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Comparison of Trial-Based, Synthesized Trial-Based, and Traditional Functional Analyses

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**COMPARISON OF TRIAL-BASED, SYNTHESIZED TRIAL-BASED, AND
TRADITIONAL FUNCTIONAL ANALYSES**

A Masters Thesis

Presented to

The Graduate College of
Missouri State University

In Partial Fulfillment

Of the Requirements for the Degree

Master of Science in Education, Special Education

By

Kara Leigh Forck

December 2017

DISCLAIMER

The results of this project was a collaborative research effort with Kaitlin Curtis. The methodology of the research study was developed and implemented by both of the researchers. Experimental control was established using a within-subject design for both studies. However, both researchers had individual participants in which they individually reported their results. The difference between the two studies were that Kaitlin Curtis only had one participant and I had two participants. Participant assignments were alternated between the two researchers.

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COMPARISON OF TRIAL-BASED, SYNTHESIZED TRIAL-BASED, AND TRADITIONAL FUNCTIONAL ANALYSES

Counseling, Leadership, and Special Education

Missouri State University, December 2017

Master of Science in Education, Special Education

Kara Leigh Forck

ABSTRACT

I evaluated a synthesized trial-based functional analysis with two students who engaged in problem behavior by combining the methods from the trial-based functional analysis and synthesized contingency functional analysis. Multiple test conditions were combined into one test condition and were evaluated in 2-min trials. The purpose of this study was to compare the degree of correspondence of the results between the trial-based, synthesized trial-based, and traditional function analyses. One participant showed exact correspondence between the three functional analyses, while the other participant showed partial correspondence.

KEYWORDS: autism, problem behavior, functional analyses, trial-based, synthesized

This abstract is approved as to form and content

Megan Boyle, PhD
Chairperson, Advisory Committee
Missouri State University

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December 2017

Approved:

Megan Boyle, PhD

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In the interest of academic freedom and the principle of free speech, approval of this thesis indicates the format is acceptable and meets the academic criteria for the discipline as determined by the faculty that constitute the thesis committee. The content and views expressed in this thesis are those of the student-scholar and are not endorsed by Missouri State University, its Graduate College, or its employees.

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CHAPTER I: INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that now affects 1 in 68 children (Centers for Disease Control, 2012). To receive a diagnosis of ASD, an individual must have demonstrated signs prior to age 3, and demonstrate impairments in social interactions and communication, and restricted or repetitive behaviors and interests (American Psychiatric Association, 2013). Horner, Carr, Strain, Todd, and Reed (2002) stated that children with autism are at an increased risk to engage in problem behavior and that their behaviors may worsen without the development and implementation of an intervention. When a child engages in problem behavior, it may negatively impact his or her educational performance, social interactions, and ability to integrate into the community. To develop a successful intervention, the factors that maintain the child's problem behavior (i.e., function) should be identified through the use of a functional analysis (FA; Hanley, Iwata, & McCord, 2003; Newcomer and Lewis, 2004).

An FA is an assessment that involves the manipulation of antecedents (e.g., events that happen prior to the problem behavior) and consequences (e.g., event that happen after the problem behavior). Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) developed the "traditional FA" arrangement, which is now known as the "gold standard" in applied behavior analysis (ABA; Hanley et al., 2003; Iwata & Dozier, 2008; Lloyd & Kennedy, 2014). Since the development of the traditional FA, there have been hundreds of replications and extensions in the field of ABA to identify the function of individuals' problem behavior (Hanley et al., 2003).

Despite the success of the traditional FA, some have described criticisms (e.g., duration of assessment), and accordingly, variations of the traditional FA have been developed (Hanley, 2012; Iwata & Dozier, 2008). Two of the variations that have shown promising correspondence with the traditional FA include the trial-based FA (Bloom, Iwata, Fritz, Roscoe & Carreau, 2011) and the synthesized-contingency FA (Hanley, Jin, Vanselow, & Hanratty, 2014). During the trial-based FA, individual conditions are examined through the use of trials which include 2-min control and tests segments (Bloom et al., 2011). During the synthesized-contingency, multiple conditions are combined into one test condition in 10-min sessions (Hanley et al., 2014).

Rationale for the Study

When a variation of an FA is developed, correspondence to the traditional FA must be assessed to determine the extent to which it accurately identifies function. Although trial-based and synthesized-contingency FAs show promising correspondence, they sometimes yield false positives or negatives (Bloom et al., 2011; Fisher, Greer, Romani, Zangrillo, & Owen, 2016; LaRue et al., 2010; Slaton, Hanley, & Raftery, 2017; Strohmeier, Murphy, & O'Connor, 2017).

A synthesized trial-based FA (Curtis, 2017), which combines the methods of trial-based and synthesized-contingency formats, was evaluated in this study to determine whether combining the methods of the two FAs decreased the likelihood of false positives produced by the synthesized-contingency FA and the likelihood of false negatives produced in the trial-based FA. Results from the synthesized trial-based FA

were compared to those from the traditional FA and trial-based FA to determine the degree of correspondence.

Purpose, Research Questions, and Hypothesis of the Study

The purpose of this study was to compare the correspondence of the results of the trial-based, synthesized-contingency trial-based, and traditional functional analyses.

In order to compare the results of the traditional, trial-based, and synthesized trial-based functional analyses, the follow research questions were addressed:

1. What is the degree of correspondence between results of the traditional and trial-based functional analyses?
2. What is the degree of correspondence between results of the traditional and synthesized trial-based functional analyses?
3. To what extent does the synthesized format reduce false negatives relative to trial-based functional analysis?

I hypothesized that the results of the trial-based functional analysis and synthesized trial-based functional analysis will correspond with the traditional functional analysis. If the trial-based functional analysis produces a false negative, then it is hypothesized that the synthesized trial-based functional analysis will not produce a false negative.

Research Design

A single-subject multielement design (Kazdin, 1982) was utilized for the traditional functional analysis to identify the function(s) of the problem behavior for each

subject. This design was used to evaluate the problem behavior under different alternating conditions (e.g., attention, escape, play, tangible).

The data for a functional analysis are graphed and visually analyzed to determine the function of the problem behavior. To analyze the graph, responding in each condition is examined relative to the control (play) condition to determine if that specific condition is maintaining the problem behavior. In other words, if problem behavior in the tangible condition is elevated relative to the play condition, then there is a tangible function (Hagopian et al., 1997).

Significance, Assumptions, and Limitations of the Study

This study contributed to the literature on FA in at least three ways:

- 1) It was the second study (Curtis, 2017) to evaluate the reliability of a *synthesized trial-based FA* by comparing traditional and synthesized trial-based FAs.
- 2) It was the second study (Curtis, 2017) to evaluate whether synthesized trial-based FAs decrease the likelihood of false negatives relative to typical trial-based FAs (Bloom et al., 2011; LaRue et al., 2010) by comparing synthesized trial-based and trial-based FA.
- 3) It was the fourth study to evaluate correspondence between traditional and trial-based FAs.

This study had the following assumptions:

- 1) Problem behavior was maintained by more than one variable.
- 2) The function of problem behavior was identified.

This study had the following limitations:

- 1) Treatment was not implemented in this study.

- 2) The study was only conducted with two participants.

Terminology

- 1) Applied behavior analysis (ABA): “The science in which tactics derived from the principles of behavior are applied to improve socially significant behavior” (Cooper, Heron, & Heward, 2007, p. 690).
- 2) Antecedent: “An environmental condition or stimulus change existing or occurring prior to a behavior of interest” (Cooper et al., 2007, p. 689).
- 3) Consequence: “A stimulus change that follows a behavior of interest” (Cooper et al., 2007, p. 692).
- 4) Establishing operations (EO): An antecedent that increases the value of a reinforcer and evokes behavior that has produced that reinforcer in the past. For example, food deprivation establishes food as an effective reinforcer and evokes behavior that has previously resulted in food (Cooper et al., 2007).
- 5) Functional analysis (FA; as part of functional behavior assessment):
An analysis of the purpose (functions) of problem behavior, wherein antecedents and consequences representing those in the person’s natural routines are arranged within an experimental design so that their separate effects on problem behavior can be observed and measured; typically consists of four conditions: three test conditions—contingent attention, contingent escape, and alone—and a control condition in which problem behavior is expected to be low because reinforcement is freely available and no demands are placed on the person (Cooper et al., 2007, p. 696).
- 6) Functional behavior assessment (FBA): “A systematic method for obtaining information about the purpose (functions) of problem behavior; results are used to guide the design of an intervention for decreasing problem behavior and increasing appropriate behavior” (Cooper et al., 2007, p. 696).
- 7) Indirect FBA:
Structured interviews, checklists, rating scales, or questionnaires used to obtain information from people who are familiar with the person exhibiting the problem behavior (e.g., teachers, parents, caregivers, and/or the individual him- or herself); used to identify conditions or events in the natural environment that correlate with the problem behavior (Cooper et al., 2007, p. 697).

- 8) Interobserver agreement (IOA): “The degree to which two or more independent observers report the same observed values after measuring the same events” (Cooper et al., 2007, p. 698).
- 9) Operant behavior: “Behavior that is selected, maintained, and brought under stimulus control as a function of its consequences” (Cooper et al., 2007, p. 700).
- 10) Reinforcer: “A stimulus change that increases the future frequency of behavior that immediately precedes it” (Cooper et al., 2007, p. 702).
- 11) Treatment integrity: “The extent to which the independent variable is applied exactly as planned” (Cooper et al., 2007, p. 707).

CHAPTER II: REVIEW OF LITERATURE

Autism Spectrum Disorder

Autism was first described by Leo Kanner in 1943. According to Kanner, autism included both language and communication impairments, as well as the need for “sameness.” Since then, the criteria for autism have evolved. Based on the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013), autism spectrum disorders (ASDs) are characterized by difficulty with communication and social interaction, and restrictive or repetitive behaviors and interest; in addition, these symptoms must be present in early childhood.

Problem behavior is common with children and adults who have been diagnosed with ASD. Horner et al. (2002) noted that approximately 13-30% of children with ASD engage in problematic behavior that requires an intervention. Children who have limited communication skills or poor social development are at an increased risk for engaging in problem behavior (Horner et al., 2002). Problem behavior such as aggression, self-injury, property destruction, and tantrums pose a challenge for caregivers and teachers, and also for the individual who emits the problem behavior. Children who engage in such behavior are at an increased risk of exclusion from less restrictive school environments, social relationships, and community activities (Horner et al., 2002; Vaughn & Horner, 1997), and are prescribed psychotropic medication to manage their behavior (Mandell et al., 2008), many of which have unintended side effects such as, weight gain, increased appetite, anxiety, and fatigue (Troost et al., 2005).

