseline. Comparatively, the probability that R2 occurred alone (i.e., in the absence of R1) was only .27, suggesting R2 typically followed R1 as predicted if they comprised a response chain.

Figure 4.6 Average baseline and intervention conditional probabilities for Jane
During these observations, additional data collected on the frequency of potential maintaining variables suggested a pattern similar to Spence’s descriptive assessment data. The descriptive assessment data on potential maintaining variables are shown in Figure 4.7. That 94.44% of occurrences of R1 emitted by Jane resulted in a verbal prompt by classroom or BBAS staff suggested that was the discriminative stimulus produced by R1 that occasioned R2 in the response chain. In addition, 94.44% of occurrences of R2 resulted in access to a preferred tangible item. This suggested that access to tangible items was the terminal reinforcer maintaining the response chain.

![Descriptive Assessment Results for Jane](image)

Figure 4.7 Descriptive assessment results for Jane
An MSWO was also conducted with Jane to determine a preference hierarchy of tangible items. Figure 4.8 shows a variety of items preferred by Jane and the highest preferred six to eight items were then used in the baseline and intervention sessions. Jane’s most preferred items were a squishy ball, a toy cell phone, markers, and a water snake.

![Jane Preference Assessment](image)

**Figure 4.8 Preference hierarchy for Jane**

In summary, there were three response chains targeted in this study determined by the descriptive assessments above, one emitted by each of three participants. Table 4.1
lists the components of each response chain, emitted by each individual. Reece’s response chain occurred during a daily put-in work task and consisted of placing the domino in his mouth that resulted in a prompt followed by putting the domino into the cardboard box. Spence’s response chain occurred throughout the day during times when a preferred item was out of reach and consisted of pointing at the item or whining which resulted in a verbal prompt which then produced a sign for the item. Jane’s response chain occurred during times in which access to desired items was restricted and consisted of grabbing or otherwise inappropriately requesting an item which resulted in a verbal prompt and was followed by a vocal request for the item.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Establishing Operation</th>
<th>Response One (Inappropriate)</th>
<th>Discriminative Stimulus</th>
<th>Response Two (Appropriate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reece</td>
<td>Work task</td>
<td>Places domino in mouth</td>
<td>Physical prompt</td>
<td>Places domino in box</td>
</tr>
<tr>
<td>Spence</td>
<td>Restricted access to tangible item</td>
<td>Points and whines or screams</td>
<td>Verbal prompt</td>
<td>Requests using manual sign</td>
</tr>
<tr>
<td>Jane</td>
<td>Restricted Access to Tangible Item</td>
<td>Grabs, points, whines, etc.</td>
<td>Verbal Prompt</td>
<td>Requests using item name</td>
</tr>
</tbody>
</table>

Table 4.1 Response chain components
Changes in Response Rates

Figure 4.8 shows the response rates of each response in each of the participants’ response chains before and following the implementation of the unchaining intervention. The graph shows that the response rates for Jane (first panel) and Spence (third panel) during baseline were very similar for R1 and R2. For Jane, the average rates per min of R1 and R2 were 1.18 (range, .9 to 1.4) and 1.32 (range, .6 to 1.9) respectively. The average rates of R1 and R2 per min for Spence were 1.17 (range, .5 to 1.7) and 1.70 (range, .4 to 2.9) respectively. However, during intervention, the graph depicts a visual separation between R1 and R2 as compared to baseline. For Jane R1 decreased from a mean of 1.18 (range, .9 to 1.4) to .61 (range, 0 to 1.3) while R2 increased from a mean of 1.32 (range, .6 to 1.9) to 2.71 (range, 1.6 to 3.3). For Spence R1 decreased from a mean of 1.17 (range, .5 to 1.7) per min to .31 (range, 0 to 1.4) per min and R2 increased from a mean of 1.70 (range, .4 to 2.9) per min to 2.16 (range, 1.6 to 2.9) per min.

Response patterns differed for Reece (second panel) in that the degree of separation between the rates of R1 and R2 on the graph decreased following implementation of the unchaining procedure. The average response rate for R1 decreased from 4.85 (range, .3 to 5.3) per min during baseline to .76 (range, 0 to 1.5) per min during intervention phases. The average response rates for R2 also decreased, although only slightly from 1.82 (range, .6 to 4.3) per min to .98 (range, .6 to 1.7) per minute.
Figure 4.9 Multiple baseline graph of response rates across participants
Although the response rates for R1 did not decrease to zero, and therefore, the response did not extinguish, there were changes noted in the topographies of R1 for Spence and Jane. There were four different topographies of the inappropriate response observed emitted by Spence: pointing, emitting an inappropriate vocalization (“eh” or “yah”), pointing with an inappropriate vocalization (“eh” or “yah”), or grabbing the item. There was a pattern of change noted during the study in that the average percentage of pointing with an inappropriate vocalization was less during intervention (23.72% of R1 responses) than during baseline (53.99% of R1 responses). The average percentage of grabbing and the inappropriate vocalization without pointing decreased as well during the intervention phase (from 6.34% to 4.77% and 9.74% to 4.13% respectively). The average percentage of pointing alone increased from 27.07% of R1 to 46.23% of R1.

There were three topographies of R1 emitted by Jane during the study: grabbing, pointing, and inappropriate vocalizations (e.g., “I want one,” or “more”). The average percentage of R1 that were grabbing responses was lower during the intervention phase (65.86%) than during the baseline phase (86.03%). The average percentage of R1 that were pointing and inappropriate vocalizations increased from baseline (from 0% to 5.32% and from 13.97% to 2.93% respectively).

Changes in Conditional Probabilities

Figure 4.6 above displays the changes in average conditional probabilities in the response chain emitted by Jane from baseline to intervention. During baseline, the average probability that R2 followed R1 was .76 whereas the average probability that R2 occurred alone was only .27. During intervention sessions, the average probability that
R2 occurred alone increased to .78 while the probability that R2 followed R1 (i.e., occurred in a response sequence or chain) decreased to .22.

Figure 4.3 above displays the changes in the average conditional probabilities in the response chain emitted by Spence from baseline to intervention. The probability that R2 occurred following R1 (i.e., in a response sequence or chain) decreased from .68 to .17 whereas the probability that R2 occurred alone increased from .30 to .98.

Figure 4.1 displays the conditional probability averages during baseline and intervention for the response chain emitted by Reece. The average probability that R2 followed R1 (i.e., responses occurred in a sequence or chain) decreased from .88 during baseline to .09 during intervention sessions. In addition, the probability that R2 occurred alone (i.e., in the absence of R1) increased from an average of .12 during baseline to .89 during intervention.

Social Validity

A social validity questionnaire was sent to each of the participants’ classroom teachers and each of the three questionnaires was returned. Each of the staff members reported that she perceived the goal of disrupting the response chain in the current study as either somewhat or very important (4 or 5 on a 1 to 5 Likert scale). Each staff member reported the goals of decreasing the inappropriate and increasing the appropriate responses within the chain as very important goals to address (5 on a 1 to 5 Likert scale).

Regarding the procedures, the staff reported that reinforcing the appropriate response whenever it occurred was either somewhat or very practical (4 or 5 on a 1 to 5 Likert scale) and that they would be willing to implement the procedure in their
classroom. Each of the staff members reported that prompting the appropriate response on a specified schedule was either somewhat or very practical (4 or 5 on a 1 to 5 Likert scale). When asked if they would be willing to implement the procedure in their classroom they responded yes or maybe. When asked if they would recommend either of the procedures to fellow staff members with students with similar response chains, two staff members responded they would recommend both procedures and one responded he/she would maybe recommend both procedures. Two staff members responded they would continue using the procedures they were currently using to address the inappropriate response within their student’s response chain, but would consider trying the procedures used in the current study, and one staff member reported she would consider using the procedure in the study.

In regards to the results, two staff reported that the response chains exhibited by their students were disrupted a little while the third reported it was disrupted a lot. In addition, two staff reported that the targeted appropriate responses increased a little, but not to acceptable levels and the inappropriate response decreased a little but not to acceptable levels. The third staff reported that the appropriate response increased to acceptable levels and the inappropriate response decreased to acceptable levels.

One social validity questionnaire was delivered to each participant’s parents or guardian and one questionnaire was returned. This parent reported that each of the goals of the current study (i.e., disrupting the response chain, increasing the appropriate response, and decreasing the inappropriate response) was very important (5 on a 1 to 5 Likert scale). This parent reported that reinforcing the appropriate response whenever it
occurred was somewhat practical to implement in their home (4 on a 1–5 Likert scale) and that he/she would be willing to implement the procedure in the home. As for the procedure of prompting the appropriate response on a specified schedule, the parent reported that he/she did not know if it was a practical procedure (3 on a 1–5 likert scale), but he/she would be willing to implement it in his/her home. This parent reported he/she would recommend both procedures to another parent for treating similar responses in a response chain. This parent also reported that he/she was not currently using any procedure to address the inappropriate response but he/she would consider using the ones used in the study.

