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Noncontingent Reinforcement in the Treatment of Attention Maintained Problem Behavior: Schedule Thinning Within Extended Sessions

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Noncontingent Reinforcement in the Treatment of Attention Maintained Problem

Behavior: Schedule Thinning Within Extended Sessions

A Thesis
by
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Abstract

Children may develop maladaptive behaviors to obtain attention from adults. With respect to problem behavior, research has shown that noncontingent reinforcement (NCR) is an effective intervention that reduces problem behavior through disruption of the relation between the behavior and the consequence. This study evaluated the treatment effects of NCR without extinction across extended, 2 hour, sessions for participants whose problem behavior is maintained by social-positive reinforcement, specifically attention. In addition, this study also emphasized the importance of extended sessions due to the reality of the caregiver/child interaction being longer than the typical 5- to 15-min sessions. The results of this study suggest that implementing NCR across extended sessions will reduce problem behavior maintained by social-positive reinforcement in the form of attention.

Keywords: attention-maintained problem behavior, extended sessions, functional analysis, noncontingent reinforcement, problem behavior, schedule thinning, social-positive reinforcement

Noncontingent Reinforcement in the Treatment of Attention Maintained Problem

Behavior: Schedule Thinning Within Extended Sessions

In order to obtain adult attention, children may develop maladaptive behaviors that often prove problematic to caregivers. With regard to problem behavior, research has shown that noncontingent reinforcement (NCR), a response-independent reinforcement procedure, is an effective antecedent intervention that reduces the behavior and disrupts the relation between the behavior and the consequence (Cooper et al., 2007, p. 489). When using NCR to intervene on problem behavior, therapists typically deliver reinforcement on a fixed-time (FT) or variable-time (VT) schedule (Cooper et al., 2007, p. 491). Best practices dictate that therapists should conduct a functional analysis (FA) before beginning NCR to ensure the functional reinforcer is delivered (Fritz et al. 2017).

Noncontingent reinforcement has been used to treat problem behaviors maintained by the range of potential functions including social-positive, social-negative, and automatic reinforcement (Carr et al., 2000). With respect to social-positive reinforcement, NCR has been found to be effective in reducing problem behavior in many cases for many different topographies (e.g., 14 out of 15 applications, Phillips et al., 2017). There are ample benefits when implementing NCR in the treatment of problem behavior. Compared to other function-based procedures such as functional communication training, NCR results in higher rates of reinforcement and more significant reductions in behavior (Carr et al., 2000). Noncontingent reinforcement requires less response effort for the client while controlling for the presence of the maintaining reinforcer. Further, NCR and differential reinforcement of other behaviors (DRO) have been demonstrated to be equally effective for problem behavior such as self-injurious behavior (SIB); however, many therapists prefer NCR due to the ease of implementation (Vollmer et al., 1993).

The mechanism by which NCR is effective has two components. One component is that the client could become satiated with the reinforcer due to continuous access. Alternatively, extinction (EXT) could occur because the reinforcer is being delivered independent of the target behavior, thereby weakening the behavior/reinforcer relationship. However, unless there is a resurgence effect, satiation effects typically weaken whereas extinction does not. Kahng et al. (2000) conducted a study to identify whether satiation or extinction occurred when NCR was implemented to treat self-injurious behavior maintained by positive reinforcement (attention or tangibles), and the results suggested it was idiosyncratic across the three participants. The results of the Kahng et al. (2000) study imply that it is not always a single mechanism by which NCR is effective. Rather, satiation and extinction can occur simultaneously.

Although NCR is typically most effective when combined with programmed extinction (withholding reinforcement for problem behavior), NCR can be implemented without extinction, though little research has been conducted on using this variation. Lalli et al. (1997) conducted a study to determine if extinction was an essential component of NCR by comparing the effects of NCR combined with extinction and NCR alone, and they concluded that NCR without EXT was effective in reducing SIB maintained by tangible positive reinforcement. Fritz et al. (2017) conducted a study implementing NCR without extinction, and NCR alone reduced problem behavior for three out of the five participants. However, NCR without extinction may only be effective when the high-preference stimulus is provided (Fisher et al., 2000). Furthermore, the mechanisms by which NCR is effective could be idiosyncratic across participants.