Function-Based Interventions

Behavior that is sensitive to consequences (e.g., reinforcers, punishers) is known as *operant behavior* (Cooper et al., 2007). Applied behavior analysts are interested mainly in problem behavior that is operant in nature, as consequences of behavior are usually easily manipulable. Accordingly, a group of interventions have been developed that specifically address the consequences maintaining problem behavior (i.e., *function-based interventions*), including extinction, differential reinforcement, and noncontingent reinforcement (Cooper et al., 2007; Matson, 2011; Miltenberger, 2012; Wong et al., 2014).

Extinction refers to no longer reinforcing a behavior that has previously been reinforced (Miltenberger, 2012). While implementing extinction, it is common for the problem behavior to increase in rate or intensity (i.e., an *extinction burst*) before the problem behavior extinguishes (Cooper et al., 2007). Extinction does not entail teaching an alternative response or skill, and therefore it is usually not used in isolation (Horner et al., 2002; Matson, 2011; Wong et al., 2014).

Differential reinforcement involves providing reinforcement contingent on a response or response pattern, or for the absence of problem behavior (Miltenberger, 2012). There are several variations of differential reinforcement, which include differential reinforcement of alternative behavior (DRA), differential reinforcement of incompatible behavior (DRI), and differential reinforcement of other behavior (DRO) (Cooper et al., 2007). During DRA, an alternative response is taught that is functionally equivalent to the problem behavior. Reinforcement is delivered contingent on the occurrence of the alternative response. During DRI, the procedures are similar to the

DRA, however the alternative response is incompatible with the problem behavior. Therefore, the child cannot engage in the problem behavior at the same time as the appropriate behavior. During DRO, a reinforcer is delivered following a period of time during which problem behavior does not occur (Cooper et al., 2007; Matson, 2011; Wong et al., 2014).

Noncontingent reinforcement (NCR) is a function-based intervention that involves delivering the reinforcer that maintains problem behavior according to a response-independent (time-based) schedule. Noncontingent reinforcement diminishes the contingency between the problem behavior and the reinforcer since the reinforcers occur independent of responding. Noncontingent reinforcement also entails the repeated delivery of reinforcers, which may influence motivating operations (Cooper et al., 2007; Lalli, Casey, & Kates, 1997).

Functional Analysis

Skinner (1953) used the term *functional analysis* to describe the process of identifying the relation between behavior, antecedents, and consequences. Skinner stated,

We undertake to predict and control the behavior of the individual organism. This is our "dependent variable"—the effect for which we are to find the cause. Our "independent variables"—the causes of behavior—are the external conditions of which behavior is a function. Relations between the two—the "cause-and-effect relationships" in behavior—are the laws of a science (p. 35).

The term “functional analysis” (FA) is now also synonymous with a type of functional behavior assessment (FBA) in which antecedents and consequences are manipulated in order to identify variables that maintain an individual’s problem behavior (Roscoe, Schlichenmeyer, & Dube, 2015).

The seminal paper on the FA of problem behavior (specifically, self-injury of individuals with intellectual and developmental disabilities) was conducted by Iwata et al. (1982/1994). The authors arranged four test conditions (academic, alone, social disapproval, and play) in a multi-element design, and each session lasted 15 min. Each condition arranged establishing operations (EOs; Michael, 1992) and consequences for a putative reinforcer. During the social disapproval condition, the participant was directed to play with toys while the therapist diverted her attention to something else. Attention in the form of disapproving statements (e.g., “Don’t do that”, “You’re going to hurt yourself”) was only provided to the participant contingent on problem behavior; all other behavior was ignored. During the academic demand condition, the therapist presented academic tasks to the participant. A 30-s break from demands was only provided to the participant contingent on problem behavior. During the unstructured play condition, no tasks were presented and the participant had noncontingent access to toys as well as attention from the therapist. During the alone (test for automatic reinforcement) condition, the participant was alone in a room without toys or any other materials. Results showed that similar topographies of problem behavior (self-injurious behavior; SIB) were sensitive to different consequences across participants, which demonstrated that at least some individuals’ SIB is operant in nature.

Weaknesses and Criticism of Traditional FA

Although FAs accurately identify the function of problem behavior, individuals outside of behavior analysis sometimes express concerns when they are implemented in the field (Hanley, 2012). For example, FAs require a considerable amount of time to

conduct. Hanley (2012) pointed out, though, that variations of the traditional FA, including brief, trial-based, or latency FAs, have been developed that can be conducted in less time. A second criticism Hanley noted was that FAs are too complex and may be difficult with low-rate behavior. In response to this criticism, Hanley described open-ended interviews to conduct prior to the FA and the use of longer sessions to allow putative EOs to strengthen. Another common criticism is the danger to the client and/or therapist. Hanley suggested taking measures to ensure a safe environment as well as utilizing briefer FA formats. Finally, caregivers may not agree with arranging conditions to evoke and subsequently reinforcing problem behavior (Hanley). For this reason, Hanley stated that it is essential that the therapist build a relationship with caregivers. The therapist should also describe the procedure and explain the reasoning behind conducting the FA, and that it is essential to identify the function of the behavior before being able to implement a treatment (Hanley).

Variations of the Traditional FA

Given the above concerns with traditional FA, researchers have developed several variations and have compared the degree to which these variations correspond with traditional FA. *Perfect correspondence* refers to two assessments identifying the same functions and excluding the same functions (e.g., both found attention functions and *only* attention functions). *Partial correspondence* refers to two assessments identifying at least one of the same functions, but one assessment identifies an additional function (e.g., one identified both attention and escape, and the second identified escape only). *No*

correspondence refers to two assessments identifying only different functions (e.g., one identified attention, and the second identified escape).

For example, Northup et al. (1991) evaluated a brief FA format in which the entire assessment can be completed within a 90-min evaluation. During a brief FA, each test condition is evaluated in one or two short (5-10 min) sessions. This contrasts the traditional FA, which usually involves longer (10-15 min) sessions and at least three sessions of each test condition. Kahng and Iwata (1999) evaluated the correspondence between the traditional FA and the brief FA. The brief FA was conducted with the first 5 min of the traditional FA and the conditions were randomized across participants. The results found that there was an overall correspondence of 66% and disagreements are based on the high rate of false positives with the brief FA.

A second alternative to the traditional FA is the structured descriptive assessment (SDA; Anderson & Long, 2002). During an SDA, the test conditions are similar to the traditional FA. The main difference is the therapist in a traditional FA is usually a trained student or professional in a clinic room and in a SDA the therapist is usually a caregiver or teacher in the natural setting (e.g., home or classroom). Another difference is the consequences in a traditional FA are manipulated and the consequences in a SDA naturally occur. A benefit of conducting an SDA is that it allows the individual to remain in their natural environment, however, the therapist has less control over environmental conditions. Anderson and Long (2002) evaluated correspondence between the traditional FA and SDA. The traditional FA was conducted prior to the SDA for all participants except one, which were conducted simultaneously and the conditions were randomized

across participants. The results found perfect correspondence for two of the four participants, partial correspondence for one, and no correspondence for the fourth.

A third alternative to the traditional FA uses response latency as the dependent variable and terminates sessions after the first instance of problem behavior and the delivery of the consequence associated with a given test condition (Thomason-Sassi, Iwata, Neidert, & Roscoe, 2011). This contrasts the traditional FA, which entails sessions that terminate following a set period of time (10-15 min) regardless of the frequency of problem behavior. Some benefits of the latency FA are that fewer responses are required to complete the assessment than in the traditional FA, which may be indicated for especially severe behavior. Thomason-Sassi et al. (2011) evaluated correspondence between the traditional and latency FA. The latency FA was conducted prior to the traditional FA and sessions were typically in the order of alone or ignore, attention, play, tangible (if applicable), and demand. The results found perfect correspondence with nine of 10 participants and partial correspondence with the remaining participant.

A fourth alternative to the traditional FA is the trial-based FA (Bloom et al., 2011; Bloom, Lamber, Dayton, & Samaha, 2013; LaRue et al., 2010; Rispoli, Ninci, Neely, & Zaini, 2014; Sigafoos & Sagger, 1995). When conducting a trial-based FA, trials are divided into control and test segments. Each putative reinforcer is evaluated within a trial (control and test segment). During the control segment of a test trial, the reinforcer is available noncontingently. During the test segment, the reinforcer is withheld and is only delivered to the participant contingent on problem behavior. Control and test segments are conducted back-to-back to ensure that any extraneous variables (e.g., fatigue) influence both the control and test segments equally. The primary benefit of trial-based

FAs is that the trials are embedded into a participant's daily routine, for example, in a classroom (Bloom et al., 2011; Bloom et al., 2013; Lambert, Bloom, & Irvin, 2012; LaRue et al., 2010). Thus, an additional clinical space and time periods do not need to be designated apart from daily activities.

LaRue et al. (2010) evaluated the correspondence between traditional FA and trial-based FA. The order in which the FAs were conducted was randomized across participants. Results for four out of the five participants showed perfect correspondence while one participant had partial correspondence (Table 1). Further, the trial-based FA took 84.8% less time than the traditional FA.

Bloom et al. (2011) also compared the results of the traditional and trial-based FAs. For all participants, the trial-based FA was conducted prior to the traditional FA to minimize the influence of the history of reinforcement during the traditional FA on the trial-based FA. In other words, problem behavior is exposed to EOs and consequences for longer periods of time during traditional compared to trial-based FAs, it is more likely that a history of reinforcement acquired during a traditional FA would influence behavior during a trial-based FA rather than vice versa. Similar to LaRue et al. (2010), Bloom et al. found high correspondence between the two FAs, with results from six out of 10 participants showing perfect correspondence, one showing partial correspondence, and one showing no correspondence (Table 1). Modifications to the trial-based FA (longer test conditions and the absence of the teacher) were made for two participants because of a lack of correspondence between the traditional FA and the trial-based FA. After the trial-based FA was modified for two participants, there was exact correspondence for those two as well.

Table 1. Trial-Based FA and Traditional FA Comparison.

