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Effects of Release Contingencies on Bout-like Responding

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Effects of Release Contingencies on Bout-like Responding

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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DEDICATION

This thesis is dedicated to my brother, Daniel, who inspired me to pursue the field of Applied Behavior Analysis. Thank you for being who you are and touching the lives of so many around you.
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ABSTRACT

Problem behavior is a concern for individuals with developmental disabilities. Research suggests that a release contingency time-out is effective to reduce problem behavior, but may increase the duration of time-out. Other sources recommend including a release contingency to avoid reinforcing problem behavior. It is possible clinicians generalize this concept to other domains, such as differential reinforcement with discrete-trial-training. Such a modification may be conceptualized as a tandem ratio requirement. Evidence from basic literature suggests that a tandem ratio requirement may increase a bout of responding. The current study examined effects of applied behavior analytic procedures using a bout analysis. The purpose was to identify a best-practice recommendation for clinicians to use when patterns of bout-like responding are evident, in order to efficiently decrease the duration of a bout. Three children with ASD participated. Results showed that release contingencies influenced bout-like responding in two participants. Social validity was assessed on the feasibility, efficacy, and likeability of the study. Social validity measures indicated the study had appreciable effects on problem behavior.
INTRODUCTION

Problem behavior, such as aggression or self-injury, is a common concern for individuals with autism and other developmental disabilities (e.g., Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Emerson et al., 2001; Horner, Carr, Strain, Todd, & Reed, 2002). In an examination of variables related to problem behavior displayed by individuals with intellectual and developmental disabilities, Emerson and colleagues (2001) found that 10-15% of such individuals engaged in challenging behavior. Additionally, they found that 5-10% of those individuals who received welfare services, such as education services, displayed more severe problem behavior, specifically behavior that resulted in injury, physical intervention from an adult, prevention from community activities, or occurred at least once a day. Additionally, Horner, Carr, Strain, Todd, and Reed (2002) emphasized that problem behavior might interfere with treatment efforts designed to improve behavioral deficits in individuals with developmental disabilities. Thus, individuals with intellectual disabilities who attend school programs might be most likely to engage in severe problem behavior.

In a review of applied behavior analysis as a treatment for individuals with autism, Roane, Fisher, and Carr (2016) identified several primary characteristics of applied behavior analysis (ABA) treatments. Roane et al. described Ivan Lovaas’s approach to treating autism called Early Intensive Behavioral Intervention (EIBI), which includes 20-40 hr of one-on-one therapy a week. This model was adopted to target specific acquisition skills while simultaneously contriving a controlled environment to address problem behavior associated with autism. One feature of EIBI is an intensive teaching style called “discrete trial training” (DTT). Discrete trial
training includes fast, repetitive presentations of various discriminative stimuli without any other distractors in the environment (Roane et al., 2016). Due to sufficient evidence supporting DTT and various ABA treatments, DTT is often combined with other procedures in more naturalistic settings, such as small group academic instruction (Roane et al., 2016).

An ABA procedure commonly used in school settings to reduce problem behavior is time-out (Donaldson & Vollmer, 2011). Time-out typically involves removing the opportunity to obtain reinforcement for some amount of time contingent on problem behavior. MacDonough and Forehand (1973) outlined several parameters associated with time out, including a release contingency. A release contingency involves adding a time component to the end of the time-out interval contingent on the occurrence of problem behavior. In this way, release contingencies might be intended to avoid adventitiously reinforcing problem behavior with a return to the time-in context and is recommended in at least one popular textbook (Cooper, Heron, & Heward, 2007).

A parallel to release contingencies likely happens in academic contexts. In the face of problem behavior, some instructors might withhold escape until problem behavior stops for some period of time. Some variations on release contingencies in academic contexts might also include the presentation of high-probability demands with the idea being to try and use the cessation of demands to strengthen compliance. For example, following an occurrence of problem behavior, therapists might continue to present demands until problem behavior stops, and then the instructor presents a series of high-probability demands.

Despite the potential justification for including release contingencies as part of standard practice, evidence is accumulating to suggest they may not be effective. First, Donaldson and Vollmer (2011) evaluated the effects of a fixed-duration time-out and a release contingency
time-out on problem behavior in pre-school children. Their results suggested that both time-out procedures reduced problem behavior outside of time-out, but the release contingency component actually increased the duration of time-out itself. Second, some basic research suggests that the addition of a tandem ratio requirement (like the addition of high-probability demands) might increase the duration of bouts of behavior.

Bouts are defined as periods of engagement in an activity that are separated by a pause (Shull, Gaynor, & Grimes, 2001; Shull & Grimes, 2003). Put simply, bouts of responding are periods in which several instances of intermittently reinforced behavior occurs. For example, meal times could be conceptualized as bouts of responding, with one bout occurring at breakfast, one at lunch, and so forth. Within the bout, several instances of discrete responses occur (e.g., picking up a spoon, pouring cereal, drinking water). Clinically, however, bouts may be problematic because it can be difficult to identify when one bout has ceased and another has begun (Shull et al., 2001). When working with individuals that emit problem behavior, bouts of problem behavior may disrupt learning opportunities, especially if bout duration persists. One example may be tantrum behavior. A tantrum may classify a group of responses such as crying, lying on the floor, hitting, or kicking objects. This may be of social importance because if a bout of tantrum behavior persists for 20 min during a 2 hr session, nearly 25% of the individual’s treatment time was consumed by problem behavior.

