TRIAL-BASED FUNCTIONAL ANALYSES: HOW TO DETERMINE RESULTS MOST EFFECTIVELY

A Thesis in

Special Education

by

Jennifer Muchmore

©2011 Jennifer N. Muchmore

Submitted in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science

August 2011
The thesis of Jennifer Muchmore was reviewed and approved* by the following:

Mary Catherine Scheeler
Associate Professor of Education
Thesis Advisor

Richard M. Kubina
Associate Professor of Education

David Lee
Associate Professor of Education

Charles Hughes
Professor of Special Education
Professor-in-charge

*Signatures are on file in the Graduate School
ABSTRACT

Trial-based functional analyses are a way to conduct Functional Analyses (FA’s) in the natural setting and less labor intensive than FA’s conducted in contrived settings. These FA’s composed of short control and test segments, have proven to have certain advantages over other standard FA’s typically conducted. This study examined past trial-based FA’s and analyzed the data in various ways to determine the most effective way to conclude the function of a targeted behavior. The percentage of responding in test conditions, the latency of responding in test conditions, the order that trials were conducted, and effects of contingent control conditions across six different trial-based FA’s were examined. There were no clear results on the best measure to use between the percentage of responding and latency, however, results suggest that both measures could be beneficial. The order that trials are conducted showed to possibly have motivating operations on targeted behaviors in FA’s. Contingent control conditions also appeared to possibly exert control over the response of the targeted behavior. Suggestions for further research are included.
# TABLE OF CONTENTS

List of Tables......................................................................................................................v

List of Figures......................................................................................................................vi

Chapter 1. INTRODUCTION.................................................................................................1
   Functional Behavioral Assessments..................................................................................2
   Functional Behavioral Analysis......................................................................................3

Chapter 2. LITERATURE REVIEW.....................................................................................7
   Latency............................................................................................................................11
   Sequential order effects.................................................................................................12

Chapter 3. METHODS.......................................................................................................15
   Study Design..................................................................................................................15
   Setting............................................................................................................................15
   Participants....................................................................................................................15
   Assessment....................................................................................................................16
   Procedures.....................................................................................................................18

Chapter 4. RESULTS.......................................................................................................21
   Percentage of responding vs. Latency of responding....................................................21
   Order of Trials.................................................................................................................23
   Contingent Control Conditions......................................................................................26

Chapter 5. DISCUSSION.................................................................................................31

REFERENCES....................................................................................................................39

Appendix A. INFORMED CONSENT FORM FOR RESEARCH STUDY.........................43

Appendix B. DATA SHEET FOR TBFA..............................................................................45
LIST OF TABLES
Table 1. Participants........................................................................................................17
Table 2. Rank Order of Percentage of Responding and Latency in Trial-Based FA’s........22
Table 3. Order of Trials for Participant A1.................................................................24
Table 4. Order of Trials for Participant B1.................................................................25
LIST OF FIGURES

Figure 1. Percentage Responding in TBFA Trials ......................................................... 27
Figure 2. Average Latency in TBFA’s ............................................................................. 29
CHAPTER 1

Introduction

Functional behavior assessment (FBA) procedures are an effective method used to understand and intervene on problem behaviors. It is a methodology that recognizes the variables that influence the occurrence of behaviors (Hanley, Iwata, & McCord, 2003; Iwata, Pace, et al., 1994; Pelios, Morren, Tesch, & Axelrod, 1999). The purpose of a FBA is to determine why behaviors occur and within what context in order to develop effective and appropriate interventions for the targeted behavior(s) (Asmus, Vollmer & Borreiro, 2002; Iwata, Pace, et al., 1994; Lewis & Sugai, 1996; Scott, Andersen, & Spaulding, 2008). Once the function(s) of a problem behavior are identified, then interventions can be developed and alternative replacement behaviors can be taught that satisfy the same function(s) (Lewis & Sugai, 1996). Knowing the impact that functional assessments have had so far on students, especially those with disabilities, and their problem behaviors, FBA procedures are being implemented more regularly by teachers/therapists/caregivers.

FBA involves a composition of different methods to obtain information in a chain of events, antecedents-behaviors-consequences, to determine the purpose of the behavior. The concept of FBA was created with the knowledge that every behavior is purposeful and serves a function. Children engage in behaviors, even when inappropriate, to achieve an outcome and this desired outcome can be viewed as the intent or function of the behavior (Carr, 1977; Iwata, Pace, et al., 1994; Larson & Maag, 1998). These functions are said to fall into four primary categories: 1) Attention (behaviors maintained by positive reinforcement) 2) Access/Denied access to items/activities (behaviors maintained by positive reinforcement) 3) Escape/avoidance (behaviors maintained by negative reinforcement) and 4) Automatic reinforcement (self-
stimulation). The first three functions are considered social because they involve others in the environment while the last function involves internal stimulation (Barnhill, 2005; Carr, 1977; Iwata, Pace, et al., 1994).

**Functional Behavioral Assessments**

The goal of a FBA, to determine the function that a problematic behavior serves, can be accomplished through indirect methods, direct methods, and experimental methods (Iwata, Pace, et al., 1994). Indirect and direct methods are generally referred to as functional behavioral assessments. Indirect methods involve gathering information from people that know the student exhibiting problem behaviors well, such as the parents, caregivers, teachers, etc. This information can be collected by evaluation of historical records, use of questionnaires or behavioral rating scales, and interviews with selected care providers. Finding information through indirect methods is easy to use and does not take much time but there are many disadvantages as well. The informant(s) must rely on memory of events and sometimes interprets questions differently or has some biases when giving information (Barnhill, 2005). Scott, Bucalos, et al. (2004) argue that there is little to no evidence that indirect methods should be used solely as a valid method of determining the function of a problem behavior. Indirect methods, specifically structured interviews, are an important step in the FBA process for gathering information on factors that influence the occurrence or non-occurrence of a behavior, however, direct observation is essential to developing a reliable functional assessment (Larson & Maag, 1998). Using these indirect methods when doing a functional assessment is a great start but generally these methods do not provide enough information or accurate information to determine proper functions of behavior (Barnhill, 2005; Larson & Maag, 1998; Scott, Bucalos, et al., 2004).
The direct methods in functional assessments include direct observation of antecedents, behaviors, and consequences. For instance, descriptive assessments are observations that can be performed in natural environments where the behavior is most likely to occur and the observer records everything that happens. These descriptive assessments identify antecedents and consequences that influence the target behavior(s). These direct observation methods have many advantages over indirect methods because they do not rely on memory but instead record every event that happens (Barnill, 2005). Neither, indirect or direct methods, allow functional relationships to be determined definitively (Barnhill, 2005; Larson & Maag, 1998). These methods are used to help build hypotheses about the consequences that maintain behaviors and/or the antecedents that evoke behaviors, and they aide in identifying environmental events correlated with problem behaviors, but “cause-effect relations” cannot be determined from these correlations (Asmus et al., 2002). Causal relationships cannot be confirmed through indirect and direct procedures but only through experimental methods that actually manipulate antecedent or consequent variables (Barnhill, 2005; Doggett, Edwards, Moore, Tingstrom, & Wilczynski, 2001; Lewis & Sugai, 1996).

