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The effects of reinforcement magnitude and session length on stereotypical behavior of an adolescent with autism

Spiro Kotsios
University of South Florida

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The Effects of Reinforcement Magnitude and Session Length on Stereotypical Behavior
of an Adolescent with Autism

by

Spiro Kotsios, B.A.

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts
Department of Child and Family Studies
College of Behavioral and Community Sciences
University of South Florida

Major Professor: Kwang-Sun Cho Blair, Ph.D.
Bobbie Vaughn, Ph.D.
Frans van Haaren, Ph.D.

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ABSTRACT

Functional Analysis is an important component of creating a treatment plan for individuals with autism. A concern of functional analysis is that it might not match the natural environment in which the problem behavior occurs. Dimensions such as varying reinforcement duration and session length may affect response rates during functional analyses in natural settings. This study investigated if varying reinforcement duration and session length during functional analyses would affect the identification of the function of problem behavior across assessors, and the intervention designed based on the functional analyses would be effective in reducing stereotypic behavior and teaching communicative skills of an adolescent with autism at home. An alternating treatment design was used to conduct functional analyses and an ABA design with generalization probes was used to test the effectiveness the function-based intervention. Results indicated that the participant's stereotypic behavior was maintained by automotive reinforcement. The intervention developed based on the function of the stereotypic behavior was found to be effective in reducing the stereotypy and teaching communicative behavior.

Chapter 1: Introduction

Autism can affect a variety of aspects of a person's quality of life, including interacting with other people, communicating ideas and feeling, and understanding what others feel or think (National Research Council, 2001). Autism begins in early childhood and persists throughout the lifetime of the afflicted individual (Crockett et al., 2007; Prior, 2003). Individuals with autism require a higher level of support than the general population. This stems from impairments in social, communicative, and repetitive and stereotyped behaviors (Rapin, 1997; Ingersoll & Gergans, 2007), which are the cornerstone of progressing throughout various environments and situations that occur in everyday life. Problem behaviors are among the most challenging and stressful issues faced by families in their efforts to provide a supportive environment. Recent surveys suggests that nearly 50-70% of individuals with autism present co-occurring behavioral and emotional problems (Gadow, Devicent, Pomeroy, & Azizian, 2004; Tonge & Einfeld, 2003). These disorders require a lifelong commitment of services for the individuals with autism and their families, costing upwards of \$4 million per individual (Jacobson, Mulick, & Green, 1998).

Researchers and professionals have recognized a powerful approach, called functional assessment, in the intervention for problem behavior of individuals with autism. Prior to the use of functional assessment approach, problem behavior of individuals with autism was typically treated by arbitrary contingencies of reinforcement or punishment over unknown sources of reinforcement for problem behavior (Mace,

1994). Functional assessment has made substantial contribution to the field of developmental disabilities including autism. Since the study by Iwata, Dorsey, Slifer, Bauman, and Richman (1982), an extensive body of research using functional analysis has been published in the behavior analytic literature demonstrating that environmental stimuli and operant function of problem behavior can be identified for certain classes of behavior. Functional assessment procedures are classified into three categories: informant assessment, descriptive assessment, and functional analysis (Lennox & Miltenberger, 1989). Informant assessments rely solely on the verbal report of caregivers and clients for information regarding potential determinants of problem behavior. The descriptive assessment employs direct observations, collecting data in a linear fashion as events in natural settings (Lalli & Goh, 1993). In functional analysis, specific environmental events are experimentally manipulated to identify the functional relationship between the environment and problem behavior. By contrast, functional analysis presents the most rigorous of the functional assessment methods (Matson & Minshawi, 2007). The purpose of identifying the functional relationship between the problem behavior and environmental stimuli is to develop an intervention that reduces or eliminates the problem behaviors by creating conditions which make these controlling variables absent from the client's environment (Cihak et al., 2007). Numerous studies have demonstrated that the individualized function-based intervention is effective in reducing or eliminating the problem behavior of individuals with disabilities. (Blair et al., 2006)

Functional Analysis

Functional analysis procedures are implemented to develop a powerful intervention by creating conditions which make these controlling variables absent from

the individual's environment. The functional analysis methods developed by Iwata et al. (1982) and Carr and Durand (1985) marked the beginning of a comprehensive approach to intervention for individuals with developmental disabilities, which has led to the development of more precise reinforcement-based interventions and a decrease in the use of punishment. The primary conditions used in functional analysis include attention, alone, demand, and control (Iwata et al., 1982). A multi-element design can be used to test each condition, alternating between each condition (Healey et al., 2001; Sidman, 1960).

One method of alternating between these conditions is to use a condition that might be responsible for the problem behavior, followed by the control condition, then followed by another condition possibly responsible for the problem behavior, and followed by the control condition again, with this pattern being repeated till all possible conditions are tested (e.g., example, attention condition, control, demand condition, control, alone condition, control, demand condition, and finally control). This is known as the sequential, test-control methodology (Iwata et al., 1994). This is an experimental design that involves alternating between the test and control conditions. This procedure differs along several dimensions from other functional assessment procedures. For example, a descriptive assessment employs observation of client and caregiver interactions and calls for instruction to the caregivers to behave as they normally would (Thompson & Iwata, 2001). An observer records each incident of problem behavior and the consequence delivered from the caregiver. The purpose of the descriptive assessment is to reveal the naturally occurring consequences for problem behavior (Thompson & Iwata, 2007). Rationale for using descriptive assessment is that the natural occurring

consequences, from caregivers, will expose the function of the problem behavior. A disadvantage of this method is that it does not isolate each function while keeping others removed. The delivery of the consequence is determined by the caregiver, and this may not match the function of the problem behavior (Hall, 2005). In the functional analysis procedure, only one consequence is delivered for each (e.g., during tangible condition, *only* a tangible is given contingent on the occurrence of problem behavior). It is expected that problem behavior will only occur at high rates during the condition which corresponds to the function of the problem behavior, and will be at a low rate during conditions which do not correspond. Through the sequential method, this is further replicated across and the data can demonstrate distinctions between each condition, therefore leading to the identification of the function of the problem behavior. This method is useful because it is important to identify the controlling variable responsible for the problem behavior (Carr & Owen-DeSchryver, 2007).

During functional analyses, reinforcers associated with each condition are presented contingent upon the target behavior. For example in the attention condition with a child whose target behavior is self-injurious behavior, whenever the child hits himself, he is given attention for a brief period. If the child exhibits self-injurious behavior (SIB) at a significantly higher rate than in the other conditions, then a hypothesis is formed that the function of the target behavior is to gain attention. In the control condition, the child is given access to reinforcers (e.g., attention and tangibles) and is free of any tasks (e.g., demand condition). Since the child has access to these reinforcers, the child is expected not to perform the target behavior as a function of attention, escape, and access to tangibles. The control condition is compared to the other

conditions to determine the function of the problem behavior. Significantly higher levels of the target behavior in one or more conditions indicate the controlling variables responsible for the target behavior. The importance of identifying these controlling variables is that they can be used in interventions focused on reducing problem behavior (Kahng, Abt, & Schonbachler, 2001).

The effectiveness of functional analysis has been demonstrated through the replication of countless studies that have proven the approach to be valuable in identifying the variables responsible for problem behaviors. This is an efficient tool to be used before developing and implementing a detailed treatment plan, as it can save a lot of “guesswork” as to why a child behaves the way he does (Alter et al., 2008). Although the majority of functional analysis studies examine self-injurious behavior the functional analysis methodology has also been widely used to identify functions of different problem behaviors, regardless of their topography. It has been used to examine a large variety of problem behaviors such as aggression, yelling, destruction of objects, tantrums, pica, elopement, self-injurious behavior, and non-compliance (Hanley et al., 2003; Moore, Fisher, & Pennington, 2004). Not only has functional analysis been used to assess problem behaviors exhibited by individuals with severe disabilities, but also to assess topographies of problem behavior exhibited by typically developing children (Hanley et al., 2003; Ward & Higbee, 2008).

Despite the utility of the functional analysis procedures, literature indicates that it may be difficult to determine the function of problem behavior of individuals with developmental disabilities (Tiger, Hanley, & Bessete, 2006). In the Piazza et al. study (1998), functional analyses determined that the problem behavior of a child with autism

was a function of escaping from tasks. Results also indicated that attention maintained destructive behavior, suggesting that escape from tasks alone was not enough to decrease the problem behavior. Fisher et al. (1996) alternated between demand, attention, tangible, and control conditions to demonstrate the function of self-injurious behavior and aggressive behavior in a child with mental retardation. The duration of access to reinforcers was varied for each condition. Lower rates of SIB and aggressive behavior were associated with greater duration of access to reinforcers. Kennedy et al. (2000) used a functional analyses including attention, demand, no attention, and recreation conditions for children with autism. There were mixed results, with two of the five children engaging in stereotypical behavior during all experimental conditions, including the recreation condition. This study demonstrated the complexity of stereotypy, and the importance of careful functional analysis procedures.