Basic research suggests bouts have at least three dimensions: rate of initiations of bouts, within bout rate of responding, and bout duration. Shull, Gaynor, and Grimes (2001) suggested that the rate of bout initiations is influenced by independent variables such as rate of reinforcement, magnitude of reinforcement, and how often a reinforcer is delivered contingent on the target response. To influence patterns of responding within-bouts, some research suggested
manipulating the quality of the reinforcer or adding a tandem response requirement (Keyl-Austin et al., 2012; Shull et al., 2001). Because the addition of a release contingency might be conceptualized as a tandem ratio requirement, it is possible that this procedure actually increases the length of a bout. Hence, by requiring students to emit a series of high-probability requests following problem behavior, they may actually be creating circumstances that increase bouts of problem behavior.

Alternatively, using differential reinforcement of alternative behavior (DRA) plus noncontingent reinforcement (NCR) may decrease the length of a bout by increasing the rate of reinforcement for alternative responses. However, there is little evidence in the clinical setting that demonstrates the effects of such variables on bout-like patterns of responding. Because DRA is commonly used to reduce problem behavior (Petscher, Rey, & Bailey, 2009), it is important to evaluate whether modifications to the procedure may worsen the occurrence of problem behavior.

Given the recommended use of release contingencies and mounting evidence that they are either ineffective or could potentially make problem behavior worse, they warrant further investigation. Therefore, the purpose of the current study was to compare two procedures (a release contingency with a tandem response requirement and DRA plus NCR) on the frequency and duration of bouts of problem behavior displayed in a school setting.
METHOD

Participants and Setting

Participants were recruited from a private school for children with developmental disabilities using informational flyers. Prior to distributing flyers, the principal investigator met with school staff to describe the purpose of the study and criteria for inclusion. Staff members were directed to distribute the flyers to families that may be eligible to participate. Parents interested in having their child participate contacted the principal investigator directly. Informed consent was obtained by the principal investigator.

The first three children who met the following criteria were selected to participate: (a) the individual was deemed at-risk for an Individualized Education Plan by his or her primary teacher; (b) the individual engaged in problem behavior during demand contexts, as reported by his or her primary teacher and Board Certified Behavior Analyst (BCBA); (c) the results from the Functional Analysis Screening Tool (FAST, see below; Iwata, DeLeon, & Roscoe, 2013) suggested that the individual’s problem behavior was socially mediated, when filled out by the individual’s primary BCBA. Individuals were excluded if the problem behavior was so severe that it resulted in either immediate medical attention or tissue damage; the results from the FAST suggested the problem behavior is maintained by automatic reinforcement; or if the results from the functional analysis (FA) were undifferentiated. Exclusion based off the FAST was defined as: the total score for potential social reinforcement was equal to or less than the total score for potential automatic reinforcement. Participant eligibility was determined based on Phases 1-3.
Janet was a 10-year-old girl diagnosed with autism. She communicated vocally, using full sentences to communicate her wants and needs. Her mother and teacher reported that she was on grade level with reading and math, but was delayed with writing skills. She was capable of holding a writing utensil, and writing letters and numbers. Aaron was a 7-year-old boy diagnosed with autism. He communicated vocally, using full sentences to communicate his wants and needs. Occasionally, Aaron repeated scripts from television shows or movies. His teacher reported that he was on grade level with math. He was capable of holding a pencil and writing letters and numbers. Luis was an 8-year-old boy diagnosed with autism. He communicated his wants and needs by reaching or grabbing for desired items, leading an adult to a desired item, emitting one-word approximations, or using picture cards. Although he occasionally used one-word approximations, his primary mode of communication was picture cards.

The study took place in an academic setting within the classrooms at the private school. The classroom resembled those in typical public educational settings, with a small table and chairs, and an array of academic materials present. Preferred items were present, but out of reach from the participants.

**Materials**

Materials used for academic tasks included flashcards, puzzles, a ball, a toy car, paper, and writing utensils. For Janet, academic tasks included math and writing worksheets. For Aaron, academic tasks included completing math and writing worksheets, completing puzzles, imitating with items, and identifying stimuli as a listener. For Luke, academic tasks included identifying stimuli as a listener, identifying body parts as a listener, and completing puzzles. All academic tasks implemented during sessions were also implemented at school and associated with high levels of problem behavior, as reported by the primary BCBA and teacher.
Additionally, preferred tangible items were present during Phases 2, 3, 4, and 5. An iPad was used for Janet, an iPhone was used for Aaron, and three plastic toys (a giraffe, a bumble bee, and pieces from a maze set) were used for Luis. Other materials present were hand-held devices and a video camera, for purposes of data collection and inter-observer agreement. Specific phases within the study required necessary materials, all of which are described below.

**Target Behavior**

Target behavior for Janet were aggression, defined as attempts or actual occurrences of scratching, pinching, hitting (open or closed hand), kicking, or biting another person; refusal statements, defined as denial statements including "no", "won't", "can't", "don't", "not" following instruction(s); and flopping, defined as dropping to the ground from a standing position following instruction(s). Target behavior for Aaron were aggression, defined as punching, hitting, hair pulling, scratching, biting, or kicking other people; refusal statements, defined as denial statements including "no", "won't", "can't", "don't", "not" following instruction(s); flopping, defined as dropping to the ground from a standing position following instruction(s); and screaming, defined as using a vocalization at a volume higher than conversational speech. Target behavior for Luis were aggression, defined as any occurrence or attempt to pinch, scratch or dig fingernails in another person's body, hitting another person with an open or closed hand, biting, or kicking another person; and self-hitting, defined as any occurrence or attempt of Luis to hit his head, face, or legs with an open or closed hand(s) or object, or hitting his head against floors or other hard surfaces. All target problem behavior were selected for each individual based on the concerns reported by the primary BCBA, teacher, and primary caregiver. Operational definitions were created for each topography using the results from Phase 2 (open-ended interviews and structured observations; see below). However, only a subset of these topographies
were observed in the FA (Phase 3) for each participant. Therefore, not all topographies were targeted during Phase 4. For Janet and Aaron, their target behavior for the remainder of the study were refusal statements. For Luis, his target behavior for the remainder of the study was aggression.

