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Sustaining Behavior Reduction by Transitioning the Topography of the Functional Communication Response During FCT

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SUSTAINING BEAHVIOR REDUCTION BY TRANSITIONING THE TOPOGRAPHY OF THE FUNCTIONAL COMMUNICATION RESPONSE DURING FCT

by

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University of Nebraska, 2020

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Initial rates of destructive behavior tend to be lower when behavior analysts select functional communication responses (FCRs) they can physically guide (e.g., a card-touch FCR). However, destructive behavior may recur at higher rates when FCR materials go missing than when the FCR no longer produces reinforcement. In Experiment 1, we extended prior research by demonstrating less resurgence of target responding when a vocal FCR remained available but no longer produced reinforcement compared to a condition in which neither the alternative response nor reinforcement was available. In contrast to these findings, Experiment 2 replicated other prior research showing that the ability to physically guide a card FCR produced less target responding than when initiating treatment with a vocal FCR. We then evaluated a set of procedures for transitioning the card FCR to the previously unlearned vocal FCR. These findings suggest benefits of training different types of FCRs at different stages of treatment and they provide a set of procedures for transitioning between FCRs while occasioning minimal target responding.

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ASD	autism spectrum disorder
EO	establishing operation
FCR	functional communication response
FCT	functional communication training
RR	response restriction

INTRODUCTION

Functional Communication Training

Functional communication training (FCT; Carr & Durand, 1985) entails teaching a communication response to individuals whose destructive behavior is reinforced by changes in the social environment (e.g., access to adult attention). When FCT is combined with extinction for destructive behavior, the newly trained functional communication response (FCR) alone produces reinforcement; thus, the FCR often replaces destructive behavior (e.g., Fisher et al., 1993; Hagopian et al., 1998). Because the FCR is a critical component of FCT, researchers have investigated various FCR topographies for treating destructive behavior, including vocal responses (e.g., Marcus & Vollmer, 1995), manual signs (e.g., Richman et al., 2001), communication cards (e.g., Greer, Fisher, Saini et al., 2016), microswitches (e.g., Wacker et al., 1998), and voice-output devices (e.g., Durand, 1999).

FCT has shown to be efficacious across many FCR topographies. Some studies have focused on identifying the optimal FCR topography for a given individual or determining the training conditions that ensure proficient use of the FCR while maintaining low-to-zero rates of destructive behavior. Findings from these lines of research suggest that behavior analysts should select FCRs that are (a) less effortful (Richman et al., 2001; Ringdahl et al., 2009), (b) preferred (Ringdahl et al., 2018; Winborn-Kemmerer et al., 2009), and (c) produce reinforcement immediately and according to a dense schedule (Horner & Day, 1991).

Minimizing Exposure to the Establishing Operation for Destructive Behavior

Another important factor to consider when initiating FCT is to select an FCR that minimizes exposure to the establishing operation (EO) for destructive behavior. For example, DeRosa et al. (2015) initiated FCT using two different FCR topographies, one that the therapist could physically guide (i.e., a card-based FCR) and another FCR topography that the therapist could not consistently occasion (i.e., a vocal FCR). Treatment with the card FCR allowed the therapist to physically guide the FCR and immediately deliver the reinforcer maintaining destructive behavior, resulting in shorter exposures to the EO and less destructive behavior. Treatment with the vocal FCR, however, failed to reliably occasion prompted FCRs, leading to prolonged EO exposures and more destructive behavior. The authors hypothesized that this difference in EO exposure across the two FCR topographies (and not the topographies themselves) were responsible for the differences they observed in the relative efficacy of the two FCT procedures. Therefore, DeRosa et al. conducted a follow-up experiment in which they examined the effects of EO exposure across two conditions that did not require an FCR and instead delivered the reinforcer according to time-based schedules that differed across two conditions. Results from this experiment were consistent with their hypothesis that EO exposure plays an important role in determining the initial efficacy of FCT.

Fisher, Greer, Mitteer et al. (2018) recently replicated and extended the findings of DeRosa et al. (2015) by examining the effects of different durations of EO exposure on the efficacy of FCT when therapists used the same FCR topography (i.e., card touch for one participant, card exchange for another participant) across conditions. For each participant, the experimenters varied EO exposure durations with identical FCR topographies by either delaying the prompt to physical guidance of the FCR or by restricting access to the FCR card for a brief period of time. Limiting EO exposure by immediately prompting the FCR or by providing immediate access to the FCR card resulted in a rapid reduction of destructive behavior without response bursting for five of the six comparisons. Taken together, these findings provide additional support for initially selecting an FCR topography that allows therapists to minimize exposure to the EO for destructive behavior.

A potential limitation of selecting a material-based FCR (e.g., card touch, card exchange) is that treatment requires continued access to those communication materials to be effective. Material-based communication systems tax the caregiver to maintain long-term treatment integrity by making those communication materials consistently available. This may be difficult in natural settings if a caregiver inadvertently lapses in making the communication materials present (e.g., forgets communication materials at home when traveling to a community setting). If intervention materials become misplaced or lost but are necessary to access reinforcement, EO exposure for destructive behavior is likely to increase in a manner similar to the extended-EO condition in Fisher, Greer, Mitteer et al. (2018). Such conditions often precipitate a recurrence of destructive behavior.

Resurgence of Destructive Behavior

Decrements in the rate of alternative reinforcement frequently produce a form of treatment relapse called resurgence (Briggs et al., 2018; Brown et al., 2020; Fisher, Greer, Fuhrman et al., 2018; Fisher et al., 2019; Fuhrman et al., 2016; Lattal & St. Peter Pipkin, 2009; Lieving et al., 2004; Ringdahl & St. Peter, 2017; Volkert et al., 2009). *Resurgence* refers to the re-emergence of target responding (e.g., destructive behavior) following a worsening of reinforcement conditions (e.g., for the FCR; Epstein, 1983; Lattal et al., 2017; Lieving & Lattal, 2003). Although numerous studies have demonstrated resurgence of destructive behavior during periods of extinction for the FCR, treatment relapse is more likely (and likely to be more pronounced) if the individual is unable to emit the alternative response altogether (e.g., if a caregiver misplaces the FCR card).

Previous investigations on restricting access to the alternative response during FCT have produced mixed results. Although early research failed to show differential effects on resurgence with the presence or absence of the alternative response (Wacker et al., 2011; Wacker et al., 2013), subsequent and more highly controlled research demonstrated clear differences (Kimball et al., 2018; Podlesnik & Kelley, 2014). For example, in a translational replication of basic research, Kimball et al. (2018) compared resurgence of target behavior between two conditions in which the alternative response was or was not available during an extinction challenge in which reinforcers were unavailable. Resurgence was greater without the alternative response in four of the five comparisons, replicating the results of Podlesnik and Kelley (2014).

The studies reviewed thus far present conflicting suggestions for practice. On the one hand, behavior analysts should select FCRs that can be quickly prompted during the initial stages of FCT. FCR topographies that are material based, including card-touch and card-exchange FCRs, seem well suited for this requirement. On the other hand, a growing body of research now suggests that it may be highly problematic if material-based FCRs become misplaced or lost. A clear goal for future research, therefore, is to reconcile these conflicting findings.

Purpose of the Current Study

We propose that one potential solution to this problem is to initially teach individuals a *retractable* FCR (e.g., a card FCR) that can be physically guided during the initial stages of FCT but to later transition that communication response to a *nonretractable* FCR topography (e.g., a vocal FCR) so that its continued availability may mitigate the resurgence of destructive behavior during local periods of extinction. A necessary first step to evaluate this possibility, however, is to ensure that the so-called nonretractable FCR mitigates resurgence when compared to a condition in which a retractable FCR becomes unavailable.

In the present study, we took a translational-research approach to evaluate whether a nonretractable, vocal FCR better mitigated resurgence of socially insignificant behavior when compared to a retractable, card FCR during a simulated period in which the communication card was misplaced and unavailable (Experiment 1). In Experiment 2, we continued this translational-research approach with another participant by first replicating lower initial rates of target responding when using a card FCR at the outset of FCT—a finding likely to contrast with that from Experiment 1. We then evaluated an exploratory set of procedures for transitioning the card FCR to an unlearned vocal FCR while maintaining low rates of target responding. If successful, such a proof of concept could outline a reasonable set of procedures for use when treating destructive behavior.

CHAPTER 1: GENERAL PROCEDURES

Participants, Setting, and Materials

We recruited 13 participants, 12 of whom participated in Experiment 1 and one who participated in Experiment 2. Participants ranged in age from 3–7 years old (*M* = 5 years old). Blake, Brendon, Edward, Ryan, Taylor, and Joanna were diagnosed with autism spectrum disorder (ASD). Abigail, Alana, Andrea, Austin, Jack, Lilly, and Selena were neurotypical. Only participants who did not engage in significant destructive behavior (e.g., aggression, self-injurious behavior) were included. We conducted sessions in an early intervention classroom or in a padded treatment room at a large center-based treatment facility for individuals with ASD.

