4-2017

Using Auditory Extinction Cues to Mitigate Resurgence

Samuel Shvarts

Using Auditory Extinction Cues to Mitigate Resurgence

by

Samuel Shvarts

A thesis submitted to the Office of Graduate Programs of
Florida Institute of Technology
in partial fulfillment of the requirements
for the degree of

Master of Science
in
Applied Behavior Analysis
and Organizational Behavior Management

Melbourne, Florida
April, 2017

We the undersigned committee hereby approve the attached thesis

Christopher A. Podlesnik, Ph.D.
Associate Professor
Schools of Psychology and Behavior Analysis

Corina Jimenez-Gomez, Ph.D.
Research Assistant Professor
School of Behavior Analysis

Radhika Krishnamurthy, Psy.D.
Professor
School of Psychology

David Wilder, Ph.D.
Program Chair
School of Behavior Analysis

Mary Beth Kenkel, Ph.D.
Dean
College of Psychology and Liberal Arts

Abstract

Title: Using Auditory Extinction Cues to Mitigate Resurgence

Author: Samuel Shvarts

Advisor: Christopher A. Podlesnik, Ph.D., BCBA-D

Resurgence is a laboratory model of treatment relapse revealing the effects of treatment-integrity errors on problem behavior eliminated through treatment with differential reinforcement of alternative behavior (DRA). This study took a translational approach to assess the effects of an auditory extinction cue (e-cue) to mitigate resurgence of target responding in children with autism using arbitrary responses to simulate target and alternative responding. The auditory cue was a recorded praise statement introduced in Phase 2 and remained in one of the test conditions in Phase 3. In 8 of 12 resurgence test comparisons (with and without the e-cue), responding was mitigated in the e-cue condition compared to the typical resurgence condition. Incorporating a praise statement within DRA treatment could maintain alternative responding while mitigating resurgence of the target response when the reinforcer is not available. This translational study connects applied research examining praise and basic research examining extinction cues to evaluate a novel DRA-treatment strategy.

Table of Contents

List of Figures

List of Tables

Acknowledgement

First of all, I'd like to thank Dr. Chris Podlesnik for his guidance and support during my thesis project. It was with his help and input that I was able to complete this project in a timely manner and really grow an appreciation for the research process.

Thank you Dr. Corina Jimenez-Gomez and Dr. Radhika Krishnamurthy for their support and commitment to this important part of my educational experience.

Also, Thanks to Rachel Thompson and James Oskam for their help with sessions and data collection.

Thank you to my participants – I couldn't have done this without you.

Dedication

This thesis is dedicated to my wife Claire-Marie, thank you for your unconditional love and support.

Introduction

Differential reinforcement of alternative behavior (DRA) is a behavioral treatment used to eliminate or reduce problem behavior in individuals diagnosed with Autism Spectrum Disorder (ASD) and developmental disabilities. Typically, DRA consists of two components; withhold reinforcers following the occurrence of problem behavior (otherwise known as extinction) and replace the targeted behavior with a more appropriate alternative behavior. The benefit of DRA is that not only is the problem behavior reduced, but an alternative and more socially appropriate behavior is taught. Reinforcing an alternative response reduces the probability of unwanted side effects that may be caused by treatment with extinction or punishment alone, such as emotional responding or extinction bursts. In a review of DRA by Petscher, Rey, and Bailey (2009) evaluating 116 empirical studies, DRA was effective in treating problem behavior, including inappropriate vocalizations, aggression, food refusal, and destructive behavior.

A commonly used application of DRA is functional communication training (FCT), introduced by Carr and Durand (1985). Participants were children whose problem behaviors were maintained by access to their teachers' attention and/or those maintained by escape from a difficult task including aggression and negative vocals. Using FCT, they replaced problem behavior with an alternative response, such as "Am I doing good work?" or "I don't understand." In this application of FCT, the teachers provided attention or assistance contingent on the alternative response while placing all problem behavior on extinction. Their procedure was successful in reducing problem behaviors and increasing appropriate vocal responses for all four participants. There are several explanations for the effectiveness of FCT, including teaching a functionally equivalent replacement behavior and reducing problem behavior (see Tiger, Hanley, & Bruzek, 2008, for a review).

When implementing FCT, a functional analysis (FA) is first used to determine the function of behavior by manipulating antecedents and consequences. Once the consequences maintaining the specific problem behavior are determined (i.e., the function of behavior), the behavior is placed on extinction, meaning that behavior no longer produces the maintaining consequence. These consequences will instead follow an alternative behavior which will produce a denser schedule of reinforcement for the desired reinforcer (Carr and Durand, 1985). FCT also reduces the motivation to emit the problem behavior because it is no longer paired with the desired consequence (Betz, Fisher, Roane, Mintz, & Owen, 2013). A limitation of FCT is that in some natural environments, it can be difficult to reinforce the alternative response every time it occurs. For example, providing an edible upon every request may be impossible in the natural environment. When the alternative response is not reinforced consistently, relapse in problem behavior could occur (see Volkert, Lerman, Call, & Trosclair-Lasserre, 2009).

This particular type of relapse of problem behavior due to omitting reinforcement for alternative responding is called *resurgence*. Resurgence is defined as the recurrence of a previously reinforced and later extinguished target response when a recently reinforced alternative response was placed on extinction (Podlesnik & Kelley, 2014). Resurgence has been demonstrated in both human and non-human laboratory models, as well as in clinical situations. Typically, resurgence procedures arrange three phases. During Phase 1, the problem behavior (target response) is reinforced. During Phase 2, the problem behavior is placed on extinction and the same reinforcer is delivered for a more recently trained alternative response. During Phase 3, the treatment is challenged by placing both target and alternative responses on extinction. Clinically, the first two phases demonstrate problem behavior being reinforced (Phase 1) followed by FCT (Phase 2). Phase 3 simulates a breakdown of the contingencies taught during FCT, which can happen due to the unavailability of the reinforcer, not enough of the reinforcer to match the number of requests, or non-delivery of the reinforcer by a novel caregiver after the alternative response is emitted. Resurgence is demonstrated when the target response reemerges after previously being extinguished, due to eliminating the relation between the alternative response and the reinforcer.

Laboratory studies with animals have demonstrated resurgence effects. For example, Sweeney and Shahan (2015) evaluated the resurgence of operant responding in rats. In Phase 1, responding on the active lever produced reinforcement on a variable-interval (VI) 45-s schedule. In Phase 2, the active lever was placed on extinction while an alternative response of pulling a chain was reinforced on a VI 10-s schedule, thereby simulating DRA. In Phase 3, they tested for resurgence by placing both responses on extinction. Thus, they demonstrated resurgence in nonhuman animals with a small but reliable increase in the target response. Resurgence has been demonstrated in laboratory studies with zebrafish (Kuroda, Mizutani, Cançado, & Podlesnik, 2017a,b), Siamese fighting fish (da Silva, Cançado, & Lattal, 2014), pigeons (e.g., Craig & Shahan, 2016; Podlesnik & Kelley, 2014), monkeys (Mulick, Leitenberg, & Rawson, 1976), typically developing humans (e.g., Kuroda, Cançado, & Podlesnik, 2016), and individuals with developmental disabilities (e.g., Reed & Clark, 2011). The generality of resurgence across species further solidifies the phenomenon of resurgence as a reliable behavioral process, and allows for further investigation in applied and translational research.

In a clinical demonstration of resurgence, Volkert et al. (2009) conducted a study examining the effects of FCT as a DRA procedure and the resurgence of problem behavior. They conducted a study to investigate resurgence effects in five children diagnosed with Autism Spectrum Disorder (ASD) between ages 5 and 9, who all engaged in self-injurious behavior (SIB), aggression, or disruption. After conducting a functional analysis, it was found that social negative reinforcement, social positive reinforcement, or both, maintained participants' problem behavior.

They conducted an ABCABC reversal design [Baseline (A), FCT training (B), and extinction (C)] and found that 4 out of 5 participants demonstrated resurgence effects. Their study demonstrated clinically that resurgence of problem behavior is a reliable behavioral phenomenon in children with ASD when implementing FCT (Peterson et al., 2017; Marsteller & St. Peter, 2014).