**Measures and Data Collection**

The primary investigator or trained research assistants collected data for all sessions using a frequency or duration measure. A frequency measure was used to record problem behavior, and a duration measure was used to record reinforcement access. The inter-response times (IRTs) between instances of problem behavior were used to measure bout length (see below). Two trained research assistants also collected data as reliability scorers. Data were collected using a mobile application called Countee (Version 1.0.4; Peic & Hernandez, 2016).

**Bout analysis.** The length of bouts was analyzed by plotting the IRTs between instances of problem behavior using a log-survivor function (Shull et al., 2001). The frequency of IRTs was plotted along the y-axis and elapsed time was plotted along the x-axis. Log-survivor functions often take one of two forms: a straight line, or a “broken-stick.” A straight line is suggestive of responding that is the result of a single process (i.e., responding is best not characterized by bouts). Alternatively, the “broken-stick” form is suggestive of responding that results from two processes: one that affects the within-bout response rate, and one that affects the rate of bout initiations. In the latter case, each leg of the stick represents different dimensions of bouts. The left-hand leg represents IRTs that occur within bouts (i.e., bout length) and the right-hand leg represents bout initiations. The longer the length of the left leg, the longer the length of a bout (refer to Figure 5; data path B indicates a longer bout length than data path C). The slope
for each leg represents the rates of within-bout responses and bout initiations, and was analyzed using visual analysis.

**Inter-observer agreement.** Two trained observers independently observed and collected data for 33% of all sessions within Phase 3 (FA) and Phase 4 (Schedules of Reinforcement). Inter-observer agreement (IOA) was assessed on the occurrence of problem behavior and the consequences provided by the primary investigator. Inter-observer agreement was calculated using block-by-block agreement, by computing the proportion in each interval and averaging the proportions across the number of intervals in the session (Cooper et al., 2007). For Janet, IOA for Phase 3 and Phase 4 was 99% (range: 98-99%) and 96% (range: 91-99%), respectively. For Aaron, IOA for Phase 3 and Phase 4 was 99% (range: 98-100%) and 96% (range: 94-98%), respectively. For Luis, IOA for Phase 3 and Phase 4 was 99% (range 99-100%) and 92% (range 88-96%), respectively.

**Treatment Integrity.** Two trained observers collected treatment integrity data during Phase 3 (FA) and Phase 4 (Schedules of Reinforcement) for each participant. For Phase 3, treatment integrity was assessed for 33% of sessions for each participant. Treatment integrity scores for Phase 3 for Janet, Aaron, and Luis were 96.99% (range: 96-97%), 98% (range: 95-100%), and 99% (range: 97-100%), respectively.

For Phase 4, treatment integrity was assessed for 33% of sessions for Janet and Luis. For Aaron, treatment integrity was assessed for 20% of sessions. Unlike the other participants, no treatment integrity was collected for Aaron during baseline. Treatment integrity scores for Phase 4 for Janet, Aaron, and Luis were 100%, 100%, and 97% (range: 83-100%), respectively.
**Experimental Design and Procedures**

After obtaining informed consent, pre-experimental conditions were conducted including the FAST, interview, structured observation, and an FA. The FAST was administered to the participant’s primary teacher and BCBA to confirm putative social contingencies. The principal investigator conducted open-ended interviews with the primary caregiver, primary teacher, and BCBA in order to develop an operational definition for each participant’s problem behavior. Additionally, the information gathered indirectly was used to develop specific contexts for other phases in the study, such as the FA. The principal investigator conducted all sessions in Phases 3 and 4.

**Phase 1: Functional Analysis Screening Tool.** The FAST was administered by the primary investigator to the primary BCBA (see Appendix D). The FAST was used to screen for the likelihood of social reinforcement. For all participants, the results from the FAST suggested their problem behavior were sensitive to social contingencies.

**Phase 2: Open-ended Interview and Structured Observation.** After completing the FAST, the principal investigator conducted open-ended interviews with each participant’s primary caregiver and primary BCBA (see Appendix F). The interview questions were designed to identify operational definitions for problem behavior, likely antecedents associated with the problem behavior, likely consequences that followed the occurrence of problem behavior, and the participant’s current abilities. Each interview contained 20 questions, however the principal investigator asked follow-up questions for clarity (Fisher, Greer, Romani, Zangrillo, & Owen, 2016).

Following the interviews, the principal investigator conducted a structured observation with the participant, similar to the procedures outlined by Fisher, Greer, Romani, Zangrillo, and
Owen (2016). The observation was broken into 4 min intervals and was designed to observe the participant’s sensitivity to positive and negative reinforcement.

During the first interval, the principal investigator provided attention and access to preferred items to the participant, while withholding nonpreferred demands (i.e., control interval). During the second interval, the principal investigator removed the putative positive reinforcer(s) that the participant interacted with during the previous interval. Contingent on problem behavior, or 30-s elapsed time, the primary investigator reintroduced the putative reinforcer(s) for 20 s. This sequence continued until the end of the interval, at which point the control interval was in effect.

