Effects of Noncontingent Reinforcement with Competing Stimuli for Decreasing Problem Behavior Maintained by Social Positive Reinforcement

By
Nicole A. Kanaman

Submitted to the graduate degree program in Applied Behavioral Science and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.

Chair: Claudia L. Dozier, Ph.D.

Pamela L. Neidert, Ph.D.

Jessica F. Juanico, Ph.D.

Date Defended: July 20th, 2020

The thesis committee for Nicole A. Kanaman certifies that this is the approved version of the following thesis:

Effects of Noncontingent Reinforcement with Competing Stimuli for Decreasing Problem Behavior Maintained by Social Positive Reinforcement

Date Approved: July 20th, 2020

Abstract

Noncontingent reinforcement (NCR) is an evidenced-based procedure that has been shown to be effective for reducing problem behavior maintained by social positive reinforcement (Carr et al., 2009). NCR typically involves the delivery of the functional reinforcer on a dense (often continuous) schedule (Carr et al., 2000) that is not feasible in all environments; thus, researchers have evaluated NCR with alternative stimuli (i.e., stimuli not responsible for maintaining the behavior) to implement during times in which the functional reinforcer is unavailable (e.g., Hanley et al., 1997). The purpose of the current evaluation is to replicate and extend this literature by (a) evaluating the use of NCR with alternative reinforcers (identified via a competing-stimulus assessment; Fisher et al., 2000) for decreasing the socially-maintained problem behavior of four adults with intellectual and developmental disabilities and (b) determine the generality of these interventions under longer session duration and with various therapists in various settings. Preliminary data suggest the efficacy and generality of providing access to noncontingent attention when the functional reinforcer is unavailable for one participant who engaged in problem behavior maintained by tangibles.

Keywords: noncontingent reinforcement, problem behavior, competing-stimulus assessment

Acknowledgments

To my advisor, Dr. Claudia Dozier, thank you for your unwavering support and guidance throughout this project and my graduate career thus far. I am forever thankful for your mentorship. To my lab mates, thank you for conducting sessions with me and providing valuable insight. Finally, to my friends and family, I would like to thank you for your constant encouragement and for the endless support you have provided throughout this process. I could not have accomplished this project without each one of you.

Table of Contents

Introduction

Large-scale functional analysis studies and review papers on functions of problem behavior in individuals with intellectual and development disabilities (IDD) suggest that approximately 30% of individuals engage in problem behavior maintained by social positive reinforcement (i.e., access to attention or tangibles; Beavers et al., 2013). Noncontingent reinforcement (NCR) is a common antecedent-based intervention for problem behavior maintained by social positive reinforcement (Carr et al., 2009). Function-based NCR procedures for problem behavior maintained by social reinforcement involve the delivery of the reinforcer maintaining problem behavior on a response-independent schedule (Carr et al, 2009). That is, NCR involves the time-based delivery of caregiver attention for problem behavior maintained by attention (e.g., Hagopian et al., 1994) or the delivery of preferred tangibles for problem behavior maintained by tangibles (e.g., Fritz et al., 2017). Often, the functional reinforcer is initially delivered on a continuous or dense schedule such that the operant mechanism for behavior change is likely satiation (e.g., Fischer et al., 1997; Lalli et al., 1997; Wallace et al., 2012); however, over time, the schedule of reinforcement is often thinned to make NCR schedules more manageable by caregivers, and thus the operant mechanism likely responsible for maintained low levels is extinction (e.g., Hagopian et al., 2004).

NCR has various strengths including its efficacy in decreasing a wide variety of behaviors in various settings (Carr et al., 2009; Phillips et al., 2017). In addition, as compared to other common interventions (e.g., differential reinforcement of alternative behaviors [DRA] or differential reinforcement of other behaviors [DRO]), NCR requires little to no monitoring of behavior on the part of the caregiver (Vollmer et al., 1993) and ensures the individual comes into contact with the functional reinforcer often (Vollmer et al., 1995). Finally, it has been

demonstrated that the use of NCR may attenuate the negative side effects of extinction (e.g., emotional responding, initial increases in problem behavior; Vollmer et al., 1998).

Although NCR has various noted strengths, there are some important considerations in programming NCR schedules for maintained effects, particularly in the everyday environment. As noted, NCR schedules are often introduced on an initially dense schedule of reinforcement that is gradually faded over time (Carr et al., 2000). In fact, research has demonstrated that initially leaner schedules of NCR are often not effective without gradually fading the schedule (Hagopian, 2004; Hagopian et al., 1994). Meindl (2019) reviewed 144 cases in which NCR was implemented to decrease problem behavior and in 96% of the cases the terminal NCR schedule was 5 min or less. That is, after fading the NCR schedule, the therapist was still delivering the functional reinforcer every 5 min or less.

In the natural environment, (a) initially dense (often continuous) schedules of attention or access to a specific tangible, (b) systematic fading to leaner schedules of NCR, or (c) maintaining an NCR schedule in which a reinforcer must be delivered every 5 min may not be feasible. For example, implementing an NCR procedure with a dense schedule of attention may not be feasible for a caregiver who is (a) responsible for multiple individuals in a home or (b) required to complete multiple other tasks in the home (e.g., cleaning). Additionally, providing a dense schedule of NCR with a specific tangible item may not always be feasible as the specific tangible item may not always be available (e.g., when a peer is using the item or when the item needs to be cleaned or fixed). Thus, it is necessary to determine procedures to aid in the thinning of NCR schedules.

To address these challenges, researchers have evaluated the use of alternative (i.e., nonfunctional) but preferred stimuli in NCR procedures to alleviate the need for caregivers to

provide a dense schedule of the functional reinforcer when it is not feasible (e.g., Fischer et al., 1997; Fisher et al., 2000; Fisher et al., 2004; Hanley et al., 1997; Phillips et al., 2017). Hanley et al. (1997) compared the effects of noncontingent access to attention (NCA) and noncontingent access to tangibles (NCT) for decreasing the attention-maintained problem behavior of two adults with IDD. During the NCA condition, the therapist delivered attention (the functional reinforcer) continuously throughout the session. During the NCT condition, the therapist removed their attention and provided continuous access to a high-preferred tangible item (identified via a paired-stimulus preference assessment [PSPA; Fisher et al., 1992]). In both conditions, problem behavior was on extinction. Results showed similar reductions in problem behavior with both NCA and NCT suggesting the noncontingent delivery of alternative (nonfunctional) but preferred stimuli on dense schedules may decrease the likelihood of attention-maintained problem behavior. It is relevant to note that for one participant, the alternative item delivered was an edible. Providing edibles on a dense schedule for a long period of time, or multiple times in a day, may not be feasible. Further, experimenters did not evaluate if the tangible item delivered in the NCT condition contributed to the maintenance of the behavior (i.e., this item was not included in the functional analysis). Thus, it is possible the item used in the NCT condition was a functional (rather than alternative) stimulus. Regardless, the outcomes of the study provide an option for treating problem behavior maintained by attention, when dense schedules of attention are not possible (Vollmer et al., 2001).

Fischer et al. (1997) conducted a similar study with the purpose of determining if noncontingent access to a high-preferred tangible item (determined via PSPA) would decrease the socially-maintained self-injurious behavior for two participants when self-injury continued to result in the functional reinforcer (i.e., attention for one participant and a specific tangible item

for the other). Therapists conducted an arbitrary reinforcer test to determine if the items used in the treatment evaluation were arbitrary (i.e., not a functional reinforcer). In this assessment, the therapist delivered the item contingent on self-injury to assess whether it contributed to the maintenance of the behavior during 15-min sessions. Results from the arbitrary reinforcer test confirmed the items used in the subsequent NCT sessions were not functional reinforcers. During the treatment evaluation, experimenters evaluated the effects of NCT with and without extinction on problem behavior during 10-min sessions. During NCT without extinction, the participant had noncontingent access to the alternative tangible item and self-injury resulted in the functional reinforcer. During NCT with extinction, the participant had noncontingent access to the alternative tangible item and self-injury did not result in the functional reinforcer. Results showed that both conditions resulted in a decrease in self-injurious behavior. However, similar to Hanley et al. (1997), edibles were used in the NCT conditions which may not be feasible for long periods of time.

Although noncontingent access to alternative reinforcers determined via preference assessments were effective in Fischer et al. (1997) and Hanley et al. (1997), it is possible that items that are preferred may not always compete with the occurrence of socially-maintained problem behavior. Thus, Fisher et al. (2000) suggested the importance of systematically determining stimuli to include as alternative reinforcers during NCR procedures by using a competing-stimulus assessment (CSA) for one participant with attention-maintained problem behavior. During CSA trials, the therapist provided the participant with access to one of each of the 15 items reported to be preferred and delivered attention only for the occurrence of problem behavior (similar to the functional analysis) during 30-s trials. The purpose of the CSA was to determine stimuli that resulted in high levels of engagement and low levels of problem behavior

suggesting that they were likely to compete with the occurrence of problem behavior. Next, therapists compared levels of problem behavior during NCR with a competing stimulus, NCR with a stimulus that did not compete with problem behavior in the CSA, and an attention condition (control condition; similar to the attention condition of the functional analysis) during 10-min sessions. Results validated the outcome of the CSA showing that NCR with the competing stimulus resulted in an immediate and maintained reduction in problem behavior as compared to the other two conditions. These results emphasize the importance of systematically evaluating the extent to which a stimulus competes with an individual's problem behavior when programming an NCR procedure with alternative stimuli.

In a follow-up study, Fisher et al. (2004) conducted a CSA to identify stimuli to use in an NCT procedure for four individuals who engaged in attention-maintained problem behavior. Experimenters compared the effects of continuous access to the functional reinforcer (NCA), continuous access to competing stimuli (NCT), and attention extinction alone on participant problem behavior during 10-min sessions. Results showed that both NCR procedures resulted in more immediate and lower levels of problem behavior than attention extinction alone.

The results of the studies discussed above suggest the efficacy of providing access to high-preferred tangible items that compete with the occurrence of socially-maintained problem behavior; however, it is important to know if an alternative stimulus in the form of attention might also be effective in an NCR procedure for behavior maintained by access to tangibles. The ability to identify competing stimuli, in various forms, to use in an NCR procedure allows for greater flexibility when designing interventions to reduce problem behavior during times of extinction (Fisher et al., 2000).

One area of research that has evaluated the use of NCR with alternative stimuli during times of extinction is during schedule thinning in functional communication training (FCT). After training a functional communication response (FCR), often the next phase involves introducing a delay to the functional reinforcer to simulate the natural environment (Tiger et al., 2008); however, these periods of extinction (i.e., when the FCR does not immediately produce the functional reinforcer) increase the likelihood of re-emergence of problem behavior (Fisher et al., 2018). Systematic fading procedures are often implemented to decrease problem behavior when the delay is introduced (e.g., Hagopian et al., 1998); however, systematic fading of the FCR schedule alone is not always successful. That is, in some case, treatment break down (i.e., increase in problem behavior, decrease in communication) has been reported when the delay to reinforcement is extended (e.g., Hagopian et al., 1998). The use of NCR with alternative stimuli, in combination with systematic fading, has been shown to be effective in bridging the delay (i.e., maintaining low levels of problem behavior) to reinforcer delivery during times of extinction in FCT (Austin & Tiger, 2015; Fisher et al., 1998; Hagopian et al., 1998; Hagopian et al., 2005; Slocum et al., 2018; Sumter et al., 2020).

