AN ANALYSIS OF LATENCY AS THE DEPENDENT VARIABLE IN TRIAL-BASED FUNCTIONAL ANALYSES

by

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ABSTRACT

Latency as a Dependent Variable in Trial-Based Functional Analysis

by

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Problem behavior can interfere with teaching and learning. Developing interventions for problem behavior may be more efficient when the function of problem behavior is known. A variety of functional analysis (FA) methods have been developed to provide information on the variables maintaining problem behavior. Unfortunately most of the current adaptations of the FA are not always feasible for classroom teachers, or suited to a typical school day. The trial-based FA is an adaptation that increases the accessibility of FA in educational settings, but typically relies on occurrence measures. The use of latency as a measure may improve the sensitivity of the trial-based FA. This study extends the literature on adaptations to the functional analysis, specifically for use in the classroom, by using latency as a measure of response strength in the trial-based FA.

(92 pages)
Public Abstract

An Analysis of Latency as the Dependent Variable in Trial-Based Functional Analyses

By

Elizabeth Dayton

The following research project consisted of two parts. The first was a data analysis of previously collected data. The second was conducted in local public schools at no cost to the teachers, students, or schools. Many individuals with disabilities engage in aberrant behaviors that negatively affect their lives and the lives of those around them. The following research paper examined a tool currently being used in schools (trial-based functional analysis; FA) to determine its effectiveness at identifying the function of an individual’s behavior.

The trial-based FA is an assessment tool that is accessible to classroom teachers to help them identify the function of the problem behavior. However, it does not always identify every function that other more established assessment tools may (functional analysis; FA). This research project looked at the use of different measurements (latency) and graphing conventions that may increase the correspondence between the trial-based FA and FA.

By more accurately identifying the function of problem behavior, teachers will be able to use an effective tool that will guide their decisions in treatment. In turn this will allow teachers to spend less time managing behaviors and more time providing a meaningful education to the individuals in their classroom.
<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>PUBLIC ABSTRACT</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td>ASSESSMENT OF PROBLEM BEHAVIOR IN SCHOOLS</td>
<td>1</td>
</tr>
<tr>
<td>LATENCY AS A MEASURE</td>
<td>8</td>
</tr>
<tr>
<td>GENERAL METHODS</td>
<td>12</td>
</tr>
<tr>
<td>EXPERIMENT 1</td>
<td>13</td>
</tr>
<tr>
<td>Subjects</td>
<td>13</td>
</tr>
<tr>
<td>Training</td>
<td>13</td>
</tr>
<tr>
<td>Dependent Variable</td>
<td>15</td>
</tr>
<tr>
<td>Data Analysis and Interpretation</td>
<td>16</td>
</tr>
<tr>
<td>Reliability</td>
<td>17</td>
</tr>
<tr>
<td>EXPERIMENT 2</td>
<td>18</td>
</tr>
<tr>
<td>Subjects and Settings</td>
<td>18</td>
</tr>
<tr>
<td>Response Definition</td>
<td>19</td>
</tr>
<tr>
<td>Reliability</td>
<td>20</td>
</tr>
<tr>
<td>Social Validity</td>
<td>21</td>
</tr>
<tr>
<td>Trial-based FA</td>
<td>22</td>
</tr>
<tr>
<td>Latency FA</td>
<td>26</td>
</tr>
<tr>
<td>Standard Functional Analysis</td>
<td>28</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>28</td>
</tr>
<tr>
<td>RESULTS</td>
<td>30</td>
</tr>
<tr>
<td>Experiment 1</td>
<td>30</td>
</tr>
<tr>
<td>Experiment 2</td>
<td>61</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td>66</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>74</td>
</tr>
</tbody>
</table>
APPENDICES ................................................................................................................................. 77

APPENDIX A .................................................................................................................................. 78

APPENDIX B .................................................................................................................................. 80

APPENDIX C .................................................................................................................................. 83
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data Analysis Team Members</td>
</tr>
<tr>
<td>2</td>
<td>Correspondence by Graphing Convention</td>
</tr>
<tr>
<td>3</td>
<td>Function Detected Correctly</td>
</tr>
<tr>
<td>4</td>
<td>Function Detected Incorrectly</td>
</tr>
<tr>
<td>5</td>
<td>False Positives/False Negatives</td>
</tr>
<tr>
<td>6</td>
<td>Correspondence Cases</td>
</tr>
<tr>
<td>7</td>
<td>Non-Correspondence Cases</td>
</tr>
<tr>
<td>8</td>
<td>Correspondence Analysis</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Travis</td>
<td>35</td>
</tr>
<tr>
<td>2 Barstow (a)</td>
<td>36</td>
</tr>
<tr>
<td>3 Barstow (b)</td>
<td>38</td>
</tr>
<tr>
<td>4 Sandra</td>
<td>39</td>
</tr>
<tr>
<td>5 Andy</td>
<td>40</td>
</tr>
<tr>
<td>6 Allen</td>
<td>42</td>
</tr>
<tr>
<td>7 Liv</td>
<td>43</td>
</tr>
<tr>
<td>8 Rachel</td>
<td>44</td>
</tr>
<tr>
<td>9 Amanda</td>
<td>45</td>
</tr>
<tr>
<td>10 Conrad</td>
<td>47</td>
</tr>
<tr>
<td>11 Ryan</td>
<td>48</td>
</tr>
<tr>
<td>12 Danny</td>
<td>50</td>
</tr>
<tr>
<td>13 Cyrus</td>
<td>51</td>
</tr>
<tr>
<td>14 Cornelius</td>
<td>53</td>
</tr>
<tr>
<td>15 Sammy</td>
<td>54</td>
</tr>
<tr>
<td>16 Ethan</td>
<td>56</td>
</tr>
<tr>
<td>17 Jonas</td>
<td>58</td>
</tr>
<tr>
<td>18 Pam</td>
<td>59</td>
</tr>
<tr>
<td>19 Brandon</td>
<td>60</td>
</tr>
<tr>
<td>20 Allison</td>
<td>62</td>
</tr>
<tr>
<td>21 Barry</td>
<td>63</td>
</tr>
</tbody>
</table>
Individuals with disabilities often engage in aberrant behavior that negatively affects their lives or the lives of those around them (Kates-McElrath & Axelrod, 2008; Meador & Osborn, 1992). Pastor, Reuben and Loeb reported that about 10% of school-aged children have some emotional or behavioral difficulty (2009). Approximately 6.9% of children with disabilities being served in special education engage in problem behavior (Lewit & Schuurmann Baker, 1996). Given this prevalence, many teachers face the difficulties that come with providing an appropriate education for children with problem behavior.

Problem behavior impacts many aspects of the classroom including social interactions with peers, academic achievement and safety (Crone & Horner, 2003). Unfortunately, many of the interventions used in schools are time consuming, not effective, and/or punishment-based (Crone & Horner, 2003; Kates-McElrath & Axelrod, 2008). This may be because many interventions are not developed based on the function of problem behavior. However, if the function of the problem behavior can be identified and incorporated into the intervention design, the effectiveness of reinforcement-based interventions may be improved.

Identifying the function of problem behavior before developing an intervention greatly increases the effectiveness of the intervention (Horner, 2003). Knowing the function allows the teacher to manipulate the antecedents and consequences that are maintaining problem behavior. The current contingencies can then be eliminated and/or the problem behaviors can be replaced with competing alternative behaviors (Iwata & Dozier, 2008; Iwata, Vollmer, & Zarcone, 1990). Identifying the maintaining
consequences before intervention can prevent implementing treatments that would inadvertently strengthen problem behavior or prove ineffective (Iwata et al., 1990).

Functional behavior assessments (FBA) are used to identify the function of problem behavior. For a complete discussion on the advantages and disadvantages of various types of FBAs, see Iwata and Dozier (2008). In summary, Iwata and Dozier stated that indirect methods (e.g. rating scales, questionnaires) are easy to conduct but are subjective, and therefore, potentially unreliable. Direct methods (descriptive analyses, functional analyses) represent an improvement because the behavior is actually observed. However, descriptive analyses (e.g. scatterplot, ABC charts) only hypothesize the function of the problem behavior by identifying antecedent events.

Descriptive analyses are conducted in the natural setting, an inherently uncontrolled environment. Therefore, the target behavior is generally followed by one or several consequences that may or may not be functional reinforcers. This is often the case in the classroom because attention is often the most frequent consequence delivered (Iwata & Dozier, 2008), but it is not always the reinforcer. For example, if someone were to conduct a descriptive analysis on sneezing, they would find that the most common consequence was someone saying, “bless you” but that it is unlikely that sneezing is actually maintained by gaining access to “bless you.” The descriptive analysis may identify the antecedents that frequently precede and follow behavior (i.e. correlational relationships) but the descriptive analysis does not demonstrate functional relationships.

In contrast to descriptive analyses, functional analyses (FA; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994) experimentally demonstrate the function of the behavior by providing specific consequences (e.g., positive/negative reinforcement) for
behavior. FAs set up conditions to test possible sources of reinforcement to identify the variables that are maintaining problem behavior. Thus, the effects of these environmental influences on problem behavior may be measured. This approach makes FAs superior to other forms of FBAs because it allows for demonstration of causal relationships between problem behavior and environmental determinants.

Iwata et al. (1982/1994) conducted a FA with nine subjects with developmental disabilities that engaged in a variety of self-injurious behavior (e.g. hair pulling, head banging, self-biting). Sessions were 15 min and alternated between four conditions: social disapproval, academic demands, play, and alone. Each test condition tests for sensitivity to a particular type of reinforcer by only providing the putative reinforcer (i.e. attention, a break from tasks) contingent upon problem behavior, and then the levels of problem behavior in the various test conditions are compared to the levels of problem behavior in the play condition (control condition). The social disapproval condition tests for social positive reinforcement, the academic demands condition tests for social negative reinforcement, and the ignore condition tests for automatic reinforcement. If the behavior is maintained by automatic reinforcement the behavior will persist in the absence of social consequences.

The FA is a powerful approach to FBA because it isolates the possible controlling variables for problem behavior and allows the behavior analyst to identify the function of problem behavior. FAs have been used with a variety of populations, targeting an assortment of problem behaviors in diverse settings over the past few decades (Hanley, Iwata, & McCord, 2003). However, FAs are not always feasible because of restricted resources (e.g. trained staff, and limited access to controlled environments) or other
challenges such as time requirements and severe or dangerous problem behaviors. Many adaptations to the FA have been developed to address these limitations.