Clinically, resurgence effects are a result of some of the limitations of using FCT to reduce problem behavior and train an alternative response. One of these limitations is a side effect of using a dense schedule of reinforcement to teach and maintain the alternative response. There are benefits to using dense schedules to teach a new response. Dense schedules of reinforcement increase the probability of that response occurring again in the future. When the response receives regular reinforcement after every occurrence, skill acquisition will be quicker than compared to if taught with a thinner schedule (Stokes & Baer, 1977). Dense schedules also more quickly reduce the probability of recurrence of the target behavior when the alternative response is constantly receiving reinforcement (Hagopian, Toole, Long, Bowman & Lieving, 2004; Sweeney & Shahan, 2013).

Despite the effectiveness of using dense schedules of reinforcement to teach new responses, its use has some problems. One drawback of arranging high rates of alternative reinforcement is the request for reinforcement may occur at non-functionally high rates (Fisher, Piazza, Cataldo, Harrell, Jefferson & Connor 1993; Tiger et al., 2008). In clinical settings, the alternative response may be easily reinforced because the student is in a 1-1 adult-student ratio, but in other environments a parent/guardian may be looking after multiple children and be unable to provide the reinforcer as easily. The request may need to be denied or delayed, which will result in unreinforced responses, causing disconnect between the request and the previously delivered consequence. This disconnection results in a failure to receive an earned reinforcer, otherwise known as an omission error, which can produce resurgence of problem behavior.

An example of the effects of omission errors was demonstrated by Durand and Carr (1991). They conducted an experiment to reduce escape maintained behavior by teaching the child to say, “I don’t understand” and the experimenter would provide assistance upon the response. Problem behavior decreased from 22.9% of 10-s intervals to 4.8% of 10-s intervals after treatment. Interestingly, another therapist was asked to implement the same procedure, but because of the child’s poor articulation, they could not understand the request and did not reinforce the behavior. Problem behavior increased above baseline levels due to the novel therapist omitting the reinforcer contingent upon the alternative response. This example from Durand and Carr (1991) shows how omission errors can lead to relapse in problem behavior. Fortunately, strategies exist from laboratory and clinical research to mitigate the likelihood of omission errors producing resurgence.

There are several methods to mitigate resurgence during FCT because resurgence can still occur even in treatment when thinning reinforcement. Often, thinning strategies are used to mitigate resurgence effects by programming non-reinforced responses in a controlled setting before introducing delays or denials to reinforcement in the natural environment. Hagopian, Boelter, and Jarmolowicz (2011) reviewed many procedures and found that all have advantages and disadvantages. Delaying reinforcement or thinning schedules of reinforcement gradually increase the delay or number of responses needed to receive reinforcement. These approaches, however, introduce non-reinforcement of the alternative response. Therefore, thinning alternative reinforcement can lead to a breakdown in the contingency between the response and the reinforcer, producing resurgence. Thus, thinning alternative reinforcement functionally can be similar to omission errors. Such findings have been demonstrated both in laboratory (e.g., Sweeney & Shahan, 2013) and clinical (Hagopian et al., 2011) studies of FCT. Therefore, other strategies should be explored to mitigate resurgence.

Some studies used an auditory signal during treatment to mitigate another relapse phenomenon called renewal. Renewal is when a change in context leads to a relapse of the target behavior. An auditory extinction cue, or e-cue, was associated with treatment conditions and mitigated the effects of renewal when present in a context different from treatment (Willcocks & McNally, 2014; Bernal-Gamboa, Gamez, & Nieto, 2017). In Phase 1, Willcocks and McNally delivered alcohol every time a rat’s nose poked on an active hole, and responses on the inactive nose-poke hole were recorded but not reinforced in Context A. In the second phase, the rats were placed in Context B and any nose poke to the active hole resulted in the alcohol delivery mechanism engaging, but not delivering alcohol, thereby extinguishing the response. Also in Phase 2, a tone was presented after four minutes, and was continually presented every six minutes for the entire session. This tone served as an e-cue to signal the extinction contingency. In the third phase, some rats were moved back to context A and others were kept in context B. Half the rats in both groups were presented with the same auditory cue provided in Phase 2, and the other half were not. In comparing the ABA groups with and without the auditory e-cue, they found that when the tone was maintained in Phase 3, renewal effects were mitigated compared to the absence of the e-cue. An auditory stimulus paired with extinction can attenuate relapse of responding compared with the absence of the auditory stimulus. Including an e-cue could be generally a successful approach to mitigating other forms of relapse. Therefore, these findings suggest incorporating a cue during FCT could mitigate resurgence of target responding when the primary reinforcer is not available.

Recently, Craig, Browning, and Shahan (2017) compared a similar e-cue signal with the delivery of food in a study of resurgence. In their study, rats remained in the same context throughout all three phases and food-correlated stimuli were used to maintain responding when food was no longer delivered in Phase 3. These stimuli were an audible click and illumination of a light. In Phase 1, responding for pressing a target lever was reinforced, contingent on the first response within a specified time frame, with edible reinforcement. In Phase 2, they withheld reinforcement on the target lever and delivered food contingent on a response on an alternative nose poke; responses were only reinforced after a set amount of time had elapsed. Phase 3 had three groups: one group received no consequences (typical resurgence), another received only the food-correlated stimuli (mitigation test), and the final group received the food-correlated stimuli and the food for nose poking (control), both contingent on nose poking. Responding on the lever did not deliver any programed consequence. They found that the group that received only the food-correlated stimuli showed smaller resurgence effects than the typical-resurgence group with no consequences for responding in Phase 3. These findings suggest that stimuli associated with DRA could have some mitigating effect on the resurgence of problem behavior.

Using an e-cue that could be present when the alternative reinforcer is not present could mitigate relapse effects. In a clinical setting, a cue paired with treatment that can be presented by any caregiver or teacher could be a practical solution for mitigating resurgence during DRA treatments. During DRA, a primary reinforcer is delivered contingent on an appropriate response, which increases responding. Other cues delivered along with the primary reinforcer might also come to control behavior in similar ways, including statements of praise.

Praise, which is a common form of social feedback, is often used by parents and caretakers to reward a child for appropriate behavior. Treatment for children diagnosed with ASD typically focuses on increasing interest in people, sensitivity to praise, and other social consequences (Strain & Timm, 1974). Pairing praise with known reinforcers could result in social stimuli exerting greater influence on behavior and perhaps lead to socially significant changes in social engagement. Furthermore, this pairing may make DRA treatments less susceptible to resurgence by linking the response to praise as an e-cue (e.g., Willcocks & McNally, 2014). Resurgence of problem behavior may remain attenuated even after the known reinforcer is unavailable because praise could serve as an e-cue for problem behavior.

Previous studies arranged pairings between praise and known reinforcers to establish praise as a reinforcer for children with various psychological disabilities, including ASD (e.g., Axe & LaPrime, 2016; Miller & Drennen 1970; see also Dozier et al., 2012). Axe and LaPrime evaluated whether praise could increase a low-probability behavior of button pressing in two children with ASD. They conducted a reinforcer assessment to determine whether the praise statement "good job" already functioned as a reinforcer. In the two participants for whom praise did not function as a reinforcer, they then paired praise with existing reinforcers (tickles or chips). They used a multi-element design to compare the effects of three consequences, including conditions with no consequence, praise, and a known reinforcer. Pairing praise with existing reinforcers resulted in an increase in button pressing compared to the group receiving no reinforcement. Further, follow-up experiments compared various reinforcement schedules between presentations of praise and no programed consequences. Overall Axe and LaPrime found that pairing praise with existing reinforcers could result in increased button pressing in both children. Therefore, praise can be an effective tool for caregivers of children with ASD to control behavior when existing reinforcers are unavailable.

The present study connects research on using praise as a reinforcer in children with ASD (Axe & LaPrime, 2016) with basic research on using an e-cue to mitigate resurgence with animals (Bernal-Gamboa et al., 2017). Taking a translational approach allows us to avoid constraints of applied research such as variability in response effort, learning history, and potential physical risks. Therefore, instead of problem behavior as the target, both target and alternative responses were arbitrary topographies.