It is a priority to ensure that the individual is kept safe when implementing functional analyses. For example, if severe aggressive behavior is the target behavior, it can be useful to examine the precursors responsible for the target behavior, to prevent serious injury (Smith & Churchill, 2002). When examining aggressive behaviors leading to physical injury (Fisher et al., 1998), the objects used during the functional analyses were of safe materials and could not harm the child if they were broken.

Functional Analysis in the Natural Settings

Functional analysis can be conducted in a wide variety of settings. Often, researchers prefer to have tight control over the settings. This environment is known as a controlled or analogue setting (Philips & Mudford, 2008). The controlled setting has its advantages mainly because it limits the number of confounding variables. Experiments

with the controlled setting are done by conducting the functional analysis in a “closed” environment, meaning being closed off from the natural environment which the client is usually exposed to (Hanley, Iwata, & McCord, 2003). The typical controlled setting might be in a clinic with limited distractions (or confounding variables). An example of this can be a small room with a table and two chairs. Materials in the room would only be those which correspond to the condition (O’Reilly et al., 2006). For example, in the tangible condition, preferred items would be present in the room. Before the attention condition, the preferred items are removed from the room, and then the attention condition begins. Other conditions, variables are removed if they do not correspond to the condition being tested. This promotes a great deal of control over both the client and the environment (O’Reilly et al., 2006). An issue concerning functional analysis is that the problem of concern may not occur in the controlled analogue settings (Call et al., 2005). For example, Roantree & Kennedy (2006) conducted a functional analysis on a child with severe mental retardation in an analogue setting which was a small room with tables and chairs. Results indicated that the function of stereotypy was attention. However, the function was determined only after noncontingent pre-session attention was introduced. Had the functional analysis taken place in a natural setting, manipulation of pre-session attention might have not been required since that is the setting where the stereotypy usually occurred. English & Anderson (2003) compared the effects of using an unfamiliar therapist versus familiar caregivers during functional analysis with children with developmental disabilities. Prior to the study, the caregivers were trained to implement functional analysis. Results indicated that for 3 of the 4 participants, rates of responding were different depending on who implemented the functional analysis.

Sheridan et al. (1996) also showed similar results. The researchers conducted a social skills intervention for school children with autism, in which intervention was implemented both in analogue and naturalistic conditions. An analogue condition involved performing 48 social scenarios with a confederate child of the same age as interventionist. The naturalistic observations were conducted during morning and recess periods at the child's school. The target behaviors were social entry, maintaining interactions, and solving problems. From baseline to treatment phases, results of the analogue condition indicated improvement in all target behaviors. Intervention during the natural conditions did not produce the same results, with no improvement for social entry and solving problems skills across baseline to treatment phases.

Conducting functional analysis sessions during natural routines at home has been emphasized in the literature (Jay et al., 2005; Richman & Lindauer, 2005). Ellingson et al. (2000) conducted a functional analysis with a high functioning child who engaged in excessive thumb sucking. It was revealed that the child engaged in thumb sucking while alone, usually while watching television in the living room. Therefore, the functional analysis was conducted at her home in the living room. Results indicated significantly higher rates of thumb sucking during the alone condition, which suggested the function was maintained by automatic consequences. This was further confirmed when bandages were put on the finger and thumb sucking dropped down again, and only occurred at high rates when the fingers were exposed. An Awareness Enhancement Device (AED) was placed on gloves, and thumb sucking dropped to near zero levels in the treatment phase.

An important factor when using the natural environment in functional analyses is deciding who will conduct the analyses (Ringdahl & Sellers, 2000). As shown by several

researchers (Brousard & Northup, 1997; Lewis & Sugai, 1996; Northup, 1997), problem behavior of children may be sensitive to attention provided by peers, but not by adults. The results of these studies indicate that unless the source of attention is accurately identified by involving peers in the functional analysis, the intervention would not be effective. Likewise, stimuli are specific to certain homes and caregivers are specific to certain individuals. Since caregivers are the people who must deal with the problem behavior. Involving families or caregivers in the functional analysis will not only contribute to accurate identification of the behavioral functions, but also increase the social validity of the analysis and intervention (Martin et al., 1999). Several studies included parents in the functional analysis. Vollmer et al. (1996) conducted a functional analysis on children with severe tantrums and limited speech. In an outclinic setting they used the parents to perform the functional analysis and determined that for one of the children, the function of the tantrums was to obtain attention from the mother and preferred items such as toys. Treatment involved using alternative forms of communication as replacement behaviors for the tantrums. The maternal attention observed between mother and son may have not been observed if a therapist, rather than the mother, performed the functional analysis. Future studies can use several therapists (e.g. mother, father, teacher, therapist) and examine if the same functions of behavior are observed across therapists. It is relevant for people with whom problem behaviors occur the most to conduct the functional analysis, since this most closely resembles interactions in the naturalistic context.

Functional Analysis of problem behaviors can also occur in other settings such as a school classroom. Mueller et al. (2001) treated a child with the problem behavior of

hand flapping in the classroom. In this study, it was hypothesized that the function of hand flapping was associated with class demands. The teacher was instructed to place a task demand on the child throughout the course of a normal class period. Results indicated that high levels of hand flapping occurred when task demands were low, and low levels of hand flapping occurred when task demands were high. His stereotypical behavior occurred even in the absence of social consequences (e.g., attention), suggesting that the child enjoyed performing the tasks and was more likely to engage in hand flapping when task demands were low. It is also possible that hand flapping resulted in lower level rate of demands. Another possible explanation for the high rates of stereotypical behavior during high task demands is that it is possible that his hand flapping was automatically reinforcing, but performing the tasks was found to be more reinforcing which competed with his stereotypical behavior.

Stereotypy of Individuals with Autism

Stereotypy can be defined as responses with properties that are relatively invariant over successive occurrences (Catania, 1998). According to Lewis & Baumeister (1982), stereotypy can be defined as repetitive or invariant behavior that serves no apparent social function. Stereotypic behavior is common in individuals with autism as well as other developmental disabilities. Functional analysis is a common method of determining the function of stereotypy. Stereotypic behavior is viewed as core symptoms of autism. These behaviors can prevent individuals with autism from acquiring new and useful behaviors, as well as isolating them from inclusive settings (Jones Wint, & Ellis, 1990; Wolery et al., 1985). If unaddressed as early, the stereotypic behaviors can be a

precursor to more serious problem behavior such as self-injury (Morrison & Rosales-Ruis, 1997).

Topographies of these behaviors can include but are not limited to lining up objects, body rocking, repetitive verbalizations, hand mouthing, hand flapping, and hair twirling (Mueller, Sterling-Turner, & Scattone, 2001). Stereotypical behaviors can serve the function of escaping from tasks, because of their aversive nature towards caretakers, therapists, and school teachers, as this has been demonstrated through the use of functional analysis (Durand & Carr, 1987). Caretakers will often leave a child alone when they engage in stereotypical behavior, and this can produce an escape function. There are studies reporting that stereotypical behaviors can be used for sensory stimulation (Lovaas, Newsom, & Hickman, 1987). However, studies have also demonstrated the social reinforcement effects on stereotypical behavior (Roantree & Kennedy, 2006).

Tang et al. (2002) examined stereotypical behaviors of a child with autism who engaged in stereotypical ear covering. Through descriptive analysis it was hypothesized that this behavior might be in response to another child's screaming. Functional analysis confirmed that stereotypical ear covering only occurred in the presence of another child screaming. Durand & Carr (1987) conducted functional analyses using 3 different experimental conditions. These conditions were the baseline condition, decreased attention condition, and increased task difficulty. Matching to sample and receptive identification tasks with picture cards were used and were separated into easy and difficult, and the easy tasks were used during baseline, while the difficult tasks were placed into the increased task difficulty condition. Attention in the form of commands

and praise was delivered contingent upon correct responses on a variable ratio schedule of VR 3, and stereotypic behavior was ignored. In the decreased attention condition, praise and commands were significantly reduced during tasks. In the increased task difficulty condition, praise and commands were delivered just as they were in baseline, except the tasks used were identified as difficult. The increased task difficult condition had the highest frequency of stereotypical behavior. This suggested that the stereotypic behavior served as a function of avoiding difficult tasks. In the second experiment of this study, the same baseline condition was used. The other condition was the time-out condition. In the time-out condition, the task was briefly paused (time-out) and the experimenter ignored the participant. The results showed an increase in stereotypic behavior in the time-out condition. These results suggest that stereotypic behavior functioned as escape from the task. Mace & Belfiore (1990) also found similar result with their study. They used functional analyses on a 38 year old lady with stereotypic behavior. The functional analyses demonstrated that stereotypic behavior was maintained by termination of demands. When stereotypy occurs at high rates in an alone condition, it is often hypothesized that the function is self-stimulatory (Repp, Felce, & Barton, 1988; Sidener, Carr, & Firth (2005).

Preference Assessments

Preference assessments are a vital component of putting together a treatment plan when determining effective reinforcers for the individual (Paramore & Higbee, 2005). While reduction of problem behavior might be beneficial to the client, this must be replaced by positive and/or replacement behaviors. Replacement behaviors are often rewarded by various reinforcers (e.g. praise, edibles, etc.), and each child is an individual

with different preferences for reinforcers. Thus, it is important to determine which items a child is interested in obtaining, more importantly, which items they want in exchange for positive behaviors.