Two such modifications include the brief FA (Derby et al., 1992; Northup et al., 1991) and FA of precursor behavior (Smith & Churchill, 2002). The brief FA allows the assessment to be conducted in a 90-min period by decreasing session durations from 15 min to 5 min and only conducting one series of sessions, followed by a brief contingency reversal phase using only the conditions in which the highest and lowest levels of behavior were observed. Whereas the FA of precursor behavior limits (or eliminates) the occurrences of dangerous behavior by reinforcing behavior that reliably precede the target behavior, rather than the target behavior itself, thus potentially eliminating the establishing operation (EO; Michael, 1993) for a particular reinforcer prior to the occurrence of the most dangerous topographies of problem behavior.

Although useful, neither of these adaptations is likely to improve the accessibility of the FA in public school settings. The brief FA can be conducted in a shorter amount of time but the consecutive number of hours (i.e. the total time) required for a teacher is still unrealistic, given other concurrent demands on their time, without at least support from the school administration or the use of another teacher or staff member to supervise the other students in the class during the brief FA. The precursor FA limits the potential increased risk of dangerous behavior but does not diminish the time requirement or the complexity, leaving it potentially unfeasible in the classroom as well.

Two additional adaptations that directly relate to the current study and will be discussed in greater detail below are the trial-based FA and the latency FA. The trial-based FA (Bloom, Iwata, Fritz, Roscoe, & Carreau, 2011; Sigafoos & Saggers, 1995)
improves the accessibility of the FA in public school settings by embedding trials throughout the regular classroom routine (rather than conducting a block of sessions), which in turn makes the time requirement more feasible (by breaking it up) and eliminates the necessity of a controlled setting. The risk from dangerous behavior is also decreased as compared to the standard FA because trials are terminated after the first occurrence of problem behavior.

Bloom et al. (2011) conducted the trial-based FA in the typical classroom, embedding trials in regular classroom routines for 10 subjects. Each trial consisted of a 2-min control followed by a 2-min test and another 2-min control. During the control segment the potential reinforcer for that condition was delivered non-contingently. For example in the control for the attention condition, attention was delivered for the duration of that segment. When the test segment began, the potential reinforcer was removed or terminated and only delivered contingent on problem behavior. Specifically, in the attention condition, once the test segment began the teacher turned away from the subject and only provided brief attention (10 s) contingent upon the first instance of the subject engaging in problem behavior. Segments were terminated after the first occurrence of problem behavior or continued for the full 2-min period if no problem behavior occurred. Ignore trials continued for the full 4-min period (2 min and 2 min) regardless of the occurrence of problem behavior. The researcher recorded data on the occurrence of problem behavior and data were presented as percentage of trials with problem behavior. The function of problem behavior was determined by comparing the first test segment to the control segment for each of the conditions.
Bloom et al. compared the outcomes from the trial-based FAs to the outcomes of a subsequent standard FA and the functions matched in 60% of the subjects. Although this FA adaptation was useful in the classroom, the utility of the trial-based FA may be limited by the measurement used. Problem behavior was calculated as percentage of trials in which problem behavior occurred, which may have provided limited information.

The limited correspondence between the trial-based FA and standard FA may be a result of the procedures, the graphing convention, or the measurement used. The procedures may be limited because trials are conducted in the classroom (uncontrolled setting) or perhaps the segments and trials are not long enough to set up EOs or finally because there isn’t enough exposure to the contingencies.

The other possibilities for poor correspondence between the trial-based and standard FA is the way the data is analyzed or the measurement used. Catania (1973) suggests that responding is not one-dimensional, and expanding our examination of a response to other measures may offer additional conclusions. The derived conclusions in the study by Bloom et al. (2011) may be a result of the measurement or graphing convention used and may not provide a complete picture of the behavior.

Although latency data was collected for the trial-based FAs, only occurrence data was displayed. Therefore displaying the data using latency may increase correspondence. Using latency in the trial-based FA may provide additional information that will increase the assessment’s utility. The methods in the trial-based FA are identical regardless of the measure (latency, occurrence) recorded and/or analyzed.

Thomason-Sassi, Iwata, Neidert, and Roscoe (2011) conducted FAs using latency as the dependent variable. Similar to the trial-based FA, the latency FA uses latency as
the dependent variable. Additionally, the procedures in the latency FA are adapted from
the standard FA specifically for the use of latency. Thomason-Sassi et al. used latency
from the start of the session to the first occurrence of problem behavior instead of rate of
behavior or percentage of intervals with problem behavior, substantially limiting the
number of times the subject engaged in the problem behavior. They compared the results
of the latency FA to a standard FA and found that for nine of the 10 subjects, the function
of problem behavior identified by the latency FA corresponded with the function of
problem behavior identified by the standard FA. This high degree of correspondence
supports the possibility of using latency in place of the traditional measures (i.e. rate or
percentage of intervals/trials in which the behavior occurred) of problem behavior.
LATENCY AS A MEASURE

Focusing solely on a specific dimension or measure for a behavior can limit the interpretation and findings. Catania (1973) stated that “a weak correlation also suggests that other behavioral factors may be operating, or that the relation involves other dimensions of responding than those along which the correlation was determined” (p. 109). In other words, looking at data by just one measurement may limit the outcomes and if the results were not the expected results it may be a result of the way the data were measured and/or analyzed and not directly related to what is actually occurring.

The measurement used in the FAs discussed above all examined rate of problem behavior or percentage of intervals with problem behavior with exception of the trial-based FA (occurrence/non-occurrence of problem behavior) and the latency FA. As a dimension of response strength a short latency may indicate a strong operant while a longer latency may indicate a weaker operant (Skinner, 1938). Therefore, latency could be used to infer a hierarchy of response strength in cases of multiple functions or to clarify the results when there is only a single function in trial-based and standard FAs. Thus, latency as a dependent variable in the trial-based FA might provide a higher correspondence rate between outcomes of a trial-based and a standard FA, and may provide additional information regarding the operant.

Latency is a dimension of response strength. In other words, a short latency may indicate a strong operant while a longer latency may indicate a weaker operant (Skinner, 1938). Therefore, latency could be used to infer a hierarchy of response strength in cases of multiple functions or to clarify the results when there is only a single function in trial-based and session-based standard FAs.
Call, Pabico, and Lomas (2009) demonstrated response strength by identifying a hierarchy of aversive tasks using latency to problem behavior. The more aversive the task was, the shorter the latency to problem behavior. Two subjects with problem behavior, hypothesized to have an escape from task demands function, participated in a demand assessment. Ten task demands were assessed (one at a time) in a 10-min session, and latency was measured from the start of the session to the first occurrence of problem behavior. The task demands with the shortest latency (highly aversive) and the longest latency (least aversive) were examined as the tasks in the escape from demands condition of the FA. Researchers were able to identify a hierarchy for both subjects. During the FA there were higher rates of problem behavior for the more aversive task when compared to the less aversive task, suggesting that latency is a useful measure of response strength.

In summary, some adaptations to the FA have increased accessibility and utility. However, there are still many limitations that make it difficult for teachers to conduct a FA in the classroom (Iwata & Dozier, 2008). The trial-based FA has increased the accessibility of FAs in educational settings, however, it is limited because the functions identified in a trial-based FA do not always correspond to the functions identified by the more established FA method, the standard FA. This may, however, be a result of the measurement (occurrence of problem behavior) rather than the method. Data is not one-dimensional and thus, does not have to be examined by only one measure. In fact, analyzing data a number of ways may provide the researcher with valuable information that suggests outcomes other than those first perceived. Research (e.g., Call et al., 2009; Thomasson-Sassi et al., 2011) has demonstrated latency is a sensitive measure of
response strength and therefore its use may increase correspondence between the trial-based FA and the standard FA.

Future research could examine the use of analyzing other measurements in the trial-based FA to increase correspondence between the trial-based FA and standard FA. The purpose of this study is to examine latency as a measure of response strength in trial-based FAs. Experiment 1 was designed to determine if latency or displaying the trial-based FA data in other manners would increase correspondence with the known function. Following calculation of the percentage of correspondence between the trial-based FA and standard FA if there was still a lower correspondence, Experiment 2 was conducted to determine if the lack of correspondence was due to the measure (latency) or perhaps the procedures of the trial-based FA.

Experiment 1 is designed to answer questions 1, 2, and 3. Experiment 2 is designed to answer questions 1, 4 and 5.

1. Will outcomes of a trial-based FA, displayed as percentage of trials with problem behavior, match outcomes when that same trial-based FA is displayed using latency?

2. Will the use of latency as a measure of response strength improve correspondence between trial-based and the standard FA as compared to occurrence?

3. Which graphing convention (mean occurrence in a histogram, occurrence trial-by-trial, mean latency in a histogram versus trail by trial latencies in a line graph, either with or without data points representing non-occurrence trials) will yield the highest correspondence rate to the standard FA?
4. Will the outcomes of latency trial-based FAs correspond to the outcomes of latency session-based FAs?

5. In cases in which correspondence between latency trial-based or latency session-based FAs is not observed, will either trial-based or latency session-based FA outcomes correspond to standard FA outcomes?
GENERAL METHODS

This study consisted of two experiments. The first experiment was an analysis of latency as the dependent variable with 19 previously collected data sets. The analysis included a comparison of latency to: (a) percentage of trials with problem behavior during the trial-based FA, and (b) rate of problem behavior during the standard FA for 16 of the 19 data sets. Only a trial-based FA was used to determine function for the remaining three data sets. Therefore, treatment outcomes were used as a point of comparison with conclusions reached by using latency as a dependent variable in trial-based FAs for those three data sets. Experiment 2 examined latency as the dependent variable in the trial-based FA using pre-determined graphing conventions compared to: (a) percent of trials with problem behavior during the trial-based FA, and (b) latency to problem behavior in the latency FA.
EXPERIMENT 1

Subjects

Data were analyzed for 19 data sets from 18 subjects (one subject participated in two trial-based FA’s for the assessment of two different behavioral classes) whom previously participated in a trial-based FA for the purposes of other studies. In those studies, all subjects attended classrooms for children with disabilities and were referred for the treatment of problem behaviors. To be included in the present study all subjects must have participated in a trial-based FA in which latency to problem behavior was recorded in an addition to the inclusion criterion from the previous studies.

Eight individuals were divided into two teams to analyze the 19 data sets. The teams were divided by considering the years of clinical experience and the research experience in behavior analysis. See Table 1 for complete information on each of the team members.