The goal of this study was to evaluate whether an auditory stimulus (praise) can mitigate relapse of target responding (simulating problem behavior before DRA) when there is a breakdown in reinforcement contingencies that maintain the alternative response in children with ASD. Specifically, the study compared the differences in resurgence of target behavior following the implementation of DRA, with and without an auditory e-cue previously delivered with the alternative reinforcer. To compare the effects on resurgence, participants were exposed to three phases. In Phase 1, only the target response was available and the participant received a reinforcer (identified through a preference assessment) contingent on the target response. In Phase 2, both target and alternative responses were available, but only alternative responding produced reinforcement and a praise statement contingent on responding, while there was no programmed consequence for the target response. The electronic praise statement can be thought of as an e-cue similar to those used in basic research (see Willcocks & McNally, 2014). Phase 3 was the test phase, where participants alternated between conditions where all responding was placed on extinction (no praise test) and where the alternative response produced praise as the e-cue (praise test). Findings revealed a strategy to mitigate effects of relapse by providing parents and practitioners with a tool that can help make DRA more effective and could be delivered when treatment integrity breaks down.

Method

Participants

Three children, ranging between ages 4 and 8, were recruited through The Scott Center for Autism Treatment for this study. Names have been changed to protect confidentiality. Sally was a 4-year-old girl diagnosed with ASD who received early intervention services 15 hours per week. Homer was a 4-year-old boy diagnosed with ASD who received early intervention services 15 hours per week at an early intervention center and attended typical pre-school 15 hours per week. Omar was a 6-year-old boy diagnosed with ASD who attended a typical elementary school and participates in a social skills group once per week. All participants communicated vocally.

Setting and Materials

Sessions were conducted in a small treatment room at The Scott Center for Autism Treatment. The room contained a table, two chairs, and session materials, which included a data sheet, counter, timer, playback device (used to record and deliver the praise statement), camera, marker, and edible reinforcers. Sessions were videotaped to score inter-observer agreement and procedural integrity.

To evaluate target and alternative responses, two Montessori Object Permanence Boxes were used (see Figure 1). The Object Permanence Box includes a small plastic ball, a 10 cm x 15 cm x 15 cm wooden box, and a 15 cm x 15 cm attached tray. The box has a hole on the top for the participant to drop the ball into and an opening on the side from which the ball rolls out and into the tray. Thus, the child can repeatedly put the ball into the hole on top and retrieve it from the tray. One natural wood box was used to evaluate the target response. A second green painted box was used to evaluate the alternative response.

A sound recording device (Amazon's stuffed animal insert and craft project device) was used to record the novel praise statement, "Cowabunga." The recording was used as the e-cue signal paired with reinforcement during DRA.

Response Definition and Measurement

In Phase 1, the dependent variable was the rate of target-box responding. In Phase 2 and 3, the dependent variables were the rate of responding on the target and alternative boxes. The target response was defined as dropping a small ball into the wood colored Montessori Object Permanence Box. The alternative response was defined as dropping the small ball into the green Montessori Object Permanence Box. The two boxes were placed on a table equally distant from the child to minimize differences in response effort between the target and alternative responses. There was only be one ball available on the table that was placed at the beginning of each session, between both boxes. The target response was placed on the left and the alternative response was placed on the right of the participant

Frequency of problem behavior (crying, screaming, throwing research materials, out of seat behavior) was recorded. Other functionally equivalent responses (e.g. attempts to steal, requests), and other emotional responses (whining, crying, or other vocalizations above conversational level) were recorded as a frequency measures as well.

Experimental Design

In Phase 1, only the target response was available and the primary reinforcer was delivered contingent on the target response. In Phase 2, the alternative response was introduced and reinforced with the primary reinforcer and praise, and the target response was placed on extinction. In Phase 3, participants alternated between conditions to evaluate if resurgence of the target behavior was mitigated in the presence versus absence of praise for the alternative response. To accomplish this, an ABBABAAB counterbalanced design was used (see Barlow & Hayes, 1979). Phase A depicts a resurgence with praise test that includes the e-cue and phase B depicts a resurgence test with no praise test (i.e., extinction).

Procedure

All participants participated in experimental sessions once or twice per week. During each visit, three to six experimental sessions were conducted.

Preference Assessment. The experimenter conducted a multiple-stimulus-without-replacement (MSWO) preference assessment according to procedures described by Carr, Nicolson, and Higbee (2000) at the beginning of every session in all phases. The top two items selected in the preference assessment were presented in a random order throughout the following sessions. Presenting two preferred reinforcers instead of the most preferred item was based on the suggestion of Egel (1981) that varying high-preferred reinforcers increases their effectiveness in maintaining responding.

Reinforcer Assessment. Each session was 1-min and participants were given a simple arbitrary task to complete and told, “you can do whatever you like, just please stay in your seat.” There were three sequential conditions for this assessment: baseline, praise, and edible condition. In the baseline condition, there were no programmed consequences for responding. In the praise condition, a novel praise statement was delivered through a playback device contingent on responding after every instance of the target response (FR1). In the edible condition, the highest ranked edibles in the preference assessment were delivered contingent on responding (see Dozier, Iwata, Thomason-Sassi, Worsdell, & Wilson, 2012). Only participants with stable, near-zero levels of responding in the baseline and praise condition compared to the edible test participated in the study. No Participants were dropped after the reinforcer assessment.

Pre-Session Training. Prior to initiating Phase 1, the participant was instructed to drop the ball in the box (“Do this”) following a demonstration. The experimenter delivered the reinforcer contingent on responding, until the participant emitted 10 consecutive responses independently.

Session Duration. Session duration was 3-min across all visits in all phases. Participants were told prior to each session they needed to remain in their seat from when the camera was started and until the session timer ended. This rule was included for the first participant during the reinforcer assessment, and included for all participants throughout all visits in all phases.

Phase 1 - Reinforce target response. The target box was placed to the left of the participant. The experimenter provided the instruction, "(Participant) you can do as much or as little as you want. Start." The experimenter then reinforced independent responses according to a variable-ratio (VR2) schedule with the reinforcers determined from the preference assessment. This means the reinforcer was delivered an average of every second consecutive target response, but varied from one to three responses between deliveries. The number of responses (1, 2, and 3) per reinforcer delivery were randomized and selected from a list. Intermittent reinforcement increases resistance to extinction by making it more difficult to discriminate between reinforcement and extinction conditions. This was selected to increase the probability of resurgence in Phase 3 (Ligget, Nastri, & Podlesnik, 2018).

Phase 2 - Differential Reinforcement of the alternative response. In this phase, the alternative box was introduced and placed on the right of the participant symmetrical to the target response box on the left. The experimenter provided the instruction, "(Participant) you can do as much or as little as you want. Start." In this phase, the target response was placed on extinction, which means the experimenter did no reinforce any instance of target responding. Instead, the experimenter reinforced the alternative response on a fixed-ratio (FR) 1 schedule with the reinforcer and e-cue.

Phase 3 - Resurgence Tests with Praise and No Praise. As with Phase 2, both boxes were present. The experimenter provided the instruction, "(Participant) you can do as much or as little as you want. Start." In this phase consequences were manipulated to reflect the two conditions, A and B. Condition A was a modified resurgence test, in which praise was delivered contingent on alternative responding but edibles were not delivered for either target or alternative responding. Hereafter, this test will be referred to as the "praise" test. Condition B was a standard resurgence test, in which both responses contacted extinction. Hereafter, this test will be referred to as the "no praise" test. Participants alternated between conditions in an ABBABAAB or BAABABBA design, counterbalanced across participants. Homer and Omar both experienced conditions in order of BAABABBA and Sally experienced conditions in order of ABBABAAB

Interobserver Agreement and Treatment Integrity. Two observers collected target responses, alternative responses, requests, and other emotional responses. Trained observers collected data from a video recording only. Agreement scores were calculated by taking the number of matching 10-s intervals and dividing the total number of 10-s intervals and then multiplying that number by

100 to obtain a percentage. Agreement scores were calculated for 33% of sessions and agreement was 90%, averaged across all three phases and participants. The independent observers also collect data on procedural integrity for at least 33% of sessions for each of the participant and in each phase. A checklist was used that separated each section into five sections for treatment integrity: MSWO was conducted, correct materials were in the correct locations, the correct edible delivery schedule was implemented, and the correct praise delivery schedule was implemented. Any error within any of the five sections of the checklist, received a zero for that section. Procedural integrity was measured by dividing the total number of trials with perfect treatment integrity by the total number of trials and multiplying that number by 100 to obtain a percentage. Treatment integrity scores were calculated for 33% of sessions, and averaged 89% across all three phases and participants.

