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Gabrielle Wiggins
gwiggins@rollins.edu

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Running head: RESURGENCE OF CAREGIVER

Resurgence of Caregiver and Therapist Responses: The Recurrence of Unwanted Responses
Under a Negative Reinforcement Context

A Thesis
By
Gabrielle Wiggins

Submitted to the Faculty of the Department of Health Professions
at Rollins College in Partial Fulfillment
of the Requirements for the Degree of

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Table of Contents

| | Page |
|--|------|
| ABSTRACT..... | 4 |
| INTRODUCTION | 5 |
| REVIEW OF LITERATURE | 7 |
| Defining Resurgence | 7 |
| What resurgence is not: other relapse phenomena..... | 10 |
| Variables that affect Resurgence | 10 |
| Resurgence Procedures | 13 |
| Resurgence of Child Problem Behavior..... | 16 |
| Caregiver Behavior..... | 17 |
| The relation between Resurgence and Treatment Integrity..... | 23 |
| STATEMENT OF THE PROBLEM..... | 24 |
| EXPERIMENT 1 METHOD | 26 |
| Participants, Settings, and Materials..... | 27 |
| Results and Discussion | 29 |
| EXPERIMENT 2 METHOD | 32 |
| Participants, Settings, and Materials..... | 32 |
| Results and Discussion | 34 |
| GENERAL DISCUSSION | 37 |
| REFERENCES | 43 |
| FIGURES..... | 47 |

Abstract

The purpose of this study was to assess the resurgence of caregiver and therapist behavior using three-phase and four-phase resurgence procedures. Two experiments were conducted to determine if caregiver and therapist behavior resurges, and if so, which procedure resulted in less resurgence. In Experiment 1, three undergraduates participated, sessions took place in a research suite, and participants were supposed to complete the three and four-phase procedures. However, only one of the three participants contacted the contingency, and a resurgence of caregiving occurred following the three-phase procedure. In Experiment 2, three registered behavior technicians (RBTs) participated, sessions took place in classrooms, and participants completed both three and four-phase procedures. Resurgence was observed for all participants in this study.

Keywords: Resurgence, treatment integrity, caregiver, therapist

Introduction

Resurgence is the recurrence of behavior that was once reinforced but is not currently being reinforced (Shahan & Sweeney, 2011). Behavior resurges when alternative or replacement behavior is also placed on extinction. The resurgence literature has demonstrated this phenomenon to be generalizable across species, settings, and reinforcement schedules (St. Peter, 2015). Recently authors have noted that the experimental designs used in resurgence procedures are nearly identical to treatments with a replacement behavior component typically seen in applied settings (Lattal & St. Peter Pipkin, 2009; St. Peter, 2015). For example, functional communication training (FCT) teaches a replacement behavior whilst placing the current target behavior on extinction. Thus, it would stand to reason that more research examining the variables that affect resurgence might be of significant contribution to applied behavior analysis (ABA). Perhaps this research might lead to treatments with more durability than current treatments that do not take resurgence into account. Some variables identified in basic research which contribute to the magnitude of resurgence include the magnitude of reinforcement (Craig, Browning, Nall, Marshall, & Shahan, 2017), the length of time spent earning reinforcement (Leitenberg et al., 1975), and learning history (Epstein, 1983). Only recently have applied researchers started to investigate these variables.

Resurgence is commonly assessed using a three-phase procedure that consists of Response 1 being reinforced, then Response 1 being placed on extinction whilst Response 2 is reinforced and, finally, Response 2 is placed on extinction as well. For example, consider a child who is engaging in poking behavior that has previously resulted in gaining attention from the “poked” individual (Phase 1). As an alternative, the therapist teaches the child to say “Excuse me” to gain attention and places poking on extinction (Phase 2). Then the therapist places

“Excuse me” on extinction as well (Phase 3). A resurgence effect would be expected, in that an increase in poking would occur (i.e., the child would start poking individuals once again).

There is also a four-phase resurgence procedure (Reed & Clark, 2010) that consists of Response 1 being reinforced, then Response 1 being placed on extinction prior to the implementation of alternative reinforcement. Once Response 1 has been extinguished, Response 2 is introduced and reinforced and, finally, Response 2 is placed on extinction as well. For example, a child is engaging in poking behavior, that has previously resulted in gaining attention from the “poked” individual (Phase 1). The therapist withholds reinforcement (i.e., providing attention) for all instances of poking (Phase 2). Alternatively, the therapist teaches the child to say “Excuse me” to gain attention (Phase 3). Then the therapist places “Excuse me” on extinction as well (Phase 4). In this example, a resurgence effect would be expected in that an increase in poking would occur during Phase 4. Although the three-phase and four-phase procedures are similar in that both procedures result in the recurrence of previously reinforced behavior, they differ in that the extinction phase in the three-phase procedure is concurrently presented with alternative reinforcement, however in the four-phase procedure extinction is conducted separately from the acquisition of the alternative response. Although both procedures have been shown to produce resurgence, it is still unknown how these procedures compare with one another. In other words, it is not known which procedure results in less resurgence.

The common application of resurgence research has been child problem behavior and how to reduce the resurgence of child problem behavior following treatment. Currently, to the author’s knowledge, no research assesses the resurgence of caregiver or therapist behavior in applied contexts. There are, however, human operant studies that demonstrate resurgence of caregiving responses in an analog caregiving situation (e.g., Bruzek, Thompson, & Peter, 2007;

Thompson, Bruzek, & Cotnoir-Bichelman, 2011). Understanding of resurgence in the context of caregiver and therapist behavior might be essential to promoting desirable treatment outcomes. This research will provide applied researchers and supervisors the opportunity to assess and promote treatment integrity in an applied setting.

St. Peter Pipkin and colleagues (2010) found that errors of commission (e.g., providing reinforcement following problem behavior) were more detrimental to treatment success in comparison to errors of omission (e.g., failing to provide reinforcement following appropriate behavior). The authors stated that commission errors might be a result of the caregiver's history of reinforcing problem behavior. Thus, one could infer that caregiver behavior does resurge, and commission errors are a result of resurgence. A similar inference could possibly be made for therapist behavior in a problem behavior treatment setting. Gaining a better understanding of resurgence effects in the context of caregiver behavior might lead to a more complete understanding of the variables that affect caregiver treatment integrity, which could ultimately lead to an increase in long-term treatment success. Further, this could have significant implications not only for treatment integrity but also give further insight into the three and four-phase procedures in the context of how these procedures affect the degree of resurgence.

Review of Literature

Defining Resurgence

Whilst resurgence has been studied since the 1920s, the phenomenon has not always been labeled resurgence. The term resurgence was first introduced by Epstein and Skinner (1980). Earlier studies assessed resurgence in the context of a punishment-induced resurgence, whereas presently most studies examine extinction-induced resurgence (Epstein, 1983).

Lattal et al. (2017) reviewed research in this area to compare resurgence definitions across studies. The authors found that all definitions included that the target response must first be reinforced, extinguished to some degree whilst an alternative behavior is reinforced, and last the alternative response must also be placed on extinction in the last phase. However, the authors found the definitions to be lacking some relevant components such as a definitive method of response measurement and how stimulus variables contribute to resurgence. The authors also noted that, generally, resurgence effects are measured using discrete responses, but some definitions simply stated “behavior” as the measure of resurgence.

Of all the definitions included in the review, Mechner and Jones’s (2015) definition was different because it did not explicitly say that “extinction, elimination, or suppression of the target response” was needed in order to be considered resurgence, only that the original response should be absent. Instead, the authors argued that, to observe resurgence, reinforcement needs to “worsen,” and this worsening can consist of decreasing the magnitude of reinforcement to low or zero levels (e.g. Lattal et al., 2017) or by adding delays to receiving reinforcement (e.g., Lieving & Lattal, 2003 Experiment 4; Nighbor et al., 2017b). Based on these findings, Lattal et al. (2017) redefined resurgence as “the transient recurrence, with consideration of the stimulus context, of some dimension of previously established but not currently occurring activity when reinforcement conditions of current behavior are worsened” (p. 90). In other words, resurgence occurs when a previous response which is not currently being reinforced returns due to a change in reinforcement.

What resurgence is not: Other relapse phenomena. Resurgence is not the only phenomenon that results in behavior returning following a period of extinction. To provide a

better understanding of resurgence within the context of the return of behavior generally, several other relapse phenomena will now be discussed.

Renewal is "a change of context after extinction that can cause a robust return of conditioned responding" (Bouton, 2004, p. 485). There are several variations of the renewal effect: ABA, ABC, and AAB renewal. In ABA renewal, a response is conditioned in Context A, placed on extinction in Context B and then, in context A, the original conditioned response returns once the original context is restored. However, in ABC renewal the response is conditioned (A), placed on extinction (B), and in the final phase (C) a test of renewal is conducted with a neutral context. The last variation of renewal is AAB, in which conditioning and extinction both occur in Context A and, once in a new context, the degree of recovery is assessed (B). From the renewal literature, it is apparent that extinction is controlled by the context, meaning that the environmental changes affect the return of the original responding (Bouton, 2004). In other words, the changes that have occurred in the contextual environment will determine to what degree the original response returns.

Reinstatement occurs when the extinguished response returns because the reinforcer was reintroduced. For example, Franks and Lattal (1976) conducted a study to assess the effects of two different schedules of reinforcement on the magnitude of reinstatement. The subjects of this study were three naïve male rats that were maintained at an 80% free-feeding weight. First, the subjects were trained on bar pressing followed by one of two reinforcement schedules. A variable-ratio (VR) 20 schedule of reinforcement was used to produce high response rates and a differential-reinforcement-of-low (DRL) rate of behavior was used to produce low response rates. The training on these reinforcement schedules was counterbalanced across subjects. After training on both schedules, several extinction sessions were implemented until responding

reached near-zero rates. Last, a fixed-time (FT) 30 s response-independent schedule was implemented that yielded even higher response rates than the previous reinforcement schedules. The authors concluded that the magnitude of reinstatement effects was influenced by the previous schedules of reinforcement (i.e., there was greater reinstatement observed following the VR baseline). In other words, the delivery of reinforcement before a period of extinction affects the degree to which the response will be reestablished.

Another relapse phenomenon, spontaneous recovery, was first studied by Pavlov in 1927. When the extinguished response returns following the passage of time outside of the experimental context, this is labeled spontaneous recovery (Bouton, 2004). In other words, spontaneous recovery is when the reappearance of a previously extinguished response occurs in a different setting.