For example, Hagopian et al. (2005) evaluated the efficacy of providing noncontingent access to alternative stimuli during schedule thinning following FCT in maintaining low levels of problem behavior for three individuals who engaged in socially-maintained problem behavior (i.e., access to attention, tangibles, or both). Therapists conducted a CSA to identify high-preferred tangible items that competed with problem behavior to deliver during delays to reinforcer access. Throughout scheduling thinning, the participant had continuous access to the stimuli found to compete during the delay-to-reinforcement periods. Schedule thinning was more successful (i.e., maintained lower levels of problem behavior) when the participant had access to

the alternative competing stimuli during delays. These results suggest the utility of using NCR with alternative tangible items during FCT. However, the only stimuli assessed in the CSA and evaluated in the treatment evaluation were tangible items; thus, it is unknown if an alternative reinforcer in the form of attention may have been effective, particularly for the participant whose behavior was maintained by access to tangibles. Further, the terminal delay was less than 10 min for each participant (i.e., 4 min, 5 min, 9 min) which may not be feasible in all environments.

Austin and Tiger (2015) evaluated the effects of providing access to alternative stimuli in the form of attention and access to tangibles during schedule thinning following FCT for one participant's socially-maintained (i.e., maintained by access to attention and access to a specific tangible [i.e., Xbox]) problem behavior. Therapists taught the participant an FCR to access preferred attention and an FCR to access a preferred tangible. Following acquisition of the FCRs, the experimenters implemented a delay fading procedure (i.e., following the FCR, therapists required the participant to wait for the programmed reinforcer). To determine whether systematic fading was necessary, therapists conducted a terminal delay probe (i.e., 5-min delay to the programmed reinforcer following FCR). The participant engaged in high levels of problem behavior during this probe for both FCRs (i.e., attention and tangible) indicating the need for systematic delay fading. Initially, the delay fading procedure was effective (i.e., low levels of problem behavior) for his attention FCR; however, therapists were unable to increase the delay beyond 120 s because problem behavior re-emerged. Following the re-emergence of problem behavior, therapists conducted delay fading for his attention FCR with noncontingent access to the participants functional tangible item (i.e., Xbox). That is, when the participant requested attention, the therapist said, "in a minute, but you may play Xbox." Results demonstrated that delay fading with the alternative reinforcer was effective for maintaining low levels of problem

behavior during the delay periods. These results were replicated with the participant's tangible FCR. That is, when access to the functional tangible item (i.e., Xbox) was withheld, access to therapist attention resulted in low levels of problem behavior. Overall, results of this study demonstrated that delay fading was enhanced when access to a functional alternative reinforcer was provided during delay to reinforcement periods following FCT. One notable limitation in this study, however, was the terminal delay was only 5 min, which may not be feasible in all environments. Further, the only alternative stimuli used in this evaluation were the variables found to maintain the participant's problem behavior (i.e., access to an Xbox and therapist attention). It is possible that there were multiple alternative stimuli that would have been effective in maintaining low levels of problem behavior. Conducting a CSA to determine multiple stimuli (i.e., different forms of attention and different tangible items) to program during extinction periods may have increased flexibility for the therapists in designing a treatment.

In an extension of Austin and Tiger (2015), Sumpter et al. (2020) evaluated the effects of providing access to alternative reinforcers during delay fading following FCT for two participants with socially maintained problem behavior (i.e., both attention and tangible). Similar to Austin and Tiger, therapists taught the participants FCRs to access preferred attention and preferred tangible items. Following acquisition of these FCRs, therapists introduced a 10-min delay to reinforcement. That is, contingent on the FCR, the therapist said, "in a minute," and the reinforcer was delivered 10 min later; there were no programmed consequences for problem behavior (i.e., extinction). The occurrence of problem behavior was compared during conditions in which the alternative reinforcer was available during the delay (i.e., access to attention when the tangible was withheld and access to the tangible when attention was withheld) versus when it was not available during the delay (i.e., participant was required to wait without access to

anything). For both participants, providing access to an alternative reinforcer during the delay resulted in lower levels of problem behavior, further suggesting the efficacy of providing noncontingent access to an alternative reinforcer during delay periods. However, similar to Austin and Tiger, the only alternative stimuli used in the treatment evaluation were those found to maintain problem behavior. Further, it is important to note that for one participant, providing access to attention when the tangible item was delayed resulted in lower levels of problem behavior compared to the delay without attention; however, the reduction was not clinically significant. Thus, the therapist's attention did not effectively compete with the occurrence of problem behavior maintained by access to tangibles for one participant.

Slocum et al (2018) further evaluated the utility of noncontingent access to alternative stimuli during periods of extinction in schedule thinning procedures with three individuals who engaged in socially-maintained (i.e., access to tangibles for two participants and access to attention for one) aggression. Specifically, experimenters evaluated the efficacy of signaling the availability of the functional reinforcer and providing access to alternative preferred stimuli while fading an initially dense NCR schedule. During the initial NCR phase, the functional reinforcer and an alternative stimulus (i.e., a preferred tangible for the participant with attention-maintained behavior and preferred attention for participants with problem behavior maintained by access to tangibles) were provided on a continuous schedule and problem behavior was on extinction. As the NCR schedule with the functional reinforcer was thinned, the therapist continued to provide access to the alternative stimulus. Additionally, there was an external stimulus present (i.e., a colored card) to indicate when the functional reinforcer was and was not available. Results demonstrated that continuous access to an alternative stimulus and providing signals for the availability of the functional reinforcer were effective in maintaining low levels of

problem behavior during NCR schedule thinning. For one participant, the experimenters conducted terminal-schedule probes to determine the necessity of systematic schedule thinning. This participant engaged in higher levels of problem behavior during probes suggesting the necessity of thinning. However, experimenters did not conduct probes with the other participants, so it is unknown whether thinning was necessary for all. Given the complexities of schedule thinning, and research suggesting that providing alternative stimuli may alleviate the need to systematically thin reinforcement schedules (e.g., Sumpter et al., 2020), this is a notable limitation. Authors note that schedule thinning did not require much time (i.e., under 3 hr for all participants); however, the schedule thinning procedure used was complex and required constant within-session monitoring. Further, the terminal delay to reinforcer access was only 4 min. Additionally, experimenters did not isolate the effects of colored-card signal and access to alternative reinforcers on participant problem behavior; thus, it is unknown whether one of these alone might have been effective. Finally, although access to the alternative stimuli used in the treatment evaluation resulted in a decrease in problem behavior, Slocum et al. did not systematically determine what type of alternative stimuli to use in their evaluation. Thus, it is unknown whether stimuli determined via a CSA might have better competed with problem behavior during periods of extinction. The terminal-schedule probes conducted for one participant suggested the need for systematic schedule thinning; however, it is unknown whether access to a competing stimulus identified via CSA would have alleviated the need for systematic schedule thinning. Additionally, research suggests that not all stimuli reported to be preferred by caregivers compete with problem behavior equally (Fisher et al., 2000); thus, it may be important to use a CSA to determine stimuli to program. Further, it is possible several stimuli might have

competed. Identifying several competing stimuli as opposed to one alternative stimulus increases a therapist's flexibility in designing an intervention.

Although NCR has been shown to be a well-established intervention (Carr et al., 2009) and several studies have demonstrated the utility of providing an alternative stimulus when the functional reinforcer is unavailable, the durability and generality of these procedures are unknown. Meindl et al. (2019) revealed that most studies on the use of NCR did not assess setting generalization and included treatment sessions that were 10 min or less. This is also true of studies on the use of NCR with alternative reinforcers in reducing problem behavior (e.g., 10 min; Austin & Tiger, 2015; Fisher et al., 2004; Hanley et al., 1997). Thus, it is unknown whether reductions in problem behavior would maintain under longer periods of time. Additionally, it is unknown whether effects will generalize (e.g., across therapists and in different settings). Therefore, the purpose of the current study is to replicate and extend previous research by evaluating (a) the efficacy of NCT for problem behavior maintained by attention, (b) the efficacy of NCA for problem behavior maintained by access to tangible items, and (c) the durability of both NCR procedures during extended session durations with various therapists across multiple settings.

Methods

Participants, Setting, and Materials

To date, the current study has included four participants that are in varying phases of the study due to the onset of shelter-in-place restrictions due to COVID-19. Participants are individuals with IDD who receive services from a large residential and day service program in the Midwest and who engage in problem behavior (e.g., inappropriate verbal behavior, physical aggression, property destruction) maintained by social positive reinforcement in the form of

access to attention, tangibles, or both, as determined by a pre-treatment functional analysis. William is a 23-year-old male with a diagnosis of autism and is non-vocal verbal. Christopher is a 27-year-old male with diagnoses of pervasive developmental disorder not otherwise specified, mild mental retardation, obsessive-compulsive disorder, bipolar mood disorder, and cerebral palsy with an extensive vocal verbal repertoire. Joseph is a 59-year-old male with diagnoses of moderate mental retardation, pervasive developmental disorder not otherwise specified, and obsessive-compulsive disorder with a limited, modified-sign repertoire. Logan is a 38-year-old male with diagnoses of profound mental retardation, autism, and cerebral palsy who is non-vocal verbal. William is the only participant to date that has completed all phases of the study. Thus, outcomes thus far and directions for future phases will be discussed separately for each participant.

For William, sessions thus far have been conducted within the natural environment at his farm-based day center. That is, sessions were conducted in various locations across his day center campus (e.g., an indoor arena, indoor barn, outdoor walking trail, indoor lodge [i.e., common room]). Future sessions with William will also be conducted in these locations. For Christopher, sessions thus far have been conducted within his natural environment at his day center. That is, sessions were conducted in various locations on his day center campus (e.g., a cafeteria, recreation room, art room). Future sessions with Christopher will also be conducted in these locations. For Joseph, all functional analysis sessions and most competing-attention sessions were conducted in a separate session room (approximately 15 ft by 30 ft) at his day center. This session room included several small tables with chairs, a bookshelf (with books and board games), and a large paper shredder. Due to construction at his day center location, the last two competing-attention assessments were conducted in the living room of his group home.

Future sessions with Joseph will be conducted in the session room at his day center until we introduce new settings (e.g., various locations on his day center campus). For Logan, functional analysis sessions were conducted in a separate session room (approximately 30 ft by 10 feet) at his farm-based day center. This session room included a long table with bench seating and a shelf with crafting supplies. Future sessions with Logan will be conducted in this session room until we introduce new settings (e.g., various locations on his day center campus).