Functional Behavioral Analysis

Experimental methods are referred to as functional analyses (FA). This is the only method that controls the antecedent and consequent variables on a behavior so it allows a functional relationship to be established (Barnhill, 2005; Carr, 1977; Iwata, Pace, et al., 1994). Hypotheses developed through the interviews, questionnaires, and direct observations are tested by systematically manipulating environmental factors that are believed to be maintaining the target behavior(s) (Larson & Maag, 1998). The test conditions that result in high incidences of
the target behavior(s) compared to a control condition demonstrate the function of the behavior (Lang et al., 2008).

Test conditions could involve the 4 categories that functions are believed to fall into. In the attention condition the teacher would give the student attention contingent on the target behavior. In the escape/avoidance condition the teacher would remove the task contingent upon the target behavior. In the access/denied access (tangible) condition the teacher would give the student an item/activity contingent on the behavior. The automatic reinforcement condition would involve the student sitting alone possibly with toys/materials available, or maybe without, to observe if the target behavior occurs. A control condition or a free-play condition involving the presence of attention, toys/items, and no demands would be added to serve as a control. The condition where the behavior occurs most frequently, compared to the control condition, is typically how the function of a behavior is determined (Iwata, Pace, et al., 1994).

There have been different experimental designs during FA’s that have been implemented. Iwata, Pace, et al. (1994), used a multi-element design (alternating sessions of different conditions), reversal design (sessions during a given condition continued until data appear stable or predictable before next session conducted), and a pairwise, test-control design (each test condition alternated with the same continuous control in a multi-element format) when conducting FA’s on self-injurious behaviors. Brief FA’s are another experimental design frequently used, consisting of exposing participants to each condition one time for durations of 5-10 minutes. On most occasions, these designs consist of removing a subject from their natural environment, where the targeted behavior typically occurs, and conducting these tests in contrived settings. In order to test a function of a behavior in the natural environment, and to
save time, an experimental design called trial-based FA, is now emerging (Bloom, Iwata, Fritz, Roscoe, & Carreau, 2011; Sigafoos & Meikle, 1996; Sigafoos & Saggers, 1999).

Due to the limitations that conducting FA’s can create, there is emerging research in the implementation of trial-based, or discrete trial, functional analyses (Bloom et al., 2011; Sigafoos & Meikle, 1996; Sigafoos & Saggers, 1999). This involves testing conditions in the natural setting under natural circumstances for short periods (i.e. 2 minutes) of time. For each condition being tested, a control segment and test segment are run back to back. Conditions are typically tested during the participant’s usual routines throughout the day. While engaging in these routines, the therapist implements a control condition in order to establish motivation and increase the possible effectiveness of the test condition to follow. Immediately following the control condition, the therapist conducts a test for the designated amount of time or until the occurrence of the target behavior. For example, if testing for an attention function, the participant receives non-contingent attention from the therapist during the control to increase the participant’s desire for attention. When the test condition is conducted, the therapist removes all attention from the participant unless the targeted behavior occurs. The control condition acts as an establishing operation to the test condition. Data are typically collected on the occurrence/non-occurrence of the targeted behavior. The condition with the highest percentage of responding is considered to be the dominant function.

There is still a lot of research to be performed on the subject of trial-based FA’s, but the research that does exist shows the potential implications of trial-based FA’s, as well as its advantages over other designs (Bloom et al., 2011; Sigafoos & Meikle, 1996; Sigafoos & Saggers, 1999). Advantages of these FA’s include conducting them in the subjects’ natural environment, embedding them into an already ongoing schedule, and implementation of short
sessions (i.e. 2-4 minutes) making it less time consuming and labor intensive than other designs. Knowing these advantages that trial-based FA’s have to offer, it is safe to say that more research on these FA’s and increasing the use of them would be beneficial to teachers/therapists/caregivers.

Although there is still more research to be done on trial-based FA’s, it is also necessary to determine the most effective ways to analyze the data to conclude accurate results. The purpose of this study is to analyze the data collected from different trial-based FA’s to determine which analyses conclude the most useful and correct results. Data will be analyzed by comparing the percentage of responding with the latency of responding, examining the effects from the sequential order of trials, and determining if different control conditions effect responding (if applicable).
CHAPTER 2
Review of Literature

The process of performing Functional Analyses (FA’s), has stirred up much debate regarding the applicability in school settings, as well as in the natural settings where problem behaviors typically occur (Scott, Bucalos, et al., 2004). Practitioners are faced with many challenges when carrying out FA’s in contrived settings such as getting inconclusive results, problem behaviors not occurring, and subject reactivity (Lewis & Sugai, 1996). Vollmer, Marcus, Ringdahl, and Roane (1995) studied 20 participants using FA methods in analogue settings (i.e. contrived settings outside of the natural environment) and many participants had to undergo four different phases until differentiated results were found. Some participants still did not yield differentiated results after four phases. It was possible that the antecedents and consequences selected for the analyses were not the same as what was maintaining the behaviors in the participants’ real environments (Vollmer et al., 1995). It is hard to capture the events occurring in the natural environment that influence problem behavior when conducting FA’s in contrived settings. Beyond not being able to replicate the natural environment, conducting FA’s in analogue settings can be time consuming and hard work (Sigafoos & Saggers, 1999). Practitioners do not always have the time or resources necessary to perform much needed FA’s correctly.

Sigafoos and Meikle (1996) and Sigafoos and Saggers (1999) implemented trial-based FA’s due to the implications of conducting FA’s in subjects’ natural environments. Bloom et al. (2011) also conducted trial-based FA’s in support of previous research to compare results of the trial-based procedures with those of more traditional FA procedures using a multi-element design.
Sigafoos and Saggers (1999) conducted trial-based FA’s on 2 students with a dual diagnosis of Autism and Mental Retardation for aggressive behaviors. All trials were imbedded during regular classroom routines and consisted of attention conditions, tangible conditions, and escape conditions. For each trial, there was a 60 second test condition (i.e. attention trials teacher ignored student for 60 seconds, tangible trials preferred items were in view but in control of the teacher, escape trials teacher prompted student through tasks) followed by a 60 second control (i.e. attention trials teacher provided undivided attention, tangible trials teacher provided student access to preferred items, escape trials tasks were removed), unless the target behavior occurred, then the condition was ended. Data were collected on the occurrence of the targeted behavior for each trial during each condition. For one student, the targeted behavior occurred during 75% of the test conditions for attention indicating aggressive behavior was maintained by positive reinforcement in the form of contingent adult attention. For the other student, the targeted behavior occurred 100% of the time during the tangible test condition indicating that aggression was maintained by positive reinforcement in the form of access to preferred items.

Sigafoos and Miekle (1996) conducted similar FA trials with 2 students diagnosed with Autism but included an alone condition in which the participants were alone with nothing present for two successive 60 second intervals to test if the problem behaviors were automatically reinforcing. Data were analyzed by calculating the percentage of responding for each condition. For both participants, the problematic behaviors were concluded as being multi-functional; attention motivated, and object motivated.

