

A Behavioral Economic Approach to Improving Communication Variability
and Treatment Efficacy

NCT05918393

Date: October 3, 2023

Approach.

The study will include comparisons between a target group and a comparison group to enable comparisons between the effects of teaching multiple responses (relative to a single response) and varying schedules of reinforcement on the occurrence of communication variability and resurgence of severe destructive behavior (SDB). The target group will be exposed to four phases: (a) response-topography proficiency assessments, (b) an initial functional communication training (FCT) intervention, (c) a behavioral-economic progressive-ratio (PR) assessment, and (d) a treatment-challenge evaluation. The comparison group will be exposed to Phases a, b, and d. Prior to enrollment in the study, a functional analysis (FA) will be conducted for all participants to determine the target functional reinforcer maintaining SDB. Following the FA, we will implement a **response-topography proficiency assessment** (RPA) across various communication responses with all participants. The type and number of response modalities may vary across participants based on individual's skill, caregiver preference, and/or availability of various materials/devices but a minimum of three responses will be targeted for each participant. Preference will be determined by asking caregivers (e.g., parents, school personnel) to rank potential communication modalities (e.g., picture exchange, augmentative device) for their child. During the RPA, participants will be exposed to a minimum of 3, 10-trial sessions per response topography during which s/he can gain access to a functional reinforcer, identified via the FA, using a variety of response modalities. At the start of a trial, the relevant EO will be presented (e.g., presentation of demands for escape maintained problem behavior) and prompts will be delivered to emit the communication response using a least-to-most prompting sequence (i.e., successive vocal, modeled, and physical prompts each separated by 5 s). For vocal communication responses, a second modeled prompt will be provided in place of the physical prompt and the trial will be scored as "no response" if the participant does not emit the response within 5 s of the final model prompt. Contingent on an independent or prompted response, the participant will receive 30-s access to the functional reinforcer. Following the 30-s reinforcement interval, the next trial will begin. The purpose of the RPA is to identify the relative proficiency with the various communication responses. The duration of the RPA is anticipated to range. Following the RPA, the individual's preference for the identified communication response topographies will be assessed within a concurrent-operant arrangement. Five, 10-trial sessions will be implemented during which the communication stimuli and correlated discriminative stimuli will be arranged on a table equidistant from the participant. At the start of each trial, the relevant establishing operation (EO) will be presented and contingent on the emission of any of the targeted communication responses, access to the functional reinforcer will be provided for 30 s. Following the 30-s reinforcement interval, or if the participant does not respond within 30-s of the EO presentation, the communication and correlated stimuli will be rearranged in a different positional order and a new trial will begin. Preference will be determined based on the emission of responses across trials (i.e., emitting more responding with an app than touching a card). The sequence of the proficiency and preference assessment is such that each participant has exposure to all response modalities before preference is assessed. The preference assessment is anticipated to last 30 to 45 min in duration.

For the target group, the PR assessment will be based on our previous work within behavioral economics and will begin with a baseline condition during which SDB is reinforced and communication is placed on extinction. Following baseline, each communication response will be taught to mastery (e.g., 3 consecutive 10-trial sessions above 80% independent responding) using a most-to-least prompting procedure plus prompt-delay fading. Next, a concurrent fixed-ratio (FR) 1 schedule of reinforcement across communication responses will be implemented during which SDB will be placed on extinction and all communication responses will result in access to the functional reinforcer. This phase will assist with determining if there is a preference or restricted pattern of responding for a specific communication response (e.g., if

the participant allocates most responding toward one of the concurrently available communication responses). Effects on participant behavior across baseline and the concurrent FR1 condition will be assessed within a reversal design. Participants in the comparison group will also be exposed to the baseline condition as described above; however, only the most preferred communication response (as identified in the preference assessment) will be taught to mastery (as described above) followed by a phase of implementation of an FR-1 schedule of reinforcement for the single communication response and extinction for SDB (as opposed to multiple communication responses for the target group). It is anticipated that enrollment in this phase will last approximately 50 h for the comparison group and 50 h for the target group.

Next, we will introduce PR schedules, for the target group only, across the various communication responses within a concurrent-operant arrangement. During a PR schedule of reinforcement, the response requirement (i.e., price) for a given reinforcer is increased throughout the course of a single observation. Price adjustments will be made in an additive fashion (e.g., 2, 4, 6, 8, 10, etc.) beginning with the most frequently emitted response during the concurrent FR-1 condition and will continue until shifts in responding (i.e., re-allocation from one communication form to another) are observed. Once a shift in responding emerges, price adjustments will then be applied to the next response that is most frequently emitted until all three responses are exposed to independent PR schedules (i.e., concurrent PR). Replications of changes in the reinforcement schedules across topographies and correlated shifts in responding will occur as deemed necessary to demonstrate experimental control and to strengthen the treatment outcomes for each individual. This phase of the study should range from duration.