Article	Number of Participants	Degree of Correspondence	Functions		Trial-Based Error
			Traditional	Trial-Based	
LaRue et al. (2010)	3	Exact	Tangible		NA
	1	Exact	Attention		NA
	1	Partial	Escape	Escape Tangible	False-Positive Tangible
Bloom et al. (2011)	2	Exact	Escape		NA
	2	Exact	Automatic		NA
	2	Exact	Tangible		NA
	1	Exact	Escape and Tangible		NA
	1	Exact	Attention		NA
	1	Partial	Escape Attention Tangible	Attention Tangible	False-Negative Escape
	1	None	Escape	Attention	False-Negative Escape False-Positive Attention

Note: NA=not applicable. When exact correspondence was found, there was no error.

Trial-based FAs are a unique variation of the traditional FA, in that brief, SDA, and latency formats are session based and are generally conducted in clinical settings. Although trial-based and latency formats both terminate a test segment or session following problem behavior and consequence delivery, the trial-based format arranges pairs of control and test segments that occur sequentially. Further, the trial-based FA was specifically developed as an alternative that could be conducted when the opportunity for a trial arises in the natural environment.

Another variation of the traditional FA is the synthesized-contingency FA (Fisher et al., 2016; Hanley et al., 2014; Jessel, Hanley, & Ghaemmahami, 2016; Santiago, Hanley, Moore, & Jin, 2016; Slaton et al., 2017; Strohmeier et al., 2017). Synthesized contingencies refer to the combination of at least two EOs and corresponding

consequences delivered simultaneously in the same test condition. This is in contrast to the contingencies that are evaluated within a traditional FA, which are deliberately isolated in order to assess the influence of each putative reinforcer. For example, a traditional FA arranges separate conditions to test for escape, attention, and, sometimes, tangible and automatic functions. In each test, a single EO is arranged (demands, withheld attention, denied access of a preferred item) and a single consequence is delivered for problem behavior (escape, attention, delivery of a preferred item). Conversely, a synthesized-contingency FA may arrange several EOs in a single test condition (e.g., demands and denied access of a preferred item) and deliver multiple reinforcers contingent on problem behavior (e.g., a break and preferred items).

The process of conducting a synthesized-contingency FA begins with an open-ended interview (Hanley et al., 2014), which gathers more idiosyncratic information about environmental variables than closed-ended interviews (e.g., the Functional Analysis Screening Tool; Iwata & DeLeon, 1996). Next, brief observations of the individual are arranged to identify additional environmental factors that may affect problem behavior. The results from the interview and the observations are then used to develop test condition(s) that generally include arranging multiple EOs and reinforcers for problem behavior. A control condition is arranged that entails noncontingent access to the reinforcers tested for in the test conditions; reinforcers not tested for are not included in the control. For example, if a synthesized-contingency of escape and tangibles is evaluated in the test condition, the control condition would consist of noncontingent access to tangibles only. This is also in contrast to the traditional FA, which generally presents all possible reinforcers (attention, tangibles) in the control condition.

Fisher et al. (2016) evaluated correspondence between the traditional FA and the synthesized-contingency FA. The order of the FAs was randomized and counterbalanced across participants. All participants who engaged in problem behavior during the assessments showed partial correspondence, and none of the participants showed perfect correspondence (Table 2). One participant did not engage in problem behavior in either of the FAs.

Slaton et al. (2017) also evaluated correspondence between the traditional FA and the synthesized-contingency FA. The synthesized-contingency FA was conducted prior to the traditional FA. Slaton et al. also reinforced precursor (i.e., behavior that happens before the problem behavior) during the synthesized-contingency. One participant showed exact correspondence between the synthesized-contingency and traditional FA, two participants showed partial correspondence (the traditional FA did not access one of the reinforcers, rituals, for one of the participants), and one participant showed no correspondence when the traditional FA identified a function. However, the traditional FA did not identify a function with five of the participants, but the synthesized-contingency did (Table 2). A modification was made for two participants who did not engage in problem behavior during the traditional FA, which precursors were then also reinforced in the traditional FA. After the modifications, one participant showed exact correspondence and one participant showed partial correspondence. It was also noted that the synthesized-contingency FA lasted approximately 28 min, and the traditional FA lasted approximately 90 min.

Strohmeier et al. (2017) also evaluated the correspondence between the traditional and synthesized-contingency FA. The initial traditional FA was conducted with

therapists, however the parents reported that the behavior was not representational of the subject's behavior in other places, therefore the participant's parents conducted the traditional FA and the synthesized-contingency FA. The traditional FA did not identify a function, indicating no correspondence between the two FAs (Table 2).

Table 2. Synthesized-Contingency FA and Traditional FA Comparison.

Article	Number of Participants	Degree of Correspondence	Functions		Synthesized Error
			Traditional	Synthesized	
Fisher et al. (2016)	1	Partial	Tangible	Attention Tangible Escape	False-Positive Attention and Escape
	1	Partial	Tangible	Tangible Escape	False-Positive Escape
	1	Partial	Tangible Escape	Attention Tangible Escape	False-Positive Attention
	1	Partial	Tangible	Attention Tangible Escape	False-Positive Attention and Escape
Slaton et al. (2017)	2	Exact	Tangible Escape		NA
	2	Partial	Escape	Attention Tangible Escape	False-Positive Attention and Tangible
	1	Partial	Escape	Escape Rituals ^a	False-Positive Rituals
	1	None	Attention	Tangible Escape	False-Positive Tangible and Escape False-Negative Attention
	1	None	Undiff	Attention Tangible Escape	NA
	1	None	Undiff	Attention Tangible Escape Stereotypy ^b	NA
	1	None	Undiff	Escape Schedules ^c	NA
Strohmeier et al. (2017)	1	None	Undiff	Tangible Escape	NA

Note: Undiff= undifferentiated (no function was determined). NA=not applicable. When exact correspondence was found, there was no error. ^a Escape to rituals. ^b Escape to toys, attention, stereotypy. ^c Escape to predictable schedules.

The newest variation of the traditional FA, synthesized-contingency trial-based FA, was developed by Curtis (2017). The synthesized-contingency trial-based FA combines the methods of the of Bloom et al. (2011) and Hanley et al. (2014). Therefore, multiple EOs are combined within a single control and test condition in a trial-based format (i.e., 2-min control and 2-min test). During the control segments, the reinforcers are available contingently, just like in the trial-based format, however, multiple conditions are evaluated simultaneously. During the test segments, the reinforcers are withheld simultaneously and only delivered contingent on problem behavior.

Curtis (2017) evaluated the correspondence between the synthesized-contingency trial-based FA, the trial-based FA, and the traditional FA. The trial-based FA was conducted first and then followed by the synthesized-contingency trial-based FA, and then the traditional FA was conducted last. Curtis evaluated one participant and found partial correspondence (false negative for escape) within the trial-based and synthesized-contingency trial-based FAs. However, the results found exact correspondence within the traditional and synthesized-contingency FAs.

Summary

Results from studies on correspondence between traditional FAs and trial-based and synthesized-contingency alternatives suggest the latter may be viable alternatives to the traditional format. However, results from both alternatives show less than perfect correspondence (Table 1 and Table 2). Errors in correspondence may be the result of *false positives* (a function was incorrectly identified) or *false negatives* (a function was incorrectly missed). As shown in Table 1, the trial-based FA resulted in two false

positives (one each for attention and tangible) and two false negatives (both for escape) (Bloom et al., 2011; LaRue et al., 2010). As shown in Table 2, the synthesized-contingency FA resulted in false positives for eight participants (four for attention, four for escape, two for tangible, and one for rituals; Fisher et al., 2016; Slaton et al., 2017; Strohmeier et al., 2017).

When a function is indicated in a synthesized-contingency FA (i.e., problem behavior is elevated in the test relative to the control condition), and results do not correspond perfectly with those of the traditional FA, the error is typically a false positive. The only way that results from a synthesized-contingency FA would indicate a false negative, would be a condition is not evaluated in the synthesized-contingency FA and is identified as a function in the traditional FA. Conversely, trial-based FAs have been associated with both false positives and false negatives, with false negatives occurring for escape. A variation of the traditional FA that Curtis (2017) evaluated involves combining methods from trial-based and synthesized-contingency formats. It is possible that a trial-based format that arranges multiple contingencies may: 1) decrease the likelihood of false positives because of the shorter duration of trials (test segments compared to sessions of the synthesized FA), and 2) decrease the likelihood of false negatives because multiple EOs are presented simultaneously, making it more likely that problem behavior will occur.

For clarification, the synthesized trial-based FA will be referred to as “SFA,” the trial-based FA will be referred to as “TBFA,” and the traditional FA will be referred to as “FA.”

CHAPTER III: METHODOLOGY

Participants, Setting, and Experimental Sequence

Prior to recruitment, the Missouri State University Institutional Review Board (IRB) approved the study on January 24, 2016 (approval #IRB-FY2017-459; Appendix A).

Two children who had been previously diagnosed with autism spectrum disorder (ASD) participated in this study. Emmanuel (a pseudonym) and Sebastian (a pseudonym) were referred by a local autism diagnostic clinic due to their high rates of problem behavior. Caregiver consent was obtained prior to the study (Appendix B).

Emmanuel was a 3-year-old male who was referred for the treatment of aggression, property destruction, and negative vocalizations. Emmanuel manded (i.e., requested) for items by leading adults to items and pointing and emitted approximations of “yes” and “no” as intraverbals, although they were usually unintelligible. Emmanuel struggled with identifying objects in an array of pictures, although he followed 1-step directions.

Sebastian was a 3-year-old male who was referred for the treatment of flopping, property destruction, and negative vocalizations. Sebastian manded for items through pointing or by leading adults to items and placing their hand on the item. Sebastian also utilized eye contact as a type of mand (e.g., made eye contact when initiating a request, such as sitting on an adult’s lap) and followed 1-step directions.

All FAs were conducted at a university-based clinic. The clinic room was equipped with a one-way observation window and padded flooring.

The assessments were conducted in the following order: TBFA, SFA, and FA. The FA was conducted last to decrease the influence of repeated exposures to contingencies in the trial-based formats.

Measurement and Reliability

Emmanuel's problem behavior included *aggression* (scratching, grabbing, pulling hair, hitting, and kicking), *property destruction* (throwing objects), and *negative vocalizations* (vocalizations above conversation level). Sebastian's problem behavior included *flopping* (forceful contact between his back and another surface, including attempts), *property destruction* (throwing objects), and *negative vocalizations* (vocalizations above conversation level).