Session rooms were equipped with relevant materials for the session including a 20.3 cm x 20.3 cm karate training pad for the target response, 7.6 cm x 7.6 cm laminated colored card for the FCR card, and preferred tangible items for reinforcement. We counterbalanced the location of the training pad and FCR card across participants and conditions. We conducted sessions either at a table or on the floor of the session room. In Experiment 2, we correlated each condition with a specific color using colored poster boards and the color of the experimenter's shirt.

Response Measurement, Reliability, and Procedural Fidelity

We taught participants an arbitrary target response to serve as a surrogate for destructive behavior. The *target* response was defined as touching the top of the training pad with at least 50% of the participant's hand. If the participant picked up their hand and touched the pad again, we considered this a second instance of a target response. The alternative response during FCT was either a card FCR or a vocal FCR. An *independent card FCR* was defined as touching the top of the laminated and colored FCR card with at least 50% of the participant's hand. A *prompted card FCR* was defined as the experimenter guiding the participant to touch the top of the FCR card. An *independent vocal FCR* was defined as a vocal phrase that specified the reinforcer. The specific vocal FCR varied across participants depending on age and the phrase that was acquired with brevity during vocal FCR pretraining. We defined *prompted vocal FCR* as the participant emitting the vocal FCR within 5 s of a vocal prompt by the experimenter. Please see Table 1 for each participant's vocal FCR.

Participant	Age (in Years)	ASD Diagnosis	Experiment	Vocal FCR
Abigail	4	No	1	—
Alana	5	No	1	“I want toys, please.”
Andrea	7	No	1	“May I have the iPad?”
Austin	6	No	1	“Can I have toys, please?”
Blake	3	Yes	1	“Toys, please.”
Brendon	6	Yes	1	“I want iPad, please.”
Edward	6	Yes	1	—
Jack	3	No	1	“Can I have toys, please?”
Joanna	4	Yes	2	“May I have toy?”
Lilly	3	No	1	—
Ryan	7	Yes	1	“Toys, please.”
Selena	3	No	1	“May I have toys, please?”
Taylor	7	Yes	1	—

Table 1. Participant Demographics and Experiment Information.

In Experiment 2, we also collected data on EO exposure or the duration of session time in which the participant did not have access to the reinforcer. We calculated EO exposure by subtracting from the session duration the total amount of time with access to the reinforcer, then dividing this number by the session duration, and multiplying by 100 to produce a percentage. Across all experimental phases, we collected data using laptop computers using the data collection program DataPal, which is a beta-version of BDataPro (Bullock et al., 2017). We measured the frequency of target responses and all independent and prompted card and vocal FCRs. We later calculated the rate of each dependent variable by dividing the total count by the session duration.

We collected reliability data for all participants by having an independent second observer score a portion of sessions (*M* = 40.2%; range, 23.1%–53.3%) either in-vivo or from video-recorded sessions across participants. To calculate interobserver agreement, first we divided each 5-min session into 10-s intervals and scored an agreement for each interval in which both data collectors recorded the same number of responses (i.e., exact agreement within the interval) for target responses, card FCRs, and vocal FCRs. Then, we calculated agreement on a session-by-session basis by summing the number of agreement intervals, dividing by the total number of intervals, and then multiplying the quotient by 100 to obtain a percentage.

We collected procedural fidelity on at least 33% (*M* = 36%; range, 33%–38%) of sessions across participants. We determined if a reinforcer was delivered or withheld correctly and considered a reinforcer to be delivered correctly if it was provided within 5 s of its programmed delivery (e.g., reinforcer delivered within 5 s of a target response in baseline). We also considered a reinforcer to be delivered correctly if the experimenter withheld the reinforcer for (a) target behavior during FCT, (b) FCRs during extinction, and (c) FCRs preceded by a target response within 3 s during FCT. We calculated procedural fidelity per session by summing the number of correct reinforcer deliveries, dividing by the total number of opportunities, and multiplying the quotient by 100 to obtain a percentage. Please see Table 2 for interobserver agreement- and procedural fidelity-coefficients for all participants.

Participant	Interobserver-Agreement Coefficients *M*% (range)			Procedural-Fidelity Coefficients *M*% (range)
	Target Behavior	Card FCR	Vocal FCR	Experimenter Behavior
Abigail	95 (73–100)	100	—	100
Alana	94 (83–100)	92 (73–100)	100	98 (85–100)
Andrea	98 (90–100)	—	98 (90–100)	97 (87–100)
Austin	97 (91–100)	—	98 (97–100)	100
Blake	96 (90–100)	100	100	99 (93–100)
Brendon	95 (87–100)	—	97 (87–100)	98 (91–100)
Edward	100	100	—	100
Jack	100	98 (93–100)	100	98 (85–100)
Joanna	95 (73–100)	97 (83–100)	98 (89–100)	98 (75–100)
Lilly	99 (97–100)	99 (93–100)	—	98 (86–100)
Ryan	100	92 (60–100)	98 (93–100)	100
Selena	99 (93–100)	—	100	100
Taylor	97 (90–100)	99 (87–100)	—	100

Table 2. Interobserver-Agreement and Procedural-Fidelity Coefficients

Experimental Design

In Experiment 1, we used a three-phase resurgence arrangement consistent with previous investigations of relapse of target behavior to compare resurgence across groups (e.g., Fisher, Greer, Fuhrman, et al., 2018; Kimball et al., 2018; Podlesnik & Kelley, 2015). Each evaluation consisted of three phases: baseline, FCT, and extinction. We implemented a between-subjects design for Experiment 1 to compare rates of target behavior between two experimental groups (i.e., a card group and a vocal group). In the card group, a card FCR was taught during the FCT phase, and the card was removed during the extinction phase to simulate a situation in which the response materials were misplaced or lost. In the vocal group, a vocal FCR was taught during FCT and then placed on extinction in the final phase.

After participants met the inclusion criteria described below for the vocal-imitation screening, we randomized them across the two groups but did so in pairs such that group membership never became unbalanced by more than 1 participant. For the final four participants in Experiment 1, we also conducted a within-subject evaluation, such that these participants experienced both experimental arrangements (i.e., card FCR and vocal FCR). We did this to understand if changes in resurgence varied as a result of FCR type within an individual participant. This also allowed us to examine relative resurgence both across- and within-participant. We similarly randomized and counter-balanced condition order across participants in the within-subject evaluation to identify potential sequence effects.

In Experiment 2, we compared rates of target behavior and FCRs in a single-subject reversal design between baseline and FCT pretraining for a card and vocal FCR in color-correlated contexts. We later evaluated a transfer procedure when we systematically transitioned the card FCR to a vocal FCR in a new context.

Pre-Experimental Procedures

Preference Assessment and Inclusion Screening

For all participants, we conducted either a paired-stimulus (Fisher et al., 1992) or free-operant (Roane et al., 1998) preference assessment to identify highly preferred tangible items that could be used as reinforcers in the experimental evaluation (data available upon request). If we identified more than one highly preferred item or observed that a participant's motivation to engage with a single item was fleeting (e.g., participant transitioned between items after short durations), we included several items as reinforcers throughout the evaluation.

We conducted a trial-based, vocal-imitation screening to ensure that participants could, at minimum, imitate single words and short sentences to request preferred items. This screening occurred before participants were randomized for group assignment. The purpose of the vocal-imitation screening was to (a) ensure the participant could engage in some vocal imitation (suggesting that a vocal FCR would be an appropriate FCR topography for the participant); (b) identify a specific, developmentally appropriate vocal-FCR topography for each participant; and (c) ensure that all participants in Experiment 1 had a vocal response in their repertoire during extinction. To conduct the vocal-imitation screening, we used the reinforcer(s) identified from the preference assessment. We used four vocal targets that were progressively more complex (e.g., Ghaemmaghammi et al., 2018) to identify the most complex vocal FCR for which the participants were proficient. These targets comprised of the name of the reinforcing stimulus (e.g., "Tablet") and up to a four-word sentence (e.g., "I want tablet, please") to request the reinforcer. We randomized the targets and presented each target in three trials for a total of 12 trials.

At the start of the vocal-imitation screening, we provided access to the reinforcer. Next, we briefly removed the reinforcer and prompted the participant to say the target by stating, "Say (insert target)." If the participant imitated the experimenter within 5 s, the experimenter provided the reinforcer. If the participant did not imitate the experimenter within 5 s, the experimenter provided a second prompt.

If the participant imitated the vocal stimulus correctly, the experimenter provided the reinforcer and moved to the next trial. If the participant did not make a response following the prompt, or had an incorrect response, the experimenter recorded the error, terminated the trial, and moved to the next trial. If the participant emitted more than the target (e.g., saying "I want toys, please." for the target "Toys, please"), we scored this as correct. We included participants who imitated targets with 75% or greater accuracy in Experiment 1.

We discontinued the vocal-imitation screening for Lilly due to noncompliance with repeating the vocal targets (i.e., consecutive no responses). However, Lilly spontaneously emitted full sentences outside the experimental sessions, so we recorded her vocal utterances while she played with the experimenter. In a 10-min sample, she emitted 17 one- to six-word sentences. Because the purpose of the vocal screener was to determine whether a participant could emit vocal FCRs, we included her as a participant in Experiment 1.