Results

During the reinforcer assessment, all participants demonstrated similar patterns of responding. As seen in Figure 2, Homer and Omar engaged in little to no target responding in conditions with no programmed consequences or electronic praise contingent on responding. In the conditions with edibles provided contingent on the target response, target responding increased to higher levels. Sally engaged in the target response during the first session of the baseline condition but responding decreased to zero for the next two sessions. During the praise condition, target responding increased temporarily before extinguishing. During the edible condition, higher rates of responding were maintained throughout the condition, excluding one session where she engaged in out of seat behavior and avoided the task. The data for all three participants demonstrated that the electronic praise device did not function as a reinforcer and that the edibles selected in the MSWO could function as a reinforcer.

Table 1 depicts the mean reinforcer rates across all sessions in Phase 1 and 2 for each participant. For Sally, Homer, and Omar averages were taken across 11, 16, and 12 sessions in Phase 1 and 15, 14, and 9 sessions in Phase 2, respectively – these were the number of sessions in both phases. Reinforcer rates were similar in Phase 1 and 2 for Omar and Sally but greater in Phase 2 for Homer. Response rates were lower in Phase 2 than Phase 1 for Omar and Sally, but similar for Homer.

Figure 3 depicts the rate of target and alternative responding across sessions in all phases for all three participants. In Phase 1 and 2, similar patterns of responding were observed across all three participants. Specifically, in Phase 1 target responding stabilized after repeated sessions on the VR2 schedule. For Omar, responding was initially very low before increasing and then stabilizing, averaging 19.2 responses after 12 sessions. Homer's responding started at a high level, and then decreased slightly before stabilizing at an average of 14.1 responses per minute after 14 sessions. Similarly, for Sally, target responding in Phase 1 averaged around 11.5 responses per minute. Therefore, Homer and Sally had stable responding, while Omar's responding first increased and then stabilized.

For Omar, target and alternative responding was more variable and showed no clear differentiation across the first six sessions of Phase 2. Following a period of non-differentiated responding, target responding dropped to zero responses per minute and alternative responding was on an increasing trend. For Omar and Sally, alternative responding was lower in Phase 2 than target responding in Phase 1, a difference that can be attributed to edible consumption competing with responding in the FR1 delivery schedule in Phase 2. Sally and Homer had more stable responding across both target and alternative responses. For Sally, alternative responding remained stable, averaging 5.8 responses per minute across all Phase 2 sessions. Target responding initially decreased before momentarily increasing across three sessions and then decreased to near-zero levels. Similarly, for Homer, alternative responding remained at a stable level averaging 13.4 responses per minute across all sessions. For Homer, target responding was more variable; initially target responding decreased to near zero levels, before an increase in responding across three sessions, followed by a return to near-zero levels of responding. Importantly, all participants showed clear differentiation between target and alternative responses by the end of Phase 2.

Figure 3 depicts data from Phase 3 with sessions in chronological order. Homer and Omar experienced probe Condition A (praise test) and Condition B (typical no praise test) in order of BAABABBA and Sally experienced the conditions in order of ABBABAAB. Average alternative responding was higher than average target responding across all probe sessions. For Sally and Homer, alternative responding was on a decreasing trend and while there were some increases target responding, they remained small. Data for all participants depict some resurgence of the target response in Phase 3. Alternative responding was much higher than seen in Phase 2 for Omar, but on a decreasing trend.

Figure 4 depicts rates of target responding in Phase 3 comparing resurgence in Conditions A and B (A-B, B-A, B-A, A-B counterbalanced). Condition A was a praise test and Condition B was a no praise test. For Homer and Sally, 3 of 4 probe comparisons demonstrated greater target responding in no praise tests compared to praise tests. Target responding was observed in 1 of 4 praise test conditions and 3 of 4 no praise tests. The final comparison for Homer demonstrated an increase in target responding in the praise test over the no praise test. For Sally, no target responding occurred in the final probe tests for either condition. For Omar, target responding in the no praise tests occurred in 2 of 4 sessions and in the praise tests occurred in 0 of 4 sessions. Overall, target responding resurged to a greater extent in the absence of praise.

Figure 5 depicts rates of alternative responding in Phase 3 for all three participants in a paired comparison of praise and no praise tests. For Sally and Omar, alternative responding was higher in praise tests than in no praise tests for 3 of 4 comparisons. One probe comparison for Sally was equal in praise and no praise tests, and Omar's responding was higher in no praise tests than praise tests for the final comparison. Omar and Homer both continued to respond on the alternative box throughout Phase 3. For Sally, responding increased slightly on the first extinction session but then decreased below Phase 2 levels of responding. Overall, alternative responding maintained to a greater extent in the presence of praise.

In Phase 3, emotional and other responses were observed. Table 2 depicts the number of emotional and other responses in praise and no praise tests across all three participants. There were no emotional responses across participants in Phases 1 and 2, and no emotional responses from Sally in Phase 3. Homer and Omar engaged in emotional responding in Phase 3 which consisted of negative vocalizations. Both engaged in one negative vocalization during modified resurgence test conditions. Homer engaged in six instances of emotional responses in the form of yelling or grunting. Omar did not engage in emotional responding during typical resurgence tests, but did engage in 23 seconds of motor stereotypy in Phase 3, which had not been seen by researchers previously. Table 3 depicts other responses which included requests for edibles in Phase 3, which did not occur in Phase 1 and 2. Homer engaged in one request for an edible. Sally and Omar made no request for an edible during the praise test conditions. In the no praise test conditions, Homer, Omar, and Sally engaged in 1, 3, and 2 instances of edible requests across sessions, respectively.

Figure 6 and 7 show mean target and alternative responses across praise and no praise tests in Phase 3 for each participant. Target responding was greater in no praise tests than praise tests for all participants. For all participants, resurgence was at least four times greater in the no praise test condition than the praise condition. In addition, alternative responding was higher in the praise test than the no praise test for Sally and Omar, but not for Homer. Differences in alternative responding between praise and no praise tests were smaller for Sally and Homer, with a greater difference in conditions seen with Omar.

Discussion

These results of the present study extend findings from basic literature by revealing the effects of using an e-cue signal in DRA with humans. More specifically, in the context of DRA, an auditory signal analogous to those used in basic research (Craig et al., 2017) was used to mitigate resurgence effects in humans. Previous research with animals demonstrated that auditory e-cues present during relapse tests have mitigated resurgence and renewal when presented contingently or non-contingently upon responding when the primary reinforcer is no longer available (Craig et al., 2017; Willcocks & McNally, 2014; Bernal-Gamboa et al., 2017). For the purposes of connecting basic research on e-cues and applied research on praise (Axe & LaPrime, 2016; Miller & Drennen 1970), an auditory signal was paired with reinforcement in the form of a praise statement in the present study.

The present study evaluated the effects an auditory e-cue used in Phase 2 (analogous with DRA treatment) had on resurgence during Phase 3. For all participants, reinforcing an alternative response in Phase 2 while simultaneously placing the target response on extinction decreased the rate of target responding and increased alternative responding, consistent with previous research with DRA treatments (Petscher et al., 2009). For Sally and Homer, a decrease in target responding in Phase 2 was more abrupt, immediately decreasing to near zero levels in the first few sessions similar to some applied (Volkert et al., 2009) and basic findings (Podlesnik & Kelley, 2014). This could be due to greater discriminability between Phase 1 and 2. Dissimilar to some basic research in which the alternative response was also available in Phase 1 (Craig et al., 2017), the alternative response was only present in Phase 2 and 3. The addition of the second object permanence box may have signaled a change in contingencies and altered responding. The sudden availability of the alternative response more closely models DRA to teach a new response not in the client's repertoire (e.g., teaching a child a sign for water) rather than DRA to promote an existing behavior (e.g., increasing greetings to peers). Finally, in Phase 3, probes were conducted with and without praise in an alternating treatment design.