It is important to decide whether or not to use EXT combined with NCR, it is also crucial to begin NCR sessions with a dense schedule of reinforcement. After establishing low or zero levels of the target behavior with a dense schedule of reinforcement, thinning

procedures can be implemented to decrease the schedule of reinforcement. Thinning an NCR schedule involves slowly decreasing the schedule of reinforcement. The three most common thinning procedures used in the context of time-base schedules are constant time increase, proportional time increase, and session-to-session time increase/decrease (Cooper et al., 2007). Constant time increase involves increasing the schedule interval. For example, in a study conducted by Lalli et al. (1997), a constant time increase thinning procedure was implemented by adding 30, 60, or 120 s across sessions. When using proportional time increase, the schedule increases by the same proportion of time each session. For example, Britton et al. (2000) evaluated the effectiveness of NCR in the treatment of aberrant behavior and used a proportional time increase thinning procedure for one of the participants by increasing the schedule by 50% of the previous thinning schedule. Finally, with session-to-session thinning, a new NCR schedule is determined at the end of each session by dividing the number of problem behaviors that occurred in the previous session by the duration of the session. Kahng et al. (2000) demonstrated the use of a session-to-session thinning procedure by evaluating the rate of problem behavior from the previous sessions to determine NCR thinning schedules.

Thinning should only occur gradually after an apparent reduction in problem behavior (Cooper et al., 2007). Thinning procedures may be necessary when it comes to the long-term maintenance of treatment effects. For example, caregivers may have other household tasks or other children to which attention must be directed which may not be feasible to do while implementing a dense schedule of attention. It may be more realistic that a parent checks on a child on a thinner interval reinforcement schedule.

Along with the consideration of the schedule thinning procedures, the session duration might also impact the effectiveness of a selected intervention, most sessions are 5-15 min. Although previous research is limited, a few studies have evaluated the impact of

extended session durations on behavioral interventions. For example, Oliver et al. (2001) compared aggregate topographies of aggression during close-proximity and distant-proximity sessions to assess the effects of social proximity. Regular and extended sessions were 5 min and 45 min in duration, respectively, to determine if aggressive behavior would extinguish during an extended exposure after. By the end of the third extended, close-proximity session, problem behavior decreased to zero following completion of the 5-min sessions (Oliver et al., 2001). In another example of extended sessions, Hagopian, LeBlanc, and Maglieri (2000) evaluated the effects of noncontingent attention during 40- to 90-min sessions in the treatment of excessive medical complaints. Extended sessions were implemented to emulate the participant's environment in medical day care (Hagopian et al., 2000). The results of the Hagopian et al. (2000) suggest that NCR was effective in decreasing problem behavior across extended sessions, even when the reinforcement schedule was thinned.

The research conducted by Hagopian et al. (2000) is one of the few examples of research on extended NCR sessions. Overall, there is a limited amount of research conducted on extended NCR sessions. Extended sessions can impact the effectiveness of NCR interventions. While most NCR sessions in published research are between 5 and 15 min in duration (Lindberg et al., 2003), extended sessions better emulate day-to-day life (i.e., caregivers, teachers, and therapists are interacting with the child for long periods of time in real life, not just in 5- to 15-min intervals). To fully evaluate the effectiveness of this intervention, it is important for the contingencies to be in place for long periods of time as they are in clinics and classrooms. Continuous exposure to an NCR intervention may affect the level of satiation or extinction contacted by the participant, which could in turn affect the effectiveness of the intervention during schedule thinning or maintenance (Wallace et al., 2012). For example, Sweeney and Shahan (2013) evaluated the relationship between

resurgence, behavior momentum, and the effects of time in extinction and the results suggest that resurgence decreases as time exposed to extinction increases.

In one notable exception to the lack of research on extended NCR sessions, Lindberg et al. (2003) evaluated treatment effects through examining two-hour extended sessions and found that the problem behavior reductions maintained across extended sessions. Specifically, Lindberg et al. (2003) evaluated effects of NCR during a brief session (10-min) compared to an extended session (120-min) during the participant's daily routine. The data demonstrated that both sessions resulted in a reduction of automatically maintained problem behavior and that satiation might occur during the extended sessions. The Lindberg et al. (2003) study also demonstrated that the effects of the extended session maintained for up to one year. The results of this study show that NCR remains effective during longer sessions while being conducted in the participant's natural environments.

The purpose of this study is to add support to the effectiveness of NCR without extinction procedures in the treatment of attention-maintained problem behavior across individuals. The study will consist of two phases. An FA and a treatment evaluation will be conducted, consisting of NCR within extended sessions.

