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Behavioral Contrast Using a Simulated Organizational Task

Brandon M. Ring
Western Michigan University, ring.brandon.m@gmail.com

BEHAVIORAL CONTRAST USING A SIMULATED ORGANIZATIONAL TASK

by

Brandon M. Ring

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Doctoral Committee:

Heather M. McGee, Ph.D., Chair
Alyce M. Dickinson, Ph.D.
Anthony DeFulio, Ph.D.
Kevin J. Munson, Ph.D.

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The purpose of the present study was to bridge a gap between Organizational Behavior Management (OBM) and the Experimental Analysis of Behavior (EAB). Although OBM's historical and scientific roots are nested within EAB, OBM research does not always strictly follow or adhere to basic research definitions or procedures. That is, terms that have specific operational definitions in EAB and Applied Behavior Analysis are sometimes used incorrectly in OBM research. Similarly, these terms are often associated with specific experimental procedures in basic literature, yet OBM research procedures may not follow the strict procedural guidelines. The purpose of the present study was to address these issues by demonstrating behavioral contrast using organizational tasks while adhering to basic paradigm procedures.

Behavioral contrast is a behavioral phenomenon that has a vast research history within EAB literature and a limited research history within applied literature. Despite the limited research history in the applied literature, it may be beneficial to assess if behavioral contrast has a potential use in organizational settings. To date, only one study has demonstrated the phenomenon within an OBM research context, however the procedures and terminology used in that study suggest that the demonstration may be flawed. Therefore, the current study attempted to demonstrate behavioral contrast with behaviors that are typical within business settings while adhering to basic paradigms and correct usage of behavioral terminology.

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INTRODUCTION

Organizational Behavior Management (OBM) is a discipline within the field of Applied Behavior Analysis (ABA) and is based upon the principles of behavior as defined by the Experimental Analysis of Behavior. Specifically, OBM applies behavior analytic principles to address various issues that occur in organizational or business settings (Johnson, Mawhinney, & Redmon, 2001). Having a singular and unifying theory differentiates OBM from other psychological disciplines that address business issues (e.g., Industrial/Organizational psychology), which do not have any one singular or unifying theory (Bucklin, Alvero, Dickinson, Austin, & Jackson, 2000). However, OBM research does not always discuss how the singular theory and its basic principles apply to OBM interventions (DiGennaro-Reed, Henley, Rueb, Crabbs, & Giacalone, 2016; Normand, Bucklin, & Austin, 1999), nor does OBM always use developments from experimental analysis of behavior research in OBM interventions (Luthans & Martinko, 1982; Mawhinney, 1984).

Reviews of the *Journal of Organizational Behavior Management* (JOBM), OBM's flagship journal, have shown that there is a lack of discussion of basic behavioral principles within published OBM research (DiGennaro-Reed et al., 2016; Normand et al., 1999). Normand et al. reviewed research articles published in JOBM between 1992-1997 to determine how often behavioral principles were discussed. For an article to be included in the review, it had to have some discussion of a behavioral principle and not just merely mention a behavioral principle. That is, articles were included only if there was, "…some emphasis on lawful relationships and relevance to principle" (Normand et al., 1999, p. 49). Results indicated that the discussion of behavioral principles in OBM research was lacking and, "… when relevant behavioral principles

are discussed, the discussions tend to be narrow in scope" (Normand et al., 1999, p. 53). DiGennaro-Reed et al. updated Normand et al. to include research articles published in JOBM between 2006-2016. DiGennaro-Reed et al. found that while the trend of discussing behavioral principles has been increasing in comparison to the trend observed by Normand et al., the percentage of articles that discuss behavioral principles is moderate (i.e., only 53% research and case study articles discussed behavioral principles) and represents a gap between articles published in JOBM and basic behavioral principles. The trend of not discussing behavioral principles in OBM research is not novel; it has been observed in JOBM since the journal's earliest days (Mawhinney, 1984). There are many potential reasons for the observed disconnect between OBM research and the experimental analysis of behavior. An initial tenet of JOBM suggested that authors resist from using technical language in an attempt to appeal to non-scientific OBM consumers (i.e., managers or business owners), which could explain why behavioral principles were not discussed in early JOBM articles (Mawhinney). More recently Normand et al. suggested that behavioral principles were not discussed because of the difficulty in translating basic principles and phenomenon to business settings.

While an exact reason for the lack of discussion of behavioral principles in OBM research is unknown, an understanding of basic research and the phenomena that have been observed and studied in experimental analysis of behavior research can be valuable for OBM academics and professionals alike (Normand et al., 1999). This understanding is important for an OBM professional even though the majority of contingencies that typically occur in an OBM setting primarily involve rule-governed behavior (Normand et al.). For example, an elementary understanding of the behavior engendered under immediate consequences compared to delayed

consequences may allow for an OBM practitioner to explain to a manager how to improve employee performance. That is, employee performance is more likely to improve if immediate feedback is delivered on the number of items produced, than if the employee only receives performance feedback during quarterly or yearly reviews. There may be several reasons why immediate consequences may be more effective than delayed consequences in this example. One potential reason is because immediate feedback is likely to be a more accurate account of a specific number of behaviors that are directly related to performance. Whereas, quarterly or yearly feedback is more likely to be less accurate and be in reference to a large number of unspecified behaviors, that may or may not be directly related to employee performance. Furthermore, immediate feedback occasions more opportunities for employees to improve performance than quarterly or yearly feedback.