Bloom et al. (2011) conducted both standard FA sessions and trial-based FA’s on 10 students with developmental disabilities to compare if there was correspondence between the two procedures. Many modifications were made to the trial-based FA’s as compared to Sigafoos and
Saggers (1999) implementation. The order of the conditions were reversed, control followed by test, and a second control was added after the test condition to determine which was more preferable (control-test or test-control). When analyzing the data, the second control condition was eliminated due to higher rates of targeted behavior occurring during this control, suggesting a possible carryover effect from the test session. As well as reversing the order and adding a third segment, each segment (i.e. control-test-control) was implemented for 2 minutes rather than one minute. Each segment was ended if the targeted behavior occurred. Trials included attention, tangible, escape and ignore conditions, conducted similar to Sigafoos and Saggers as described previously. Six of the participants showed agreement in the results of both the trial-based and standard FA procedures. Four of the participants did not show correspondence between the two procedures. For the trial-based FA’s, data were collected on the percentage of responding of the targeted behavior during each condition as well as the latency of responding. When analyzing the data to determine the results of the FA, the analysis only included the percentage of responding.

Due to this research and the findings of the effective implementation and use of trial-based FA’s, an ABA-based school for students with Autism has performed several trial-based FA’s to determine functions of problematic behaviors. These FA’s have been conducted across attention, tangible, escape from task, escape from people, and alone conditions. Implementation procedures of FA’s have varied including control-test conditions, test-control conditions, one minute segments, 2 minute segments, contingent control conditions (i.e. ending control contingent on target behavior) and/or non-contingent controls (i.e. control conditions continue even if target behavior occurs). Conducting two different control conditions (i.e. contingent vs. non-contingent), has changed the results of some FA’s, as well as how the data have been
analyzed. The school collects data on the percentage of responding, the latency of the targeted behaviors, and the sequential order of the trials. The different ways that data were analyzed has had an effect on the results of FA’s.

Data collection from standard FA’s (i.e. multi-element design, reversal, brief FA’s) generally focus on the rates of responding during each condition. Although this has been effective and yielded accurate results for multi-element designs and brief FA’s, there are still times when the data concluded undifferentiated results. Hanley et al. (2003) have concluded possible changes to consider when undifferentiated results occur such as including stimuli from a subject’s natural environment, or conducting an FA in the natural environment; minimizing the number of response topographies; graphing response topographies separately; observing effects over longer periods; etc. Preventatively, there are ways to minimize the likelihood of undifferentiated results when conducting FA’s if test conditions are reflective of indirect and direct observations and are based on individual circumstances (Hanley et al., 2003). However, once an FA has already been conducted there is no way to reduce the likelihood of undifferentiated results except by possibly examining the data in various ways (Berg et al., 2000; Hanley et al., 2003; Thomason-Sassi, Iwata, Neidert, & Roscoe, 2011). Data collection tends to focus on the rate of responding of targeted behaviors in FA’s but it is possible that data should also be collected on the latency of responding and possible carryover or sequential order effects of the conditions (Berg et al., 2000; Call, Pabico, & Lomas, 2009; Hanley et al., 2003; Iwata, Duncan, Zarcone, Lerman, & Shore, 1994; Iwata, Pace, et al., 1994; Michael, 1982; O’Reilly, 1999; O’Reilly & Carey, 1996; Thomason-Sassi et al., 2011).

Data from FA’s are typically displayed through visual inspection and then analyzed by interpreting the visual inspection through examining patterns of responding across and within
conditions (Hagopian, Fisher, Thompson, & Owen-DeSchryver, 1997; Hanley et al., 2003). Interventions are then based on the results from these interpretations. This analysis can be simple, especially if the data are stable with a great magnitude of differentiation. However, it is not always easy to interpret the data, specifically if the data are variable or there are relatively small differences between conditions. Data analysis and interpretations can become subjective depending on the person analyzing the data (Hagopian et al., 1997; Hanley et al., 2003). In these cases, wrong interventions may be selected or implemented based on different interpretations. Accurate and reliable analysis and interpretation of FA data is a vital part of the FA process when selecting interventions based on results (Hagopian et al., 1997). Hagopian et al. (1997) conducted research with the purpose of formalizing criteria for visual inspection of multi-element FA data to determine functions so that it would no longer be subjective across people. He determined criteria that were effective and able to be generalized across people to assist in the visual inspection of data by operationally defining decision-making rules.

**Latency**

Call et al. (2009) evaluated the latency of problematic behaviors during demand conditions, to guide the demand conditions conducted in an FA. The purpose was to determine if less aversive or more aversive demands would affect the results in an FA. Prior to conducting an FA, different demands were given to participants and the latency of problem behaviors were measured, in seconds, from the start of the session to the first occurrence of problem behavior. The demands with the shortest and longest latencies were included in the FA. Results for one participant showed that his problem behavior was maintained by positive reinforcement in the form of attention, and negative reinforcement in the form of escape but only during the highly aversive demands. For the second participant, results indicated that her problem behaviors were
maintained by negative reinforcement in the form of escape, with higher rates in the highly aversive demands compared to the less aversive demands. Determining the aversiveness of demands by using latency measures prior to an FA resulted in determining more accurate functions of problem behavior for at least one participant. Evaluating the latency of the occurrence of problem behaviors during demands was beneficial, so this could lead to potential benefits of evaluating latencies in all FA conditions, especially for FA’s that result in multi-functional behaviors. It may be worth researching the effects of analyzing latencies within conditions, determining the leading function to be the one with the lowest latencies.

**Sequential order effects**

Michael (1982) discovered that a stimulus’s reinforcing or punishing value may be altered depending on a person’s establishing operations. For example, if a person is hungry, the presence of food will be more reinforcing than after a person has just eaten. Prior events can change a person’s response to particular stimuli. Variability in functions of a person’s responses may vary due to changes in the arrangement of prior stimuli. Iwata, Duncan, et al. (1994) and Iwata, Pace, et al. (1994) discovered that the sequence of test conditions in FA’s could influence participants’ performance and responding for each condition. The sequence of conditions may create deprivation or satiation, therefore, increasing or decreasing the potential reinforcing value maintaining a behavior. O’Reilly (1999) also tested this hypothesis and found that FA results may be influenced by the sequential order of trials.

Berg et al. (2000) conducted a study involving 3 different experiments to determine if preceding events affected the occurrence of participant’s behaviors. The first experiment compared the results of the occurrence of hand biting in a contingent attention condition of an FA when preceded by a free-play condition versus a contingent escape condition. The subject
engaged in hand biting on average 62% more intervals during the attention condition when followed by contingent escape conditions. Hand biting occurred differentially depending on the condition that preceded the attention condition. The second experiment looked at effects on problem behavior during diverted attention with extinction assessment conditions when followed by continuous non-contingent attentions (i.e. free play) versus alone conditions. When diverted attention conditions occurred after an alone condition, the participant engaged in the problem behaviors 53% more intervals than when after free play conditions. The third experiment included preference between attention and preferred toys and activity chosen after high versus low levels of attention. The participant chose attention more frequently when it preceded low levels of attention, and chose playing with toys alone when followed by high levels of attention. O’Reilly and Carey (1996) also found that problem behaviors occurred at different rates depending on the events right before each condition. The participant’s classroom teacher would engage her in classroom demands or classroom attention for minimum durations of 20 minutes each day prior to conducting FA conditions in a contrived setting. There were higher levels of aggressions in the attention condition than the demand or play conditions, however, aggressions were higher during the demand conditions after classroom attention. This research suggests that there may be advantages to analyzing effects of the establishing (and abolishing) operations that could be affecting the test conditions as well as, possible carryover effects based on the consequence that the subject experienced from the previous condition.