When asked about the perceived changes in response rate, the parent reported that the response chain was disrupted a lot, but he/she was not sure if the appropriate response increased. Finally he/she reported that the inappropriate response decreased a little, but not to acceptable levels. This parent also wrote on the questionnaire that he/she believed his/her child was “greatly helped” by the procedures in the study especially in showing the “correct behaviors”, but he/she was not sure if his/her child was “at the appropriate levels” and this is why he/she answered the way he/she did.
The research questions guiding this study were: (a) Will an unchaining procedure, consisting of delivering the discriminative stimulus for the appropriate response and then reinforcing it whenever it occurs, disrupt a behavior chain consisting of an inappropriate followed by an appropriate response by affecting the conditional probability that R2 will follow R1? (b) What effect if any will this unchaining procedure have on the frequency of the inappropriate response in the chain, and (c) What effect if any will this unchaining procedure have on the frequency of the appropriate response in the chain? The multiple baseline across participants analysis showed that the unchaining procedure consisting of reinforcing the appropriate behavior regardless of when it occurred and providing the appropriate discriminative stimulus on a fixed schedule was effective in disrupting all three response chains targeted. This disruption was evident in the changes in the response rates during the intervention phase for all three participants.

The changes in response rates of R1 and R2 (see Figure 4.9) following intervention for Jane and Spence, suggest the unchaining procedure resulted in a disruption in the response chain. In addition, the inappropriate response (R1) decreased while the appropriate response increased or maintained for both these participants.
Although the rates of R1 did not decrease to zero for any participant, there were changes in the topographies of R1 emitted by Spence and Jane during the study. The average percentage of R1 that were grabbing responses and pointing with inappropriate vocalizations emitted by Spence decreased, while pointing alone increased as compared to baseline. These data suggest that the percentage of inappropriate responses that were more inappropriate responses (grabbing and pointing with yelling “eh”) decreased while the less inappropriate response (pointing) increased. The average percentage of R1 that consisted of grabs (the most inappropriate response emitted by Jane) decreased while the average percentage of R1 that were points and inappropriate requests increased as compared to baseline. In addition, the inappropriate vocalizations emitted by Jane were not inappropriate in and of themselves, as they were vocalizations such as, “I want one,” and “Give me more.” Instead they were inappropriate because it was difficult to determine which item Jane wanted. However, they were vocalizations as opposed to points and as such were closer approximations to vocalizations that were considered appropriate (i.e., saying the item name).

Regarding Reece, there was a change in response rates following the implementation of the unchaining intervention as well, suggesting the unchaining procedure did have an effect on the response rates within the chain. Although the inappropriate response (R1) decreased, the appropriate response (R2) decreased slightly as well. This suggests the response chain may have been disrupted but not to a clinically acceptable level (possible explanations for this are described below).
The effectiveness of the unchaining procedure was shown in two ways. First, the rates of R1 and R2 differed from baseline after the unchaining intervention was implemented in each participant’s response chain. Second, the conditional probabilities calculated from the intervention sessions suggest that the responses no longer met the response sequence requirement of the response chain definition after the intervention was implemented. Specifically, following implementation of the intervention, R2 occurred alone more often than it followed R1 for each participant. Each response chain was no longer a response sequence and was therefore not a response chain following intervention. Even in the response chain emitted by Reece the majority of occurrences of R2 occurred in the absence of R1 following baseline. Therefore, even though the rate of R2 did not increase, the chain was disrupted.

Reece was the only participant who did not show an increase in the appropriate response (R2) with the unchaining procedure. This might be expected if the target responses comprised a response sequence instead of a response chain. This is not likely, however, given that the first response decreased more rapidly than the second response as predicted by response chain disruption research (Fantino, 1965). A more likely explanation for the lack of increase in the frequency of R2 for Reece was that the descriptive assessment did not definitively reveal the terminal reinforcer for the response chain. Physical attention was not delivered frequently contingent on the appropriate response during the descriptive assessment (see Figure 4.2). Nevertheless, it was used as a consequence for the appropriate response because observations and staff interviews suggested it was preferred. However, during the sessions in this study, it may not have
functioned as an effective reinforcer for the appropriate response targeted. It is possible that an increase in the rate of R2 may have been observed had a more potent reinforcer been delivered contingent on R2.

It is possible that the attentional prompt used was not the discriminative stimulus most likely to occasion R1 or that the prompt provided attention that functioned to reinforce R1. The assessment conducted to determine the variables maintaining the response chain was only descriptive and thus the maintaining variables may have been misidentified. A functional analysis may have added support to the hypothesis produced from the information and data gathered during the descriptive assessment about the function of the response chain.

In addition to the possibility that the attentional prompt may not have been the discriminative stimulus that would more frequently occasion R1, it may be that the protocol for delivering the attentional prompt did not allow for proper access to the reinforcement contingency. For example, it was necessary to block the entry of the domino into Reece’s mouth because once in his mouth, it was often difficult to remove from the tight grasp between his teeth. To accomplish this, the investigator had to be close enough to block entry into the mouth. To avoid physically removing the domino from Reece’s mouth and to allow for more opportunity to independently respond, an occurrence of R1 was recorded when the domino came within 2 in of Reece’s mouth. This close positioning of the investigator to Reece may have functioned as attention, and thereby obscured the effects of the fixed schedule delivery of physical attention arranged by the experimenter to act as the discriminative stimulus for R2. In addition, it was
occasionally necessary to block other inappropriate behavior exhibited by Reece that may have interfered or been incompatible with the appropriate response (e.g., physical destruction of the box). This blocking was often necessarily physical (e.g., removing Reece’s hand or mouth from the box) and may have functioned as physical reinforcement for the inappropriate behaviors. This could have impeded an increase in the appropriate response.

According to the responses on the social validity questionnaires from the three teachers and one parent, the goals of this study were at least somewhat important to address. In addition, the procedures used in this study were reported to be at least somewhat practical to implement in the classroom and somewhat practical to implement in the home. Finally, staff and parents reported that the response chains were disrupted at least a little and inappropriate responses decreased. These responses, albeit less than enthusiastic endorsements, are still encouraging considering the overall tone and culture of the particular schools in which this study was conducted. The staff in the two schools from which these data were collected were often reluctant to make any changes in their classroom. The work tasks students were expected to complete were often not functional tasks for those students, the overall rate of reinforcement delivered by staff was low, and the ratio of instruction to leisure time was low throughout the two schools. Therefore, it can be seen as a small accomplishment that the staff serving the students in this study returned the social validity questionnaires without entirely rejecting the procedures used by the investigator.
Implications and Contributions

This study contributes to the literature on response chains in at least three ways. First, the study successfully implemented an unchaining procedure to disrupt three response chains. Second, this procedure was used with a response chain consisting of an inappropriate response followed by an appropriate response that had been inadvertently established in the natural environment. Third, this study used conditional probabilities to support the conceptualization of inappropriate behavior as being a member of a response chain that could be disrupted using an unchaining procedure.

Many applied studies have investigated the technology of establishing response chains (e.g., Hagopian, Farrell, & Amari, 1996; McWilliams, Nietupski, & Hamre-Nietupski, 1990; Miltenberger, 2001). However, few applied studies have investigated the technology of disrupting response chains (e.g., Contrucci-Kuhn et al., 2006) and even fewer have investigated disrupting response chains that contain inappropriate behavior (e.g., Hagopian, Paclawskyj, & Contrucci-Kuhn, 2005). The current study examined the technology involved in disrupting response chains that involved a combination of inappropriate and appropriate behavior. In addition, this study addressed response chains containing responses that had already been established inadvertently in the natural environment.

The current study used the conceptual discussion of Michael (2000) and the conditional probability application technology of Hagopian et al. (2005) to conceptualize problem behavior as a component in a response chain and also to disrupt that chain. Michael (2000) suggested that one way to disrupt a response chain is to reinforce the
second response regardless of whether it occurred within the response chain or alone. This procedure was chosen to disrupt response chains that contained an inappropriate behavior followed by an appropriate behavior because of its potential to maintain the latter while decreasing the former. This type of response chain (an inappropriate followed by an appropriate response) was chosen for investigation in this study because research in this area could contribute to the literature in addressing such difficult chains (Contrucci-Kuhn et al., 2006). In addition, this is the most common chain involving a combination of inappropriate and appropriate behavior; therefore, research in this area is likely to have clinical significance (Martin & Pear, 2003).