Bouton, Winterbauer, and Todd (2012) argued that all the previously discussed relapse effects are a form of renewal because the findings of studies across all relapse effects imply extinction effects are not permanent and are mediated by the context. In other words, the extinction effects are not permanent in that they commonly do not apply across multiple settings. A change in any number of context variables that occur in reinstatement and resurgence can cause a return of responding. Additionally, it is understood that when extinction has occurred in one setting, it does not mean extinction will necessarily generalize to another setting.

Variables that affect resurgence. Behavioral history plays an essential role in resurgence effects, as the behavioral repertoire is an accumulation of multiple behaviors that can be utilized when the most recent response has undergone extinction (Lattal & St. Peter Pipkin, 2009). For instance, when the alternative response or the replacement behavior is inadvertently placed on extinction, in most cases the learner will return to the most recent reinforced response

(Lattal & St. Peter Pipkin, 2009). Three variables found to affect resurgence are: reinforcer magnitude, the length of time spent earning reinforcement, and the length of learning history the subjects have been exposed to within the experiment. Each of these factors will now be briefly considered.

Reinforcer magnitude. Craig, Browning, Nall, Marshall, and Shahan (2017) conducted an experiment to determine if the reinforcer magnitude affected resurgence. Specifically, the authors assessed how the different rates of reinforcement magnitude delivered in Phase 2 would affect resurgence in Phase 3. In Phase 1, three groups of rats pressed levers and received one food-pellet on a variable-interval (VI) 60-s schedule. In Phase 2, the target lever pressing was placed on extinction, and an alternative lever resulted in either one food-pellet, five food-pellets, or no food-pellet. Each group was assigned to one of the reinforcer magnitude groups, and reinforcement was delivered on a VI 60-s schedule. Then, in Phase 3, the alternative lever pressing was placed on extinction as well. The authors concluded that providing a higher magnitude of reinforcement resulted in faster suppression of the target response. A more significant resurgence effect was observed, once the higher magnitude of reinforcement was no longer being delivered. These findings are potentially significant because they indicate that the magnitude of reinforcement provided can influence the magnitude of resurgence effects.

Learning history. Reed and Morgan (2006) conducted an experiment in which rats were taught three sets of response sequences. A response sequence is a series of individual responses completed consecutively; for example, in this study, the response sequences consisted of randomized left and right level presses. First, the rats were magazine trained using a VI 60-s schedule of reinforcement; next, two 20-min lever pressing sessions resulted in continuous reinforcement (CRF). The first sequence was taught until acquired, and then the second and third

sequences were taught until they were acquired as well. After all the sequences were taught, responding on all levers was placed on extinction. Generally, the last response to be reinforced is the one that will resurge first. These findings imply that resurgence is not simply extinction-induced variability but it is orderly and appears to use a hierarchy of the most recent responses to the older responses that previously resulted in reinforcement.

Although learning history does play an essential role in resurgence (as an organism's learning history essentially creates their "repertoire"), the length of time spent earning reinforcement can also influence the magnitude of resurgence effects. Winterbauer, Lucke, and Bouton (2013) conducted a series of experiments to determine the extent to which the duration of reinforcement history affected resurgence. In Phase 1, 16 rats were placed in one group that had four sessions of initial training and responding on lever one was reinforced under a random ratio (RR) schedule. The other group of 16 rats received 12 sessions of initial training and was reinforced on a VI schedule yoked to the RR schedule of the first group of rats. In Phase 2, responding on lever one was placed on extinction, whereas responding on Lever two was reinforced on a fixed-ratio (FR) 10 schedule. Finally, in Phase 3 responding on the second lever was placed on extinction as well. The results of this study indicated that, when the alternative response is placed on extinction, the original response returns at a much higher rate when there is a longer reinforcement history (i.e., 12 vs. 4 sessions) in comparison to a response with a shorter reinforcement history.

Resurgence Procedures. There are two procedures that have been demonstrated to result in resurgence effects: three-phase and four-phase resurgence procedures. Each of these procedures will now be discussed.

Three-phase resurgence procedure. In a three-phase procedure a target response is reinforced (Phase 1) then placed on extinction and an alternative response is reinforced (Phase 2) before, finally, the alternative response is placed on extinction as well (Phase 3).

For example, Sweeney and Shahan (2013) conducted a study using a three-phase resurgence procedure with four groups of rats. The authors sought to determine the degree to which the rate of alternative reinforcement (and whether that reinforcement was thinned) contributed to resurgence. One group received reinforcement at a high rate initially (VI 45 s), but the rate of reinforcement was subsequently thinned to a lean schedule (the VI increased by 10 s daily until the schedule reached a VI 100 s). The second group received a rich schedule of reinforcement, the third group received a lean schedule of reinforcement, and the fourth group was the control group, so no alternative reinforcement was available. The results of this study indicated that low rates of reinforcement might not be sufficient to prevent the original (i.e., target) response from occurring. Also, though the rich group's target response was thoroughly suppressed by the end of Phase 2, the removal of the rich schedule increased the magnitude of resurgence more than the other schedules of reinforcement. These results could have interesting implications for applied literature. For example, using a rich schedule of reinforcement during the acquisition of the alternative behavior might successfully suppress the original (problem) behavior; however, if treatment integrity failure (i.e., errors of omission of alternative reinforcement) occurs, the original behavior will likely resurge at high rates.

The three-phase procedure is more commonly used relative to the four-phase procedure within both the basic and applied literature. This is perhaps because the three-phase procedure emulates what commonly occurs when treatment is implemented in an applied setting. For example, in a differential-reinforcement-of-alternative (DRA) behavior procedure, the target

response is placed on extinction and an alternative response is taught, as in Phase 2 of a three-phase resurgence procedure. An example of the three-phase resurgence procedure in an applied setting was conducted by Volkert, Lerman, Call, and Trosclair-Lasserre (2009), who examined resurgence effects in the context of functional communication training (FCT). The purpose of this study was to determine whether resurgence of problem behavior would occur after a newly taught behavior was placed on extinction or the implementation of a lean schedule. There were five children whose problem behavior was maintained by multiple social reinforcers who participated in this study. Teachers or parents selected three different alternative responses based on the participant's skills. One participant held a card out that was attached to his waist, two participants were taught an approximation of an American Sign Language (ASL) sign for “break”, another participant was taught to say “Talk to me, please” and the other participant was taught to say “Toy, please”. There was a recovery of problem behavior for all of the participants following the resurgence test. The authors found that repeated exposure to extinction did not lessen the magnitude of resurgence and also resurgence was observed following the thinning of the schedule of reinforcement.

Four-phase Resurgence Procedure. In a four-phase procedure, a target response is first reinforced (Phase 1) then placed on extinction (Phase 2), next an alternative response is reinforced but the target response remains on extinction (Phase 3) and, finally, the alternative response is placed on extinction as well (Phase 4).

A four-phase resurgence procedure was conducted by Reed and Clark (2011). The study consisted of 24 children diagnosed with autism spectrum disorder (ASD). The purpose of this study was to examine the extent to which the length (i.e. time spent earning reinforcement) and amount of reinforcement received during the acquisition of Response 2 would have on the

magnitude of resurgence for Response 1. In Phase 1, a response was taught to the children and then was placed on extinction (Phase 2). In Phase 3 an alternative response was taught with various levels of reinforcement. One group received 30 min of exposure to the contingency on a VR-4 schedule, 60 min of exposure on a VR-4 schedule, and 30 min with a VR-2 schedule that was equal to that of the 60-min group. In Phase 4, the alternative response was placed on extinction as well. The group that received reinforcement on a VR-4 schedule for 30 min had the most resurgence compared to the other groups.

The authors concluded that the length of time between the initial training of the response and the resurgence test had no impact on the resurgence effect. These findings would indicate that, although learning history is an essential factor, the length of time between the last reinforcement of problem behavior and the discontinuation of the alternative response have no impact on the degree of resurgence. Also, the amount of reinforcement affected the degree to which resurgence was observed, as the group which received more reinforcement had less resurgence after the extinction of the alternative response.

As previously discussed, the difference between the three-phase and the four-phase procedure is that the four-phase procedure isolates the extinction of the target response. Prior researchers have discussed that isolated extinction might result in more "truly extinguished" behavior, whereas the three-phase procedure results in temporary suppression of behavior (Winterbauer, Lucke, & Bouton, 2013). For example, Rawson, Leitenberg, Mulick, and Lefebvre (1977) suggested that, in their study, performing the alternative response whilst simultaneously undergoing extinction of the original response suppressed the original response temporarily and inhibited the learning of extinction. These same authors have also suggested that the reason resurgence occurs is because the cessation of reinforcement of the alternative response acts as a

discriminative stimulus that signals a return to baseline (i.e., reinforcement for the original response). Therefore, separating extinction from the teaching of the alternative response might, in turn, result in less resurgence.

Comparing Resurgence Procedures. The three-phase procedure is often utilized in the literature more than the four-phase procedure. It is unclear why the three-phase procedure is used more frequently by experimenters, as this is an issue that has not been directly discussed in the published literature. However, one could speculate about some possible reasons why this might be the case. First, resurgence effects have been observed in both procedures. Thus, it could be that researchers were successful in observing a resurgence effect without the need for the "extra phase" of the four-phase procedure, thereby using the three-phase shortened the overall time needed to conduct resurgence experiments. Second, the four-phase procedure might have been used less because of less reliable experiment results, meaning resurgence effects were not observed as frequently. Also, the four-phase procedure does not reflect the typically applied model of treatment whereas the three-phase procedure does. To the author's knowledge, there are currently no studies that compare both procedures within a single experiment. Due to the different methodologies, subjects, and variables of individual studies, this makes it difficult to compare the results across numerous studies.

Resurgence of Child Problem Behavior

Regardless of the procedures used, most of the applied resurgence literature has focused on examining resurgence in one specific context, namely the resurgence of child problem behavior following treatment implementation. Prior researchers might have focused on the resurgence of problem behavior following treatment because the resurgence literature has demonstrated that failure to correctly implement a treatment can lead to resurgence, thereby

affecting the success of the intervention (Lattal & St. Peter Pipkin, 2009). If reinforcement is withheld for alternative responses, the original behavior (i.e., problem behavior) returns, and one could take steps to reduce resurgence by ensuring that reinforcement for the alternative response continues.