The TBFA (Appendix C) and the SFA (Appendix D) were divided into 2-min segments, and observers scored the presence or absence of problem behavior in each segment. Data were converted into "percentage of trials with problem behavior" by dividing the number of segments with problem behavior by the total number of trials.

The FA (Appendix E) consisted of 10-min sessions, and observers scored the frequency of problem behavior. Data were converted into "responses per min" by dividing the frequency of responses by the session duration (10 min).

Trained undergraduate or graduate students collected data. A second observer collected data during at least 33% of all trials and sessions. Reliability for the TBFA and the SFA was calculated by dividing the number of segments in which both researchers recorded either the presence or absence of target behavior in each segment by the total number of segments, and this quotient was multiplied by 100 to yield a percentage score.

Reliability for the FA was calculated by dividing the sessions into 10-s intervals. For each interval, the smaller number of recorded responses was divided by the larger; the percentage agreement for each session was calculated by determining the mean agreement across intervals, and multiplying the mean by 100. Results of IOA are shown in Table 3. The overall agreement was 98.8% during the TBFA, 96.5% during the SFA, and 97.5% during the FA.

Table 3. Interobserver agreement for TBFA, SFA, and FA.

Participants	Trial-Based	Synthesized Trial-based	Traditional
Emmanuel	100%	93%	96% (86%-100%)
Sebastian	98% (93%-100%)	100%	99% (94%-100%)

Treatment Integrity

An independent observer collected data on treatment integrity during at least 33% of trials (Appendix F, G, and H) and sessions (Appendix I). Consequence deliveries by the therapists were scored as “correct” or “incorrect.” An incorrect consequence delivery could have consisted of a) an error of commission (i.e., when a consequence was delivered when problem behavior did not occur), or b) an error of omission (i.e., when a consequence was not delivered for the occurrence of problem behavior), which included consequences delivered following the 3-s criterion. A “percentage correct” score for each session or trial was calculated by dividing the frequency of correct consequences by the sum of correct and incorrect consequence deliveries and multiplying by 100. Results of

treatment integrity are shown in Table 4. The overall treatment integrity for TBFA was 98.5%, SFA was 95.5%, and FA was 94.5%.

Table 4. Treatment integrity for TBFA, SFA, and FA.

Participants	Trial-Based	Synthesized Trial-Based	Traditional
Emmanuel	98% (75%-100%)	94% (80%-100%)	95% (86%-100%)
Sebastian	99% (75%-100%)	97% (90%-100%)	94% (83%-100%)

Procedures

Indirect Assessments. Similar to Fisher et al. (2016), we conducted the open-ended interview developed by Hanley (2012) to inform the synthesized contingencies of the SFA. Results of the Functional Analysis Screening Tool (FAST; Iwata & DeLeon, 1996) informed the development of the TBFA and FA.

A FAST (Appendix J) was conducted with a caregiver prior to the open-ended interview. The FAST is a closed-ended interview that is conducted with a caregiver to identify factors that may influence problem behavior. The interview includes 16 “yes” or “no” questions about antecedents and consequences of problem. Each question relates to one of four possible maintaining contingencies: social-positive reinforcement, social-negative reinforcement, automatic-positive reinforcement, and automatic-negative reinforcement. Scores for each contingency range from 0-4, with higher scores indicating a higher likelihood of a potential function. The FAST also includes 12 open-ended questions about the participant, the problem behavior, and situations in which the

problem behavior is most likely to occur. The results from the FAST identified potential operational definitions for the problem behavior, the antecedents that typically evoke the problem behavior, and consequences that may maintain problem behavior.

The Hanley (2012; Appendix K) open-ended interview was conducted following the FAST. The interview includes 20 questions about the participant's current abilities, their problem behavior, situations in which problem behavior is likely to occur, and others' responses to the problem behavior. The therapist often asked individualized questions to clarify or gain more information about the participants' problem behavior. The results from the Hanley interview identified operational definitions of problem behavior as well as idiosyncratic variables that may have influenced problem behavior, which aided in the identification of the combined contingencies to use in the SFA.

Preference Assessment. Prior to each FA, a multiple-stimulus-without-replacement (MSWO; DeLeon & Iwata, 1996) preference assessment was conducted to identify highly and moderately preferred items. The items were arranged in front of the participant and the participant was instructed to select one. While the participant had access to the selected item for 30 s, the therapist removed the unselected items. Following the 30 s, the unselected items were re-presented in a different order in front of the participant. The participant was again instructed to select one, and again had 30-s access to the selected item. This process continued until all of the items were selected or the participant refused to select an item. Three MSWOs were conducted with each participant.

Structured Observation. A structured observation was conducted prior to the functional analyses for Sebastian utilizing procedures similar to Fisher et al. (2016). The

purpose of the structured observation was to identify potential variables that may influence problem behavior. The observation was divided into six 4-min segments for a continuous 24-min session.

The observation began with a 4-min control segment during which Sebastian had noncontingent access to highly preferred items, attention, and escape. If problem behavior occurred during the control segment, no consequences were delivered. Following the 4-min control period, the therapist removed the highly preferred items but continued to provide noncontingent attention and escape (an EO for tangibles). The therapist delivered the highly preferred item for 20 s contingent on problem behavior or after 30 s, whichever occurred first. After the 20-s access to the preferred items, the therapist again removed the items.

Next, a second 4-min control segment was conducted (noncontingent access to highly preferred items, attention, and escape), which was followed by the therapist removing Sebastian's highly preferred item and instructing him to clean up his low-preferred toys (an EO for tangibles and escape). The therapist delivered the highly preferred items and removed the demands for 20 s contingent on problem behavior or after 30 s, whichever occurred first. After the 20-s access to preferred items and the removal of demands, the therapist again removed the items and began delivering demands.

Following the 4 min in the tangible and escape segment, a third 4-min control segment was conducted, which was followed by the therapist instructing Sebastian to clean up his toys. During this segment, Sebastian had noncontingent access to his highly preferred item (a video on a tablet) while the instructions were given. The therapist

removed the demands for 20 s contingent on problem behavior or after 30 s, whichever occurred first. After the 20-s break, the therapist again began delivering demands.

Trial-Based Functional Analysis. The TBFA was conducted using procedures similar to Bloom et al. (2011). Twenty trials were conducted for each condition. All 20 trials of a given condition were conducted back-to-back. If trials of different conditions had been interspersed or alternated, there might have been a lack of differentiation of problem behavior across conditions (e.g., a therapist from one condition may have evoked problem behavior in the control segment of another condition if she remained in the room as a data collector), and logistically it would have been difficult to switch therapists and materials after each trial with minimal time between trials.

Each trial consisted of a control segment followed by a test segment. Each segment lasted 2 min or until problem behavior occurred. Control segments consisted of noncontingent access to the putative reinforcer. If problem behavior occurred during a control segment, no consequences were delivered and the test segment began. Test segments consisted of the EO for the putative reinforcer, and problem behavior resulted in the delivery of the reinforcer. There was a programmed 5-s delay between the termination of the control segment and the initiation of the test segment to prevent adventitious punishment for problem behavior before the test segment began. In other words, if problem behavior occurred during the control segment, the therapist waited 5 s prior to initiating the test segment to avoid the removal of the reinforcer potentially acting as a punisher for the problem behavior. Following each trial, there was a programmed 1-min inter-trial interval (ITI) to reduce the likelihood of carryover of problem behavior in the test segment to the following control segment. During the ITI, the reinforcer was

available noncontingently. If problem behavior occurred during the ITI, the therapist waited an additional 30 s with no problem behavior prior to starting the next trial.

The purpose of the attention condition was to test for maintenance of problem behavior by social-positive reinforcement in the form of attention. During both of the attention segments, the participant was provided access to moderately preferred items as identified in the MSWO. During the control segment, the therapist delivered attention throughout the entire segment; if problem behavior occurred, the therapist did not deliver any programmed consequences and the segment was terminated. The test segment began when the therapist stated that she “had work to do” and turned away from the participant. If the participant engaged in problem behavior, the therapist delivered brief attention to the participant in the form of statement of concern (i.e., “it’s okay, what’s wrong?”) and the segment was terminated.

The purpose of the demand condition was to test for maintenance of problem behavior by social-negative reinforcement in the form of escape. During the control segment of the demand trial, the therapist was close enough to the participant such that the participant could reach out and engage in aggressive behavior, but the therapist was seated facing away from the participant. No items or materials were present; if problem behavior occurred, the therapist did not deliver any programmed consequences and the segment was terminated. The test segment began with the therapist delivering instructions using a three-step prompting sequence. Receptive-motor tasks (e.g., “clap your hands”, “stomp your feet”, etc.) were used with Emmanuel and Sebastian was instructed to clean up his toys (low preferred items from the MSWO into a small box). If the participant

engaged in problem behavior, the therapist stated, “Okay, you don’t have to,” and removed the demands for 30 s and the segment was terminated.

The purpose of the tangible condition was to test for maintenance of problem behavior by social-positive reinforcement in the form of access to preferred items. During the control segment, the participant had noncontingent access to highly preferred items identified by the MSWO. If problem behavior occurred, the therapist did not deliver any programmed consequences and the segment was terminated. The test segment began with the therapist removing the items from the participant. If the participant engaged in problem behavior, the therapist returned the items to the participant for 30 s and the segment was terminated.

Synthesized Trial-Based Functional Analysis. The SFA procedures were identical to the TBFA described earlier with the exception of multiple EOs and consequences in a single test condition. Contingencies in the SFA were identified in the open-ended interview (Hanley, 2012).

Results from the Hanley (2012) interview indicated that possible functions for Emmanuel’s problem behavior included attention, escape, and access to tangibles. During the control segments, Emmanuel had noncontingent access to attention and highly preferred items, and the therapist did not deliver any demands. During the test segments, Emmanuel was instructed to clean up the highly preferred items using a three-step prompting sequence; no other attention was delivered. Problem behavior in the test segment resulted in attention from the therapist, access to the items, and a 30-s break, and the segment was terminated.

Results from the interview (Hanley, 2012) indicated that possible functions for Sebastian's problem behavior included attention and access to tangibles. During the control segment, Sebastian had noncontingent access to attention and highly preferred items. During the test segments, the therapist removed the items and diverted her attention from Sebastian. Problem behavior in the test segment resulted in attention from the therapist and access to the items, and the segment was terminated.