To test for negative reinforcement, during the next interval the primary investigator restricted access to the putative positive reinforcer(s) and began to deliver nonpreferred demands suggested to evoke problem behavior. Again, the putative reinforcer(s) was delivered for 20 s contingent on problem behavior, or 30 s elapsed time. This cycle continued until the next control interval. In the final test interval, the principal investigator removed all putative positive reinforcer(s) and began to place nonpreferred demands for a second time. However, contingent on problem behavior, or 30 s elapsed time, a 20 s break from demands were delivered but access to the positive reinforcer(s) continued to be restricted.

During the open-ended interview, Janet’s mother reported that Janet often engaged in problem behavior when she was denied access to preferred items or activities, and when rapid demands were given. Additionally, her teachers and BCBA reported that Janet was likely to engage in problem behavior when preferred items were removed and non-preferred activities were introduced. During the structured observation, Janet reliably engaged in problem behavior
following the removal of the iPad as well as when demands were placed. However, Janet did not engage in problem behavior when attention was withheld.

During the open-ended interview with Aaron’s caregivers, they reported that Aaron often engaged in problem behavior when he didn’t “get his way”, specifically when required to terminate a preferred activity. His teachers and BCBA also reported that his problem behavior was likely to occur when transitioning away from a preferred activity, as well as when demands were given. During the structured observation, Aaron reliably engaged in problem behavior following the removal of preferred items (e.g., iPhone) as well as when demands were given. However, he did not engage in problem when attention with withheld.

During the open-ended interview with Luis’s mother, she reported that Luis often engaged in problem behavior when preferred activities were terminated, or when Luis was required to sit at a table for a duration longer than a few minutes. Luis’s teacher and BCBA also reported that Luis’s problem behavior occurred when redirected away from a preferred activity, when demands were given, or when his requests were denied. During his structured observation, Luis engaged in problem behavior following the removal of preferred items and when demands were provided. However, he did not engage in problem behavior when attention was withheld.

**Phase 3: Functional Analysis.** After completing Phase 2, a synthesized FA (Hanley, Jin, Vanselow, & Hanratty, 2014) was conducted to determine the reinforcing contingencies maintaining each participant’s target problem behavior. Sessions took place in an isolated area located at the school, lasting 5 min each (Fisher et al., 2016). Each participant’s assessment included one test condition that may be sensitive to all putative reinforcing contingencies suggested to maintain problem behavior, as identified by Phase 2. Thus, the control condition was designed to reduce the relevant establishing operation(s) that corresponds with the test
condition. For all participants, the test condition included tangible and escape contingencies. Each FA alternated between control and test sessions, however Luis’s FA alternated between two test sessions and one control after the first three sessions.

**Phase 4: Schedules of Reinforcement.** Following the FA, two interventions were alternated to determine their effects on bout length. Sessions were conducted in a one-to-one teaching ratio with the primary investigator as therapist. Task demands were presented in discrete training trials. The content of task demands were derived from current clinical programs used by the school, including programs associated with high-probability responding and programs associated with problem behavior. Session length was 10 min across both interventions. Both conditions included extinction and the contingencies typically used to maintain appropriate behavior, in addition to those described below. For all participants, praise in the form of vocal statements (e.g., nice work) was delivered on an FR 2 schedule for compliance. For Aaron, the statement “first work, then phone” was delivered at the onset of sessions.

The primary research question involved a comparison between bout characteristics in Phases B and C (see below), which was demonstrated using a multi-element. A secondary question was the comparison of these interventions to baseline, which was demonstrated using a non-concurrent multiple baseline across participants.

**Baseline.** Prior to implementing the schedules of reinforcement, baseline sessions were conducted for each participant. Baseline sessions were 5 min in duration and conducted similarly to the test condition from Phase 3.

**Tandem response requirement (Condition B).** During Condition B, a tandem response requirement was implemented contingent on the occurrence of problem behavior. That is, the target problem behavior resulted in escape extinction, requiring the participant to complete the
task that evoked problem behavior. Once the participant completed the task and the target problem behavior ceased, three high-probability demands were given. If at any point in the tandem requirement the participant engaged in the target problem behavior, escape extinction was reintroduced. Once the participant emitted the required tandem response, the functional consequence(s) (identified in Phase 3) were delivered for 20 s.

*Differential reinforcement plus noncontingent reinforcement (Condition C).* During Condition C, differential reinforcement of alternative behavior (DRA) plus noncontingent reinforcement (NCR) was implemented. For each participant, compliance to task demands resulted in praise. Contingent on the target problem behavior, the principal investigator provided a prompt to appropriately request the functional reinforcer(s) identified in Phase 3. For Janet and Aaron, the vocal response “I want to take a break” was introduced, and the principal investigator used a vocal prompt to evoke the FCR. For Luis, a picture card reading the word “break” was introduced, and the principal investigator used a gestural and vocal prompt to evoke the FCR. For each participant, the alternative response was reinforced on an FR 1 schedule for both prompted and unprompted responses. Additionally, the same consequences were delivered on a fixed-time schedule throughout the session. The following rule was used to determine the schedule of reinforcement for NCR: the schedule would be no less than FT 40 s, and no less than twice the rate of reinforcement from the previous tandem schedule session, but the denser schedule will always be selected. The FT schedule resets every minute. For example, if FT 40 s was implemented, the FT 40 s schedule was reset following the reinforcement period so that no less than 20 s out of every minute included reinforcement.