During all sessions for William, Joseph, and Logan thus far, therapists wore denim jackets and protective sleeves to increase their safety (i.e., reduce harm by physical aggression in the form of biting and scratching). During functional analyses, materials included condition-specific discriminative stimuli to aid in discrimination across sessions (i.e., therapists [i.e., trained graduate students] wore different color shirts). In addition, during the tangible and control conditions, items that were high preferred (determined via a stimulus preference assessment) or reported to possibly evoke or maintain problem behavior (determined by pre-experimental indirect assessments and direct observation) were used. Finally, in the attention condition, items that were moderately preferred as determined by a stimulus preference assessment were used. Materials included in the CSA were items and activities reported to potentially compete with problem behavior, were found to be high preferred in the pre-experimental preference assessment, or were observed to potentially compete with problem behavior during direct observations.

The treatment evaluation has only been conducted with William thus far. During these sessions, the tangible item found to maintain problem behavior (a basketball) was used. Moving forward, for participants whose problem behavior is maintained by attention, tangible items found to compete with problem behavior in the competing-items assessment (i.e., items

associated with low levels of problem behavior and high levels of engagement in the competing stimulus assessment) will be included. For participants whose problem behavior is maintained by tangibles, the tangible item found to maintain their problem behavior will be included.

Response Measurement and Interobserver Agreement

Trained observers (graduate and undergraduate students) collected data on participant and therapist behavior using handheld data-collection devices. The primary dependent variable in all sessions was the frequency of target problem behavior, which was converted to a rate measure. William's target problem behavior was physical aggression (i.e., hitting and biting). Christopher's target problem behavior included inappropriate verbal behavior (i.e., loud vocalizations, profanity, or repeated comments) and physical aggression (i.e., hitting, pushing, kicking). Joseph's target problem behavior included property destruction (i.e., forceful table pounding) and physical aggression (i.e., grabbing, pushing, hitting). Logan's target problem behavior included self-injurious behavior (i.e., head hitting and head banging) and physical aggression (i.e., grabbing, hitting, biting). See Table 1 for specific definitions of each participant's target problem behavior.

A secondary dependent variable during the competing-items assessment and NCT sessions was the duration of engagement with the tangible item provided during the session. For items that involved manual manipulation (e.g., pin box and hand-held memory game), engagement was scored when the participant was touching the item with any part of their hands using a duration measure. Specifically, duration of engagement was scored using an immediate onset and a 3-s offset of touch. For items that did not require manual manipulation (e.g., viewing a video, looking at pictures in a book), engagement was scored when the participant was looking at the item. Specifically, duration of engagement was scored using an immediate onset and 3-s

offset of eye gaze. If participants have visual limitations (i.e., Logan) or for items that include auditory stimulation, engagement will not be scored. Furthermore, data on engagement were not collected during competing-attention sessions as engagement with the therapist's attention was difficult to operationalize (e.g., looking at or being in proximity with the therapist did not adequately capture engagement).

In addition to participant behaviors, data collectors measured the therapist's delivery of stimuli and attention programmed in various sessions. Data collectors measured the therapist's delivery of programmed attention and tangible items during the functional analysis using a frequency measure. During CSA and NCA sessions, data collectors measured therapist's delivery of programmed attention using a 10-s partial interval measure.

A second observer simultaneously and independently collected data on at least 30% of sessions for all phases for all participants. We used proportional agreement to calculate interobserver agreement (IOA). For frequency measures, we divided the session into 10-s intervals and divided the smaller frequency by the larger frequency in each interval, summed proportions across intervals, divided the sum by the total number of intervals, and then multiplied by 100%. For duration measures, we divided the smaller duration by the larger duration in each 10-s interval, summed proportions across intervals, divided the sum by the total number of intervals, and then multiplied by 100%. IOA was calculated for 33% of William's functional analysis sessions; mean agreement was 100% for physical aggression. IOA was calculated for 50% of William's competing-attention assessment sessions; mean agreement was 100% for physical aggression. IOA was calculated for 45% of William's treatment evaluation sessions; mean agreement was 100% for physical aggression and 99.8% for engagement (range, 99.6%-100%). IOA was calculated for 31% of Christopher's functional analysis sessions; mean

agreement was 100% for physical aggression, 100% for property destruction, and 99% for inappropriate verbal behavior (range, 97%-100%). IOA was calculated for 50% of Christopher's competing-attention assessment sessions; mean agreement was 100% for physical aggression and inappropriate verbal behavior. IOA was calculated for 33% of Christopher's competing-items assessment sessions; mean agreement was 100% for physical aggression, 91% for inappropriate verbal behavior (range, 72%-100%), and 89% for engagement (range, 84%-92%). IOA was calculated for 33% of Joseph's functional analysis sessions; mean agreement was 100% for property destruction and physical aggression. IOA was calculated for 36% of Joseph's competing-attention assessment sessions; mean agreement was 99% for physical aggression (range, 94%-100%) and 100% for property destruction. IOA was calculated for 33% of Logan's functional analysis sessions; mean agreement was 99% for self-injurious behavior (range, 97%-100%) and 99% for physical aggression (range, 97%-100%).

General Procedures

To determine participants to include in the study (i.e., individuals who engaged in problem behavior maintained by social variables), therapists conducted indirect assessments using a modified version of the Functional Analysis Screening Tool (FAST; Iwata et al., 2013) with individuals referred for the treatment of problem behavior. In addition to the closed-ended questions included in the FAST, therapists asked questions about specific types of attention or tangibles delivered contingent on problem behavior and the situations in which the behavior was likely to occur (e.g., when a preferred item was removed, when caregivers were assisting another individual, when the caregiver was preparing dinner). If results of the FAST suggested the participant's behavior was sensitive to social reinforcers (i.e., access to attention, tangibles, or

both), the therapist conducted informal direct observations to gather information about the common antecedents and consequences surrounding the occurrence of target problem behavior.

If information from the indirect assessments and direct observations suggested an individual's problem behavior was maintained by social positive reinforcers, therapists conducted a stimulus preference assessment. The purpose of the stimulus preference assessment was to determine a tangible preference hierarchy to inform items to use in the functional analysis and items to include in the competing-items assessment.

Following the stimulus preference assessment, therapists conducted a functional analysis (Iwata et al., 1982/1994) with each participant. The purpose of the functional analysis was to validate the results of the indirect assessment and determine participants for whom problem behavior was maintained by social positive reinforcement. We used a multielement design to compare the effects of an attention, tangible, and control condition on the occurrence of problem behavior. Participants whose problem behavior was maintained by social positive reinforcement (attention, tangibles, or both) were included in the remainder of the study. Following the functional analysis, we conducted (or will conduct) CSAs with the participants to determine alternative stimuli (i.e., items/activities or attention) that might compete with the occurrence of problem behavior when access to the functional reinforcer is withheld.

Following the CSAs, we conducted (or will conduct) the treatment evaluation. The purpose of the treatment evaluation is twofold. The first purpose is to evaluate the effects of providing access to an alternative competing stimulus (as determined by the CSA) on participant target problem behavior when access to the functional reinforcer is withheld for 10 min. To evaluate this, we compared (or will compare) the effects of continuous access to the functional reinforcer (i.e., NCT for tangibly maintained behaviors or NCA for attention-maintained

behaviors) to the effects of providing continuous access to an alternative competing stimulus (i.e., NCT for attention-maintained behavior or NCA for tangibly maintained behaviors) on participant target problem behavior during 10-min sessions. The second purpose was to determine the generality of the intervention(s) by evaluating its effects during extended sessions and with different therapists in various settings. To evaluate this, we implemented (or will implement) NCR with the alternative competing stimulus (i.e., NCT for attention-maintained behaviors or NCA for problem behavior maintained by access to tangibles) during 30-min sessions. Further, we will conduct sessions with various therapists across new settings (if applicable). We will use a multielement within a reversal design to compare the effects of NCR with a functional reinforcer and NCR with an alternative stimulus (as determined by the CSA) on problem behavior.

Safety procedures used across all conditions for all participants included the use of response blocking for instances of severe problem behavior (i.e., behaviors that could result in harm to the participant or therapist) and the presence of at least two therapists trained in program-specific crisis management procedures. Termination criteria across all conditions for all participants was the use of physical restraint as a result of ongoing severe problem behavior, a participant request to use the restroom, or an incident of incontinence.

Stimulus Preference Assessment

Therapists conducted informal interviews with caregivers or the participant (Christopher only) to determine items to include in the preference assessment. Additionally, therapists conducted informal direct observations to observe what the participant typically engaged with during the day to determine additional items that might be included in the preference assessment.

For Christopher, William, and Logan, we conducted a PSPA (Fisher et al., 1992) with 8 to 11 stimuli. Prior to starting the PSPA, the therapist provided the participants with pre-session exposure to each of the items included. That is, the therapist provided the participant with access to each item for approximately 2 min such that the participant could engage with the item and the therapist could demonstrate how the item was used if necessary. On each trial of the PSPA, the therapist placed two tangible items equidistant in front of the participant and said, "pick one." If the participant selected one of the items, the therapist provided the participant with 30-s access to the selected item and removed the unselected item. Following access, the therapist removed the selected item and presented the next trial. If the participant did not select one of the items within 5 s of presentation, the therapist removed both items briefly (i.e., approximately 5 s) and then represented the same two items. If the participant did not select one of the items within 5 s of the re-presentation, "no selection" was scored. This process was repeated until each item was presented with every other item. PSPA trials were conducted across several days.

For Joseph, the therapist conducted a multiple-stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) after attempts to conduct a PSPA and a free-operant assessment (Roane et al., 1998) were associated with severe problem behavior. At the beginning of a trial, the therapist placed all five items reported to be preferred in a linear array in front of Joseph. The therapist then said, "pick one." If Joseph selected one of the items, the therapist provided him with 30-s access and removed the remainder of the items from the array. Following 30 s of access, the therapist placed the remainder of the items in a linear array in front of Joseph and said, "it's time to switch." Following this instruction, Joseph handed the therapist the previously selected item and selected a new item from the array. The therapist placed the previously selected item into a container out of Joseph's sight (i.e., items were not re-placed into

the array following a selection). This was repeated until Joseph had selected all items in the array. Three MSWOs were conducted and selection percentages across the MSWOs were averaged to determine a hierarchy.

The results of the preference assessment were used to inform items in the functional analysis. Specifically, to inform high-preferred items used in the tangible conditions and control conditions and moderate-preferred items in attention conditions. Further, these results were used to inform items to assess in the competing-items assessment. Two items were found to be high preferred (i.e., at least 80% selection) for Christopher (a computer and tablet) and one item for Logan (a music box). For William and Joseph, no items met criteria for high preferred; however, a specific item was reported to evoke problem behavior when removed for both participants, so this item was included in the tangible condition of the functional analysis. William's moderately preferred item (i.e., ranked in the middle) was an exercise ball, Christopher's moderately preferred item was a word search, Joseph's moderately preferred items were a handful of white poker chips, and Logan's moderately preferred item was a maraca.