In the study conducted by Contruci-Kuhn and colleagues (2006), two of the three participants continued to emit the first response in the response chain when R2 was differentially reinforced (regardless of when it occurred) until the discriminative stimulus that was produced by R1 and which occasioned R2 was presented and made continuously visible. Therefore, in the present study, the procedures used to disrupt the already established response chain containing an inappropriate response followed by an appropriate response, was to present the discriminative stimulus to occasion the appropriate response and to reinforce the appropriate behavior (R2) whenever it occurred.

The discriminative stimulus procedure used in this study was slightly different from that used in the Contrucci-Kuhn et al. (2006) study in that the discriminative stimulus could not be presented and remain visible continuously. The discriminative stimuli discovered to occasion the second response in all three response chains in this study were verbal or physical prompts delivered by a staff member. Given that the
discriminative stimuli were discrete occurrences of a response exhibited by another person, they were delivered on a fixed schedule. The schedule was determined by the baseline rate of R1 in order to be a more practical and natural schedule. Although this procedure was slightly different from that used in the Contrucci-Kuhn et al. study, it was found to be successful in disrupting all three response chains (as noted by the changes in the conditional probabilities following implementation of the unchaining intervention). It was also successful in occasioning the appropriate response to increase the rate of R2 in response chains emitted by two of the three participants (i.e., Spence and Jane). The procedure was reported to be at least “somewhat practical” to implement in the classroom and the parent who responded to the social validity questionnaire said she would be willing to implement it in the home. These reports imply a step forward in the task of finding a technology that teachers and parents would consider implementing. By using the conditional probability calculations to support a response chain conceptualization and then using response chain disruption procedures, these parents and teachers may have more success in treating certain problem behaviors.

Limitations and Future Research

There are a few limitations of the present study that deserve discussion. First, the study used the unchaining procedure with only three participants. In addition, two of the three response chains targeted for disruption in this study involved manding (requesting) objects spontaneously (as opposed to only following staff prompts). It is possible that the effectiveness of this unchaining procedure is limited to the participants in this study or to only the types of the response chains targeted in this study. Replications across
participants and other response chain topographies would lend credibility and generality to the results found here.

As discussed earlier, the study used descriptive assessments (i.e., staff interviews and observations) because it was assumed that these descriptive assessments would effectively determine the maintaining variables for each response chain (i.e., the discriminative stimuli and the terminal reinforcer). It is possible that the variables hypothesized to be maintaining the chains according to these assessments were inaccurate (e.g., the discriminative stimulus and terminal reinforcer for the response chain emitted by Reece). Future studies should use more systematic experimental procedures (i.e., functional analysis) to support the hypothesis developed by the descriptive assessment regarding the variables that maintain the responses within the response chain. The results of the descriptive assessment may aid in developing specific conditions to be included in the functional analysis.

Another limitation of the study is that there were several instances of low interobserver agreement (IOA). Previous studies using conditional probabilities in descriptive functional assessments used partial interval data collection procedures (Vollmer et al., 2001). Calculations were then made for each conditional probability by counting the number of intervals in which an event was recorded within, before, or after the interval in which problem behavior occurred. Calculations to determine conditional probabilities in the current study could not be done in a similar manner because data needed to convey the specific sequence of responses and partial interval recording would obscure that sequence. Therefore, frequency data were collected in a trial format in order
to determine the sequence of occurrences of the responses within the chain. The occurrences of each response chain did not naturally occur in a discrete trial format and was instead operationally defined as such for calculation purposes. This made exact trial-by-trial agreement between two observers a difficult standard to achieve. For example, if an occurrence of R1 was recorded by only one of the observers, the order of all subsequent recordings would then be different for the two observers with comparisons occurring between different trials. The total and conditional probability IOA may be more accurate as the data analyzed in this study consisted of the rates of each response and the changes in conditional probabilities.

Future researchers may want to construct and test a new technology to determine if the sequences were chains. This technology would need to include procedures that determine that each response in the chain produces a change in the environment that acts as a discriminative stimulus for the next response. This may involve experimental conditions that systematically present and prevent the occurrence of that discriminative stimulus following R1 and determining the effects of those conditions on the rates of R2. In addition, procedures would also need to determine that the same change in the environment that was caused by R1 and which acted as a discriminative stimulus for R2 also acted as a conditioned reinforcer for R1. This may involve a reinforcer assessment to determine the effects of R1 in either producing or not producing that change in the environment on the future rates of R1. Finally, these procedures would need to determine that there was a terminal reinforcer, produced by the final response in the chain, that maintains the occurrence of all responses within the chain. This may involve another
reinforcement assessment to investigate the effects of either producing or not producing reinforcer delivery on the rate of each response within the chain.

Other ways to calculate conditional probabilities of the occurrence of the responses within a chain may be discovered and found to reveal more accurate patterns of responding. Researchers may want to verify experimentally that the change in the environment caused by R1 acts as a conditioned reinforcer for R1 and as a discriminative stimulus for R2. Researchers should focus on finding an assessment procedure that would determine if a sequence was a chain so that effects of procedures can be studied on both sequences and chains, in the event that the effects may differ.

A final limitation is that the intervention did not differ greatly from the baseline sessions. The revealed response chains were fairly efficient in producing the terminal reinforcer in the natural environment. For example, Spence and Jane almost always received the reinforcers they requested when the response chain was emitted. Therefore, the baseline protocol was to deliver the requested reinforcer when it was requested. However, during baseline, appropriate requests in the absence of inappropriate responses were rarely made by the participants. Therefore, response chains were reinforced with the delivery of the terminal reinforcer throughout baseline sessions and the main procedural difference implemented during intervention sessions was the addition of the delivery of the discriminative stimulus on a fixed schedule. Similarly, Reece’s inappropriate behavior almost always resulted in a prompt in the natural environment and therefore resulted in a prompt during experimental sessions. This suggests that the particular piece
of the intervention that was effective in changing the rates of responses was the delivery of the discriminative stimulus.

Future studies that target similar response chains may investigate the unchaining procedure differently by determining the rate at which inappropriate responses resulted in delivery of the discriminative stimuli and then delivering the discriminative stimuli at this rate during baseline sessions and after every inappropriate response during intervention sessions. Similarly, researchers could determine the rate at which the terminal reinforcer was delivered following R2 and arrange a similar schedule during baseline sessions and a more continuous schedule during the intervention. This would not only simulate the naturally occurring contingencies more closely (a goal of applied research) but also allow systematic investigation of the effectiveness of the unchaining procedures. In addition this would make it more likely that R2 would increase during the intervention phase, as the rate of reinforcement would be higher than during the baseline phase. These schedules of discriminative stimulus and reinforcer delivery could then be faded to more natural intermittent levels and may then elicit more favorable reports of practicality of implementation from teachers and parents. Future researchers could also manipulate the reinforcement and S^D schedules in a parametric analysis.

The current study is the first step on a longer journey in investigating the effectiveness of the unchaining procedure on response chains that include inappropriate behavior followed by appropriate behavior. The current study successfully disrupted three response chains in a multiple baseline across participants design. This finding lends support to conceptualizing inappropriate or challenging behavior in response chains and
then implementing procedures that would disrupt those chains. Future research should replicate and extend these findings and determine the contexts in which the unchaining procedures are effective. Future investigations should also continue to determine the most effective technology for disrupting response chains that include inappropriate behavior. In addition, future research could compare these procedures to procedures suggested by other conceptualizations of challenging behavior.
REFERENCES


APPENDIX A

LETTER OF SCHOOL SUPPORT
01 December 2007

Members of The Ohio State University Institutional Review Board,

I am writing this letter to indicate that the project "Breaking the Link: An Analysis of Procedures to Decrease Inappropriate Behavior When it is a Link in a Response Chain" conducted as a dissertation study by Amanda E. Guld and the members of Buckeye Behavior Analysis Services, under the supervision of Dr. Nancy Neef and Dr. Helen Malone, has the full support of Franklin County Board of Mental Retardation and Developmental Disabilities.

Our schools serve students with severe to profound developmental disabilities, many of who have difficulty learning new skills due to problem behaviors (e.g., self-injurious behavior, aggression towards staff and classmates, etc.) that prevent the students from contacting appropriate instruction. oftentimes problem behaviors occur within a chain of multiple behaviors and sometimes that chain includes appropriate and inappropriate behaviors. The above named study is designed to decrease the problem behavior that occurs within a chain while maintaining and increasing the appropriate behavior. We believe that any examination of methods for assessing and intervening on behaviors that may inhibit learning is appropriate for this population and believe that this project will benefit our students.