Traditional Functional Analysis. The FA was conducted using procedures similar to those described by Iwata et al. (1982/1994). Attention, escape, tangible, and play conditions were conducted with both participants. Sessions lasted 10 min. A multielement design (Kazdin, 1982) was used in which conditions were presented in the following order: attention, escape, play, tangible. At least 12 sessions were conducted, and sessions continued until rates of problem behavior were differentiated between play and one or more test conditions.

During the attention condition, the participant had noncontingent access to moderately preferred items. The therapist began the session by stating she "had work to do" and turned away from the participant. If Emmanuel engaged in problem behavior, he received 30-s access to attention. Following the 30 s, the therapist stated she again "had work to do" again and turned away. If Sebastian engaged in problem behavior, the therapist delivered attention in the form of a brief statement of concern. All other behavior was ignored.

During the play condition, the participant had noncontingent access to highly preferred items and attention from the therapist. No demands were issued and the therapist responded to all bids for attention from the participant. In addition, the therapist

attempted to match the “energy” level of the participant (e.g., ran along with the participant if he was running, or sat quietly next to the participant if he was sitting). No consequences were delivered contingent on problem behavior.

During the tangible condition, the therapist removed highly preferred items from the participant. If problem behavior occurred, the participant received 30-s access to the preferred items. Following the 30 s, the therapist removed the preferred items.

During the escape condition, the therapist issued the same instructions as were used during the TBFA. If the participant complied, the therapist delivered brief praise. If the participant engaged in problem behavior, the therapist stated “okay, you don’t have to” and removed the demands for 30 s. Following the 30 s, the therapist re-presented the tasks.

Data Analysis. Graphs with results from each FA (with participant identifying information removed) were sent to three Master’s or Doctoral-level Board Certified Behavior Analysts (BCBA), who scored the graphs in terms of behavioral function. Scorers were blind regarding which assessments are from the same participants to minimize any biased scoring (e.g., seeing three assessment results from the same participant might increase the likelihood of scoring the same function for each of the assessments).

CHAPTER IV: RESULTS

Emmanuel

Indirect Assessments. Based upon the results from the FAST (DeLeon & Iwata, 1996), Emmanuel's caregiver indicated that the primary behavioral concerns were aggression (scratching, grabbing, pulling hair, hitting, and kicking), property destruction (throwing items), and negative vocalizations (yelling and screaming). The results from the FAST indicated possible social-positive reinforcement and social-negative reinforcement functions. In the area of social-positive reinforcement, Emmanuel scored 3 out of 4, indicating possible attention and tangible functions. In the area of social-negative reinforcement, Emmanuel score 4 out 4, indicating a possible escape function.

Based upon the results from the Hanley (2012) interview, Emmanuel's caregiver indicated that the primary behavioral concerns were aggression (e.g., scratching, grabbing, hitting, kicking, and hair pulling), property destruction (e.g., throwing objects), and negative vocalizations (e.g., yelling and screaming). Emmanuel's caregiver stated that Emmanuel typically engaged in problem behavior when his schedule was changed, when he was denied access to preferred items, and when he was instructed to complete demands. When Emmanuel engaged in problem behavior, Emmanuel's caregiver indicated that he typically soothed him (i.e., cuddling) or removed him from the area (i.e., timeout). Results from the open-ended interview suggested attention, escape, and tangible functions.

Trial-Based Functional Analysis. Figure 1 shows results from the TBFA with Emmanuel. During the attention condition, Emmanuel engaged in problem behavior in

10% of control segments and in 65% of test segments. During the escape condition, he engaged in problem behavior in 40% of control segments and in 100% of test segments. During the tangible condition, Emmanuel engaged in problem behavior in 5% of control segments and in 95% of test segments. Results from the TBFA indicated attention, escape and tangible functions, as problem behavior occurred in a larger percentage of test segments than control segments for each condition.

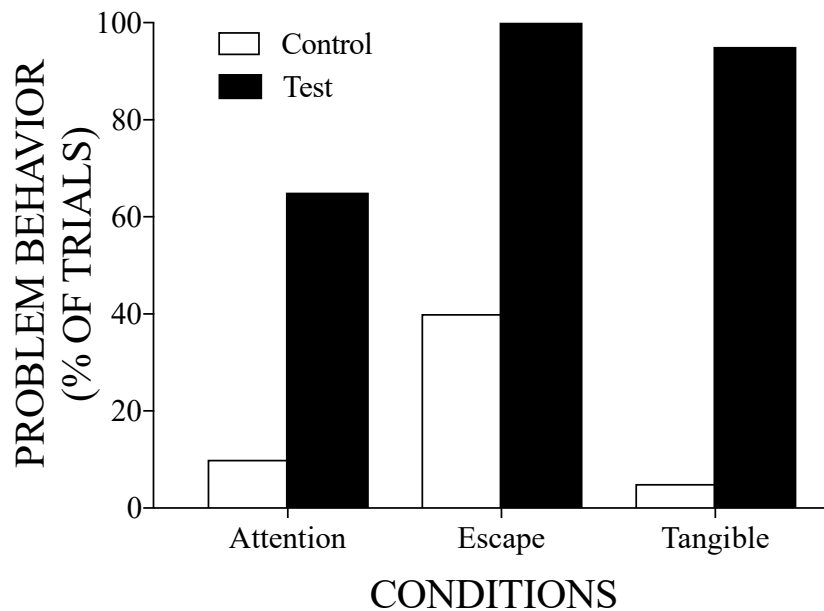


Figure 1. Results from Emmanuel's TBFA.

Synthesized Trial-Based Functional Analysis. The results of Emmanuel's SFA are shown in Figure 2. Based on the results of the Hanley (2012) interview, the combined function tested included attention, escape, and tangible contingencies. Emmanuel engaged in problem behavior in 5% of control segments and in 100% of test segments.

Results from the SFA indicated attention, escape, and tangible functions, as problem behavior in the combined test segments was elevated relative to the control segments.

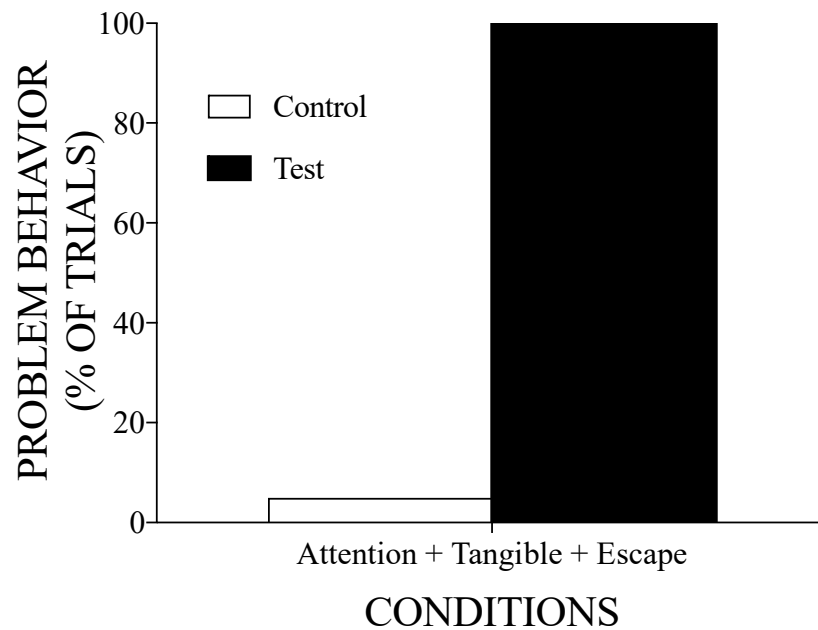


Figure 2. Results from Emmanuel's SFA.

Traditional Functional Analysis. Results of Emmanuel's FA are shown in Figure 3. Emmanuel's problem behavior was consistently higher in the tangible and escape conditions relative to play. However, problem behavior was variable during the attention condition. Therefore, we conducted a "pairwise" FA to isolate the attention condition (Iwata, Duncan, Zarcone, Lerman, & Shore, 1994), by alternating attention and play sessions. Problem behavior in the pairwise analysis was elevated in attention sessions relative to play, thus results from the FA indicated attention, escape, and tangible functions.

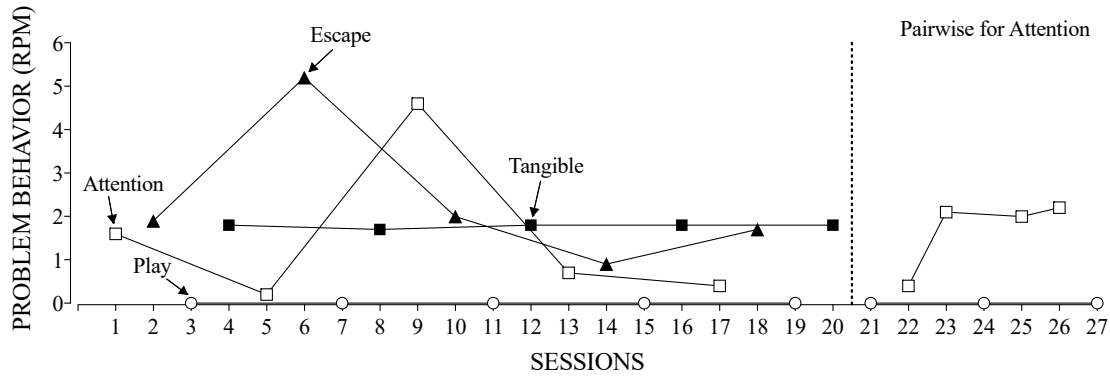


Figure 3. Results of Emmanuel's FA.

Sebastian

Indirect Assessments. Based upon the results from the FAST (DeLeon & Iwata, 1996) Sebastian's caregiver indicated that the primary behavioral concerns were property destruction (e.g., throwing objects), negative vocalizations (e.g., screaming and yelling), and flopping (e.g., forceful contact between Sebastian's back and a surface). The results of the FAST indicated possible functions in the areas of social-positive and social-negative. In the area of social-positive, Sebastian scored 3 out of 4, indicating possible attention and tangible functions. In the area of social-negative reinforcement, Sebastian scored 2 out of 4, indicating a possible escape function.