Training

The two data analysis teams underwent data analysis training to calibrate their analysis of functional analysis data. Graphing trial-based FA data trial-by-trial and as latency is not a common graphing convention. Therefore, to increase the likelihood of consistent visual analysis the team analyzed 10 different data sets. Sample graphs were developed to encompass a variety of possible scenarios. All members analyzed, discussed, and reached a consensus on the sample graphs.
Sample Graphs

The researcher generated two groups of five sample data sets. Sample data sets were developed from sample mean occurrence graphs from a previous unrelated study. The sample graphs did not contain latency data or trial-by-trial data therefore these data were created. To increase the likelihood of a variety of samples a volunteer unrelated to the field and unfamiliar with the procedures was asked to produce the appropriate amount of numbers within the necessary range (1-120) for the 10 data sets. The volunteer was given the occurrence data from each of the pre-made graphs. From this data he produced latency data for the appropriate number of segments and trials. He arbitrarily selected the

<table>
<thead>
<tr>
<th>Team member</th>
<th>Clinical Experience (years)</th>
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</thead>
<tbody>
<tr>
<td><strong>Team 1</strong></td>
<td></td>
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trials in which problem behavior occurred. The researcher generated the five graph types for each data set produced by the volunteer.

**Data-Analysis Training**

Graphs were placed into a PowerPoint in a mixed order to help prevent the outcome from one graph influencing the outcome of another graph for the same sample subject. The first five data sets (25 graphs) were presented to all eight individuals. The team discussed pertinent details and came to a consensus on the function of the behavior.

Upon completing the analysis of the first sample data set the second group of data sets were presented for independent evaluation. Each member individually determined the function of problem behavior for each graph and wrote the response on a piece of paper. After all responses were recorded answers were revealed and the researcher determined the percentage of agreement for each graph. The next graph was not presented until the team reached 87.5% (7/8) agreement on the function of problem behavior for the current graph. If 87.5% agreement was not reached the team discussed the graphs and the necessary information and reached consensus before moving on to the next graph. Training was completed following agreement on the final data set.

**Dependent Variable**

Latency to problem behavior is defined as the time elapsed from the start of the trial/session to the first occurrence of problem behavior. A number of articles have included examples of the variety of ways that latency can be displayed (e.g. Ardoin, Martens, & Wolfe, 1999; Call et al., 2009; Carr & Carlson, 1993; Thomasson-Sassi et al., 2011). For the purposes of this study latency data were graphed as: mean latency in a
histogram, a line graph with latency trial-by-trial, and a line graph with latency trial-by-trial in which only segments in which problem behavior occurred were graphed.

In addition to the latency graphs occurrence data was graphed two different ways: a histogram showing percentage of trials with problem behavior, divided by condition and trial segment and occurrence in a line graph format trial-by-trial. For all graphs the function of problem behavior is determined by comparing responding in the test segment to responding in the control segment for each condition, or in the case of problem behavior maintained by automatic reinforcement, responding that persists across all segments in all conditions, and across both test segments of the ignore trials.

**Data Analysis and Interpretation**

The researcher displayed the standard FA data (when available) and the trial-based FA data using five different graphing conventions for 19 data sets. All graphs were numbered or aliases were used and graphs were presented in a mixed order (i.e. not all members of the same set together) to each team independent of each other. Team 1 was selected as the primary data analysis team and Team 2 was the reliability team. Each team reached consensus and recorded their responses.

Following the analysis the researcher compared the findings identified by latency in the trial-based FA and occurrence trial-by-trial to the findings in (a) the trial-based FA and (b) standard FA (when applicable) to determine correspondence between both types of analysis for the trial-based FA (occurrence versus latency) and to determine whether or not correspondence between the trial-based and standard FAs was improved by using latency instead of occurrence as a dependent measure. Based on the answers to research
questions 1 (Will outcomes of a trial-based FA displayed as percentage of trials with problem behavior match outcomes when that same trial-based FA is displayed using latency?) and 2 (Will the use of latency as a measure of response strength improve correspondence between trial-based and the standard FA as compared to occurrence?), researcher answered question 3 (Which graphing convention [average latency in a histogram versus trail by trial latencies in a line graph, either with or without data points representing non-occurrence trials versus trial-by-trial occurrence in a line graph] will yield the highest correspondence rate?) by determining the best graphing convention to use regarding latency.

**Reliability**

The two teams independently analyzed and determined the function for 100% of the graphs for the 19 data sets. Reliability was calculated by dividing the total number of complete agreements (partial agreements were not included) by the total number of graphs. An agreement was recorded if both teams determined the same function or functions of problem behavior for the given graph. A disagreement was recorded if different functions were identified or if there was partial correspondence. Overall reliability between the two teams was 95.67% and ranged from 89% to 100%. Reliability for the standard FA, mean occurrence, mean latency, occurrence trial-by-trial, latency trial-by-trial, and latency trial-by-trial with responses only were, 100%, 100%, 95%, 95%, 89%, and 95%, respectively.
EXPERIMENT 2

Following Experiment 1 we validated latency as a sensitive measure of problem behavior by comparing the best graphing conventions from Experiment 1 to mean occurrence in the trial-based FA and to the latency FA. If no correspondence was found with the latency FA then a standard FA was conducted. This provided insight on whether a non-correspondence was a result of the measurement (latency) used or a result of the procedures.

Subjects and Settings

The individuals, Allison, Barry, and Tommy, were selected from referrals from local schools and teachers for engaging in problem behavior. After receiving a referral the researcher informed the teacher of the project. Next, the teacher was encouraged to discuss the project with the parent. If the parent was willing to learn more, the teacher facilitated a meeting between the parent and researchers. At that meeting, the researchers explained the study and obtained consent for participation from the parent.

These subjects were included in this study because their problem behavior directly affected learning and/or safety. Additionally, their teachers were willing to conduct a trial-based FA. All subjects attended classrooms that serve individuals with disabilities. Allison was a 9-year-old girl diagnosed with Down syndrome and Autism referred for hair pulling. Barry was a 3-year-old boy diagnosed with communicative disorder referred for elopement. Tommy was an 8-year-old diagnosed with Down syndrome referred for chair tipping/throwing. All sessions were conducted in either the
subjects’ classroom (trial-based FA) or in another room in the school (latency FA/Standard FA, when applicable).

**Response Definition**

Problem behavior was assessed using the trial-based FA, latency FA, and standard FA (when necessary). During the trial-based FA the teacher recorded data on latency to problem behavior from the trial onset. The trial-based FA was separated into 2 two-min segments, during which the teacher recorded the elapsed time from the start of the segment to the first occurrence of problem behavior. During the latency FA observers recorded data on latency to problem behavior from the session onset.

Problem behavior was defined specifically for each subject via teacher interview and classroom observation. For Allison hair pulling was defined as intertwining fingers with hair of another person. Elopement for Barry was defined as leaving assigned area without permission. Examples include standing when asked to sit, being under table when not allowed, and/or having both feet outside of designated area. Chair tipping for Tommy was defined as tilting a chair at a minimum of a 45-degree angle and/or lifting the chair so all four legs were off the ground and then releasing it.

Data in the trial-based FA were analyzed as percentage of trial segments of each type (test, control) and for each condition (attention, escape, tangible, ignore) with problem behavior. Percentage of trials with problem behavior was calculated by dividing the number of trial segments with problem behavior divided by the total number of trial segments for each type and condition.
Reliability

The teacher collected primary data for the trial-based FA. Researchers collected reliability data for the trial-based FA and all data for the latency session-based FA and standard FA. The teacher/researcher and an observer collected data independently for a percentage of trials/sessions for each subject. The researcher calculated reliability for both occurrence/non-occurrence (for the trial-based FA) and latency to problem behavior (trial-based FA, session-based latency FA). Data from both observers was compared in each segment/session to determine reliability.

**Trial-based FA**

An agreement of occurrence/non-occurrence was calculated if both observers recorded behavior occurring or not occurring for that segment. The number of agreements was divided by the total number of trials and multiplied by 100 to calculate the percentage agreement. Reliability data was obtained for a total of 24.18% of trials, 29% for Allison, 33.33% for Tommy and 10% for Brandon. Reliability for all subjects was 100%.

An agreement, for latency, was recorded if the latencies scored by the two observers from the beginning of the segment/session to the first occurrence of problem behavior were within 2 s of one another. The number of agreements were divided by the total number of disagreements plus agreements and multiplied by 100 to calculate the percentage agreement. Reliability data for latency in the trial-based FA was calculated for 24.18% of trials. Overall reliability averaged 97.73% for all subject. Reliability for Allison, Brandon, and Tommy was 100%, 95% and 100%, respectively.
Latency FA

Reliability for latency was calculated identically to that for latency in the trial-based FA. For the latency FA reliability data was obtained for a total of 45.83% of sessions: 37.5% for Allison, 50% for Barry, and 58% for Tommy. Overall average reliability for Allison, Barry, and Tommy was 98.88%, 92.31%, and 71.43%, respectively.

In the play condition for the latency FA (and in the standard FA), attention was recorded as partial interval therefore, reliability was calculated as an agreement if both observers recorded occurrence or if both observers did not record an occurrence during the 10 s interval. A disagreement was recorded if one observer recorded an occurrence and the other observer did not record an occurrence. Dividing the total number of agreements over the total number of intervals and multiplying by 100 calculated reliability. Overall average of reliability for attention in the play condition was 74.74%, and ranged from 55%- 97%.

Standard FA

Data collectors recorded frequency per 10-s interval. Agreement was calculated across each 10-s interval. The smaller number was divided by the larger number for each and averaged for the entire session. Total average of session with reliability for Barry and Tommy was 29.2% ranging from 33% for Barry and 25% for Tommy. Overall agreement was 95.65% and individually 94.74% for Barry and 96.67% for Tommy.

Social Validity
We provided the teachers with a questionnaire regarding the feasibility and acceptability of the trial-based FA. All questions were rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Barry’s teacher completed and returned the questionnaire (Appendix A). Although Allison and Tommy’s teacher did not return the questionnaire, anecdotally she was satisfied with the results of the trial-based FA. She recommended the assessment to another teacher in her school and asked for direction on how to begin the trial-based FA with another student. The results from Barry’s teacher suggest that it is an assessment that is appropriate for her classroom and she would recommend it to other teachers. Her one concern is the feasibility of embedding trials into the routine. She had difficulty finding opportunities to conduct trials.

**Trial-based FA**

Before the trial-based FA, a multiple-stimulus without replacement preference assessment (DeLeon, & Iwata, 1996) was conducted to identify moderately preferred and high-preferred tangible items. These items were used in the assessments. For example, the two items selected most often (when available) were considered highly preferred and were used during the tangible condition in the trial-based FA and in the tangible and play conditions of the latency and standard FAs. Moderately preferred items were included in the attention condition.