I am looking forward to collaborating with Dr. Nancy Neef and Amanda Guld on this project, which I believe will greatly assist us in meeting the needs of the students who receive services in our schools. When ethical clearance is obtained from your IRB, I will assist with recruitment by having our teachers send out the Consent Forms to families. Thank you.

Sincerely,

[Signature]

Jack Brouseley
Director of Schools
Franklin County Board of Mental Retardation and Developmental Disabilities
APPENDIX B

LETTER TO PARENTS, BBAS CONSENT FORMS, AND STUDY CONSENT FORMS
Dear Parent/Guardian,

My name is Amanda Guld and I am a third year Ph.D. student in special education at The Ohio State University. Our organization is a partnership with FCBMRDD and Columbus Public Schools (CPS), called Buckeye Behavior Analysis Services: Partners in Preparation and Prevention (BBAS). This project seeks to enable children and adults with behavioral difficulties to increase their level of independence and remain in or return to their local schools or worksites. BBAS aims to work with the personnel at the students’ local school or worksite to promote the individuals’ independence and/or successful transition to less restrictive placements. In addition, BBAS seeks to prevent the need for new referrals to more restrictive placements. All evaluation, treatment recommendations, and follow-up will be provided in consultation with OSU faculty and advanced trainees in special education and school psychology.

Your child has been referred for participation in these services by a staff member at FCBMRDD or CPS. We are writing to request your consent for your child’s participation in these activities. Under the direction of OSU faculty, we will complete the following activities with your child:

- Interview your son/daughter’s teacher or staff regarding the problem behavior (we may also interview you about your concerns)
- Observe your son/daughter during his/her typical routine at school or home
- Observe your son/daughter’s behavior under a variety of conditions where we change the consequences for his/her problem behavior
- Develop and implement a positive behavior intervention that is designed to decrease problem behavior and increase appropriate behavior; provide training to your child’s teachers or supervisors on the intervention
- Write a report that summarizes the assessment and intervention plan; this report will be given to you and to the school/work staff
- If possible and if desired, attend a parent teacher conference to describe our findings and intervention plan

We may videotape our assessments and interventions in order to help us better analyze your son/daughter’s behavior. However, your son/daughter’s dignity and privacy will be
protected at all times. We will not discuss your son/daughter with anyone who is not affiliated with this evaluation, and the videotapes will not be shown to anyone else unless you give us express written consent to do so. Also, the videotapes will be destroyed when we are no longer involved with your son/daughter. We may provide you or the school/worksite with a video clip of the intervention to assist in training if you so desire.

I hope that this collaboration will be beneficial for your son/daughter and your son/daughter’s teacher. If you agree to allow your son/daughter to participate in such an evaluation, please complete the attached form and return it to ________________ by________________. At that time, we can move forward with our evaluation.

Thank you so much for your time and consideration. If you have any questions regarding this project or if you should want to revoke your consent at any time, please do not hesitate to contact Amanda Guld BBAS service provider via phone (XXX-XXX-XXXX) or by email guld.X@osu.edu. We would be more than happy to discuss the project with you.

Sincerely,

Amanda E. Guld, MA, BCBA
Enc.
Consent Form
Video Release Consent Form
CONSENT FORM FOR PARTICIPATION IN FUNCTIONAL ANALYSIS AND INTERVENTION PROJECT

I, ____________________________ (print your name), give permission for my son/daughter, ____________________________ (print his or her name) to participate in the Buckeye Behavior Analysis Service project described in the attached letter. Specifically, I give permission for the faculty and advanced students affiliated with this project to:

- View my child’s educational and/or work records
- Interview my child’s teacher/supervisor regarding his/her problem behavior
- Observe my child in the classroom/worksite and make notes of his/her problem behavior
- Conduct an analysis of my child’s problem behavior
- Implement a positive intervention for problem behavior
- Provide copies of a summary report (including a videotape) of the assessment and intervention activities to my son/daughter’s teachers/supervisors
- Videotape assessment and intervention sessions for observation purposes

I understand that my son/daughter’s dignity and privacy will be protected. Members of this project will not discuss my son/daughter outside of project activities or with others not associated with the project. I understand the videotapes (with the exception of the ones given to the school/work staff for training purposes) will be destroyed when OSU project staff are no longer involved with my son/daughter.

I understand that I may revoke my consent for my son/daughter’s participation in this project at any time without any negative repercussions for my son/daughter by contacting ___________ at (___) _____-_______ or __________@osu.edu

Signed: ____________________________ (your signature)
Parent or Legal Guardian or Participant
Address: ____________________________ (please provide this so we can mail
________________________________________ you a copy of the final report)
Phone: ____________________________ (please provide this so we may contact you if we have questions)
Dear Parent/Guardian,

We would like your permission to include a video clip of your son/daughter’s intervention sessions for some instructional materials we are developing for practitioners working in special education. The video clip will be taken from the collection of videos that we have on record from your son/daughter’s participation in the Buckeye Behavior Analysis Service. We will carefully select the video clips to ensure your son/daughter’s confidentiality and protect his/her dignity. Upon request, we will provide you with a copy of the presentation and the clip that your son/daughter appears in. If you do not wish to provide consent, your son/daughter will still be able to receive BBAS services, and his/her services will not be diminished as a result. If you have any questions or concerns you can contact _____________, BBAS Service Provider at (___) ___-_____ or _______@osu.edu. We thank you for considering our request.

Sincerely,

____________________________
Consent Form for
Release of Videotaped Information

I, ________________, give consent for the release of videotaped information of my son/daughter, _______________. I understand that this consent is for educational purposes only and that care will be taken to protect the confidentiality and dignity of my son/daughter. I understand that video clips of my daughter will be incorporated into training materials and will be used and distributed in training workshops. I understand that I may receive a copy of said materials upon request.

Signed: _________________________
(Parent or Legal Guardian)

Date: _________________________
Dear Parents,

We would like to include your child in a study that will examine the effectiveness of using positive behavior support interventions to increase the independence of individuals with developmental disabilities. The purpose of this project is to investigate positive behavioral interventions (e.g., positive reinforcement, prompting, modeling, etc.) to decrease problem behaviors and produce educational gain in individuals with developmental disabilities. In this project, we will be targeting students attending Franklin County Board of Mental Retardation and Developmental Disabilities Schools (i.e., Northeast and West Central Schools). Your student can benefit from these interventions by increasing their independence and enabling them to learn more efficiently while in their educational setting.

If your child takes part in this study, sessions will be conducted 4-5 times weekly for approximately 30 minutes. During these sessions, they will participate in assessments (e.g., functional behavior assessments) and various evidence-based interventions (i.e., interventions based on the discipline of Applied Behavior Analysis) within and outside the classroom. We will be examining which assessments and interventions are the most effective and efficient with your student. We will also be working with the staff involved with your student as his or her school in order to best serve your child through collaboration with all that come in contact with him or her.

I will be leading this project with the assistance of my graduate students. If you would like more information, please feel free to contact me at the phone number or email address below. If you would like for your child to participate in this study, please sign the attached consent form and return it to your child’s teacher. Please know that your consent for your child’s participation is voluntary, you can refuse to answer questions that you do not wish to answer, and you can refuse your child’s participation or withdraw your child at any time without penalty or repercussion.

Thank you for your time and attention.

Helen I. Malone, Ph.D.
Assistant Professor
The Ohio State University
XXX Arps Hall
XXX N High Street
Columbus OH 43202
malone.XXX@osu.edu
XXX-XXX-XXXX

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CONSENT FOR PARTICIPATION IN RESEARCH

I consent to my child's participation in research entitled: *An examination of the effects of positive behavioral interventions on the challenging behavior of individuals with developmental disabilities*. I also consent to the use of video taping sessions for later coding of data.

Helen Malone, Principal Investigator, or her authorized representative has explained the purpose of the study, the procedures to be followed, and the expected duration of my child's participation. Possible benefits of the study have been described, as have alternative procedures, if such procedures are applicable and available.

I acknowledge that I have had the opportunity to obtain additional information regarding the study and that any questions I have raised have been answered to my full satisfaction. Furthermore, I understand that I am free to withdraw consent for my child's participation at any time and to discontinue participation in the study without prejudice to my child.