Phase 3 was conducted in a BAABABBA or ABBABAAB counterbalanced probe design (see Barlow & Hayes, 1979). This design was used to arrange a within-subject comparison of praise and no praise tests, while minimizing multiple treatment interference, which is when responding in one condition is affected by previous conditions. Specifically, instead of using an ABCABD reversal design, where C and D would represent resurgence tests with and without praise, this alternating treatment design was used for multiple reasons. Fewer sessions were needed because repeating baseline and treatment phases (Phase 1 and 2) are not necessary in an alternating treatment design. In turn, using an alternating treatment design reduced the number of sessions needed to demonstrate a difference between two resurgence tests. Also, probes could be compared within the same phase, where a reversal design would have required comparison across phases. This allowed for a more direct comparison of conditions across sessions. In addition, because this study is translational, switching between resurgence tests may demonstrate omission errors during natural implementation of DRA more accurately. In other words, praise may be omitted more intermittently in a clinical setting than would be demonstrated in a reversal design. While this is the first study examining resurgence in a rapid alternating treatment design, the present results demonstrate it to be effective at differentiating between resurgence test conditions. The praise test generally mitigated resurgence relative to no praise tests.

The current findings support previous basic research on auditory e-cues mitigating relapse of target responding in non-human animals (Craig et al., 2017; Willcocks & McNally, 2014; Bernal-Gamboa et al., 2017). While Willcocks and McNally (2014) and Bernal-Gamboa et al. (2017) examined auditory e-cues in renewal and reinstatement, respectively, Craig et al. (2017) examined e-cues in resurgence, more similar to this study. In Craig et al., rats were presented a click and light immediately before edible delivery, in every edible presentation across all three phases. While results still support the use of auditory extinction cues in mitigating resurgence, it does not simulate a clinical implementation of DRA when presenting the e-cue in Phase 1. The e-cue in their study functions more as a signal for reinforcement than for the treatment in place. The present study did not include the e-cue in Phase 1 to more closely simulate DRA to teach a new skill in clinical settings. While promising, it is important to note the present results were obtained in a translational model, in which target and alternative responses were simulated and did not correspond with clinically significant behaviors.

One limitation of the present study is that problem behavior was only simulated. For practical purposes, we can only infer that resurgence of problem behavior would be mitigated in an applied context. For the purposes of demonstrating the resurgence mitigation effect with auditory e-cues in humans, this study took a laboratory approach to avoid some of the limitations of applied research. Limitations of an applied approach include variability in response effort, learning history, and potential physical risks. The present approach established control over previous learning histories with the target and alternative responses, e-cue, and other variables that may come to control behavior during DRA treatments in applied settings (Podlesnik & Kelley, 2015). With a clinical implementation of these e-cue procedures, there would likely need to be more exposure to treatment and systematic fading rather than abrupt removal of treatment (Doughty et al., 2009). This study provides proof of concept that using auditory e-cues in DRA within applied settings is worth examining as an intervention for mitigating resurgence of problem behavior.

The use of DRA in applied settings is to teach an alternative appropriate response while extinguishing a problem behavior that has a past history of reinforcement. In applied settings, there is typically a long learning history with the targeted problem behavior and often there is a difference in response effort between the target and alternative response. Accounting for differences between target and alternative responding, especially learning history, is important in applied settings. Laboratory studies suggest resurgence is more likely to occur following a longer reinforcement history with the target response before introducing the alternative response (Bruzek, Thompson, & Peters, 2009; Doughty et al., 2009). The resurgence effects in this study tended to be small and different across participants for both conditions, which might have limited the ability to observe larger differences between conditions. The results revealed small resurgence effects even in the no praise test, but might have been larger if participants were exposed to Phase 1 for a longer duration.

Another explanation to the minimal resurgence effects is that the e-cue used in this study could have affected responding in the praise test condition. During Phase 3, Homer and Omar responded faster than the total duration of the e-cue presenting the artificial praise statement. This was problematic, as the device used to deliver the e-cue was incapable of reproducing the praise statement on every occurrence of the alternative response. These procedural integrity issues forced by the technology resulted in the e-cue not being delivered consistently and in its entirety for every alternative response with high response rates (e.g., Omar). Procedural integrity errors may have impacted the results in the praise test conditions because of the breakdown in the e-cue contingency in Phase 3. Future research should either use a shorter e-cue for the auditory cue or a longer response cycle for the chosen response.

The e-cue selected for this study was one that more closely resembled natural praise from another human, but consisted of a novel statement in order to control for previous history with the chosen word. In previous applied research on praise, researchers provided a standard praise statement delivered directly to the client (Axe & LaPrime, 2016; Miller & Drennen 1970; Dozier et al., 2010). Controlling a learning history with praise is nearly impossible. In other words, a child has likely encountered praise in some context and controlling for all those encounters is not possible. As well, when praise is delivered, typically the inflection and tone are different on every occurrence. For the purposes of the present study,, controlling the consistency of praise statements deviates for natural presentation of praise but was important for extrapolating research findings to those from basic laboratory research using automated presentations of e-cues (Craig, et al., 2017; Willcocks & McNally, 2014; Bernal-Gamboa et al., 2017).

By using identical session materials and e-cues between Phase 2 sessions and relapse testing in Phase 3, it was possible to control for reinforcement history with the e-cue, aspects of e-cue presentation, and other possible signaling effects of a condition change. While this strategy was practical for connecting to basic research, it may not have been an ecologically relevant stimulus to control behavior. Using a consistent e-cue that resembled a praise statement and controlling for other social consequences by using an electronic device likely eliminated some social variables associated with praise (Brophy, 1979) while still resembling praise (Dozier et al., 2012). The artificial praise might have been less salient to the participants than natural praise, but the effect on behavior is difficult to determine within the scope of this study. Future research should consider using typical variations in the presentation of natural praise statements and consequences following alternative responses.

This study also provides the groundwork for a few other applications for the auditory e-cue. Firstly, future research could also fade out alternative reinforcement more gradually, as commonly practiced when implementing DRA in clinical settings (Doughty, Cash, Finch, Holloway, & Wallington, 2010; Betz et al., 2013). Secondly, research could demonstrate the effectiveness of auditory e-cues in other extinction procedures such as renewal and reinstatement (Nieto, Uengoer, & Bernal-Gamboa, 2017) in humans. While e-cues are effective at maintaining the alternative response in DRA and mitigating resurgence in humans, it is important to better understand more practical clinical applications, such as those that can be used by practitioners and caregivers.

The data collected in this investigation with e-cues contribute to understanding how DRA can be implemented more effectively, particularly when planning for transitioning treatment to more natural environments or when thinning the reinforcement schedule for appropriate behavior. Additional research into how e-cues can mitigate resurgence when presented in the absence of alternative reinforcement used in DRA training could enhance long-term effectiveness of DRA treatments. Studying praise in this context provides the first demonstration of the e-cue signal used in basic research with a common social consequence (praise) to mitigate resurgence in humans. Overall, the current findings are promising for the use of auditory e-cues to mitigate resurgence of problem behavior in humans.

References

Axe, J. B., & Laprime, A. P. (2016). The effects of contingent pairing on establishing praise as a reinforcer with children with Autism. *Journal of Developmental and Physical Disabilities,29*(2), 325-340. doi:10.1007/s10882-016-9526-9

Barlow, D. H., & Hayes, S. C. (1979). Alternating treatments design: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis*, *12*, 199-210. doi:http://dx.doi.org.portal.lib.fit.edu/10.1901/jaba.1979.12-199

Bernal-Gamboa, R., Gamez, A.M., Nieto, J. (2017) Reducing spontaneous recovery and reinstatement of operant performance through extinction-cues. *Behavior Processes*. doi: 10.1016/j.beproc.2016.11.010.