Typical preference assessment procedures systematically present reinforcers to determine the participant's preferred item. This item is then used as a reinforcer during functional analysis and treatment. There are several commonly used preference assessment procedures. For the Pace Procedure (also known as single item procedure) one item is presented at a time (Pace et al., 1985). Choosing the item signals they prefer it. For example, there may be a total of 16 items, and each item is presented 10 times in random order. The number of times each item is presented is divided by the number of times it is approached. A limitation of this preference assessment is that it may overestimate preference, since it is possible for all items to be chosen when presented (Fisher et al., 1992).

The Forced Choice Procedure, also known as paired choice, (Carr, Nicolson, & Higbee, 2000) involves showing 2 items at a time and waiting, and then allowing the participant to choose one of the two items. A group of items is selected and then each item is paired with the other in the group. For example item A is paired with item B, item A paired with item C, item A paired with item D, etc. An advantage of this procedure, unlike the Pace Procedure, is that it is not possible for every item to be chosen 100% of the time. The participant must choose one of two items, which can create a hierarchy of preference, and items can be ranked relative to each other. In a study comparing the Pace Procedure and Forced Choice Procedure, Fisher et al. (1992) conducted both of these preference assessments. After the preference assessments were conducted, two chairs

were available to sit in. Depending on which chair they sat in, they received access to a certain item used in the preference assessment. Using this concurrent operant approach, they determined the Forced Choice Procedure was significantly more accurate at predicting which item the participant would choose, while the Pace Procedure overestimated the preference of the participants.

Harding et al. (2002) used reinforcer assessments to determine which reinforcers were responsible for specific behaviors. Highlights how multiple reinforcers, rather than just one reinforcer may be responsible for problem behaviors, and how multi-component interventions are important. Zarcone et al. (1999) assessed the effects of negative reinforcement during tasks. The study provides good information on reinforcer assessment and how they can be used in interventions aimed at decreasing destructive behavior. Poling (1987) used reinforcer assessments containing forced exposure as well as choice trials. The study was unique in the fact that it used more than one type of preference assessment, rather than just one which is common practice. Considering the fact that an item might have a different value in an analogue condition as opposed to an individual's natural environment, it is important that the item determined in the preference assessment, which will be reinforcing the problem or competing replacement behavior in the natural environment should be used during functional analysis and intervention. Items that are reinforcing in one environment might not be as reinforcing in another environment.

Schedules of Reinforcement

Schedules of reinforcement can be created and manipulated in several ways during functional analysis. The vast majority of studies administered consequences on a

continuous reinforcement (CRF) schedule (Hanley et al., 2003). With a CRF schedule, a programmed reinforcer is delivered after the occurrence of each problem behavior. Studies that used intermittent schedules of reinforcement, delivered the reinforcer sporadically. This might be observed in the naturalistic environment as well, since often the caregiver does not deliver reinforcement after each incident of problem behavior (Lali & Casey, 1996). Issues with the intermittent schedule of reinforcement are that since the reinforcer is delivered intermittently, it is possible that the reinforcement might not be delivered sufficiently after the problem behavior, which might extend the length of the functional analyses (Hanley et al., 1996).

Tiger, Hanley, & Heal (2006) conducted a study using multiple schedules of reinforcement to determine school children's preferences. They used different color cards presented to the experimenter, and each card was associated with various schedules of reinforcement. The conditions included: two stimuli (e.g. different colored cards and leis around the experimenter's neck) in which one was associated with reinforcement and another with extinction; only one stimuli was presented which was associated with reinforcement (continuous schedule of reinforcement; and the mixed schedule in which stimuli associated with reinforcement and extinction were not presented. The children who were able to discriminate better when the stimulus associated with extinction was presented preferred the mixed schedule of reinforcement. Children who were not as accurate at discriminating the stimulus associated with extinction preferred the reinforcement only condition (continuous schedule of reinforcement). Paisey, Whitney, and Hislop (1991) embedded trials of their functional analyses within the natural routine (e.g. lunch time) of adults with intellectual disabilities who engaged in aggressive

behavior. Due to the high frequency and severity of a participant, they used an intermittent schedule of reinforcement (FR3). Results indicated aggressive behavior under all conditions, which suggested that he was under the control of social contingencies (e.g. disrupted during lunchtime), regardless of the condition. Therefore, future research in functional analyses in natural settings should conduct the analyses using either intermittent or continuous schedules of reinforcement depending upon the severity of the individual's problem behavior and the characteristics of caregiver responses on problem behavior.

Magnitude of Reinforcement

The term *magnitude* can refer to several dimensions including the size, quantity, or number of an object or time (Hoch et al., 2002). It can also make reference to the importance, or quality of an object. Reinforcement is defined as a consequence that follows an operant response that increase (or attempts to increase) the likelihood of that response occurring in the future (Skinner, 1953). Magnitude of reinforcement can be defined as “The rate, quality, intensity, or duration of reinforcement” (Hoch et al., 2002). Reinforcement itself has been manipulated, and examined in countless studies. It can be thought of as one of the most fundamental aspects of behaviorism. Using reinforcement is of extreme importance, if not entirely required, when developing a behavioral intervention plan. This is obvious to most researchers and reinforcement has been examined in a variety of ways. However, few studies have directly evaluated reinforcement magnitude. The few studies that have made magnitude of reinforcement the main focus of their studies have yielded inconsistent results. Some studies have found that an increase in magnitude of reinforcement results in an increase in response

rates (Jenkins & Clayton, 1949; Reed, 1991). On the other hand, numerous studies have found that an increase in magnitude produces a decrease in response rates, which is an inverse relation (Belke, 1997).

For example, Volkert et al. (2005) conducted functional analyses on 6 children with developmental disabilities. Engagement in problem behaviors was examined during each condition. The researchers tested the effects of varying the magnitude of reinforcement duration during functional analysis using 3 sec., 20 sec., and 120 sec. reinforcement durations. Access to reinforcers varied with 3 different lengths of time contingent on problem behavior. With the greatest length of time the children had access to reinforcers, rates of problem behavior were lowest. The results indicated no difference in the identification of problem behavior across the 3 sec., 20 sec., and 120 sec. duration. On the other hand, other studies have found an inverse relation in reinforcer duration and responding (Reed, 1991; Staddon, 1970).

There are several explanations as to why the results are inconsistent with each other. A simple answer might be that not enough studies have directly examined magnitude of reinforcement. When examining any aspect of behavior, results will vary due to many environmental variables (Volkert, Lerman, & Vorndran, 2005). With such few studies being done on magnitude of reinforcement during functional analysis with the target behavior of stereotypy, we can not reasonably come to a solid conclusion yet, and it is possible that certain procedures were not valid or reliable. The more research is done on the magnitude of reinforcement, the greater reliability we have on the conclusions drawn from all studies. Another explanation of the inconsistent results is that most of the studies used reinforcers different than what is usually evaluated in the functional analysis

for problem behavior. For example, access to candy rather than escape from demands or attention might be used for a child who is trying to escape from demands or attempting to receive attention. An inaccurate use of reinforcement will not produce valid results. The function of a problem behavior must be determined, and the proper form of reinforcement addressing that behavior needs to be used in the functional analysis.

Recently, there have been several studies that directly and systematically examined the magnitude of reinforcement. Volkert et al. (2005) directly examined reinforcement magnitude, the dimension of duration of reinforcement. This was done during the functional analysis of children with mental disabilities to examine if the duration of reinforcement effects the identification of problem behavior. Volkert and her colleagues used three different durations of reinforcement: small duration (3 seconds), medium duration (20 seconds), and large duration (120 s). Different durations can be related to durations of reinforcement in the natural environment. For example, a small duration of 3 seconds might be equivalent to verbally praising a job, such as saying “good job” and smiling, or a pat on the shoulder. The medium duration of 20 seconds can be similar to having a short conversation with the child. Asking the child what they made in art class or tickling a child may last approximately 20 seconds. The large duration of 120 seconds can be closer to the length of break time given for in between tasks, or sitting together and watching television. Although 120 seconds can be considered a long period of reinforcement, it may not even come close to the amount of reinforcement that might be seen in the natural environment (Lindberg et al., 2003). For example, a parent might play sports with their child in the park for 30 minutes at a time, and maybe even longer. A child might find a gym class at school which lasts 50 minutes to be a stimulating

source of reinforcement. If a child is given only 2 minutes of a 50 minute gym class, it may have an adverse effect on behavior. 120 seconds of reinforcement might only be a fraction of the durations of reinforcement we see in the natural environment. However, for the purposes of conducting a functional analysis, it is understandable to use 120 seconds for the “long” duration. This also makes a functional analysis more practical in most cases. The results of the functional analysis concluded that there were no differences in the identification of problem behavior. It is possible that these results were due to reinforcement duration being arbitrarily manipulated.