One participant (Joanna) imitated only some of these targets accurately and at a lower percentage than the other participants (i.e., 50% of trials correct). Joanna's performance on the vocal screener differed from the other participants; we included her in Experiment 2 because she demonstrated the ability to imitate some phrases but did not have generalized vocal imitation.

CHAPTER 2: EVALUATING RESURGENCE OF TARGET BEAHVIOR WITH RETRACTABLE AND NON-RETRACTABLE FCRS

Method

Target Response Pretraining

Prior to conducting baseline, we conducted target response pretraining with all participants to teach the surrogate for destructive behavior. At the beginning of the trial, the experimenter (a) provided brief access to the reinforcer, (b) removed the reinforcer, (c) immediately prompted the target response using physical guidance, and (d) immediately thereafter provided access to the reinforcer for 20 s on a continuous reinforcement (CRF) schedule. After the reinforcement interval elapsed, the experimenter removed the reinforcer until the participant made a subsequent target response. The experimenter increased the delay to the prompt after one block of 10 trials. However, if the participant began to engage in the target response independently at the 0-s prompt delay (e.g., began reaching for the target pad at the same time the experimenter began to physically guide the response), the experimenter initiated within-session prompt fading such that the prompt delay increased (e.g., 2 s, 5 s, 10 s) each trial. The experimenter continued to conduct pretraining until each participant emitted the target response independently for 10 consecutive trials.

Because all participants in Experiment 1 could emit the vocal FCR at any point during this target response pretraining and during the following baseline phase, we also made available during both of these phases the FCR card for those participants who would later experience FCT with the card FCR. This allowed for similar histories of extinction for the alternative responses to be reinforced later, which if left uncontrolled, may itself affect resurgence (Greer & Shahan, 2019) and potentially confound the results. The experimenter did not make any statements about the presence of the card, nor were any card or vocal FCRs reinforced during either of these phases.

Baseline

The procedures for baseline were the same as target response pretraining with the exception that the experimenter did not provide prompts to emit the target response, and sessions lasted 5 min. We conducted at least five baseline sessions and continued baseline until the data were stable as assessed by both visual inspection and by applying an objective stability criterion (i.e., standard deviation below 50% of the mean for the last five sessions).

FCT Pretraining

We conducted FCT pretraining using the same procedures as target pretraining with the exception that we placed the target response on extinction and prompted the FCR corresponding to that condition (i.e., vocal or card FCR for participants in the vocal or card group, respectively). If the participant emitted a target response, the experimenter waited 3 s and prompted the participant to emit an FCR without a co-occurring target response (i.e., a 3-s changeover delay). Depending on the condition, the experimenter prompted either the card FCR using physical guidance or the vocal FCR by stating, "Say, '(insert vocal FCR).'" Similar to target response pretraining, we conducted this phase until the participant emitted the relevant FCR independently for 10 consecutive trials without a target response.

FCT

The procedures for FCT were the same as FCT pretraining with the exception that the experimenter did not provide prompts to emit the FCR, and sessions lasted 5 min. We conducted at least five FCT sessions and continued this phase until independent FCRs were stable while target responding remained below an 85% reduction from baseline rates for the final two FCT sessions.

Vocal Group

The experimenter reinforced only vocal FCRs during FCT for the vocal group. Like target response pretraining and during baseline for this group, no FCR card was present during these FCT sessions.

Card Group

The experimenter reinforced only card FCRs during FCT for the card group.

Extinction

For both groups, the experimenter provided access to the reinforcer at the beginning of the phase. The first session of the phase began with the experimenter removing the reinforcer and withholding it for all responding. For participants in the card group, the experimenter removed the FCR card at the outset of the extinction phase. Sessions occurred consecutively such that the participant did not gain access to the reinforcer between sessions of the extinction phase. Extinction sessions continued until (a) two or more consecutive sessions occurred with at least an 85% reduction in target responding from baseline rates, (b) five sessions occurred, or (c) the research appointment ended which is consistent with previous clinical investigations on resurgence (e.g., Fisher et al., 2019)

Results and Discussion

Participants in Experiment 1 correctly imitated 86% (range, 75%–100%) of the vocal targets on the vocal-imitation screening. On average, participants acquired the target response in 31 trials (range, 14–60), the vocal FCR in 33 trials (range, 10–110), and the card FCR in 29 trials (range, 6–50).

Figure 1 displays data for Abigail, Edward, Lilly, and Taylor, who experienced only the card condition. Across all participants, we observed moderate and stable rates of target behavior during baseline (*M* = 2.5 responses per min; range, 2.2–2.8). We observed zero card FCRs across all participants with the exception of Abigail and Taylor who each emitted one card FCR in baseline. Following FCT pretraining for the card FCR, we observed moderate and stable rates of card FCRs across all participants during FCT (*M* = 2.5 responses per min; range, 2.2–2.7). We observed near-zero and stable rates of target behavior (*M* = .07 responses per min; range 0–.2) across all participants during FCT. When we progressed to extinction, we observed variable responding across participants (*M*[Abigail] = .93 responses per min; range, 0–2.8; *M*[Edward] = 0 responses per min; *M*[Lilly] = .13 responses per min; range, 0–.4;

M[Taylor] = 4.6 responses per min; range, 1.8–5). Abigail engaged in an initially high rate of target behavior in the first session and zero rates thereafter. This response pattern differed from Taylor who continued to engage in a high rate of target behavior across four sessions of extinction. Lilly showed some resurgence of target responding in the first session of extinction but none thereafter, and Edward engaged in no target behavior during extinction.

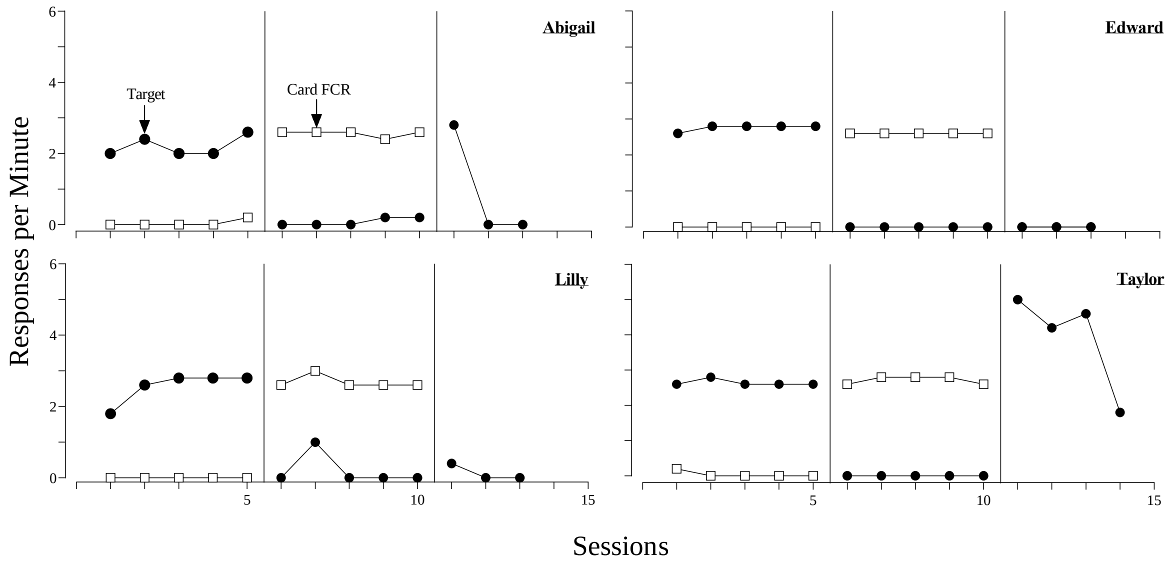

Figure 1. Response Rates Across Baseline, FCT, and Extinction Phases. Responding for individuals who experienced the card condition. The FCR card was not available during the extinction phase.

Figure 2 depicts data for Brendon, Austin, Andrea, and Selena, who experienced only the vocal condition. Similar to the individuals in the card group, we observed stable rates of target responding (*M* = 2.5 responses per min; range, 2.2–2.9) in baseline. With the exception of Brendon, who emitted one vocal FCR, no participants emitted vocal FCRs during baseline. Following FCT pretraining for the vocal FCR, all participants engaged in moderate and stable rates of vocal FCRs (*M* =2.4 responses per min; range, 2.2–2.5) during FCT. All participants engaged in zero or near-zero rates of target responding (*M* = .02 responses per min; range, 0–.04) during FCT. When we progressed to extinction, we observed low rates of target behavior (*M* = .14 responses per min; range, 0–.32) and higher yet decreasing rates of vocal FCRs (*M* = .45 responses per min; range .3–.8) across all participants.