The classroom teacher conducted all trials of the trial-based FA in the classroom embedding trials into classroom activities and routines. Before the trials began, the researcher provided the teachers with a written description of each condition and all data sheets (Appendix B). The researcher met with the teacher to go over the features of each
condition, answer any questions and clarify any confusion. The researcher observed the 
teacher during the first trial of each condition and provided feedback and additional 
training if trials were not conducted with high procedural integrity. Procedural integrity 
was recorded by self-report on the data sheet and recorded by another observer (the 
researcher).

Teachers recorded data by using pencil and the data sheet (see Appendix C for 
example data sheet). Teachers began a trial by starting a timer and continued the trial 
until problem behavior occurred, at which point they stopped the timer and recorded the 
elapsed time. If no problem behavior occurred in a segment the teacher stopped the trial 
after 2 min and drew a dash in the box. If the teacher was unable to complete the trial or 
they weren’t able to implement the trial with high procedural integrity they crossed out 
the trial, recorded a failed trail in the space provided at the top of the data sheet and 
marked a “no” for procedural integrity for that trial.

The procedures followed for the trial-based FA were similar to those outlined by 
Bloom et al. (2011). The subjects were exposed to the conditions based on the possible 
functions of their problem behaviors. Allison and Barry were both exposed to attention, 
escape, and tangible conditions. Tommy was exposed to attention, escape, and ignore 
conditions. Barry was exposed to attention, escape, tangible, and ignore conditions.

One to 12 trials were conducted weekly. Trials from the same condition were not 
conducted back to back. Ten total trials were conducted of each condition and the number 
of trials completed at any given point was balanced. In order to balance the trials a 
condition could not be “ahead” or “behind” another condition by more than two trials. 
Teachers conducted the trials in an order that best fit their schedule, to allow the teacher
to conduct the conditions at the most appropriate times. However, they alternated between the trial types so that not all the trials from one condition were conducted in a row.

Trials were split into two segments, a control segment followed by a test segment. Segments terminated after the first occurrence of problem behavior or 2 min. If problem behavior occurred during the first segment, that segment terminated and the second segment began immediately (except in the Ignore condition). If problem behavior occurred during the second segment then the programmed consequence was delivered.

**Attention**

During the first segment the subject was provided with moderately preferred tangible items. The teacher sat next to the subject and provided continual attention (no more than 10 s between interactions). At the end of the segment (after 2 min or the occurrence of problem behavior) the teacher turned away from the subject and stated, “I have to do some work.” During the second (test) segment, attention in the form of brief, gentle physical contact and a mild reprimand was delivered contingent on the occurrence of problem behavior. This condition tested for social positive reinforcement in the form of access to attention.

**Escape**

During the first segment the teacher sat next to the subject, with the tasks nearby. No demands were placed on the subject and the subject was not given access to tangible items. At the end of the first segment (after 2 min or the occurrence of problem behavior) the second segment began and the teacher placed demands on the student. A brief
unenthusiastic praise statement (e.g., “good,” “that’s right”) was delivered contingent on compliance. If the subject did not comply within 5 s then demands were delivered in a three-step sequence (vocal, model, physical). If the subject did not comply within 5 s of the first vocal instruction, the therapist modeled the task and waited an additional 5 s. If the subject still did not comply the therapist manually guided the subject to complete the task. A 30-s break from demands was provided contingent on the occurrence of problem behavior. This condition was the test for social negative reinforcement in the form of escape from demands.

**Tangible**

During the first segment the teacher was seated next to the subject. The subject had access to highly-preferred tangible items. Neutral attention was delivered about every 30 s. Attention was provided if the subject sought it by engaging in appropriate attention seeking behaviors (e.g. “hi,” tapping the teacher on the shoulder). At the end of the first segment (after 2 min or the occurrence of problem behavior) the teacher removed the items and began the second segment. The second segment ended after 2 min or the occurrence of problem behavior. The tangible items were returned to the subject contingent on the occurrence of problem behavior. This condition tested for social positive reinforcement in the form of access to tangibles.

**Ignore**

In both segments the subject was seated alone for the full 2 min without tangible items, attention, or demands. There were no programmed consequences for problem
behavior. Problem behavior did not end the segment and all other behaviors were ignored. This condition tested for automatic reinforcement.

**Latency FA**

The procedures followed for the trial-based FA were similar to those outlined by Thomasson-Sassi et al. (2011). Sessions lasted up to 5 min and were conducted by graduate students. If there were no clear results session length was extended to 10 min. The same tangible items used in the trial-based FA were used for the sessions in the latency FA. The subjects were exposed to the same conditions as in the trial-based FA with the addition of the play condition. The play condition served as the control for all of the subjects.

There was a 5-min break after each session in which the researcher walked out of the room or area and any tangible items from the attention, tangible, or play conditions were removed. The data collector stayed in the room/area but did not deliver demands or provide consequences for any behaviors. In Tommy’s case the chairs stayed in the room at all times because problem behavior could only occur in the presence of these items.

**Attention**

In the attention condition the student had access to the moderately preferred items identified in the preference assessment. The researcher sat near the student, turned to him or her and said “I have to do some work.” Then she turned away and only provided attention contingent upon the occurrence of problem behavior. Attention was provided in the form of a mild reprimand combined with brief physical contact. After the delivery of
attention the session ended. If no problem behavior occurred the session continued for the full 5 min and latency was be recorded as 300 s.

**Escape**

In the demand condition the researcher placed demands on the student. If the student did not comply within 5 s then the researcher used the three-step prompting sequence (vocal, model, full physical) described in the trial-based FA. Upon the first occurrence of problem behavior the researcher provided a 30 s break from demands and the session terminated. If no problem behavior occurred the session continued for the full 5 min and latency was recorded as 300 s.

**Tangible**

In the tangible condition the student had access to his or her highest preferred items as identified by the preference assessment. At the beginning of the session the researcher took the toys. Toys were returned for 30 s, contingent upon the first occurrence of problem behavior and then the session ended. If no problem behavior occurred the session was 5 min and latency was recorded as 300 s.

**Ignore**

In the ignore condition the student was in the room without any materials. The data collector stepped into the corner of the room and turned away. There were no programmed consequences for any behaviors. Sessions terminated 1 min following problem behavior or continued for the full 5 min. If no problem behavior occurred latency was recorded as 300 s.
Play

In the play condition the subject had access to his or her highest preferred items identified by the preference assessment. The teacher delivered attention at least every 30 s and did not issue any demands. There were no programmed consequences for any behavior. Sessions terminated 1 min following problem behavior or continued for the full 5 min. If no problem behavior occurred latency was recorded as 300 s.

Standard Functional Analysis

The following assessment was only conducted for Barry and Tommy because latency and occurrence in the trial-based FA did not correspond (i.e. the outcomes of the two assessments did not suggest the same function for problem behavior) to the latency session based FA. The procedures were similar to the standard FA outlined by Iwata et al. (1982/1994). All sessions were 5 min and conducted in a separate room in the school. Graduate students conducted the sessions. The conditions conducted in the standard FA were the same as the conditions conducted in the latency FA.

All sessions were conducted in the same manner as in the latency FA except that sessions lasted the entire 5 min, each occurrence of problem behavior contacted the programmed contingency (if a programmed contingency is appropriate for that condition type) and frequency data was collected on behavior.

Data Analysis

The data analysis teams from Experiment 1 examined the data for the trial-based FA and latency FA separately. Trial-based FA data was graphed as percentage of trials
with problem behavior (mean occurrence), occurrence trial-by-trial, latency trial-by-trial, and latency trial-by-trial with occurrences only. The latency FA data was graphed in a multi-element design. Each graph was presented to each data analysis team to be visually inspected. A function of problem behavior was determined for each graph by consensus. All identifying information was removed and graphs for each subject were presented in a mixed order to avoid any biases.

After functions were identified for each graph, the outcomes were compared within subjects in order to identify the correspondence rate between the assessment types and data analysis types. Specifically the researcher used the findings of the data analysis team to answer questions 1 (Will outcomes of a trial-based FA displayed as percentage of trials with problem behavior match outcomes when that same trial-based FA is displayed using latency?), 4 (Will the outcomes of latency trial-based FAs correspond to the outcomes of latency session-based FAs?), and 5 (In cases in which correspondence between latency trial-based or latency session-based FAs is not observed, will either trial-based or latency session-based FA outcomes correspond to standard FA outcomes?)
RESULTS

Experiment 1

We analyzed the correspondence between the functions identified in the trial-based FA graphing conventions and the known function two different ways. Primarily we analyzed the results by using the individual as the unit of analysis. In other words correspondence was determined on whether the trial-based FA identified the same function or functions as those identified in the standard FA or treated in the treatment evaluation on an individual basis. The secondary way we analyzed the results was by using the function (i.e. attention, tangible, escape, automatic) as the unit of analysis.

Table 2 below shows the correspondence for each graphing type when compared to the known function (identified by a standard FA or a treatment evaluation) using the individual as the unit of analysis. Graphing the trial-based FA as mean occurrence yielded 63% correspondence, 11% non-correspondence and 26% partial-correspondence. Mean latency also had a 63% correspondence rate, however the non-correspondence rate was 16% and partial correspondence was 21%. The other three graphing conventions, occurrence trial-by-trial, latency trial-by-trial and latency trial-by-trial with responses only, yielded the highest correspondence rate with the known function with 74% correspondence, 11% partial correspondence and 16% non-correspondence.

Table 3 and 4 below summarize the data using the function of problem behavior as the unit of analysis. The graphing conventions, mean occurrence, occurrence trial-by-trial, and latency trial-by-trial with responses only had the highest percentage (85%) of detecting the correct function. In addition occurrence trial-by-trial and latency trial-by-trial with responses only had the lowest percentage (9%) for detecting the function
incorrectly. All graphing conventions (with exception of Mean occurrence) detected tangible and Automatic functions correctly 100% of times.