This significant finding however, came with a few limitations. There were only 14 to 16 sessions for each participant. More sessions may have produced satiation effects (Lindberg et al, 2003). Also each session only lasted for 10 minutes. The session length might have affected the levels of target behavior during the analyses. In a study with children with intellectual disabilities, Roscoe et al. (2003) observed lower response rates of behavior during 30 minute sessions when compared to 10 minute sessions. The results indicated that larger magnitudes of reinforcement produced a lower rate of responding. Wallace and Iwata (1999) manipulated session lengths of 5 min., 10 min., and 15 min. for individuals with mental retardation. The 10 min. and 15 min. sessions produced the same results. However there were a few discrepancies between the 5 min. and 15 min. sessions, with an increased frequency of problem behavior towards the later parts of the 15 min. sessions.

In the natural environment, sessions may last much longer. For example, a therapist or caregiver conducting discrete trial training at an in home setting might work with the child for up to 4 hours. Although breaks may be provided in between each work

period, the therapist might wish to work with the child for 30 minutes at a time to increase aspects of attention or vigilance. This is important when looking at the format of teaching in school classrooms. Class periods typically last approximately 50 minutes. A child might be able to perform well for the first 10, or perhaps even 20 minutes. For example, if the function of a child's behavior is to gain attention, a 10 minute session might not be sufficient to determine this function. Children are different and some might be able to go longer without attention than others. For example, a child may not engage in problem behavior for the first 10 minutes of a class period. However, after 20 min. of deprivation of attention, from the teacher or peers, may lead to problem behavior. If a classroom period lasts 50 minutes, a 10 minute functional analysis session is only one-fifth of that class period. Therefore, future studies should conduct the functional analysis in conditions more similar to the naturalistic setting, which can be done by manipulating several variables. It is possible that behaviors that are not exhibited early in the session might start to occur and increase towards the end of the session. Increasing the session to longer than 20 minutes however, might be impractical since it can interfere with other routines that caregivers wish the participant to engage in such as household chores, homework, discrete trial therapy, etc. Reinforcer duration should also be manipulated to examine any differences across the durations. With a session length of longer minutes, it may be more reasonable to see problem behaviors occur with long durations of reinforcement (e.g. 120), which might not be observed with shorter session lengths (e.g. 5-10 min.). Varying durations of reinforcement can match the different durations seen in the naturalistic environment. For example, a 3 sec. duration is approximately the amount of time a caregiver might provide attention in the form of a short statement, such as

“Don’t do that”. A duration of 20 second might be equal to attention being provided from a caregiver with by a couple of sentences, or the amount of time it takes to finish a small candy. The 120 second duration is rarely used in functional analysis, although many instances of this duration, and even longer, occur every day in a child’s environment. Hugging a child and watching television together, or being sent out of a classroom and avoiding a lesson can last way beyond 120 seconds. Varying both session length and duration of reinforcement during functional analysis can more closely match the environments, and increase ecological validity.

Functional Analysis-Based Intervention to Reduce Stereotypy

Intervention designed based on the functional analysis results closely link to the functions of stereotypy. For example, Ahearn et al. (2007) used functional analysis to determine the function of vocal stereotypy in children with autism. After the identification of the function of stereotypy, the participant’s teachers were trained to use a response and interruption and redirection program, which was used to replace the stereotypy with appropriate vocalizations. Contingent upon vocal stereotypy, the teacher presented the children with simple vocal demands such as “What color is your shirt?” These vocal demands were presented until the child answered 3 consecutive times without an incident of vocal stereotypy. Results indicated a significant decrease in vocal stereotypy and an increase in appropriate vocalizations.

Sidener, Carr, & Firth (2005) performed a functional analysis on children who engaged in stereotypy. Stereotypy was highest in the alone condition and it was determined the function was automatic reinforcement. The researchers found that an environmental enrichment procedure significantly reduced stereotypy. This procedure

involved access to three highly preferred items, suggesting that a reinforcer rich environment competed with stereotypical behavior.

Through function based interventions, alternative behaviors can replace problem behaviors. Kennedy (2000) determined that stereotypical behavior was observed in the attention, demand, and no attention conditions. It was hypothesized that the problem stereotypical behaviors occurred to communicate for attention and escape demands. In the treatment phase, the alternative behavior of signing was introduced and was reinforced, while the stereotypical behavior was ignored. Significant decreases in stereotypical behavior were observed in the treatment phase.

Family involvement has become increasingly common in the function-based intervention literature. Parents have actively involved not only as informants or assessors, but also as intervention agents in the process of intervention development and implementation (Arndorfer, Miltenberger, Woster, Rortredt, & Gaffaney, 1994; Derby et al., 1997; Vaughn, Clarke, & Dunlap, 1997; Wacker, Cooper, Peck, Derby, Berg, 1999). Arndorfer et al. (1994) involved parents in the brief experimental analysis in the context of family routines in the home. Derby et al. (1997) involved mothers in the functional analysis and intervention procedures. Lucyshyn, Albin, & Nixon (1997) targeted four family routines in the home and community involving parents of a 14-year-old-child with multiple disabilities in comprehensive assessment including the experimental functional analysis and intervention procedures. Intensive training and maintenance support was provided to the parents during the implementation of the intervention. Although the family involvement has been emphasized and valued in the literature, only a small

number of research studies have reported family involvement both in the functional analysis and intervention procedures (Dunlap, Newton, Fox, Benito, & Vaughn, 2001).

Purpose and Research Questions

The purpose of this research is to examine the effects of varying duration of reinforcement and session length during functional analyses on stereotype of an adolescent with autism and the effects of intervention designed based on the functional analysis results on his stereotype and replacement behavior. This study extended the literature by (a) examining the interaction effects of reinforcement duration and session length on stereotype and (b) involving the family in the functional analysis and intervention procedures during a natural family routine. Questions addressed were whether (a) the identification of function of stereotype would be different across varying session lengths and varying durations of reinforcement; (b) the combinations of session lengths and durations of reinforcement would produce different results; and (c) the function-based intervention based on the functional analysis results would lead to a decrease in stereotypical behavior and increase in communicative behavior.

Chapter 2: Method

Participants

The participant in the study was Mike, a 19 year old adolescent diagnosed with autism by an independent psychologist according to the criteria of *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR*; American Psychiatric Association, 2000). Mike's intelligence was reported to be 2.0 below the mean on the *Standord-Binet-IV* (Thorndike, Hagan, & Sattler, 1986). The *Vineland Adaptive Behavior Scale* (Sparrow, Balla, & Cicchetti, 1984) indicated that he functioned at 2-year-old level. On the *Childhood Autism Rating Scale* (Schopler, Reishler, & Renner, 1988), he scored in the severe range. Mike has also taken a communication evaluation. For the Receptive-Expressive Emergent Language Scale (REEL), Mike scored 7-9 months on Receptive Language and 20 months on Expressive Language. On the Sequenced Inventory of Communication Development (SICD), he scored 20 months for Expressive Communication, and 8 to 16 months for Receptive Communication. Mike lived with his parents in upper middle class neighborhood, and attended a special school for children with autism and other related disabilities. Mike had been on and off of several medications within the past year which include Depakote, Risperdal, Clonidine, and Melatonin. He appeared to be in good physical health, and received medical care on a regular basis from his primary care physician. He had limited vocal skills, and only spoke the first phoneme, or at most two phonemes of a word. He performed well at tacting objects, and when asked to vocally identify an object, he could say the first phoneme of

the object, but had trouble pronouncing the entire word. His fine motor skills were rather poor and often needed physical guidance to perform such tasks. Mike's community safety skills were very limited which put him at serious danger in the community without appropriate supervision. Mike frequently engaged in stereotypical behavior at home and school, and had a history of doing so most of his life. He had worked with speech therapists, neuropsychologists, and most recently ABA therapists. Most of his recent therapy had focused on skill acquisition such as speech, motor skills, and social skills. The discrete trial method had been used for the majority of his skill acquisition. He did not have a history of therapy to reduce his stereotypy.

Setting

The functional analysis and treatment were conducted in the participant's home. The routine that was targeted for analysis and intervention was transition from meal after school to house chores with his mother. The transition period occurred after Mike was done with his first meal after school, which was usually eaten soon after being dropped off from his school bus. Generalization sessions were conducted during transition activity time that occurred after the discrete trial activities with his therapist. Functional analyses were conducted in the living room area, where Mike spent most of his time during transition. During transition time, Mike did not engage in any structured activities, spending his time mostly walking around the house, laying down on the couch, and watching television, while he frequently engaged in stereotypy.