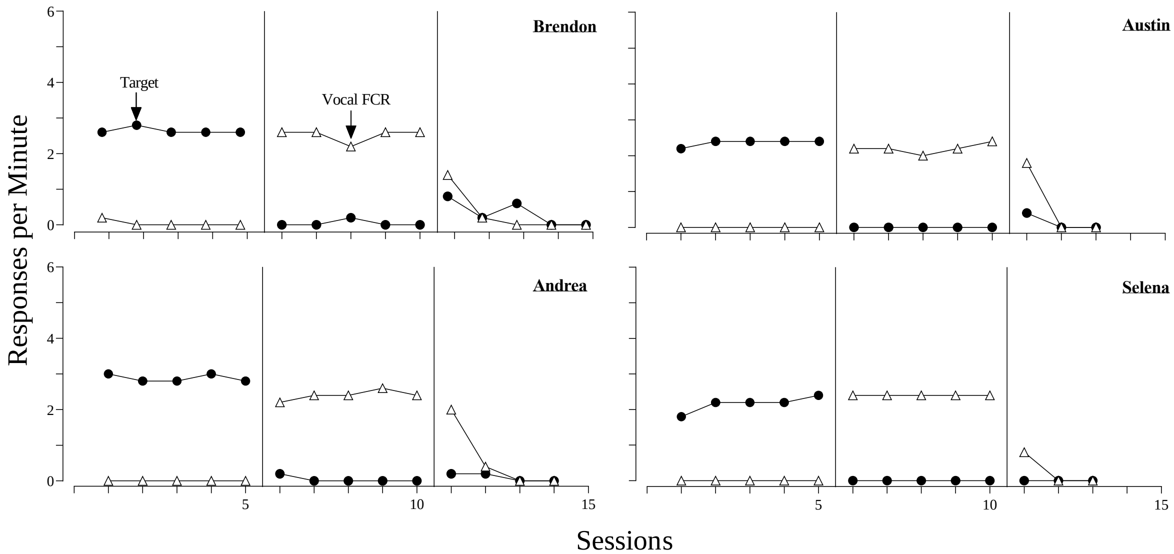

Figure 2. Response Rates Across Baseline, FCT, and Extinction Phases. Responding for individuals who experienced the vocal condition. The vocal FCR remained available during the extinction phase.

Figure 3 displays data for Jack, Alana, Ryan and Blake, who experienced both the card and vocal conditions of Experiment 1. The data appear in the counterbalanced sequence that each participant experienced. Across both conditions, all participants displayed high and stable rates of target behavior (*M* = 2.5 responses per min; range, 2.2–2.8) during baseline. All participants generally displayed zero or near-zero rates of target behavior and high and stable FCRs (*M* = 2.6 responses per min; range, 2.4–2.8) during FCT. For the card condition, Jack, Ryan, and Blake all demonstrated resurgence of target behavior during extinction, with Ryan showing some persistence of target responding. Target responding for Alana did not resurge during extinction of the card condition. All participants showed less resurgence of target responding during the vocal condition relative to the card condition with the exception of Alana, who engaged in minimal responding in only one session of extinction (i.e., the second extinction session of the vocal condition). Similar to Brendon, Austin, Andrea, and Selena (Figure 2), all four participants engaged in higher rates of the vocal FCR than target responding during extinction. Sequence order did not appear to affect these results.

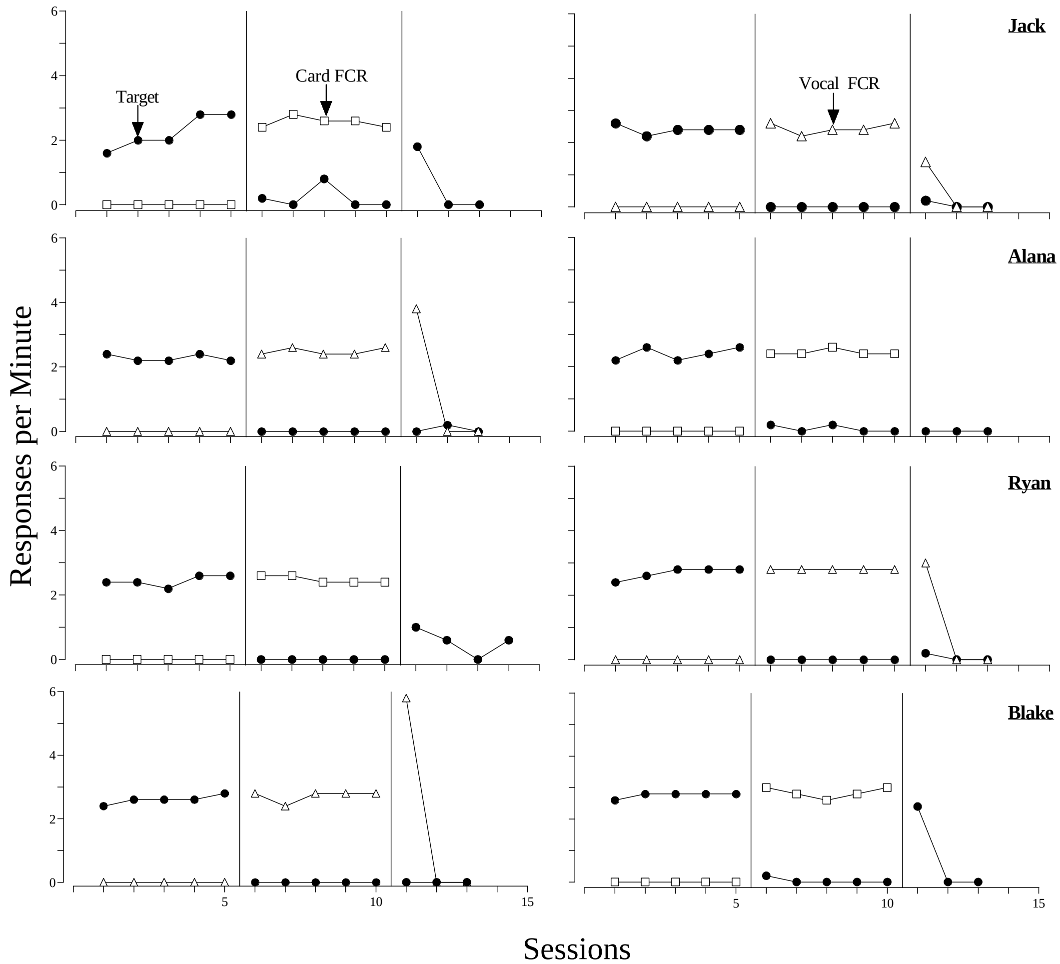

Figure 3. Response Rates Across Baseline, FCT, and Extinction Phases. Responding for the four individuals who participated in the within-subject evaluation of Experiment 1. Each row corresponds to the data for one participant, according to the condition order experienced.

To assist with visual inspection for difference between groups, Figure 4 depicts target behavior during the final two sessions of FCT and the initial three sessions of extinction when expressed as a proportion of baseline responding across all participants and conditions of Experiment 1. The left panel depicts data for the card condition, and the right panel depicts data for the vocal condition. For the card condition, participants displayed variable levels of resurgence (*M* = .8 responses per minute; range, 0–3.9). Taylor, Abigail, Blake, and Jack demonstrated resurgence that approximated or exceeded baseline response rates (i.e., a proportion of 1.0). Ryan and Lilly also demonstrated resurgence during the card condition. For the vocal condition, we observed less variability in resurgence both across and within participants when compared to the card condition. Resurgence, when observed, never approximated or exceeded baseline response rates, and on average, proportional responding was much lower (*M* = .05; range, .0–.1) than for the card condition.

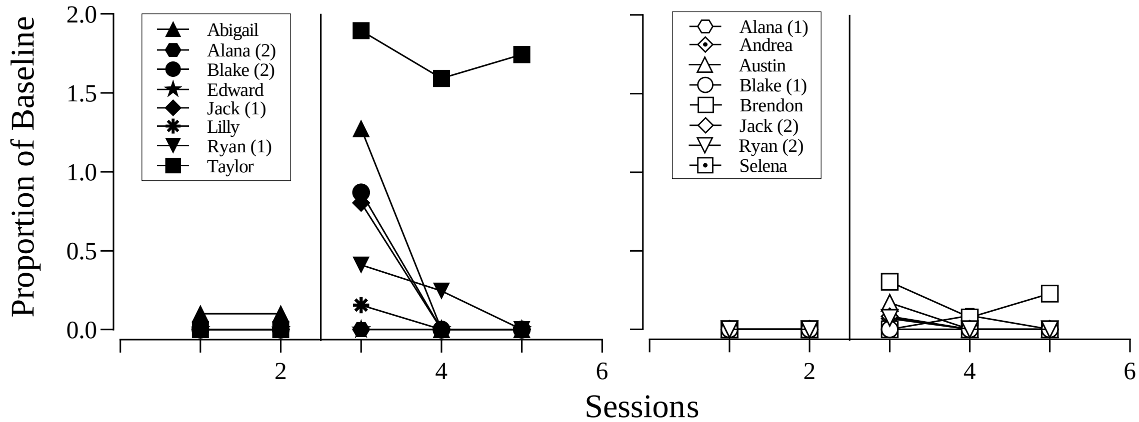

Figure 4. Proportion of Baseline Target Responding During FCT and Extinction Phases by Group. Proportion of baseline target responding for each individual for the first three sessions of the card (left panel) or vocal (right panel) extinction phase. The parenthetical number beside participants' names indicates condition order for those participants who experienced the card and vocal conditions.