Functional Analysis

The therapist used information from the pre-experimental indirect assessment and direct observations to program types of attention to deliver in the attention condition of the functional analysis (i.e., attention typically delivered for the target behavior in the everyday environment) and to determine situations in which the behavior was likely to occur (e.g., when a caregiver was doing chores, when a preferred item was removed, when caregivers were paying attention to peers). Tangible items used in the tangible condition of the functional analysis were items found to be highest preferred in the preference assessment unless there was a specific item reported or observed to evoke problem behavior contingent on removal. Specifically, for William and

Joseph, it was reported and observed that removal or restricted access to specific items evoked problem behavior; thus, specific items (a basketball for William and a bowl of manipulatives for Joseph) were used in the tangible condition. For Logan and Christopher, the item found to be highest preferred during the preference assessment (i.e., a music box for Logan and a computer for Christopher) was used in their tangible conditions.

All sessions were 5 min in duration and were conducted 1-3 days a week depending on the participant's schedule. Sessions were conducted in a session block (i.e., one attention, one control, and one tangible session) and participants were given a brief break following each block. For Joseph and Christopher, one session block was conducted a day due to their schedule and tolerance for remaining in the session room (Joseph only). For William and Logan, more than one session block was conducted in a day. One functional analysis session was terminated for Joseph because of incontinence and one session was terminated for Christopher after he requested to use the restroom. Data from both terminated sessions were included for data analysis.

Attention condition. During attention sessions, the therapist wore a blue T-shirt to aid in discrimination. Prior to the session, the therapist said, "This is the blue condition, I have some work to do and won't be able to talk to you." During the session, the therapist read materials and removed all attention from the participant. However, if the participant engaged in the target problem behavior, the therapist delivered programmed attention for 3 to 5 s. Programmed attention for Joseph, Logan, and William included a brief reprimand (e.g., "don't hit me that hurts."); programmed attention for Christopher included a brief expression of care (e.g., "Hey are you ok? You seem upset."). The participant had continuous access to a moderately preferred

tangible item (determined via the pre-experimental preference assessment) throughout the session.

Tangible condition. During tangible sessions, the therapist wore a yellow T-shirt to aid in discrimination. Prior to the session, the therapist provided access to the programmed tangible item for 2 min. After the 2 min had elapsed, the therapist said, "This is the yellow condition, it's time to put the toys away," removed the tangible item(s), and began engaging with the items. However, if the participant engaged in the target problem behavior, the therapist immediately provided the participant access to the tangible items for 30 s. After 30 s, the therapist again removed the items and said, "It's my turn."

Control condition. During control sessions, the therapist wore a white T-shirt to aid in discrimination. Prior to the session, the therapist said, "This is the white condition. We get to play and hang out." During the session, the therapist delivered continuous high-preferred attention and continuous access to high-preferred items (same items used in the tangible condition). There were no programmed consequences for problem behavior.

Competing-Stimulus Assessments (CSA)

We used information from informal caregiver interviews, direct observations, and results from the pre-experimental preference assessment to determine high-preferred items or types of attention to include in a CSA. If the results of the functional analysis demonstrated that a participant's target behavior was maintained by access to attention, the therapist conducted a competing-items assessment with the participant to determine items or activities that may compete with the occurrence of problem behavior. If the results of the functional analysis demonstrated that a participant's target behavior was maintained by access to tangible items, the therapist conducted a competing-attention assessment with the participant to determine whether a

form(s) of attention may compete with the occurrence of problem behavior. If the results of the functional analysis demonstrated that a participant's target behavior was maintained by both access to attention and access to tangibles items, the therapist conducted both a competing-items assessment and a competing-attention assessment. If we are unable to find alternative stimuli (i.e., attention or tangibles) that competed with a participant's problem behavior (i.e., access does not result in an 80% reduction in problem behavior), we may conduct a CSA with an alternative form of the functional reinforcer. That is, if an individual engages in problem behavior maintained by access to tangibles, and we are unable to identify a form of attention that competes with problem behavior, we will conduct a competing-items assessment with items different from the functional tangible item to determine alternative tangibles items that might compete with the participants problem behavior.

Thus far, we have conducted a competing-items assessment with one participant, Christopher, and we assessed six items. We have conducted a competing-attention assessment with William, Christopher, and Joseph. For William, we assessed the extent to which generic and specific attention competed with his problem behavior. Generic attention included a combination of attention types (i.e., praise, conversation, physical attention [high fives, back pats]) that were observed to be delivered by staff in his natural environment; specific attention involved the therapist singing and making silly sounds (e.g., animal noises, "raspberry" sound) while walking and holding hands with William. During informal interviews, it was reported that William did not prefer staff attention; however, during observations and rapport building periods with the therapist prior to the study, the primary investigator observed that William appeared to prefer this specific attention type. That is, he would smile and approach the therapist when this type of attention was delivered.

For Christopher, we only assessed one type of attention, conversation about preferred topics. Christopher reported that this was his favorite type of attention and his caregivers agreed; thus, we did not assess any other form of attention. For Joseph, similar to William, during caregiver interviews it was reported that he did not prefer staff attention. Thus, for the competing-attention assessment, we compared the two types of attention reported to be best tolerated by Joseph (i.e., conversation and touch [specifically hand holding and handshakes]). See Table 2 for specific items and types of attention assessed thus far for each participant.

All CSA (i.e., attention and tangible) sessions were 3 min in duration and were conducted 1-3 days a week depending on the participant schedules. Therapists conducted three sessions in which one trial with each tangible item or attention type was presented individually; the order of items or attention type presented in each session was quasi-random and determined by drawing a number (associated with an item or attention type) from a hat. We used items and attention types in the treatment analysis that resulted in at least an 80% reduction of problem behavior compared to the attention (for attention-maintained behavior) or tangible (for tangibly maintained behavior) condition of the functional analysis.

Competing-items assessments. For each trial, the therapist presented one of the 2 to 6 items or activities (e.g., pin box, tablet, crossword, coloring book, magazines) to the participant. At the beginning of each trial, the therapist said, “I can’t talk right now, but you can play with this,” presented them with the programmed item (no other items were present), and removed their attention (e.g., diverted eye contact, no conversation). However, if the participant engaged in target problem behavior, the therapist delivered the same type of brief attention delivered in the attention condition of the functional analysis.

Competing-attention assessments. For each trial, the therapist delivered one of the 1 to 3 attention types (e.g., conversation, singing, walking while holding hands) to the participant. At the beginning of each trial, the therapist said, "your [preferred tangible items] (same items used in the functional analysis) are not available, but I can hang out with you," removed the preferred item(s), and began providing the programmed attention type. The therapist withheld access to the tangible item(s) but kept the item(s) in the participant's view. If the participant engaged in target problem behavior, the therapist removed their attention (e.g., diverted eye contact, no conversation) and provided the participant with the same tangible item(s) delivered in the tangible condition of the functional analysis for 30 s.

Treatment Evaluation

Thus far, we have conducted the treatment evaluation with one participant, William. We compared the effects of continuous schedules of NCT with the tangible item found to maintain his problem behavior (i.e., a basketball), NCA with generic attention (found to compete during CSA), and NCA with specific attention (found to compete during CSA) on William's target problem behavior. Sessions were 10 min or 30 min in duration depending on the condition and were conducted 1-3 days a week. Several 10-min sessions were conducted in a day and William was given a break following each session. For 30-min sessions, only one session was conducted a day.

For all sessions that involved provision of an alternative competing stimulus, the functional reinforcer was delivered for a brief period of time at the end of each session to simulate lean schedules of functional reinforcer delivery that are likely to occur in the natural environment.

Baseline. If results of the functional analysis demonstrate that an individual's target behavior is maintained by access to attention, baseline is identical to the attention condition of the functional analysis. If results of the functional analysis demonstrate that an individual's target behavior is maintained by access to tangibles, baseline is identical to the tangible condition of the functional analysis. If results of the functional analysis demonstrate that an individual's target behavior is maintained by both access to attention and access to tangibles, two evaluations will be conducted with two separate baselines.

NCT (10 min). For participants whose behavior is maintained by access to attention, prior to NCT (10 min) sessions, the therapist will provide the participant with access to all competing stimuli (identified via the competing items assessment) and instruct the participant to select three items with which to engage. If three items were not found to compete with problem behavior in the competing items assessment, the therapist will provide the participant with all items found to compete. For participants whose behavior is maintained by access to tangibles, prior to NCT (10 min) sessions, the therapist will provide the participant with access to their functional tangible item(s). Next, the therapist will say, "I have work to do and won't be able to talk to you for a bit, but you can play with these things." At the beginning of the session, the therapist will begin working on a task (e.g., reading materials, dishes, talking to others) and remove all attention from the participant. The participant will have continuous access to the array of competing stimuli throughout the session. There will be no programmed consequences for the occurrence of problem behavior. At the end of the session, the therapist will deliver the functional reinforcer (i.e., preferred attention determined via pre-experimental caregiver interviews and direct observations) for 2 min.

NCA (10 min). Prior to NCA (10 min) sessions, the therapist will say, "your [preferred tangible items] (same items used in the functional analysis) are not available right now, but I can hang out with you!," remove the preferred tangible item(s), and begin providing continuous attention type(s) found to compete (via the competing- attention assessment) with the occurrence of problem behavior (for participants with problem behavior maintained by access to tangibles) or the type of attention found to maintain problem behavior (for participants with attention-maintained problem behavior). The preferred tangible item(s) will be kept within view of the participant throughout the session. There will be no programmed consequences for the occurrence of problem behavior. At the end of the session, the therapist will deliver the functional reinforcer (i.e., preferred tangible items) for 2 min.

NCT (30 min). Sessions will be conducted identical to NCT (10 min); however, at the end of the session, the therapist will deliver the functional reinforcer for 5 min. Following stable responding during the 30-min sessions, new therapists and various settings will be introduced to determine generality of the intervention.

NCA (30 min). Sessions will be conducted identical to NCA (10 min); however, at the end of the session, the therapist will deliver the functional reinforcer for 5 min. Following stable responding during the 30-min sessions, new therapists and various settings will be introduced to determine generality of the intervention.

Results

In this section, we describe the results thus far for each participant along with a discussion of future steps for each participant.

William

Figure 1 depicts results from William's completed functional analysis (top panel), completed competing-attention assessment (second panel), and nearly completed treatment evaluation (third panel). William's functional analysis data show he engaged in increasing levels of physical aggression in the tangible condition as compared to zero levels in the attention and control condition. These data suggest William's physical aggression was maintained by access to tangibles.

During William's competing-attention assessment, two types of attention were evaluated (i.e., generic and specific). The dotted line on the graph denotes an 80% reduction in problem behavior compared to the tangible condition of the functional analysis (i.e., stimuli inclusion criteria). Results of the competing-attention assessment show William did not engage in any physical aggression during either condition. Thus, both attention types, generic and specific, competed with William's target behavior during 3-min sessions in which his preferred tangible was restricted.

