EVALUATION OF A LATENCY-BASED COMPETING STIMULUS ASSESSMENT (LBCSA)

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

EVALUATION OF A LATENCY-BASED COMPETING STIMULUS ASSESSMENT (LBCSA)

Presented by Madison Imler,

a candidate for the degree of Master of Science,

and hereby certify that, in their opinion, it is worthy of acceptance.

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Evaluation of a Latency-Based Competing Stimulus Assessment (LBCSA)

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Abstract

A competing stimulus assessment (CSA) is used in the treatment of automatically maintained problem behavior to identify items that compete with the sensory consequences that are associated with the targeted problem behavior. The proposed study aims to evaluate a more efficient means of conducting a CSA by evaluating the effectiveness of a latency-based competing stimulus assessment (LBCSA). During the LBCSA, a therapist presented potential competing stimuli to the participants, and contingent on the occurrence of problem behavior the session was terminated. The results of this study indicated that the items identified as long latency to problem behavior were effective in competing with the hypothesized sensory consequences relative to items identified as short latency to problem behavior for two out of three participants. Subsequently, the LBCSA effectively increased the efficiency of evaluating competing stimuli by systematically decreasing the amount of time it took to evaluate these items.

Introduction

Autism spectrum disorder (ASD) is defined as a neurodevelopmental disorder that can be characterized into two domains. Specifically, deficits in both social communication and restricted interest or repetitive behaviors (American Psychiatric Association & American Psychiatric Association., 2013). The Center for Disease Control and Prevention's (CDC) Autism and Developmental Disabilities Monitoring (ADDM) Network estimates that within the United States one in 44 children are formally diagnosed with ASD (Maenner., 2021). Through parent reports, many different atypical problem behaviors have been identified as a difficult and stressful time for children with ASD and their parents (Dominick et al., 2007). With the significant number of children diagnosed with ASD in the United States and the impact that atypical behaviors can have on children with ASD and their parents, the need for intervention or support is increasingly important. The CDC recognizes applied behavior analysis as a notable treatment approach for individuals diagnosed with ASD (Center for Disease Control and Prevention [CDC]. 2019). In addition, it is a widely accepted treatment for ASD among healthcare professionals, as well as being utilized as a treatment for ASD in many schools and treatment clinics.

Functional Analysis of Problem Behavior

Applied behavior analysis (ABA) is a science focused on understanding human behavior and improving socially significant behavior (Cooper et al., 2014). More specifically behavior analysts commonly develop systematic evidence-based interventions for children diagnosed with ASD that engage in problem behavior.

To develop these systematic evidence-based interventions, behavior analysts must first identify what variables are maintaining problem behavior. Typically, this is done by conducting a functional analysis (FA) of problem behavior consisting of a varying sequence of environmental conditions (Iwata et al., 1994). Each condition systematically manipulates antecedents and consequences, to identify the functional relationship between problem behavior and the specific environmental events maintaining the targeted problem behavior. While there are many variations of the FA that can be utilized (Beavers et al., 2013) Iwata et al. (1994) description of the FA as what a majority of behavior analysts most commonly use and refer to as the traditional FA.

The different conditions within the traditional FA are described as follows. The social disapproval condition, also known as the attention condition, involves the therapist pretending to be busy and ignoring the participant while the individual has access to preferred toys. The therapist then provides attention in the form of a vocal statement of concern or disapproval contingent on the occurrence of the targeted problem behavior. The academic demands condition, also known as the demand condition, is when the therapist presents demands (e.g., “touch your nose”), and contingent on the occurrence of the targeted problem behavior the individual is given a 30-s break from demands. Unstructured play, or the play condition, involves providing free access to preferred items, access to therapist attention every 30-s, no demands are presented, and all instances of the targeted problem behavior are ignored. The alone condition involves placing the individual alone in a room with no stimuli or therapist. A modification to the alone condition can be made in the form of an ignore condition. The ignore condition is identical to the alone condition except, there is a therapist in the room with the individual, but the therapist ignores all instances of problem behavior. Furthermore, most clinicians include a tangible condition in their FA which is considered to be an additional manipulation of the FA (Hagopian et al., 2013). During the tangible condition, the therapist is in the room along with preferred tangibles (e.g., toys, leisure items). Before the start of the session, the individual is provided with access to the tangible items for 2 min. Once the session begins the therapist would remove access to the tangible items and contingent upon problem behavior the therapist would represent the items to the individual for a fixed amount of time. In addition, the therapist would also interact with the individual every 30-s to control for attention-maintained variables within the tangible condition.

After the conditions of the FA have been conducted, the next step is to evaluate the data via visual inspection. If there are elevated rates of problem behavior in the attention condition relative to play, this suggests that problem behavior is maintained by social positive reinforcement in the form of access to attention. If there are elevated rates of problem behavior in the academic demands condition relative to the play condition, this suggests that problem behavior is maintained by social negative reinforcement in the form of escape from demands. If there are elevated rates of problem behavior in the tangible condition relative to the play condition, it suggests that the problem behavior is maintained by social positive reinforcement in the form of access to tangibles. If the problem behavior is maintained by automatic reinforcement (i.e., the behavior itself is reinforcing), there are two patterns of behavior we may observe. First, there could be elevated rates of responding across all conditions. Secondly, there could be elevated rates of responding in the alone or ignore condition relative to the play condition.

In addition to the traditional FA, there is another way to evaluate if the problem behavior is maintained by automatic reinforcement. That is, the therapist could conduct a series of alone or ignore conditions as a screening procedure, also known as autoscreening, whenever problem behavior is suspected to be maintained by automatic reinforcement (Querim et al., 2013). When evaluating data collected in the alone or ignore conditions, the therapist can conclude that problem behavior is maintained by automatic reinforcement if there are consistently elevated rates of problem behavior throughout the series. If there are not consistently elevated rates of problem behavior, then the data do not suggest that the targeted problem behavior is maintained by automatic reinforcement and further evaluation is needed. By isolating these conditions in a screening procedure, the therapist can maximize time and resources. Subsequently, the behavior analyst then can more efficiently identify that the maintaining reinforcers for problem behavior are a direct result of the behavior itself (Vaughan & Michael, 1982).

Treatment of Automatically Maintained Problem Behavior

Treatment of automatically maintained problem behavior can be difficult because the behavior itself is reinforcing. That is, the behavior may produce sensory consequences that reinforce the problem behavior (e.g., visual stimulation, tactile stimulation). Given that the behavior itself is reinforcing, it may be difficult or impossible to eliminate the reinforcing consequences that the behavior itself provides.

Instead of eliminating the sensory consequences of the problem behavior, it is possible to treat automatically maintained problem behavior by providing access to a competing stimulus identified via a competing stimulus assessment (CSA). The purpose of a CSA is to identify items that compete with the sensory consequences that are associated with the targeted problem behavior. This typically consists of systematically evaluating the level of engagement with competing items that offer similar reinforcing value as the automatically maintained behavior while measuring problem behavior (Haddock & Hagopian, 2020).

Once competing items are identified via a CSA, they are then provided noncontingently to reduce problem behavior (Phillips et al., 2017). Noncontingent reinforcement (NCR) involves systematically presenting stimuli with a known reinforcing value on a fixed or variable schedule, independent of behavior (Cooper et al., 2014). NCR with competing items has been documented as an effective treatment component for automatically maintained behavior (Clay et al., 2018; Deleon et al., 2000; Rooker et al., 2018).

Competing Stimulus Assessments

A CSA can be used to identify items that compete with problem behavior (Piazza et al., 1996; Piazza et al., 2000). Before the CSA, a list of potential competing items is identified, and the participants are exposed to each of these items. Following the exposure, 5-min sessions are conducted in which a single potential competing item is placed in front of the participant and they can interact with the item noncontingently. These procedures are continued until each potential competing stimulus is evaluated.

During each session, data are collected on the duration of item interaction or manipulation, and the duration or rate of problem behavior. Item interaction is defined individually for each item and generally includes orientation toward the item, consumption of edible items, or manipulation of the object in the manner for which it was intended (Piazza et al., 1996). The goal is to identify items that are associated with a low level of problem behavior and a high level of engagement (i.e., competing items). However, there have been multiple procedural variations (i.e., matched versus unmatched, prompting or no prompting, response blocking or no response blocking, and length of session) of the CSA that further evaluate the identification and effectiveness of competing stimuli.