Figures 5, 6, and 7 display aggregated data across all participants for the initial three sessions of extinction in Experiment 1. Figure 5 displays target behavior expressed as an average proportion of baseline responding for the card and vocal groups. On average, the card condition produced substantially more resurgence than did the vocal condition at each time point of extinction. Figure 6 depicts the mean rate of target behavior across the two groups during extinction, as well as the mean rate of target behavior for individual participants comprising each group. Target responding was often considerably higher and more variable for the card group during extinction than for the vocal group. Figure 7 depicts mean rates of target and alternative behavior during extinction as stacked bars for both groups. A recent history of reinforcement for a vocal FCR that remained available during extinction appeared not only to compete with target responding, but vocal FCRs seemed to replace target responding that may have otherwise occurred, as the total amount of responding during extinction (i.e., the sum of the stacked bars) was highly similar across the two groups.

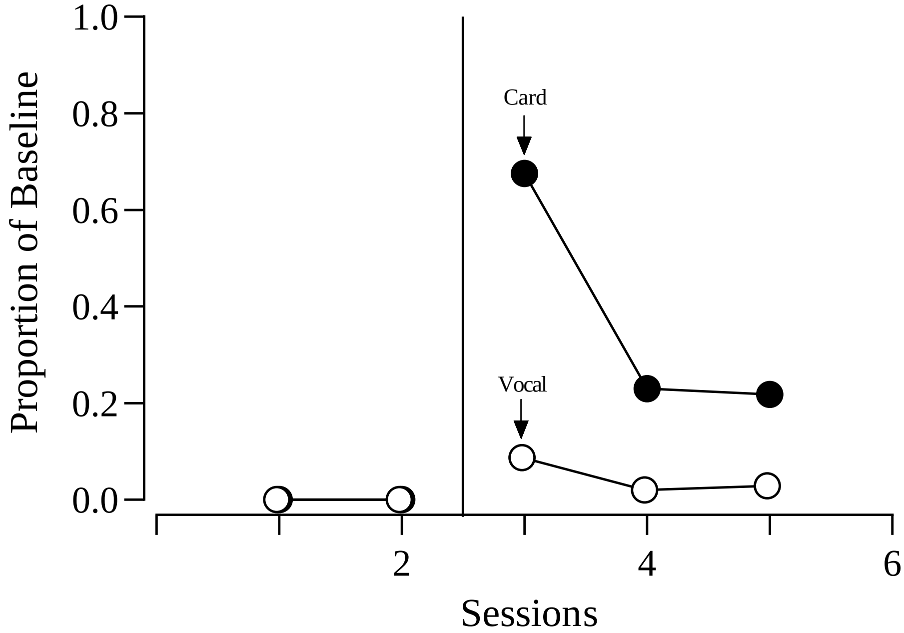

Figure 5. Average Proportion of Baseline Target Responding by Group. Average proportion of baseline target responding across the card and vocal groups.

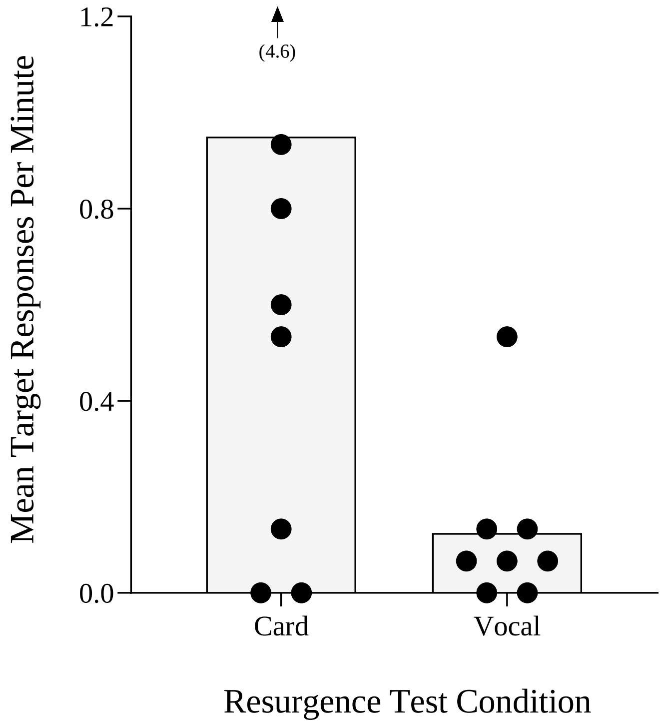

Figure 6. Target Response Rates During Extinction by Group. Bars indicate average target responding during the extinction phase for the group; data points indicate responding at the level of the individual. The data are grouped by condition.

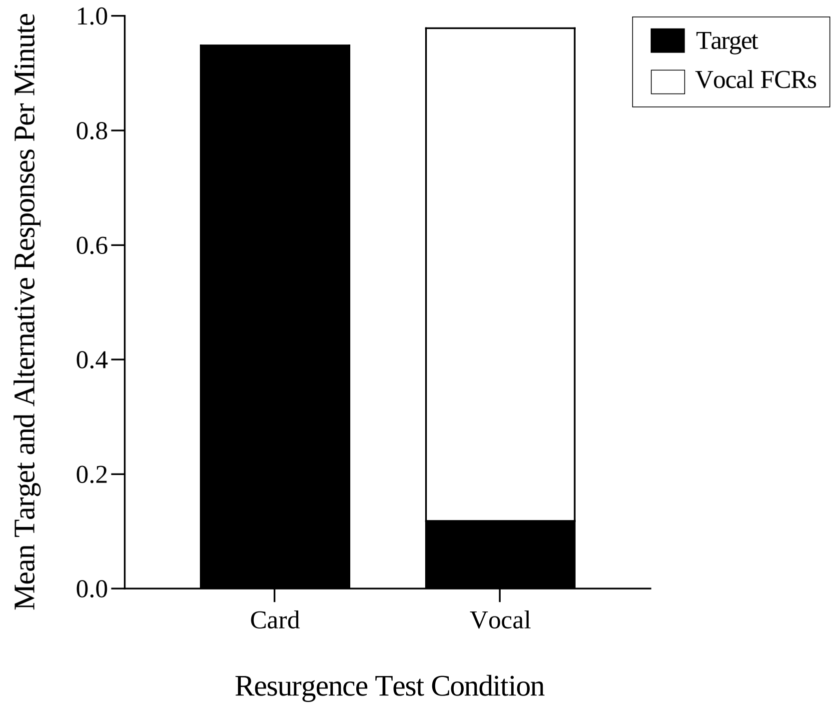

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Figure 7. Average Target and Alternative Response Rates During Extinction. Average target and alternative responding during the first three sessions of the extinction phase across all individuals, separated by group.

Statistical analysis allows supplementation of visual inspection. To supplement the above findings and determine whether participants' responding across the two groups in Experiment 1 differed significantly, we conducted a randomization test, which is both appropriate for small-*n* designs and which employs a method of resampling by randomly selecting pairs of data points and redistributing those pairs of data points across groups (Craig & Fisher, 2019). The randomization test included all of the data from Experiment 1 because we detected no effect of sequence type for participants who experienced both the card and vocal conditions (see Figure 3). Using $R_{3.6.1}$ (R Core Team, 2017) and the proportion of baseline data on target responding from the first session of each extinction challenge experienced, group differences were statistically significant ($p = 0.02$).

In Experiment 1, we sought to compare differences in resurgence of target responding when alternative communication materials (i.e., a card FCR) are temporarily unavailable and unable to produce reinforcement with a condition in which a different communication topography is trained that cannot be restricted (i.e., a vocal FCR) but nevertheless contacts extinction. The present results provide additional support for the finding that loss of communication materials is likely to result in more robust resurgence of target behavior (Kimball et al., 2018; Podlesnik & Kelley, 2014). This experiment extends prior research on the topic by showing less resurgence of target responding and more alternative responding than target responding after training an FCR topography that is difficult to restrict (i.e., the vocal FCR), suggesting that training a vocal FCR may circumvent this specific concern of heightened relapse of destructive behavior when communication materials are temporarily misplaced or lost in the home, school, or community setting.

The results of Experiment 1 suggest that vocal FCRs and other FCR topographies that are not material based and that cannot be easily restricted (e.g., manual sign) may help mitigate resurgence over situations in which the alternative response becomes unavailable. However, prior research that has focused on the early stages of training an FCR for the purposes of FCT has shown that such vocal FCRs can produce higher levels of destructive behavior than card-touch and card-exchange FCRs because therapists are better able to control and minimize the EO for destructive behavior with the latter approach (DeRosa et al., 2015; Fisher, Greer, Mitteer et al., 2018). Thus, in Experiment 2, we propose a potential solution to this problem and (a) replicate previous research showing that FCRs that can be physically guided (e.g., a card FCR) result in less target responding than FCRs that cannot be guided (e.g., a vocal FCR) during the initial stages of FCT and (b) evaluate a novel method for transitioning from an established card FCR to an unlearned vocal FCR in light of the results of Experiment 1. If such procedures are effective in facilitating the acquisition of a vocal FCR while minimizing the occurrence of target responding, highly similar procedures may also prove effective when treating destructive behavior. Thus, Experiment 2 was in part a replication of prior research on FCT efficacy and an example of exploratory research conducted in an analogue arrangement to gauge the potential of a practical solution to the problem outlined in Experiment 1.