In William's treatment evaluation, NCT with the functional reinforcer was compared to NCA with generic attention and NCA with specific attention. Results show elevated levels of problem behavior in the initial baseline phase and an immediate decrease to zero levels of physical aggression in NCT, NCA with generic attention, and NCA with specific attention. These results were replicated in a reversal to baseline and a re-implementation of the intervention conditions. Next, therapists combined the two attention types (i.e., specific and generic) to determine their efficacy when therapists switched between attention types within session, which would be similar to what would likely be feasible in the natural environment. Results of NCA with both types of attention showed maintained zero levels of physical aggression. Next, sessions were extended to 30 min and physical aggression remained at zero. Moving forward with

William, we will introduce new therapists to assess whether problem behavior will maintain at low levels. Given that William's sessions were conducted in various locations at his day service facility (e.g., outside, inside in the common room, in a pull-out room, in an indoor arena, in a barn), new settings will not need to be introduced.

Christopher

Figure 2 depicts results from Christopher's completed functional analysis (top panel), completed competing-attention assessment (second panel), and near completed competing-items assessment (third panel). Initially, functional analysis sessions with Christopher were conducted in a session room at his day service facility; however, no problem behavior occurred during these sessions. Next, we conducted sessions with the same therapist but in a common area of the day service facility in an attempt to replicate the natural conditions under which this behavior occurred; however, we continued to observe low levels of problem behavior. However, we observed that Christopher would engage in problem behavior immediately after sessions when he went back to work with his day service staff. The therapist conducting functional analysis sessions (Therapist #1) was a known and preferred individual for Christopher who had a history of differentially reinforcing appropriate behavior and implementing extinction for problem behavior. Therefore, we hypothesized this history may have interfered with the occurrence of problem behavior. Next, we introduced a new therapist (Therapist #2) who was less known to Christopher to conduct sessions in the common area of the day service facility. Results showed Christopher engaged in higher levels of problem behavior in the attention and tangible conditions as compared to the control condition suggesting his target behaviors were maintained by access to attention and tangibles.

During Christopher's competing-attention assessment, one type of attention was evaluated, conversation about preferred topics (e.g., his favorite places to eat, recent events he attended, his family members), as this was the type of attention Christopher and his caregivers reported to be highest preferred. The dotted line on the graph denotes an 80% reduction in problem behavior compared to the attention condition of the functional analysis. Results of the competing-attention assessment show Christopher did not engage in any problem behavior during the assessment; thus, conversation about preferred topics competed with Christopher's target behavior during 3-min sessions in which his preferred tangible was restricted.

The third graph depicts data from Christopher's competing-items assessment. It is important to note that these data depict the average occurrence of problem behavior and average duration of engagement across two exposures. Once we are able to again conduct sessions, we will conduct one more round of trials (i.e., one more exposure to each item) and this information will be used to determine which items will be used in NCT sessions. The dotted line on the graph denotes an 80% reduction in problem behavior compared to the tangible condition of the functional analysis. Thus far, no items have resulted in an 80% reduction in problem behavior; however, access to the computer, scrapbook, and tablet have resulted in low levels of problem behavior and high levels of engagement.

After completing the CSA, we will conduct two treatment evaluations. In Evaluation 1, baseline will be identical to the attention condition of the functional analysis and we will evaluate the efficacy of NCT when caregiver attention is withheld during 10-min sessions. In Evaluation 2, baseline will be identical to the tangible condition of the functional analysis and we will evaluate the efficacy of NCA when Christopher's preferred tangible item is withheld during 10-min sessions. If we find effects during 10-min sessions, we will then conduct 30-min sessions

and introduce new therapists to determine the generality of the procedures. Given that Christopher's sessions will be conducted within his natural environment, sessions will likely take place in various locations at his day service facility (e.g., in the lunch room, outside, in the recreation room, in a pull-out craft room); thus, new settings will not need to be introduced.

Joseph

Figure 3 depicts results from Joseph's completed functional analysis (top panel) and completed competing-attention assessment (second panel). Joseph's functional analysis data show he engaged in problem behavior exclusively in the tangible condition suggesting his behavior was maintained by access to tangibles. During Joseph's competing-attention assessment, we compared the two types of attention reported to be best tolerated by Joseph (i.e., conversation and touch [specifically hand holding and handshakes]). The dotted line on the graph denotes an 80% reduction in problem behavior compared to the tangible condition of the functional analysis. Joseph engaged in target problem behavior at rates higher than the inclusion criteria (i.e., 80% reduction) across both conditions. Further, the frequency and intensity of Joseph's target problem behavior increased across sessions. Thus, we combined the attention types to assess whether a combination of attention types might compete. Joseph continued to engage in high levels of problem behavior in this condition.

Once we are able to again conduct sessions with Joseph, we will conduct a competing-items assessment to attempt to find alternative tangible items that might compete when his preferred tangible items (i.e., small chosen manipulatives in a bowl) are not available. We will conduct a competing-items assessment with various receptacles (e.g., boxes, plates, small containers, things he can stack) that are similar to his preferred items but do not include a bowl. If we are able to find items that compete with his preferred tangibles, we will use these items in

the treatment evaluation and compare NCT with his preferred items (manipulatives in a bowl) to NCT with tangibles found to compete.

Logan

Figure 4 depicts results from Logan's functional analysis. Logan's functional analysis data show he engaged in problem behavior at higher levels in the attention and tangible conditions as compared to the control condition. These data suggest Logan's target behaviors were maintained by access to both attention and tangibles. Given these results, the next steps for Logan will be to conduct both types of CSAs. We will conduct a competing-attention assessment to determine types of attention that might compete when access to preferred tangible items is restricted and a competing-items assessment to determine items that might compete when access to attention is restricted. Items and attention types that result in an 80% reduction of problem behavior as compared to the functional analysis will be used in the treatment evaluation.

Discussion

Preliminary results suggest the efficacy of providing NCA, as determined by the competing-attention assessment, in reducing problem behavior maintained by access to tangible items during times in which that tangible was withheld. For William, access to continuous therapist attention resulted in a reduction of problem behavior during 10-min sessions and maintained when sessions were extended to 30 min. Further, these results suggest the utility of the competing-attention assessment in identifying attention types that might compete when the functional reinforcer is withheld. These results suggest that attention may be an effective substitute for some individuals with tangibly maintained problem behavior when their preferred tangible item is not available.

The current study extends the literature in several important ways. Most studies on the use of NCR have been conducted during short session durations (i.e., 10 min or less; Meindl et al., 2019) and did not evaluate setting generalization (Meindl et al., 2019). In the current study, we assessed (or plan to assess) the effects of the intervention during longer sessions durations (i.e., 30 min) and with novel therapists in multiple settings. Further, for William and Christopher, all sessions have been conducted within their natural environment (i.e., within their on-going day service facilities routine); thus, sessions have been conducted in various settings across conditions.

Additionally, previous research has primarily evaluated the use of alternative stimuli in the form of preferred tangibles in an NCR procedure. In the current study, we are evaluating the use of attention as an alternative reinforcer for individuals with problem behavior maintained by access to tangibles. For William, whose behavior was maintained by tangibles, access to attention effectively competed. Furthermore, all participants included in the study were adults. Currently, most studies on NCR have been conducted with children (Meindl et al., 2019).

Although preliminary results for William are promising, the current data set is incomplete and requires further investigation to determine the efficacy of the procedures with the remaining participants. Further, there are some notable limitations in the current study. As a part of our current procedures, we have not included an arbitrary reinforcer assessment (Fischer et al., 1997) to determine if the stimuli identified to be competitive also contribute to the maintenance of the participant's problem behavior. Although a tangible and attention condition have been included in the functional analyses, it is unknown whether the specific tangible items or attention types identified in the CSA are functional variables. It is possible that the competitive stimuli may be effective in the treatment evaluation because they are functional (rather than alternative) stimuli.

It may be necessary for future research to include an arbitrary reinforcer assessment following the identification of a competitive stimulus to definitively determine if access to an alternative (rather than functional) stimulus is effective in maintaining low levels of problem behavior when the functional reinforcer is unavailable.

Another notable limitation in the current study is the limited number of attention types assessed in the competing-attention assessments. That is, we only included two types of attention in William's assessment, one type of attention in Christopher's assessment, and three types of attention in Joseph's assessment. Identifying a variety of competitive attention types may be important as having several stimuli options allows for greater flexibility in designing NCR procedures (Fisher et al., 2000). Additionally, there is information to suggest that competing stimuli in the form of attention may not always compete as well with tangibly-maintained problem behavior as access to competing stimuli in the form of tangibles does with attention-maintained problem behavior (e.g., one participant in Sumpter et al., 2020; Joseph in the current study). Thus, it is important to identify several types of attention to assess.

In the current evaluation, we had difficulty identifying various forms of attention that were appropriate for the participants in the study. Previous research on evaluating preference for attention often includes attention types that are not applicable for the adult population. For example, Kelly et al. (2014) identified seven common forms of attention (i.e., singing, hugs, high-fives, head rubs, tickles, and praise) and assessed participant's preference for these attention types; however, several of these forms of attention would not be appropriate to deliver to an adult (e.g., hugs and tickles) and would not be feasible to deliver repeatedly over an extended period of time (e.g., delivering a praise statement once every 10 s is not feasible). For Christopher in particular, sessions were conducted within his natural environment in front of his

peers; thus, therapists did not want to provide attention that would be socially stigmatizing. Therefore, we only included conversation which he reported to be highly preferred. Results of the competing-attention assessment demonstrated that conversation did compete with problem behavior; however, it may be beneficial to identify varying forms of conversation that may compete. For example, Roscoe et al. (2010) utilized an attention preference assessment to identify high- and low-preference conversation topics. Future research may include a similar assessment as a component of the competing-attention assessment to determine additional competitive conversation topics.

For William, one of the forms of attention assessed, specific attention, involved the therapist making silly sounds (e.g., animal noises, "raspberry" sounds) and holding hands with William. Although this was observed to be highly preferred (e.g., associated with smiles and approaching the therapist) and to compete with problem behavior, this form of attention may not be feasible or appropriate in all environments (e.g., the doctor's office) or for an extended period of time. This was the primary reason we assessed specific attention in combination with generic attention (e.g., praise, conversation, physical attention [high-fives, back pats]) as a combination of these attention types may be more feasible and appropriate. Future research should continue to identify and evaluate individuals' preferences for varying attention types, particularly with the adult population.

For one participant, Joseph, we were unable to find a form of attention that effectively competed during the competing-attention assessment. As a result of the severity of problem behavior observed during competing-attention assessment sessions conducted thus far, we will not continue to assess attention types; rather, we will attempt to find alternative tangible items (i.e., different from the items that maintain his problem behavior) to provide when his preferred

tangible items are not available. Future research might involve evaluating ways to establish different forms of attention as a reinforcer when a competing-attention assessment does not identify a competitive form of attention. For example, results from Dozier et al. (2012) demonstrated that simple stimulus pairing (i.e., pairing the delivery a preferred stimulus [in this case, an edible] with a neutral stimulus [in this case, praise]) was not effective in establishing the neutral stimulus (praise) as a reinforcer. However, for four participants, response-stimulus pairing was effective. Therapists paired the delivery of praise (previously neutral) with a high-preferred edible contingent on a target response. Following several pairing sessions, praise alone was delivered contingent on the target response to evaluate if the target response would maintain with praise alone. For four participants, the target response maintained which suggested that praise had been established as a reinforcer. Researchers might evaluate the efficacy of a similar procedure for establishing other forms of attention as a reinforcer.