Finally, I acknowledge that I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date: ____________________________________________________________________________
Signed: ____________________________________________________________________________
(Participant)

Signed: ____________________________________________________________________________
(Principal Investigator or his/her authorized representative)

Signed: ____________________________________________________________________________
(Person authorized to consent for participant, if required)

Witness: ____________________________________________________________________________

HS-027E  Consent for Participation in Exempt Research
APPENDIX C

DESCRIPTIVE ANALYSIS DATA SHEET
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APPENDIX D
RESPONSE CHAIN DATA SHEET
## Response Chain Data Sheet

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<thead>
<tr>
<th>Participant</th>
<th>Observer</th>
<th>Therapist</th>
<th>Session</th>
<th>Date</th>
<th>Condition</th>
<th>Session</th>
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<thead>
<tr>
<th>Trial</th>
<th>Initial $S^D$ or EO</th>
<th>R1</th>
<th>$S^D$</th>
<th>R2</th>
<th>$S^R$</th>
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**Total**

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<tr>
<th>Formula</th>
<th>Proportion</th>
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<tr>
<td>P of R1</td>
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<tr>
<td>P of R2</td>
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<tr>
<td>P of R2/R1</td>
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<tr>
<td>P of R2/no R1</td>
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</tbody>
</table>

120
APPENDIX E

BASELINE PROCEDURAL INTEGRITY DATA SHEET FOR REECE, SPENCE, AND JANE
Response 1- Reece moves the domino with his hands to any point within 2 in of his lips or past his lips.

SD – Therapist says, “put in.” as a verbal prompt to continue task or provides physical assistance to help Reece put item in container (note with a “v” for verbal and “p” for physical in SD column on data sheet).

Response 2- Reece releases item into container through the slot cut in the top of the container with or without prompting.

1. If Reece puts two items in his mouth or in the container at the same time – count as one trial.
2. If Reece puts item in his mouth and item is released from Reece’s grip (either independently or by therapist) and is placed back on the table, count the next time it is picked up as a new trial.
3. R1 constitutes a new trial; trial concludes with R2 or no response for 10 seconds following R1 or an SD.
4. Place a tally mark in the reinforcer column each time verbal praise is delivered.

<table>
<thead>
<tr>
<th>Session timer is started for 10 minute session.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reece is presented with the cardboard box and a basket of dominos.</td>
</tr>
<tr>
<td>Therapist begins session by saying, “put in”</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19</td>
</tr>
<tr>
<td>When Reece places item in his mouth the therapist verbally and/or physically prompts Reece to put item in container.</td>
</tr>
<tr>
<td>Reece is given verbal + physical praise for putting item into container</td>
</tr>
<tr>
<td>Data Collection ends when timer sounds.</td>
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</tbody>
</table>
Response 1: Spence grabs an item or asks for an item in an inappropriate manner (e.g., points, says “eh, eh,” or “yah,” or screams.)

S^D – Therapist says, “Tell me what you want?” If Spence does not respond and the desired object is known, the therapist will say, “Tell me what you want; sign [item],” and models the appropriate sign. If multiple objects are desired, or the exact object is unknown, the therapist will say, “tell me what you want” and models a general sign (e.g., toy or food) and offers Spence a choice between at least two items by holding them out in her hands.

Response 2: Spence asks appropriately for an item (i.e., signs the item using manual signs or an approximation or gives the sign for “toy”).
- R1 constitutes a new trial; trial concludes with R2 or no response for 10 seconds following R1 or an S^D.
- If Spence points or says “eh/yah” and this is not followed by a prompt from the therapist or an appropriate sign from Spence, consider the trial over and the next trial begins with the next R1 or R2.

<table>
<thead>
<tr>
<th>Session timer is started for 10 minute session.</th>
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<tbody>
<tr>
<td>At least six preferred items (including at least one toy and one edible) are present and access to them is restricted by placing them closer to the therapist than to Spence.</td>
</tr>
<tr>
<td>Therapist begins session by saying, “if there is something you want, you have to tell me what it is”</td>
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<tbody>
<tr>
<td>When Spence asks appropriately for an item (i.e., signs the item) the therapist provides access to that item for 20 seconds (or until consumed) and then removes the item by saying “my turn” and taking the item.</td>
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<tr>
<td>When Spence grabs an item or asks for an item in an inappropriate manner (i.e., points or says, “eh” or “yah”): Therapist will block access to the item (or remove item from Spence’s possession if necessary)</td>
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<td>Once the item is blocked or removed from Spence’s possession following an inappropriate response, the therapist will prompt appropriate communication by saying, “tell me what you want.”</td>
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<td>If Spence does not respond or does not produce an appropriate sign, the therapist will give a model/phys prompt for the item (i.e., say, “tell me what you want” and model the sign for item)</td>
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<td>If it is not evident what Spence wants or he emits an unknown sign or signs an unavailable item, the therapist will say, “do you want [item] or [item]” and hold up two available items.</td>
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<td>If Spence then reaches toward an item, therapist will prompt the sign for that item.</td>
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<td>If Spence continues to point or reach, therapist repeats “do you want [new item] until Spence reaches for the item and then prompts for a sign.</td>
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Session ends when timer sounds.
Baseline Procedural Integrity

Participant: Jane

Date: __________________________ Session: ________________________

Response 1 - Jane grabs an item or asks for an item in an inappropriate manner (e.g., says, “I want one,” “in my hand,” “eh, eh,” says “that” while not pointing to an item, or “I want more”)

$S^P$ - Therapist says, “What do you want?” If Jane does not respond and the desired object is known, the therapist will say, “What do you want; say [item].” If multiple objects are desired, or the exact object is unknown, the therapist will say, “What do you want; [one item] or [another item]?”

Response 2 - Jane asks appropriately for an item (i.e., says the name of the item or points to one particular item and says, “that”).

- R1 constitutes a new trial; trial concludes with R2 or no response for 10 seconds following R1 or an $S^P$.

| Session timer is started for 10 minute session. |  |
| At least six preferred items are present and access to them is restricted by placing them closer to the therapist than to Jane. |  |
| Therapist begins session by saying, “if there is something you want, you have to tell me what it is” |  |

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<tbody>
<tr>
<td>When Jane asks appropriately for an item (see above) regardless of whether the response was prompted or not, access to that item for 20 s (or until consumed)</td>
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<td>When Jane grabs an item or asks for an item in an inappropriate manner (see above), therapist will block access to the item (or remove item from Jane’s possession if necessary)</td>
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<td>Once the item is blocked or removed from Jane’s possession following an inappropriate response, the therapist will prompt appropriate communication by saying, “what do you want.”</td>
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<td>If Jane does not respond or does not produce an appropriate response, the therapist will give an echoic prompt for the item (i.e., say, “what do you want, say X”)</td>
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<tr>
<td>If it is not evident what Jane wants or she refers to more than one item the therapist will give a choice of two items that she most likely wants at that moment (i.e., “do you want x or y”)</td>
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<td>Session ends when timer sounds.</td>
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APPENDIX F

INTERVENTION PROCEDURAL INTEGRITY DATA SHEETS FOR REECE, SPENCE, AND JANE
Intervention Procedural Integrity          Participant: Reece

Date: ____________________________________________ Session: ___________________________________

**Response 1**: Reece moves the domino with his hands to any point within 2 in of his lips or past his lips.

SD – Therapist says, “put in.”" as a verbal prompt to continue task or provides physical assistance to help Reece put item in container (note with a “v” for verbal and “p” for physical in SD column on data sheet).

**Response 2**: Reece releases item into container through the slot cut in the top of the container with or without prompting.

- \( S^D \) constitutes a new trial (if not immediately following an R1) or R1 constitutes a new trial if it occurs immediately following an \( S^D \) given an \( S^D \) that was in response to an R1; trial concludes with R2 or no response for 10 seconds following R1 or an \( S^D \).  
- Place a tally mark in the reinforcer column each time verbal praise is delivered.

<table>
<thead>
<tr>
<th>Session timer is started for 10 minute session.</th>
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<tbody>
<tr>
<td>Reece is presented with the cardboard box and a basket of dominos.</td>
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<tr>
<td>Therapist says, “Reece, put it in the box,” and physically guides Reece to pick up a domino and guides hand to right over the container’s opening.</td>
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<tr>
<td>Therapist waits 3 seconds before beginning the next trial with a prompt if no response occurs</td>
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<tr>
<td>If Reece brings item to within 2 in of mouth, therapist blocks domino from entering mouth and begins physically guiding hand to over box opening (to begin new trial)</td>
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<tr>
<td>Reece is given verbal + physical praise for putting item into container</td>
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<tr>
<td>Data Collection ends when timer sounds.</td>
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</tbody>
</table>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Response 1 - Spence grabs an item or asks for an item in an inappropriate manner (e.g., points, says, “eh, eh,” or, “yah,” or screams.)

S0 – Therapist says, “Tell me what you want?” models or physically prompts an appropriate request.