For example, Marsteller and St. Peter (2014) used a three-phase resurgence procedure in a translational resurgence study. The authors examined the effects of an FT schedule yoked to a DRA to determine if this would prevent the resurgence of problem behavior. Four children participated in this study. During baseline, each instance of problem behavior resulted in reinforcement on an FR1 schedule and no consequences were arranged for appropriate behavior. Next, a DRA training session occurred in which the child was taught to mand for the reinforcer using a prompt sequence. Next, DRA was implemented, problem behavior was placed on extinction, and appropriate mands were reinforced on an FR 1 schedule. Next, in the FT phase, problem behavior and the appropriate response were placed on extinction and reinforcement was delivered on an FT schedule that was equated to the mean of reinforcement received during the DRA phase. Last was the extinction phase in which no reinforcement was delivered. The authors found that, when FT schedules were yoked to a DRA schedule of reinforcement, the resurgence effects were suppressed because the participants did not contact extinction and the alternative response rates maintained. However, the authors found that the cessation of the FT schedule did lead to a resurgence of problem behavior.

Another example of how the resurgence literature has been extended to clinical settings is Lieving, Hagopian, Long, and O'Connor's (2004) experiment that examined resurgence within response-class hierarchies. Two subjects participated in the study. Both engaged in severe problem behavior such as aggression and self-injurious behavior. Functional analyses were

conducted and it was determined the function of both subject's behaviors was maintained by access to preferred items. Initially, reinforcement was delivered on a fixed-time (FT) 1-min schedule for all topographies. This reinforcement schedule was unusual because, in most resurgence studies, reinforcement is contingent on the alternative response. In this study, the authors used a response-independent reinforcement schedule for all topographies so that when the responses were placed on extinction they could confidently conclude that a resurgence effect had occurred across topographies. In the next phase, one of the topographies (e.g., disruptions) was placed on extinction. In the third phase another topography, such as aggression, was placed on extinction until all topographies were on extinction. In the last phase, the FT 1 min was reinstated and the behaviors returned to baseline levels.

The authors observed a greater magnitude of resurgence for the first behavior (in the present, example, disruption) placed on extinction during the first phase. These findings are potentially significant because there are typically multiple topographies of problem behavior occurring at once. This study replicates the link between primacy effects and resurgence first demonstrated by Reed and Morgan (2006) and extends this finding to the resurgence of socially significant behavior of children.

Caregiver Behavior

Resurgence effects are commonly studied within the context of the behavior of children. The focus is most likely because ABA is focused on studying socially relevant behavior, and the resurgence of problem behavior is something that those in applied settings wish to reduce. However, little research has been conducted that evaluates the resurgence effect explicitly in the context of caregiver behavior. Further research should examine therapist behavior and determine

if resurgence occurs. These findings could be significant and add to the current treatment integrity literature.

Perhaps when caregiver treatment integrity failures occur following successful parent training, it is not a failure of the training per se, but resurgence. For example, a caregiver might be providing attention when their child throws a tantrum; with parent training, they are taught to ignore the tantrum and not provide any attention. Eventually, the child stops engaging in tantrums to gain their caregiver's attention, thus reinforcing the caregiver's ignoring of the tantrum. However, if the child started to engage in tantrum behaviors again (e.g., kicking and screaming) despite the caregiver's continued ignoring, the caregiver might engage in the last behavior that resulted in the child stopping their tantrum (i.e., providing attention). In this example, the caregiver's behavior has resurged. A similar model may also be relevant to the behavior of therapists in behavior treatment settings. For example, the return of a client's once-extinguished problem behavior might cause resurgence of counter therapeutic therapist behavior (i.e., reinforcing problem behavior).

There are only a few studies that examine resurgence effects in the context of a caregiving situation. Bruzek et al. (2007) conducted a human operant experiment that simulated a caregiving scenario with seven undergraduate students. In Experiment 1, the authors used a negative reinforcement contingency to determine if resurgence would be observed. At the beginning of each phase, a recorded infant cry was played and, contingent on the participants engaging in a specific caregiving response, was turned off. In the second phase, the original response was placed on extinction, and an alternative response was reinforced with the termination of the recorded cry. During the final phase, the infant cry was once again played,

however this time neither the alternative nor the original caregiving response resulted in the cessation of the cry. Thus, in this phase extinction was used to mimic inconsolable crying.

Using a negative reinforcement procedure was novel because previous resurgence literature had used positive reinforcement (e.g., Sweeney & Shahan, 2013; Craig, Browning, Nall, Marshall, & Shahan, 2017). Also, a negative reinforcement contingency mimics what might occur between a caregiver and a child. For example, perhaps the caregiver wishes to stop or escape their child's aversive behavior (e.g., yelling or crying). By providing the item the parent reinforces the child's problem behavior, but also in doing so might negatively reinforce their own behavior (i.e., escape from aversive situation). Bruzek et al.'s Experiment 2 replicated the first experiment, except the authors wanted to evaluate the effects of learning history on resurgence. The authors found that responses with a longer reinforcement history were more likely to resurge than those with more recent and shorter history, consistent with other investigations of resurgence and behavioral history (e.g., Reed & Morgan, 2006).

The results of this simulated caregiving situation were that the caregiver's behavior was maintained by negative reinforcement in the form of escape. In other words, perhaps what might happen is a reoccurrence of inappropriate responding to problem behavior (i.e., providing attention) due to a long history of escape from aversive stimuli when engaging in that response. From this hypothetical example, caregiver's responses might need to be intervened upon much like the treatment models implemented for children. Continuing the research of resurgence and treatment integrity, and determining how they relate to caregiver's behavior, might provide a better model for parent training.

A limitation of the Bruzek et al. (2007) study was that one of the participants engaged in Response 1 (vertical rocking) and the control response (feeding) at the same level during the

resurgence test, which suggests that extinction-induced variability was occurring and not resurgence of vertical rocking. However, the authors pointed out that this could have been due to the behavioral history of the participants outside of an experimental context (i.e., previous caregiving experience). Perhaps a way to control for this would have been to select a behavior that was less likely to have served as a negative reinforcer in the past (e.g., burping) as a control response.

Thompson, Bruzek, and Cotnoir-Bichelman (2011) conducted a follow-up study of the original Bruzek et al. (2007) study but used a four-phase resurgence procedure. Eleven subjects participated in this study; however, only nine of these subject's caregiving responses were found to be maintained by the negative reinforcement contingency. The other two participants were excluded from the study because they did not contact the negative reinforcement contingency. The authors were able to replicate the negative reinforcement contingency across the nine subjects who contacted the contingency. Of the nine, two subjects' responses were resistant to extinction (i.e., the subjects continued responding). This experiment yielded similar results to the Bruzek et al. (2007) study, in that the participant's behavior was maintained by negative reinforcement in the form of avoidance of the infant's crying.

A limitation of the Thompson et al. (2011) study was the assignment of target responses. For example, some participants were only assigned one target response (i.e., vertical rocking) during the reinforcement phase. However, others were assigned multiple target behaviors (i.e., vertical rocking, horizontal rocking, and playing) during the reinforcement phase before extinction was implemented. The authors stated how a few of the participant's behaviors were difficult to extinguish, and that perhaps reinforcing multiple behaviors created that problem. Reinforcing multiple responses is more naturalistic of a caregiving situation that might have

strayed away from the original research question (i.e., does a negative reinforcement contingency result in resurgence) and created unnecessary confounds.

Overall the authors of these studies stated a better understanding of how aversive stimuli affect caregiver responding. However, these studies might have implications for how the resurgence of caregiver and therapist behavior relates to treatment integrity. Persistent crying and fussing have been shown to lead to negative responses from caregivers such as being less responsive and, in some cases, such responses may lead to violence such as shaking (Keenan, Runyan, Marshal, Nocera, Mertan, & Sinal, 2011; St. James-Roberts, Conroy, & Wilsher, 1998), which could potentially contact reinforcement and subsequently resurge. If the same resurgence effects observed within children's behavior can be seen with caregivers and therapist behavior, then perhaps some of the applied research being conducted to decrease resurgence can be applied to caregivers and therapists.

The Relation between Resurgence and Treatment integrity

Treatment integrity is "the extent to which the independent variable is applied exactly as planned and described and no other unplanned variables are administered inadvertently along with the planned treatment" (Cooper, Heron, & Heward, 2007). There are two common types of treatment integrity failures: errors of omission and commission. St. Peter Pipkin et al. (2010) defined an error of omission as failing to deliver reinforcement in accordance with the reinforcement schedule. Errors of commission were defined as delivering reinforcement following problem behavior.

An error of omission would result in the resurgence effects commonly observed and studied within the literature. For example, a child is engaging in aggression whenever he is motivated to leave the table during school, this behavior is placed on extinction, and an

alternative behavior "take a break" is taught with every instance of this behavior reinforced. However, the teacher does not respond to the child's request to take a break (i.e., a treatment integrity omission error), so the child begins to engage in aggression. This resurgence of aggression occurred due to the change in the reinforcement schedule (i.e., the break was not given). Errors of commission are not commonly discussed within the resurgence literature. For example, a child starts engaging in aggression instead of the teacher ignoring the aggression (as previously taught), she allows the child to take a break. In this instance, the teacher has committed an error of commission and reinforced the problem behavior, which could result in treatment relapse. In other words, by reinforcing problem behavior once again, this increases the probability that the child will start engaging in aggression when deprived of a break for an extended amount of time (i.e., when an EO is in place). More research is needed about treatment integrity failures and the relation to resurgence specifically in discovering which error results in more resurgence.

St. Peter Pipkin et al. (2010) conducted a series of three experiments that examined how errors of commission and omission affected responding during a DRA intervention. The first experiment was a human operant study in which the researchers examined errors of commission alone and then combined commission and omission errors. From the first experiment, the authors concluded that both commissions alone and the combined errors resulted in high rates of problem behavior.

The second experiment replicated the finding with two subjects diagnosed with autism and developmental delays. The last experiment specifically evaluated whether the order in which the errors were applied would affect treatment integrity. Interestingly, the authors noted that

errors of omission alone were not as detrimental to the DRA intervention as errors of commission alone.