To isolate competing stimuli that align with the hypothesized sensory consequence each stimulus can be categorized as either matched or unmatched. Typically, matched items are identified as items that provide a consequence that is similar to the hypothesized sensory consequence of the targeted problem behavior. Unmatched stimuli are defined as items that produced sensory consequences, but the consequences are not similar to the hypothesized sensory consequence (Piazza et al., 2000). Piazza et al. (2000) indicated that whenever stimuli matched the hypothesized sensory consequence, there were significantly lower rates of problem behavior relative to the unmatched stimuli.

Research has also evaluated the effects of prompting and blocking during the CSA. For example, Jennett et al. (2011) examined the use of prompts and blocking to further evaluate the identification of competing stimuli. Prompting involved the therapist placing the item back in the participant's hand if the participant was not interacting with the item for 5 s. In addition, all attempts to engage in all topographies of problem behavior were blocked. As a result, using prompts and blocking procedures aided in the identification of effective competing stimuli. Furthermore, Hagopian et al. (2020) evaluated the effects of prompting and blocking via an augmented competing stimulus assessment (A-CSA) which promotes engagement with competing stimuli and decreases problem behavior during the assessment (Hagopian et al., 2020). The A-CSA involved evaluating four conditions: free access, prompted engagement (i.e., the therapist placed the participant's hands on the item and guided manipulation), prompted engagement, and response blocking (i.e., all instances of problem behavior were blocked and the participants were redirected to the item by placing the participant's hands on the item), and repeated free access. If competing stimuli didn't result in an 80% or greater reduction in problem behavior when compared to the no-stimulus trial (i.e., control trial) the next condition was presented (Hagopian et al., 2020). Therefore, the A-CSA provides procedural variations that have the potential to both identify and establish competing stimuli.

Researchers have evaluated the effects of trial duration on the identification of effective competing stimuli. DeLeon et al. (2005) evaluated the effects of different trial durations on the subsequent predictive validity of a CSA. Initially, a CSA with 15-min sessions were conducted. Based on the results of the 15-min sessions, a duration was identified based on the number of minutes estimated to produce accurate extended effects in relation to the results of the initial CSA. A second CSA was then conducted to evaluate the validity of the estimated number of minutes to produce accurate effects and the number of stimuli being evaluated. The number of stimuli being evaluated in the second CSA was identified on an individual basis ranging from 7 – 14 items. This assessment indicated that both evaluating more stimuli and longer session duration does produce better predictive validity of the CSA (DeLeon et al., 2005). However, when increasing session time and the number of stimuli, practitioners face even more barriers to implementing an assessment of competing stimuli. In a literature review of 15 studies on

CSAs, Haddock and Hagopian (2020) identified the need for a more efficient CSA and suggested that researchers need to evaluate different parameters related to efficiency. Therefore to evaluate the efficiency of the CSA, the individual session duration was assessed, and found that individual trial duration varied from 2 – 15 min and it does not affect the outcome of the CSAs (Haddock & Hagopian, 2020). This suggests that the individual trial duration can be modified to increase the efficiency of implementing a CSA without compromising the outcome of a CSA.

Within the application of behavior analysis, there is a common concern with the efficiency of assessments and treatment evaluations (Haddock & Hagopian, 2020). Due to time constraints and limited resources of clinicians, school personnel, and/or support staff, extensive time-consuming assessments may not be feasible. The time it takes to conduct a CSA can be lengthy because the session duration can be between 2 and 15 min for each stimulus and each stimulus is usually evaluated at least three times. The time required to conduct this assessment may limit the use of CSAs in the development of overall effective interventions. Given that CSAs have been shown to significantly reduce problem behavior when incorporated within a treatment package (Fisher et al., 2004; Hagopian et al., 2005), there is a need for increasing the efficiency of conducting CSAs.

Purpose Statement and Research Questions

The purpose of the current study is to evaluate the effects of using a latency-based competing stimulus assessment (LBCSA) which may increase the efficiency of conducting a CSA. By increasing the efficiency of the CSA, clinicians, school personnel, and support staff can better utilize the assessment in the identification of competing stimuli that will aid in the development of more effective interventions for automatically maintained problem behavior. The specific research questions are as follows:

1. To what extent will using a latency-based measure impact the efficiency of conducting a CSA?
2. To what extent will competing stimuli identified via an LBCSA (i.e., items with long latencies to problem behavior) decrease the rate of problem behavior during extended sessions relative to items associated with short latencies to problem behavior during the LBCSA?

Method

Participants

The primary researcher recruited three participants that attend a Midwest university-affiliated applied behavioral intervention clinic. To be included in this study, the individual had an ASD diagnosis and was referred to the study by the participant's Board Certified Behavior Analyst (BCBA). The participants included Tucker who was a 12-year-old male that engaged in property destruction in the form of ripping, picking off, or crushing items. Tucker communicated in full sentences and followed multi-step instructions. Tinley was a 6-year-old female that engaged in vocal stereotypy in the form of noncontextual vocalizations. Tinley communicated in one syllable phoneme and follows one-step instructions with therapist prompts. Walter was a 10-year-old male that engaged in property destruction in the form of throwing items. Walter communicated in one-word utterances but used an augmented and alternative communication (AAC) as his main form of communication. Walter will follow two-step instructions.

Setting and Materials

All sessions took place within individual rooms at the clinical facility. If the targeted problem behavior was property destruction, the session room was baited with items selected by consulting with the participant's current clinical team. The clinic room for Tucker contained two tables and multiple chairs along with baited items which included nine worn crayons, label maker tape, nine pieces of generic clear tape, and two animal figurines that had five pieces of label maker tape on each figurine. These baited items were placed throughout the room. For Walter, the clinic room contained a table and two chairs along with protective coverings over the lighting to ensure that when Walter engaged in throwing the baited items, there was no risk of any components of the light breaking. Walter's baited item included a half-deflated plastic ball to ensure that if the ball were to hit any other items or persons in the room, it would minimize damages.

During the LBCSA, the items evaluated for Tucker were large reusable stickers with backgrounds, velcro person with interchangeable clothing, Bristle Blocks, scratch art, animal face reusable stickers, a balloon with a string, and a ball. For Tinley, the items evaluated were a wand that played songs from the movie Frozen, a massager, a remote that produced sound when pressing its buttons, the Dora theme song played on repeat through the therapist's phone speakers, a rainmaker, a sound machine that also had a light on it, and a pop tube. For Walter, the items evaluated were a sound machine, a video on an iPad that was of a therapist throwing a ball up at the air in the same manner that Walter did, a rail twirler, a velcro person with interchangeable clothing, a ball game that had a string on it and a cup to land the ball in, and sticky notes. As described by Piazza et al. (2000) the stimuli selected to be evaluated varied for each participant, but considerations were made using the following parameters, (a) the number of items that researchers can identify that appear to compete with the hypothesized sensory consequence of the targeted behavior, (b) the number of items identified through consultation with the participant's clinical team, and (c) items that could be identified following direct observation of the behavior.

Data collection materials included two iPod ® touches equipped with Countee ©. In addition, all session rooms were equipped with a video recording system, XProtect Milestone Image Server, so that trained data collectors could collect treatment integrity by reviewing recorded sessions.

Response Definition and Measurement

Throughout each session, data were collected by trained data collectors ~~as they are~~ in the session room with the participant. The primary dependent variables that were measured in this study were the frequency of problem behavior, latency to targeted problem behavior, and percentage of engagement with the competing stimuli.

Each problem behavior was individually defined as the primary researcher consulted with the participant's clinical team, and directly observed the targeted behavior before the start of baseline. Direct observations of the participant's targeted problem behavior occurred when the primary researcher attended a portion of the participant's regular clinical sessions. Once the consultation and direct observations were completed the primary research identified operational definitions for each participant's targeted problem behavior. For Tucker, the operational definition for his property destruction included each instance of Tucker successfully ripping a portion of an item off its original surface, crushing an item into both hands, and successfully breaking an item into more pieces than the original item. In addition, property destruction with the competing items was scored if Tucker successfully popped, ripped, or tore any items. For Tinley's vocal stereotypy a duration measure was utilized and the operational definition was any instance of any unrecognizable vocalization with a new instance scored with a 3s or greater pause between vocalizations. For Walter, his property destruction was defined as any instance of an item leaving his hand not intended to be thrown. Subsequently, once the operational definition was identified the researchers utilized this definition to evaluate the latency to the targeted problem behavior.

Engagement was defined as any attempt to manipulate, experience, or consume the stimulus in a way it was intended. Engagement was broadly defined in the following seven stimuli categories visual stimuli, edible stimuli, auditory stimuli, vestibular stimuli, olfactory stimuli, tactile stimuli, and social stimuli. The primary researcher has developed a general foundation of operational definitions for each topography of engagement to build upon as participants are recruited (see Appendix A: *Operational Definitions*).