Response 2 - Spence asks appropriately for an item (i.e., signs the item).

- R1 constitutes a new trial; trial concludes with R2 or no response for 10 seconds following R1 or an S0.

<table>
<thead>
<tr>
<th>Response 1</th>
<th>Response 2</th>
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<tbody>
<tr>
<td>Spence grabs an item or asks for an item in an inappropriate manner (e.g., points, says, “eh, eh,” or, “yah,” or screams.)</td>
<td>Spence asks appropriately for an item (i.e., signs the item).</td>
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</tbody>
</table>

Session timer is started for 10 minute session.

At least six preferred items (including at least one toy and one edible) are present and access to them is restricted by placing them closer to the therapist than to Spence.

Therapist begins session by saying, “if there is something you want, you have to tell me what it is.”

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<tbody>
<tr>
<td>The S0 (see above) is delivered at least every 24 s throughout the session (i.e., after inappropriate responses, immediately after reinforcer consumption, and every 20-24 s otherwise)</td>
<td>When Spence asks appropriately for an item (i.e., signs the item) the therapist provides access to that item for 20 seconds (or until consumed) and then removes the item by saying “my turn” and taking the item.</td>
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<tr>
<td>When Spence grabs an item or asks for an item in an inappropriate manner (i.e., points or says, “eh” or “yah”): Therapist will block access to the item (or remove item from Spence’s possession if necessary)</td>
<td>Once the item is blocked or removed from Spence’s possession following an inappropriate response, the therapist will prompt appropriate communication by saying, “tell me what you want.”</td>
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<tr>
<td>If Spence does not respond or does not produce an appropriate sign, the therapist will give a model/phys prompt for the item (i.e., say, “tell me what you want” and model the sign for item)</td>
<td>If it is not evident what Spence wants or he emits an unknown sign or signs an unavailable item, the therapist will say, “do you want [item]?”</td>
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<tr>
<td>If Spence then reaches toward that item, therapist will prompt the sign for that item.</td>
<td>If Spence continues to point or reach, therapist repeats “do you want [new item] until Spence reaches for the item and then prompts for a sign.</td>
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<td>Session ends when timer sounds.</td>
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**Intervention Procedural Integrity**  
**Participant:** Jane

**Date:** ____________________________  
**Session:** ____________________________

**Response 1:** Jane grabs an item or asks for an item in an inappropriate manner (e.g., says, “I want one,” “eh, eh,” says “that” while not pointing to an item, “in my hand,” or “I want more”)  

**$S^D$** – Therapist says, “What do you want?” If Jane does not respond and the desired object is known, the therapist will say, “What do you want; say [item].” If multiple objects are desired, or the exact object is unknown, the therapist will say, “What do you want; [one item] or [another item]?”

**Response 2:** Jane asks appropriately for an item (i.e., says the name of the item or points to one particular item and says, “that”).

R1 constitutes a new trial; trial concludes with R2 or no response for 10 seconds following R1 or an $S^D$

<table>
<thead>
<tr>
<th>Session timer is started for 10 minute session.</th>
<th>At least six preferred items are present and access to them is restricted by placing them closer to the therapist than to Jane.</th>
<th>Therapist begins session by saying, “if there is something you want, you have to tell me what it is”</th>
</tr>
</thead>
<tbody>
<tr>
<td>When Jane asks appropriately for an item (see above) regardless of whether the response was prompted or not, access to that item for 20 s (or until consumed)</td>
<td>When Jane asks appropriately for an item (see above) verbal praise is delivered.</td>
<td>The $S^D$ (see above) is delivered at least every 25 s throughout the session (i.e., after inappropriate responses, immediately after reinforcer consumption, and every 20-25 s otherwise)</td>
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<tr>
<td>When Jane grabs an item or asks for an item in an inappropriate manner (see above), therapist will block access to the item (or remove item from Jane’s possession if necessary)</td>
<td>Once the item is blocked or removed from Jane’s possession following an inappropriate response, the therapist will prompt appropriate communication by saying, “what do you want.”</td>
<td>If Jane does not respond or does not produce an appropriate response, the therapist will give an echoic prompt for the item (i.e., say, “what do you want, say X”)</td>
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<tr>
<td>If it is not evident what Jane wants or she refers to more than one item the therapist will give a choice of two items that she most likely wants at that moment (i.e., “do you want x or y”)</td>
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Session ends when timer sounds.

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APPENDIX G

MULTIPLE STIMULUS WITHOUT REPLACEMENT PREFERENCE ASSESSMENT
DATA SHEET
Items

1.
2.
3.
4.
5.

Data Summary

1. Record item selection each trial.
2. Item selection is defined as physical contact with one of the presented items.
3. Calculate the number of times an item was selected by the number of trials during which the item was presented (percentage of trials selected).

Item 1
Number of trials selected / number of trials presented X 100 = 
______ / ______ X 100 = __________% of trials selected

Item 2
Number of trials selected / number of trials presented X 100 = 
______ / ______ X 100 = __________% of trials selected

Item 3
Number of trials selected / number of trials presented X 100 = 
______ / ______ X 100 = __________% of trials selected

Item 4
Number of trials selected / number of trials presented X 100 = 
______ / ______ X 100 = __________% of trials selected

Item 5
Number of trials selected / number of trials presented X 100 = 
______ / ______ X 100 = __________% of trials selected
APPENDIX H

SOCIAL VALIDITY LETTER AND QUESTIONNAIRE FOR PARENTS
June 17, 2008

Dear Parents,

I conducted a study this spring for my PhD Dissertation and, per your consent, included your child in the study. I am gathering my data to begin writing my document and realized there was a questionnaire I forgot to send out. I would greatly appreciate it if you completed the attached questionnaire and sent it back in the enclosed envelope. I have also enclosed a copy of the final report discussing the results that I sent home with your child the last week of school. Please refer to that to answer the questions. There is no need to send the report back with the questionnaire and please do not put your names on the questionnaire, unless you have any questions and would like me to get back to you. Thank you for your prompt response in advance and thanks again for allowing your child to participate in my study. I hope you have a wonderful summer!

Thanks!

Amanda Guld, MA, BCBA
Guld.X@osu.edu
(XXX) XXX-XXXX
Social Validity Questionnaire – Parents

Your child was involved in a study involving response chains. A response chain that your child exhibited that contained an appropriate behavior followed by an inappropriate behavior was selected for study. Then a procedure was implemented to attempt to disrupt the response chain and to decrease the appropriate behavior while increasing the inappropriate behavior. The following questions are an effort to elicit your opinions about the goals, procedures and results of the study conducted. Please refer to the final report (attached) regarding your specific student to answer the following questions.

Goals

In the study conducted with your child, one of the goals of the study was to disrupt the response chain selected for your child. Disrupting the chain refers to implementing a procedure that reduces the likelihood that the two responses would occur in a predictable sequence (i.e., one always following the other). In the response chain selected for your child, how important do you think it is to address this goal in the home setting (please circle one number)?

1 2 3 4 5
Not Somewhat I don’t know Somewhat Very
Important Important Important Important

Another goal was to decrease the inappropriate behavior that occurred in the response chain selected in your child (please refer to the attached for a definition of the response). How important do you think it is to address this goal in the home setting (please circle one number)?

1 2 3 4 5
Not Somewhat I don’t know Somewhat Very
Important Important Important Important

A final goal was to increase the appropriate behavior that occurred in the response chain selected in your child (please refer to the attached for a definition of the response). How important do you think it is to address this goal in the home setting (please circle one number)?

1 2 3 4 5
Not Somewhat I don’t know Somewhat Very
Important Important Important Important

Procedures
In the study, the procedure used to address the above goals was to reinforce the appropriate response every time it occurred (regardless of if it occurred in the chain or alone). How practical do you think this procedure would be to implement in the home? Please refer to the attached for a more detailed description of the procedure.

1  2   3   4   5
Not  Somewhat I don’t know Somewhat Very
Practical Practical Practical Practical

Would you be willing to implement this procedure in your home?

Yes      Maybe      No

The second part of the procedure used was to give a prompt for the appropriate behavior on a specific schedule (please see the attached for details of your students particular schedule of prompting). How practical do you think this procedure would be to implement in the home?

1  2   3   4   5
Not  Somewhat I don’t know Somewhat Very
Practical Practical Practical Practical

Would you be willing to implement this procedure in your home?

Yes      Maybe      No

Would you suggest implementing either of these procedures to a parent if they wanted to address goal similar to those above in one of their children that had a similar response chain?

Yes      Maybe      No

If so, which one (please check)?