Finally, we will complete a treatment-challenge evaluation, within a multiple-schedule of reinforcement arrangement across all participants. For the target group, we will assess the maintenance of variant responding when threats (i.e., schedule thinning) to treatment are introduced and, for both groups, we will evaluate the presence of resurgence of SDB. Within the multiple-schedule arrangement, signaled intervals of reinforcement (i.e., the functional reinforcer is available contingent on communication) and extinction (i.e., the functional reinforcer is unavailable and thus both SDB and communication are on extinction) will be alternated within a single session. During the treatment-challenge evaluation, SDB will remain on extinction throughout and all communication responses will be reinforced on an FR-1 schedule during the signaled reinforcement intervals. That is, we will examine the reemergence of SDB by comparing the average occurrence of SDB during the extinction intervals of the first 3 treatment challenge sessions relative to the last 3 concurrent PR sessions (target group) or FCT intervention sessions (comparison group). If differences in resurgence are observed across groups as hypothesized, individuals in the comparison group will then be exposed to the PR assessment such that they are taught multiple communication responses across varying schedules of reinforcement. Data will be analyzed such that any positive proportion is indicative of resurgence. We will evaluate varied responding (target group) by combining the occurrence of all communication responses into one variable (total communication) and then calculate the proportion of total allocation toward the individual communication responses. Responding will be considered invariant if the resulting proportion for response allocation is 1.0 for a given response in a particular session. Ideal variant responding would be considered as equivalent proportions (e.g., 0.33) across responses.

Preliminary Research. Results of preliminary implementation of the initial FCT intervention and PR analysis are presented to demonstrate the feasibility of the proposed project.

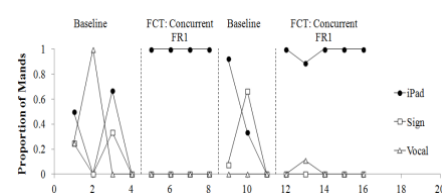
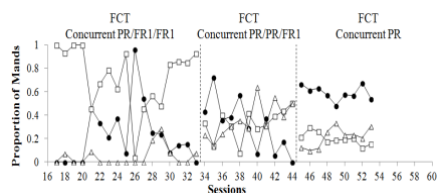


Figure 1 demonstrates a participant's response allocation toward the iPad communication response (to the exclusion of other, concurrently available responses) during the FCT intervention (i.e., low-schedule requirement). Figure 2 represents response allocation across the three communication responses within the PR analysis (i.e., increases in schedule requirement). Results indicated that when the PR schedule of reinforcement was introduced for the iPad communication response, the participant's responding shifted toward an alternative communication response (i.e., manual sign). Furthermore, when the PR schedule was implemented for both the iPad and manual sign responses, we observed increases in the occurrence of responses allocated toward the vocal communication response. Finally, when the PR schedule was implemented across all three responses, we observed a shift in response allocation primarily toward the iPad. However, we observed variability in responding across all three responses under the concurrent PR arrangement relative to when low-schedule requirements were in place (i.e., FCT intervention). Thus, these outcomes suggest that exposing all communication response to the PR arrangement was effective in (1) establishing an initial allocation towards at least one of the targeted communication responses (i.e., the iPad), and (2) shifting response allocation as reinforcement schedules were altered across communication responses resulting in increases in varied communication. However, further investigation is warranted to (1) determine how preference and proficiency with communication responses affects these outcomes, and (2) how these shifts in response allocation affect the occurrence of SDB and more specifically the resurgence of SDB when treatment challenges are introduced (not evaluated with the preliminary case).

Data Analysis. Prior to the start of the study, appropriate communication responses for each participant will be selected based on language level as identified via the Peabody Picture Vocabulary Test, 4th edition (PPVT-4) and/or the Expressive Vocabulary Test-3rd edition (EVT-3), which will be administered by the PI who is a licensed psychologist. Additionally, we will develop individualized operational definitions for each participant's target dependent variables (e.g., SDB, communication responses). Information will be gathered via caregiver report and direct observation to aid in developing the operational definitions. Following identification of operational definitions, we will select the appropriate data collection system for each participant. Data collection will generally consist of frequency (for discrete responses such as hitting or communication responses) and/or duration recording (for behaviors with a temporal dimension such as crying). Frequency data will be analyzed as a response rate (i.e., frequency over time). Duration data will be analyzed as a percent of session (e.g., 120 s of a 240 s session = 50% of session time).

Throughout the study, data will be recorded via a computer-based data collection program (BDataPro). Data summaries (i.e., rate, percent of session) will then be uploaded to an MS Excel spreadsheet allowing for development of a graphical presentation (i.e., scatterplot line graph) of the data. The results will be evaluated using structured visual inspection criteria developed by our research team.⁴⁰ Visual inspection procedures have a long history of use in single-case research design and will be used to evaluate and interpret the data given that this method allows for identification of the effects of the relevant independent variable(s) on the dependent variable(s) based on changes in level, trend, and stability of the data.^{41, 42} The obtained results will be analyzed within participants, such that each participant serves as his/her own control. Therefore, visual analysis of the data is the most appropriate evaluation measure to determine the outcomes of our study. External validity of single-case research designs such as those employed in this proposal is established through replication. We have sufficient resources to replicate the anticipated findings across 15 participants in the target group to increase the confidence in the external validity of these results. We will also examine demand curves²⁴ during the PR portion of our study. Demand curves plot reinforcer consumption across price and therefore can readily observe the consumption of the functional reinforcer across the

various communication responses as the schedule requirements are manipulated. The use of demand curves provides a clear, summative approach to examine the number of reinforcers earned across various communication responses and has been used in our research and other studies involving behavioral economic analyses.^{26, 43, 44}

Finally, treatment integrity data will be collected on all independent variables and inter-observer agreement (IOA) data will be collected on both independent and dependent variables. For treatment integrity, we will define specific procedural variables (e.g., delivery of reinforcement) and record the number of occurrences divided by the opportunity for occurrences multiplied by 100%. For IOA we will calculate exact- and/or partial-interval agreement depending on the relevant measurement of our variables (frequency and duration recording, respectively). Treatment integrity and IOA will be collected during at least 30% of sessions for all participants and both will be equal to or greater than 80% for all variables. These measures are typical practice at the clinical-research site and thus should be easily attainable.