Visual stimulation was defined as stimulation that triggers a response in the receptor cells in the retina (APA, 2013). Visual engagement was scored when the individual orients their gaze toward the stimuli and makes eye contact with the stimuli. Edible stimulation was defined as the consumption of the edible stimuli in the absence of spitting the edible stimuli out or taking edible stimuli out of the mouth. As defined by Zuh et al. (2019) auditory stimulation is a type of stimulation that can enrich the environment to improve arousal and awareness state. Auditory engagement was defined as engaging in bodily movements to engage with a song or sound (e.g., rocking, clapping, moving auditory stimuli closer) or engaging in any form of vocalization in relation to the auditory stimuli (e.g., singing or humming). As described by Kumar (2017), the vestibular system is a sensory system that incorporates several sensory and motor pathways to precisely regulate body movement and balance. Therefore, vestibular engagement was scored whenever the participant engages in body movements (e.g., sitting on, rocking, or swinging) with the stimuli. Olfactory stimulation is defined as the excitation of the cilia of olfactory receptors in the nasal cavity by inhaled odorants, which are absorbed into nasal mucus (APA, 2013). Olfactory engagement was scored if the participant's face is within 6 in of the object and accompanied by facial contortion. Tactile stimulation is defined as the activation of a sensory receptor by a touch stimulus (APA, 2013). Engagement with tactile stimuli was scored if the participant is making physical contact with the item being evaluated (e.g., grasping or holding, or manipulating the item with hands). Lastly, social stimulation is defined by any agent, event, or situation with social significance, particularly an individual or group, that elicits a response relevant to interpersonal relationships (APA, 2013). Engagement with social stimuli was recorded if the participant allows the therapist to provide social stimuli without engaging in avoidance behaviors (i.e., pushing, pulling away, or attempts to aggress). For engagement to occur with social stimuli the stimuli had to be socially mediated by the therapist (e.g., competition through a board game or creating a project together). The duration of each participant's engagement with the competing stimuli was recorded using two iPod ® touches equipped with Countee ©. The start of engagement duration began with the immediate onset of the participant engaging with the stimuli as defined and had an immediate offset once the participant no longer meets the engagement definition.

Interobserver Agreement (IOA) and Procedural Fidelity

Interobserver agreement was collected for a minimum of 33% for all phases of the study, a second trained observer collected reliability data on the dependent variables. During the autoscreening, IOA was calculated by dividing the session into 10-s intervals and then taking the smaller frequency of problem behavior in each interval and dividing it by the larger frequency count of problem behavior in each interval, averaging the total in each interval, and multiplying by 100 to obtain the proportional agreement percentage for the occurrence of problem behavior. During the Autoscreening, the mean IOA was 93% (range 90%–95%) for Tucker, 93% (range 90%–95%) for Tinley, and 89% (range 84%–93%) for Walter. During the LBCSA, IOA was calculated for engagement by taking the smaller duration of time in seconds dividing it by the larger duration of time in seconds, and then multiplying it by 100 to obtain a percentage. The mean IOA for engagement was 90% (range 50%–100%) for Tucker, 88% (range 50%–100%) for Tinley, and 80% (range 45%–100%) for Walter. Additionally, IOA for problem behavior was calculated by taking the smaller latency to problem behavior in seconds, dividing it by the larger latency to problem behavior in seconds, and then multiplying it by 100 to obtain an IOA percentage for latency to problem behavior. The mean IOA for problem behavior was 92% (range 50%–100%) for Tucker, 89% (range 55%–100%) for Tinley, and 99% (range 96%–100%) for Walter. During the evaluation of short-latency and long-latency stimuli, IOA was calculated by dividing the session into 10-s intervals and taking the smaller number and dividing it by the larger number, then averaging the total in each interval, and multiplying by 100 to obtain an IOA percentage for the occurrence of problem behavior. The mean IOA was 94% (range 66.7%–100%) for Tucker, 91% (range 82%–100%) for Tinley, and 91% (range 82%–100%) for Walter.

To ensure that therapists correctly implemented procedures in each condition of the study, procedural fidelity was assessed for a minimum of 33% of sessions for all phases of the study. Trained data collectors recorded procedural fidelity data by reviewing recorded videos of the session. Data was recorded on a procedural fidelity checklist (see Appendix B: Procedural Fidelity). The data collected was evaluated by taking the number of yes responses divided by the total of yes and no responses which were then multiplied by 100 to produce a percentage. The average procedural fidelity for the autoscreening was 100% for Tucker, 100% for Tinley, and 90% for Walter. The average procedural fidelity during the LBCSA was 94% for Tucker, 100% for Tinley, and 100% for Walter. The average procedural fidelity during the evaluation of short-latency and long-latency stimuli was 99% for Tucker, 96% for Tinley, and 100% for Walter.

The components of the auto screening procedural fidelity were as follows: (a) no tangibles, (b) no demands placed, and (c) all behavior is ignored. The LBCSA procedural fidelity components include: (a) the therapist waited at least 5 s with no problem behavior before the start of the session, (b) the item is placed in the participant's hand or on the participant's body (depending upon the item being assessed), (c) when an item falls on the ground, the therapist replaces the item, (d) when the item is thrown in a non-contextually appropriate way the therapist does not replace the item, (e) when the participant requests attention (e.g., asking a question or speaking to the therapist) the therapist should provide attention, (f) contingent on the occurrence of problem behavior the therapist terminates the session, (g) following the termination of the session the therapist removes the item after one minute, and (h) throughout the session the therapist ignores all non-targeted problem behavior. Lastly, the procedural fidelity components for the evaluation of the short-latency and long-latency items were identical to those of the LBCSA except sessions were not terminated following the occurrence of the targeted problem behavior and sessions were 5 min in length.

Experimental Design

In this study, the researchers utilized a multielement design to identify competing stimuli with short latency to disruptive behavior and competing stimuli with long latency to disruptive behavior. In addition, researchers evaluated the comparison of short-latency and long-latency items by utilizing a multielement design embedded within a reversal (ABAB) design.

Procedures

This study included three phases: auto screening, LBCSA, and evaluation of short-latency and long-latency items. Sessions were conducted in a session room separate from the participant's typical session room. When the targeted problem behavior was property destruction the participant went between two different rooms in the clinical facility to allow researchers to reset the baited items in the session room. These baited items were placed throughout the session room to ensure that the response effort to engage in problem behavior is low if the participant is sitting or standing in any part of the session room. During the auto screening, sessions were 5 min. During the LBCSA, sessions were 5 min or until the first instance of problem behavior. Lastly, during the evaluation of short-latency and long-latency, sessions were 5 min and the termination criterion was based on consistent responding in both conditions determined by visual inspection.

Functional Analysis Screening

The purpose of the FA screening sessions was to determine if the participant's problem behavior is maintained by automatic reinforcement. The therapist was in the room with the participant but no tangible items were presented, no demands were placed, and all behaviors were ignored for the entire 5 min. If the targeted problem behavior was property destruction, the researchers prepared the session room with baited items specific to the individual participant.

Latency-Based Competing Stimuli Assessment (LBCSA)

If the participant demonstrated elevated rates of responding in the autoscreening leading researchers to conclude that the targeted problem behavior was maintained by automatic reinforcement, then the participant moved on to phase two, the LBCSA. Prior to the start of the LBCSA, participants had pre-exposure to each of the seven potential competing stimuli for 30 s. Following exposure to the competing stimuli, the participants were taken to another room in the clinical facility for at least a 2-min break. During this time, the participant was provided with minimal attention and all problem behavior was ignored. At the start of the session, the therapist brought the participant back into the session room and waited for 5 s without the occurrence of problem behavior before the session started. The session began as soon as the therapist handed the participant the competing item and stated, "Here is the (item), you can play with it." If the participant dropped the item during the session, then the therapist placed the item back in the participant's hands, but if the participant threw the item in a non-contextually appropriate way, then the therapist did not replace the item in the participant's hands. If the participant asked a question or sought attention from the therapist, then the therapist provided brief attention. Subsequently, the session was terminated contingent upon the occurrence of the targeted problem behavior. Once the session was terminated, the therapist waited 1 min to remove the competing item. When the item was removed, the therapist then took the participant to a separate clinic room.