Further, it is possible that Joseph's behavior was multiply maintained by access to tangibles and escape from social interaction (i.e., social avoidance). Thus, it is possible that the removal of attention in the competing-attention assessment (i.e., problem behavior resulted in access to tangible and removal of therapist attention) contributed to the maintenance of problem behavior observed in session. In addition to the pairing procures described above, it may be necessary to implement an intervention to make attention less aversive (e.g., Harper et. al., 2013) prior to conducting the competing-attention assessment. Additionally, implementing extinction during the competing-attention assessment (i.e., problem behavior does not result in escape from therapist attention) may be a way to mitigate this; however, given the severity of Joseph's behavior in session, extinction may not be feasible.

Additionally for Joseph, we conducted three different types of pre-experimental preference assessments (i.e., paired-stimulus, free-operant, MSWO) as a result of severe problem behavior. When the therapist attempted to conduct a PSPA, Joseph engaged in problem behavior when prompted to relinquish a selected item. Thus, the therapists attempted to conduct a free-operant preference assessment as this type of assessment is typically associated with less problem behavior (Roane et al., 1998); however, once Joseph selected an item to engage with, he would attempt to put all other items away (i.e., clean up items he did not select) and engaged in severe problem behavior when the therapist blocked him from cleaning up the materials during the assessment. Therefore, the therapist conducted an MSWO preference assessment and successfully completed the assessment. When it was time to select a new item in the MSWO assessment, the therapist said, "it's time to switch," which was a common instruction for Joseph (e.g., Joseph was prompted to "switch" his items regularly at home). It is possible that this instruction functioned as a rule for Joseph which may be why the therapist was successful with the MSWO and not the PSPA or free-operant assessment. If we provided the instruction, "it's time to switch," in the other assessments, we might have been successful in completing them.

In the current study, NCR with alternative stimuli was (or will be) implemented on a dense schedule (i.e., continuously) across all treatment sessions. That is, the NCR schedule was not faded. This may pose barriers for implementation in the natural environment, particularly with NCA. However, these procedures may be useful for short periods of time in which a preferred tangible item is not available (e.g., the item needs to be washed) or times in which a caregiver's attention will be unavailable (e.g., when the caregiver does the dishes). In these circumstances, it is likely the alternative reinforcer (i.e., attention or tangibles) can be delivered on a dense schedule. Research has demonstrated that schedule thinning can be effective after an

initially dense schedule of NCR (Carr et al., 2000); however, it is important to know if the same procedures would be effective for NCR procedures with alternative reinforcers, particularly in the form of attention.

Furthermore, we did not evaluate the efficacy of the procedures with the participant's direct support staff within the context of the normal day (i.e., with normal staffing ratios). Although training direct support staff to implement the NCR procedures was not the primary purpose of the current investigation, it is important to determine the feasibility of the intervention within the context of the natural environment. More to this point, it is necessary to determine the efficacy of these procedures during more extended durations (e.g., throughout the day) and when implemented several times in a day (e.g., during all meal prep times [i.e., when caregivers are cooking breakfast, lunch, and dinner]). Thus, researchers should evaluate the feasibility of the current procedure with direct support staff in the context of the natural environment.

We did not conduct social validity assessments to determine participant or caregiver preference for the procedures used in the current evaluation. There is research to suggest that NCR procedures, as compared to response-contingent procedures, may not preferred by caregivers (e.g., Gabor et al., 2016) or participants (e.g., Luczynski et al., 2009). However, it is important to note that both of these studies were conducted with children; thus, it is unknown whether the same is true to adult participants.

One notable limitation of NCR is the lack of strengthening of an appropriate alternative response (Iwata & Kahng., 20005). Thus far, NCR with an alternative reinforcer has been effective for maintaining low levels of problem behavior during times in which the functional reinforcer was withheld; however, teaching appropriate alternative behaviors (e.g., communication) is a necessary component of programming for an individual with disabilities

who engages in problem behavior. Often, NCR procedures are combined with a teaching procedure (e.g., FCT; Austin & Tiger, 2015). Future research might evaluate the procedures used in the current evaluation in combination with a teaching procedure like FCT. NCR is often used in FCT procedures when a delay-to-reinforcement is implemented. Results from the current evaluation further suggest the efficacy of providing access to alternative stimuli during these times (i.e., delays to reinforcer access) in maintaining low levels of problem behavior. Additionally, William's treatment evaluation results suggested that therapist attention effectively competed with his tangibly maintained problem behavior for 30 min while his functional tangible reinforcer was withheld. This suggests the efficacy of providing alternative access to alternative reinforcers during longer periods of delay to the reinforcer which would be valuable in an FCT procedure.

Overall, results from this preliminary evaluation are promising; however, more data are necessary to determine the effects of providing NCR with competing stimuli on participant problem behavior when the functional reinforcer is withheld.

References

Austin, J. E., & Tiger, J. H. (2015). Providing alternative reinforcers to facilitate tolerance to delayed reinforcement following functional communication training. *Journal of Applied Behavior Analysis, 48*(3), 663-668. https://doi.org/10.1002/jaba.215

Beavers, G. A., Iwata, B. A., & Lerman, D. C. (2013). Thirty years of research on the functional analysis of problem behavior. *Journal of Applied Behavior Analysis, 46*(1), 1-21. https://doi.org/10.1002/jaba.30

Carr, J. E., Coriaty, S., Wilder, D. A., Gaunt, B. T., Dozier, C. L., Britton, L. N., Avina, C., & Reed, C. L. (2000). A review of "noncontingent" reinforcement as treatment for the aberrant behavior of individuals with developmental disabilities. *Research in Developmental Disabilities*, *21*(5), 377-391. https://doi.org/10.1016/s0891-4222(00)00050-0

Carr, J. E., Severtson, J. M., & Lepper, T. L. (2009). Noncontingent reinforcement is an empirically supported treatment for problem behavior exhibited by individuals with developmental disabilities. *Research in Developmental Disabilities*, *30*(1), 44-57. https://doi.org/10.1016/j.ridd.2008.03.002

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29*(4), 519-532. https://doi.org/10.1901/jaba.1996.29-519

Dozier, C. L., Iwata, B. A., Thomason-Sassi, J., Worsdell, A. S., & Wilson, D. M. (2012). A comparison of two pairing procedures to establish praise as a reinforcer. *Journal of Applied Behavior Analysis, 45*(4), 721-735. https://doi.org/10.1901/jaba.2012.45-721

Fischer, S. M., Iwata, B. A., & Mazaleski, J. L. (1997). Noncontingent delivery of arbitrary reinforcers as treatment for self-injurious behavior. *Journal of Applied Behavior Analysis, 30*(2), 239-249. https://doi.org/10.1901/jaba.1997.30-239

Fisher, W. W., DeLeon, I. G., Rodriguez-Catter, V., & Keeney, K. M. (2004). Enhancing the effects of extinction on attention-maintained behavior through noncontingent delivery of attention or stimuli identified via a competing stimulus assessment. *Journal of Applied Behavior Analysis, 37*(2), 171-184. https://doi.org/10.1901/jaba.2004.37-171

Fisher, W. W., Greer, B. D., Fuhrman, A. M., Saini, V., & Simmons, C. A. (2018). Minimizing resurgence of destructive behavior using behavioral momentum theory. *Journal of Applied Behavior Analysis, 51*(4), 831-853. https://doi.org/10.1002/jaba.499

Fisher, W. W., Kuhn, D. E., & Thompson, R. H. (1998). Establishing discriminative control of responding using functional and alternative reinforcers during functional communication training. *Journal of Applied Behavior Analysis, 31*(4), 543-560. https://doi.org/10.1901/jaba.1998.31-543

Fisher, W. W., O'Connor, J. T., Kurtz, P. F., DeLeon, I. G., & Gotjen, D. L. (2000). The effects of noncontingent delivery of high- and low-preference stimuli on attention-maintained destructive behavior. *Journal of Applied Behavior Analysis, 33*(1), 79-83. https://doi.org/10.1901/jaba.2000.33-79

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*(2), 491-498. https://doi.org/10.1901/jaba.1992.25-491

Fritz, J. N., Jackson, L. M., Stiefler, N. A., Wimberly, B. S., & Richardson, A. R. (2017). Noncontingent reinforcement without extinction plus differential reinforcement of alternative behavior during treatment of problem behavior. *Journal of Applied Behavior Analysis, 50*(3), 590-599. https://doi.org/10.1002/jaba.395

Gabor, A. M., Fritz, J. N., Roath, C. T., Rothe, B. R., & Gourley, D. A. (2016). Caregiver preference for reinforcement-based interventions for problem behavior maintained by positive reinforcement. *Journal of Applied Behavior Analysis, 49*(2), 215-227. https://doi.org/10.1002/jaba.286

Hagopian, L. P., Fisher, W. W., & Legacy, S. M. (1994). Schedule effects of noncontingent reinforcement on attention-maintained destructive behavior in identical quadruplets. *Journal of Applied Behavior Analysis, 27*(2), 317-325. https://doi.org/10.1901/jaba.1994.27-317

Hagopian, L. P., Fisher, W. W., Sullivan, M. T., Acquisto, J., & LeBlanc, L. A. (1998). Effectiveness of functional communication training with and without extinction and punishment: a summary of 21 inpatient cases. *Journal of Applied Behavior Analysis, 31*(2), 211-235. https://doi.org/10.1901/jaba.1998.31-211

Hagopian, L. P., Kuhn, S. A., Long, E. S., & Rush, K. S. (2005). Schedule thinning following communication training: using competing stimuli to enhance tolerance to decrements in reinforcer density. *Journal of Applied Behavior Analysis, 38*(2), 177-193. https://doi.org/10.1901/jaba.2005.43-04

Hagopian, L. P., Toole, L. M., Long, E. S., Bowman, L. G., & Lieving, G. A. (2004). A comparison of dense-to-lean and fixed lean schedules of alternative reinforcement and

extinction *Journal of Applied Behavior Analysis, 37*(3), 323-338. https://doi.org/10.1901/jaba.2004.37-323

Hanley, G. P., Piazza, C. C., & Fisher, W. W. (1997). Noncontingent presentation of attention and alternative stimuli in the treatment of attention-maintained destructive behavior. *Journal of Applied Behavior Analysis, 30*(2), 229-237. https://doi.org/10.1901/jaba.1997.30-229

Harper, J. M., Iwata, B. A., & Camp, E. M. (2013). Assessment and treatment of social avoidance *Journal of Applied Behavior Analysis, 46*(1), 147-160. https://doi.org/10.1002/jaba.18

Iwata, B. A. & Kahng. S. (2005). Some undesirable effects of noncontingent reinforcement. *European Journal of Behavior Analysis, 6*, 47-50. http://dx.doi.org/10.1080/15021149.2005.11434248