Betz, A.M., Fisher, W.W., Roane, H.S., Mintz, J.C., & Owen, T.M. (2013). A component analysis of schedule thinning during functional communication training. *Journal of Applied Behavior Analysis*, *46(1)*, 219-241.

Brophy, J. (1981). Teacher praise: A functional analysis. *Review of Educational Research*, *51(1)*, 5-32. doi:http://dx.doi.org.portal.lib.fit.edu/10.2307/1170249

Bruzek, J. L., Thompson, R. H., & Peters, L. C. (2009). Resurgence of infant caregiving responses. *Journal of the Experimental Analysis of Behavior, 92(3)*, 327-343.

Carr, E.G. & Durand, V.M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 33(3*), 353.

Caulfield, J. B., & Martin, R. B. (1976). Establishment of praise as a reinforcer in chronic schizophrenics. *Journal of Consulting and Clinical Psychology,44(1),* 61-67. doi:10.1037//0022-006x.44.1.61

Craig, A. R., Browning, K. O., & Shahan, T. A. (2017). Stimuli previously associated with reinforcement mitigate resurgence. *Journal of the Experimental Analysis of Behavior*, *108(2),* 139-150. doi:10.1002/jeab.278

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

Durand, v.m., & Carr, E.G. (1991). Functional communication training to reduce challenging behavior: maintenance and application in new settings. *Journal of Applied Behavior Analysis*, 24(2), 251-264. Doi:10.1901/jaba.1991.24-251

Doughty, A. H., Cash, J. D., Finch, E. A., Holloway, C., & Wallington, L. K. (2010). Effects of training history on resurgence in humans. *Behavioural Processes,* 83, 340-343.

Fisher, W., Piazza, C., Cataldo, M., Harrell, R., Jefferson, G., & Conner, R. (1993). Functional communication training with and without extinction and punishment. *Journal of Applied Behavior Analysis*, 26(1), 23-36.

Hagopian, L.P., Boelter, E.w., & Jarmolowicz, D.P. (2011). Reinforcement Schedule thinning following functional communication training: review and recommendations. *Behavior Analysis in Practice,* 4(1), 4-16.

Hagopian, L. P., Toole, L. M., Long, E. S., Bowman, L. G., & Lieving, G. A. (2004). A comparison of dense to lean and fixed lean schedules of alternative reinforcement and extinction. *Journal of Applied Behavior Analysis,*37(3), 323-338.

Kuroda, T., Cançado, C. R., & Podlesnik, C. A. (2016). Resistance to change and resurgence in humans engaging in a computer task. *Behavioural Processes*, 125, 1-5. doi:10.1016/j.beproc.2016.01.010

Kuroda, T., Mizutani, Y., Cançado, C. R., & Podlesnik, C. A. (2017). Reversal learning and resurgence of operant behavior in zebrafish (Danio rerio). *Behavioural Processes*, 142, 79-83. doi:10.1016/j.beproc.2017.06.004

Liggett, A. P., Nastri, R., & Podlesnik, C. A. (in press). Assessing the combined effects of resurgence and reinstatement in children diagnosed with Autism Spectrum Disorder. *Journal of the Experimental Analysis of Behavior*.

Marsteller, T. M., & Peter, C. C. (2014). Effects of fixed-time reinforcement schedules on resurgence of problem behavior. *Journal of Applied Behavior Analysis,47*(3), 455-469. doi:10.1002/jaba.134

Miller, P. M., & Drennen, W. T. (1970). Establishment of social reinforcement as an effective modifier of verbal behavior in chronic psychiatric patients. *Journal of Abnormal Psychology,76*(3, Pt.1), 392-395. doi:10.1037/h0030400

Nieto, J., Uengoer, M., & Bernal-Gamboa, R. (2017). A reminder of extinction reduces relapse in an animal model of voluntary behavior. *Learning & Memory*, 24(2), 76-80. doi:10.1101/lm.044495.116

Peterson, S. M., Frieder, J. E., Quigley, S. P., Kestner, K. M., Goyal, M., Smith, S. L., Brower-Breitwieser, C. (2017). Concurrent schedules of reinforcement as “challenges” to maintenance. *Education & Treatment of Children*, *40*(1), 57-76. doi:http://dx.doi.org.portal.lib.fit.edu/10.1353/etc.2017.0004

Petscher, E.S., Rey, C., & Bailey, J.S. (2009). A review of empirical support for differential reinforcement of alternative behavior. *Research in Developmental Disabilities*. 30(3), 409-425.

Podlesnik, C.A., & Kelley, M.E. (2014). Resurgence: Response competition, stimulus control, and reinforcer control. *Journal of Experimental Analysis of Behavior*, 102(2), 231-240.

Podlesnik, C. A., & Kelley, M. E. (2015). Translational research on the relapse of operant behavior. *Revista Mexicana De Análisis De La Conducta*, 41(2), 226-251. Retrieved from https://search-proquest-com.portal.lib.fit.edu /docview/1779463578?accountid=27313

Podlesnik, C. A., & Kelley, M. E. (2017). Beyond intervention: Shaping policy for addressing persistence and relapse of severe problem behavior. *Policy Insights from the Behavioral and Brain Sciences, 4,* 17-24.

Silva, S. P., Cançado, C. R., & Lattal, K. A. (2014). Resurgence in Siamese fighting fish, Betta splendens. *Behavioural Processes*, 103, 315-319. doi:10.1016/j.beproc.2014.01.004

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, *10*(2), 349–367. http://doi.org/10.1901/jaba.1977.10-349

Strain, P. S., & Timm, M. A. (1974). An experimental analysis of social interaction between a behaviorally disordered preschool child and her classroom peers. *Journal of Applied Behavior Analysis*, 7(4), 583-590. doi:http://dx.doi.org.portal.lib.fit.edu/10.1901/ jaba.1974.7-583.

Sweeney, M.M., & Shahan, T.A. (2015). Renewal, resurgence, and alternative reinforcement context. *Behavioural Processes*, 116, 43-49.

Sweeney, M.M., & Shahan, T.A. (2013) Effects of high, low, and thinning rates of alternative reinforcement on response elimination and resurgence. *Journal of the experimental analysis of behavior*, 100(1), 102-116.

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

Volkert, V.M., Lerman, D.C., Call, N.A., & Trosclair-Lasserre, N. (2009). An evaluation of resurgence during treatment with function communication training. *Journal of Applied Behavior Analysis*, 42(1), 145-160

Willcocks, A. L., & Mcnally, G. P. (2014). An extinction retrieval cue attenuates renewal but not reacquisition of alcohol seeking. *Behavioral Neuroscience*,*128*(1), 83-91. doi:10.1037/a0035595

Winterbauer, N.E., & Bouton, M.E. (2012). Effects of thinning the rate at which the alternative behavior is reinforced on resurgence of an extinguished instrumental response. *Journal of Experimental Psychology*: Animal Behavior Processes, 38(3), 279.

Tables

Participant	Average Edible Delivery Per Minute	
	Phase 1	**Phase 2**
Sally	5.6	5.8
Homer	7.5	13.4
Omar	6.3	6.1

Table 1: Depicts average reinforcer deliveries across Phase 1 (VR2 Schedule) and Phase 2 (FR1 schedule).

Participant	Total Emotional Responses Phase 3							
	Praise Tests **Homer and Omar** *(Session 2, 3, 5, 8)* **Sally** *(Session 1, 4, 6, 7)*				**No Praise Tests** **Homer and Omar** *(Session 1, 4, 6, 7)* **Sally** *(Session 2, 3, 5, 8)*			
Test Number	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Sally	0	0	0	0	0	0	0	0
Homer	1	0	0	0	4	1	0	1
Omar	0	0	0	1	0	0	0*	0

Table 2: Depicts emotional responses across sessions in Phase 3. Emotional responses include negative vocalizations, crying, loud vocalizations, physiological or physical signs of distress. *The participant engaged in novel motor stereotypy.