Evaluation of Short- and Long- Latency

By evaluating the short-latency stimuli in comparison to the long latency items researchers were able to determine the effectiveness of the LBCSA in identifying competing stimuli. Baseline sessions were identical to the autoscreening phase. Following baseline, the items associated with the shortest latency to problem behavior and items associated with the longest latency to problem behavior were compared. Prior to the start of sessions, the presentation of the short-latency and long-latency items were randomized using Research Randomizer (Urbaniak & Plous, 2013). Throughout the entirety of these sessions, the competing items were available noncontingently throughout the entire session while all problem behavior was ignored. Sessions began after the participant was brought into the room and no problem behavior was observed for 5 s. The therapist then placed the item in the participant's hands or on the participant's body, depending on what was contextually appropriate for the item, and stated, "Here is the (item), you can play with it.". To begin the session a procedural modification was made for participants that engaged in property destruction that included starting the session following the therapist placing the item in the participant's hands. If the item fell on the ground, the therapist replaced the item in the participant's hands or on their body, but they did not replace it if the participant threw the item in a non-contextual manner. If the participant requested attention, the therapist did provide brief attention.

Results

Figure 1 displays the results of the autoscreening for Tucker. Consistent and stable elevated rates of problem behavior are observed suggesting that the problem behavior is maintained by automatic reinforcement.

Figure 2 displays the results of the LBCSA for Tucker. These results indicate that the ball was associated with the longest latency to problem behavior and the balloon with a string was associated with the shortest latency to problem behavior. These data were then utilized in the following evaluation.

Figure 3 displays the results from the evaluation of short-latency and long-latency stimuli for Tucker. Tucker showed a consistent decreasing frequency of problem behavior during the long-latency stimulus conditions and variable but there were elevated levels of the frequency of problem behavior during the short-latency stimulus conditions. These results suggest that the LBCSA was effective in identifying items that compete with the sensory consequences produced by the targeted problem behavior. These results were replicated during the reversal. Therefore, researchers can exclusively conclude that the long latency to problem behavior competing stimuli was the controlling variable for Tucker's reduction in property destruction.

Figure 4 displays the results of the autoscreening for Tinley. Consistent and stable elevated duration of vocal stereotypy were observed suggesting that her vocal stereotypy problem behavior is maintained by automatic reinforcement.

Figure 5 displays the results of the LBCSA for Tinley. These results indicate that the Dora theme song is associated with the longest latency to problem behavior and the massager, poptube, and remote have similar short latencies to problem behavior. The remote was used as the short-latency item and the Dora theme song as the long-latency item for subsequent analyses.

Figure 6 displays the results from the evaluation of short-latency and long-latency stimuli for Tinley. These data showed consistently decreased rates of problem behavior during the long-latency stimulus conditions and elevated rates of problem behavior during the short-latency stimulus conditions. These results suggest that the LBCSA was effective in identifying items that compete with the sensory consequences produced by her vocal stereotypy. These results were replicated in a reversal. Therefore, researchers can exclusively conclude that the long latency to problem behavior competing stimuli was the controlling variable for the reduction in Tinley's vocal stereotypy.=

Figure 7 displays the results of the autoscreening for Walter. Consistent and stable elevated rates of problem behavior are observed suggesting that the problem behavior is maintained by automatic reinforcement.

Figure 8 displays the results of the LBCSA for Walter. These results indicate the iPad with a video of a balling being tossed in the air is associated with the longest latency to problem behavior and the sticky notes, rail twirler, and velcro have similar short latencies to problem behavior. The rail twirler was used as the short-latency item and the iPad video was used as the long-latency item for subsequent analyses.

Figure 9 displays the results from the evaluation of short-latency and long-latency stimuli for Walter. These data showed elevated rates of problem behavior during the long-latency and short-latency conditions. These results suggest that the LBCSA was not effective in identifying items that compete with the sensory consequences produced by Walter's property destruction.

Discussion

The purpose of this study was to evaluate the effects of using an LBCSA to identify long latency competing stimuli that compete with the sensory consequence of the targeted problem behavior. Researchers found that the results of the evaluation of short- and long-latency to problem behavior items identified through the LBCSA were effective for two of three participants (Tucker and Tinley).

Effectiveness is defined as a measure of success in which a clearly stated objective is achieved and therefore efficiency is cost-effective where the efficient solution is most effective with minimal cost (McCormick, 1981). For practitioners, educators, and staff members the need for an effective and efficient assessment is vast and necessary (Luiselli et al., 2010; Nelson et al., 1999). The LBCSA seeks to address the need for both effective and efficient assessments by systematically decreasing the amount of time that it takes to conduct a traditional CSA. In the current study, it took 43 min to complete the LBCSA for Tucker and 22 min to complete the LBCSA for Tinley. Given that the mean duration of session during a CSA is 5 min (Haddock & Hagopian, 2020), this saves 77 min for Tucker and 98 min for Tinley. By decreasing the amount of time it takes to conduct the CSA those implementing the assessment are better able to allocate time for assessment while also remaining within the scope of their typical duties.

Piazza et al. (2000) found that competing stimuli were most effective whenever the stimuli matched the hypothesized sensory consequence of the behavior. Similar results for matched were replicated for Tucker and Tinley. However, matched and unmatched items were not effective competing stimuli for Walter as demonstrated during the evaluation of short-latency and long-latency stimuli. Future researchers should continue to compare stimuli that match and do not match the hypothesized sensory consequence of the problem behavior.

Although there are many important impacts on the practical assessment of competing stimuli in this study, there are several limitations. First, although the LBCSA was successful in identifying an effective competing stimulus for Tucker's property destruction, both the long-latency stimuli (i.e., ball) and short-latency item (i.e., the balloon with string) resulted in low rates of the behavior. It may have been beneficial to include items that were less similar. However, some differentiation was observed and it is hypothesized that Tucker engaged in more problem behavior with the short-latency item due to the texture of the balloon or rubber band string.

In addition, when evaluating the effectiveness of competing stimuli, researchers evaluated the competing stimuli in a controlled session room and did not assess the generalization of the effects to other environments. This lack of generalization leads to potential limitations in the overall effectiveness of the items in competing with the hypothesized sensory consequence. Subsequently, researchers also did not train stakeholders in the procedures. Given that items may lose their reinforcing value over time, it is important to teach parents ways to identify the competing items. However, the researchers did share the results and procedures with the participant's current BCBA who has regular contact with the participant's stakeholders.

While identifying potential competing stimuli for Tinley, the researchers identified items that were hypothesized to result in the same sensory consequence as her vocal stereotypy. However, a potential limitation could be that the items were not chosen based on the practical application for the items to be used during all skill acquisition. More specifically when implementing prompting during skill acquisition, the sound-producing toys may interfere with the use of vocal prompts. However, with the Dora theme song for Tinley, future researchers could evaluate the effectiveness of lowering the volume of the sound during prompting within the context of skill acquisition.

Future researchers should also develop a framework for when and when not to assess stereotypy for individuals with ASD. For Tinley, we targeted vocal stereotypy because her BCBA reported that her vocal stereotypy was hindering skill acquisition. It would be beneficial to develop a framework to identify when vocal stereotypy interferes with daily life to help clinicians determine when they should target that behavior. For example, stereotypy may interfere with skill acquisition (Koegel & Covert, 1972). In addition, in regard to identifying competing stimuli that compete with vocal stereotypy, future researchers should also evaluate the social validity with caregivers to be able to more accurately address direct concerns with vocal stereotypy (Shawler et al., 2019).

Within the literature, Haddock and Hagopian (2020) identify the need for more efficient procedures in evaluating competing stimuli. While this study sought to address this concern directly by evaluating the overall time it takes to conduct an assessment of competing stimuli, there is a need for further improvement in the efficiency of conducting a CSA. More specifically, future researchers should evaluate the number of items needed to effectively identify competing stimuli. Future researchers should also further evaluate the long-term effectiveness of the competing stimuli and if there is a need to re-conduct the LBCSA to identify more competing stimuli over time.

This study contributes to the literature by providing practitioners, educators, and staff with additional resources to further develop function-based interventions. These efficient and effective procedures also allow for behavior analysts to have a more practical and time-efficient assessment to train service providers on (Luiselli et al., 2020). Although there are many barriers to implementing assessments and identifying competing stimuli, the current procedures directly improve each of these barriers.

Overall, the use of the LBCSA increased the efficiency of the CSA and identified effective competing stimuli for two of three participants that engaged in automatically maintained problem behavior. These findings suggest that using the LBCSA will improve the efficiency of conducting a CSA and make the application of the assessment more feasible for practitioners, educators, and staff members. As a result, the LBCSA will positively impact the development of effective treatments for automatically maintained problem behavior.