As previously discussed, the current resurgence literature focuses on the resurgence of child problem behavior. Therefore, it is assumed that caregivers make errors of omission, in that they will not reinforce the appropriate behavior. In other words, every instance of the appropriate behavior might not be reinforced as originally intended, creating a "worsening" of reinforcement conditions that might cause resurgence. Although failing to deliver reinforcement following the schedule of reinforcement is a treatment integrity failure, St. Peter Pipkin et al. (2010) suggested that delivering reinforcement following problem behavior is more likely to lead to treatment failure. Since commission errors might be a result of resurgence of caregiver or therapist behavior, research should be conducted to better understand resurgence effects in the context of the treatment integrity literature.

Statement of the Problem

Resurgence phenomena have thoroughly been investigated and found to be replicable, across species (e.g. humans and pigeons), settings (e.g. lab and clinic), and responses (e.g. vertical rocking and key pecking; Lattal & St. Peter Pipkin, 2009). As previously discussed, procedures resulting in resurgence have been well researched and there are distinctive variables that distinguish resurgence from other relapse phenomena such as renewal or spontaneous recovery. Recently, applied resurgence researchers have begun to examine resurgence in the context of socially significant behavior, specifically with the problem behavior of children. Researchers have suggested that resurgence might be the cause of treatment relapse for interventions which use extinction and the teaching of an alternative response, for example, FCT (Volkert et al., 2009).

Although it has been well established that resurgence is a reliable phenomenon, it is still unclear how the three-phase and four-phase procedures compare. Applied resurgence literature heavily relies on the three-phase procedure. To the author's knowledge, there is no research that actively looks at comparing the resurgence effects between the three-phase and four-phase procedures, either using a within-subject or between-subject design. Even though the three-phase and four-phase procedures can be evaluated across studies, the procedural variations make it difficult to compare the procedures directly. It is a relevant comparison that needs to be assessed but, regardless of which procedure is used, resurgence has important implications for ABA.

However, the resurgence of child problem behavior is not the only implication of this research, and a better understanding of the resurgence of caregiver behavior is needed. Researchers are beginning to investigate resurgence of child problem behavior and how it affects caregiver behavior, but they have yet to link the resurgence of caregiver or therapist behavior to the treatment integrity literature. To the author's knowledge, there are currently no articles that assess the resurgence of caregiver behavior and how this can affect the children's behavior in turn.

The resurgence of child problem behavior research relies heavily on the assumption that resurgence occurs due to an error of omission (i.e., failing to provide reinforcement). However, according to St. Peter et al. (2010), errors of commission (i.e., reinforcement following problem behavior) are more damaging to interventions. Based on this finding it would seem imperative to investigate the resurgence of caregiver and therapist behavior. St. Peter Pipkin et al. found that errors of commission were more detrimental to treatment integrity than errors of omission. One explanation for low treatment integrity with caregivers and therapists might be due to a learning history of reinforcing problem behavior, which is evident in errors of commission.

Understanding resurgence in the previously mentioned context might lead to the designing of better caregiver training. If resurgence is found to occur at a higher magnitude in the three-phase relative to the four-phase procedure, then one way to reduce resurgence of caregiver behavior might be to use a four-phase approach during caregiver training. Once the inappropriate response has been extinguished (i.e., providing attention to problem behavior), then ABA therapists can begin teaching the caregiver to provide attention only when the child engages in the alternative behavior.

To address the previously mentioned gaps in the literature, this study assessed the resurgence of caregiver and therapist responses after an alternative response was introduced. This study also assessed the degree to which resurgence was observed in a three-phase and four-phase procedure using a within-subject design. Finally, this study attempted to determine if the resurgence of caregiver and therapist behavior occurs and determine which procedure results in higher magnitudes of resurgence.

Experiment 1

Method

Participants and Setting. Three undergraduate students, two females and one male with several years of experience as caregivers participated in this study. All sessions occurred in a behavioral research suite on a college campus; Figure 1 shows a diagram of the setting. The session room was an open space where the participant engaged in caregiving behavior with the baby doll. The observation room was behind the one-way mirror. Research assistants took data and implemented phase conditions from within the observation room.

Materials. The session room included a chair placed next to a 1.5 m by 0.58 m table upon which one baby doll, a fleece blanket, and a small beanie toy laid. On the other side of the

room, there was a table with magazines and a children's book. A Bluetooth® speaker was located approximately 1 m from the table, and the speaker was used to play a recording of an infant crying. The cry was controlled via an iPad from the observation room.

Response Measurement and Interobserver Agreement (IOA).

Trained data collectors recorded the behavior of participants from the observation room using B-Data Pro software. To create an analog to maladaptive caregiving in the natural environment, the target response was “ignoring” the baby's cry. Ignoring was defined as the participant oriented away from and not in close proximity (i.e., within 0.91 m) with the baby for 3 consecutive seconds. The alternative caregiving response was rocking, defined as 3 consecutive seconds of the participant cradling the doll with the visible movement of the participant's arms (operational definitions were based on Bruzek et al., 2007, and Thompson et al., 2011). Frequency and duration of both responses were recorded across all phases. IOA was assessed via video data collection after the conclusion of all the sessions for 53% of sessions using the Countee app. Each session was divided into 5- min intervals and observers scores were compared interval-by-interval. Intervals when both observers' scores matched were divided by the total number of intervals and multiplied by 100. Agreement averaged 77.3% across all sessions and ranged from 33% to 100%.

General Procedure

Two resurgence procedures were arranged for this study: a four-phase and a three-phase procedure. It was planned that the order in which participants were exposed to the procedures would be counterbalanced across participants. However, as discussed below, no participants completed both procedures and therefore no counterbalancing was necessary. Each resurgence procedure included several phases. After the participant completed each phase, they were asked

to step out of the room and the materials were reset (i.e., everything placed back into its original location). Each phase was implemented for a fixed duration; the duration of the phases was based on a pilot study that used similar procedures.

Three-Phase Resurgence Procedure

Baseline. During this phase, the recording of the infant cry started at the beginning of the phase and turned off for 30 s contingent on the occurrence of ignoring. Thus, each occurrence of ignoring was reinforced on a FR 1. The phase was in effect for 30 min.

Extinction + FR 1. During this phase, the recording of the infant cry started at the beginning of the phase and contingent on the occurrence of rocking turned off for 30 s. Ignoring was under extinction throughout this phase (i.e., the cry did not stop if the participant engaged in ignoring). This phase was in effect for 30 min.

Test. During the resurgence test phase, ignoring and rocking were both on extinction. The recorded infant cry started at the beginning of the phase and continued until the phase ended, regardless of the participants' responding. This phase was in effect for 15 min.

Four-Phase Resurgence Procedure

Baseline. During this phase, the recording of the infant cry started at the beginning of the phase and contingent on the occurrence of ignoring turned off for 30 s. Thus, each occurrence of ignoring was reinforced on an FR 1. The phase was in effect for 30 min.

Extinction. Ignoring was under extinction throughout this phase (i.e., the cry did not stop if the participant engaged in ignoring). This phase was in effect 15 min.

FR 1. The recording of the infant cry started at the beginning of the phase and contingent on the occurrence of rocking turned off for 30 s.

Test. During the resurgence test phase, ignoring and rocking were both on extinction. The recorded infant cry started at the beginning of the phase and continued until the phase ended, regardless of the participants' responding. This phase was in effect for 15 min.

Results and Discussion

Only one of three participants in this study (Emma) completed all of the phases of a resurgence procedure, and none of the participants completed both three- and four-phase resurgence procedures as planned. Jim started with the three-phase procedure and continuously engaged in caregiving responses (e.g., rocking and playing) throughout the baseline phase and only contacted reinforcement (i.e., cessation of the cry) five times within the 30 min phase. Due to the low magnitude of reinforcement received during baseline, Jim was terminated following Phase 1. Mia began the four-phase procedure and did not engage in any caregiving responses with the baby during the baseline phase, but did engage in the target response (i.e., ignoring the cry). She sat with her back towards the baby during most of the phase and, because she continuously ignored the cry, the recording remained off. During Phase 2, she did not interact with the baby at all and thus did not contact the new contingency (FR 1 for rocking), so her session was terminated following Phase 2 of 4.

Emma completed the three-phase procedure, but terminated her participation following this procedure. Figure 2 displays the target response (ignoring) and the alternative response (rocking) as the duration of responding in minutes across consecutive 5-minute bins. Initially during baseline, the duration of ignoring averaged one minute before increasing to an average duration of five minutes (i.e., 100% of the phase). In Phase 2 (EXT Ignoring + FR1 rocking), initially the duration of ignoring was 0.7 s before it decreased to zero levels (Bins 8-12). Initially the alternative response of rocking occurred at a duration of one minute before decreasing to

near-zero levels. During the test phase, both responses were placed on extinction, and the duration of rocking decreased throughout the phase. Resurgence of ignoring (i.e., an increase in ignoring relative to the previous phase) was observed.

The success of this experiment might have been better if a few changes had been made to the procedure. For example, one of the main factors that might have contributed to the participant's failure to contact the contingency was the operational definition of ignoring. It is possible that the definition of ignoring was too stringent and ultimately hindered Jim's and Mia's ability to acquire the response during baseline. Perhaps a less-stringent operational definition, such as head oriented away from the baby or walking away from the baby, would have been more effective.

Additionally, the behavior selected for baseline might have contributed to the failed implementation of the experiment as planned. The desire to examine a maladaptive caregiving response (as an analog of maladaptive caregiving in the natural environment) led to the selection of ignoring as a target response. Bruzek et al. (2007) and Thompson et al. (2011) observed resurgence using multiple topographies of common caregiver behaviors such as rocking, playing, and feeding. Thus, it is likely that if the response reinforced during baseline had been a typical caregiving behavior (e.g., playing or feeding), participants might have more easily contacted the contingency. Of course, this would not be the case for Mia as she did contact the contingency (i.e., ignoring the baby), but perhaps what was observed was not ignoring but merely the absence of behavior (i.e., the participant failed to behave, perhaps due to reactivity, and was waiting until the conclusion of the phase). The lack of behavior could also explain why Mia failed to contact the alternative response in the next phase.

In conclusion, resurgence was observed following the three-phase procedure for Emma. The participant was able to acquire the initial and alternative responses quickly; however, that was not the case for Jim, who struggled to acquire the initial response, whereas Mia was not able to acquire the alternative response. The implications of these findings add to the resurgence of caregiver behavior literature.