Based upon the results from the Hanley (2012) interview, Sebastian's caregiver indicated that the primary behavioral concerns were property destruction (e.g., throwing objects), negative vocalizations (e.g., screaming), and flopping (e.g., forceful contact between Sebastian's back and a surface). Sebastian's caregiver stated that he engaged in problem behavior when he did not get his way, or when he was told "no" or "wait". When Sebastian engaged in problem behavior, Sebastian's caregiver indicated that they typically yelled at him to stop, asked him what he wanted, or placed him in his room (i.e.,

timeout). Results from the open-ended interview suggested attention and tangible functions.

Structured Observation. The results of Sebastian's structured observation are shown in Figure 4. During all of the control conditions, Sebastian did not engage in any problem behavior (0%). During the tangible condition, he engaged in problem behavior on 83% of the occasions. During the synthesized tangible and escape condition, Sebastian engaged in problem behavior on every occasion (100%). However, during the escape-only condition, Sebastian did not engage in any problem behavior (0%).

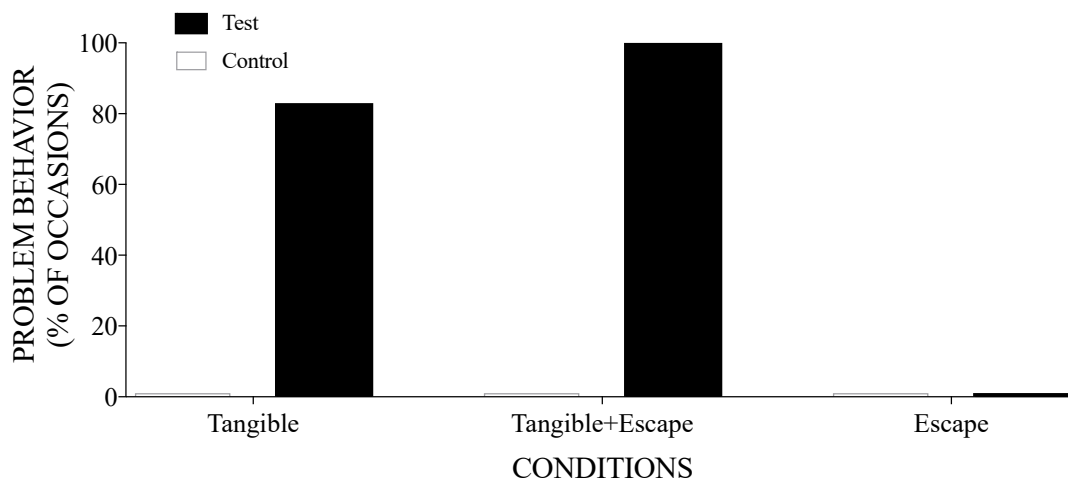


Figure 4. Results of Sebastian's Structured Observation.

Trial-Based Functional Analysis. The results of Sebastian's TBFA are shown in Figure 5. During the attention condition, Sebastian engaged in problem behavior in 55% of control segments and in 65% of the test segments. During the escape condition, he engaged in problem behavior in 30% of the control segments and in 85% of the test segments. During the tangible condition, Sebastian engaged in problem behavior in 25%

of the control segments and in 95% of the test segments. Results from the TBFA indicated escape and tangible functions, as problem behavior in the escape and tangible conditions occurred at a higher percentage in the test segments relative to the control segments.

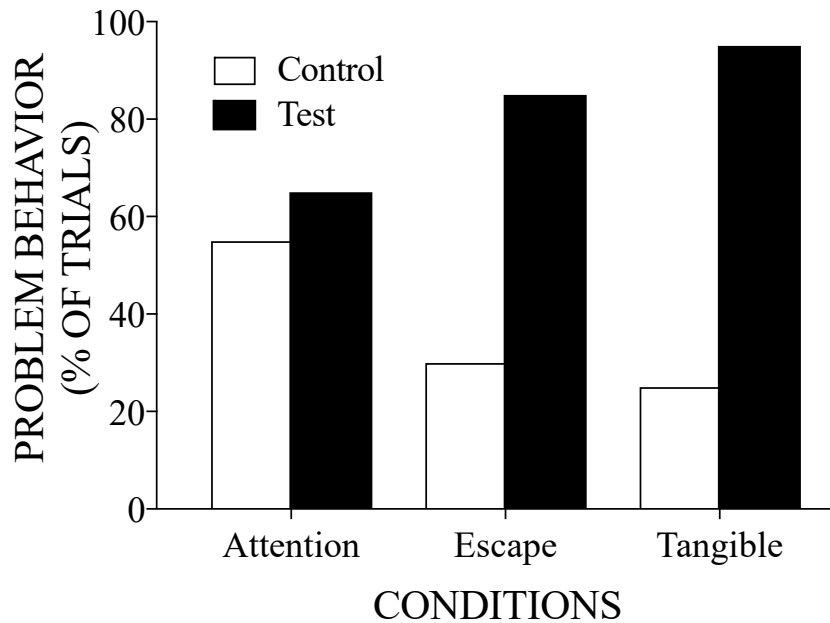


Figure 5. Results of Sebastian's TBFA.

Synthesized Trial-Based Functional Analysis. Figure 6 shows the results of Sebastian's SFA. Based on the results of the Hanley (2012) open-ended interview, the combined functions tested included attention and tangible. Sebastian engaged in problem behavior in 10% of the control segments and in 95% of the test segments. Results from the SFA indicated attention and tangible functions, as the percentage of problem behavior in test segment was higher than the percentage in the control segment.

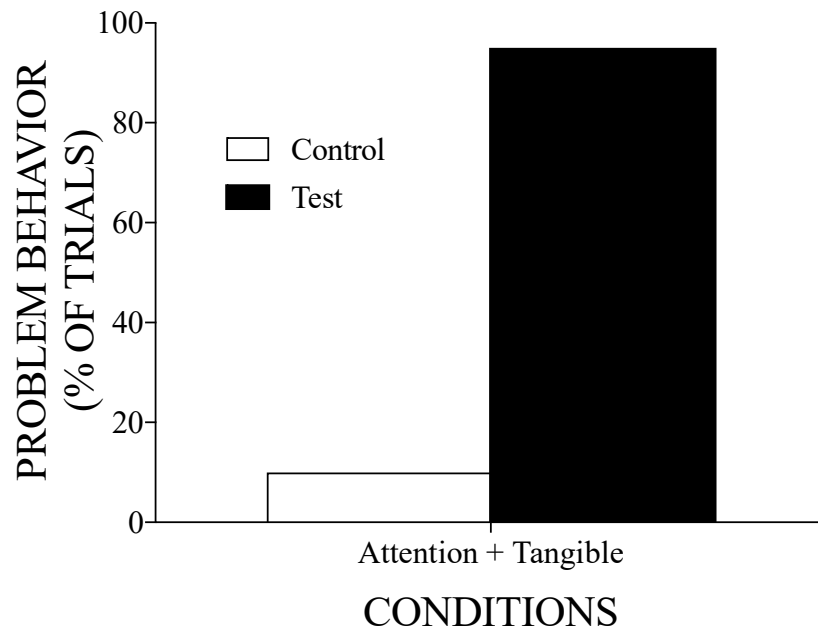


Figure 6. Results of Sebastian's SFA.

Traditional Functional Analysis. The results of Sebastian's FA are shown in Figure 7. Sebastian's problem behavior was only consistently higher in the tangible condition relative to the play condition, which indicated a tangible function. Problem behavior in the other conditions was low, with the exception of the first session of the attention condition. During this session, Sebastian was emitting negative vocalizations and attempting to open the door and leave the clinic room, which we hypothesized was evoked by an EO for escape. In subsequent attention sessions, problem behavior decreased and remained low.

Table 5 summarizes the results of all FAs for both participants. One participant (Emmanuel) had exact correspondence, while the other participant (Sebastian) had partial correspondence for the TBFA and SFA. The TBFA resulted in a false positive for escape in Sebastian, whereas the SFA resulted in a false positive for attention.

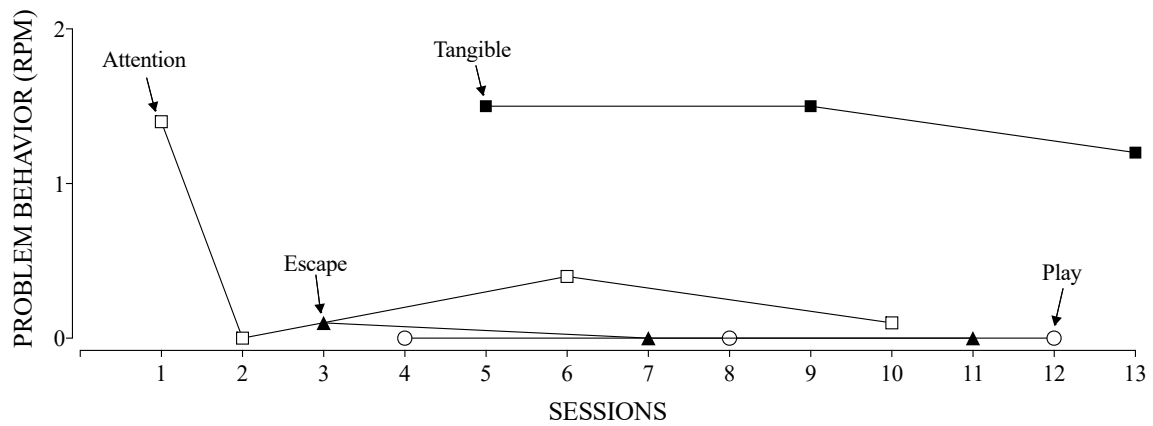


Figure 7. Results of Sebastian's FA.

Table 5. Correspondence Results of FA, TBFA, and SFA.

Participants	Degree of Correspondence	FA	Functions TBFA	SFA	TBFA Error	SFA Error
Emmanuel	Exact	Attention Escape Tangible	Attention Escape Tangible	Attention Escape Tangible	NA	NA
Sebastian	Partial	Tangible	Escape Tangible	Attention Tangible	False Positive Escape	False Positive Attention

Note: NA=not applicable. When exact correspondence was found, there was no error.

Data Analysis

The graphs from all three assessments were sent to three Master's or Doctorate-level BCBA's to examine the behavioral function for both participants. Two of the three BCBA's returned the information regarding the behavioral function identified with each graph. One of the BCBA's had exact correspondence with both participants. The other BCBA had exact correspondence with Emmanuel's function identification, however only had partial correspondence with Sebastian. The BCBA identified an attention, escape, and tangible function of Sebastian's TBFA and an attention and tangible function in the FA.