Method

Participants and Setting

Two children, Dwight and Jim, who engaged in problem behavior hypothesized to be maintained by social-positive reinforcement participated in this study. Participants were recruited from a local applied behavior analysis (ABA) center located in central Florida. To participate in the treatment evaluation, an FA for each participant must have indicated that problem behavior was maintained by attention. If problem behavior was hypothesized to be maintained by attention and an FA was completed but indicated that problem behavior was

maintained by a different function, then the client was referred for appropriate services. All sessions were conducted in the ABA center. Materials needed to conduct sessions were present including items for each FA condition and data collection sheets.

Measurement Procedure and Reliability

The dependent variable that was measured for Dwight was screaming, which was defined as an occurrence of vocalizations above normal conversational volume. The dependent variable that was measured for Jim was perseverative speech, which was defined as repeatedly talking about one or more specific topics. Problem behavior was measured using frequency recording and converted into rate of responses per hour. A second independent observer collected data for 62% of FA sessions and 42% of NCR sessions to assess reliability. Interobserver agreement (IOA) was calculated using total count IOA meaning the total calculated by observer 1 divided by the total calculated by observer 2 multiplied by 100. Mean agreement across IOA sessions was 81% (ranging from 79% to 100%) for FA sessions and 98% (ranging from 0% too 100%) for NCR sessions. IOA was also taken on each perseverative speech topics; mean IOA for topic of phones was 93%, Pinterest was 96%, schedule was 86%, car was 80%, toy was 93%, past therapist was 83%, and past events was 91%. Treatment integrity was assessed through direct observation and self-report during NCR sessions. Observers took data on the therapist implementing the intervention using a treatment integrity checklist. The therapist also did a self-report on the extent of implementation of NCR sessions using a treatment integrity checklist. Direct observation data was taken during 48% of sessions and self-report data was taken during 78% of sessions. Mean treatment integrity was 95% (ranging from 80% to 100) for direct observation and 96% (ranging from 86% to 100%) for self-report.

Standard Functional Analysis

Procedure

Functional analysis sessions were 5 min in duration. A multielement design was used. No interaction, attention, play, and escape conditions were included in a fixed sequence (Hammond et al. 2013). A tangible condition was only be included if there is an indication that problem behavior is maintained by access to tangibles. A multiple stimulus without replacement (MSWO) preference assessment was conducted prior to the FA to determine high and low preference items to use in the relevant conditions (DeLeon & Iwata, 1996). The preference assessment began with five items in the array and those items were selected in consultation with the participant's behavior analyst. Functional analysis sessions were recorded and scored at a later date.

No Interaction. The purpose of this condition was to evaluate if problem behavior was automatically maintained. These sessions took place in a barren environment with no toys available and no access to the therapist's attention. There were no consequences for target behavior. The therapist was present but not interacting with the client.

Attention. The purpose of this condition was to evaluate if problem behavior was maintained by social-positive reinforcement in the form of attention. The therapist told the participant that they were busy working and only provided attention contingent on problem behavior. Attention was provided for 5 s. Free access to the participant's lowest preferred items was provided.

Play. The purpose of this condition was to serve as a control condition. The participant had free access to toys and attention from the therapist and no demands were placed. There were no programmed consequences for problem behavior. The participant's moderate or highest preferred items were provided. Attention was continuously delivered noncontingently in the form of general praise or comments.

Escape. The purpose of this condition was to evaluate if problem behavior was sensitive to negative reinforcement. Demands were selected in consultation with the participant's behavior analyst. The therapist placed a demand and verbal prompt (e.g., "Do your work") and if problem behavior occurred, the task demand was removed for 30 s. Once the 30 s elapsed, the demand and verbal prompt were delivered again.

Modified Functional Analysis

Procedure

A modified functional analysis was conducted for Jim due to undifferentiated results in the standard functional analysis. Anecdotal notes suggested that Jim's perseverative speech was maintained by attention, and therapists for the FA described high levels of preservative speech between FA sessions. Based on these discrepancies between FA data and descriptive reports, we replicated Fisher et al. (2013) in which a modified functional analysis was conducted for perseverative speech. Sessions were 5 min in duration. An ABA reversal design was used. A conversation and no interaction condition were included.