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Figure 1

Frequency of Problem Behavior for Tucker's Autoscreening

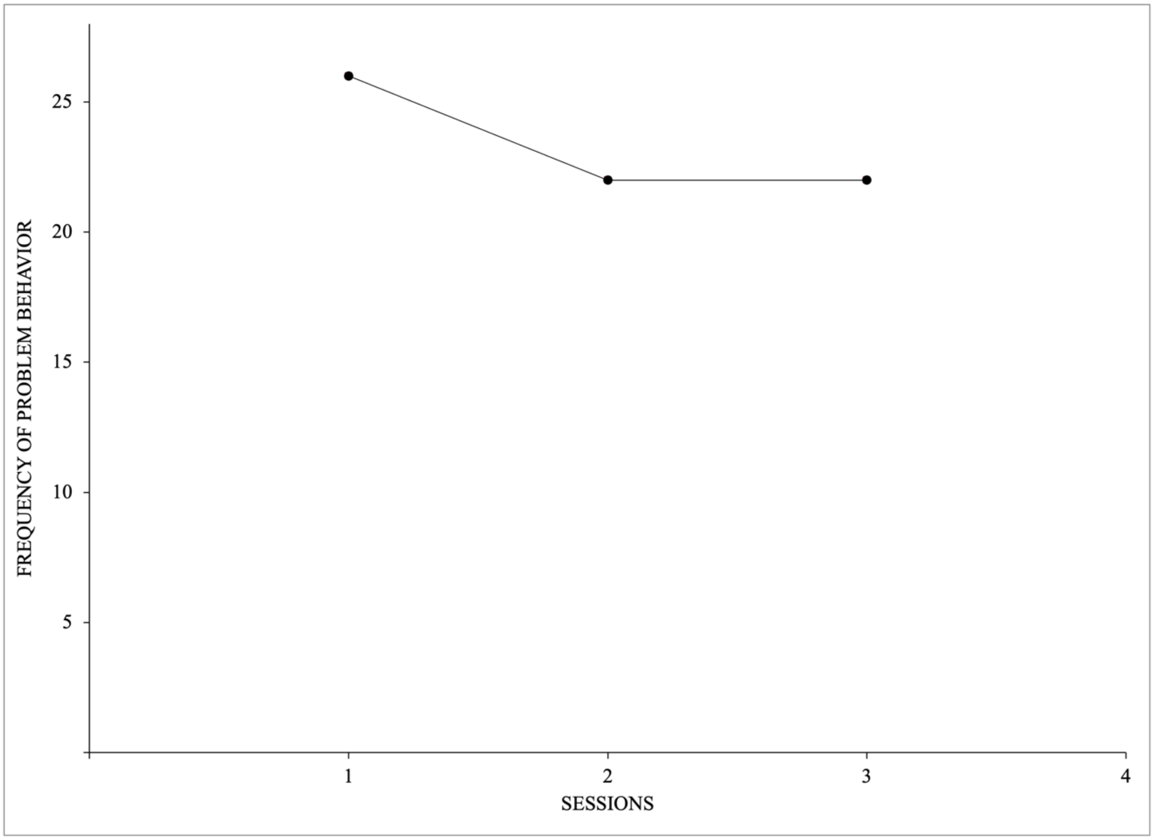


Figure 2

Average Latency to Problem Behavior and Duration of Engagement for Tucker's LBCSA

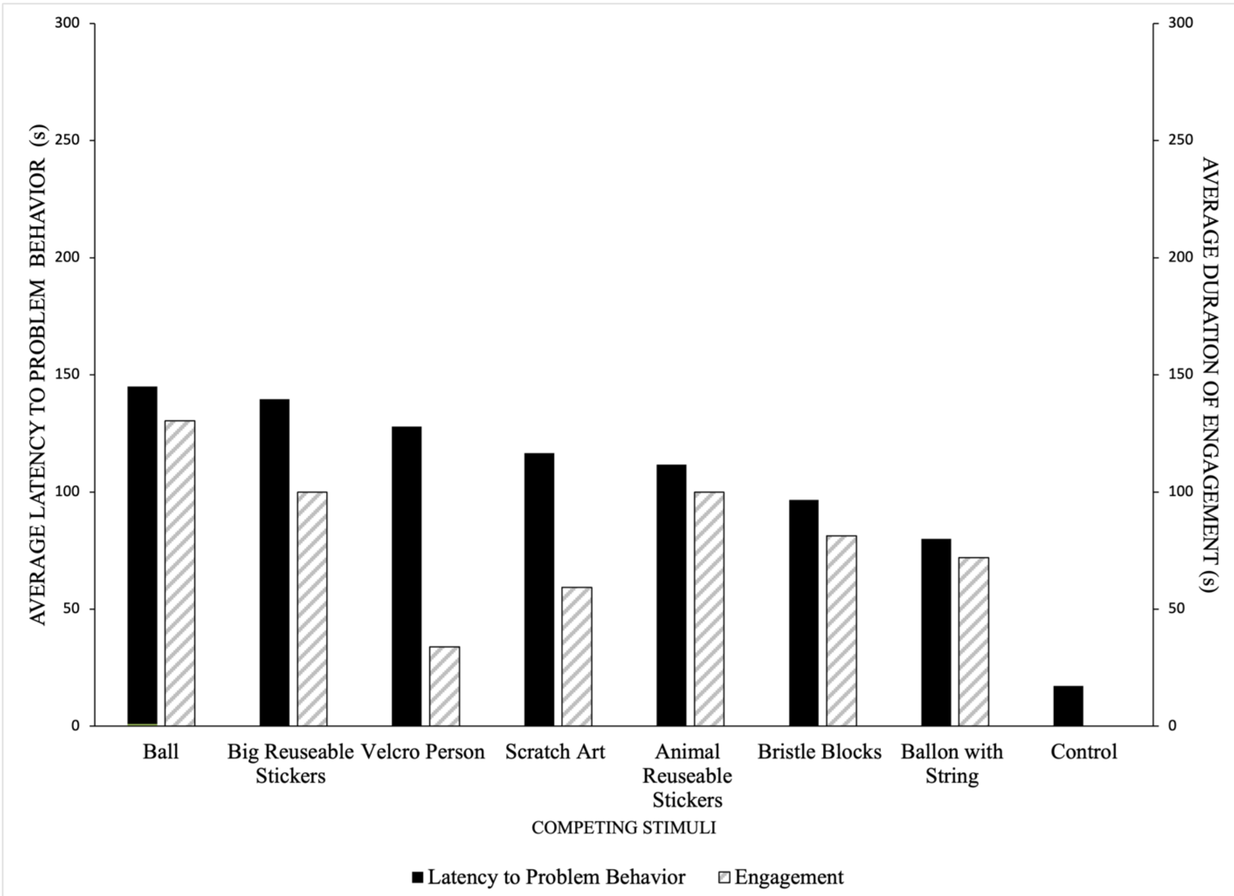


Figure 3

Frequency of Problem Behavior for Baseline the Evaluation of Short-Latency vs. Long-Latency Items for Tucker