CHAPTER 3: TRANSITIONING THE TOPOGPGRAPHY OF THE FCR

Procedures

Target Response Pretraining

We conducted target response pretraining using the same procedures as in Experiment 1.

Baseline

Baseline was identical to the baseline in Experiment 1 with the exception that we conducted sessions in two contexts each associated with a unique color of shirt worn by the therapist and matching color of poster board displayed in the room. These two contexts would later be associated with the card and vocal conditions of FCT pretraining. Similar to Experiment 1, the FCR card was present across both contexts to equate the availability of both FCR topographies. For baseline and the following phase of FCT pretraining, we conducted sessions across these two contexts according to a multielement design, randomizing condition order with the exception that no more than two sessions of the same condition type occurred consecutively. We continued baseline until there were at least five sessions in each context and until independent responding was stable.

FCT Pretraining

Across both contexts, we implemented FCT pretraining by placing target behavior on extinction and providing access to the functional reinforcer following each instance of the FCR according to a CRF schedule during 5-min sessions. We provided brief access to the reinforcer prior to the start of the session and then (a) restricted access to the reinforcer, (b) immediately prompted the appropriate FCR according to a 0-s prompt delay, and (c) immediately thereafter delivered reinforcement for 20 s immediately following the FCR. If the participant emitted a target response, the experimenter waited 3 s and prompted the participant to emit an FCR without a co-occurring target response (i.e., a 3-s changeover delay). We did not increase the prompt delay beyond 0 s during FCT pretraining.

Card Condition

We prompted and reinforced only the card FCR in this condition. A 3-s changeover delay remained in place for the vocal FCR and target response.

Vocal Condition

We prompted and reinforced only the vocal FCR of “May I have toy?” in this condition, selected from the results of her vocal-imitation screening. Unlike the card FCR, we were unable to physically guide the participant to engage in the FCR. Thus, when the participant did not emit the vocal FCR following the initial prompt, we continued to prompt the vocal FCR every 5 s until the participant emitted the vocal FCR. A 3-s changeover delay remained in place for the card FCR and target response.

Transfer of FCR Topography

FCT Baseline

We established independent use of the card FCR before transferring the card FCR to a vocal FCR. Following the recent history with a 0-s prompt delay for the card FCR during FCT pretraining, we systematically increased the prompt delay to emit the card FCR following two consecutive sessions in which the participant did not engage in target behavior. We increased the prompt delay to 2 s, 5 s, 10 s, and then 20 s or until we established consistent, independent use of the card FCR. We ended this phase after observing three sessions in which the participant engaged in independent card FCRs during 80% or more of the programmed opportunities and no target behavior.

FCR Transfer

The goal of the FCR transfer was to promote independent use of the terminal vocal FCR of “May I have toy?” while ensuring that target responding remained low by systematically manipulating response effort (i.e., vocal response complexity) and EO exposure (i.e., response restriction and prompt delays).

Response Effort.

To ensure minimal EO exposure during the FCR transfer and to promote rapid and independent use of the vocal FCR, we shaped the vocal FCR by reinforcing successive approximations of the terminal vocal FCR. We used a response effort manipulation because Joanna was able to independently emit each portion of the full vocal FCR in isolation but unable to emit the full sentence accurately and fluently. We began by differentially reinforcing a one-word vocal FCR (i.e., "May?") until the participant independently emitted this response for two consecutive sessions. We then systematically increased the response effort of the vocal FCR by increasing the response requirement by one additional word (i.e., progressing from "May?" to "May I?") after the participant independently emitted the partial vocal FCR for two consecutive sessions with 80% or greater accuracy. After the participant met this criterion for the current response, we placed this response on extinction and differentially reinforced the next approximation of the terminal vocal FCR (i.e., "May I have?"). We continued this shaping process until the participant could independently emit the terminal vocal FCR of "May I have toy?" for two consecutive sessions with 80% or greater accuracy.

Response Restriction and Progressive Prompt Delay.

We used transfer procedures similar to those described by Goh et al. (2000) to transfer Joanna's use of the card FCR to the vocal FCR while minimizing exposure to the EO for target behavior. We used response restriction to capitalize on motivation to evoke an independent vocal FCR and progressive prompt delays to prompt the vocal FCR while maintaining low target responding. We accomplished this by restricting the availability of the FCR card (i.e., response restriction; RR) for progressively longer durations (i.e., fading exposure to the EO for target responding) while simultaneously increasing the delay to prompting the vocal FCR currently eligible for reinforcement according to the procedures described above. Reinforcement was always available for both independent and prompted vocal FCRs, as well as independent card FCRs.

We began with a 0-s prompt delay for the vocal FCR and a 2-s RR interval. At the beginning of the session, we simultaneously restricted the reinforcer and the FCR card, then immediately prompted the vocal FCR currently eligible for reinforcement. If the participant did not emit the vocal FCR immediately after the prompt, the experimenter prompted the vocal FCR every 2 s until either (a) the RR interval ended or (b) the participant emitted the vocal FCR. The experimenter immediately reinforced any independent or prompted vocal FCR. Once the RR interval ended, the experimenter returned the FCR card but continued to withhold reinforcement until either FCR occurred, at which point the experimenter terminated the EO for target responding by delivering the reinforcer. The FCR card remained present during the reinforcement interval until the reinforcement interval had elapsed and the experimenter removed the card and reinforcer simultaneously.

We progressively increased the delay to the prompt for the vocal FCR currently eligible for reinforcement while simultaneously increasing the RR interval such that the first prompt always occurred 2 s prior to the end of the RR interval. When we observed that at least 80% of FCRs were vocal (independent or prompted but always specific to the topography currently eligible for reinforcement) or independent card touches for two consecutive sessions and less than 85% of target responding relative to baseline, we increased both the delay to the prompt and the RR interval by 2 s. We increased response effort by introducing the next successive approximation of the terminal vocal FCR when we began to see consistent, independent use of the vocal FCR currently eligible for reinforcement. Specifically, we made this change after observing two consecutive sessions with 80% or greater independent vocal FCRs currently eligible for reinforcement and less than 85% of target responding relative to baseline.

For each new successive approximation of the vocal FCR (e.g., progressing to “May I?” from “May?”), we reverted to the immediate prompt for the new vocal FCR and the 2-s RR interval to minimize EO exposure to target responding given this increase in response effort. We continued the process of removing earlier prompts and increasing the RR interval for each successive approximation of the vocal FCR until the participant consistently emitted the terminal vocal FCR.

Results and Discussion

Joanna imitated 50% of the targets correctly during the vocal-imitation screening, and she acquired the target response after 50 pretraining trials. Figure 8 displays Joanna's responding across baseline and FCT pretraining of Experiment 2. During baseline across both contexts, Joanna displayed high and generally stable rates of target responding. She did not engage in any vocal or card FCRs during baseline. During FCT pretraining phases in the vocal context (top panel), Joanna engaged in zero prompted vocal FCRs and moderate to low rates of target behavior. Although the card FCR was not prompted or reinforced in this context, she engaged in high to moderate rates of independent card FCRs. During FCT pretraining phases in the card context (bottom panel), Joanna displayed high and stable rates of prompted card FCRs and low to zero rates of target responding.