Although analyzing FA’s by looking at the rate of responding usually gives enough insight into the function of the targeted behavior, there are times when the rate of responding does not give conclusive results, or results show multi-functions (Bloom et al., 2011; Hanley et al., 2003; Iwata, Pace, et al., 1994; Sigafoos & Meikle, 1996). Analyzing the data in more depth
and across several variables may give different results. An ABA based school for students with Autism found that analyzing the latency of the occurrence of targeted behaviors, as well as examining the order that trials were conducted indicated differences or more insight to the overall findings of trial-based FA’s. The different implementations of the control conditions, contingent vs. non-contingent controls, were found to impact responding in trials and affect the results. This study will attempt to answer the necessity of analyzing the latency of responding, and the sequence trial implementation when determining results in trial-based FA’s as well as if contingent controls impact responses in test conditions.
CHAPTER 3

Methods

Study design

This study is a descriptive case study on data analysis for trial-based FA’s. Data from trial-based FA’s previously conducted on a variety of problematic behaviors were analyzed for this study. Data were analyzed on a multiple of variables including the percentage of responding, the latency of responding, sequential order effects, and the comparison of contingent control conditions to non-contingent control conditions.

Setting

Data from trial-based FA’s performed at an ABA-based school for students with Autism in the suburbs of the Northeastern part of the country were analyzed. The school consists of children with Autism ranging from ages 3 to 20. Students’ skills range from verbal to non-verbal, academic to life skills. Functional analyses were conducted on an as needed basis when students engaged in problematic behaviors where the function was unclear. Trial-based FA’s were used, when possible, in order to keep students in their natural environments such as their classrooms. When FA’s were conducted in the school, they were videotaped and data were collected and inserted into excel spreadsheets and graphs. The data were kept in each student’s files.

Participants

Recruitment letters were sent to parents of students who previously participated in trial-based FA’s that were videotaped (due to students being minors and unable to give consent due to functioning level, parents were asked to give consent). Four out of five parents agreed to participate (See Appendix A for sample of consent form). Of the four participants, two had
participated in two or more FA’s for different problematic behaviors; gagging self and touching others for one participant, and head hitting and squeezing others for the other participant. Other problematic behaviors included verbal stereotypy, and wrist biting. There were a total of six trial-based FA’s analyzed for this study, and four participants. Past FA’s that were not videotaped, or that did not have raw data available, were excluded from this study.

Of the participants, all were male, ranging from the ages of 12 to 16. (See Table 1). Participants were given codes to protect identity. Participant A1 and A2 is the same student who took part in two FA’s for touching others (A1) and gagging self (A2). Participant B1 and B2 is also the same student who took part in two FA’s for squeezing others (B1) and head hitting (B2). Participant C1 participated in an FA due to wrist biting. Participant D1 took part in an FA due to loud verbal stereotypy’s.

**Assessment**

Videotapes of participants past FA’s were watched and raw data examined, if available, by the researcher to determine if the raw data reflected the videos accurately. The researcher is currently finishing her Master’s of Science in Special Education degree and has been working as a Behavior Consultant at an ABA-based school for students with Autism for 2 years. Raw data for participant C1 were not located so data on the occurrence of targeted behavior, sequential order of trials, and latency were collected by watching the video of the FA. Raw data existed for participant A2, however, the video could not be located to determine the order trials were conducted. Videos of the remaining FA’s were studied to determine the order of trials (if not indicated on the raw data) and to ensure the accuracy of the raw data previously collected. Once data were collected, they were inserted into excel spreadsheets and graphs in order to be analyzed by the researcher. Data were analyzed based on the percentage of responding for each
<table>
<thead>
<tr>
<th>Participants</th>
<th>Age</th>
<th>Problematic behavior targeted in FA</th>
<th>Definition of target behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>13</td>
<td>Touching others</td>
<td>Participants hand coming on contact with another person’s body</td>
</tr>
<tr>
<td>A2</td>
<td>13</td>
<td>Gagging self</td>
<td>Participant putting hand in throat attempting to cause self to throw up</td>
</tr>
<tr>
<td>B1</td>
<td>14</td>
<td>Squeezing others</td>
<td>Participant wrapping two or more fingers around another person’s body and applying pressure</td>
</tr>
<tr>
<td>B2</td>
<td>14</td>
<td>Head hitting</td>
<td>Participant forcefully swinging open or closed hand towards head and making contact</td>
</tr>
<tr>
<td>C1</td>
<td>12</td>
<td>Wrist biting</td>
<td>Participant clenching top and bottom teeth around wrist</td>
</tr>
<tr>
<td>D1</td>
<td>16</td>
<td>Verbal stereotypy’s</td>
<td>Participant making vocalizations not related to ongoing activity</td>
</tr>
</tbody>
</table>
condition, the average latency of responding for each condition, the order trials were conducted, and an analysis of the control conditions if contingent controls were implemented.

**Procedures**

Trial-based FA’s were conducted across alone, tangible, attention, escape from staff, and escape from task conditions. Trials included either contingent controls, non-contingent controls, or both. During contingent controls, the control conditions ended contingent on the target behavior and the test conditions were immediately presented. During non-contingent controls, the controls lasted for the designated amount of time, even if the targeted behavior occurred. During alone conditions, the occurrence of the targeted behavior resulted in no consequence for either control or test conditions. During tangible conditions, the participant had access to preferred items/activities during the control, and items were removed for the test. Contingent on the targeted behavior, items/activities were returned during the test. During attention conditions, the participant received non-contingent attention during the control. Attention was removed during the test. If targeted behavior occurred during the test, the participant received attention again. During escape from staff conditions, the participant received no attention during the control. Attention was given to the participant during the test. Contingent on the target behavior, attention was removed again. During escape from task conditions, participant sat alone during the control. Tasks were presented during the test but removed contingent on targeted behavior. Data analyses on trial-based FA’s for this study were based on FA’s that included the above conditions.

Data from trial-based FA’s were analyzed for each participant by comparing functional assessment outcomes when percentage of responding and the average latency of the target behavior were used as measures. A second analysis was performed to determine whether the
order of trial presentation effected functional outcomes. The final analysis examined the effect of contingent vs. non-contingent termination of the control condition.

Two separate measures were obtained for each participant for each condition; percentage of responding by condition (i.e. number of trials that participant responded/total trials) and the average latency from the start of the condition to the targeted response (See Appendix B for data collection form). These two measures were placed in rank order from the most likely dominant function to the least likely function. For the percentage of responding, the condition with the highest percentage was ranked first. The lowest percentage of responding was ranked last. The first-ranked condition was considered the dominant function. For the latency, conditions were ranked from the shortest latency (i.e. closest to zero) to the longest (i.e. closest to 120 minutes), with the shortest latency designated as the dominant function for problematic behaviors. Comparisons were made between the rank order of trials based on the percentage of responding and the latency of target behaviors between conditions to determine if both measures conclude the same function(s) for each subject.