CHAPTER V: DISCUSSION

Research has indicated that children with ASD are at an increased risk to engage in problem behavior. In order to develop a successful intervention, the maintaining variables of the problem behavior must first be identified (Newcomer & Lewis, 2004). The traditional FA (i.e., the “gold standard”) has been shown to effectively identify the function of problem behavior, however, the duration of the assessment, need for clinical space, and need for trained clinicians may make the traditional format cumbersome in some situations (Hanley, 2012).

Several variations have been developed to address the shortcomings associated with the traditional format. For example, the TBFA was developed to identify the function of problem behavior in a shorter format. Research has indicated that the TBFA and the FA have had high correspondence when compared, with 12 out of 15 of the participants having exact correspondence (see Table 1; LaRue et al., 2010; Bloom et al., 2011). The synthesized-contingency FA was also developed to identify the function of problem behavior in a shorter period of time (Hanley et al., 2014). Research has indicated that the correspondence between the synthesized-contingency FA and the FA have had relatively low levels of correspondence, with only 2 out of the 12 participants having exact correspondence (Fisher et al., 2016; Slaton et al., 2017; Strohmeier et al., 2017). However, Slaton et al. (2017) and Strohmeier et al. (2017) found that the synthesized-contingency FA sometimes identified false positives (see Table 2).

The purpose of this study was to compare the results obtained from the TBFA, SFA, and FA with regards to function identification with two participants diagnosed with

ASD. The TBFA and the FA assessed the reinforcement contingencies individually (Bloom et al., 2011; Bloom et al., 2013), while the SFA assessed the reinforcement contingences simultaneously (Hanley et al., 2014; Fisher et al., 2016; Slaton et al., 2017).

The first research question that was evaluated was, “What is the degree of correspondence between results of the FA and TBFA?” LaRue et al. (2010) and Bloom et al. (2011) evaluated the correspondence between the TBFA and FA and found an overall high level of correspondence between the two. Additionally, Curtis (2017) found a partial correspondence between the TBFA and FA with a false negative for escape. The results of the present study found exact correspondence with one participant (Emmanuel) and partial correspondence with a false positive for escape with the other (Sebastian) (see Table 5 with results).

The second research question that was evaluated was, “What is the degree of correspondence between results of the FA and SFA?” Fisher et al. (2016), Slaton et al. (2017), and Strohmeier et al. (2017) evaluated the correspondence between the synthesized-contingency FA and the FA and found low levels of correspondence between the two. The SFA used in the present study also found equivocal results, in that exact correspondence occurred with one participant (Emmanuel) and partial correspondence with a false positive for attention with the other (Sebastian) (see Table 5 with results). Additionally, Curtis (2017) found an exact correspondence between the SFA and FA.

The third research question that was evaluated was, “Does the synthesized format reduce false negatives relative to TBFA?” LaRue et al. (2010) and Bloom et al. (2011) concluded that the TBFA format may results in false positives for attention and tangible and false negatives for escape. Additionally, Curtis (2017) identified a false negative for

escape in the TBFA and the SFA identified exact correspondence. Therefore, the synthesized format reduced the false-negatives for escape during the TBFA. Since the TBFA did not result in a false negative in the current study, this question does not apply.

Implications and Future Research

The results of this study indicated the SFA should not be used as a replacement for the TBFA or FA. Though, the SFA did not show exact correspondence with the traditional FA, this may still be beneficial in an applied setting. The synthesized format of FA may better reflect the variables maintaining the problem behavior in the participant's daily life (Hanley et al. 2014). For example, when a caregiver removes preferred items (tangible) they also typically ask the child to engage in another activity (escape). This type of situation also occurs in the classroom, where TBFAs are typically conducted (Bloom et al., 2011). Combining the TBFA and the synthesized-contingency FA, the SFA may better reflect situations outside of the clinical setting, while allowing trials to be conducted as they would naturally occur.

Future research is needed in the field of ABA regarding the SFA. The SFA methods should be conducted in an applied setting, such as a classroom, to identify the effectiveness of the assessment with regards to more natural opportunities that may occur throughout the day (e.g., having the students clean up their preferred activities from a break and starting an academic period). To further evaluate the effectiveness of the SFA, treatment should also be evaluated in future research. Treatment for the functions identified in both the SFA and FA should be compared and analyzed to evaluate the function identification of both FAs.

Limitations

There are some limitations of the current study. The first limitation was that this study was conducted in a clinical setting. The TBFA's were developed to implement in a more natural setting such as in classrooms (Bloom et al., 2011). This study was implemented in a university-based clinic room to reduce the risk of background variability and have more environmental control over the trials/sessions. The behaviors that occurred in the clinical setting may not have reflected what occurs in the natural setting.

A related limitation is that the trials were contrived rather than occurring naturally. Another major aspect of the trial-based format is that it can be conducted as the opportunity occurs (Bloom et al, 2011). In this study, the trials were conducted back-to-back in a contrived format since the opportunities to conduct the trials would not occur naturally in the clinical setting.

A third limitation is that treatment data are not reported as part of the current study due to time constraints. The results indicated the participant's functions, however the treatment is not included to further validate the function identification.

The fourth limitation was that there were only two participants. With only two participants in the study, and with the data between the two participants being variable, additional participants would be necessary to conclude the effectiveness of the SFA format.

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APPENDICES

Appendix A: IRB Approval

To: Megan Boyle
Counseling Ldrshp & Special Ed

RE: Notice of IRB Approval
Submission Type: Initial
Study #: IRB-FY2017-459
Study Title: Comparison of Trial-Based, Synthesized-Trial-Based, and Traditional
Functional Analyses
Decision: Approved

Approval Date: Jan 24, 2017
Expiration Date: Jan 24, 2018

This submission has been approved by the Missouri State University Institutional Review Board (IRB) for the period indicated.

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects or others occur it must be reported immediately to the IRB.

This study was reviewed in accordance with federal regulations governing human subjects research, including those found at 45 CFR 46 (Common Rule), 45 CFR 164 (HIPAA), 21 CFR 50 & 56 (FDA), and 40 CFR 26 (EPA), where applicable.

Researchers Associated with this Project:

PI: Megan Boyle

Co-PI:

Primary Contact: Megan Boyle

Other Investigators: Linda Garrison-Kane, Reesha Adamson, Kaitlin Curtis, Kara Forck

Appendix B: Informed Consent

CONSENT FOR PARTICIPATION

A Comparison of Traditional, Trial-Based, and Synthesized Trial-Based Functional Analyses

Dr. Megan Boyle, Kaitlin Curtis, & Kara Forck

Introduction

Before you agree to participate in this study, it is important that you read and understand the following explanation of the procedures involved. The principal investigator, Dr. Megan Boyle, will also explain the project to you in detail. If you have any questions about the study now or in the future, please do not hesitate to contact Dr. Boyle by phone (417-836-4140) or via email MeganBoyle@MissouriState.edu.

To provide consent for your child to participate, you will need to sign this. Taking part in this study is entirely your choice, and you may withdraw your consent at any time. If you decide to stop, you do not have to provide a reason, and there will be no negative consequences for ending your participation.

Purpose of this Study

The purpose of this study is to compare three methods of assessing problem behavior (traditional, trial-based, and synthesized trial-based functional analyses) with children diagnosed with autism spectrum disorders. Specifically, we are interested in the extent to which the three methods of assessment produce the same results.

Description of Procedures

Prior to the start of the assessments, you will be asked to answer questions about your child's behavior to be assessed in the functional analyses. Your child will then attend weekly sessions (one visit per week) which will last up to 2.5 hours. Total time spent in the study (prior to treatment sessions) will range from 5-20 hours, with exact time based on how consistent your child's problem behavior is. Sessions will be conducted in a clinic room equipped with a one-way observation window at a Missouri State University office building. You will have the opportunity observe all sessions and Dr. Boyle will be available to answer any questions while sessions are conducted. Your child will participate in preference assessments to identify preferred items, functional analyses to determine the functions or reasons why problem behavior is occurring, and treatment sessions in order to identify methods to improve your child's behavior.

What are the risks?

Your child may experience emotional discomfort during functional analysis and treatment sessions, as the functional analysis is designed to encourage problematic

behavior, and treatment will entail the withholding of reinforcement for problem behavior. Due to the nature of your child's behavior (aggression, property destruction, self-injury, etc.), there is a possibility of physical injury. We will take precautions during assessment and treatment by conducting sessions in a clinic room with padded floors. Therapists will block any of your child's attempts to bite him or herself, or to make forceful contact between his or her head and the wall. Sessions will be terminated if problem behavior occurs so frequently that therapists are unable to prevent injury.

What are the benefits?

Following this study, we will conduct a reinforcement-based treatment evaluation with your child using results from the traditional functional analysis. The treatment evaluation will continue until problem behavior has been reduced by at least 80%. Caregivers will then be trained on how to implement the intervention in the participants' homes.

Results of this study will also benefit the field of Applied Behavior Analysis by contributing to its technology of assessing problem behavior.

How will my privacy be protected?

The results of this study are confidential and only the investigators will have access to the information which will be kept in a locked facility at the University. A pseudonym will be used in place of your child's name. Personal identifying information will not be used in any published reports of this research. Data collected in the study (with no identifying information) will be kept indefinitely for dissemination purposes (in publications or at conferences). Data with identifying information will be destroyed within six months following completion of the study (for each participant).

Consent to Participate

If you would like your child to participate in this study you are asked to sign below, confirming that you agree with the following:

"I have read and understand the information in this form. I have been encouraged to ask questions and all of my questions have been answered to my satisfaction. By signing this form, I agree voluntarily to allow my child to participate in this study. I further understand that audiotaping and/or videotaping of activities that include my child may be conducted, and that these materials will only be used to supplement data collection for the current study (e.g., if in-person data collectors are unavailable for sessions). I may also consent for video to be utilized following the study for training purposes or at conference presentations, but this is *not* a requirement of the study. I know that I can withdraw from the study at any time. I have received a copy of this form for my own records."

Check the corresponding statement to indicate your consent for video for training and conference purposes.