Response Measurement

Stereotypical behavior for functional analysis and intervention, and replacement communicative behavior for intervention was measured using a 10-s partial interval

recording procedure. Data on the target behaviors was converted to a percentage of intervals for each session. Stereotypical behavior included occurrence of hand flapping, repetitive vocalizations, jumping up and down, stomping feet, saying “wa-hee”, twirling an object, and shaking an object. *Hand flapping* was defined as rapidly moving an open hand back and forth at least twice within 5 seconds. *Repetitive vocalizations* were defined as repeating the same sound at least two times within 5 seconds. *Jumping up and down* was defined as the feet leaving the ground and the body moving vertically, unless the current activity requires jumping (e.g. jumping jacks, trampoline, etc.). *Stomping feet* was defined as lifting one or two feet off the ground and hitting them against the ground at least two times within 5 seconds. *Saying “wa-hee”* is defined as the client verbally saying the phrase “wa-hee”. *Twirling an object* was defined as holding an object in hands or fingers and moving the object around in a circular motion at least twice in 5 seconds. *Shaking an object* was defined as holding an object in hands or fingers and moving it back and forth at least twice within 5 seconds. Communicative behavior was defined as using appropriate vocalizations (e.g., saying the name of a preferred object or activity, or a close approximation) or pointing to an item or a specific picture of item or activity to request items or activities on verbal prompts (e.g., What do you want?). To be considered a correct communicative response, the participant would have to clearly indicate a *specific* preferred activity or item upon being prompted or independently, and the parent would have to clearly understand his response. A response must indicate which item or activity Mike wants on the first attempt. For example, if Mike’s mother asked him “What do you want?” and the participant vocally said the item or pointed to the item and the mother understood what he said or pointed, that would qualify as a

communicative response. However, if the mother did not understand, and then said “Do you want to go bike riding”? and Mike responded “yes”, this would not qualify as a correct communicative response. A correct communicative response must be clear to the person providing the activity or item, and not require guessing or a process of elimination by asking a series of potential items or activities that the child might be interested in.

Procedural Integrity

Therapist and parent procedural integrity was measured to determine the accurate implementation of functional analysis and intervention procedures. It measured the therapist’s and parents correct responses contingent upon stereotypical behavior. For example, during the attention condition of functional analysis, only the delivery of attention contingent on problem behavior was marked as a correct response. In addition, the delivery of the correct corresponding reinforcer within 3 seconds and the delivery of the reinforcement duration matching the duration designated for that condition within 2 seconds were recorded. For example, if the condition was for the 20 sec. reinforcement duration, then reinforcement must have been provided between the ranges of 18-22 seconds. Also, session length must have lasted within no more than 5 seconds of its designated condition. An example of this is for the 8 min. session to last no less than 7 min. and 55 sec., and no more than 8 min. and 5 sec. During the attention condition of the functional analysis, attention delivery was defined as providing social attention in the form of statements such as “Stop doing that”, or “Hey what are you doing?” contingent upon stereotypical behavior, and would last for 3 sec., 20 sec., or 120 sec. depending on the designated duration of reinforcement for that session. During tangible condition, tangible delivery was defined as access to a preferred item contingent upon stereotypical

behavior for 3 sec., 20 sec., or 120 sec. depending on the designated duration of reinforcement for that session.

During the intervention phase, parent delivery of sensory extinction occurred by removing stimulation directly produced by the stereotypy such as a pen, string, popsicle stick, and sock. Creating an enriched environment by providing activities with parents, and delivery of correct prompts, time delay, and reinforcement contingent upon communicative behavior were measured. Percentage of correct use of procedures was measured to determine the procedural integrity by dividing the number of correct use of procedures by the total number of opportunities to implement the procedures and multiplying by 100. The results of fidelity assessment indicated that both implementers (researcher and mother) did adhere to all treatment procedures scoring a mean of 98% for the researcher and 94% for the mother, overall mean of 96% and overall range of 92%-100%. IOA for treatment fidelity was 94%.

Data Collection Procedures and Interobserver Agreements

46% of the functional analysis and intervention sessions were video recorded, and the video recorded sessions were scored by the researcher and a data collector (a graduate student in the Applied Behavior Analysis program). The data collectors scored the sessions using paper and pencil while they listened to an auditory cue emitted from an audiotape. They practiced observations using the 10-s interval recording procedure while they observed prerecorded video sessions. Upon attaining a minimum criterion of 90% across behaviors, they concurrently but independently, scored the video-recorded data. Interobserver agreements were obtained across conditions and behaviors. Mean interobserver agreement for FA was 97% (range, 90% to 100%). Mean interobserver

agreement for stereotypy during baseline and intervention were 96% and 94%, respectively. Mean interobserver agreement for communicative behavior during baseline and intervention were 98% and 100%, respectively.

Preference Assessment

The Forced Choice Procedure (Fisher et al., 1992) was used prior to each session to determine highly preferred items to be used in the functional analysis phase. Three items (i.e., jelly beans, crackers, and potato chips) and 3 activities (i.e., ball tossing game, reading comic books, and doing picture card tasks) determined to be highly preferred through an interview with the mother and observations by the researcher were used. Each item was paired with every other item in the group until all possible combinations were used. The order in which the items were paired and presented was in randomized order to control for sequence effects. For example item A was paired with item B, item A was paired with item C, Item B was paired with item C, etc. Each item was presented for approximately 5 seconds. The item that had the highest percentage of being chosen was used as a reinforcer for the tangible condition of the functional analysis and intervention phase. During each session, the second data collector (a graduate student) recorded whether or not the participant approached a presented item. Each stimulus was presented once with other stimuli in the group for a total of 2 presentations. Approaching a stimulus resulted in approximately 5 seconds of access. If the stimulus was not approached within 5 seconds, the participant was prompted to sample one of the stimuli. If the stimulus was not approached, it was briefly removed and placed in front of the participant and was prompted again to make a choice. A total of 3 presentations occurred prior to each session. The percentage of times each stimulus was approached was divided by the

number of times it was presented. The item with the highest percentage was considered the most highly preferred item, and was used for that session.

Design and Procedures

The study used a multi-element treatment design for functional analysis procedures and a reversal design (i.e., A-B-A-B'-A design) (Dewein & Miller, 2008) for intervention testing. The reversal design involved baseline, intervention, and intervention with generalization promotion.

Descriptive functional assessment: Prior to the functional analysis, Mike's parents were given the Motivation Assessment Scale (MAS; Durand & Crimmins, 1992). The MAS uses a Likert-type scale and asks respondents to rate the likelihood of the problem behavior occurring in various situations (e.g., receiving social attention, escape from difficult situations, receiving tangibles, and sensory stimulation). The respondents rate on a scale of 0-7 (e.g. 0 = never, 7 = always). The scores are totaled and the category with the highest score is assumed to be the maintaining function of the problem behavior. For example, if the attention category receives the highest score, it is assumed that attention is most likely the function of the problem behavior. In addition, an interview with Mike's parents using Functional Assessment Interview Form (O'Neill et al., 1997) and two days of ABC observations (Bijou, Peterson, & Alt, 1968) were conducted during the target transition time to corroborate the MAS results. Results of the MAS indicated that the highest score of 19 was for the sensory function. This was followed by tangible at 17, attention at 15, and escape at 9. The interview with the parents and direct ABC observations revealed he engaged in high rates of stereotypy when he was not engaged in any structured activities and was in transition periods between activities. Therefore, it

was determined that stereotypy was least likely to occur during situations that involved performing activities such as house chores with his mother, structured leisure activities, and discrete trials with his mother or therapist, and most likely to occur during situations when Mike had to be left alone and not provided any activities. For this reason, the demand condition which was the least likely to maintain the function of Mike's stereotypy was excluded from the functional analysis in this study in order to make the functional analysis more efficient, reducing the amount of time the participant and implementer had to spend during the functional analysis.

Functional analysis. A functional analysis of stereotypy based on the procedures used by Iwata et al. (1982; 1994) was conducted, by the researcher and Mike's mother. Four conditions were tested during in the functional analysis phase: Control (play condition), attention, tangible, and alone. The functional analysis manipulated session lengths (Roscoe, Iwata, & Rand, 2003) using 8 min., and 15 min. session lengths. There were 3 durations of reinforcement which were varied: 3 sec., 20 sec., and 120 sec. (Volkert et al., 2005). All possible combinations of the functional analysis conditions (control, attention, tangible, and alone) along with the session lengths (8 min. and 15 min) and durations of reinforcement (3 sec., 20 sec., and 120 sec.) were combined during the analysis phase. A total of 24 conditions (4 functional analysis conditions x 2 session lengths x 3 reinforcement durations) were repeated 2 times for each possible combination, once by the researcher and once by Mike's mother. Some of the conditions were repeated once more either by the researcher or the mother.

During *attention* conditions, Mike was asked to play with a moderately preferred item, while the implementer was seated approximately 4 feet away reading paperwork.

Contingent upon stereotypical behavior, Mike was given attention in the form of mild reprimands and conversation that varied in length based on the duration of reinforcement designated for that condition (3 s., 20 s., or 120 s.). Prior to the *tangible* conditions, Mike was given access to a preferred item for 1 to 2 minutes. At the beginning of the session, the experimenter placed the item approximately 3 feet from Mike and out of reach. Contingent on the occurrence of stereotypical behavior, Mike was given access to a preferred item that varied in length based on the duration of reinforcement designated for that condition. At the end of the pre-specified duration of reinforcement, the reinforcer was removed, and access was only given contingent upon the occurrence of stereotypical behavior. During *alone* conditions, Mike was left alone in the living room. No leisure activities were provided during this condition. The experimenter observed the participant from outside the living room, and no consequences were provided contingent upon stereotypical behavior. During *control* conditions, the participant had access to preferred items or activities, and attention from the researcher or mother. The implementer provided frequent attention in the form of brief verbal comments. There were no consequences for stereotypical behavior.