In order to analyze the order of trials, data were examined by looking at the percentage of responding in each condition following the previous condition for two participants. For participant A2, the video on the FA for gagging self behaviors could not be located and the raw data did not indicate the order that trials were presented. For participants B2, C1, and D1, there were not enough trials (i.e. less than 40) conducted to determine a significant percentage based on the order of trials. Participants A1 and B1 were included in this analysis because each had over 60 trials conducted and each condition having at least three or more incidences that were preceded by each of the other conditions (i.e. attention condition preceded by task, attention, tangible and alone conditions at least 3 times), thereby providing enough data to be analyzed.
The researcher counted how many times each condition was preceded by every other condition and calculated the percentage of responding by dividing the number of times the target behavior occurred by the number of trials conducted. If there was a difference greater than 20% between the percentage of responding in one condition, based on the previous condition, from the overall percentage of responding across all conditions, the researcher considered it a significant difference, therefore indicating that the previous trial may have impacted responding in the following trial.

For participant B1 and B2, contingent and non-contingent control conditions were implemented during the FA’s. It is hypothesized that the response contingent termination of the control condition and start of the test condition may exert control over the target response. Data were analyzed by comparing the percentage of responding and the latency in the contingent and non-contingent control conditions to the test conditions to determine if these events served as reinforcers or punishers for the target response. If this were true, the rates of the target response would be opposite in the contingent controls and test conditions, specifically when compared to non-contingent control trials. The researcher inserted the percentage of responding and latency for both control and test conditions for each trial into an excel spreadsheet. The data were then inserted into a bar graph in order to compare the differences between the contingent and non-contingent controls, specifically if there were opposite effects. For example, if the percentage of responding is low in the contingent control and high in the test, it should be the opposite for the non-contingent control trials for the same condition. Data were examined based on this hypothesis as this opposite effect exposes the possibility of the test condition acting as reinforcer or punisher when implementing contingent controls. Inter-rater reliability on the data analysis of the trial-based FA’s was not assessed.
CHAPTER 4

Results

Percentage of responding vs. Latency of responding

Table 2 displays rank-ordered frequencies and latencies of responding (1 as the dominant function, 6 as the least dominant function). When comparing the percentage of responding to the latency of responding, there were only two participants out of six who had the same function ranked as number one; participants B2 and D1. Participant B2 had 100% responding in the alone/control condition, tangible condition, and task condition indicating an automatic function for head hits. The latency data ranked task as the predominant function. For participant D1, attention was the dominant function for noise-making behaviors as it had the highest percentage of responding. The latency data agreed with this ranking as well. With the remaining participants, the percentage of responding and latency data did not match the same function for problematic behaviors. However, for participants A1, B1, and C1, escape from task and escape from staff conditions were ranked as number one for both percentage and latency of respond indicating that the problematic behavior may have been socially mediated for “escape.”

For participant A2, task conditions were rated 2nd for both percentage of responding and latency, with agreement in 4th place across both measures with the escape from staff with touch condition. For participant B1, the tangible condition was rated as 2nd for both percentage of responding and latency, with attention rating 3rd for both measures. Although there was some agreement in conditions, overall the data do not indicate which measure best predicts the dominant function of problematic behaviors.
Table 2

<table>
<thead>
<tr>
<th>Participant</th>
<th>% responding</th>
<th>Alone/Control</th>
<th>Tangible</th>
<th>Attention</th>
<th>Task</th>
<th>Esc staff touch</th>
<th>Esc staff w/o touch</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>% responding</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>1</td>
<td>--</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>B1</td>
<td>% responding</td>
<td>--</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>--</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>% responding</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>% responding</td>
<td>No TB</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>No TB</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>% responding</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Latency</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
</tbody>
</table>

% of responding ranked from highest percentage =1 to lowest = 6
Latency ranked from lowest seconds = 1 to highest seconds = 6
TB=targeted behavior
Order of trials

Tables 3 and 4 examine if the previous trial had an impact on responding in the next trial for participants A1 and B1. Each table indicates the number of times that the target behavior occurred along with the percentage of responding for each condition based on the previous condition. Along the top of the table (i.e. the columns) are the conditions which occurred first in the sequence. Along the side of the table (i.e. the rows) displays the conditions that followed. The data represents the outcome in the second condition. The overall percentage of responding across all trials (i.e. overall total times target behavior occurred/total trials conducted) for each condition was included to determine if there was a significant difference of responding (i.e. greater than 20 %) based on the sequence of trials.

Data for participant A1 (see Table 3) indicate that the subject only responded in the tangible condition when it followed the attention condition. He also only responded in the task condition when it followed the alone condition. There were only responses in the attention condition when it followed the alone or task condition, with little difference in the percentage of responding across both conditions (29%-33%).

Data for participant B1 (see Table 4) indicate that the subject responded at a significantly lesser rate in the tangible condition (i.e. 13%), when followed by a tangible condition compared to the total percentage of responding across all trials (i.e. 45%). There was also significant difference in the percentage of responding during the task trials when followed by escape from staff conditions (i.e. 67%), and task conditions (i.e. 13%), compared to total percentage of responding of all task trials (i.e. 43%). During the attention conditions, there was a significant increase in the percentage of responding when following the task condition (i.e. 80%) compared
Table 3  Order of Trials for Participant A1

Frequency and Percentage of Responding in 2\textsuperscript{nd} Condition Based on Previous Condition

<table>
<thead>
<tr>
<th>1\textsuperscript{st} condition</th>
<th>Alone</th>
<th>Tangible</th>
<th>Attention</th>
<th>Task</th>
<th>Range in % responding</th>
<th>Total % responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone</td>
<td>X</td>
<td>2 (50%)</td>
<td>4 (57%)</td>
<td>0 (0%)</td>
<td>57% (0-57)</td>
<td>44%</td>
</tr>
<tr>
<td>Tangible</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (20%)</td>
<td>0 (0%)</td>
<td>20% (0-20)</td>
<td>12%</td>
</tr>
<tr>
<td>Attention</td>
<td>2 (33%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>2 (29%)</td>
<td>33% (0-33)</td>
<td>29%</td>
</tr>
<tr>
<td>Task</td>
<td>1 (17%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>17% (0-17)</td>
<td>6%</td>
</tr>
</tbody>
</table>
Table 4. Order of Trials for Participant B1

Frequency and Percentage of Responding in 2\textsuperscript{nd} Condition Based on Previous Condition

<table>
<thead>
<tr>
<th>2\textsuperscript{nd} condition (Frequency of target behavior and % responding)</th>
<th>1\textsuperscript{st} condition</th>
<th>Escape from staff</th>
<th>Tangible</th>
<th>Attention</th>
<th>Task</th>
<th>Range in % responding</th>
<th>Total % responding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escape from staff</td>
<td>3 (43%)</td>
<td>3 (38%)</td>
<td>8 (53%)</td>
<td>6 (60%)</td>
<td>22% (38-60)</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Tangible</td>
<td>7 (58%)</td>
<td>1 (13%)</td>
<td>5 (63%)</td>
<td>5 (42%)</td>
<td>50% (13-63)</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td>3 (33%)</td>
<td>5 (33%)</td>
<td>2 (33%)</td>
<td>8 (80%)</td>
<td>47% (33-80)</td>
<td>44%</td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>8 (67%)</td>
<td>3 (33%)</td>
<td>5 (50%)</td>
<td>1 (13%)</td>
<td>54% (13-67)</td>
<td>43%</td>
<td></td>
</tr>
</tbody>
</table>
to the other 3 conditions and the total percentage of responding across all trials (i.e. 44%). The data indicate that the order of trials may impact the occurrence of the target behavior in FA’s.