Participant	Total Other Responses Phase 3							
	Praise Tests **Homer and Omar** *(Session 2, 3, 5, 8)* **Sally** *(Session 1, 4, 6, 7)*				**No Praise Tests** **Homer and Omar** *(Session 1, 4, 6, 7)* **Sally** *(Session 2, 3, 5, 8)*			
Test Number	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Sally	0	0	0	0	0	0	1	1
Homer	1	0	0	0	1	1	0	1
Omar	0	0	0	0	3	0	0	0

Table 3: Depicts other responses across sessions in Phase 3. Other responses include requests for edibles.

Figures

Figure 1: Montessori Object Permanence Box

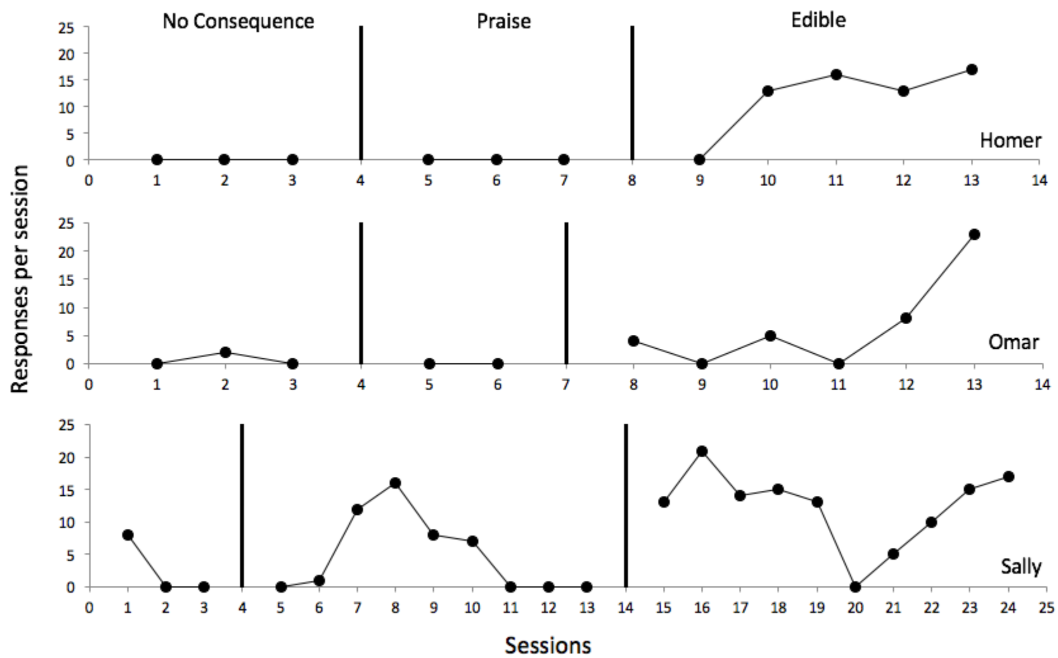

Figure 2: Depicts number of responses per session during the reinforcer assessment across all three participants in three sequential phases: No consequence, electronic praise, and an edible selected in an MSWO.

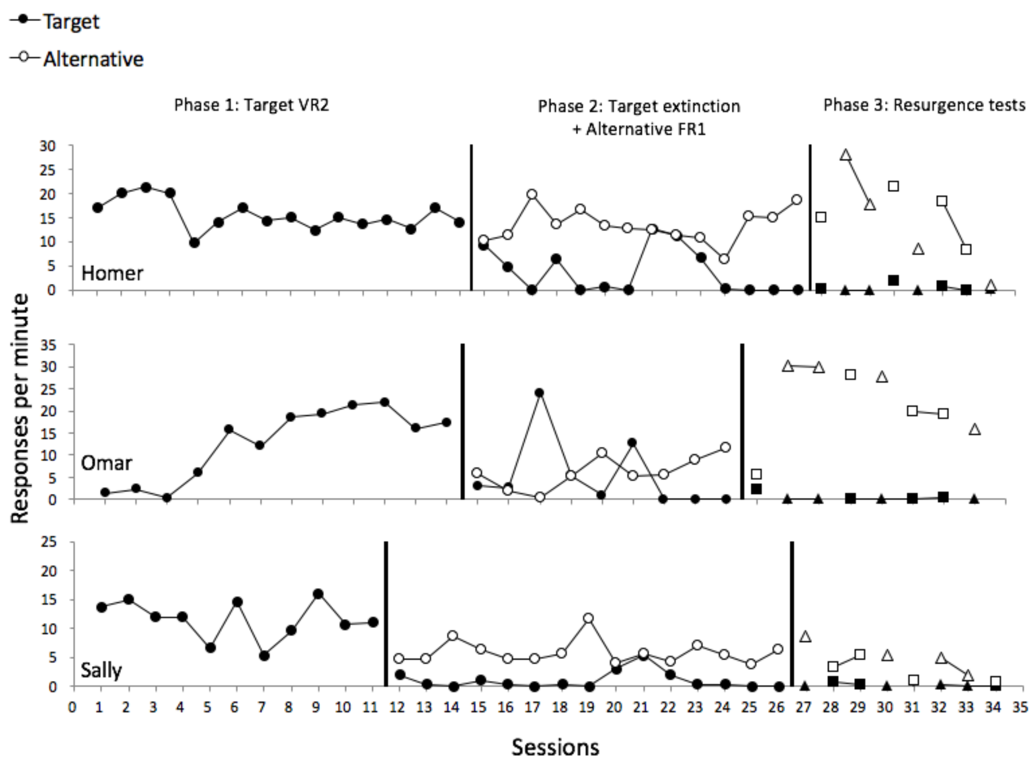

Figure 3: Demonstrates target and alternative responses per min across Phase 1, Phase 2, and Phase 3 for each participant. In Phase 3, square data points represent no praise tests and triangles represent praise tests. Note the y-axis differs across participants.

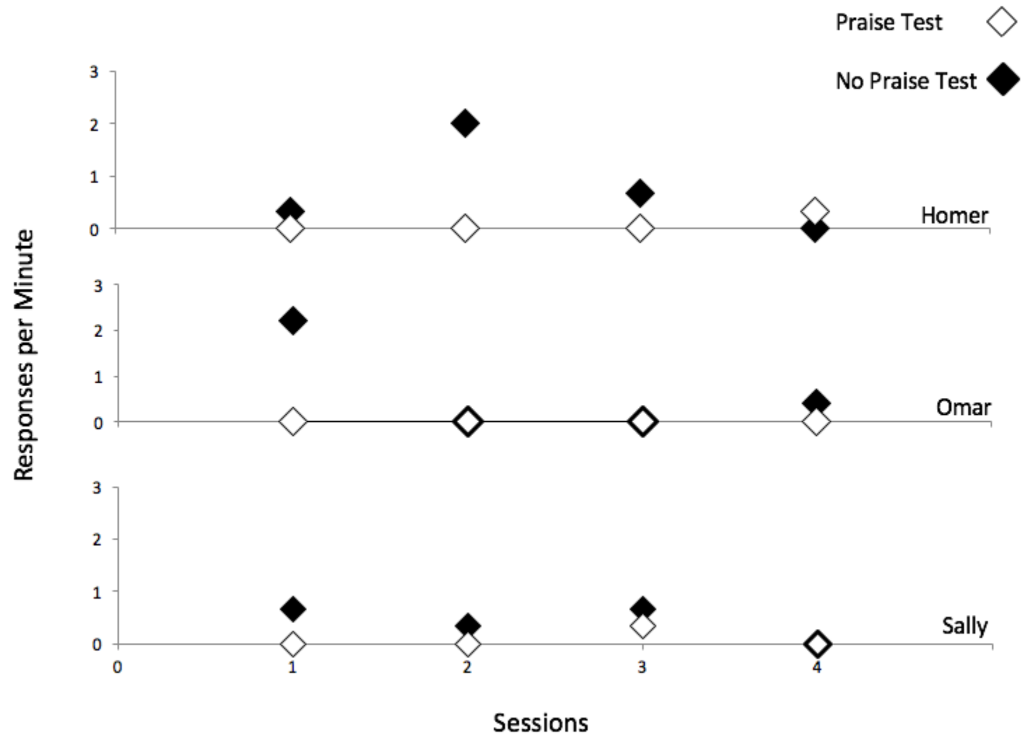

Figure 4: Depicts Target responding in Phase 3 across consecutive AB probes paired for comparison.