This study was able to replicate the findings of Bruzek et al. (2007) study; a similar methodology was implemented, such as using a negative reinforcement contingency in the context of a simulated caregiver scenario. The use of a negative reinforcement contingency is novel within the resurgence literature as most studies use a positive reinforcement contingency. The current study was able to demonstrate not only that resurgence of caregiver behavior does occur, but also that resurgence of caregiver behavior does occur within a negative reinforcement contingency.

However, only one procedure was conducted for one participant, and because of that, it was still unknown if resurgence was replicable across subjects. Due to Emma's termination of her participation, the four-phase data could not be collected. So, it was also still unknown whether the three or four-phase resurgence procedure resulted in a higher magnitude of resurgence. In a continued effort to answer the original research questions of which resurgence procedure (three or four-phase) results in higher magnitudes of resurgence and to determine the degree of resurgence in a within-subject comparison, a second experiment was conducted in which resurgence was assessed in a stimulated supervised therapy session using registered behavior technicians (RBTs).

Experiment 2 was like Experiment 1 in that three-phase and four-phase resurgence procedures were compared across and within-subjects. A different population (RBTs)

participated in this study, as the author no longer had access to undergraduate students. Also, to avoid participants not returning for their second appointment, both procedures were conducted on the same day (whereas in Experiment 1, each procedure was to be conducted as two separate appointments on different days). The experimental protocol was changed as well and simulated a supervised therapist session where the participants interacted with a research assistant who was acting as a client. Although Experiment 2 was different from Experiment 1, the same research questions were evaluated. How does the three-phase compare to the four-phase procedure within the same study and participant?

Experiment 2

Method

Participants and Setting. Three RBTs participated in this study: two females and one male who had been RBTs for at least one year (Table 2). Participants were recruited from local clinics providing ABA services via an emailed flyer. All sessions were conducted in four separate college classrooms. Each classroom had two desk-chairs placed in the front center of the room. Coloring sheets and crayons or colored pencils were present on one of the desks. A camera was set up on a tripod a few meters in front of the desks to record video for data collection. During sessions, each participant was paired with two researchers: one who served as a role-play supervisor and one who served as a role-play client. The “supervisor” initiated and terminated phases and took data. The participant was instructed to work with the client: “This is _____” he/she will be your client for this training session. They are working on completing worksheets independently. Please react in the way you feel appropriate to alleviate any problem behavior. I will inform you when the therapy session has ended.”

Clients engaged in problem behavior, including whining (high pitched protest statements or vocalizations), self-injurious behavior (lighting hitting the head with an open palm), and disruptive behavior (stomping, hitting the desk, etc.). “Clients” were instructed that, while engaging in problem behavior, they should cycle through all topographies with an interresponse time of approximately 5 s.

Measurement and IOA

The target response was attending, this was operationally defined as physical and or verbal attention. IOA was assessed via video data collection after the conclusion of all the sessions for 30% of sessions across all participants (ranged, 21% to 41.6%) using the Countee app. Each session was divided into 5-min intervals and observers’ scores were compared interval-by-interval. Intervals when both observers’ scores matched were divided by the total number of intervals and multiplied by 100. Agreement averaged 54.3% across all participants and ranged from 33% to 100%.

General Procedure. All participants were exposed to three-phase and four-phase resurgence procedures in two separate (approximately 75 min) sessions. A 15-min break was provided in between the sessions. The duration of the sessions was determined based on the length of sessions in a prior pilot study. The order of exposure to the two procedures was counterbalanced across participants.

Three-Phase Resurgence

Baseline. The “client” started engaging in problem behavior at the start of the phase and stopped for 30 s contingent on the participant attending to problem behavior. Each occurrence of attending was reinforced on an FR 1 schedule. This phase was in effect until the participant earned 25 reinforcers or 30 min elapsed, whichever came first.

DRO. During this phase, the “client” implemented a resetting 30-s DRO schedule for the target behavior of attending. The “client” started engaging in problem behavior at the start of the phase and stopped for 30 s contingent on the participant not attending to problem behavior for 10 s. This phase was in effect for 30 min.

Test. The “client” started engaging in problem behavior at the start of the phase and continued until the phase ended. This phase was in effect for 15 min.

Four-Phase Resurgence

This procedure was identical to the three-phase procedure except for the additional “extinction only” phase in which attending to problem behavior was placed on extinction before the introduction of the 10-s DRO phase. The duration of the DRO phase in this procedure was only 15 min instead of 30 min; this was so that the total duration of the extinction phase (15 min) and DRO phase (15 min) in the four-phase procedure would be equal to the DRO phase (30 min) in the three-phase procedure. The total time of three and four-phase extinction and DRO were equaled across phases to control for time that participants were exposed to extinction.

Results and Discussion

Allan and Ariel both completed the three and four-phase resurgence procedure, and Jen completed the original four-phase procedure and an altered four-phase procedure. The altered four-phase procedure was implemented for Jen because she continued to respond at high rates during the DRO phase (described below). Because the four-phase procedure was the first procedure conducted with this participant (it was the second procedure conducted for Allan), the experimenters decided to forgo the three-phase procedure in lieu of a modified four-phase procedure, shown in the fourth panel of Figure 4. In this modified procedure, the participant was provided the following verbal instruction prior to the DRO phase, "Please do not respond

physically or verbally when the client engages in problem behavior." This instruction was intended to be comparable to corrective feedback that might be given to a therapist or caregiver during supervision or caregiver training.

Figure 3 displays the rate of attending across consecutive five-minute bins during the three-phase resurgence procedure for Allan and Ariel. Both Allan and Ariel engaged in high rates of attending during baseline. During the DRO phase, attending to the problem behavior decreased for both participants. Ariel's attending decreased rapidly when the DRO was implemented, whereas Allan's attending exhibited a gradual decreasing trend, reaching zero only during the final 5 min of the DRO. Resurgence was observed in the test phase for both participants. For Allan, attending returned to baseline levels of attending to problem behavior immediately upon termination of the DRO. Ariel's attending exhibited an increasing trend, with rates of attending returning to baseline levels in the final 10 min of the resurgence test.

Figure 4 displays the rate of attending across consecutive five-minute bins during the four-phase procedure for Allan, Ariel, and Jen. All the participants engaged in high rates of attending during the baseline phase. During the extinction phase attending was not eliminated for any of the participants. The initial level of Allan and Jen's attending in extinction was initially higher than baseline. However, Allan, Ariel, and Jen's (v.1) responding exhibited decreasing trends during this phase. Throughout the DRO phase, attending to problem behavior decreased for all the participants. However, in Jen's (v.1) of the four-phase procedure rate of responding in the DRO increased above baseline levels. Ariel's attending quickly decreased and reached zero (Bins 11 and 12), whereas in Jen's (v.2) attending decreased to levels lower than baseline. Although Allan's responding decreased relative to the previous phase attending was still occurring at rates equal to baseline. During the test, Ariel's rate of attending returned to baseline

levels, whereas Jen's (v.2) rate of attending increased to levels slightly above the baseline level. Allan continued to attend to problem behavior during the test at similar rates as the previous phase. Because Allan's attending was never eliminated, it was not possible to observe resurgence during the four-phase procedure. Of the three participants who completed the four-phase procedure, resurgence was observed in two participants. Extinction seemed to be unsuccessful in eliminating attending to problem behavior for all the participants. However, the DRO was successful in decreasing attending to problem behavior for Allan, Ariel, and Jen (v.2).

Figure 5 displays a percentage of the baseline graph that compares the three-phase and four-phase procedures to each other and is the percent of baseline across consecutive five-minute bins. This graph was used to account for differences in baseline response rates across the two procedures. If there are differences in baseline responding, the data must be displayed relative to baseline levels across both procedures to compare the procedures accurately. There is not a percentage of the baseline graph for Allan because resurgence was not observed during his four-phase procedure. As there was no resurgence observed during the four-phase procedure, then it would not be possible to compare the magnitude of resurgence observed in the three-phase and four-phase procedures.

In Ariel's graph, during the three-phase procedure treatment phase there is a low level of attending to problem behavior with no trend and little variability. During the test phase, there is an increasing trend with little variability. In the four-phase procedure treatment phase, attending to problem behavior ranged from 259% to 67% of baseline responding. Whereas, after the start of the DRO phase, there was a decrease in attending that ranged from 217% to 0% of baseline responding. During the test phase, attending to the problem behavior occurred at a moderate

level with slight variability. A higher magnitude of resurgence was observed following the four-phase procedure.

General Discussion

Two investigations of maladaptive resurgence were conducted in the present study. In Experiment 1, resurgence of maladaptive caregiving behavior (i.e., ignoring a baby's cry) was observed with one college student in an analog caregiving situation. In Experiment 2, resurgence of maladaptive therapist behavior (i.e., attending to problem behavior) was observed for three RBTs in a role-play therapy situation. The primary research question was answered, in that resurgence of both caregiver and therapist behavior was observed. These results replicate and extend the highly reliable resurgence phenomenon in a new applied context, specifically an analog therapy session. However, the question of which procedure results in greater resurgence was still not answered as procedural limitations prevented a thorough comparison of the two procedures.

This was the first study, to the author's knowledge, to assess the resurgence of therapist behavior. Furthermore, this study assessed resurgence in the context of a socially significant role-play therapy session. This is important in that it is not a scenario that resurgence literature has assessed as of yet. However, as therapists are implementing protocols daily and providing caregiver training on said protocols, it stands to reason that it is important to understand the factors that lead to resurgence of therapist behavior during therapy sessions. Also, this study examined resurgence of negatively reinforced behavior. Demonstrations of resurgence with negative reinforcement are rare (Bruzek et al., 2007; Thompson et al., 2011). It is essential to understand the resurgence of negatively reinforced behavior because caregiver and therapist's behavior might often be negatively reinforced. Experiment 1 replicated the findings of Bruzek et

al. with a maladaptive caregiving response (ignoring), rather than the adaptive caregiving responses (e.g., rocking). Experiment 2 extended Experiment 1 and the previous research in that a new population (therapists) was assessed and a different context (role-play therapy session) was examined. For Ariel, the procedure allowed for a comparison of the three-phase and four-phase resurgence procedures within a study and within-subject.