**Contingent Control Conditions**

In order to analyze the effects of contingent control conditions versus non-contingent control conditions, data from the percentage of responding were displayed on bar graphs for both contingent and non-contingent controls and the test conditions that followed. (See Figure 1 for results). For participant B1, escape from staff, attention, and task conditions demonstrated the relationship predicted (i.e. opposite responding) if the contingent control was exerting control over the occurrence of the target behavior in the test conditions. For escape from staff conditions, he responded at a lower percentage in the contingent control (20%) and higher in the test (65%). The opposite was true with the non-contingent control trials; 40% in the control and 35% in the test. In the attention conditions, he responded less in the contingent control (32%) than the test (58%), but higher in the non-contingent control (40%) and lower in the test (30%) that followed. In the task condition, he responded more in the contingent control (45%) to the test (35%) but less in the non-contingent control (20%) and more in the test (50%) that followed. The data indicate that ending the contingent control for task was reinforced by presenting tasks, while ending the contingent controls for escape from staff, and attention was punishing due to it presenting the test condition. For participant B2, tangible and attention conditions demonstrated that the contingent control may have been exerting control over the target behavior in the test conditions. For tangible conditions, the percentage of responding in the contingent and control conditions were 100%, however, it was less in the non-contingent control (75%) than the test (100%) that followed. For attention, the percentage of responding for contingent controls was 100%, and test was 86%. For the non-contingent controls, he responded across 80% of trials and
Participant B1: Percentage of Trials in which Target Behavior Occurred with Contingent Controls

Participant B2: Percentage of Trials in which Target Behavior Occurred with Non-Contingent Controls

Figure 1 Percentage of Responding in Trial-Based Functional Analyses Trials
100% in the test conditions that followed. Data for the alone condition were not included in this analysis due to no change in conditions when targeted behavior occurred. This data would indicate that ending the contingent control for attention was reinforced by the presentation of the test. Since the participant responded in 100% of test conditions for tangible, it is hard to assess whether the control conditions effected responding in the tests, however, it did appear that he was responding in the contingent controls to have items removed, but stopped responding in the non-contingent controls when there was no consequence.

Data were also analyzed by examining the latency data in the same manner (See figure 2 for results). In regards to latency, there should be the opposite effect of the percentage of responding; latency for contingent controls should be more than the test conditions and the opposite should stay true for non-contingent control and test trials. For participant B1, the average latency of responding in the contingent controls were all higher than the test conditions. For the escape from staff conditions and attention conditions, the non-contingent control trials were opposite of the contingent control trials. The average latency in the contingent controls of escape from staff conditions was 39.3 seconds and 27.2 seconds in the tests. The non-contingent control trials indicate a lower latency on controls (23.9 s) and higher latency in the test (32.3s). For attention, the average latency in the contingent controls was 38 seconds and 18.6 seconds in the test. The average latency in the non-contingent controls was less at 21.1 seconds and higher in the test (27.3s).

For participant B2, the average latency in the contingent control trials and non-contingent control trials does not show the predicted relationship that there will be opposite responding. The average latencies in the control conditions, whether contingent or non-contingent, are higher than all test conditions. The average latency of the target behavior for participant B2 in the tangible
Figure 2 Average Latency in Trial-Based Functional Analyses
conditions indicates that the control was higher (i.e. 35.5s) than the test (6.8s). In the attention conditions, the average latency was higher (i.e. 33.1s) than the test (i.e. 11.3s) and the average latency in the task conditions was higher (i.e. 51.3s) than the test (i.e. 14.1s). This data agrees with the percentage of responding in the controls for the task conditions, however, the latency in the attention conditions indicates that the termination of the control condition may have been punishing due to the presentation of the test condition. As for the tangible condition, there was 100% responding in the control and test conditions, however, the latency data shows that the control condition may have exerted control over the presentation of the test condition.

Although when examining the non-contingent control trials, there is not always the opposite effect from the contingent control trials, the latency data for the contingent control conditions should be opposite from the data from the percentage of responding in contingent control trials. For participant B1, the escape from staff, tangible, and attention conditions agree with the percentage of responding data, by indicating opposite effects from percentage of responding to latency. This indicates that the contingent controls may exert control over the target response. The average latency for the task conditions, however, did not agree with the outcomes of the percentage of responding that the behavior in the control was reinforced by the presentation of the task. For participant B2, the task condition was the only condition that demonstrated a clear relationship that the control condition may have been exerting control over the target behavior when comparing the latency and percentage of responding.
CHAPTER 5

Discussion

FA’s have taken many different forms over the years, including trial-based FA’s, which show potential and many advantages over implementation of FA’s with multi-element designs, reversal designs, brief FA’s, etc. Since data from standard FA’s typically only focus on the frequency and/or percentage of responding of the target behavior across conditions, to determine the dominant function of a problematic behavior, the purpose of this study was to analyze the data of trial-based FA’s across various dimensions in order to determine the best way to analyze the data and/or if other variables effect responding. Data for six different trial-based FA’s were analyzed in various degrees including the percentage of responding, the latency of responding, the order trials were conducted, and possible effects of the implementation of contingent controls.

In regards to the percentage of responding compared to the latency of responding, there were very few cases in which the data for the percentage of responding and the data for the average latency agreed. This analysis did not determine that either measure is equal, or which measure is most reliant. This would suggest that more research needs to be conducted comparing the two different measures to determine if both are necessary or one measure over the other. It could be argued that both measures did give important information as to the function(s) of the targeted behaviors.

Although the analysis on the percentage of responding and the latency did not give clear results, it did indicate that there are benefits to both measures. For instance, for participant A1, the latency data indicated that he was touching others as an escape from task function. Even though the percentage of responding data indicated an escape from staff function, the
disagreement could be due to the participant wanting to escape the staff giving the task, rather than the actual task. Although the latency was shorter in the escape task condition, it still serves an escape function. Escaping task and the staff may have been more motivating than just escaping staff, indicated by a shorter latency. It may have been beneficial to conduct escape from task trials including tasks that required teacher-directed conditions (i.e. teacher present and delivering demands consistently) versus semi-direction conditions (i.e. teacher at a distance and participant completing tasks independently) to test if the function was to escape staff or task. Without examining the latency data, this may have been overlooked. This same possibility remains true for participants B1 and C1 as the percentage of responding ranked escape from staff as the dominant functions and the latency ranked escape from task. Both measures demonstrated an escape function, which shows a little agreement between measures, however, it is unclear whether it’s more motivating to escape staff, task or both.

When data from the percentage of responding may not give clear results, the latency data may be valuable to examine as it may help determine the function of a problematic behavior by indicating quicker responses. Evaluating both measures may help a therapist determine the function with more confidence and/or give insight with more specific detail of the function.