Conversation. The purpose of this condition was to evaluate if problem behavior was maintained by social-positive reinforcement in the form of attention. Prior to the first session of this condition, a list of topics Jim perseverated on consistently was made in consultation with his behavior analyst and behavior technicians. The therapist began the session by asking Jim, "What do you want to talk about?" Attention was provided contingent on Jim's talking for both perseverative and non-perseverative speech. The therapist responded with questions or statements relating to the topic. If Jim was quiet for 5 s, the therapist asked, "What do you want to talk about?" again. The duration of perseverative and non-perseverative speech was scored.

No interaction. These sessions were identical to the no interaction sessions in the standard functional analysis.

Noncontingent Reinforcement

Procedure

The NCR without extinction sessions were 120 min and were conducted during Jim's normal day-to-day routine. Sessions were conducted at the same time each day, and the effect of NCR on problem behavior was evaluated in a ABAB reversal design.

Baseline. During baseline sessions, the therapist interacted with Jim as they normally would during clinic times. If problem behavior occurred, the therapist responded as they normally would. No specific items were provided during NCR conditions due to session duration and multiple activity changes. Attention was delivered as it normally was during Jim's daily routine.

Noncontingent Reinforcement. During NCR without extinction, attention was delivered on a FT schedule of reinforcement. The therapist used a smart watch or timer for a discrete prompt to signal when the reinforcement interval elapsed. Attention was provided noncontingently when the timer went off and was provided in the form of statements based on the participant's reinforcing topics such as "I like going on Pinterest" or "I already cleared my notifications today." If problem behavior occurred, the therapist was instructed to respond as they normally would. The initial NCR interval was calculated by dividing the total duration of baseline sessions by the total number of instances of problem behavior that occurred. Data was not taken when running specific programs with Jim such as his "play quietly" program. If Jim talked about multiple topics in one sentence it was counted under the first topic mentioned. It counted as two counts if the same topics were mentioned 5 minutes apart.

Once an 80% or greater reduction in problem behavior relative to baseline was obtained for three consecutive NCR sessions, the FT schedule was increased by 50% of the previous thinning schedule. The schedule continued to increase by 50% of the previous

thinning schedule after two consecutive sessions below 80% reduction, rounding to the

nearest 5 s, until an FT 600-s was in place. If problem behavior began to occur more than

50% of session time for five consecutive sessions during the schedule thinning procedures,

then the thinning schedule was reverted back to the previous thinning schedule until behavior

was at a near-zero level of responding.

Results

Figure 1 shows the results of Dwight's standard FA. Screaming occurred at high rates

during the escape condition and did not occur in the other conditions. Dwight was referred

back to his behavior analyst for intervention, and the FA data was given to the participant's

behavior analyst for further analysis.

Figure 2 shows the results of Jim's standard and modified FAs. Jim's standard FA

resulted in undifferentiated responding. Both perseverative and non-perseverative speech

occurred during conversation conditions, but perseverative speech occurred at a higher rate

during this condition. Neither perseverative nor non-perseverative speech occurred during the

no interaction condition. These results suggest Jim's perseverative speech was maintained by

attention.

Figure 3 shows the results of NCR without extinction during extended sessions.

Problem behavior occurred at high rates during baseline, averaging at about 34.4 responses

per hour. The initial NCR schedule was calculated by dividing the total duration all of

baseline session by the total occurrences of problem behavior during baseline sessions.

Problem behavior occurred at low levels of responding during the initial 105-s FT NCR

session. Problem behavior decreased by 80% or more relative to baseline during sessions 18,

19, and 20. When baseline procedures were reinstated, problem behavior began to occur at

higher rates of responding, averaging at about 21.2 responses per hour. When the 105 FT NCR was implemented, problem behavior occurred at low rates.

Discussion

The results of this study suggest that implementing NCR during an extended session will reduce problem behavior maintained by social-positive reinforcement in the form of attention. Consistent with previous research, NCR implemented during extended sessions decreased problem behavior by 80% or greater.

This study contributes to the existing literature on extended sessions by supporting the use of natural, realistic session durations. NCR has been found to be effective in reducing problem behavior while requiring less response effort from the therapist. There are limited studies that have evaluated treatment effects during extended sessions; however, the studies that have been conducted prove that extended sessions are effective. During extended sessions the contingencies are in place for longer periods of time, emulating day-to-day life. The experiment provides a new insight into the effects of NCR across longer periods of time. It is important for the contingencies to be in place for longer periods of time in order to fully evaluate the effectiveness of this intervention.