**Phase 5: Social Validity.** Following the completion of Phase 4, social validity was measured by the primary teacher and BCBA for each participant. Video clips of sessions in
Conditions B and C were used for teachers to observe bouts of problem behavior. Likert-type questionnaires were provided for the teacher to rate the severity, frequency, and disruptiveness of the bouts observed in the videos (Appendices A and B). The teachers were blind to the condition in each video. The BCBA was trained to implement the most effective treatment based on results from Phase 4. Following implementation, Likert-type questionnaires were provided for the BCBA to rate the feasibility, likeability, and efficacy of the recommended intervention, and degree of academic improvement for the participant (Appendix C).

**Video preparation.** Video clips were taken during Conditions B and C for each participant. Two different videos were prepared per condition. Video clip 1 was edited to include only the duration of bouts of problem behavior that occurred during the session. These videos represented bout length. Video clip 2 consisted of the entire session duration and represented the rate of bout initiations. By presenting the occurrence of bouts in these two ways, observers may be more likely to discriminate between the rate of bouts and the duration of bouts. This discrimination may be important because the severity of one bout may be greater than the number of bouts that occur.

**Training.** The primary investigator used Behavioral Skills Training to train each participants’ BCBA how to implement the recommended treatment (based on the results from Phase 4). Once the BCBA demonstrated she was capable of implementing the intervention with fidelity (i.e., did not require corrective feedback), she was given a task analysis of the intervention and instructed to implement the treatment for 5 consecutive days during regular academic sessions with the relevant participant. The primary investigator observed at least three sessions to monitor treatment integrity.
Treatment integrity. The primary investigator measured treatment integrity of the recommended intervention using the same task analysis provided to the BCBA. The task analysis included 10 steps. The primary investigator observed at least three sessions and recorded the percentage of steps implemented correctly. If the BCBA scored below 80%, the primary investigator provided corrective feedback following the session. Treatment integrity of the BCBA for Janet was 100% across five sessions; for Aaron was 85% across four sessions; and for Luis was 100% across three sessions.

Likert scales for teachers. The Likert-type rating scales for teachers included at least six questions that required the teacher to rate the severity of a bout, the severity of bout initiations, how disruptive a bout of problem behavior was for the amount of learning time, and how disruptive the frequency of bouts were for the amount of learning time. Additionally, there were questions addressing the impact of a bout on academic instruction versus the impact of the rate of bouts on academic instruction. The scales included five points that ranged from “strongly agree” to “strongly disagree”.

Likert scales for Board Certified Behavior Analysts. The Likert-type rating scales for BCBAs included seven questions that required the BCBA to rate the feasibility of implementation, how disruptive a bout was for the amount of learning time, how disruptive the rate of bouts were for the amount of learning time, whether the BCBA would recommend the intervention to other BCBAs or students, and the magnitude of improvement of the participant’s problem behavior. The scales included five points that ranged from “strongly agree” to “strongly disagree”.


RESULTS

Figure 1 represents the results from the synthesized FA for each participant. For all three participants, the results confirmed their target problem behavior were sensitive to escape from demands and access to preferred tangible items.

Figure 2 represents the rate of problem behavior during baseline and intervention for all three participants. During baseline, rates of problem behavior were stable for Janet and Aaron. For Luis, his rates of problem behavior were more variable but overall on an increasing trend. During intervention, the DRA+NCR schedule reduced problem behavior more than the tandem schedule, as well as lower than baseline levels, for all three participants. However, the effects of each schedule on problem behavior varied across participants. For Janet (top panel of Figure 2), the tandem schedule increased rates of problem behavior greater than baseline levels. For Aaron (middle panel of Figure 2), the tandem schedule produced higher rates of problem behavior compared to baseline in two sessions only. For Luis (bottom panel of Figure 2), the tandem schedule produced higher rates of problem behavior compared to baseline. However, there was a decreasing trend that resulted in overlap between the tandem schedule and some baseline sessions.

Figure 3 represents the IRTs during baseline for each participant along the log-survivor plot. In this figure, the plots for all participants appear best described by a straight line, which suggests responding was not organized into bouts during baseline.
Figure 4 represents the IRTs during intervention for each participant along the log-survivor plot. The data paths from baseline (extracted from Figure 3) are included in each participant’s panel for comparison. For both Janet and Aaron (top and middle panels of Figure 4), there was a greater proportion of long IRTs during the tandem schedule as compared to baseline. Although, because more instances of problem behavior occurred overall in the tandem schedule, overall rates were higher in the tandem schedule as compared to baseline. For both participants, bout-like responding was evident in the tandem condition as indicated by the “broken-stick” feature of the data paths. However, Janet’s and Aaron’s IRTs during the DRA+NCR condition are suggestive of responding as a result of a single process, similar to responding in baseline for both participants. Janet’s median IRTs in the tandem schedule and DRA+NCR schedule were 3 s and 9.5 s, respectively. Aaron’s median IRTs in the tandem schedule and DRA+NCR schedule were 3 s and 6 s, respectively.

Alternatively, Luis’s results (bottom panel of Figure 4) suggest his IRTs during the tandem schedule and DRA+NCR schedule were smaller than his IRTs during baseline, as indicated by the fact that the data path representing IRTs during baseline falls above the data paths representing the IRTs during the intervention conditions. Unlike Janet and Aaron, Luis’s data suggest bout-like responding was evident in the DRA+NCR schedule (as indicated by the “broken-stick” feature of the data path) rather than the tandem schedule. Luis’s IRTs in the tandem schedule are suggestive of responding as a result of a single process, similar to his responding in baseline. Luis’s median IRT for both schedules was 12 s.