Table 2
Correspondence by Graphing Convention

<table>
<thead>
<tr>
<th></th>
<th>Correspondence</th>
<th>Partial Correspondence</th>
<th>Non-Correspondence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Occurrence</td>
<td>63%</td>
<td>26%</td>
<td>11%</td>
</tr>
<tr>
<td>Mean Latency</td>
<td>63%</td>
<td>21%</td>
<td>16%</td>
</tr>
<tr>
<td>Occurrence Trial-by-Trial</td>
<td>74%</td>
<td>11%</td>
<td>16%</td>
</tr>
<tr>
<td>Latency Trial-by-trial</td>
<td>74%</td>
<td>11%</td>
<td>16%</td>
</tr>
<tr>
<td>Latency trial-by-trial (with responses only)</td>
<td>74%</td>
<td>11%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Table 3
Function Detected Correctly

<table>
<thead>
<tr>
<th>Function</th>
<th>Mean Occurrence</th>
<th>Mean Latency</th>
<th>Occurrence trial-by-trial</th>
<th>Latency trial-by-trial</th>
<th>Latency trial-by-trial w/ responses only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>67% (2/3)</td>
<td>67% (2/3)</td>
<td>67% (2/3)</td>
<td>67% (2/3)</td>
<td>67% (2/3)</td>
</tr>
<tr>
<td>Escape</td>
<td>83% (10/12)</td>
<td>53% (7/12)</td>
<td>75% (9/12)</td>
<td>67% (8/12)</td>
<td>75% (9/12)</td>
</tr>
<tr>
<td>Tangible</td>
<td>100% (7/7)</td>
<td>100% (7/7)</td>
<td>100% (7/7)</td>
<td>100% (7/7)</td>
<td>100% (7/7)</td>
</tr>
<tr>
<td>Auto</td>
<td>75% (3/4)</td>
<td>100% (4/4)</td>
<td>100% (4/4)</td>
<td>100% (4/4)</td>
<td>100% (4/4)</td>
</tr>
<tr>
<td>Total</td>
<td>85%</td>
<td>77%</td>
<td>85%</td>
<td>81%</td>
<td>85%</td>
</tr>
</tbody>
</table>
Table 4

*Function Detected Incorrectly*

<table>
<thead>
<tr>
<th>Function</th>
<th>Mean Occurrence</th>
<th>Mean Latency</th>
<th>Occurrence trial-by-trial</th>
<th>Latency trial-by-trial</th>
<th>Latency trial-by-trial w/ responses only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>13% (2/16)</td>
<td>13% (2/16)</td>
<td>6% (1/16)</td>
<td>6% (1/16)</td>
<td>6% (1/16)</td>
</tr>
<tr>
<td>Escape</td>
<td>29% (2/7)</td>
<td>14% (1/7)</td>
<td>14% (1/7)</td>
<td>14% (1/7)</td>
<td>14% (1/7)</td>
</tr>
<tr>
<td>Tangible</td>
<td>40% (2/5)</td>
<td>20% (1/5)</td>
<td>20% (1/5)</td>
<td>20% (1/5)</td>
<td>20% (1/5)</td>
</tr>
<tr>
<td>Auto</td>
<td>0% (0/4)</td>
<td>0% (0/4)</td>
<td>0% (0/4)</td>
<td>0% (0/4)</td>
<td>0% (0/4)</td>
</tr>
<tr>
<td>Total</td>
<td>19%</td>
<td>13%</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Table 5 below shows the false positives (+), cases in which the graphing conventions for the trial-based FA identified a function not identified by the standard FA, and false negatives (-), cases in which the graphing conventions for the trial-based FA did not identify a function that was identified by the standard FA. Overall there were the same more false negatives (23) then false positives (20). Indicating that overall the trial-based FA does not detect as many functions as the standard FA does.

The trial-based FA had more false negatives than false positives for the escape function. Overall, the trial-based FA did not identify as many escape functions as did the standard FA. The occurrence trial-by-trial and latency trial-by-trial with responses only did not identify an escape function for three cases in which the standard FA did identify an escape function.
The trial-based FA graphing conventions did not have any false negatives for the tangible function and only had one or two false positives. With exception of the mean occurrence graphing convention there were no false positive or false negatives for the automatic function. Overall occurrence trial by trial and latency trial-by-trial with responses only yielded the least number of false positives and the same number of false negatives as the other graphing conventions (with the exception of mean latency), the errors were not attributable to the same graphing conventions.

Table 5

<table>
<thead>
<tr>
<th>False Positives/ False Negatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Attention</td>
</tr>
<tr>
<td>Mean Occurrence</td>
</tr>
<tr>
<td>Mean Latency</td>
</tr>
<tr>
<td>Occurrence Trial-by-Trial</td>
</tr>
<tr>
<td>Latency Trial-by-Trial</td>
</tr>
<tr>
<td>Latency Trial-by-Trial w/responses only</td>
</tr>
</tbody>
</table>

Summary

<table>
<thead>
<tr>
<th>False Positives</th>
<th>False Negatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 6 below shows the functions identified by all the graphing conventions and the known function for the 11 correspondence cases.
All graphing conventions corresponded for Travis, and identified both a tangible and escape function. Figure 1 shows all graphing conventions and escape and tangible functions determined by the (a) raised data paths in the standard FA (b) difference between the control and test segments in the mean occurrence graph and mean latency graph (bars to 120s indicate segments in which no behavior occurred) (c) raised data paths in the test segments in the occurrence trial-by-trial graph and (d) lowered data paths in the test segments in both latency trial-by-trial graphs. There was some responding in the ignore trials of the trial-based FA. However, responding did not persist across both segments, therefore an automatic function was not identified.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Function for all graphing conventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travis</td>
<td>Tang, Esc</td>
</tr>
<tr>
<td>Barstow (a)</td>
<td>Tang, Esc</td>
</tr>
<tr>
<td>Barstow (b)</td>
<td>Auto</td>
</tr>
<tr>
<td>Sandra</td>
<td>Esc</td>
</tr>
<tr>
<td>Andy</td>
<td>Auto</td>
</tr>
<tr>
<td>Allen</td>
<td>Tang</td>
</tr>
<tr>
<td>Liv</td>
<td>Esc</td>
</tr>
<tr>
<td>Rachel</td>
<td>Esc</td>
</tr>
<tr>
<td>Amanda</td>
<td>Auto</td>
</tr>
<tr>
<td>Conrad</td>
<td>Tang</td>
</tr>
<tr>
<td>Ryan</td>
<td>Esc</td>
</tr>
</tbody>
</table>

Table 6: Correspondence Cases
Figure 1. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Travis.
All graphing conventions corresponded for Barstow’s tantrum behavior, identifying both a tangible and escape function. Figure 2 shows all graphing conventions and an escape and a tangible function determined by the (a) difference between the

Figure 2. Results of trial-based FA including: mean occurrence (top-left), mean latency (top-right), latency trial-by-trial for segments with responses only (middle-left), occurrence trial-by-trial (middle-right), and latency trial-by-trial for all segments and trials (bottom-left) for Barstow’s tantrum behavior.
control and test segments in the mean occurrence and mean latency (bars to 120s indicate segments in which no behavior occurred) (b) raised data paths in the test segments in the occurrence trial-by-trial and (c) lowered data paths in the test segments in both latency trial-by-trial graphs.

All graphing conventions corresponded for Barstow’s stereotypy, identifying an automatic function. Figure 3 shows all graphing conventions and an automatic function determined by the (a) raised data paths across all conditions and the increasing trend in the extended ignore sessions in the standard FA (b) high bars across all segments for all conditions in the mean occurrence, (c) low latencies across all segments for all conditions in the mean latency (c) raised data paths across both control and test segments for all conditions in the occurrence trial-by-trial and (d) lowered data paths in all control and test segments in both latency trial-by-trial graphs.

All graphing conventions corresponded for Sandra, identifying an escape function. Figure 4 shows all graphing conventions and an escape function determined by the (a) raised data path in the standard FA (b) large difference between the control and test segments in the escape condition in the mean occurrence and mean latency (c) consistent raised data paths in the escape test segment in the occurrence trial-by-trial and (d) consistent lowered data path in the escape test segment in both latency trial-by-trial graphs. There was some responding in the control and test segments of the attention trials of the trial-based FA, however there was not a large difference between the control and test segments. No attention function was identified.
Figure 3. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Barstow’s stereotypy behavior.
Figure 4. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Sandra.
All graphing conventions corresponded for Andy, identifying an automatic function. Figure 5 shows all graphing conventions and an automatic function determined

![Graphs showing various metrics for Andy](image)

*Figure 5. Results of trial-based FA including: mean occurrence (top-left), mean latency (top-right), latency trial-by-trial for segments with responses only (middle-left), occurrence trial-by-trial (middle-right), and latency trial-by-trial for all segments and trials (bottom-left) for Andy’s mouthing behavior.*
by the (a) high bars across all segments for all conditions in the mean occurrence, (c) low latencies across all segments for all conditions in the mean latency (c) raised data paths across both control and test segments for all conditions in the occurrence trial-by-trial and (d) lowered data paths in all control and test segments in both latency trial-by-trial graphs. There were two trials in the control segment of the attention condition and two trials in the test segment of the escape condition in which no problem behavior occurred. Problem behavior occurred over the majority of the trials and at low latencies.

All graphing conventions corresponded for Allen, identifying a tangible function. Figure 6 shows all graphing conventions and a tangible function determined by the (a) raised data path in the standard FA (b) high bar in the tangible test segment and no responding in the control segment of the tangible condition in the mean occurrence (c) the difference between the control and test segment in the tangible condition for the mean latency (c) consistent raised data path in the tangible test segment in the occurrence trial-by-trial and (d) persistent lowered data path in the test segment in both latency trial-by-trial graphs. Although the escape condition had low latencies in two segments because of the inconsistent responding only a tangible function was identified.

All graphing conventions corresponded for Liv, identifying an escape function. Figure 7 shows all graphing conventions and an escape function determined by the (a) raised escape data path in the standard FA (b) higher bar in the test segment when compared to the control segment in the escape condition in the mean occurrence (c) lower bar in the test segment when compared to the control segment in the escape condition in the mean latency (d) persistent raised data path in the test segment of the escape
condition in the occurrence trial-by-trial and (e) persistent lowered data path in the escape test segment in both latency trial-by-trial graphs.

Figure 6. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Allen.
There was some responding in the control and test segments of the attention trials of the trial-based FA, however there was more responding in the control segment of and both segments were at low latencies. Therefore no attention function was identified.

*Figure 7.* Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Liv.
All graphing conventions corresponded for Rachel, identifying an escape function. Figure 8 shows all graphing conventions and an escape function determined by the (a) raised escape data path in the standard FA (b) large difference between the control and test segments in the escape condition in the mean occurrence and mean latency (bars

*Figure 8. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Rachel.*
to 120s indicate segments in which no behavior occurred) (c) raised data paths in the escape test segment in the occurrence trial-by-trial and (d) lowered data path in the escape test segment in both latency trial-by-trial graphs.

All graphing conventions corresponded for Amanda, identifying an automatic function. Figure 9 shows all graphing conventions and an automatic function determined

*Figure 9.* Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Amanda.
by the (a) raised data paths across all conditions in the standard FA (b) high bars across all segments for all conditions in the mean occurrence, (c) low latencies across all segments for all conditions in the mean latency (d) raised data paths across both control and test segments for all conditions in the occurrence trial-by-trial and (d) lowered data paths in all control and test segments in both latency trial-by-trial graphs.