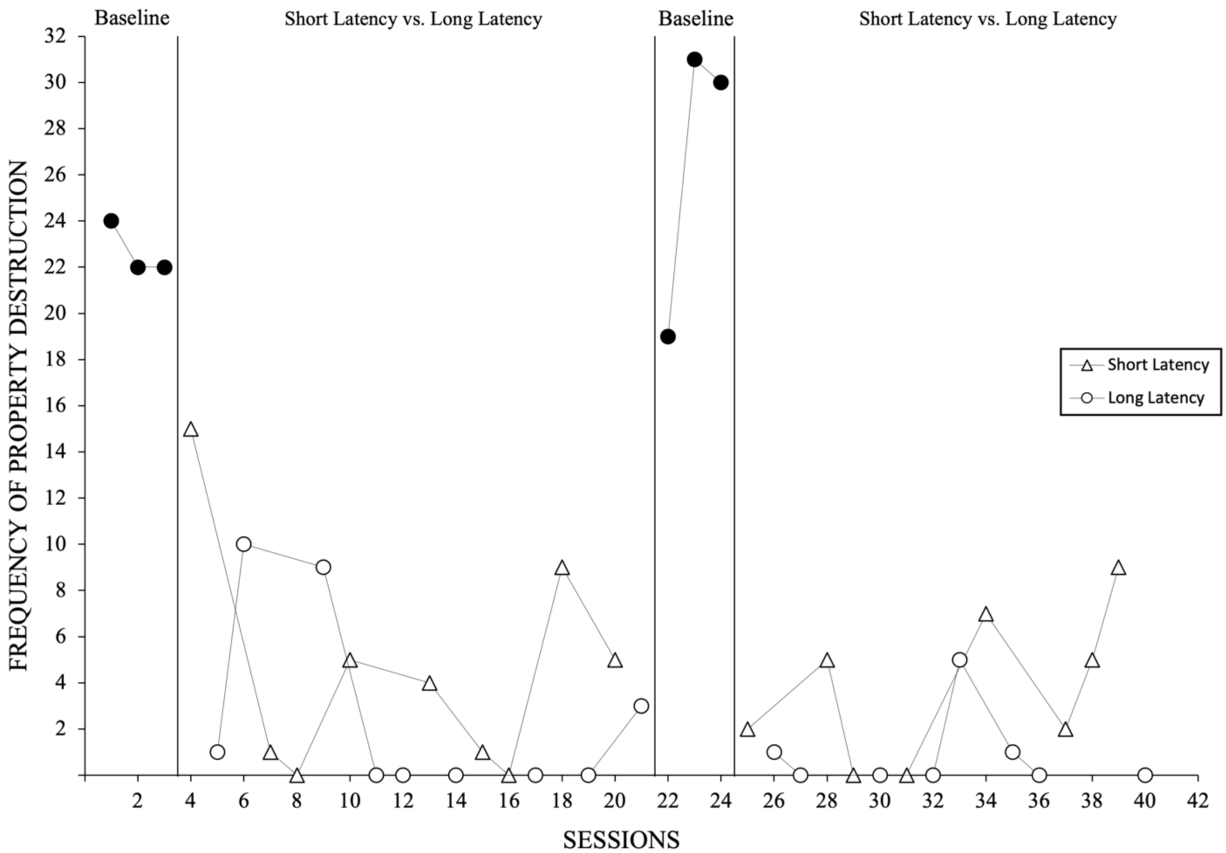


Figure 4

Duration of Vocalizations for Tinley's Autoscreening

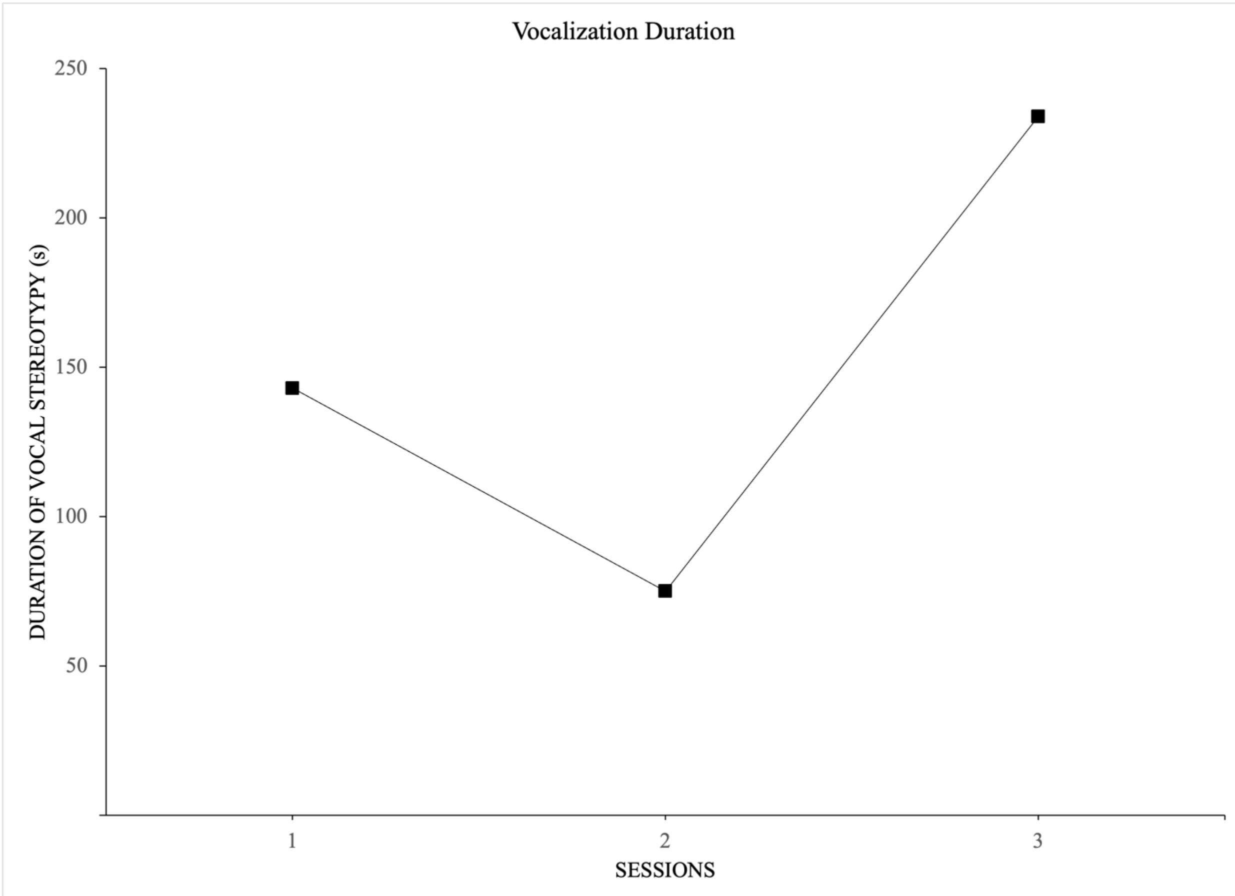


Figure 5

Average Latency to Problem Behavior and Duration of Engagement for Tinley's LBCSA

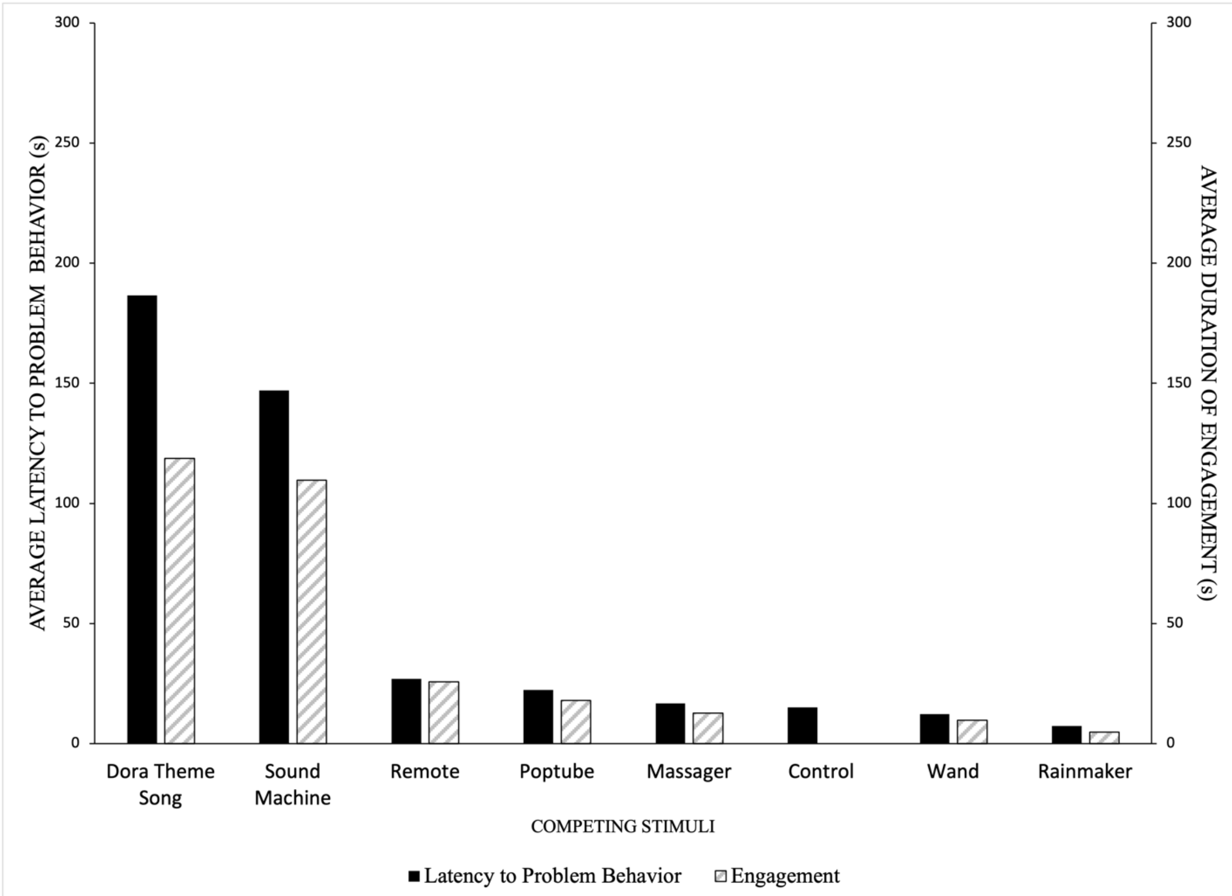


Figure 6

Frequency of Problem Behavior for Baseline and Evaluation of Short-Latency vs. Long-Latency Items for Tinley