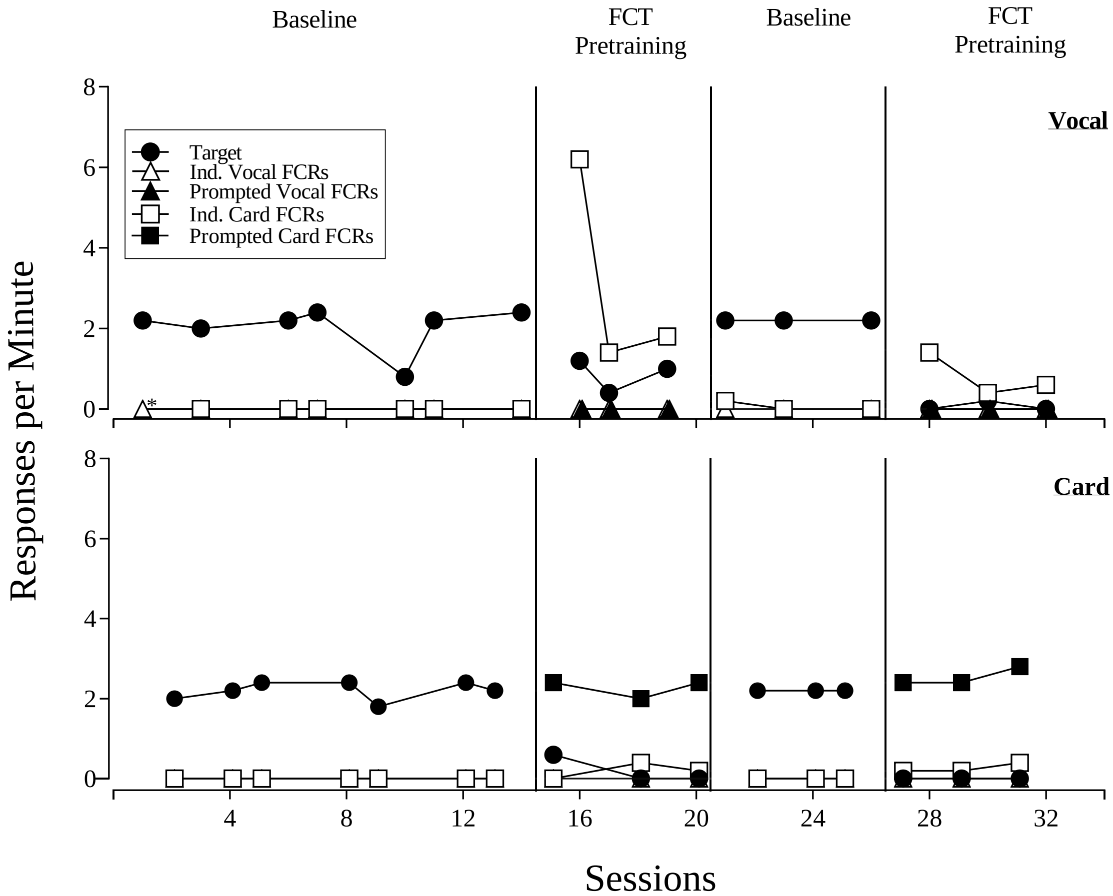

Figure 8. Target, Independent FCR, and Prompted FCR Rates Across Conditions. Joanna's response rates during baseline and FCT pretraining across the vocal (top panel) and card (bottom panel) conditions.*FCR card missing from the first session.

Figure 9 displays the FCT baseline and FCR transfer. During FCT baseline, we observed a high and stable rate of card FCRs. When we initiated the FCR transfer and prompted the initial portion of the vocal FCR (i.e., "May?"), we observed a high rate of prompted vocal FCRs and near-zero rates of independent card FCRs. Following the increased delay to the vocal prompt and the RR interval, we observed a high rate of independent vocal FCRs. We observed zero rates of independent card FCRs and target behavior. When we progressed to the next portion of the vocal FCR (i.e., "May I?") and reverted to an immediate prompt and decreased RR interval, we observed an increase in prompted vocal FCRs. We observed low and stable independent card FCRs until we increased the delay to the vocal prompt and the RR interval, at which point Joanna engaged in a high rate of independent vocal FCRs, zero card FCRs, and zero target responding.

When we progressed to the next portion of the vocal FCR (i.e., "May I have?"), we observed low rates of prompted vocal FCRs and high, variable rates of independent card FCRs. When we increased the delay to the prompt and the RR interval to 4 s and 6 s, respectively, we observed an increase in independent vocal FCRs and a decrease in independent card FCRs and prompted vocal FCRs. We observed zero target responding. When we progressed to the terminal vocal FCR (i.e., "May I have toy?"), we observed high and stable vocal FCRs with decreasing independent card FCRs and zero target responding. Finally, we removed the card FCR and reinforced only the vocal FCR, which produced high and stable independent vocal FCRs of the terminal vocal FCR and zero target responding.

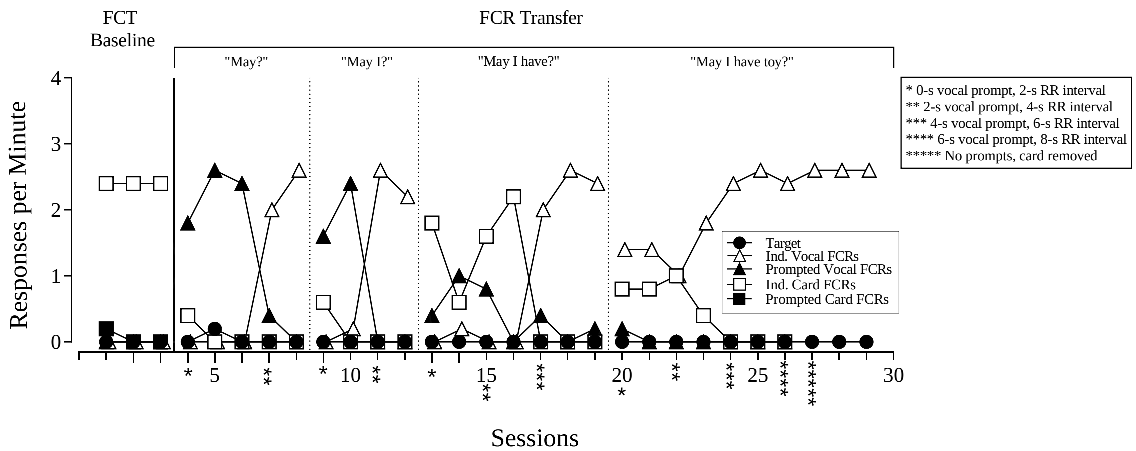

Figure 9. Card to Vocal Transfer. Rates of Joanna's target responding, independent and prompted vocal FCRs, and independent and prompted card FCRs across the FCT-baseline and FCR-transfer phases. Asterisks denote when and how prompt delays changed, as well as the duration of the response-restriction (RR) interval.

Figure 10 displays the percentage of session duration with EO exposure across baseline, FCT pretraining, FCT baseline, and the FCR transfer (corresponding to the data across Figures 8 and 9). We observed similarly low-to-moderate percentages of EO exposure in baseline across the card and vocal conditions. During the FCT pretraining phases, however, we observed a high and stable percentage of EO exposure during the vocal condition and a low and stable percentage of EO exposure during the card condition. During FCT baseline and FCR transfer, EO exposure was reasonably well controlled and minimized across sessions as Joanna learned increasingly more effortful approximations of the terminal vocal FCR.

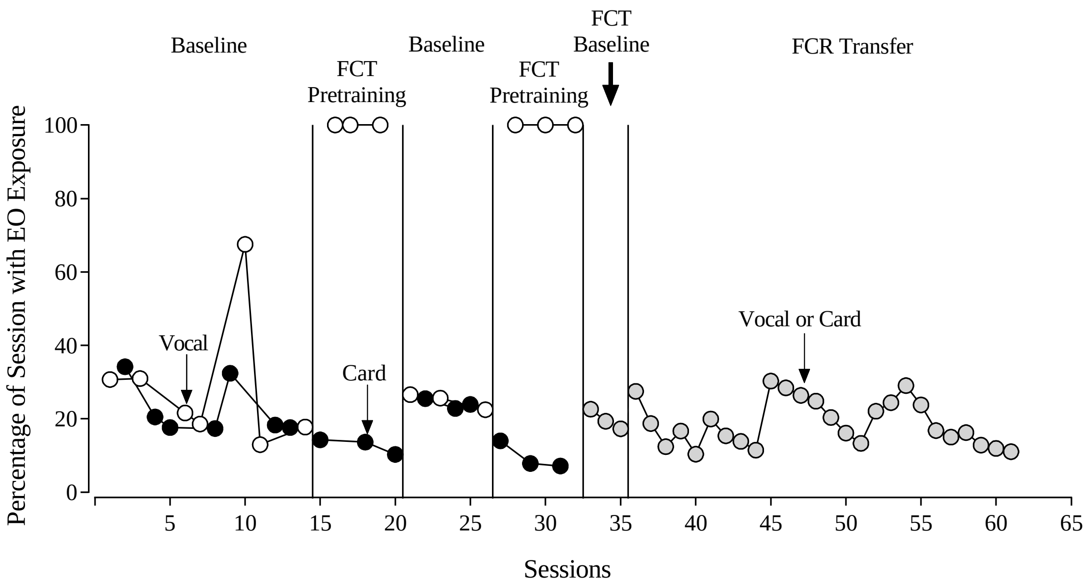

Figure 10. EO Exposure During Card-to-Vocal FCR Transfer. Percentage of session duration with exposure to the establishing operation (EO) across conditions and phases of the card-to-vocal FCR transfer.

Experiment 2 replicates prior research on the importance of controlling prompts when initiating FCT by showing better suppression of target responding when therapists could physically guide the alternative (card-touch) response than when therapists were unable to reliably occasion the alternative (vocal) response. Furthermore, large differences in the percentage of session duration with EO exposure across the card- and vocal-FCR conditions suggest this effect was due to differences in EO exposure and not necessarily FCR topography, also replicating prior research by DeRosa et al. (2015) and Fisher, Greer, Mitteer et al. (2018).

A novel contribution of Experiment 2 was the evaluation of a set of procedures for transferring a mastered card FCR to an unlearned vocal FCR. We systematically transitioned the topography of the FCR from a card FCR to a vocal FCR by manipulating response effort while also adjusting exposure to the EO for target responding. When targeting each approximation of the terminal vocal FCR, we observed a reliable pattern of increased card FCRs and prompted vocal FCRs followed by a decrease of both these responses and a corresponding increase in independent vocal FCRs eligible for reinforcement. This pattern continued until we established the terminal vocal FCR, suggesting that the procedures established precisely the desired pattern of responding we intended.