The analysis of the order of trials in which conditions are conducted did show some effects on participants’ responding. This analysis was only based on two different FA’s due to the limited number of trials with all participants so this is a limitation in this study. The data for the order of trials in FA’s indicated that the sequence in which trials are conducted may impact the likelihood of the targeted behavior occurring. The data suggest that previous conditions may serve as establishing operations (EO) or abolishing operations (AO). An EO is a motivating operation that increases the effectiveness of a stimulus, object or event. An AO decreases the
reinforcing effectiveness of a stimulus, object or event. For participant A1, the attention condition may have been an EO for the tangible condition since the only responses during tangible were when followed by attention. The attention condition presented before the tangible may have motivated the subject to engage in the target behavior during the tangible condition, possibly wanting the staff to engage with him. The other 3 conditions, tangible, alone and task may have served as AO’s, meaning the participant was not motivated to perform the target response, since he did not respond in the tangible condition when presented after these conditions. In regards to task trials, the alone condition may have served as an EO since the only responses in task trials were when followed by alone conditions. Tangible, attention and task may have served as AO’s for task trials.

As for participant B1, data indicated that when tangible conditions were followed by tangible conditions, the first tangible may have acted as an AO, punishing the target behavior, since there was a significant decrease in responding following this order. The order, task trial followed by task trial, also indicate that the first task condition may have served as an abolishing operation since there was significantly less responding in trials with this sequential order compared to responding across all task conditions. Task trials implemented after escape from staff trials indicate that escape from staff may have been an EO to the task conditions following this order due to the significant increase in percentage of responding. Since the target behavior removed staff, it may have motivated the participant to engage in the target behavior in order to remove tasks. Attention trials implemented after task trials indicated a significant increase in responding concluding that the first task condition may have functioned as an EO.

A possible explanation to conditions being an EO or AO could be satiation and/or deprivation. For instance, participant B1 responded significantly higher in the task conditions
when followed by escape from staff, and significantly lower when followed by another task condition. A possible hypothesis to responding at higher rates when followed by escape from staff could be satiation. The participant may have had enough interaction with staff during escape from staff conditions since staff were engaging with him using physical and social interactions, that by the time the task condition started, he wanted staff to be away. Staff’s interactions with the subject during the task condition was less physical and intrusive than the escape from staff, possibly explaining why he was less likely to respond in the task trials, when followed by task trials. In the attention trials, the participant responded significantly higher in the attention conditions when followed by task, compared to his responding when followed by escape from staff conditions. It could be hypothesized that this was due to deprivation from the type of interactions he was receiving from staff. During the task conditions, staff were giving him little attention besides placing demands, motivating participant to want more attention, possibly explaining an increase in responding during the attention condition. The attention the participant received in the escape from staff conditions was more intrusive, serving as an AO, possibly indicating why he responded less in the attention conditions following this, due to satiation of staff and not wanting his/her interactions anymore.

The analysis of the effects of contingent controls in trial-based FA’s did show that these contingent controls may exert control over the occurrence of the target behavior. Again, this was only examined in two participants making it difficult to make a final judgment and adding another limitation to the study. The data, however, did show some evidence when comparing opposite effects of percentage of responding and latency within control and test trials for each condition. If there were low rates of the target response during the contingent controls, than the test conditions should have had higher responding than the contingent controls. Responding
during the contingent controls would appear to be a function of the presentation of the test. If there were higher rates of responding in the contingent controls than the tests, it would appear that the presentation of the test conditions would be a reinforcer. This did appear to be true in some of the conditions. As participants learned the contingency that the target behavior results in termination of a control condition and presentation of the test condition, their behavior was altered, indicating important information when analyzing the data. This termination of the control condition may affect the overall results of an FA.

Also, if the response of the target behavior terminated the control condition, it should exert control on the behavior and the pattern of responding in a sequence of trials should reflect the contingent effect. For instance, in those cases where there is a relatively higher percentage of responding in the test condition, there should be more responses in the first ranked presentations of the control condition than in the latter. This is because terminating the control condition is a punisher if producing the test acts as a reinforcer. The same reverse logic applies when the percentage of responding is relatively lower in the test condition than in the control condition. In this case, there should be a higher percentage of responding in the latter trials of the contingent controls since the occurrence of the target behavior cause the presentation of the test condition. Although this concept was not studied in this research, it is something to be studied in the future.

There were some limitations to this study. One limitation was that there was no inter-rater reliability. The researcher was the only person who reviewed the tapes of the FA and analyzed the data. It would have been more reliable, or credible, if a second person viewed the videos and collected data to determine the reliability after the research and findings.

A second limitation was there were few participants in this study. Altogether there were six participants, all six were only included in the first analysis; comparison between the
percentage of responding and latency data. More participants may have provided clearer results in this analysis and would be necessary to make a clear judgment on which measure is most accurate. As for the order of trials, and contingent vs. non-contingent control analyses, there were only 2 participants represented in both categories. This is not enough to make a final conclusion on how these areas can affect results in an FA. Participants in this study did not have enough trials conducted during their FA’s, or only implemented one type of control condition so there was very little analysis done. When examining the order of trials for the two participants, there were also a different number of trials for each participant. Participant A1 had 66 trials, while participant B1 had 180. The analysis was not comparable. When examining the contingent and non-contingent control conditions, participant B1 had 180 trials while participant B2 only had 42 trials. Again, it is hard to study when there are such big differences within trials of the FA’s and only two to analyze.

The analysis could have been stronger if there had been more participants and more trials within the participants in order to do more comparisons and add more studies to the order of trials and contingent control analyses. Also missing from this study was a discussion of the implementation of interventions based on the FA’s were discussed to show which analyses determined the correct functions for the problematic behaviors.

Despite the limitations in this study, the analysis of trial-based FA’s did suggest that there is more research to be conducted and this study revealed areas of need to focus on. There were no clear indications on the best or most accurate measure of data within trial-based FA’s between the percentage of responding or the latency of responding. Both measure have benefits and may reveal crucial information, however, more research needs to be conducted in order to know for sure. To really determine which is most accurate, interventions could be implemented
based on the data from both measures. This would not be suggested for a dangerous behavior however, due to being time consuming and implementation of multiple interventions to determine the most effective, possibly delaying an accurate intervention when the behavior needs to be decreased in a timely manner. If interventions were implemented based on the findings in the percentage of responding and latency data, it would show which measure is more accurate.

In regards to the order of trials, knowing that there is a possibility that the sequential order can effect responding, therapists should be careful to leave adequate time between the implementation of trials. It may also be beneficial to only conduct one condition at a time to avoid carryover effects, such as establishing operations or abolishing operations from the previous conditions. More research with more participants and trials should be conducted on the order of trials in FA’s to determine if the order does cause a significant change in responding. Research can also be done on different ways to conduct trials to determine how to best avoid carryover effects.

As for contingent and non-contingent control conditions in trial-based FA’s, there is no research on which control, if either one, is better. This study suggests that the contingent controls may exert control of the target behavior and act as a reinforcer or punisher to the test condition. There may be advantages to conducting more research on the differences between contingent and non-contingent controls in trial-based FA’s as it remains unclear. This could be done by examining the rate of responding in contingent controls as trials continued. There should either be an increase or decrease in responding as participants learn the contingency. If the control is exerting control over the behavior, it would be seen in the pattern of responding.