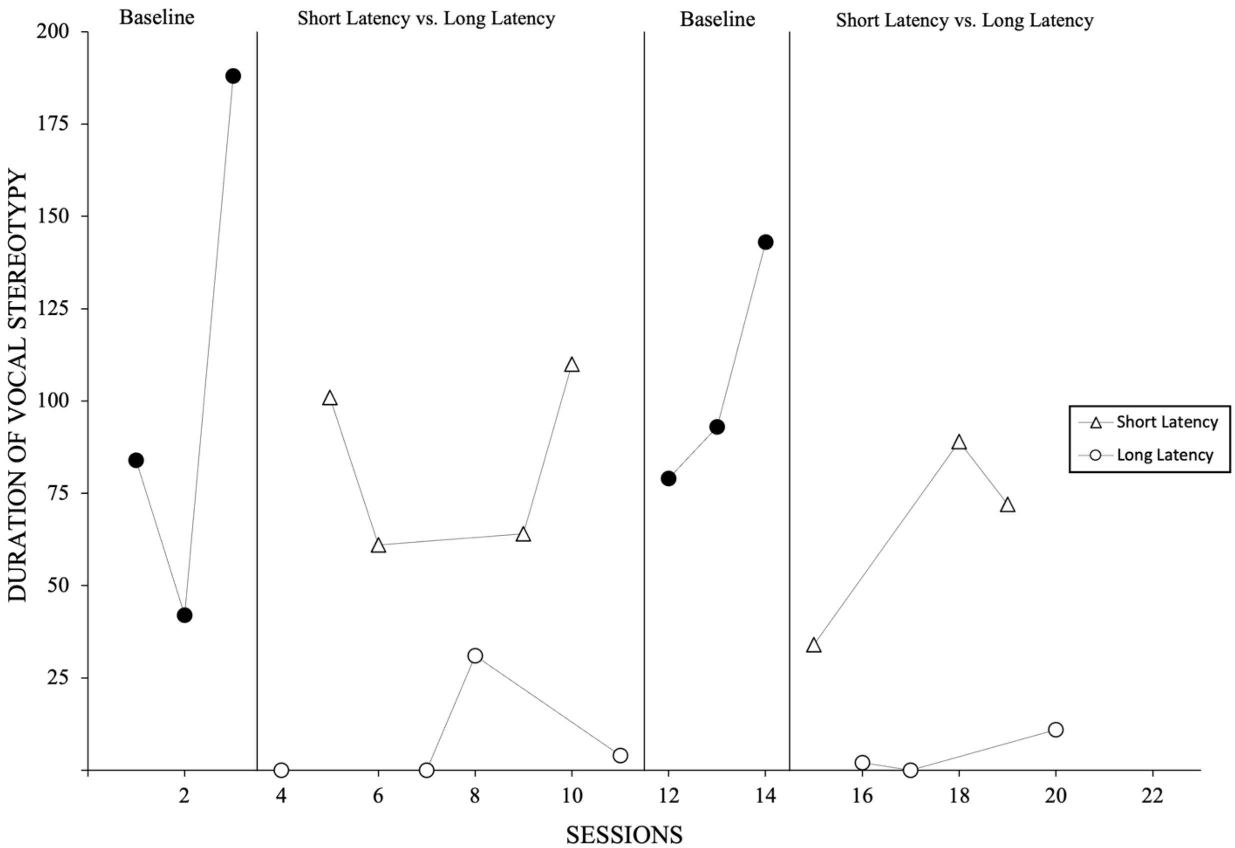


Figure 7

Frequency of Problem Behavior for Walter's Autoscreening

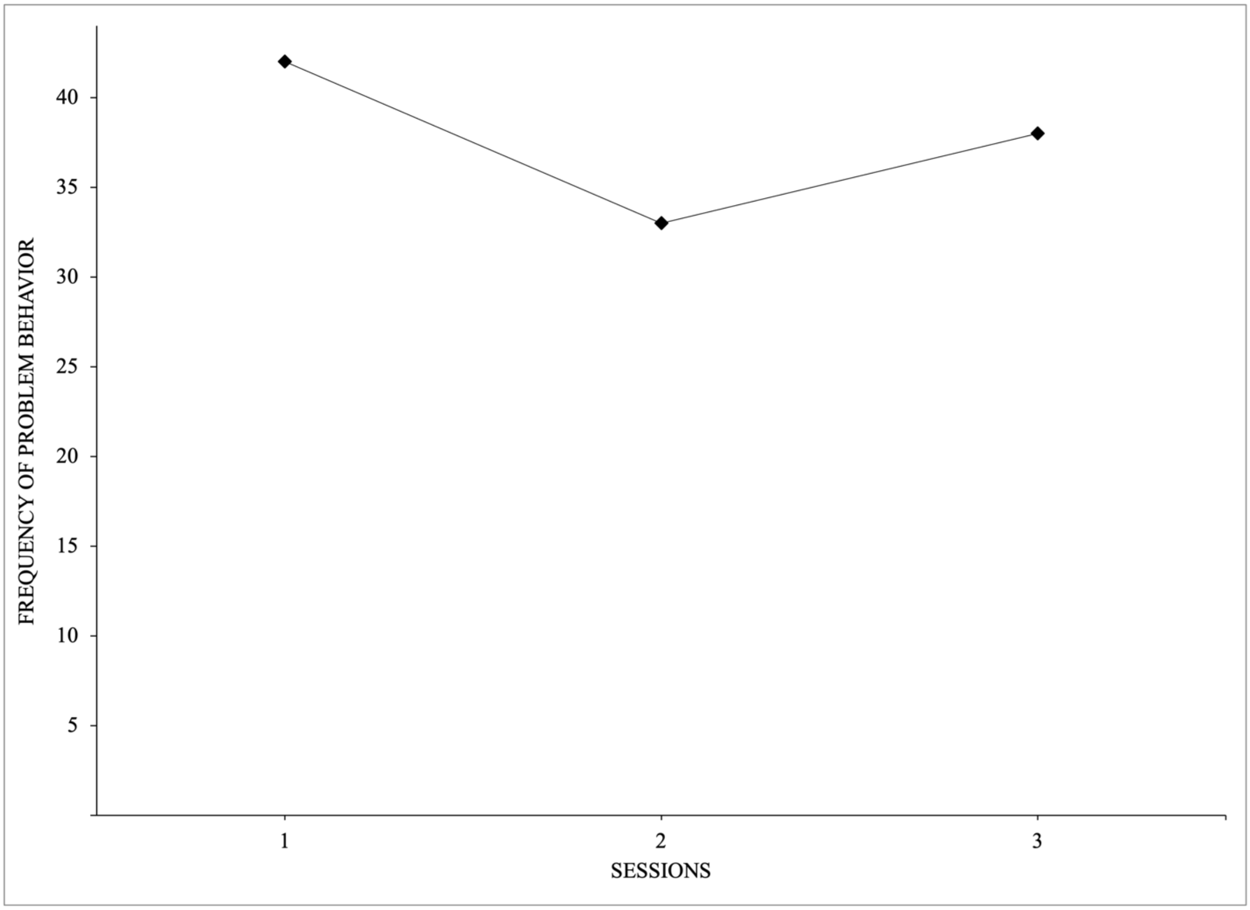


Figure 8

Average Latency to Problem Behavior and Average Duration of Engagement for Walter's LBCSA