___ the reinforcement procedure
___ the prompting procedure
___ both

If you were already using a procedure to decrease the inappropriate response addressed in this study, would you continue that procedure or adopt the procedure used in this study in the future? Please check one:

___ I would continue to use the procedure I was already using
___ I would consider trying the procedure used in the study

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I was not using a procedure to address this behavior, but would consider using the one used in the study.
I was not using a procedure to address this behavior, but would not consider using the one used in the study and would instead use another procedure.
I was not using a procedure to address this behavior, and would continue to not use a procedure to address this behavior.

Results

In the attached report, how satisfied were you that the behavior chain was disrupted (see graph and description of the results on the report for details)? Please check one.

The behavior chain was disrupted a lot
The behavior chain was disrupted a little
The behavior chain was not disrupted
I am not sure

In the attached report, how satisfied were you that the appropriate response increased to appropriate levels (see graph and description of the results on the report for details)? Please check one.

The response increased to appropriate levels
The response increased a little, but not to appropriate levels
The response did not increase
I am not sure

In the attached report, how satisfied were you that the inappropriate response decreased to appropriate levels (see graph and description of the results on the report for details)? Please check one.

The response decreased to appropriate levels
The response decreased a little, but not to appropriate levels
The response did not decrease
I am not sure

Thank you for taking the time to complete this questionnaire, your input is appreciated!
Amanda Guld
APPENDIX I

SOCIAL VALIDITY LETTER AND QUESTIONNAIRE TO STAFF
Dear Staff,

I conducted a study this spring for my PhD Dissertation and included one of your students in the study. I am gathering my data to begin writing my document and realized there was a questionnaire I forgot to send out. I would greatly appreciate it if you completed the attached questionnaire and sent it back in the enclosed envelope or mail to me at the below address or email it to me at the below address. I have also enclosed a copy of the final report discussing the results that I sent home with your student the last week of school. Please refer to that to answer the questions. There is no need to send the report back with the questionnaire and please do not put your names on the questionnaire, unless you have any questions and would like me to get back to you. Thank you for your prompt response in advance and thanks again for allowing your child to participate in my study. I hope you have a wonderful summer!

Thanks!

Amanda Guld, MA, BCBA
Guld.X@osu.edu
(XXX) XXX-XXXX
Social Validity Questionnaire – Staff

One of your students was involved in a study involving response chains. A response chain that your student exhibited that contained an appropriate behavior followed by an inappropriate behavior was selected for study. Then a procedure was implemented to attempt to disrupt the response chain and to decrease the appropriate behavior while increasing the inappropriate behavior. The following questions are an effort to elicit your opinions about the goals, procedures and results of the study conducted. Please refer to the final report (attached) regarding your specific student to answer the following questions.

Goals

In the study conducted with your student, one of the goals of the study was to disrupt the response chain selected for your student. Disrupting the chain refers to implementing a procedure that reduces the likelihood that the two responses would occur in a predictable sequence (i.e., one always following the other). In the response chain selected for your student, how important do you think it is to address this goal in the classroom setting (please circle one number)?

1  2   3   4   5
Not Important Somewhat Important I don’t know Somewhat Very Important
Important Important Important Important

Another goal was to decrease the inappropriate behavior that occurred in the response chain selected in your student (please refer to the attached for a definition of the response). How important do you think it is to address this goal in the classroom setting (please circle one number)?

1  2   3   4   5
Not Important Somewhat Important I don’t know Somewhat Very Important
Important Important Important Important

A final goal was to increase the appropriate behavior that occurred in the response chain selected in your student (please refer to the attached for a definition of the response). How important do you think it is to address this goal in the classroom setting (please circle one number)?

1  2   3   4   5
Not Important Somewhat Important I don’t know Somewhat Very Important
Important Important Important Important

Procedures
In the study, the procedure used to address the above goals was to reinforce the appropriate response every time it occurred (regardless of if it occurred in the chain or alone). How practical do you think this procedure would be to implement in the classroom? Please refer to the attached for a more detailed description of the procedure.

<table>
<thead>
<tr>
<th>Practical</th>
<th>Somewhat</th>
<th>I don’t know</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not</td>
<td>Practical</td>
<td>Practical</td>
<td>Practical</td>
<td></td>
</tr>
</tbody>
</table>

Would you be willing to implement this procedure in your classroom?

Yes       Maybe    No

The second part of the procedure used was to give a prompt for the appropriate behavior on a specific schedule (please see the attached for details of your students particular schedule of prompting). How practical do you think this procedure would be to implement in the classroom?

<table>
<thead>
<tr>
<th>Practical</th>
<th>Somewhat</th>
<th>I don’t know</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not</td>
<td>Practical</td>
<td>Practical</td>
<td>Practical</td>
<td></td>
</tr>
</tbody>
</table>

Would you be willing to implement this procedure in your classroom?

Yes       Maybe    No

Would you suggest implementing either of these procedures to a fellow staff member if they wanted to address goal similar to those above in one of their students that had a similar response chain?

Yes       Maybe    No

If so, which one (please check)?

___ the reinforcement procedure
___ the prompting procedure
___ both

If you were already using a procedure to decrease the inappropriate response addressed in this study, would you continue that procedure or adopt the procedure used in this study in the future? Please check one:

___ I would continue to use the procedure I was already using
___ I would consider trying the procedure used in the study

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___ I was not using a procedure to address this behavior, but would consider using the one used in the study.
___ I was not using a procedure to address this behavior, but would not consider using the one used in the study and would instead use another procedure.
___ I was not using a procedure to address this behavior, and would continue to not use a procedure to address this behavior.

**Results**

In the attached report, how satisfied were you that the behavior chain was disrupted (see graph and description of the results on the report for details)? Please check one.

___ The behavior chain was disrupted a lot
___ The behavior chain was disrupted a little
___ The behavior chain was not disrupted
___ I am not sure

In the attached report, how satisfied were you that the appropriate response increased to appropriate levels (see graph and description of the results on the report for details)? Please check one.

___ The response increased to appropriate levels
___ The response increased a little, but not to appropriate levels
___ The response did not increase
___ I am not sure

In the attached report, how satisfied were you that the inappropriate response decreased to appropriate levels (see graph and description of the results on the report for details)? Please check one.

___ The response decreased to appropriate levels
___ The response decreased a little, but not to appropriate levels
___ The response did not decrease
___ I am not sure

Thank you for taking the time to complete this questionnaire, your input is appreciated!
Amanda Guld
APPENDIX J

DISSERTATION RESULTS SUMMARY LETTERS SENT TO PARENTS AND STAFF AND INCLUDED IN SOCIAL VALIDITY QUESTIONNAIRES FOR REECE, SPENCE, AND JANE

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To the Parents/Guardian of Reece and XXX School Staff,

My name is Amanda Guld and I am a doctoral candidate in the Special Education Department of the Ohio State University (OSU). Earlier in the year, I sent home a letter asking for consent to include Reece in my dissertation study. Reece was happy to come and work with me each day and I greatly appreciate his participation. It is now the end of the school year, and I have completed my data collection and would like to share my results with you.

Why Reece? I included Reece in my dissertation because I was searching for students that had two behaviors that occurred frequently together in a particular sequence (i.e., a behavior chain). Specifically, these behaviors had to be an inappropriate behavior followed by an appropriate behavior. In Reece’s case, he was observed to frequently place an item in his mouth before putting it in a container during work tasks. Once he was given a physical prompt (e.g., physically prompting him to place the item in the container) he would occasionally release the item into the container. Therefore the behavior chain I wanted to target with him was placing the item in his mouth (inappropriate behavior) followed by appropriately releasing the item into the container (appropriate behavior).

What did my study entail? I began my study by collecting baseline data (see the portion of the graph below labeled “baseline”) on both the inappropriate behavior and the appropriate behavior. During all my sessions, I brought Reece into a small room (the vision room) and we sat at a table. I had a cardboard box with a slot cut into the top and a container full of dominoes. This was a work task he was asked to complete every day by releasing the dominoes, one at a time, into the slit cut into the box. During baseline, the inappropriate behavior occurred frequently and the appropriate behavior infrequently, and the appropriate behavior rarely occurred alone. In other words, Reece infrequently released the dominoes into the container and when he did he always put the domino in his mouth first. I then implemented an intervention that consisted of immediately physically prompting Reece to place the domino into the box at the start of each trial. The physical prompting involved using hand-over-hand prompting to have Reece pick up the domino and then placing his hand over the box, thereby allowing him the opportunity to release the domino into the box independently. If Reece did not release the domino into the box within three seconds, I started the trial over and began again with the same physical prompt. If Darin attempted to put the domino in his mouth, I blocked the attempt, but taking his hand and gently placing it over the box. If Reece released the domino into the
box I delivered enthusiastic verbal praise and some physical attention that was seen to be preferred by Reece (e.g., rubbing his head or patting his back).