One limitation of the current study is that it only evaluated behavior maintained by social-positive reinforcement in the form of attention with one participant. Future research should evaluate the effectiveness of extended sessions across behaviors maintained by social-negative reinforcement and automatic reinforcement. NCR is procedurally different when used to decrease problem behavior maintained by social-negative (escape) or automatic reinforcement. NCR using a social negative reinforcer, more commonly known as noncontingent escape (NCE), allows for response-independent escape or breaks (Kodak et al., 2003) and for automatic reinforcement NCR typically involves the delivery of a matched

stimuli to compete with the sensory consequences gained through problem behavior (Britton et al., 2002).

The Lindberg et al. (2003) study suggested that extended NCR sessions maintained longer compared to short sessions. Overall, there is a limited amount of research conducted on extended NCR sessions. Another potential limitation is that this study did not evaluate the maintenance effects after intervention; future research should evaluate the maintenance of NCR treatment effects during extended sessions. It is important for the therapists who consistently work with this participant to continue to use NCR during sessions to maintain treatment effects. Future research should evaluate the maintenance effects as well as generalization of treatment effects outside of the clinic. For example, caregivers can be trained to implement the protocol in the home setting. Experimenters can consider factors such as social validity (e.g., feasibility) of the intervention to caregivers as well as the degree of treatment integrity necessary. Experimenters could evaluate how results are affected by changes in schedules of reinforcement for problem behavior versus appropriate behavior. This may be important for generalization since caregivers are unlikely to implement the procedure with 100% fidelity long-term and across settings.

A conceptual limitation could be the lack of clarity regarding understanding which mechanism will be effective in reducing problem behavior during NCR sessions. It cannot be said that extinction was not implemented throughout NCR sessions; there was some variable, intermittent schedule for problem behavior. In regard to this paper, without extinction meant without explicit programming for problem behavior. It has been found that satiation and extinction can coincide; however, if satiation is occurring there may be a temporary increase in problem behavior due to the shift of the establishing operation and if extinction is occurring then problem behavior should remain at low rates of responding due to the contingency remaining the same (Kahng, et al., 2000). This could be evaluated by conducting

a minute-by-minute analysis of the response patterns of problem behavior. This would have implications particularly on maintenance and generalization of treatment effects. If effects are due to satiation, there may be greater response effort long-term for the implementer of the procedure. If effects are due to extinction, considerations should be made regarding extinction bursts or resurgence of problem behavior.

Another limitation is that there were different therapists delivering NCR and taking data within one session. One therapist was not always conducting the two-hour sessions in their entirety; sometimes one therapist would conduct the first hour and another therapist would conduct the second hour. Sessions were conducted in a typical clinical setting which could impact behavior. Another potential confound could be interns shadowed the therapist conducting sessions some days. Attention could not be delivered if the client or therapist were using the restroom or when the participant was running his "play quietly" or "wait quietly" programs. For example, a new therapist began working at the clinic during the last NCR phase and began working with the participant which resulted in her having to get trained at a late point in the study.

This can be a threat to internal validity because experimenters cannot be certain whether this extraneous variable (i.e., history and novel therapist) was responsible for the change in behavior. However, because treatment effects maintained despite this change, external validity, though not specifically evaluated, may be high. Environmental changes may also be a threat to reliability due to, for example, potential inconsistency in measurement from one implementer to the next. Evaluating thinning the NCR schedule in a contrived session is important to ensure experimental control and to minimize interference from extraneous variables (e.g., attention from a sibling in the home). However, evaluating whether treatment effects maintain when other variables interfere is necessary when considering generalization of treatment effects across settings, and implementers.

Important treatment and/or research decisions are made based off validity, data reliability, and treatment integrity; conducting a study in less-controlled clinical setting poses a threat to those listed. It is important to have a clear operational definition for the dependent variable to ensure all data collectors are measuring the correct behaviors. However, IOA data were taken, and immediate feedback was given to data collectors when direct observation took place increases data reliability and treatment integrity. Examples were provided and implementers were instructed not to count every topic occurrence as perseverative speech as long as it was appropriate for Jim to be talking about (i.e., when working on texting, it is okay for him to talk about phones/texting).