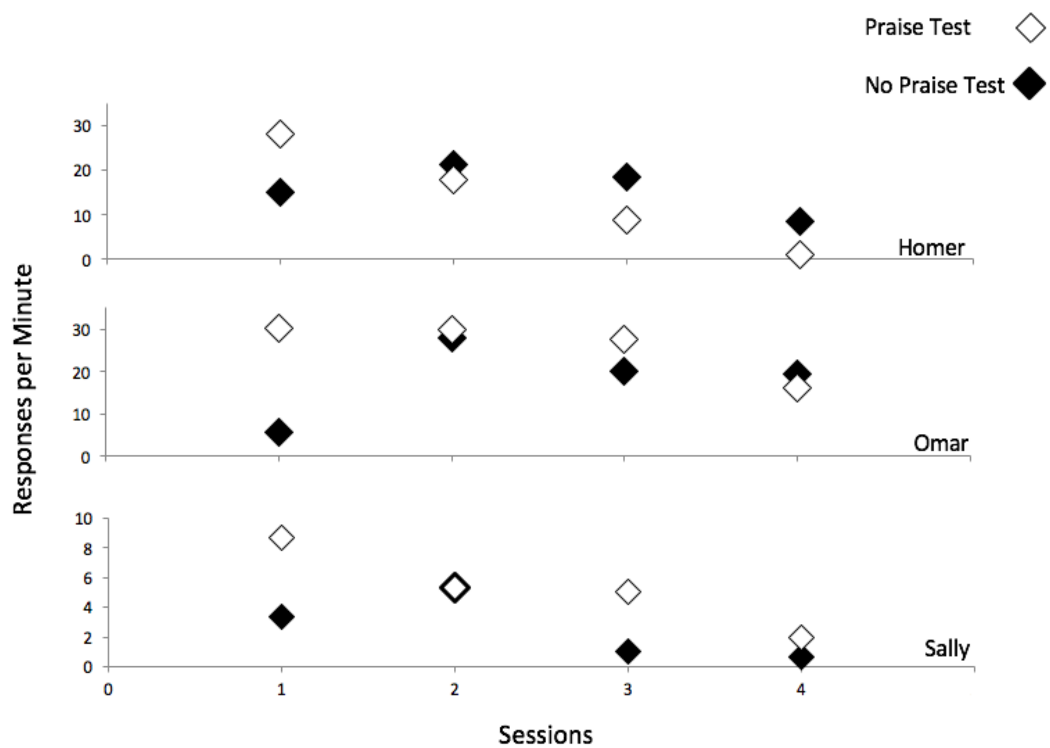

Figure 5: Depicts alternative responding in Phase 3 across consecutive AB probes paired for comparison. Note the y-axis differs for Sally.

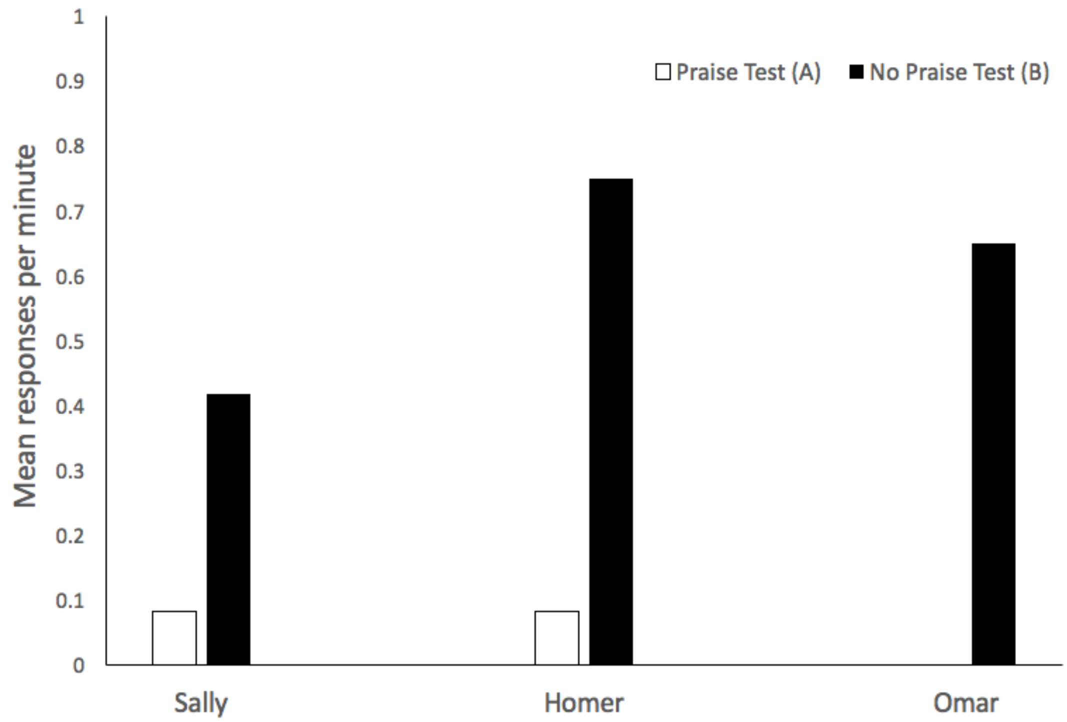

Figure 6: Depicts average target responding across all praise and no praise tests in Phase 3.

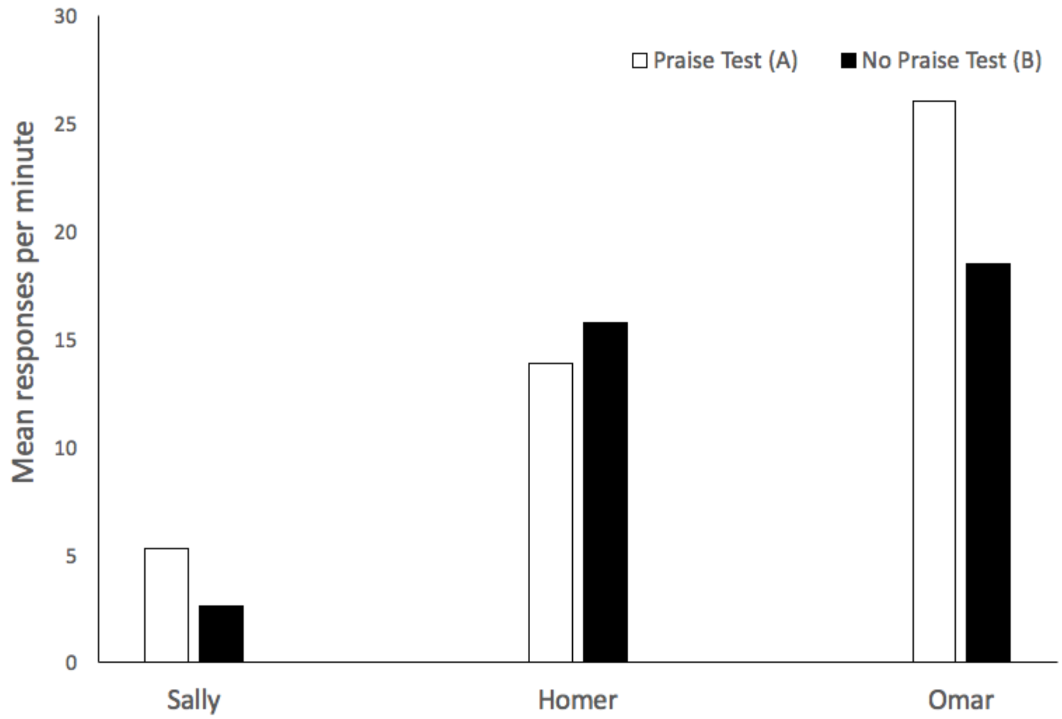

Figure 7: Depicts Alternative responding across all praise and no praise tests in Phase 3.