Mike's mother was involved in all conditions. She was trained to deliver positive (i.e., attention and tangible) reinforcement correctly contingent upon stereotype. Modeling, role play with the child, and feedback procedures were used during a 2-hour training session. This was done to ensure that the mother could properly implement the functional analysis procedures.

Baseline. Before the implementation of intervention, baseline data was collected during transition time. Sessions with the therapist were conducted in the participant's

home in the living room. The room remained the same as it typically was during the baseline phase, with no alterations. Transition lasted about 15-20 minutes. For Mike, the transition time involved resting in the living room, engaging in stereotypy using a string, pen, or beads. Mike's stereotypy was ignored, but sometimes Mike's mother came to Mike to ask what he wanted and provided activities or items that were available. During baseline, Mike's mother spent her time in the same fashion as she typically would. She spent her time preparing dinner, cleaning up, answering phone calls, doing paperwork, etc. Baseline observations were conducted during 15 min sessions. During each session, a trained observer (a graduate student) recorded each instance of stereotypical behavior and communicative behavior using a 10-s partial interval recording procedure. 46% of the sessions were video recorded to obtain interobserver agreements.

Intervention. Before the intervention was implemented, Mike's parents worked together with the researcher to develop intervention procedures that would reduce Mike's stereotypy and to increase his communicative behavior. The intervention focused on Mike's behavior when he was most likely to be alone during transitional periods. The intervention package consisted of providing an enriched environment by providing access to preferred activities that competed with Mike's stereotypy (Sidener et al., 2005), removing of stimuli related to Mike's stereotypy (Rincover, 1978), teaching communicative behavior of requesting activities (Jones, Drew, & Weber, 2000; Mace et al., 1992) using prompts, and providing reinforcement contingent upon Mike's engagement in the activities and communicative behavior.

After careful planning between the researcher and parents, it was determined that physical activities and tasks would be beneficial to Mike's well being, as well as reducing

his stereotypy. It was observed that Mike often enjoyed an activity that was considered a “chore” (e.g. laundry) rather than an activity that may seem more stimulating or leisurely (e.g. bicycle riding). When identifying the chores, higher preferred chores were identified rather than lesser preferred chores since preference in tasks could result in a lower amount of problem behavior (Vaughn & Horner, 1997). Preference for chores was determined through interview with the mother, and chores that were reported to result in the least amount of problem behavior were used more often than lesser preferred chores. However, this was not much of an issue, since Mike performed all chores with few instances of problem behaviors. Physical activities and house chores such as doing laundry, jogging on the treadmill, taking out the trash, bicycle riding and rollerblading were selected to be used during intervention. Soon as Mike was done eating after being dropped off from his school bus, Mike’s mother directed him to engage in a household chore. If a household chore was not available at the moment, he was instructed to choose from one of the preferred physical activities. The focus was on keeping Mike occupied and avoiding giving him the opportunity to be alone and unengaged from activities.

Mike’s stereotypy would often begin while coming into contact with an object that could be swirled or shaken. These objects were small such as a pen, string, popsicle stick, sock, etc. Before the intervention, these objects were often in reach and Mike would use them to engage in stereotypy. The parents were instructed to keep these objects out of Mike’s reach as often as possible. The intervention also involved teaching communicative behavior and providing reinforcement contingent upon when Mike appropriately engaged in communicative behavior and engaged in activities. An issue of Mike being alone was that he would rarely initiate communication to request preferred

activities. Although his stereotypy was not maintained by tangible reinforcers, the parents and the researcher agreed that teaching Mike how to request activities would be meaningful and increase his access to preferred activities, which would result in decreases in his stereotypy. Due to his poor verbal communication skills, and inability of signing due to his limited fine motor skills, the parents and researcher determined to use pictures as a means of initiating activities. Pointing to a picture of a preferred activity or verbally sounding the name of the activity was designated as a proper communicative behavior. First, pictures of preferred physical activities were taken, such as pictures of Mike's treadmill, trampoline, rollerblades, bicycle, etc. Pictures of the laundry machine, garbage bin, and garden were also included as preferred activities. The pictures were then placed on a table in the same fashion as they would be during his tacting picture cards task.

Before implementing the intervention, Mike's mother taught Mike during six 15 minute sessions to discriminate each object by using a manding procedure (e.g., "Where's the treadmill?) and asking to point at the picture of the object or pronounce the name of the object while his mother pointed at the card by asking questions (e.g. "What is this?"). The correct response was prompted through least to most prompting, and praise was delivered immediately upon the correct response. The researcher assisted Mike's parents with the training. Once Mike was able to successfully discriminate the picture cards, he was then introduced the contingency of choosing a card by his mother or father. Between 6 to 9 cards (4" x 6" inch cards) were arranged on a table in rows of 3 with each card approximately 1 inch apart from each other. If there were 7 or 8 cards used, then the first two rows closest to the participant had 3 cards in each row and the top row had 1 or

2 cards respectively. Mike stood next to the table where the cards were placed and the first row was approximately 6 inches from the participant. Prompting consisted of being asked “What do you want to do?”, and as soon as he pointed to a card he was immediately guided to that activity. For example, if he pointed to a picture of the trampoline, the parents would say “Alright, let’s go to the trampoline”, and he was guided outside and directed to get on the trampoline. Praise for engaging in an activity was given often by the parents, and no attention was given to stereotypical behaviors.

The parents received 2-hour training from the researcher before they implemented the intervention procedures to learn how to provide cues, verbal prompts, time-delay procedures, and how to respond to Mike’s communicative behaviors (Lafasakis & Sturme, 2007). Training strategies included scenarios, role-play, modeling, and feedback. During training, parents were asked a series of questions providing scenarios of Mike engaging in stereotypical behavior, and what they would do in those situations, and they participated in role plays to practice implementation skills. The researcher asked the parents to review the scenarios and intervention procedures during the first three intervention sessions and reminded them of what the procedures were. During the implementation phase, the researcher used 4 steps similar to those used by Dib & Sturme (2007) to support parent implementation of intervention: a) caregiver behavior checklist, b) positive and corrective feedback, c) modeling and instructions, and d) continued feedback and modeling. The researcher and the parents reviewed the progress data daily by examining the level and trend of stereotypical and communicative behavior. Both parents were encouraged to provide any feedback and questions regarding the intervention.

Modified intervention. Following the intervention and the reversal baseline phases, a replication phase of intervention with generalization promotion was conducted to promote parents' independent implementation of intervention strategies and the generalization of Mike's target behaviors. The intervention involved developing picture cards of new items of activities and providing Mike with choices on new activities. Four new picture cards of activities were added to the choice of activities he could choose. However, the parents did not receive any training or feedback from the researcher during implementation of the intervention. Percentage of stereotypy and communicative behavior were measured. This data was collected by the researcher, and IOA was determined through the use of a trained secondary observer.

Social Validity

A Social Validity Scale (see Appendix), adapted from the Treatment Acceptability Rating Form-Revised (Reimers et al., 1992), was used to measure parent acceptance of the intervention procedures. It consists of 15 items that are rated on a 5-point scale, where 1 = not at all acceptable, 3 = neutral, and 5 = very acceptable. Social validity was measured by both parents after the intervention phase. Both Mike's mother and father filled out the social validity rating scale at the end of intervention.

Chapter 3: Results

Functional Analysis

The results of the functional analysis are depicted in Figure 1. As seen in Figure 1, the results indicated that the function of stereotypy was the same under both 8min. and 15 min. session lengths regardless of who conducted the functional analysis. The frequency of stereotypical behavior was significantly higher in the alone condition than any other conditions for both session lengths across the experimenters (i.e., researcher and mother). Although the tangible condition had the second highest level of stereotypy, the levels of stereotypy during tangible conditions were also similar in both the 8 min. and 15 min. session lengths. Mike's mean percentage for stereotypy during alone conditions in the 8 min sessions was 68% (83% with mother and 58% with researcher). In the 15 min sessions, his stereotypy averaged 62% (78% with mother and 45% with researcher). His stereotypy occurred at higher rates during sessions with his mother than during sessions with the researcher. It was found that determining the function of stereotypy was also not effected by all 3 reinforcement magnitudes of 3 sec., 20sec., and 120 sec. As seen Figure 1, stereotypy was significantly higher in the alone condition than in any other condition across reinforcement magnitudes. Combinations of different reinforcement magnitudes and session lengths did not hinder the identification of the function of stereotypy.