The results from social validity measures suggested that the DRA+NCR schedule was more effective for reducing problem behavior for two participants. Janet’s and Aaron’s teacher rated the effects of DRA+NCR as more appreciable, and less intrusive to academic time than the
effects of the tandem schedule. These ratings are consistent with the results from both participants, suggesting DRA+NCR was most effective for reducing problem behavior and did not produce bout-like responding. Luis’s teacher rated the effects of the DRA+NCR as more disruptive than the effects of the tandem schedule. This rating is also consistent with his results, suggesting the DRA+NCR schedule produced bout-like responding whereas the tandem schedule did not. Unlike Janet’s and Aaron’s teacher, Luis’s teacher did not rate the effects of DRA+NCR as more appreciable compared to the tandem schedule, even though his results suggested DRA+NCR reduced his overall rate of problem behavior more than the tandem schedule.

Additionally, Janet’s and Aaron’s BCBA implemented the DRA+NCR treatment with each participant. Janet’s BCBA reported that Janet’s bouts of problem behavior were not as disruptive as they were prior to using the intervention. Aaron’s BCBA reported that one bout of Aaron’s problem behavior was more problematic than the frequency of bouts, but that the occurrence of bouts was not as disruptive as they were prior to using the intervention. These reports were consistent with both Janet’s and Aaron’s data, which suggested bout-like responding did not occur in the DRA+NCR condition and problem behavior occurred at a low rate during the DRA+NCR schedule for both participants. Additionally, the BCBA reported that it did not take a long time to learn the interventions, the interventions were easy to implement, she would recommend the interventions to other BCBAs, and would try the interventions with other clients.
DISCUSSION

Results from the synthesized FAs identified socially maintained problem behavior in all participants. Next, we evaluated two interventions: DRA+NCR and a tandem schedule. Consistent with previous research (Petscher et al., 2009), the DRA+NCR was more effective in reducing the overall rate of problem behavior.

We were successful identifying bouts in at least one function-based intervention in all three participants. For Janet and Aaron, we identified bout-like responding during the tandem schedule. For Luis, we identified bout-like responding during the DRA+NCR schedule. Bout analysis is a novel tactic for describing socially-mediated problem behavior and our results suggest the generality of the approach. That is, the patterns observed in the log-survivor plots, specifically during the tandem schedule, resemble the broken-stick patterns observed in Shull et al. (2001). That bouts were observed in the tandem schedule for Janet and Aaron, and not the DRA+NCR schedule is also consistent with previous research showing that tandem FR requirements can increase bout durations.

Results for Luis were different in that bouts were observed in DRA+NCR and not the tandem condition. However, unlike the other participants, Luis emitted many alternative responses during the DRA+NCR schedule that produced reinforcement on a schedule other than the programmed DRA+NCR schedules. That is, Luis complied with demands more often than Janet or Aaron, and compliance resulted in praise throughout the DRA+NCR schedule. This
might account for the bouts in his implementation of DRA+NCR, but it does not explain the absence of bouts in his tandem condition.

Luis’s results are also interesting because the condition associated with the highest rates of problem behavior did not produce bout-like responding. The independence of high rates of behavior and the occurrence of bouts is important for justifying the clinical consideration of tools like log-survivor plots for analyzing bouts.

Because a tandem schedule may be conceptualized as a release contingency, the present results support the notion that release contingencies in academic contexts may increase the length of bouts of problem behavior. The current study demonstrated that a release contingency might influence within-bout response rates, such that more responses occurred within a bout when a release contingency was implemented in two out of three participants. These results are consistent with Donaldson and Vollmer (2011), who suggested the addition of release contingencies in time-out procedures might increase the duration of time-out. Furthermore, all three participants’ rate of within-bout responding was greater during the tandem schedule than during the DRA+NCR schedule.

Another contribution is that these results may provide further support for using the Shull method to identify the IRTs between bouts. Currently, when clinicians measure bouts of problem behavior it is likely they arbitrarily choose the duration of time that must elapse without responding before a second bout is recorded. Using a bout analysis approach similar to that employed here might provide clinicians a more objective measure of bouts.

By collecting data on the rate of responding, rather than just the rate of bout-initiations, and supplementing data analysis with the log-survivor plot, changes in bout-like responding may be more evident across intervention changes. Similar to the suggestions from Shull et al. (2001),
the results from the current study also suggest that contingencies may affect either rate of responding, and may affect the rates differently. If only one rate of responding is recorded, it is possible to overlook behavior change on a molecular scale or incorrectly claim an intervention as effective. For example, looking at Figure 4, the “broken-stick” data paths (tandem schedule for Janet and Aaron, top and middles panels; DRA+NCR schedule for Luis, bottom panel) reveal information regarding within-bout responses rates as well as bout-initiation rates. Additionally, the data paths that take the form of a straight line indicate only one dimension of responding occurred under those schedules of reinforcement. Although the affected dimension cannot be identified using this model, the model does indicate whether bout-like responding occurred under different schedules of reinforcement.