Research has suggested there are limited studies that implement NCR across extended sessions as well as other interventions. Generalization and maintenance are key concept in Applied Behavior Analysis and implementing interventions during an extended study can help train for generalization and maintenance across different settings and therapists. During extended sessions contingences are in place for longer periods of time which emulate day-to-day life. Caregivers, teachers, and therapists are interacting with children for long periods of time in real life, not just in 5- to 15-min intervals.

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Figure 1

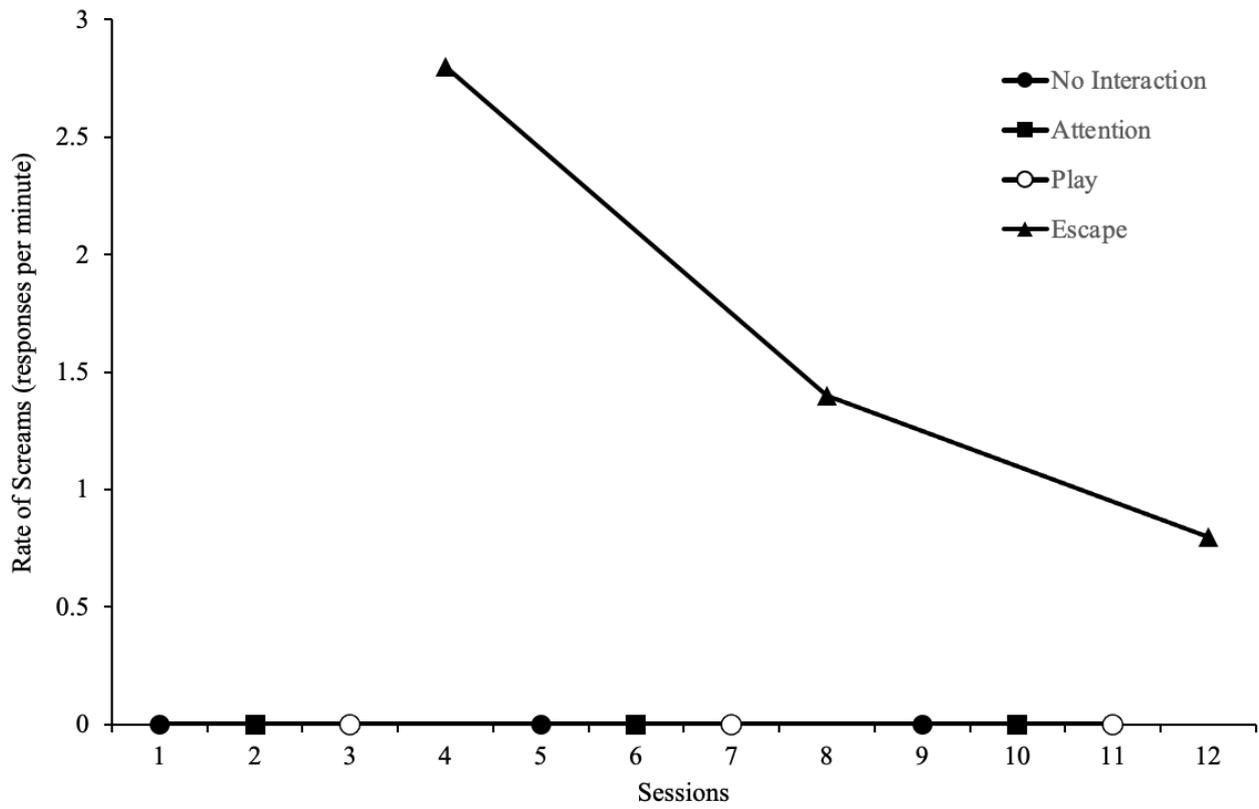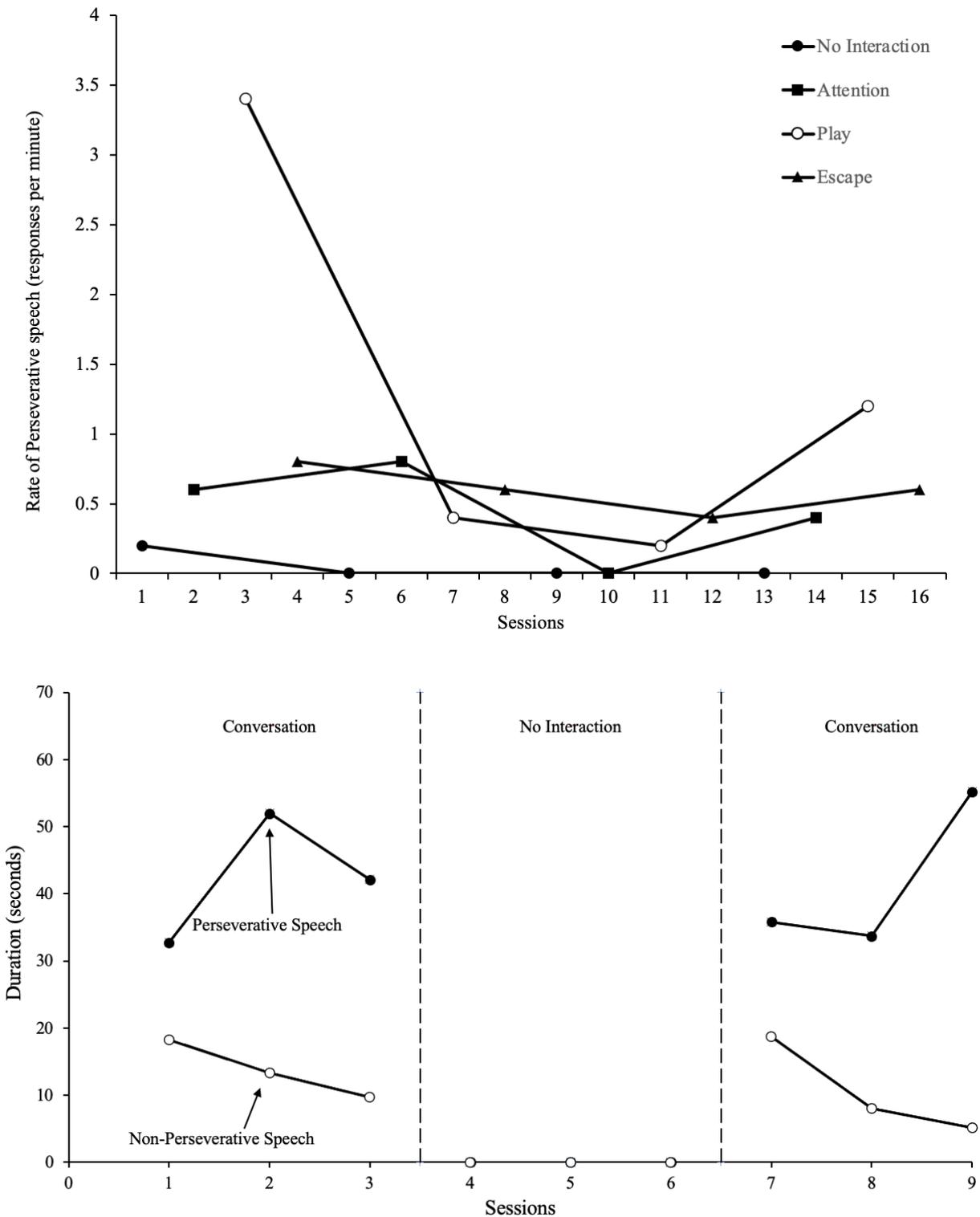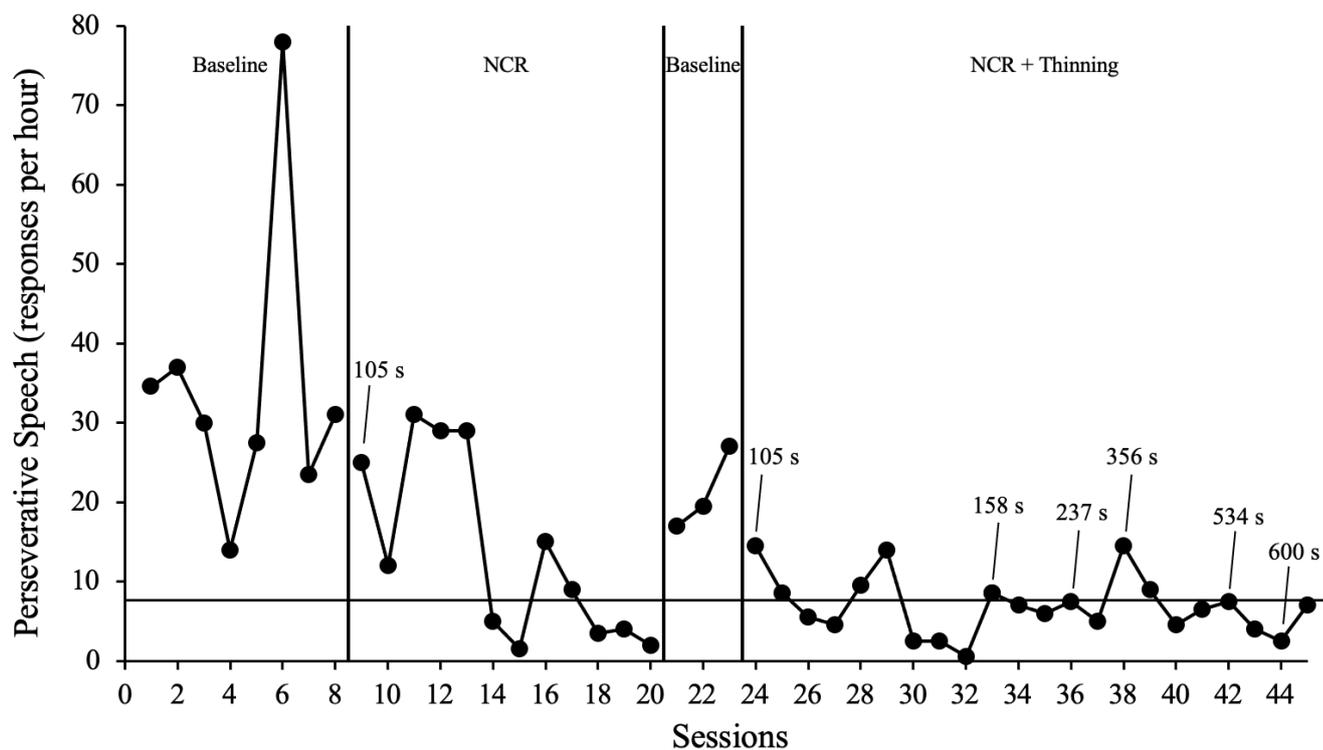*Dwight's Standard Functional Analysis*