One barrier to demonstrating experimental control in a human operant study is the behavioral history of human subjects, and this was certainly the case with the present study. In Experiment 1, the participant's history of caregiving could have impacted the study by affecting the behavior the participants emitted. For example, Jim consistently interacted with the baby, by playing with the baby, reading to the baby, and attempting to soothe the baby. Perhaps due to the participant's long history of caregiving behavior, he was unable to contact the contingency (i.e., reinforcement contingent upon ignoring) and acquire the target response. In Experiment 2, the participants' history of providing therapy could have affected the study by affecting how the participants responded to problem behavior. For example, therapists might have attempted different procedures they had used successfully in the past to deal with the current problem behavior they were presented with. Perhaps, some of the participants could have been attempting to implement escape extinction for the currently-available task (i.e., coloring). For example, in Allan's four-phase procedure, he consistently responded to problem behavior, but in doing so, re-presented and hand-over-hand prompted the "client" through the task.

One limitation of the present study is that treatment integrity data was not taken during either experiment. Thus, it is unclear if all procedures were implemented as intended and to what degree, if any, there were treatment integrity failures. In Experiment 1, treatment integrity data was not taken during the sessions because this was not something that the author planned at the

start of the experiment. In Experiment 2, it was not possible to take treatment integrity data during the sessions without altering the therapy role-play scenario between the two research assistants and the participant. There is no data that indicates that the procedures were implemented as intended, however, there is also no indication that the procedures were not implemented as intended. The results of this study are supportive of the independent variable being responsible for changes in responding. For example, in Experiment 2 the participants were able to successfully acquire the response of attending to problem behavior on a FR1 schedule. Although the EXT phase was not successful in completely decreasing behavior, looking at the data the removal of reinforcement affected the participants responding (i.e. high spikes of responding at the start of the phases).

In Experiment 1, our demonstration of experimental control is weakened by the fact that we did not replicate the phases of the resurgence procedure within-subject (although such replication was planned). We were not able to replicate the conditions within a participant due to participant attrition. However, not replicating phases within-subject is standard in the resurgence literature (e.g., Bouton & Schepers, 2013; Bruzek et al., 2007). Typically, subjects are exposed to each of the phases a single time and only one resurgence test is conducted per subject (consistent with the present Experiment 1). Similarly, both experiments deviated from a typical resurgence procedure because the phases were not run until stability was met. This was due to the time constraints with respect to participant participation. For example, in Experiment 2 in order to complete both procedures within one day and because of the allotted time approved by the institutional review board (IRB), the max time with the participants was three hours. The original IRB application was not amended to extend the session time because it would have been difficult

to provide the board with a definite amount of time needed. The participant might have needed a large duration of time before stability was met in one phase, let alone the following phases that would also have needed to be run until stability was met. There is some precedence for fixed-duration phases in the human operant resurgence literature (e.g., Kestner, Romano, St Peter, & Mesches, 2018); however, the phase durations we selected may have been too short. Perhaps the phases, specifically the extinction phases, could have been conducted more similarly to Bruzek et al. (2007), where they repeated the extinction phase until the participant met the extinction criteria in one session.

The target behavior was not eliminated with extinction or DRO for two participants during the four-phase procedure. One reason this might have occurred is order effects, which we attempted to control for with counterbalancing. Perhaps when the three-phase procedure occurred before the four-phase procedure, a learning history was developed that caused participants to continue to engage in the original behavior (attending) during the four-phase extinction and DRO phases in an attempt to contact reinforcement. Because in the three-phase procedure extinction of the original behavior (attending) and the DRO (10 s) co-occurred, meaning that even though the initial response was no longer being reinforced there was still reinforcement available. During the four-phase procedure, reinforcement is not concurrently available during the extinction of the initial response; however, this only occurred with one participant for whom this pattern of results was observed.

Another reason why responding was not eliminated under DRO conditions was that perhaps the DRO interval was too long. Previous research (Poling & Ryan., 1982) has shown that DRO is more effective at suppressing responding when implemented with initially short intervals. However, the DRO was the same in the three and four-phase procedure and it was

successful at eliminating behavior in both procedures for both participants. This suggests that the duration of the DRO interval cannot fully account for the effects observed. Last, it is possible exposure to the extinction phase before the DRO phase made the DRO less effective in suppressing target behavior. In theory, it would be reasonable to expect that implementing extinction before DRO would facilitate DRO's suppression of the target response. However, due to the fixed duration of phases and the high degree of extinction bursting that was observed, this resulted in the DRO being initiated when rates of attending, though decreasing, were as high as or higher than baseline. This could have been addressed by continuing the extinction phase until behavior reached low rates or was eliminated. This could have made a comparison of the three-phase and four-phase procedures difficult because, due to the time constraints, it might not have been possible to conduct both procedures.

It is still unclear how the three-phase and four-phase procedures compare and whether the four-phase procedure is a viable model for reducing resurgence. The four-phase procedure might be feasible if the extinction phase can be run out until behavior is eliminated. Of course, this might not be possible in an applied setting if there are time constraints (e.g., cannot continue extinction for an extended period of time) and if the client engages in severe behavior (e.g., self-injurious behavior and aggression) that could be potentially harmful to themselves and the therapist. Also, more research should be conducted on the resurgence of caregiver and therapist behavior. With more research, it might be possible to explain treatment integrity errors and how they relate to resurgence. For example, St. Peter Pipkin et al. (2010) showed that errors of commission are more damaging to treatment than errors of omission. Errors of commission, like providing attention contingent upon problem behavior during a DRA+EXT treatment for attention-maintained problem behavior, decrease the effectiveness of a treatment. Experiment 2

did not examine errors of commission per se, because we did not instruct the participants in the implementation of a particular treatment. However, participants provided a lot of attention following problem behavior, and this attention would likely function as a reinforcer for at least some of the clients with which they work. Based on the results of the study, it is reasonable to predict that resurgence can account for at least some treatment integrity errors, specifically errors of commission, in treatments that place attention on extinction (i.e., removal of attention following problem behavior). In Experiment 2, it was observed that therapist behavior was sensitive to contingencies, meaning that therapist behavior was altered based on the reinforcement received (i.e., escape from problem behavior). This implies that a therapist's behavior is not entirely infallible but is affected by client behavior. Ultimately discovering if training can be designed that will decrease caregiver and therapist resurgence may increase the long-term success of interventions.

References

- Bouton, M. E. (2004). Context and Behavioral Processes in Extinction. *Learning & Memory, 11*(5), 485-494. doi:10.1101/lm.78804
- Bouton, M. E., Winterbauer, N. E., & Todd, T. P. (2012). Relapse processes after the extinction of instrumental learning: Renewal, resurgence, and reacquisition. *Behavioural Processes, 90*(1), 130-141. doi: 10.1016/j.beproc.2012.03.004
- 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. doi:10.1901/jeab.2009-92-327
- Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis*. Upper Saddle River, NJ: Pearson Education.
- Craig, A. R., Browning, K. O., Nall, R. W., Marshall, C. M., & Shahan, T. A. (2017). Resurgence and alternative-reinforcer magnitude. *Journal of the Experimental Analysis of Behavior, 107*(2), 218-233. doi:10.1002/jeab.245
- Doughty, A. H., & Oken, G. (2008). Extinction-induced response resurgence: A selective review. *The Behavior Analyst Today, 9*(1), 27-33. doi:10.1037/h0100644
- Doughty, A. H., Reed, P., & Lattal, K. A. (2004). Differential reinstatement predicted by preextinction response rate. *Psychonomic Bulletin & Review, 11*(6), 1118-1123. doi: 10.3758/bf03196746
- Epstein, R. (1983). Resurgence of previously reinforced behavior during extinction. *Behaviour Analysis Letters, 3*, 391-397. doi:10.3758/bf03193045

- Keenan, H. T., Runyan, D. K., Marshall, S.W., Nocera, M. A., Merten, D. F., & Sinal, S. H. (2003). A population-based study of inflicted traumatic brain injury in infants. *Journal of the American Medical Association*, 290, 621–626. doi:10.1001/jama.290.5.621
- Kestner, K. M., Romano, L. M., St. Peter, C., C., & Mesches, G. A. (2018). Resurgence following response cost in a human-operant procedure. *The Psychological Record*, 68(1), 81-87. doi:http://dx.doi.org.ezproxy.rollins.edu:2048/10.1007/s40732-018-0270-7
- Lattal, K. A., Cançado, C. R. X., Cook, J. E., Kincaid, S. L., Nighbor, T. D., Oliver, A. C. (2017). On defining resurgence. *Behavioural Processes*, 141, 8591. doi:10.1016/j.beproc.2017.04.018
- Lattal, K. A., & St. Peter Pipkin, C. C. (2009). Resurgence of previously reinforced responding: Research and application. *The Behavior Analyst Today*, 10(2), 254-266. doi:10.1037/h0100669
- Lieving, G. A., Hagopian, L. P., Long, E. S., & O'Connor, J. (2004). Response-class hierarchies and resurgence of severe problem behavior. *The Psychological Record*, 54(4), 621-634. doi: 10.1007/bf03395495
- Lieving, G. A., & Lattal, K. A. (2003). Recency, repeatability, and reinforcer retrenchment: An experimental analysis of resurgence. *Journal of the Experimental Analysis of Behavior*, 80(2), 217-233. doi:10.1901/jeab.2003.80-217
- Marsteller, T. M., & St. 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

- Mechner, F., & Jones, L. D. (2015). Effects of repetition frequency on operant strength and resurgence of non-criterial features of operants. *Revista Mexicana de Analisis de la Conducta*, *41*, 63-83. doi: 10.5514/rmac. v41.i2.63729
- Nighbor, T. D., Oliver, A. C., & Lattal, K. A., (2017b). Delay of Reinforcement Generates Resurgence. Department of Psychology, West Virginia University, Morgantown WV, USA.
- Peter, C. C. (2015). Six Reasons Why Applied Behavior Analysts Should Know About Resurgence. *Revista Mexicana De Analisis De La Conducta*, *41*(2), 252-268. doi: 10.5514/rmac. v41.i2.63775
- Pipkin, C. S., Vollmer, T. R., & Sloman, K. N. (2010). Effects of Treatment Integrity Failures During Differential Reinforcement of Alternative Behavior: A Translational Model. *Journal of Applied Behavior Analysis*, *43*(1), 47-70. doi:10.1901/jaba.2010.43-4
- Poling, A., & Ryan, C. (1982). Differential-Reinforcement-of-Other-Behavior schedules therapeutic applications. *Behavior Modification*, *6* (1), 3-21. doi/10.1177/01454455820061001
- Rawson, R. A., Leitenberg, H., Mulick, J.A., & Lefebvre, M.F. (1977). Recovery of extinction responding in rats following discontinuation of reinforcement of alternative behavior: A test of two explanations. *Animal Learning & Behavior*, *5*(4), 415–420. doi:10.3758/bf03209589
- Reed, P., & Clark, C. (2010). Impact of intervening learning on resurgence in humans with Autism Spectrum Disorders. *Learning & Behavior*, *39*(2), 163-170. doi:10.3758/s13420-010-0014-2
- Reed, P., & Morgan, T. A. (2006). Resurgence of Response Sequences during Extinction in Rats