The interpretations offered by the log-survivor plot may be meaningful for treatment in at least two ways. First, it may provide evidence of whether a release contingency is necessary to include in teaching contexts. Although the addition of a release contingency may be conceptualized as a tactic to avoid adventitious reinforcement, Aaron’s results suggest it may increase the overall number of bouts of problem behavior that occur. Second, the bout analysis allows clinicians to identify a less subjective IRT for measuring bouts of behavior. Over time, behavior change on either dimension may shift in the log-survivor plot, informing clinicians of the effects of their interventions on behavior change. For example, if treating severe problem behavior such as aggression or self-injury, it may be more meaningful to reduce the overall number of bout-initiations. Alternatively, if treating less dangerous behavior such as tantrum behavior, it may be more desirable to reduce the within-bout response rate. The log-survivor plot could provide evidence of changes in both rates for either behavior.
Despite the contributions of the current study, there are several limitations. First, the NCR schedule of reinforcement selected for the DRA+NCR schedule was no leaner than FT 40 s, and the DRA schedule of reinforcement was FR 1. Although this schedule decreased problem behavior to near zero levels for all three participants, the overall rate of reinforcement was so dense that it competed with available academic time. For Janet and Aaron, they emitted the DRA response efficiently, ultimately obtaining reinforcement immediately after the previous reinforcement period ceased. Anecdotally, Janet’s and Aaron’s teacher reported that both students frequently requested breaks from academic tasks following participation in the study. Additionally, the schedules of reinforcement for both components of the DRA+NCR schedule may not be feasible to implement in settings that do not consist of one-to-one teaching ratios. Future research may consider the effects of fading the schedule of reinforcement and evaluating the effects on bout-like responding as well as maintaining low levels of problem behavior.

While compliance to academic tasks poses limitations for applied purposes, the low rate of problem behavior in the DRA+NCR schedule also poses a limitation for interpreting behavior change using a bout-analysis approach. There were not enough occurrences of problem behavior during the DRA+NCR schedule to address bout-like responding. The number of IRTs in this schedule was much fewer than the number of IRTs in the tandem schedule for two participants, leading to a poor interpretation of bout-like responding in this condition. Future research may evaluate the effects of yoking the schedule of reinforcement in the DRA+NCR schedule to that in the tandem schedule to better match the rates of reinforcement.

Another limitation of the current study may be the amount of time spent recording the target behavior in each condition. The study sessions were 10 min long and the number of sessions in each condition ranged from five to seven across all three participants. It is possible
that a longer observation period would have captured more IRTs in each condition, providing additional data for interpreting the log-survivor plots. Similarly, each participant engaged in multiple topographies of problem behavior during academic contexts but only one topography resulted in programmed consequences. Due to the parameters of the current study, programmed consequences were only provided for the topography observed in each participant’s FA. However, additional topographies of problem behavior were observed with all three participants when the schedules of reinforcement were introduced. It is possible that these responses contributed to a bout of problem behavior, but were not captured. Future research may conduct a more extensive FA to occasion multiple topographies of problem behavior, and program consequences for a variety of topographies when implementing schedules of reinforcement.

The bout analysis approach itself may be limiting in a few ways. First, it may not be feasible to collect data on every occurrence of problem behavior in other settings. Because the bout analysis approach entails frequency recording, it requires continuous observation. Settings such as classrooms or group homes may not have the resources to support such data collection. Second, bout analysis may be less useful to analyze behavior that occurs in less controlled settings. Even if continuous observation is feasible, it is possible that behavior change on both dimensions may be less evident if the specific contingencies affecting behavior are less clear. Overall, the current study extended the use of bout analysis to the treatment of socially-mediated problem behavior. Bout-like responding was observed in all participants, and the DRA+NCR schedule reduced problem behavior most efficiently. Consumers rated the occurrences of bouts under the DRA+NCR schedule more tolerable and less intrusive to academic instruction. This approach may be clinically significant if problem behavior occurs in a bout-like fashion and treatment effects can be continuously observed and systematically introduced.
REFERENCES


APPENDICES

Appendix A

Social Validity Questionnaire for Teachers – Condition B

*Please rate the following statements regarding your participation in the study Effects of Release Contingencies on Bout Duration. Your answers are anonymous and will be considered for future research and social justification.*

1. The bouts of problem behavior in Video 1 were severe.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
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<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

2. The bouts of problem behavior in Video 1 were more severe than those in Video 2.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

3. The occurrence of one bout is more problematic than the frequency of bouts.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

4. The bouts of problem behavior in Video 1 did not impede academic learning.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

5. The bouts of problem behavior in Video 2 impeded academic learning.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

6. The bouts of problem behavior in both videos were not disruptive for academic learning.
   
<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix B
Social Validity Questionnaire for Teachers – Condition C

Please rate the following statements regarding your participation in the study Effects of Release Contingencies on Bout Duration. Your answers are anonymous and will be considered for future research and social justification.

1. The bouts of problem behavior in Video 1 were severe.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

2. The bouts of problem behavior in Video 1 were more severe than those in Video 2.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

3. The occurrence of one bout is more problematic than the frequency of bouts.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

4. The bouts of problem behavior in Video 1 did not impede academic learning.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

5. The bouts of problem behavior in Video 2 impeded academic learning.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

6. The bouts of problem behavior in both videos were not disruptive for academic learning.

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree

7. The bouts of problem behavior from this Condition (C) were less disruptive than the bouts from the first Condition (B).

   5 Strongly Agree  4 Agree  3 Neutral  2 Disagree  1 Strongly Disagree
Appendix C
Social Validity Questionnaire for BCBA

Please rate the following statements regarding your participation in the study Effects of Release Contingencies on Bout Duration. Your answers are anonymous and will be considered for future research and social justification.