_____ Yes, I also consent for videos of my child to be used for training and conference purposes.

_____ No, I do *not* consent for videos of my child to be used for training and conference purposes.

Parent/Guardian Signature

Date

Printed Name of Participant

Signature of Person Obtaining Consent

Date

Appendix C: TBFA Data Sheet

Trial-Based FA Data Sheet

Client: _____ Failed Trials: _____ Primary/Reli _____ Target BX: _____
 Condition: _____

Date	Obs.	Control	Test	TH	TX I?	Date	Obs.	Control	Test	TH	TX I?

Condition: _____

Date	Obs.	Control	Test	TH	TX I?	Date	Obs.	Control	Test	TH	TX I?

Condition: _____

Date	Obs.	Control	Test	TH	TX I?	Date	Obs.	Control	Test	TH	TX I?

[illegible]

Appendix E: FA Data Sheet

Generic Session Data Sheet

Client:

Therapist:

Date:

Data Collector(s):

Session Duration:

Intervals (Y/N):

Response 1:

Response 2:

Response 3:

Sessions & Descriptions	R1	R2	R3
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Appendix F: TBFA Treatment Integrity

Control Condition: Attention

Steps	Correct/Incorrect/NA
Provides attention throughout	
Provides moderately preferred items	
Does not provide demands	
Does not provide consequences for problem behavior	
Ends segment when problem behavior occurs or 2 min	

Test Condition: Attention

Steps	Correct/Incorrect/NA
Turns away from the student	
States "I have some work to do"	
Ignore all behavior besides the targeted behaviors	
Turns toward students and makes delivers brief attention	
Ends segment when problem behavior occurs or 2 min	
1 min inter-trial prior to next trial	

Control Condition: Tangible

Steps	Correct/Incorrect/NA
Provides highly preferred items	
Does not provide demands	
Does not provide consequences for problem behavior	
Ends segment when problem behavior occurs or 2 min	

Test Condition: Tangible

Steps	Correct/Incorrect/NA
Remove the highly preferred items	
Ignore all behavior besides the targeted behaviors	
Return preferred items contingent on problem behavior	
Ends segment when problem behavior occurs or 2 min	
1 min inter-trial prior to next trial	

Control Condition: Escape

Steps	Correct/Incorrect/NA
Does not provide preferred items	
Does not provide demands	
Does not deliver attention	
Does not provide consequences for problem behavior	
Ends segment when problem behavior occurs or 2 min	

Test Condition: Escape

Steps	Correct/Incorrect/NA
States a receptive motor/clean up task	
Uses 3 step prompting sequence	
Ignore all behavior besides the targeted behaviors	
Remove the demands contingent on problem behavior	
Ends segment when problem behavior occurs or 2 min	
1 min inter-trial prior to next trial	

Appendix G: SFA Treatment Integrity (Emmanuel)

Control Condition: Attention + Tangible + Escape

Steps	Correct/Incorrect/NA
Provides attention throughout	
Provides highly preferred items	
Does not provide demands	
Does not provide consequences for problem behavior	
Ends segment when problem behavior occurs or 2 min	

Test Condition: Attention + Tangible + Escape

Steps	Correct/Incorrect/NA
States "Clean up your toys"	
Uses three-step prompting sequence	
Ignore all behavior besides the targeted behaviors	
Return preferred item, attention, and removes demands contingent on problem behavior	
Ends segment when problem behavior occurs or 2 min	
1 min inter-trial interval prior to next trial	

Appendix H: SFA Treatment Integrity (Sebastian)

Control Condition: Attention + Tangible

Steps	Correct/Incorrect/NA
Provides attention throughout	
Provides highly preferred items	
Does not provide demands	
Does not provide consequences for problem behavior	
Ends segment when problem behavior occurs or 2 min	

Test Condition: Attention + Tangible

Steps	Correct/Incorrect/NA
Removes highly preferred	
Turns away from the subject	
States "It's my turn now"	
Ignore all behavior besides the targeted behaviors	
Return preferred item and attention contingent on problem behavior	
Ends segment when problem behavior occurs or 2 min	
1 min inter-trial interval prior to next trial	

Appendix I: FA Treatment Integrity

Attention

Steps	Correct	Incorrect (C or O)
States "I have some work to do"		
Ignores all behavior besides the targeted behavior		
Provides brief reprimand/statement of concern contingent on problem behavior Or 30s access to attention (<i>For Emmanuel only</i>)		
Diverts attention after 30 s (<i>For Emmanuel only</i>)		

Escape

Steps	Correct	Incorrect (C or O)
Delivers demands		
Ignores all behavior besides the targeted behavior		
States “Okay you don’t have to” contingent on problem behavior		
Turns away from subject contingent on problem behavior		
Delivers demands after 30s		

Tangible

Steps	Correct	Incorrect (C or O)
Removes highly preferred item and states "It's my turn"		
Ignores all behavior besides the targeted behavior		
States "Okay you can have it" contingent on problem behavior		
Gives highly preferred back contingent on problem behavior		
Removes highly preferred after 30s		

Play

Steps	Correct	Incorrect (C or O)
Provides attention		
Provides highly preferred items		
Does not deliver demands		
No consequences were delivered contingent on problem behavior		

Appendix J: FAST Interview

FAST

Functional Analysis Screening Tool

Client: _____ Date: _____

Informant: _____ Interviewer: _____

To the Interviewer: The FAST identifies factors that may influence problem behaviors. Use it only for screening as part of a comprehensive functional analysis of the behavior. Administer the FAST to several individuals who interact with the client frequently. Then use the results to guide direct observation in several different situations to verify suspected behavioral functions and to identify other factors that may influence the problem behavior.

To the Informant: Complete the sections below. Then read each question carefully and answer it by circling "Yes" or "No." If you are uncertain about an answer, circle "N/A."

Informant-Client Relationship

1. Indicate your relationship to the person: ☐ Parent ☐ Instructor
☐ Therapist/Residential Staff ☐ (Other)
2. How long have you known the person? ☐ Years ☐ Months
3. Do you interact with the person daily? ☐ Yes ☐ No
4. In what situations do you usually interact with the person?
☐ Meals ☐ Academic training
☐ Leisure ☐ Work or vocational training
☐ Self-care ☐ (Other)

Problem Behavior Information

1. Problem behavior (check and describe):
☐ Aggression _____
☐ Self-Injury _____
☐ Stereotypy _____
☐ Property destruction _____
☐ Other _____
2. Frequency: ☐ Hourly ☐ Daily ☐ Weekly ☐ Less often
3. Severity: ☐ Mild: Disruptive but little risk to property or health
☐ Moderate: Property damage or minor injury
☐ Severe: Significant threat to health or safety
4. Situations in which the problem behavior is most likely to occur:
Days/Times _____
Settings/Activities _____
Persons present _____
5. Situations in which the problem behavior is least likely to occur:
Days/Times _____
Settings/Activities _____
Persons present _____
6. What is usually happening to the person right before the problem behavior occurs?

7. What usually happens to the person right after the problem behavior occurs?

8. Current treatments _____

- | | |
|--|------------|
| 1. Does the problem behavior occur when the person is not receiving attention or when caregivers are paying attention to someone else? | Yes No N/A |
| 2. Does the problem behavior occur when the person's requests for preferred items or activities are denied or when these are taken away? | Yes No N/A |
| 3. When the problem behavior occurs, do caregivers usually try to calm the person down or involve the person in preferred activities? | Yes No N/A |
| 4. Is the person usually well behaved when (s)he is getting lots of attention or when preferred activities are freely available? | Yes No N/A |
| 5. Does the person usually fuss or resist when (s)he is asked to perform a task or to participate in activities? | Yes No N/A |
| 6. Does the problem behavior occur when the person is asked to perform a task or to participate in activities? | Yes No N/A |
| 7. If the problem behavior occurs while tasks are being presented, is the person usually given a "break" from tasks? | Yes No N/A |
| 8. Is the person usually well behaved when (s)he is not required to do anything? | Yes No N/A |
| 9. Does the problem behavior occur even when no one is nearby or watching? | Yes No N/A |
| 10. Does the person engage in the problem behavior even when leisure activities are available? | Yes No N/A |
| 11. Does the problem behavior appear to be a form of "self-stimulation?" | Yes No N/A |
| 12. Is the problem behavior <u>less</u> likely to occur when sensory stimulating activities are presented? | Yes No N/A |
| 13. Is the problem behavior cyclical, occurring for several days and then stopping? | Yes No N/A |
| 14. Does the person have recurring painful conditions such as ear infections or allergies? If so, list: _____ | Yes No N/A |
| 15. Is the problem behavior <u>more</u> likely to occur when the person is ill? | Yes No N/A |
| 16. If the person is experiencing physical problems, and these are treated, does the problem behavior usually go away? | Yes No N/A |

Scoring Summary

Circle the number of each question that was answered "Yes" and enter the number of items that were circled in the "Total" column.

Items Circled "Yes"	Total	Potential Source of Reinforcement
1 2 3 4	_____	Social (attention/preferred items)
5 6 7 8	_____	Social (escape from tasks/activities)
9 10 11 12	_____	Automatic (sensory stimulation)
13 14 15 16	_____	Automatic (pain attenuation)

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Appendix K: Hanley Interview

Client's Name: _____ DOB: _____

Interviewee: _____ Relationship to Client: _____

Interviewer: _____ Date of Interview: _____

Problem Behavior: Definitions and Priorities

1. What are the top 2 concerning behaviors, in order of importance and what do they look like?
2. Describe the intensity of the problem behavior(s)? Is s/he or anyone else likely to get hurt? Is property likely to be destroyed?
3. When problem behavior occurs, do multiple behaviors occur together in clusters (e.g., yelling while also hitting and swiping items off surfaces)?
4. Do specific low-level problem behaviors typically precede other problem behavior (e.g., yelling comes just before hitting or throwing items)?

Antecedent Conditions

1. In what situations is the problem behavior most likely to occur (e.g., activities, situations)?
2. What seems to trigger problem behavior?

3. Does problem behavior occur when you break routines or interrupt activities? If so, describe.

4. Does problem behavior occur when he/she does not get his/her way? If so, describe the things that the child attempts to control.

Reactions & Consequences

1. How do you and others react to the problem behavior?

2. What do you and others do to calm him/her down once problem behavior has started?

3. What do you and others do to distract him/her from engaging in problem behavior?

4. What do you think he/she is trying to communicate with his/her problem behavior?

5. Do you think problem behavior is form of self-stimulation?

6. Why do you think he/she engages in problem behavior?