**What were the results?** After I began implementing the intervention described above (see the potion of the graph labeled “intervention”), Reece’s inappropriate behavior (placing the domino in his mouth, depicted as open circles on the graph) immediately decreased. Thereafter, he only rarely put the domino in his mouth. However, the appropriate behavior (placing the domino in the box, depicted as closed squares on the graph) remained low.

**What do these results mean?** I had hoped that the intervention would result in a decrease in the inappropriate behavior (putting the domino in his mouth) and an increase in the appropriate behavior (releasing the domino into the container). However, although Reece rarely put the domino in his mouth after the intervention was implemented, he did not put the domino in the box any more frequently than in baseline. Therefore, I believe this was a successful intervention to decrease the object mouthing, but would need some modifications to increase the desired task behavior of putting the domino in the box. It is possible that Reece’s appropriate behavior (i.e., putting the domino in the box) may increase more if a more potent reinforcer were delivered contingent upon each instance of putting the domino in the box. For example, maybe delivery of a highly preferred item (e.g., toy, small piece of edible, etc.) would be effective and then the rate of reinforcement could be thinned from delivery of the reinforcer upon every domino put into the box to upon every 2 dominoes, 3 dominoes, 5 dominoes, 10 dominoes, 15 dominoes, etc.

I wanted to thank you all for your help and participation and for allowing Reece to participate in my study. Thanks to you I am two months away from graduating from OSU with my PhD in Special Education and Applied Behavior Analysis. Please feel free to contact me with any questions or concerns.

With Sincere Thanks,

Amanda E. Guld, MA, BCBA
Doctoral Candidate
The Ohio State University
Guld.X@osu.edu
(XXX) XXX-XXXX

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Dear Mr. & Mrs. XXX and XXX School Staff,

My name is Amanda Guld and I am a doctoral candidate in the Special Education Department of the Ohio State University (OSU). Earlier in the year, I sent home a letter asking for consent to include Spence in my dissertation study. Spence was happy to come and work with me each day and I couldn’t have asked for a more perfect participant. It is now the end of the school year, and I have completed my data collection and would like to share my results with you.

**Why Spence?** I included Spence in my dissertation because I was searching for students that had two behaviors that occurred frequently together in a particular sequence (i.e., a behavior chain). Specifically, these behaviors had to be an inappropriate behavior followed by an appropriate behavior. In Spence’s case, he was observed to frequently point and whine or yell or emit a verbal, “eh” sound when he wanted a preferred item. However, once he was given a verbal prompt (e.g., “Spence, tell me what you want?”) he would emit an appropriate manual sign for the item. Therefore the behavior chain I wanted to target was pointing and yelling (inappropriate behavior) followed by a sign requested the item (appropriate behavior).

**What did my study entail?** I began my study by collecting baseline data (see the portion of the graph below labeled “baseline”) on both the inappropriate behavior and the appropriate behavior. During all my sessions, I brought Spence into a small room (the conference room) and we sat at a table. I had 6-8 of his preferred items on the table but out of his reach. During baseline, both behaviors occurred frequently and the appropriate behavior infrequently occurred alone. In other words, Spence infrequently requested items using his sign without first pointing and yelling and then being prompted to sign for the item. I then implemented an intervention that consisted of prompting Spence every 20 seconds for an appropriate request, by saying, “If you want something, tell me what you want.” If Spence requested the item appropriately (with a sign), I gave him access to the item for 20 seconds, then removed the item and asked him again to tell me what he wanted. If Spence pointed or yelled, I immediately prompted him to tell me what he wanted with signs and if necessary physically prompted the appropriate sign.

**What were the results?** After I began implementing the intervention described above (the potion of the graph labeled “intervention”), Spence’s inappropriate behavior (the pointing and yelling, depicted as open circles on the graph) immediately decreased and his appropriate requesting (signs, depicted as closed squares on the graph) increased. By
the end of the study, he was requesting items using sign frequently and only very rarely pointing or yelling to request items.

**What do these results mean?** These results suggest that if Spence were prompted frequently (i.e., Spence is verbally told, “if you want something, tell me what you want”) and if he is reinforced (using verbal praise or by giving him access to the item he asked for) whenever he does sign for an item, he will no longer need to point or whine and will instead, begin spontaneously requesting items more using signs. These sessions were run in a room when the items he requested were immediately available, therefore I suggest using a timer to let Spence know when he can receive the item he requests if he cannot have it immediately. If it is an item he can absolutely not have at any time, I would suggest giving him a choice of two other items that he may have access to immediately. In addition, I prompted Spence to request items every 20 seconds, however I believe this time interval could be increased gradually and systematically to longer and longer periods of time that would be more appropriate.

I wanted to thank you all for your help and participation and for allowing Spence to participate in my study. Thanks to you I am two months away from graduating from OSU with my PhD in Special Education and Applied Behavior Analysis. Please feel free to contact me with any questions or concerns.

With Sincere Thanks,

Amanda E. Guld, MA, BCBA
Doctoral Candidate
The Ohio State University
Guld.X@osu.edu
(XXX) XXX-XXXX
Dear Ms. XXX and XXX School Staff,

My name is Amanda Guld and I am a doctoral candidate in the Special Education Department of the Ohio State University (OSU). Earlier in the year, I sent home a letter asking for consent to include Jane in my dissertation study. Jane was happy to come and work with me each day and I couldn’t have asked for a more perfect participant. It is now the end of the school year, and I have completed my data collection and would like to share my results with you.

**Why Jane?** I included Jane in my dissertation because I was searching for students that had two behaviors that occurred frequently together in a particular sequence (i.e., a behavior chain). Specifically, these behaviors had to be an inappropriate behavior followed by an appropriate behavior. In Jane’s case, she was observed to frequently point and whine or grab or say, “I want that” (without letting you know what it was that she wanted) when she wanted a preferred item. However, once she was given a verbal prompt (e.g., “Jane, tell me what you want?”) she would emit an appropriate verbal request for the item (e.g., say, “ball” if she wanted the ball or say, “I want ball” or some other form of an appropriate verbal request). Therefore the behavior chain I wanted to target with her was grabbing and inappropriate asking (inappropriate behavior) followed by an appropriate verbal request for the item (appropriate behavior).

**What did my study entail?** I began my study by collecting baseline data (see the portion of the graph below labeled “baseline”) on both the inappropriate behavior and the appropriate behavior. During all my sessions, I brought Jane into a small room (the vision room) and we sat at a table. I had 6-8 of her preferred items on the table but out of her reach. During baseline, both behaviors occurred frequently and the appropriate behavior infrequently occurred alone. In other words, Jane infrequently requested items verbally without first grabbing or asking inappropriately and then being prompted to verbally ask for the item. I then implemented an intervention that consisted of prompting Jane every 20 seconds for an appropriate request, by saying, “If you want something, tell me what you want.” If Jane requested the item appropriately (with a verbal request), I gave her access to the item for 20 seconds, then removed the item and asked her again to tell me what she wanted. If Jane grabbed or asked inappropriately, I immediately prompted her to tell me what she wanted.

**What were the results?** After I began implementing the intervention described above (see the portion of the graph labeled “intervention”), Jane’s inappropriate behavior (the grabbing and inappropriate asking behavior, depicted as open circles on the graph)
immediately decreased and his appropriate requesting (verbal requests, depicted as closed squares on the graph) increased. By the end of the study, she was appropriately requesting items frequently and only very rarely grabbing or inappropriately requesting items.

What do these results mean? These results suggest that if Jane were prompted frequently (i.e., Jane is verbally told, “if you want something, tell me what you want”) and if she is reinforced (using verbal praise or by giving her access to the item she asked for) whenever she does request appropriately for an item, she will no longer grab or ask inappropriately and will instead, begin spontaneously requesting items more appropriately. These sessions were run in a room when the items she requested were immediately available, therefore I suggest using a timer to let Jane know when she can receive the item she requests if it is an item she cannot have immediately. If it is an item she can absolutely not have at any time, I would suggest giving her a choice of two other items that she may have access to immediately. In addition, I prompted Jane to request items every 20 seconds, however I believe this time interval could be increased gradually and systematically to longer and longer periods of time that would be more appropriate.

I wanted to thank you all for your help and participation and for allowing Jane to participate in my study. Thanks to you I am two months away from graduating from OSU with my PhD in Special Education and Applied Behavior Analysis. Please feel free to contact me with any questions or concerns.

With Sincere Thanks,

Amanda E. Guld, MA, BCBA
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