All graphing conventions corresponded for Conrad, identifying a tangible function. After inconsistent responding in the first 20 trials a modification to the trial-based FA was made. The modification involved six additional tangible trials with the regular teacher out of the room. Figure 10 shows all graphing conventions and a tangible function determined by the (a) raised tangible data path in the standard FA (b) difference between the control and test segments in the escape condition in the mean occurrence and mean latency (bars to 120s indicate segments in which no behavior occurred) (c) raised data paths in the tangible test segment in the occurrence trial-by-trial and (d) low latencies in the tangible test segment in both latency trial-by-trial graphs.

All graphing conventions corresponded for Ryan, identifying an escape function. Figure 11 shows all graphing conventions and an escape function determined by the (a) raised escape data path in the standard FA (b) large difference between the control and test segments in the escape condition in the mean occurrence and mean latency (c) raised data paths in the escape test segment in the occurrence trial-by-trial and (d) lowered data path in the escape test segment in both latency trial-by-trial graphs. Segments in which problem behavior is graphed at 60 s indicate segments in which only occurrence was recorded.
Figure 10. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Conrad.
Figure 11. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Ryan.
Table 7 shows the functions identified for each graphing convention for the eight non-correspondence or partial-correspondence cases.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Known Function</th>
<th>Mean Occurrence</th>
<th>Mean Latency</th>
<th>Occurrence trial-by-trial</th>
<th>Latency trial-by-trial</th>
<th>Latency trial-by-trial w/ responses only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danny</td>
<td>Esc</td>
<td>Esc</td>
<td>Tang</td>
<td>Esc</td>
<td>Esc</td>
<td>Esc</td>
</tr>
<tr>
<td></td>
<td>Tang</td>
<td>Tang</td>
<td>Tang</td>
<td>Tang</td>
<td>Tang</td>
<td>Tang</td>
</tr>
<tr>
<td>Cyrus</td>
<td>Esc Attn</td>
<td>Esc Attn</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
<tr>
<td></td>
<td>Esc Tang</td>
<td>Esc Tang</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
<tr>
<td>Cornelius</td>
<td>Esc Attn</td>
<td>Esc Attn</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
<tr>
<td>Sammy</td>
<td>Esc Attn</td>
<td>Esc Attn</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
<tr>
<td>Ethan</td>
<td>Auto Esc</td>
<td>Auto Esc</td>
<td>Auto Esc</td>
<td>Auto Esc</td>
<td>Auto Esc</td>
<td>Auto Esc</td>
</tr>
<tr>
<td>Jonas</td>
<td>Attn Esc</td>
<td>Attn Esc</td>
<td>Attn Esc</td>
<td>Attn Esc</td>
<td>Attn Esc</td>
<td>Attn Esc</td>
</tr>
<tr>
<td>Pam</td>
<td>Esc Tang</td>
<td>Esc Tang</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
<tr>
<td>Brandon</td>
<td>Esc Attn</td>
<td>Esc Attn</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
<td>Esc Esc</td>
</tr>
</tbody>
</table>

For Danny all graphing conventions with the exception of mean latency show both escape and tangible functions. Figure 12 displays all graphing conventions. The (a) large difference between the control and test segments in the escape and tangible conditions in the mean occurrence (b) raised data paths in the escape and tangible test segments in the occurrence trial-by-trial and (c) lowered data paths in the escape and tangible test segments in both latency trial-by-trial graphs suggest both escape and tangible functions. The difference between the control and test segments in the tangible
condition for the mean latency graph suggests a tangible function. There was a difference between the control and test segments in the escape condition however the data analysis team determined it was not a large enough difference to identify a function. Therefore, the team determined there was no escape function when examining the mean latency graph.

Figure 12. Results of trial-based FA including: mean occurrence (top-left), mean latency (top-right), latency trial-by-trial for segments with responses only (middle-left),
occurrence trial-by-trial (middle-right), and latency trial-by-trial for all segments and trials (bottom-left) for Danny.

For Cyrus, all graphing conventions, with the exception of mean occurrence and mean latency, show only an escape function. Figure 13 displays all graphing conventions. The (a) raised escape data path in the standard FA (b) consistent raised data paths in the

*Figure 13*. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Cyrus.

escape test segments in the occurrence trial-by-trial and (c) lowered data paths in the escape test segments in both latency trial-by-trial graphs suggest an escape function. Although there was responding in the test segments of the attention condition the data analysis team determined there was no attention function because responding was inconsistent (every other trial) only occurred during three trials and didn’t persist over the last two trials. The large difference between the control and test segments in the escape and tangible conditions. For the mean occurrence and mean latency graphs suggest both escape and tangible functions.

For Cornelius (Figure 14) the raised data paths in the standard FA suggest attention, escape, and tangible functions. The mean occurrence, occurrence trial-by-trial and latency trial-by-trial with responses only show escape and tangible functions. The difference between the control and test segments in the mean occurrence graph suggests escape and tangible functions. The occurrence trial-by-trial graph showed an escape and tangible function as a result of the raised data paths in the test segments of the escape and tangible functions. Although responding occurred in the test segments of the attention condition there was also responding in the control segments of those same trials. Therefore no attention function was identified.

The team identified escape and tangible functions in the latency trial-by-trial with responses only evidenced by the lower latencies in the test segments when compared to the latencies in the control segments of the escape and tangible conditions. There were an equal number of trials with responding in both control and test segments of the attention
condition. The control segment had a lower latency than the test segment therefore no attention function was identified. The team identified only a tangible function with the mean latency graph. Although there was a difference between the control and test segments in the attention and escape conditions the team decided that there wasn’t a large enough difference to determine a function. The team determined responses in the tangible

![Graphs showing latency and occurrence](image)

*Figure 14.* Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Cornelius. Condition for the latency trial-by-trial graph suggested a tangible function however responding in the escape condition was inconsistent and did not persist suggesting no escape function.

Figure 15 shows all graphing conventions for Sammy. In the standard FA the

Figure 15. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
team identified attention, escape, and tangible functions while all other graphing conventions suggested only attention and tangible functions. The raised data paths in the standard FA suggest attention, escape, and tangible functions. The raised bars in the test segment and no responses in the control segments of the attention and tangible conditions in the mean occurrence graph suggest attention and tangible functions. Although there was responding in the escape condition there was not a large enough difference between the control and test segment. The multiple raised trials in the test segments of the attention and tangible conditions in the occurrence trial-by-trial graph suggest attention and tangible functions. The mean latency graph shows both attention and tangible functions evidenced by the difference between the control and test segments for those conditions. The low latencies across multiple test segments in the latency trial-by-trial graphs suggest both attention and tangible functions.

Figure 16 shows all graphing conventions for Ethan. The standard FA shows an automatic function as a result of the raised data paths across all conditions and the stable data paths in the extended ignore sessions. The difference between control and test segments in the escape condition of the mean occurrence graph suggests an escape function. The total number of trials in the ignore condition decreased over time (second test segment) suggests no automatic function. The raised bars across all segments in all conditions in the mean latency graph, the raised data paths across all segments in all conditions in the occurrence trial-by-trial graph, and the low latencies across segments
and trials for all conditions in both latency trial-by-trial graphs suggest an automatic function.

Figure 16. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Ethan.

Figure 17 shows all graphing conventions for Jonas. After unclear results in the attention function for the trial-based FA some modifications were made. Control segments were shortened to 1 min and test segments were extended to 5 min. The standard FA shows an attention function evidenced by the raised data paths during the pair-wise FA. All other graphing conventions suggest attention and escape functions. Although control segments in the modification were only 120 s bars in the mean latency graph go to 300 s to simplify visual inspection.

Figure 18 shows all graphing conventions for Pam. The standard FA shows an escape function evidenced by the raised data path. The mean occurrence graph shows both escape and tangible functions as a result of the raised bars in the test segments of those conditions and no responding in the control segments. In the occurrence trial-by-trial graph responding in the test segments of the escape condition occurred near the beginning of the trials and only occurred two times suggesting a tangible function. The large difference between the control and test segments in the mean latency graph suggests a tangible function. Both latency trial-by-trial graphs show a tangible function evidenced by the low latencies in the test segments of the tangible condition.

Figure 19 displays all graphing conventions for Brandon. The raised data path in the escape condition in the standard FA suggests an escape function. The mean occurrence graph showed an attention and tangible function determined by the difference between the control and test segments in the attention and tangible conditions. The
occurrence graph shows only an attention function. No tangible and escape functions were identified as a result of the raised bars in the control segments.

*Figure 17.* Results of standard FA (top-center), trial-based FA (left side) and the modified trial-based FA (right side) for Jonas. Trial-based FAs are displayed in the
following order from top to bottom: mean occurrence, occurrence trial-by-trial, mean latency, latency trial-by-trial for all segments and trials, and latency trial-by-trial for segments with responses only.

**Figure 18.** Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Pam.

The mean latency graph shows an attention function evidenced by the large difference between the control and test segments. The latency trial-by-trial graphs both show an attention function as a result of the low latencies. There was responding with low latencies in multiple trials of the test segment in the tangible condition however, no tangible function was identified because responding in the control segments were also at low latencies.

Figure 19. Results of standard FA (top-left), and trial-based FA including: mean occurrence (top-right), occurrence trial-by-trial (middle-left), mean latency (middle-
right), latency trial-by-trial for all segments and trials (bottom-left), and latency trial-by-trial for segments with responses only (bottom-right) for Brandon.

Occurrence trial-by-trial, latency trial-by-trial and latency trial-by-trial with responses only all improved the overall correspondence between the trial-based FA and the standard FA.

**Experiment 2**

The subjects from Experiment 2 all had different correspondence between the trial-based FA and latency FA. All three subjects participated in a trial-based FA and latency FA. In addition, Tommy and Barry participated in a standard FA because the trial-based FA graphing conventions and latency FA did not correspond.

Table 8 below shows the function for all of the graphing conventions for the three subjects. All graphing conventions corresponded to the Latency FA for Allison. There

<table>
<thead>
<tr>
<th>Subject</th>
<th>Trial-based FA</th>
<th>Latency FA</th>
<th>Standard FA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Occurrence</td>
<td>Latency trial-by-trial</td>
</tr>
<tr>
<td>Allison</td>
<td>Tang</td>
<td>Tang</td>
<td>Tang</td>
</tr>
<tr>
<td>Barry</td>
<td>Attn</td>
<td>Tang</td>
<td>Tang</td>
</tr>
<tr>
<td>Tommy</td>
<td>Auto</td>
<td>Auto</td>
<td>Auto</td>
</tr>
</tbody>
</table>

---

**Table 8**

*Correspondence Analysis*
was only a partial correspondence for Barry’s graphs. The occurrence trial-by-trial and latency trial-by-trial graphs corresponded with the latency and standard FA’s. The mean occurrence and latency trial-by-trial with responses only graphs showed a partial correspondence. Finally, for Tommy all graphing conventions for the trial-based FA showed an automatic function that did not correspond with the escape function suggested by the latency FA and standard FA.