Throughout the FCR transfer, we maintained low levels of EO exposure, levels similar to those measured during FCT pretraining with the card FCR but not with the vocal FCR. We believe that controlling and minimizing EO exposure during the FCR transfer was key to maintaining the low to zero rates of target responding we observed throughout the FCR transfer. If such procedures are similarly effective when treating destructive behavior, the implications could be clinically significant.

CHAPTER 4: GENERAL DISCUSSION

We conducted two interrelated experiments in which we demonstrated a problem when retractable communication materials are lost (Experiment 1) and demonstrated a potential solution to this problem by transitioning responding to a nonretractable response for one participant (Experiment 2). In Experiment 1, we compared levels of resurgence when a nonretractable alternative response (i.e., a vocal FCR) was continually available but placed on extinction to a condition in which materials necessary to engage in the alternative response (i.e., the FCR card) were unavailable. Resurgence was larger and more variable for the card-FCR condition than for the vocal-FCR condition, suggesting that loss of an alternative response may be more detrimental in terms of treatment relapse than simply arranging extinction for the alternative response.

These results differ from clinical investigations of resurgence when the alternative response was removed. For example, Wacker et al. (2013) did not observe differences in resurgence of destructive behavior when the FCR card was restricted compared to when it remained available and was placed on extinction. One potential reason for these differing results is that Wacker et al. conducted repeated extinction probes prior to their resurgence evaluation, which may have confounded their ability to detect changes resulting from this specific experimental manipulation because target responding may have decreased as a function of repeated exposure to extinction (cf. Craig et al., 2019; Shahan et al., 2019). In contrast, the present findings are consistent with more recent and more highly controlled investigations on this topic (Kimball et al., 2018; Podlesnik & Kelley, 2014).

We took a number of steps to help ensure the results of Experiment 1 would be valid. For example, we equated the baseline- and FCT-phase durations across the card- and vocal-FCR groups to minimize the possibility that differences in phase length affected the results. We also programmed identical schedules of reinforcement across the two groups and obtained highly similar rates of reinforcement as a result (*M*[Card (Baseline)] = 2.5 reinforcers per min; range, 2.1–2.8;

M[Vocal(Baseline)] = 2.5 reinforcers per min; range, 2.1–2.8; *M*[Card (FCT)] = 2.6 reinforcers per min; range, 2.5–2.7; *M*[Vocal(FCT)] = 2.5 reinforcers per min; range, 2.2–2.8).

We did not always observe resurgence for participants exposed to the card condition. For example, Edward, Lilly, and Alana demonstrated low to zero levels of resurgence during this condition. Previous research has documented that resurgence does not always occur (e.g., Craig & Shahan, 2016; Fisher et al., 2019). For example, resurgence occurred reliably for only four of seven participants in the study by Fisher et al. (2019). The variability that we observed in terms of the prevalence and magnitude of resurgence both across and within participants is generally consistent with other small-*n* studies on resurgence. However, our use of continuous schedules of reinforcement likely increased the discriminability of transitioning from FCT to extinction, which likely hampered the resurgence effect for some participants (cf. Nevin & Grace, 2000). Leaner schedules of reinforcement, paired with lengthier histories of reinforcement for destructive behavior, suggest that the group differences we observed in Experiment 1 would likely be stronger and more consistent when treating destructive behavior.

Removal of the FCR card during extinction for participants who experienced the card condition may have signaled the unavailability of reinforcement (i.e., an extinction cue) for some participants but not others, which may have contributed to the mixed results across participants within this experimental group. In a departure from traditional resurgence tests, we removed the alternative response at the beginning of extinction for the card condition. To the degree that this procedure functioned as an extinction cue for some participants, prior research has shown that such extinction cues can mitigate resurgence (e.g., Fuhrman et al., 2016; Fisher et al., 2020). However, in these investigations, extinction cues were stimuli correlated explicitly with extinction (i.e., S-). Therefore, important procedural differences across the present study and prior research on extinction cues should be considered when interpreting this possibility.

Another, and perhaps more likely, interpretation of how removal of the FCR card may have affected target-response variability across participants in the card group during extinction is that FCR card removal may have functioned as a new stimulus context for some participants. It seems reasonable that this new stimulus context, unassociated with reinforcer delivery, may have been sufficiently distinct from the preceding baseline phase for some participants that target responding failed to generalize to the extinction phase.

One implied limitation of Experiment 1 would be that removal of the FCR card for the card group may have entailed both a change in context (i.e., removal of the FCR card), as well as the omission of reinforcers from the environment by way of removal of the alternative response. Relapse preparations that combine tests for multiple forms of relapse (e.g., renewal and resurgence) often produce higher levels of relapse (Kincaid et al., 2015; Liggett, Nastri, & Podlesnik, 2018; Wathen & Podlesnik, 2018), suggesting another potential interpretation of Experiment 1. Because the purpose of Experiment 1 was to compare levels of resurgence when communication materials were lost (i.e., a card FCR) to a condition in which the FCR topography could not be restricted (i.e., a vocal FCR), to the extent that removal of the FCR card function as a context change, such a context change was a necessary component for the applied question driving Experiment 1. It is not immediately clear how one would disentangle the independent roles of context change from the unavailability of the alternative response when designing a different experiment or when interpreting the present results.

The data from Figure 7 suggest that response competition likely played an important role in the results of Experiment 1. We observed a high rate of alternative behavior and a lower rate of target behavior during extinction for the vocal group across all participants, and the total amount of behavior (i.e., target plus alternative responding) for the vocal group closely approximated the amount target responding for the card group. The continuous availability of the vocal FCR during extinction for the vocal group likely competed with target responding for the vocal group, whereas the card FCR was unavailable to compete with target responding for the card group. This interpretation of response competition impacting relapse is consistent with the results of similar investigations (e.g., Kimball et al., 2018). Additionally, we observed shorter latencies to resurgence for the card group compared to the vocal group. On average, individuals in the card group who emitted a target response did so after 7 s (range, 4 s–13 s) of the start of extinction, and individuals in the vocal group who emitted a target response did so after of 32 s (range, 3 s–50 s) of the start of extinction. Based on these data, it seems likely that the nonretractable vocal FCR helped mitigate both the magnitude and latency of the return of target behavior. Training a nonretractable FCR (e.g., a vocal- or manual-sign FCR) may be beneficial when treating destructive behavior with FCT because it may ensure an appropriate option for response allocation other than destructive behavior.

In Experiment 2, we replicated the results of DeRosa et al. (2015) and Fisher, Greer, Mitteer et al. (2018) by showing more target responding and greater EO exposure in the FCT-pretraining condition in which we trained a response that the experimenter could not physically guide (i.e., the vocal FCR) when compared to one the experimenter could reliably occasion (i.e., the card FCR). We then implemented a set of transfer procedures that systematically manipulated response effort (i.e., vocal response complexity) and EO exposure (i.e., response restriction and prompt delays) with the goal of establishing closer approximations of the terminal vocal FCR while minimizing EO exposure and, thus, target responding. These procedures resulted in low rates of target responding as we systematically transferred the topography of the FCR from a card FCR to a terminal vocal FCR.

Our procedures were similar to those described by Goh et al. (2000), who provided continuous initial access to reinforcement and then prompted an alternative response when reinforcement was programmed to be unavailable for increasing amounts of time (i.e., an NCR to DRA transition). Similarly, we provided initial continuous access to the FCR card in Experiment 2. Goh et al. (2000) imposed brief periods in which the schedule of continuous access to the reinforcer was unavailable. We mimicked that procedure by imposing brief intervals in which the participant was unable to emit the card FCR card to obtain the reinforcer (i.e., RR interval). This method of imposing brief periods of extinction for the alternative response may be useful in applied settings for teaching multiple alternative responses while maintaining low levels of EO exposure.

Conclusions about the generality of our FCR-transfer procedures and the optimal conditions under which to select these procedures are limited because we had only one participant. We did not conduct an experimental evaluation of the FCR transfer procedure; however, we demonstrated a proof of concept by showing a reliable pattern during the FCR transfer procedure such that when we progressed to the next response requirement of the vocal FCR, Joanna first engaged in prompted vocal FCRs, followed by independent vocal FCRs that met the current criterion for reinforcement. This pattern continued based on our prompting procedure and response-restriction manipulation.

The success of any such FCR-transfer procedures are likely to be impacted by participant variables (e.g., vocal repertoire, compliance) which may slow or hasten the acquisition of a given terminal vocal FCR. For Joanna, we used forward chaining to shape the terminal vocal FCR. We did this because she was able to emit each word in isolation correctly but could not emit the full sentence initially. We suggest using screening tests like the one described herein as a means of selecting developmentally appropriate vocal FCRs. Simple, low-effort manual signs may be more appropriate for some individuals.

The present experiments collectively suggest benefits of training different types of FCRs at different stages of treatment with FCT. The exploratory results of Experiment 2 also provide a proof of concept by suggesting a practical set of procedures for transitioning between FCRs while treating destructive behavior and occasioning minimal target responding. Future research that extends this work is key for determining the necessity and sufficiency of such FCR-transfer procedures when treating destructive behavior.

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