Iwata, B. A., Deleon, I. G., & Roscoe, E. M. (2013). Reliability and validity of the functional analysis screening tool. *Journal of Applied Behavior Analysis, 46*(1), 271-284. https://doi.org/10.1002/jaba.31

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis, 27*(2), 197-209. https://doi.org/10.1901/jaba.1994.27-197

Kelly, M. A., Roscoe, E. M., Hanley, G. P., & Schlichenmeyer, K. (2014, Spring). Evaluation of assessment methods for identifying social reinforcers. *Journal of Applied Behavior Analysis, 47*(1), 113-135. https://doi.org/10.1002/jaba.107

Lalli, J. S., Casey, S. D., & Kates, K. (1997). Noncontingent reinforcement as treatment for severe problem behavior: some procedural variations. *Journal of Applied Behavior Analysis, 30*(1), 127-137. https://doi.org/10.1901/jaba.1997.30-127

Luczynski, K. C., & Hanley, G. P. (2009). Do children prefer contingencies? An evaluation of the efficacy of and preference for contingent versus noncontingent social reinforcement during play *Journal of Applied Behavior Analysis, 42*(3), 511-525. https://doi.org/10.1901/jaba.2009.42-511

Meindl, J. N., Ivy, J. W., Glodowski, K. R., & Noordin, K. (2019). Applying Standards of Effectiveness to Noncontingent Reinforcement: A Systematic Literature Review. *Behavior Modification,* https://doi.org/10.1177/0145445519865073

Phillips, C. L., Iannaccone, J. A., Rooker, G. W., & Hagopian, L. P. (2017). Noncontingent reinforcement for the treatment of severe problem behavior: An analysis of 27 consecutive applications. *Journal of Applied Behavior Analysis, 50*(2), 357-376. https://doi.org/10.1002/jaba.376

Roane, H. S., Vollmer, T. R., Ringdahl, J. E., & Marcus, B. A. (1998). Evaluation of a brief stimulus preference assessment. *Journal of Applied Behavior Analysis, 31*(4), 605-620. https://doi.org/10.1901/jaba.1998.31-605

Roscoe, E. M., Kindle, A. E., & Pence, S. T. (2010). Functional analysis and treatment of aggression maintained by preferred conversational topics. *Journal of Applied Behavior Analysis, 43*(4), 723-727. https://doi.org/10.1901/jaba.2010.43-723

Slocum, S. K., Grauerholz-Fisher, E., Peters, K. P., & Vollmer, T. R. (2018). A multicomponent approach to thinning reinforcer delivery during noncontingent reinforcement schedules. *Journal of Applied Behavior Analysis, 51*(1), 61-69. https://doi.org/10.1002/jaba.427

Sumter, M. E., Gifford, M. R., Tiger, J. H., Effertz, H. M., & Fulton, C. J. (2020). Providing noncontingent, alternative, functional reinforcers during delays following functional communication training. *Journal of Applied Behavior Analysis*. https://doi.org/10.1002/jaba.708

Tiger, J. H., Hanley, G. P., & Bruzek, J. (2008). Functional communication training: a review and practical guide. *Behavior Analysis in Practice, 1*(1), 16-23. https://doi.org/10.1007/BF03391716

Vollmer, T. R., Borrero, J. C., Wright, C. S., Van Camp, C., & Lalli, J. S. (2001). Identifying possible contingencies during descriptive analyses of severe behavior disorders. *Journal of Applied Behavior Analysis, 34*(3), 269-287. https://doi.org/10.1901/jaba.2001.34-269

Vollmer, T. R., Iwata, B. A., Zarcone, J. R., Smith, R. G., & Mazaleski, J. L. (1993). The role of attention in the treatment of attention-maintained self-injurious behavior: noncontingent reinforcement and differential reinforcement of other behavior. *Journal of Applied Behavior Analysis, 26*(1), 9-21. https://doi.org/10.1901/jaba.1993.26-9

Vollmer, T. R., Marcus, B. A., & Ringdahl, J. E. (1995). Noncontingent escape as treatment for self-injurious behavior maintained by negative reinforcement. *Journal of Applied Behavior Analysis, 28*(1), 15-26. https://doi.org/10.1901/jaba.1995.28-15

Vollmer, T. R., Progar, P. R., Lalli, J. S., Van Camp, C. M., Sierp, B. J., Wright, C. S., Nastasi, J., & Eisenschink, K. J. (1998). Fixed-time schedules attenuate extinction-induced phenomena in the treatment of severe aberrant behavior. *Journal of Applied Behavior Analysis, 31*(4), 529-542. https://doi.org/10.1901/jaba.1998.31-529

Wallace, M. D., Iwata, B. A., Hanley, G. P., Thompson, R. H., & Roscoe, E. M. (2012). Noncontingent reinforcement: a further examination of schedule effects during treatment.

Journal of Applied Behavior Analysis, 45(4), 709-719.

https://doi.org/10.1901/jaba.2012.45-709

Figure 1

William's functional analysis, competing-attention assessment, and treatment evaluation results

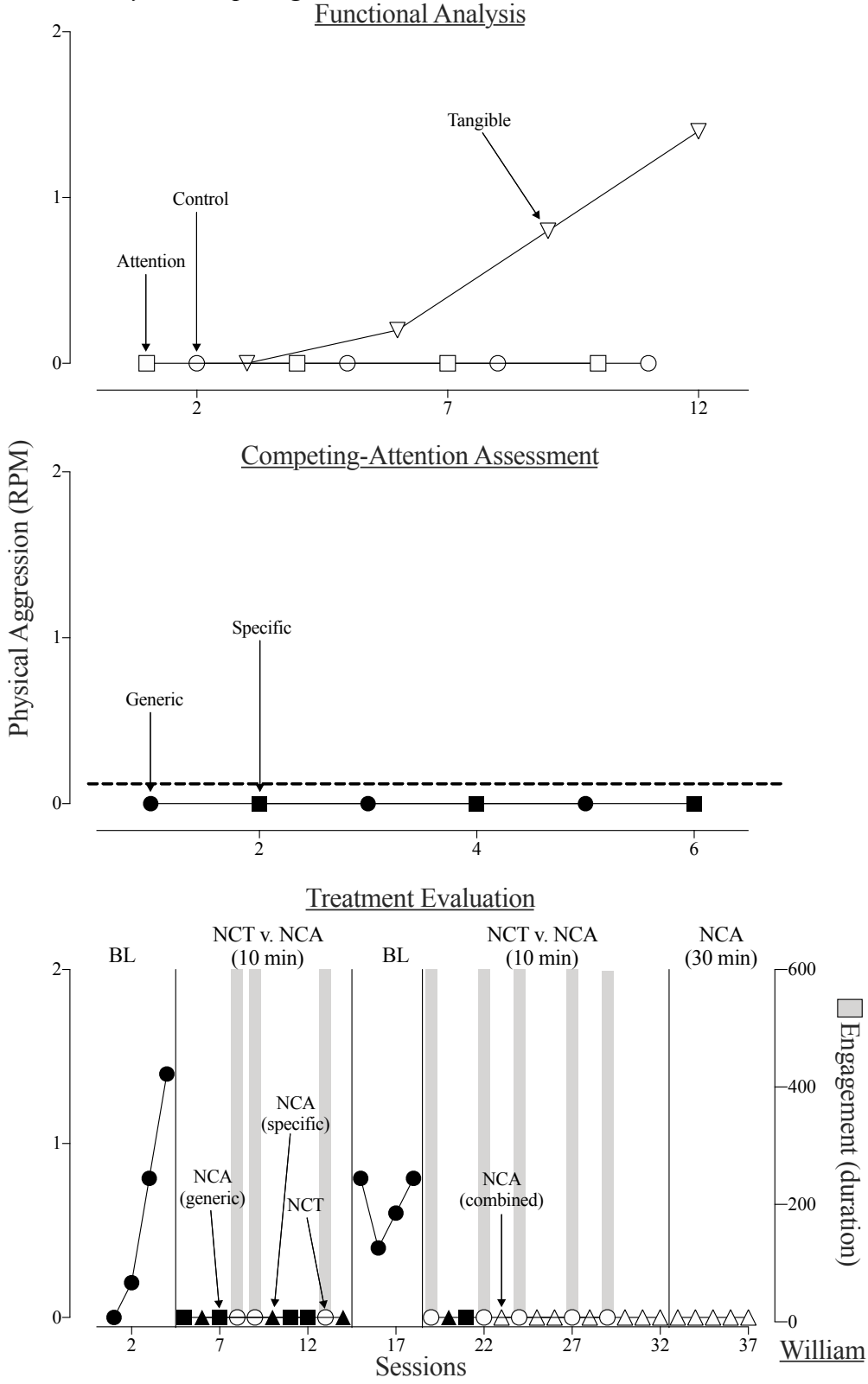

Figure 2

Christopher's functional analysis, competing-attention assessment, and competing-items assessment results