All graphing conventions of the trial-based FA corresponded with the latency FA for Allison showing a tangible function. Figure 20 shows all graphing conventions

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**Figure 20.** Results of latency FA (bottom-left) and trial-based FA including: mean occurrence (top-left), occurrence trial-by-trial (middle-left), latency trial-by-trial for all
segments and trials (top-right), latency trial-by-trial for segments with responses only (bottom-right) for Allison.

showing a tangible function evidenced by the (a) higher bar in the test segment when compared to the control segment in the tangible condition in the mean occurrence (b) raised data path in the test segment of the tangible condition in the occurrence trial-by-trial (c) lowered data path in the tangible test segment in both latency trial-by-trial graphs and (d) low latencies in the tangible sessions of the latency FA.

Figure 21 shows all graphing conventions for Barry. The difference between the

*Figure 21. Results of standard FA (bottom-right), latency FA (bottom-left) and trial-based FA including: mean occurrence (top-left), occurrence trial-by-trial (middle-left),
latency trial-by-trial for all segments and trials (top-right), and latency trial-by-trial for segments with responses only (middle-right) for Barry.

test segments when compared to the control segments in the attention and tangible conditions suggest attention and tangible functions for the mean occurrence graph. The raised data path in the test segment of the tangible condition of the occurrence trial-by-trial graph suggests a tangible function. The latency trial-by-trial graph with all responding shows only a tangible function. Responding at low latencies in both segments of the attention condition suggest there was no attention function. Latency trial-by-trial with occurrences only, showed both attention and tangible functions. The team determined an attention function because the graph allowed for easy examination of trial eight and the team determined that the extremely low latency in the test segment and the higher latency in the control segment of the attention condition indicate a possible attention function. The latency FA and standard FA corresponded with each other, both identified a tangible function as a result of the lowered data path in the latency FA and the raised data path in the tangible condition of the standard FA.

Figure 22 shows all graphing conventions for Tommy. All trial-based FA graphs suggest an automatic function as a result of the (a) high bars across all control and test segments for all conditions in the mean occurrence graph, (b) the raised data paths in both control and test segments for all conditions in the occurrence trial-by-trial graph, (c) the lowered data paths in both control and test segments across all conditions in both latency trial-by-trial graphs. The previous graphs did not correspond with the latency FA and standard FA. The latency FA graph shows an escape function evidenced by the low
latencies in the escape sessions. The standard FA also shows an escape function as a result of the raised data path in the escape condition.

Figure 22. Results of standard FA (bottom-left), latency FA (bottom-right), and trial-based FA including: mean occurrence (top-left), occurrence trial-by-trial (middle-left),
latency trial-by-trial for all segments and trials (top-right), and latency trial-by-trial for segments with responses only (middle-right) for Tommy.

**DISCUSSION**

In Experiment one when the data were analyzed using function of problem behavior as the unit of analysis occurrence trial-by-trial and latency trial-by-trial with responses detected the function, on average, 85% of cases and only incorrectly detected the function, on average, 9% of cases. The mean occurrence graph detected the function correctly an average of 85% of times however; it was the graphing convention that had the highest percentage of incorrectly identifying the function. This implies that the trial-based FA will generally over identify functions rather than miss a function identified by standard FA when graphing the data as mean occurrence. Although analyzing the data using function as the unit of analysis provides researchers with additional information that may direct future research, we suggest that data continue to be analyzed using the student as the unit of analysis.

Practitioners and teachers need to select an assessment tool that will provide the most information about the individual. Analyzing the results using the student as the unit of analysis allows researchers to be more conservative in their conclusion of function. From a practitioner’s point of view it is better to look at the individual as the unit of analysis because an assessment tool that identifies some functions and not others will result in interventions that address some functions but not all. Thus, after intervention, problem behavior attributable to the function that was missed during assessment will still occur. This may lead to poor outcomes for the individual and a loss of confidence in the
general professional approach. However, researchers should continue to look at the differences between the trial-based FA and standard FA using function as the unit of analysis to determine if this analysis will provide additional information on changes that could be made to the trial-based FA to increase its utility.

When analyzing the data using the function as the unit of analysis the graphing conventions with the highest correspondence between the trial-based FA and standard FA are latency trial-by-trial with responses only and occurrence trial-by-trial. Cornelius is a case in which the graphing convention latency trial-by-trial with all data points identified only a tangible function while latency trial-by-trial with responses and occurrence trial-by-trial identified both tangible and escape functions. Although neither graphing convention matched completely with the standard FA (attention, tangible, and escape) latency trial-by-trial with responses only corresponded with more functions then did latency trial-by-trial with all data points.

This may be due impart to the amount of “noise” in the data. It is difficult to determine at which points in time behavior occurred and at what latency without meticulous inspection of the data. The latency trial-by-trial with responses only allow for quicker, less effortful examination of the data by removing many of the data points.

In Experiment two, Barry is an example in which the latency trial-by-trial graph actually corresponded with the standard FA and latency FA but the latency trial-by-trial with responses only did not. This may still be due to the amount of “noise” on the graph. Latency trial-by-trial with responses only makes it clear that the last trial in which problem behavior occurred in the test segment for attention also had problem behavior immediately prior, in the control segment. Therefore the team determined that for this
reason there was not adequate evidence that attention was a function of problem behavior. Responding was more inconsistent and variable than in the very clear tangible function. However, in the latency trial-by-trial graph the data point in the control segment of the attention condition may not have been as clear and therefore could have been dismissed by the team. The outcomes from Experiment 1 and 2 answered the experimental questions and provided the evidence for use of different graphing conventions and the use of latency in the assessment of problem behavior. First, the trial-based FA data when using the individual as the unit of analysis and graphed as percentage of trials with problem behavior (mean occurrence) matched the outcomes of the data when graphed as mean latency for 12 out of 19 cases (68%), and 14 out of 19 cases (74%) when graphed as latency trial-by-trial. The outcomes from the latency graphs matched the outcomes of the mean occurrence graph for two of the three cases and partially matched for the third participant.

Second, occurrence trial-by-trial, latency trial-by-trial, and latency trial-by-trial with responses only all increased correspondence between the trial-based FA and standard FA. Mean latency did not increase correspondence between the trial-based FA and standard FA. The correspondence between the trial-based FA and standard FA increased using the above mentioned graphing conventions, indicating that in some cases the lack of correspondence was due to the graphing convention. For example, these graphing conventions increased correspondence between the trial-based FA and standard FA for Cyrus and Ethan in Experiment one and Barry in Experiment 2.

Latency is a sensitive measure of problem behavior and therefore the lack of correspondence between the trial-based FA and the standard FA may be due to the
procedures of the trial-based FA. This may be the case for Tommy in Experiment 2. The graphing conventions in the trial-based FA identified a different function than the latency FA and standard FA. The lack of correspondence may be due to possible procedural limitations.

In the trial-based FA all trials were embedded into the regular classroom routine. The uncontrolled classroom setting may have made it difficult for Tommy to discriminate when demands were placed on him. The classroom and teachers were discriminative stimuli for work. Therefore, in the presences of the classroom or a teacher Tommy engaged in problem behavior. As a result, Tommy engaged in problem behavior across 60% of trials in the control and test segments of the attention condition, and 75% of both segments in the escape and ignore conditions. Thus, the trial-based FA showed an automatic function for Tommy’s problem behavior. Whereas, the standard FA and latency FA were conducted in a separate setting that may have allowed for easier discriminations between conditions and preventing stimulus control exerted by the teacher or classroom from interfering with assessment.

Third, the graphing conventions that produced the highest correspondence rate between the trial-based FA and standard FA for both experiments were occurrence trial-by-trial and latency trial-by-trial. In Experiment 2 the latency trial-by-trial with responses only graph for Barry’s problem behavior did not correspond with the standard FA. Therefore, the overall outcomes from both studies show that occurrence trial-by-trial and latency trial-by-trial yielded the highest correspondence rate.

It is unclear whether latency as a measure of response strength is the reason for the increased correspondence or whether analyzing data trial-by-trial is the reason for the
increased correspondence. However, when looking at the correspondence rate across both experiments using the function as the unit of analysis, occurrence trial-by-trial yielded the highest correspondence rate. This finding suggests that latency was not the necessary variable in increasing overall correspondence but instead being able to analyze the data over time was the most important feature.

One possible explanation for the increase in correspondence between the trial-based FA and standard FA could be that examining data trial-by-trial allows evaluation of changes in problem behavior over time. Analyzing changes in problem behavior over time provides the experimenter with information on the effects of multiple exposures to the contingencies in each condition. If no behavior occurred at the beginning of the assessment but the latter trials contained problem behavior, trial-by-trial data allows the experimenter to consider the occurrence of problem behavior in relation to time.

Examining trial-by-trial may be advantageous in cases in which an individual does not begin engaging in problem behavior until the end of the assessment. This pattern of responding may indicate the individual needed more exposure to the contingencies. Visually analyzing the data trial-by-trial gives the experimenter the flexibility to make decisions on the total number of trials to conduct. Trial-by-trial graphs allow the experimenter to easily identify which trials have problem behavior and possibly continue conducting trials until there is a clear pattern of responding. This was not specifically analyzed directly in this study but could be an area for future research.

Correspondence between the trial-based FA and standard FA increased to 74% when examining different graphing conventions. However, the graphing conventions with the highest correspondence had no or partial correspondence with the standard FA
for 26% of cases. There may be two possible reasons the trial-based FA did not produce a higher correspondence rate with the standard FA, either the graphing convention does not appropriately illustrate the problem behavior, and/or the procedures of the trial-based FA are limited.

This study examined the possibility of the graphing convention being responsible for the lack of correspondence by evaluating the same data using five different graphing conventions. Changing the graphing convention, specifically, using occurrence trial-by-trial, latency trial-by-trial, and latency trial-by-trial with responses only, increased correspondence between the trial-based FA and the standard FA in two (Cyrus and Ethan) of eight cases. Graphing the data as mean latency did not increase correspondence between the trial-based FA and standard FA. In conclusion, when trained researchers examined trial-based FA data, trial-by-trial graphing conventions were superior to mean graphing conventions.