Figure 2

Jim's Standard and Modified Functional Analysis

Note. The top graph shows Jim's standard FA results, which were undifferentiated. The bottom graph shows the modified FA conducted which was replicated from Fisher et al. (2013).

Figure 3

Jim's Extended NCR Reversal and Schedule Thinning Graph

Note. The phase lines represent when intervention began or when baseline was reinstated. NCR began at a FT 105 s schedule of reinforcement. The horizontal line above the x axis represents the 80% reduction line, problem behavior needed to be at or under this line for three consecutive sessions before moving on to the next step.

Appendix A

Table 1

Jim's Perseverative Speech Topics List

Topic	Jim's Perseverative Topic Example	Therapist Example
Phones/Texting/Clear/Brightness	"I like texting. Can I clear your notifcations? "What about brightness? "I'm a full brightness person."	"My brightness is all the way up on my phone" "I cleared all of my notifications"
Pinterest	"Can I go on pinterest? I'm going to find toys. What do you look for on pinterest?"	"I like watching recipe videos on pinterest" "I like scrolling through pinterest"
Schedule/Fake Order/Time/What you will do next	"What will we do next week? What about the next week? Can we go on a walk next time? What about texting?"	"It's almost time to go home" "Next week we can go on a walk"
Cars/Gas	"Where's your car? Do you need gas? How much gas is in your car right now?"	"I need to get gas today" "My car is in the parking lot right now"
Toys/Playing/Games/Playground	"Where are the bubbles? How do you play with bubbles and animal toys at the same time? Can we take the toys outside or is that silly?"	"I like playing UNO" "I like the big bottle of bubbles better than the smaller one"
Past therapists/teachers	"I miss *name*. Can we text them? Where are they?"	"I miss *name*" "I wonder how *name* is doing"
Past events	"I went to longwood last week. I don't go there anymore but I did go. Have you been there?"	"I had fun going on a walk last week" "Last spring break you went to music camp"

Note. Listed here are Jim's perseverative speech topics and examples of the statements he consistently repeated; although most of these statements are appropriate and socially acceptable, they were considered problematic due to the excessive repetition. Examples of the statement's therapists stated during NCR are also listed.