1. The recommended intervention was not easy to implement.
   ![Rating Scale]
   
2. The bouts of problem behavior during sessions were not as disruptive as they were prior to participation in Effects of Release Contingencies on Bout Duration.
   ![Rating Scale]
   
3. The occurrence of one bout was more problematic than the frequency of bouts.
   ![Rating Scale]
   
4. I would not recommended the intervention from Phase 5 to other BCBAs.
   ![Rating Scale]
   
5. I will try the recommended intervention from Phase 5 with other potential clients.
   ![Rating Scale]
   
6. It did not take a long time to learn the recommended intervention.
   ![Rating Scale]
   
7. The amount of learning time during sessions improved following the completion of Effects of Release Contingencies on Bout Duration.
   ![Rating Scale]
Appendix D

F A S T

Functional Analysis Screening Tool

Client: __________________________ Date: __________
Informant: ________________________ Interviewer: __________

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

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

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

Problem Behavior Information
1. Problem behavior (check and describe):
   __ Aggression ____________________________
   __ Self-Injury ____________________________
   __ Stereotypy ____________________________
   __ Property destruction ____________________
   __ Other ________________________________
2. Frequency: __ Hourly __ Daily __ Weekly __ Less often
3. Severity: __ Mild: Disruptive but little risk to property or health
   __ Moderate: Property damage or minor injury
   __ Severe: Significant threat to health or safety
4. Situations in which the problem behavior is most likely to occur:
   Days/Times ________________________________________________
   Settings/Activities _________________________________________
   Persons present ____________________________________________
5. Situations in which the problem behavior is least likely to occur:
   Days/Times ________________________________________________
   Settings/Activities _________________________________________
   Persons present ____________________________________________
6. What is usually happening to the person right before the problem behavior occurs?
   ___________________________________________________________
7. What usually happens to the person right after the problem behavior occurs?
   ___________________________________________________________
8. Current treatments ___________________________________________

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

Scoring Summary
Circle the number of each question that was answered “Yes” and enter the number of items that were circled in the “Total” column.

<table>
<thead>
<tr>
<th>Items Circled “Yes”</th>
<th>Total</th>
<th>Potential Source of Reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4</td>
<td></td>
<td>Social (attention/preferred items)</td>
</tr>
<tr>
<td>5 6 7 8</td>
<td></td>
<td>Social (escape from tasks/activities)</td>
</tr>
<tr>
<td>9 10 11 12</td>
<td></td>
<td>Automatic (sensory stimulation)</td>
</tr>
<tr>
<td>13 14 15 16</td>
<td></td>
<td>Automatic (pain attenuation)</td>
</tr>
</tbody>
</table>

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Appendix E

Open-Ended Interview Questionnaire

1. Describe his/her language abilities.
2. Describe his/her play skills and preferred toys or leisure activities.
3. What else does he/she prefer?
4. What are the problem behaviors? What do they look like?
5. What is the single-most concerning problem behavior?
6. What are the top 3 most concerning problem behaviors? Are there other behaviors of concern?
7. Describe the range of intensities of the problem behaviors and the extent to which he/she or others may be hurt or injured from the problem behavior.
8. Do the different types of problem behavior tend to occur in bursts or clusters and/or does any type of problem behavior typically precede another type of problem behavior (e.g., yells preceding hits)?
9. Under what conditions or situations are the problem behaviors most likely to occur?
10. Do the problem behaviors reliably occur during any particular activities?
11. What seems to trigger the problem behavior?
12. Does problem behavior occur when you break routines or interrupt activities? If so, describe.
13. Does the problem behavior occur when it appears that he/she won’t get his/her way? If so, describe the things that the child often attempts to control.
14. How do you and others react or respond to the problem behavior?
15. What do you and others do to calm him/her down once he/she engaged in the problem behavior?
16. What do you and others do to distract him/her from engaging in the problem behavior?
17. What do you think he/she is trying to communicate with his/her problem behavior, if anything?
18. Do you think this problem behavior is a form of self-stimulation? If so, what gives you that impression?
19. Why do you think he/she is engaging in the problem behavior?

20. Other comments额外的例子:

Source: Open-Ended Functional Assessment Interview; Gregory Hanley, PhD, BCBA-D
April 4, 2017

Chelsea Schubiger
ABA-Applied Behavior Analysis
Tampa, FL 33612

RE: Expedited Approval for Initial Review
IRB#: Pro00029899
Title: Effects of release contingencies on bout duration

Study Approval Period: 4/4/2017 to 4/4/2018

Dear Ms. Schubiger:

On 4/4/2017, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol

Document(s):
Study protocol

Consent/Assent Document(s)*:
Combined Consent and Parental Permission.pdf
Consent Form for BCBAs.pdf
Written Assent Form (for children over age 12).pdf
Assent Script

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent documents are valid until
the consent document is amended and approved. The Child Verbal Assent (titled as Assent Script) is not a stamped form.

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110. The research proposed in this study is categorized under the following expedited review category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Study involves children and falls under 45 CFR 46.404: Research not involving more than minimal risk.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) calendar days.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, Ph.D.,
Chairperson USF Institutional Review Board
Figure 1. Results from the functional analysis (Phase 3) for Janet, Aaron, And Luis.
Figure 2. Results from baseline and intervention (Phase 4). This graph depicts the rate of problem behavior on the y-axis with sessions along the x-axis for Janet, Aaron, and Luis.
Figure 3. Results plotted on the log-survivor function for baseline (Phase 4) for Janet, Aaron, and Luis.
Figure 4. Results plotted on the log-survivor function for Condition B and Condition C for Janet, Aaron, and Luis. The thinnest dotted line indicates the data from Figure 3 (baseline).
Figure 5. Hypothetical results for Condition B and Condition C using the log-survivor plot for one participant.