- Shows a Primacy Effect. *Journal of the Experimental Analysis of Behavior*, 86(3), 307-315. doi:10.1901/jeab.2006.20-05
- Shahan, T. A., & Sweeney, M. M. (2011). A Model of Resurgence Based on Behavioral Momentum Theory. *Journal of the Experimental Analysis of Behavior*, 95(1), 91-108. doi:10.1901/jeab.2011.95-91
- St. James-Roberts, I., Conroy, S., & Wilsher, K. (1998). Links between maternal care and persistent infant crying in the early months. *Child: Care, Health, and Development*, 24, 353-376. doi:10.1046/j.1365-2214.2002.00089
- 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. doi:10.1002/jeab.26
- Thompson, R. H., Bruzek, J. L., & Cotnoir-Bichelman, N. M. (2011). The Role of Negative Reinforcement in Infant Caregiving: An Experimental Simulation. *Journal of Applied Behavior Analysis*, 44(2), 295-304. doi:10.1901/jaba.2011.44-295
- Volkert, V. M., Lerman, D. C., Call, N. A., & Trosclair-Lasserre, N. (2009). An evaluation of resurgence during treatment with functional communication training. *Journal of Applied Behavior Analysis*, 42, 145-160. doi:10.1901/jaba.2009.42-145
- Winterbauer, N. E., Lucke, S., & Bouton, M. E. (2013). Some factors modulating the strength of resurgence after extinction of an instrumental behavior. *Learning and Motivation*, 44(1), 60-71. doi: 10.1016/j.lmot.2012.03.003

Table 1

Demographics of Participants in Experiment 1

| Participant | Gender | Procedure Order |
|-------------|--------|-----------------|
| 1 | Male | 3 , 4 |
| 2 | Female | 3 , 4 |
| 3 | Female | 4 , 3 |

Table 2

Demographics of Participants in Experiment 2

| Participant | Gender | Procedure Order |
|-------------|--------|-----------------|
| Allan | Male | 3 , 4 |
| Ariel | Female | 4 , 3 |
| Jen | Female | 4 , 4 |

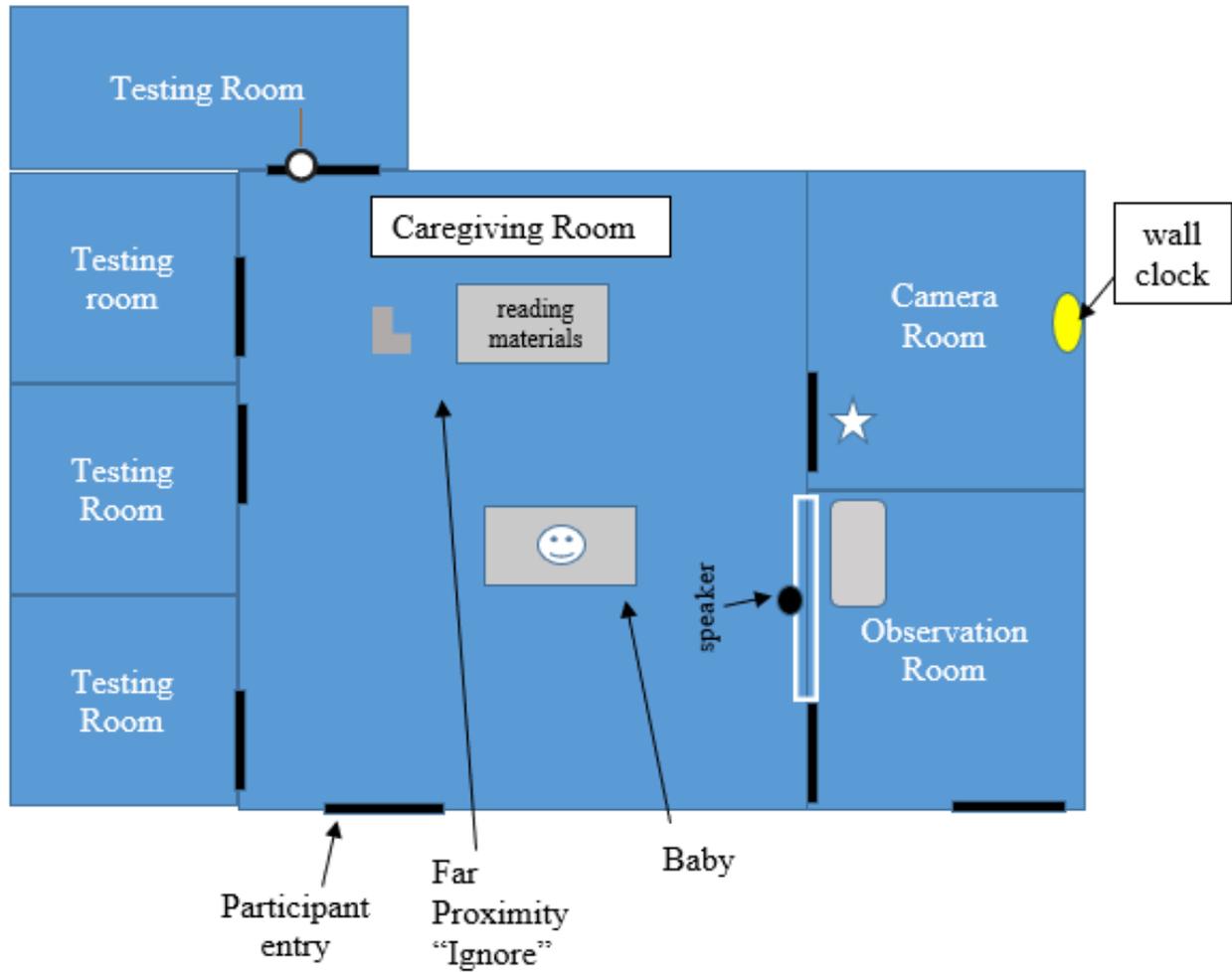


Figure 1. A diagram of the room where Experiment 1 sessions were run and where the materials were located during the experiment. The star represents where the camera was set up in the room.

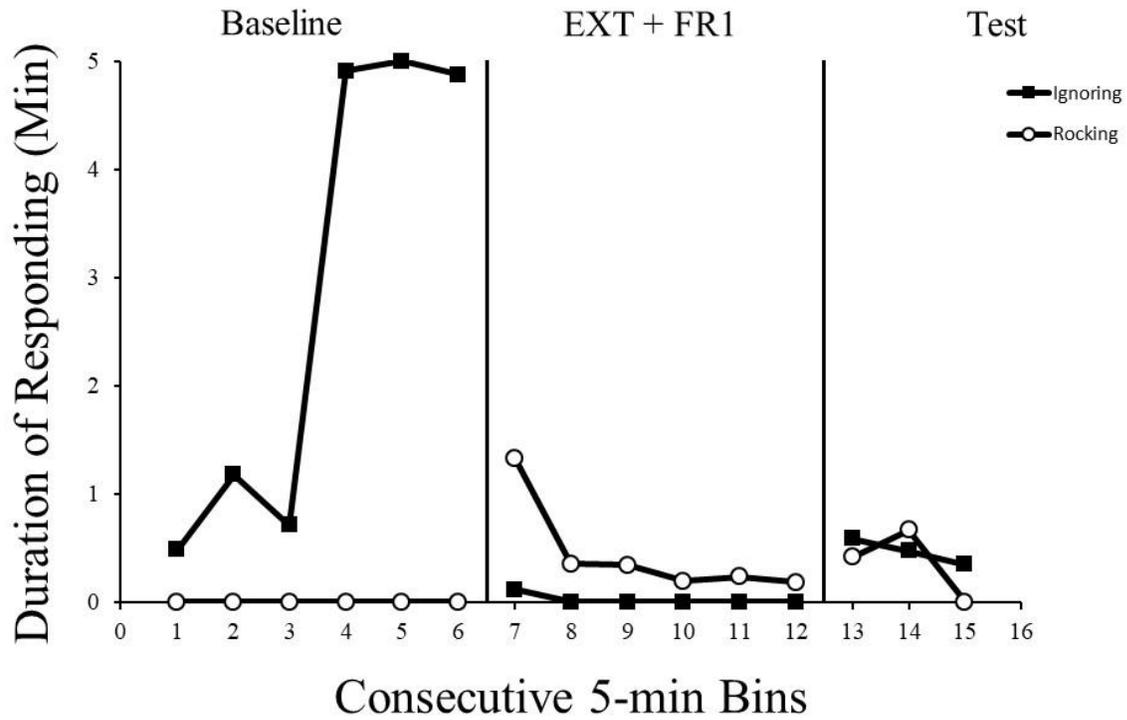


Figure 2. Three-phase procedure data for Emma displays rate of caregiving across consecutive 5-min bins. In this graph maladaptive caregiver behavior is indicated with a square marker and alternative caregiver behavior is indicated with an open circle marker.