The lack of correspondence between the trial-based FA and standard FA for many of the participants may be due to procedural limitations and may suggest directions for future research. The lack of exposure to contingencies or the lack of discrimination between conditions may be limitations with the methods of the trial-based FA that could be further examined.

Analyzing the data using a different measurement alone (latency vs. occurrence) did not substantially increase correspondence. One may conclude that latency is not an appropriate measure of problem behavior in the trial-based FA. This does not preclude the possibility that it may be appropriate in other forms of assessment. Therefore further evaluation of latency was needed to examine the utility of latency as a measure.
The correspondence between the trial-based FA and standard FA in Experiment 2 suggests that the results obtained from the trial-based FA are idiosyncratic across subjects. Allison is a case in which all graphing conventions of the trial-based FA showed the same function of problem behavior as the latency FA. Whereas, Barry is a case in which the different graphing conventions were interpreted differently and different functions were hypothesized. Although some of the graphing convention corresponded with the latency FA and the standard FA others did not correspond. The latency FA corresponded with the standard FA in all three cases, providing support that latency is a sensitive measure of problem behavior. This outcome provides evidence that the lack of correspondence was most likely due to the procedures in the trial-based FA.

Fourth, the outcomes from the trial-based FA when graphed as latency trial-by-trial corresponded with the latency FA for two of the three participants (67%). Latency trial-by-trial corresponded with the latency FA for one of the three participants (33%).

Fifth, a standard FA was conducted for Barry and Tommy because the trial-based FA graphing conventions did not completely correspond with the latency FA. In both cases the latency FA corresponded with the standard FA. These results indicate that latency is a sensitive measure and the lack of correspondence with the trial-based FA and standard FA is due to the procedures of the trial-based FA. Latency by itself did not appear to increase correspondence in the trial-based FA more than occurrence trial-by-trial. Therefore examining data trial-by-trial may be the critical feature to increase correspondence of the trial-based FA to the standard FA.

In this study the team members examining the data were either PhD level behavior analysts or were enrolled in doctoral programs and all individuals underwent
data analysis training. It is unclear whether teachers without data analysis training would hypothesize the same function of problem behavior, for each of the graphing conventions, (mean occurrence, mean latency, latency trial-by-trial, and latency trial-by-trial with responses only), as the trained data analysis teams. The trial-based FA is an adaptation to the standard FA specifically for use by classroom teachers. If classroom teachers are unable or unwilling to examine their data trial-by-trial then there may be no purpose in possibly complicating the data analysis process.

Overall the standard FA and latency FA show a procedural superiority over the trial-based FA. Whenever possible, of the FAs examined in the two studies, it would be suggested to conduct a standard or latency FA. However, teachers frequently opt out of conducting an FA because of the limitations described in the introduction. In these cases the trial-based FA may be a reasonable method to identify the function of problem behavior. When the trial-based FA is used evaluating the data trial-by-trial may be most advantageous either using occurrence or latency.

REFERENCES


APPENDICES
Appendix A

Feasibility/Acceptability of the Assessment Procedures

Name: _________

Please circle the items below that match your responses to the questions.

1. The assessment is something that I can do independently.
   1 Strongly Disagree 2 Disagree 3 Undecided 4 AGREE 5 Strongly Agree

2. I am likely to use the assessment in the future.
   1 Strongly Disagree 2 Disagree 3 Undecided 4 AGREE 5 Strongly Agree

3. I am comfortable with using the procedures in the assessment and I think that they are appropriate for special-education settings.
   1 Strongly Disagree 2 Disagree 3 Undecided 4 AGREE 5 Strongly Agree

4. I have concerns about the feasibility of the assessment.
   1 Strongly Disagree 2 Disagree 3 Undecided 4 AGREE 5 Strongly Agree

5. I have concerns about the acceptability of the assessment.
   1 Strongly DISAGREE 2 Disagree 3 Undecided 4 Agree 5 Strongly Agree

6. **I WOULD/WOULD NOT** (circle one) recommend these procedures for other special-educators.

General comments/suggestions/concerns:

I love this assessment tool. I have used it for the past two years with 4 different students. It proved to be worthwhile in giving us a clearer picture of what the function of difficult behaviors could be. My biggest concerns include the fact that it is a time consuming process. In almost every case it was taking me so long to complete the assessment that I had had to implement “best guess” interventions in the mean time to try to decrease the behaviors before having any results from this assessment. And in a couple of cases my “best guess” interventions DID decrease the behaviors which made this tool seem strangely superfluous.
I am not sure how the time consuming nature could be improved. If a child could be the focus and we
could run 4 trials a day on them for two weeks it would be super quick and valuable. I suppose if my staff were trained on how to help run the trials, and perhaps our behavior specialist were trained to step in and assist for a couple of days it could work. Or perhaps I need to reframe the process, and for two weeks do nothing with this child BUT run trials. (put academics and other data on hold for that time.) That might be a good way for me to approach it in the future.
Appendix B

Trial-based FA Session Descriptions

Participant Name: Therapist Name:
Date initiated/finished: Target Behavior:
Operational definition of target behavior:

Conditions to use (no ignore if behavior requires another person, no tangible if there is absolutely no reason to suspect that the behavior happens to access tangible items):

Conditions: First conduct preference assessment (MSWO with 5-7 items). Next, conduct trial-based FA. Then the research team will conduct either the standard FA (see standard FA session description – separate document) and help you develop an intervention OR will just help you develop an intervention.

Multiple Stimulus without Replacement Preference assessment (Deleon & Iwata, 1996)
2 Highly-preferred items for tangible trials:
2 Moderately-preferred items for attention trials:

Procedure: Select 7 toys, including toys/materials the student really likes and toys/materials the student doesn’t particularly enjoy (but doesn’t hate!). Before starting, allow student to play with each of the items for 30s. Present all items in an array (spaced equally close to the student) on a table and ask them to select an item. When they pick one, they can play with it (or eat it if it is edible) for 30s. Score “1” for the item chosen. Repeat with all items (minus the item selected in previous trial) until no items are left. Each subsequent choice is scored with the next number in the sequence (2, 3, and so on). If no choice is made within 10s, provide 1 additional vocal prompt (say, “you can pick one”). If no choice is made following additional prompt, remove all items and score “0” for unselected items. Repeat entire assessment 3 times. Calculate the number of times each item was selected out of the total number of times it was available to determine the percent selected. Use Preference Assessment Data sheet. Note, the identified toys may not be the only things the student interacts with during the attention and tangible trials. The key is to make sure that they aren’t playing with their very favorite things during the attention trials, but that the favorite things are used in the tangible trials. That means if something else becomes a favorite, you can include it in the tangible trials, as long as at least one of the items from the preference assessment is also present.

Trial-based FA

Conduct trials throughout day, embedded in ongoing activities. For example, attention trials can be conducted during play periods and demand trials can be conducted during work periods. Make sure that a reliability observer is present for at least 30% of all trials (and at least 3 trials of each type). Use the Trial-based FA data sheet. Stop after 10 completed trials (not including failed trials, and evaluate whether or not more trials are needed). You should have an equal number of all types of trials when you are finished.
Only use Ignore trials for behaviors other than aggression. Only use tangible trials if a tangible function is possibly suspected. Otherwise, just use the Attention and Escape Trials. Use a timer/watch/clock to keep track of the length of the trials.

Ignore trials: Both 2-minute segments are “test” segments. You should start this trial by moving away from the student (4-6 feet if possible). Make sure that the student has no materials. Observe whether or not the problem behavior occurs during each segment. Problem behavior does NOT end that segment. Don’t start the second segment until the first segment clocks out at 2 minutes. Do not provide ANY consequences for problem behavior. Ignore all problem behavior. No eye contact! This is the only type of trial that will always take all 4 minutes.

Attention trials: The first 2-minute segment is the “control” segment and the second 2-minute segment is the “test” segment. Sit with the student and give them at least one of the moderately-preferred toys from the preference assessment. Give them continuous attention (vocal and occasional physical if appropriate) for the entire 2-minute segment. If problem behavior occurs, stop and turn away. Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to start the second segment). Start the second segment by saying “I have to work” to the student and turn away from the student but stay close (arm’s length) to the student. Ignore all of the student’s requests. If the student engages in the problem behavior, turn and face the student and deliver attention (vocal and physical) for about 10-30s. For example, touch the student’s arm and say, “hey, why are you doing that?” or “you shouldn’t do that.” Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to end the trial and go back to other activities).

Escape trials: The first 2-minute segment is the “control” segment and the second 2-minute segment is the “test” segment. Sit with the student but turn away from the student for the entire 2-minute segment. The student should not have any toys or materials (unless they need them to engage in the problem behavior). Make sure there are no demands placed on the student (not even to stay seated). Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to start the second segment). Start the second segment by saying “it’s time to work” and deliver prompts to complete academic tasks or other tasks that have resulted in problem behavior in the past. Start with a vocal prompt. If the student does not comply within 5s, deliver a model and vocal prompt. If the student does not comply within 5s, physically guide the student to complete the task. Continue to deliver prompts for the entire 2-minute segment. Note, if you think that another prompting strategy used in your classroom is more likely to result in problem behavior, it is okay to use that strategy as long as demands are continually present during the test. If problem behavior occurs, stop, remove the materials, and turn away. You may say, “ok, you don’t have to.” Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to end the trial and go back to other activities, but make sure that they have at least a 30s break before you ask them to do anything else). Remember, this is assessment, not teaching, so do not provide reinforcers for getting something right. List the types of demands used:
Tangible trials: The first 2-minute segment is the “control” segment and the second 2-minute segment is the “test” segment. Sit with the student and give them 1-2 highly-preferred toys from the MSWO. If the student talks to you or interacts with you, respond in kind. Comment on the toy or the environment at least once every 30s but do not issue any demands or ask any questions. For example, don’t say, “don’t you like playing with that toy” because that is asking them to respond. Say instead, “It looks like you are having fun playing with that toy” or “I’m happy that today is Wednesday.” Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to start the second segment). Start the second segment by saying, “all done” or “my turn” and physically take the toy(s) away from the student. Continue to respond to the student if they talk to you or interact with you and make sure you continue to comment on the environment at least once every 30s. If the student engages in problem behavior, give the toy(s) back to the student. Problem behavior ends that segment (i.e. you don’t have to wait the whole 2 minutes to end the trial and go back to other activities, but make sure they get to play with the toy(s) for at least 30 more seconds).
Appendix C

Teacher Data Collection Sheet

**TBFA Data Sheet**

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<th>Client #</th>
<th>Failed trials</th>
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**Target behavior:**

Circle one: Primary/Reli

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<th>Obs.</th>
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**Ignore:**

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**Demand:**

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**Tangible:**

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