Intervention Outcomes

Figure 2 displays the results of the intervention. During the first baseline phase, when no environmental enrichment, removal of stimuli, communicative behavior

instruction, and reinforcement procedures were present, Mike's stereotypy occurred at a mean percentage of 51% (range = 26% - 89%) of intervals. Although there was a decrease in stereotypy in the second session, Mike's stereotypy increased again in the third session. During intervention when Mike was presented with the environmental enrichment procedure by being allowed to engage in a variety of activities with his parents, when the stimuli associated with stereotypy was eliminated, and when the communicative behavior was taught with prompts with the combination of reinforcement procedure, a significant decrease in Mike's stereotypical behavior was observed. His stereotypy occurred at a mean percentage of 7% (range = 0% - 29%) . As seen in Figure 2, Mike's stereotypy stabilized as the session progressed occurring at very low rates. During the repeated baseline phase when the intervention was withdrawn, his pattern of stereotypy reversed, occurring at a mean percentage of 62% (range = 48% - 93%).

The results also indicated that Mike's communicative skills through the use of pointing to pictures of preferred activities or vocalization of word approximation increased significantly during the intervention phase. During the first baseline phase, Mike did not engage in any communicative behavior across sessions. He did not initiate requesting when verbal prompts were provided. On the other hand, when the intervention was introduced, Mike demonstrated the communicative behavior 80% of the time throughout the intervention sessions when verbally being prompted to use the pictures of preferred activities. Mike indicated his preference on activities by pointing at pictures or verbalizing word approximation at 80%. When the intervention was withdrawn during the second baseline condition, Mike did not initiate any requesting during verbal prompts.

Modified Intervention

During the second intervention with generalization promotion, Mike engaged in low levels of stereotypy while maintaining high levels of communicative behavior. Mike's mean percentage of intervals of stereotypy was 7%. His communicative behavior occurred 100%. However, when the intervention was withdrawn, his stereotypy increased again. During the final baseline condition Mike's mean percentages of intervals were 43% for stereotypy and 0% for communicative behavior.

Social Validity

Overall, the parents found the function based intervention to be very acceptable (see Appendix A). According to their scores, they were very willing to carry out the intervention, did not think there might be disadvantages following the intervention, felt that a moderate amount of time was needed to carry out the intervention, and were confident the plan would be effective and make permanent improvements in their child's behavior. They found the procedures to be not all disruptive, liked the procedures used in the intervention, and felt other staff was helpful in carrying out the intervention. The parents felt their child experienced a low level of discomfort, they were willing to change their routines to carry out the intervention, and the behavior plan fit in very well with their existing routine. They felt the behavior plan was effective in teaching their child appropriate behavior and the intervention fit with the team's goals to improve their child's behavior.

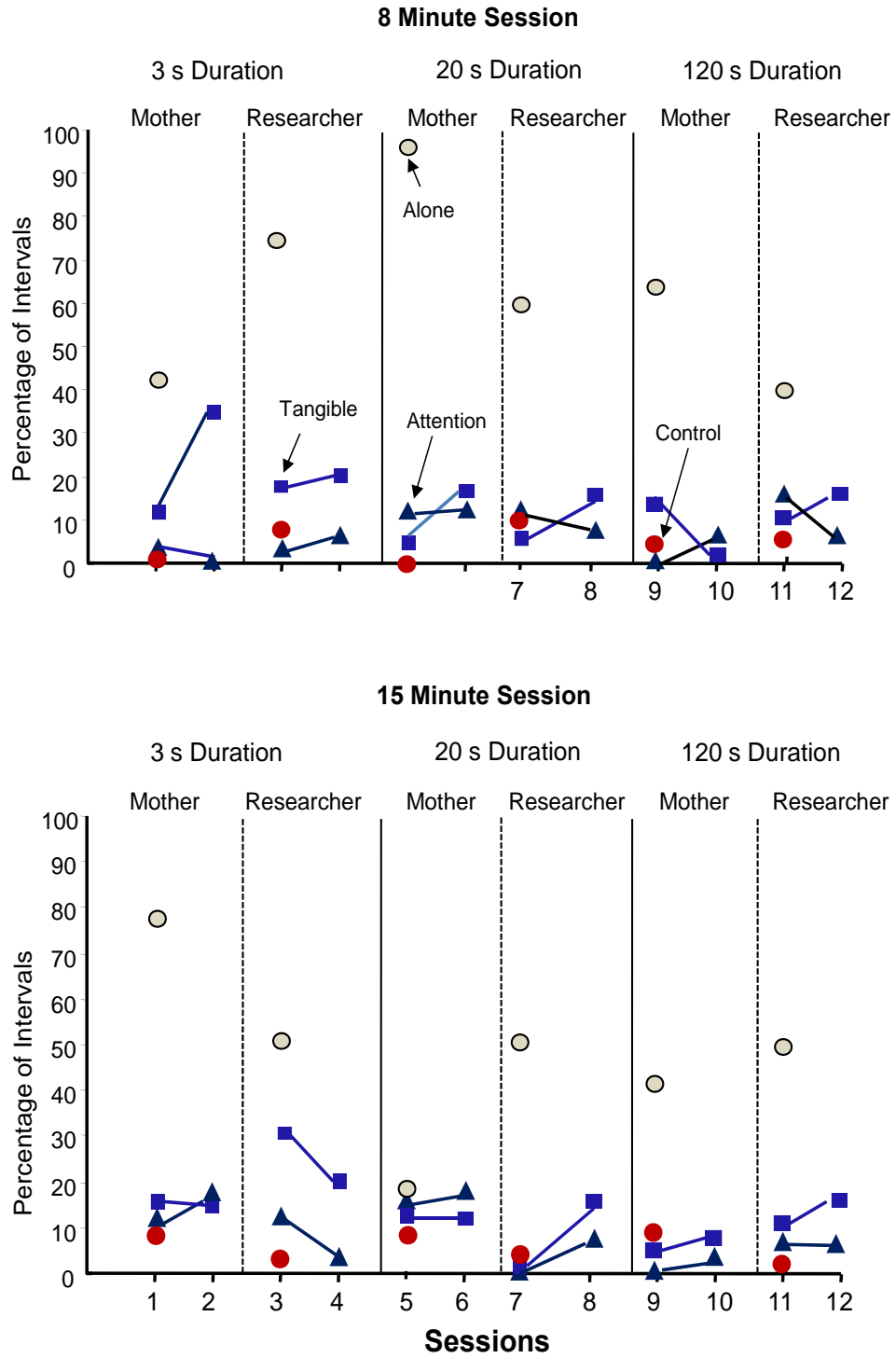


Figure 1. Percentage of Stereotypy across Functional Analysis Conditions

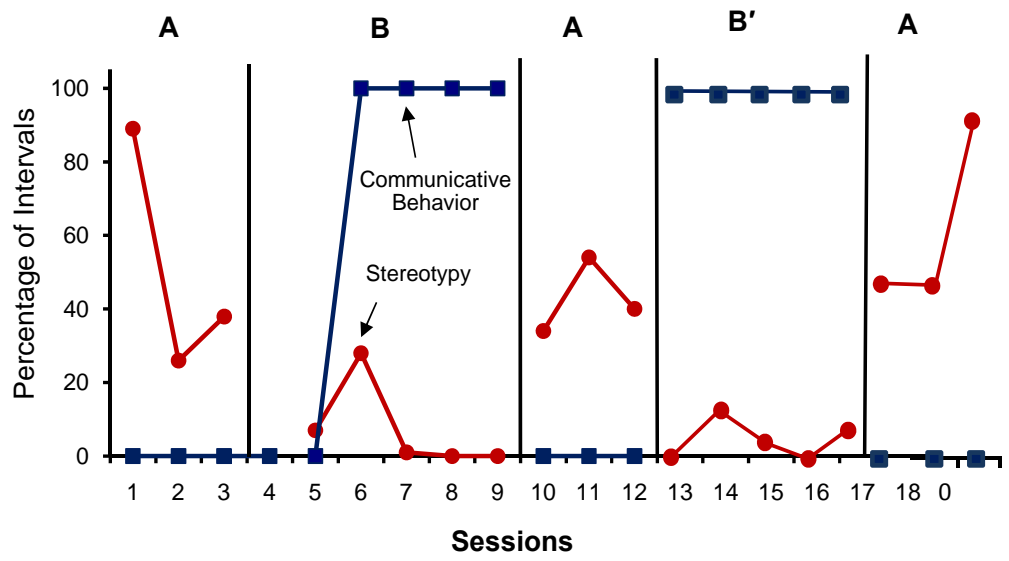


Figure 2. Percentage of Stereotypy and Communicative Behavior across Experimental Conditions

Chapter 4: Discussion

This study evaluated the functional analysis procedures and function-based intervention for a 19-year old adolescent with autism in the home setting. One purpose of the study was to examine the effects of varying the duration of reinforcement and session length during functional analyses on stereotypical behavior of the individual with autism in the natural home setting. The second purpose was to examine the effects of an intervention designed by the researcher and caregivers and was implemented by the natural caregiver based on the functional analysis results on the individual's stereotypical behavior and communicative behavior. Descriptive functional assessment revealed that Mike's stereotypy was least likely to occur when activities, regardless of the levels of demand, were provided. The results of the functional analysis involving attention, tangible, alone, and control conditions indicated that Mike's stereotypy occurred at higher rates during the alone condition across reinforcement magnitudes and session durations than during any other conditions, indicating that his stereotypy was maintained by automatic reinforcement. Consistent with previous research (Roscoe et al., 2003; Volkert et al., 2005), this study suggests that the function of stereotypy can be determined regardless of the magnitude of reinforcement and session length. The levels of stereotypy during the alone condition were similar across reinforcement magnitude and session lengths. The results also indicated that the levels of responding were somewhat undifferentiated within the same conditions across different session lengths as well as reinforcement magnitudes. However, it may be possible that the level of stereotypical

behavior would increase in longer session durations as indicated by Wallace and Iwata (1999). Wallace and Iwata found that the frequency of problem behavior toward the later parts of the longer session increased.