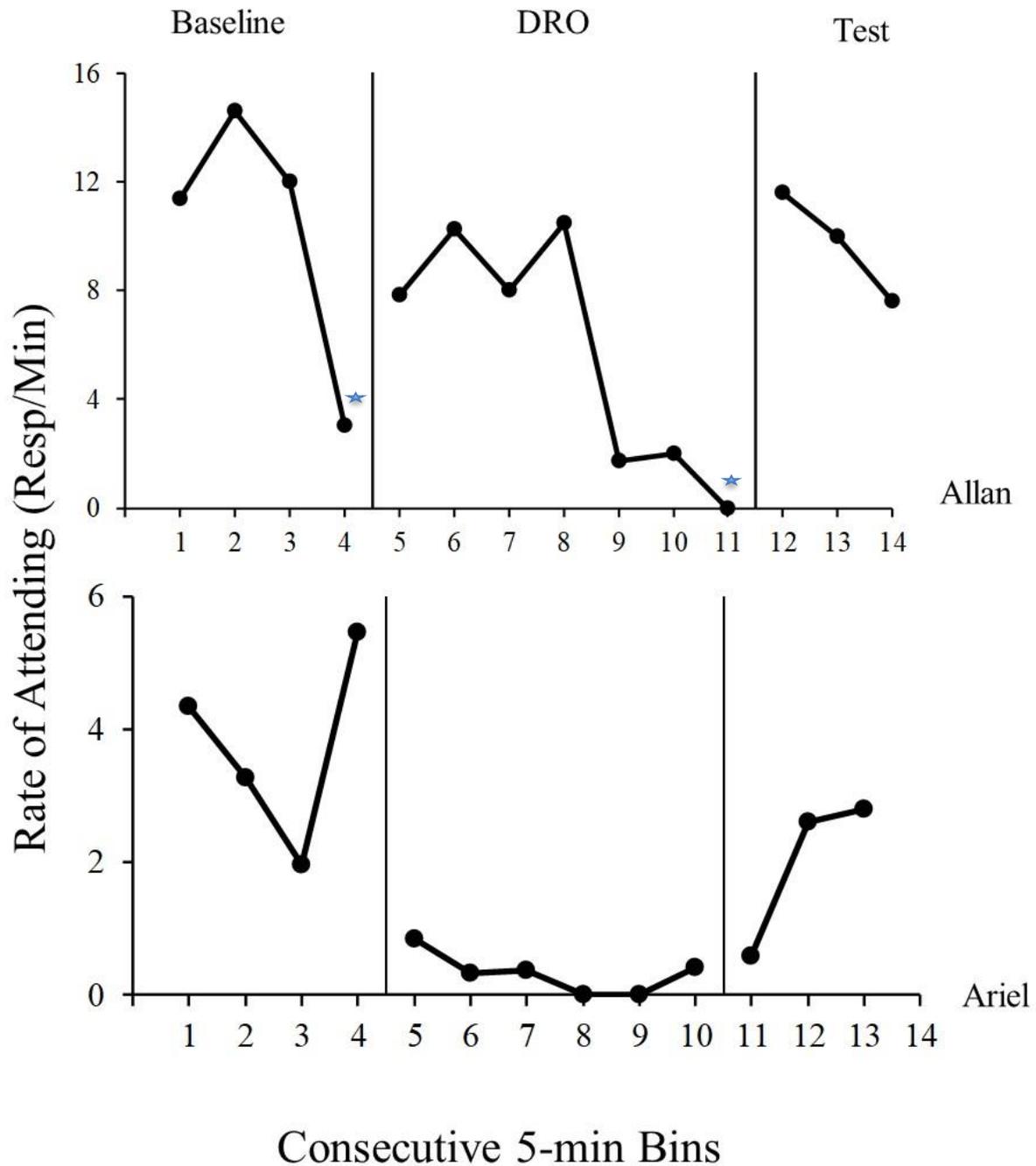


Figure 3. Three-phase procedure graphs for Allan and Ariel which displays rate of attending across consecutive 5-minute bins. In Allan's graph the last data point (Bin 4) of baseline is not 5-min but is only 2 min 20 s. Also, it should be noted that the last data point (Bin 11) in the DRO phase of Allan's graph is only 33 s. These shorter durations are indicated on the graph with a star symbol.

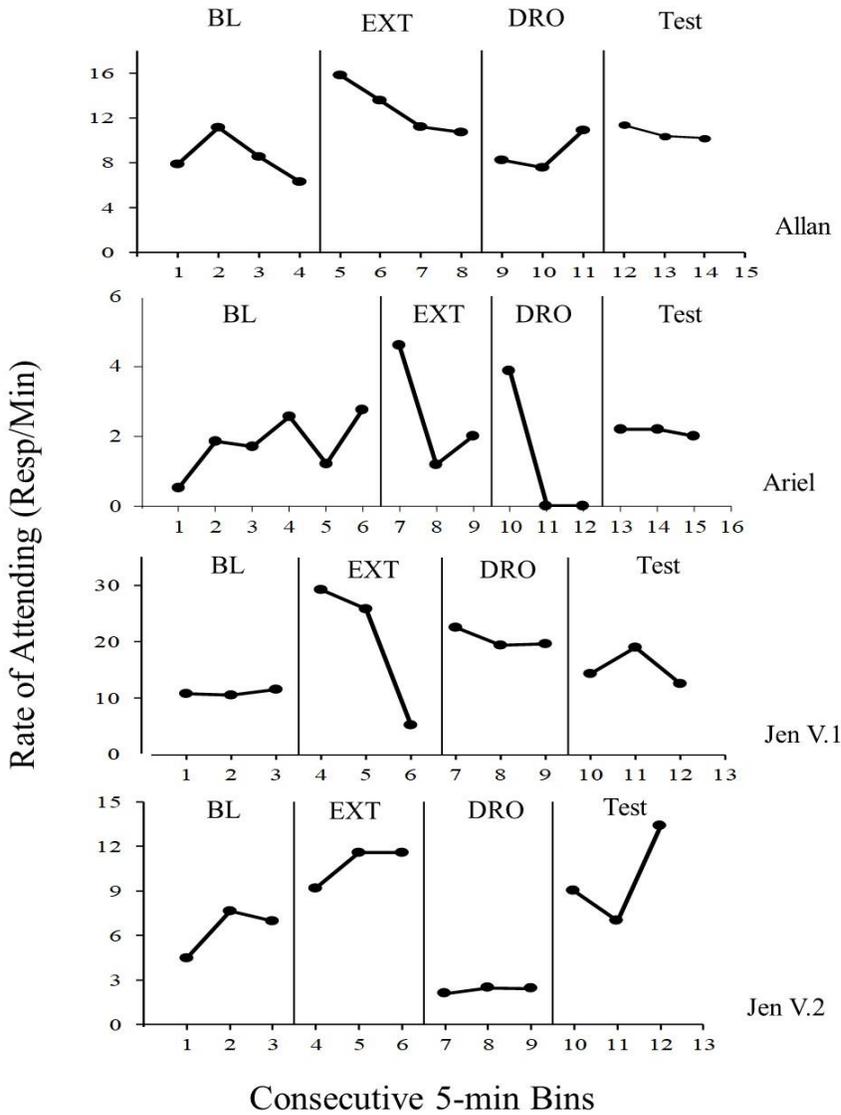


Figure 4. Four-phase procedure graphs for Allan, Ariel, and Jen which display rate of attending across consecutive 5-minute bins. In Allan’s graph the last data point in baseline (Bin 4) is not 5-min but is only 1 min 40 s in duration. Also, it should be noted that the last data point (Bin 8) in EXT phase is only 33.6 s in duration. There are two versions of four-phase procedure graphs for Jen. V.1 is the first version that was run this was the same as the four-procedure for the other participants. V.2 is the second version that was run this included a verbal direction before the DRO phase.

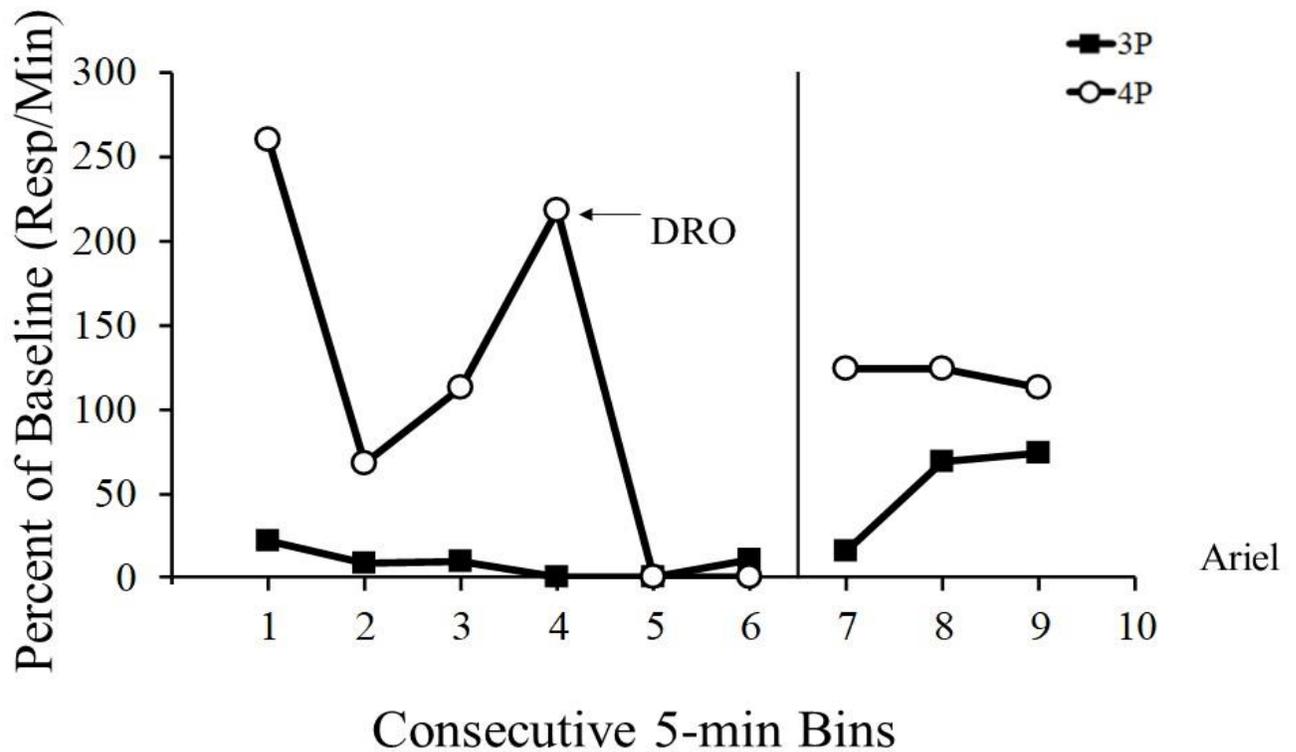


Figure 5. In this graph Ariel's three-phase and four-phase procedures are compared using a percent of baseline graph. The four-phase procedure is indicated with an open circle marker and the three-phase procedure is indicated with a black square. The start of the third phase of the four-phase procedure is indicated with an arrow and a label which reads 'DRO'.