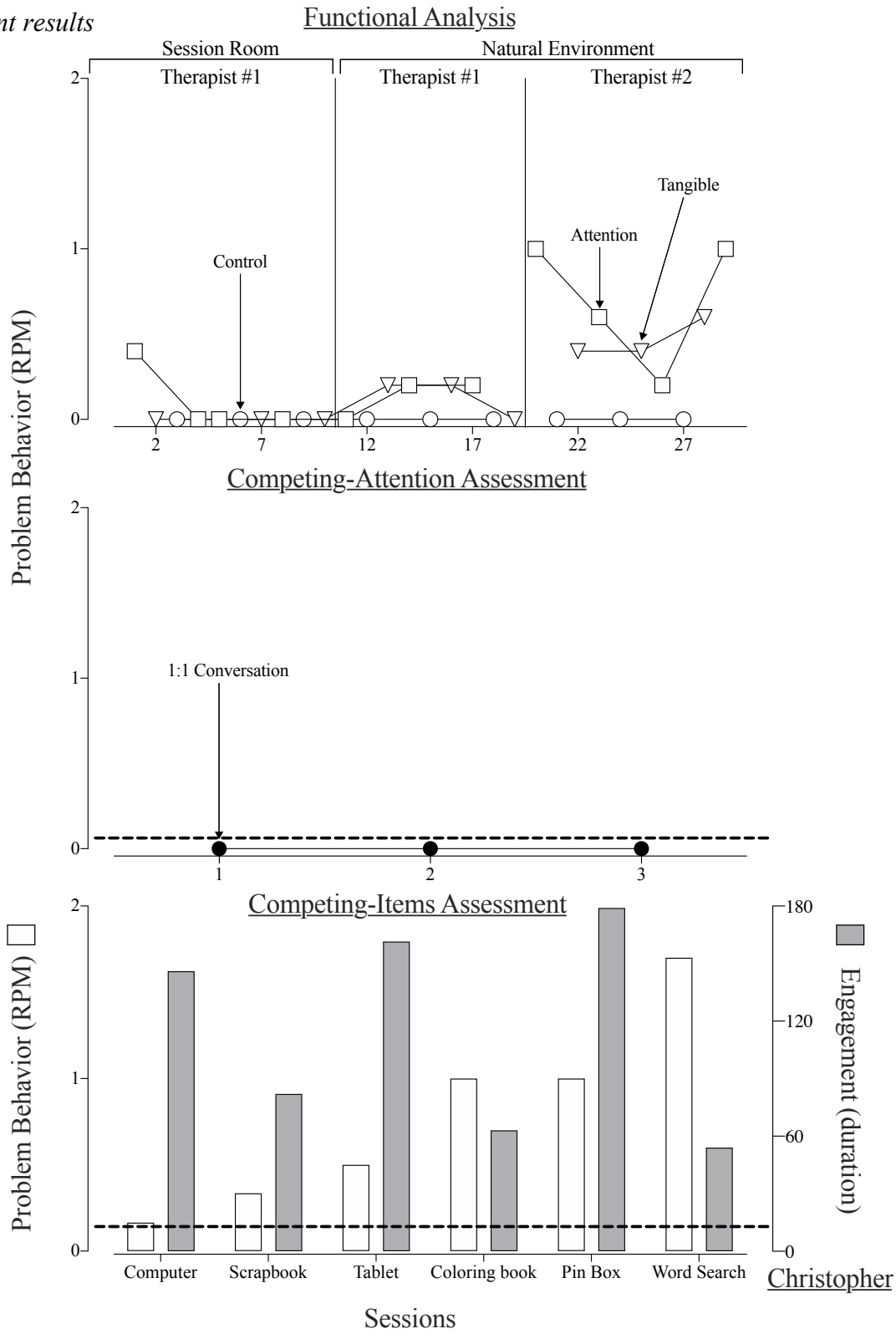

Figure 3

Joseph's functional analysis and competing-attention assessment results

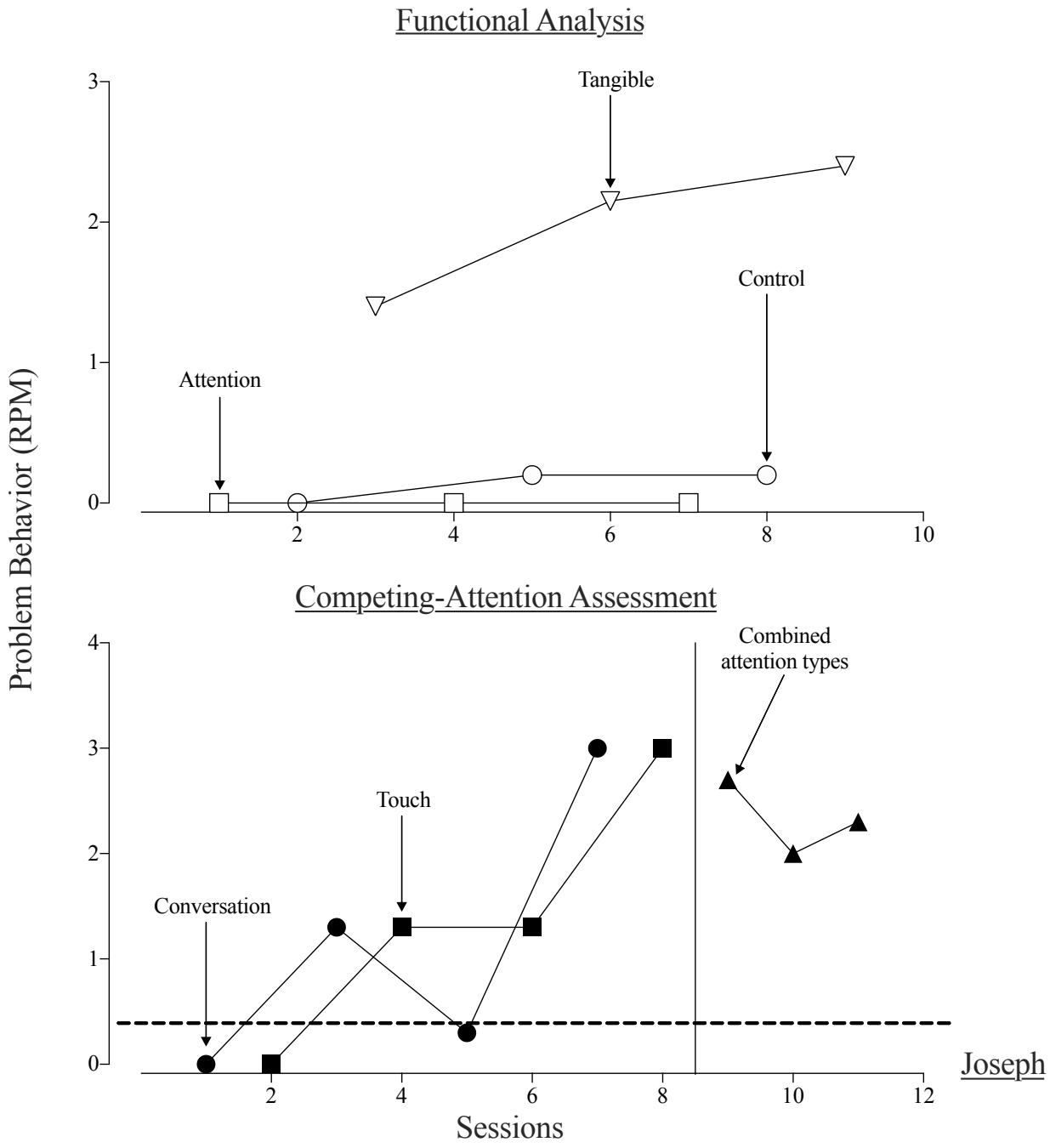

Figure 4

Logan's functional analysis results

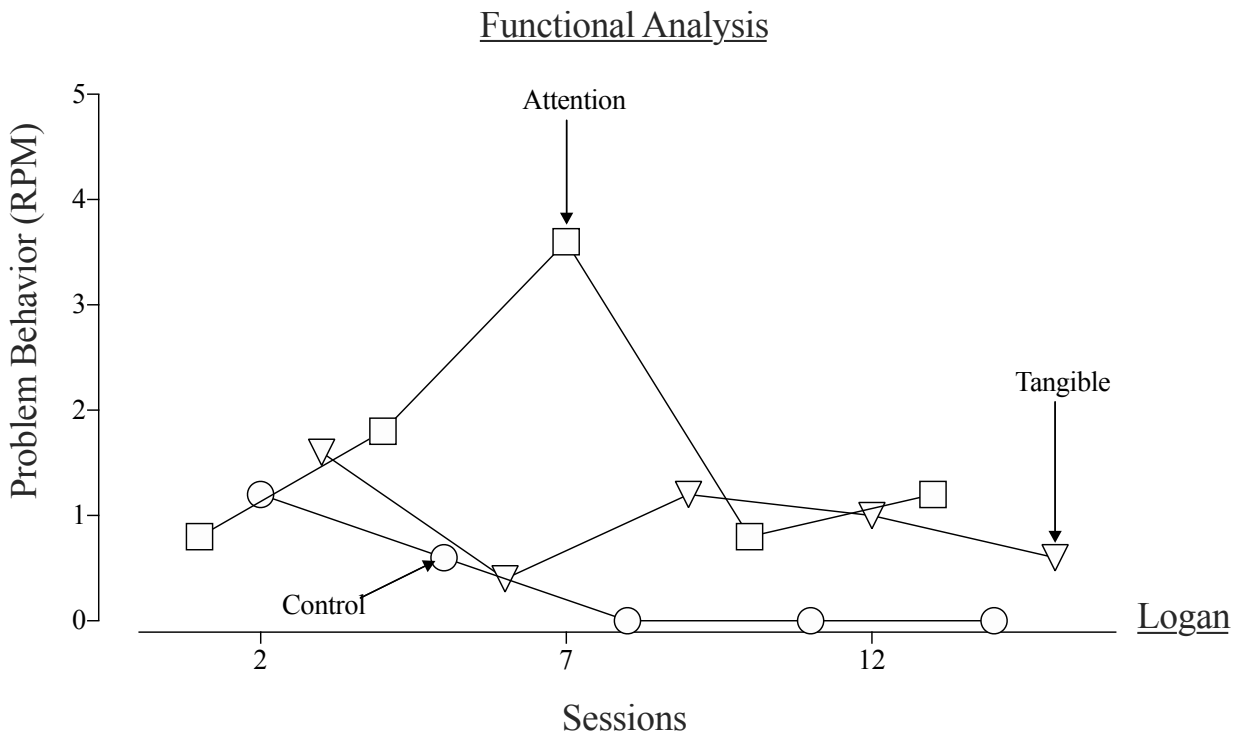

Table 1

Participant Problem Behavior Definitions

Participant	Behavior	Definition
William	Physical aggression	Any attempt or occurrence of hitting (i.e., forceful contact between William's hand and the therapist) or biting (i.e., placing open mouth on any part of therapist body)
Christopher	Physical aggression	Any attempt or occurrence of hitting (i.e., forceful contact between Christopher's hand and any part of the therapist), pushing (i.e., Christopher's body contacting the therapist with enough force to move them from the spot they were standing), or kicking (i.e., forceful contact between one or both of Christopher's legs and the therapist)
	Inappropriate verbal behavior	Any vocalization above conversational volume, use of profanity, or repeating a questions or statement in quick succession (i.e., 30 s or less between statements)
Joseph	Physical aggression	Any attempt or occurrence of grabbing (i.e., anytime Joseph used one or both hands to grasp another person), pushing (i.e., Joseph's body contacting the therapist with enough force to move them from the spot they were standing), or hitting (i.e., forceful contact between Joseph's hand and the therapist)
	Property destruction	Any instance in which one or both of Joseph's hands came in contact with the table with enough force to make an audible sound
Logan	Physical aggression	Any attempt or occurrence of grabbing (i.e., anytime Logan used one or both hands to grasp another person), hitting (i.e., forceful contact between Logan's hand and the therapist), or biting (i.e., placing open mouth on any part of the therapist)
	Self-injurious behavior	Any attempt or occurrence of hand-to-face hitting (i.e., forceful contact between Logan's hand and his own face) or head-to-surface hitting (i.e., forceful contact between Logan's head and a surface)

Table 2

Items and Types of Attention Included in the Competing-Stimulus Assessments

Participant	FA results	Competing-Items Assessment	Items Assessed	Competing-Attention Assessment	Types of Attention Assessed
William	Tangible	No	N/A	Yes	Generic attention: a combination of attention types observed in natural environment (i.e., praise, conversation, physical attention [high fives, back pats]) Specific attention: therapist singing and making silly sounds (e.g., animal noises, "raspberries") while walking and holding hands with William
Christopher	Attention & tangible	Yes	Computer Tablet Scrapbook Coloring book Pin box Word search	Yes	Christopher-led conversation about preferred topics (e.g., favorite places to ear, recent events he had attended, family members)
Joseph	Tangible	No	N/A	Yes	Conversation: therapist discussed preferred topics (e.g., recent events Joseph had attended) and on-going activities Physical touch: hand holding and handshakes Combined conversation and physical touch
Logan	Attention & tangible	N/A	N/A	N/A	N/A