During the intervention implementation phase, the function-based intervention, using the environmental enrichment, removal of sensory stimuli, and systematic communicative skill instruction with the contingent reinforcement procedure decreased the occurrence of stereotypical behavior and increased the communicative behavior. The intervention procedures were implemented in the context of a naturally occurring family routine. Before intervention, Mike was mostly left alone during transition time in which structured activities were not provided. Limited activities with family members were available during this time, which resulted in Mike's stereotypy. During the intervention, a variety of activities chosen by Mike were provided. Parents actively engaged in the activities providing an enriched environment. Physical activities and chores that were preferred by Mike were available during intervention.

Study findings suggest that enriching the environment by providing preferred activities and social engagement is an effective intervention for stereotypy if the behavior occurs most frequently when an individual is deprived of access to stimulation (Horner, 1980). Studies have shown that increases in activity engagement may produce the same effects. For example, physical exercises have been found to be effective in decreasing stereotypic behaviors (Ellis, Maclean, & Gazdag, 1989; Levinson & Reid, 1993; Watters & Watters, 1980). It is suggested that the non-contingent nature of this environmental enrichment makes it simple for caregivers to implement the procedure relative to the rearrangement of behavioral contingencies (Vollmer, 1994).

In addition to stereotypy, Mike's parents' concern was his limited communication skills. Mike rarely initiated communication to indicate what he wanted or what activities he wanted to engage in. Although a variety of possible activities were available for Mike, it was a burden for the parents to constantly figure out what he wanted to do. Due to his poor verbal and signing skills, teaching communicative skills using picture cards of preferred activities was included in the intervention. Mike was taught how to request by pointing to the activity he wanted or verbally saying the words when verbally prompted. His communicative behavior was heavily dependent on verbal prompts, but he was able to request what he wanted. His parents were very excited about having the reciprocal interaction between Mike and them. As Mace et al.(1992) suggested, teaching Mike communicative skills of requesting preferred activities was an effective way of reducing stereotypy that is reinforced by automatic reinforcement. Although his stereotypy was not maintained by the communicative function of obtaining tangible items or activities, teaching him communicative skills contributed to increases in access to preferred activities which resulted in decreases in Mike's stereotypy. Moreover, the second intervention phase data indicated that Mike successfully used communicative skills to request new activities. His parents were successfully able to implement the intervention procedures with minimum researcher's support, which promoted Mike's use of communication skills and access to preferred activities and resulted in decreases in stereotypy and acquisition of communicative skills.

Another strategy included in the intervention was the elimination of stimuli that were associated with Mike's stereotypy. Mike's stereotypy with stimulus objects such as pens, strings, and popsicle sticks often occurred for a large portion of stereotypy prior to

the intervention phase. Keeping these objects out of reach and sight in part contributed to a decrease in Mike's stereotypy. Studies (Rincover, 1978) indicate that elimination or extinction of stimuli that are directly produced by stereotypy is an effective way of reducing stereotypy. The use of parents as intervention agents could have a significant impact on the support of individuals with autism within home settings. Family or parent implemented functional analysis and intervention would enhance positive social interaction between parents and individuals with autism and contribute to success at school and inclusion in the community. As suggested by previous studies, this study indicates that involving parents actively not only as informants or assessors, but also as intervention agents in the process of intervention development and implementation would enhance the intervention effectiveness and promote generalization (Lucyshyn et al., 1997; Miltenberger, et al., 1994; Vaughn et al., 1997)

Despite the favorable results achieved in this study, there are several limitations that must be addressed in interpreting the results of the study. One of the limitations is the difficulty of controlling extraneous variables due to the implementation of the functional analysis and intervention procedures in the natural family setting. The functional analysis was conducted in the living room of the participant's home, and the mother conducted a large portion of the functional analysis. Although this can be of great value due to the similarity between the functional analysis setting and the real life setting of the participant's environment, it does come along with a loss of control, which is an important part of conducting functional analysis. Certain environmental variables may vary across sessions which cannot be controlled. For example, visiting family members or unexpected guests might have altered Mike's behavior in the home. As shown in the

functional analysis data, the variability of Mike's stereotypy in a few sessions during functional analysis and baseline was relatively high.

Another limitation of the study is the limited data collected during functional analysis and baseline. Although the brief functional analysis was found to be effective in identifying the function of Mike's stereotypy as indicated in previous studies (Cihak et al., 2007), the data were not sufficient to compare the levels of Mike's stereotypy during conditions with his mother to those during conditions with the researcher. The third limitation is that the study only examined stereotypical behavior in an in home setting. The frequency of stereotypy while being in public places such as during school was not recorded. Perhaps a reduction in stereotypy in one setting and during one portion of the day may have an effect on the frequency of stereotypy in other settings and during other times of the day.

The fourth limitation is that setting events were not examined during this study. Changes in the participant's school day routines that occurred prior to the routine that was targeted in the study may have had an effect on data during the functional analysis and baseline phases. Routines such as taking a different bus home, getting in trouble at school, and not getting enough sleep the night before, may have affected the occurrence of Mike's stereotypical behavior later on in the day. The fifth limitation of the study is no examination or no instruction of teaching Mike communicative skills without prompting during the intervention phase. Mike's communicative behavior taught and recorded in the study was prompt dependent behavior. Considering the fact that Mike was able to successfully use the communicative behavior with prompts, the intervention should have

included the phase of teaching Mike spontaneous communicative behavior without prompts using time delay procedure.

This study has extended the literature by demonstrating that the interaction effects of reinforcement duration and session length may not change the identification of the function of stereotypy. Overall, the function remained the same through all conditions. This suggests that a session length of approximately 8 min. and short reinforcement duration (e.g. 3-20 s.) may be sufficient to determine the function of stereotypical behavior (Volkert et al., 2005). This study also demonstrates the importance of involving the family in the functional analysis and intervention phases, while engaging in natural family routines. While a trained therapist may be able to implement effective intervention procedures, ultimately it is the caretaker's long term responsibility to ensure these intervention procedures remain effective over the long term. By including the participant's parents from the beginning of the study, a higher sense of participation and input in the treatment plan may increase the likelihood of the parents implementing a plan which they had a great deal of creating along with the therapist (Dunlap et al., 2001). Future studies that conduct functional analysis in a naturalistic setting can examine setting events which occur prior to the functional analysis sessions. Setting events occur in a naturalistic setting just as the functional analysis does. Examining setting events would further increase the social validity of the study, as well as create interventions that can be applied outside the home setting. The parents of this study expressed great satisfaction with the process and outcomes of the function-based intervention. Although the functional analysis process may have been less socially valid due to the time consumed, this study offers a relatively easily implemented intervention that may assist

families in managing stereotypy of individuals with autism. By providing families with effective procedures for their children with autism, the likelihood of successful family-based intervention will be dramatically increased.

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Appendices

8. How much did you like the procedures used in the intervention?

| | | | | |
|-------------------------|----------|----------|----------|---------------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Do not like them at all | | Neutral | | Like them very much |

9. How willing did other family member help to carry out this intervention?

| | | | | |
|--------------------|----------|----------|----------|--------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Not at all willing | | Neutral | | Very willing |

10. To what extent did undesirable side-effects result from this intervention?

| | | | | |
|------------------------|----------|----------|----------|--------------------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| No side-effects likely | | Neutral | | Many side-effects likely |

11. How much discomfort did your child experience during this intervention?

| | | | | |
|----------------------|----------|----------|----------|----------------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| No discomfort at all | | Neutral | | Very much discomfort |

12. How willing were you to change your routines to carry out this intervention?

| | | | | |
|------------|----------|----------|----------|--------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Not at all | | Neutral | | Very willing |

13. How well was carrying out this intervention to fit into the existing routine?

| | | | | |
|-----------------|----------|----------|----------|-----------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Not at all well | | Neutral | | Very well |

14. How effective was the intervention in teaching your child appropriate behavior?

| | | | | |
|----------------------|----------|----------|----------|----------------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Not at all effective | | Neutral | | Very effective |

15. How well did the goal of the intervention fit with the team's goals to improve the child's behavior?

| | | | | |
|------------|----------|----------|----------|-----------|
| <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> |
| Not at all | | Neutral | | Very much |

(Adapted from the TREATMENT ACCEPTABILITY RATING FORM—REVISED; TARF-R, Reimers & Wacker, 1988)