This data analysis did not determine the best measure to use between percentage of responding and latency in trial-based FA’s. There was only agreement in two participants where
both measures determined the same dominant function. It is unclear as to which measure is most accurate, however, data did show that both measures have their own benefits and together, they may give more insight into specifics in function. As for the order of trials, this study revealed that there may be sequential order effects within FA trials. It is possible that the previous trial may serve as an establishing or abolishing operation to the next trial. Contingent control conditions in trial-based FA have showed the possibility of exerting control over the problematic behavior. In at least one of the two cases studied, the contingent controls demonstrated a controlling relationship, revealing the test condition possibly acting as a reinforcer or punisher. Although focusing on the percentage of responding may be sufficient when determining the function of a problematic behavior from trial-based FA’s, this study does reveal benefits to analyzing a variety of measures. There were no clear results on the best measure between percentage of responding and latency, or strong enough results for the effects of the order of trials and impact of contingent controls. This study did give researchers/therapists a variety of measures to examine if results are not clear by simply focusing on the percentage of responding.
References


Scott, T. M., Bucalos, A., Liaupsin, C., Nelson, C. M., Jolivette, K., & DeShea, L.

Making a case for effectiveness and efficiency. *Behavioral Disorders, 29,* 189-201.


Appendix A

INFORMED CONSENT FOR RESEARCH STUDY
Title of Project: Analysis of Data from Trial-Based Functional Analyses

Principal Investigator: Jennifer Muchmore
1515 Rothsville Rd, Lititz PA, 17543
jmuchmore@thevistaschool.org
work: 717-835-0310 cell: 717-271-9584

Advisor: Dr. Mary Catherine Scheeler
Penn State Great Valley, Malvern PA, 19355
mcs13@psu.edu
Work: 610-648-3272 Fax: 610-725-5253

1. **Purpose of the Study:** The purpose of this study is to determine how data collected from trial-based functional analyses should be analyzed in order to find out the appropriate function of a problem behavior.

2. **Procedures to be followed:** Data from previous trial-based functional analyses will be analyzed by looking at the percentages in responses for each condition, the latency (i.e. how long it took for the response to occur once condition was started) of the targeted response in each condition, the order that the trials were conducted (i.e. attention followed by escape, etc) as well as comparing the control conditions if there were two different control conditions conducted (i.e. control ending if targeted response occurred or control continuing even if targeted response occurred). Since your child participated in a trial-based FA in the past, the data collected from the FA will be analyzed as mentioned above. To ensure that the data collection was accurate and to look at all the needed variables, the video tapes of the FA may be watched. Your child will not be asked to do anything additional for this research study.

3. **Discomforts and Risks:** There are no risks in participating in this research beyond those experienced in everyday life.

4. **Benefits:** Although there will not be any immediate benefits for your child after this study, since it only involves looking at previous data, there could be benefits for the future when trial-based functional analyses are conducted. The benefits for the future would include knowing how to analyze the data collected from the FA’s to ensure that the function discovered is correct. If the right function is determined, the right interventions can be implemented for problematic behaviors.

5. **Duration/Time:** This research will require no additional time for the parent or participant.
6. **Statement of Confidentiality:** Your child’s participation in this research is confidential. The previously collected data is stored and secured at *The Vista School* on tapes/DVD’s kept in a locked filing cabinet and locked office during non-school hours. Previous written data collected from the FA’s is kept in your child’s folder in a locked filing cabinet or on the Vista network which is secured by a username and password. Any analyses of data that occurs from these sources will be kept on the principal investigators computer, Jennifer Muchmore, which is also secured by a username and password. When the analyses are completed and the study is done, they will be kept secured in a locked cabinet or on a secured computer for up to 3 years. The principal investigator, Jennifer Muchmore, will be the only person that has access to the analysis of data completed for this research. The analyses will be kept on a computer secured with user name and password as well as a locked cabinet. Names of participants will not be stated in the study or on analyses. The Pennsylvania State University’s Office for Research Protections, the Institutional Review Board and the Office for Human Research Protections in the Department of Health and Human Services may review records related to this research study. In the event of a publication or presentation resulting from the research, no personally identifiable information will be shared.

7. **Right to Ask Questions:** Please contact Jennifer Muchmore at (717) 271-9584 with questions, complaints or concerns about this research. You can also call this number if you feel this study has harmed your child. If you have any questions, concerns, problems about your child’s rights as a research participant or would like to offer input, please contact The Pennsylvania State University’s Office for Research Protections (ORP) at (814) 865-1775. The ORP cannot answer questions about research procedures. Questions about research procedures can be answered by the research team.

8. **Voluntary Participation:** Your permission for the use of your child’s data is voluntary. You can withdraw your permission for the use of your child’s data at any time. Refusal to take part in or having data withdrawn from this study will involve no penalty or loss of benefits you would receive otherwise.

If you give permission for the use of your child’s data to be used in this study and agree to the information outlined above, please sign your name and indicate the date below.

You will be given a copy of this consent form for your records.

“I give permission for my child, ____________________, to participate in this research study.”

__________________________________________  ______________________
Parent signature  Date

__________________________________________  ______________________
Person Obtaining Consent  Date
Appendix B

DATASHEET FOR TBFA
### Trial Based (Classroom) Functional Analysis

Conduct trials throughout the day over the course of a week. Each trial consists of two segments (control, then test). **Control:**
(a) If no target behavior by the end of one minute, circle "-" and go to test. (b) If target behavior occurs before one minute, circle "+," end segment immediately, and go to test. **Test:** (a) If no target behavior by the end of one minute, circle (-) and end segment. (b) If target behavior occurs before one minute, deliver specified consequence, circle "+," and end segment. Try to conduct 20 trials of each type, and summarize as % of each trial type with target behavior.

**Alone:** Two consecutive test segments are conducted. Observe when client is not working, not interacting with others, and has no access to leisure items.

**Tangible:**
*Control:* Client has continuous access to preferred object.
*Test:* Take away preferred object, place it in sight but out of reach, and turn away from client. If target behavior occurs, return preferred object.

**Attention:**
*Control:* Therapist is near client and delivers non-contingent attention (pleasant conversation, no tasks).
*Test:* Turn away from client while remaining close. If target behavior occurs, turn to client and resume delivering non-contingent attention for 10 seconds.

**Task:**
*Control:* Observe client while no task demands are present in setting which task is typically presented.
*Test:* Deliver frequent prompts to engage in somewhat difficult work. If target behavior occurs, remove work.

**Start Date:** _____________________________  **End Date:** _____________________________

**Target Behavior:** ________________________________________________________________

<table>
<thead>
<tr>
<th>Trial</th>
<th>Condition</th>
<th>Control</th>
<th>Control Latency</th>
<th>Test</th>
<th>Test Latency</th>
<th>Trial</th>
<th>Condition</th>
<th>Control</th>
<th>Control Latency</th>
<th>Test</th>
<th>Test Latency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>26</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>2</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>27</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>3</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>28</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>4</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>29</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>5</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>30</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>6</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>31</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>7</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>32</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>8</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>33</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>9</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>34</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>10</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>35</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>11</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>36</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>12</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>37</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>13</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>38</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>14</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>39</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>15</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>40</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>16</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>41</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>17</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>42</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>18</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>43</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>19</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>44</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>20</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>45</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>21</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>46</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>22</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>47</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>23</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>48</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>24</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>49</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
<tr>
<td>25</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
<td>+</td>
<td>+</td>
<td>50</td>
<td>Alone</td>
<td>Tan</td>
<td>Att</td>
<td>Task</td>
</tr>
</tbody>
</table>