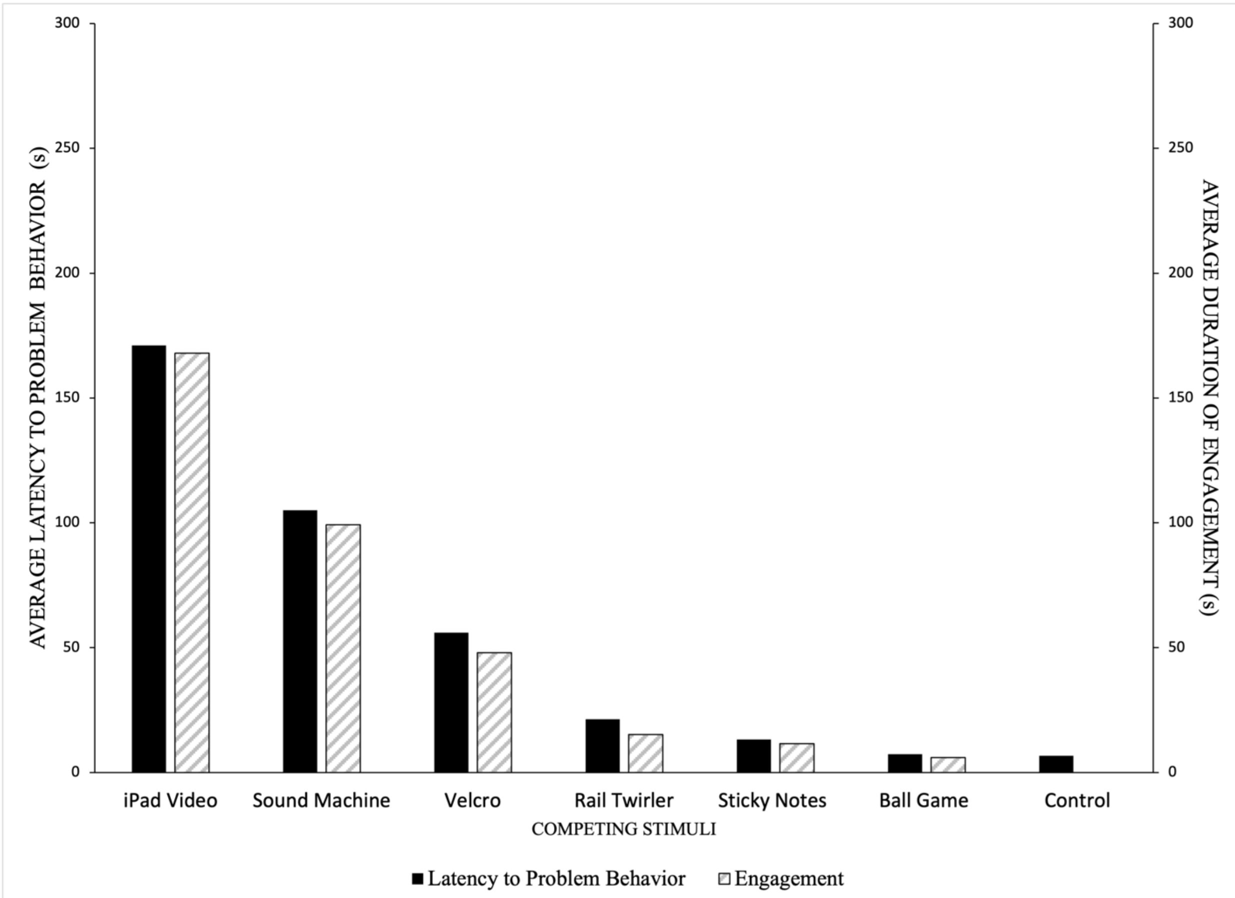
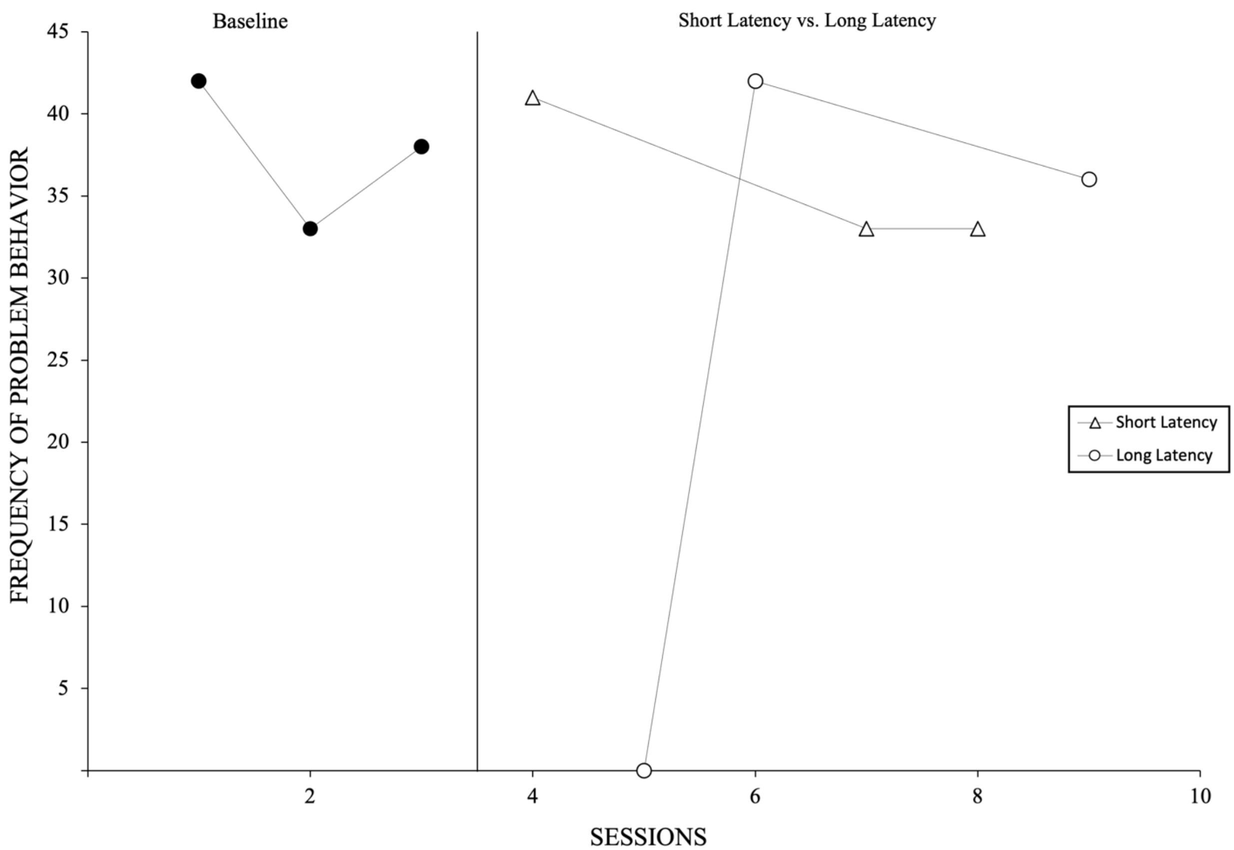


Figure 9

Frequency of Problem Behavior for Baseline and Evaluation of Short-Latency vs. Long-Latency Items for Walter



Appendices

Appendix A: Operational Definitions

Stimuli Engagement Behaviors

Behavior	Operational Definition
Visual stimuli	The participant will make sustained eye contact and orient their gaze towards the stimuli.
Edible stimuli	The participant will consume the stimuli without spitting or taking any portion of the stimuli out of their mouth.
Auditory stimuli	The participant leans towards an auditory sound, engages in a physical motion to the beat of the sound (e.g., rocking or clapping), or engages in vocalizations in relation to the auditory sound (e.g., humming or singing).
Vestibular stimuli	The participant will move their body in such a way that their body experiences movement or gravity (e.g., sitting on, rocking, or swinging).
Olfactory stimuli	The participant is within six inches of the stimuli and any form of facial contortion occurs.
Tactile stimuli	The participant will use any part of their body to physically manipulate the stimuli (e.g., learning towards, holding, or grasping).
Social stimuli	The participant allows the therapist to provide social stimulus without engaging in avoidance behaviors in the form of pushing, pulling away, or removing themselves from the session area.

Appendix B: Procedural Fidelity

FA Screening

Procedures	Yes/No	
1. No tangibles provided	Yes	No
2. No demands placed	Yes	No
3. All behavior ignored	Yes	No
(Yes/Yes + No)x100=		

LBCSA

T(x) Component	Yes	No	N/A
Waited at least 5 s with no PB before the start of the session			
Item placed in the participant's hand or on the participant's body (depending on the item)			
When an item falls on the ground, the therapist should replace the item			
When the item is thrown the therapist does not replace the item			
When attention is requested (e.g., asking, talking), the therapist should provide attention			
Contingent on target PB, the session is terminated			
Item removed after 1 min of session termination			
Ignored all nontargeted PB			
Total:			
(Yes/Yes + No) x 100 =			

Appendix B: Procedural Fidelity

Comparison of Short Latency and Long Latency

T(x) Component	Yes	No	N/A
The therapist has the correct corresponding item present in the session room			
Waited at least 5 s with no PB before the start of the session			
Item placed in the participant's hand or on the participant's body (depending on the item)			
When an item falls on the ground, the therapist should replace the item (the item is NOT replaced if they throw the item)			
When attention is requested (e.g., asking, talking), the therapist should provide attention			
Ignored all nontargeted PB			
Total:			
(Yes/Yes + No) x 100 =			