Knowledge of basic behavioral research also allows OBM researchers to conduct translational or bridge studies and OBM practitioners to apply basic research findings in business settings (Luthans & Martinko, 1982; Sidman, 2011). Despite calls for translational research during the early years of OBM (Luthans & Martinko), translational studies have been more common in other disciples of ABA (e.g., with clinical populations) (Lerman, 2003). A potential reason for the lack of translational research could be due to the strong influence of rule-governed behavior that occurs in business settings (Normand et al., 1999). While the influence of rule-governed behavior may limit the direct application of basic phenomena to applied settings, using basic principles in applied settings may still be of value.

Schedules of Reinforcement

One behavioral principle that was repeatedly researched in early OBM studies is schedules of reinforcement (Aldis, 1961; Dickinson & Poling, 1996; Hantula, 2001; Latham & Huber, 1992). Schedules of reinforcement specify when or which response will produce some consequence (Catania, 2007). Two common types of basic schedules are ratio schedules and interval schedules (Catania). A ratio schedule is an arrangement in which, a certain number of responses must occur prior to reinforcement delivery and the number of responses can be fixed (fixed ratio schedule [FR]) or variable (variable ratio schedule [VR]). An interval schedule is an arrangement in which, reinforcement is delivered following the first response after some duration of time has elapsed and the duration of time can be fixed (fixed interval schedule [FI]) or variable (variable interval schedule [VI]).

Aldis (1961) first suggested that employers could use schedules of reinforcement in their pay structures, as a means of increasing employee performance. Following Aldis, many researchers assessed how manipulating compensation using various reinforcement schedules affected employee performance (Latham & Huber, 1992) or what was later described as the effect of schedules of monetary reinforcement (Dickinson & Poling, 1996). However, there are several issues with the use of schedules of monetary reinforcement in the workplace (Dickinson & Poling).

Issues with Schedules of Reinforcement in OBM

In a review of simulation and field studies, Latham and Huber (1992) assessed the effectiveness of monetary reinforcement delivered under various schedules on worker performance by using different experimental designs (i.e., within-group design compared to

between-subjects design), with different populations (e.g., union workers compared to non-union workers), and by assessing the maintenance of behavior with a long-term follow-up. The review concluded that while there may have been some issues with field applications (e.g., lack of experimental control), schedules of monetary reinforcement were generalizable to the field.

Following Latham and Huber (1992), Dickinson and Poling (1996) re-reviewed each article and determined that the results were, at best, unclear and varied. Specifically, Dickinson and Poling suggested that the results of the reviewed articles did not support Latham and Huber's assertion that schedules of monetary reinforcement were generalizable to the field. In addition to this conclusion, Dickinson and Poling called into question the validity of the schedules of reinforcement used in the reviewed articles compared to schedules of reinforcement used in basic research. The first issue was that reinforcers used in the reviewed studies were secondary reinforcers (e.g., money), while reinforcers used in the basic literature were usually primary reinforcers (e.g., food). A second issue addressed by Dickinson and Poling was the difference in delay of reinforcement. In the reviewed studies the delay was often hours or days, while in the basic studies there was often little to no delay (e.g., 0-30 s) in reinforcement presentation. A third issue was the use of complex behaviors in the reviewed studies. Dickinson and Poling argued that in the articles reviewed by Latham and Huber, behaviors that were needed to gain access to the reinforcer were often long chains of repeated behavior. For example in Yukl and Latham (1975), one behavior consisted of walking, bending, and planting a seedling approximately 1,000 times. This 'behavior' is not similar to simple behaviors (e.g., lever pressing) that are often used in basic research. A fourth difference was the use of base or hourly pay salaries in the reviewed studies, which was not common in basic research. Additionally, the authors noted that studies

with humans also must account for verbal behavior as a confounding variable, which the reviewed studies failed to do. These issues led Dickinson and Poling to suggest the articles reviewed by Latham and Huber, "…are not a good example of how basic research findings successfully drive practical applications, nor behavioral similarities in the basic research laboratory and the workplace" (p. 87).

Most of the differences between basic research and OBM research that were discussed by Dickinson and Poling (1996) are still valid concerns. However, one difference, the use of primary reinforcers (e.g., food) used in basic experiments compared to secondary reinforcers (e.g., money) used in OBM experiments, may warrant further analysis. While the majority of basic experiments use primary reinforcers, conditioned reinforcers (e.g., tokens) are used in basic research with non-human animals (Hackenberg, 2009). Still, a difference may be that secondary reinforcers (e.g., tokens) used with non-human animals often only allow access to one primary reinforcer (e.g., food access only), whereas secondary reinforcers (e.g., money) used with humans are generalizable to many primary reinforcers (e.g., food or water). Researchers have reported generalized functions of conditioned reinforcers (e.g., tokens that could be used to access food or water) with pigeons (DeFulio, Yankelevitz, Bullock, & Hackenberg, 2014). These results suggest that the concern suggested by Dickinson and Poling regarding the use of different types of reinforcers in basic research (i.e., primary reinforcers) compared to OBM research (i.e., secondary reinforcers) may not be as critical now as when originally reported.

Another issue regarding schedules of reinforcement used in OBM settings compared to schedules of reinforcement used in basic paradigms is the design of the schedule itself (Dickinson & Poling, 1996). While Latham and Huber (1992) did acknowledge that, "…the

reinforcement schedules reviewed here were not 'pure'" (p. 138), the reviewed articles themselves often did not describe how the designs were impure. Latham and Huber were not the only authors to note that schedules of reinforcement used in applied OBM settings are not pure; other authors have referred to OBM studies as being an analogue to basic studies (Agnew, 1999) or have termed studies that assess schedules of reinforcement as synthesis studies, "…in which schedules are manipulated to model or build performances that are hypothesized to be controlled by those particular schedules in organizations" (Hantula, 2001, p. 156). While these authors may acknowledge that schedule paradigms that are used in OBM research are only analogues to the schedules used in basic research, to use the same behavioral nomenclature when describing the analogue schedules is incorrect and misleading. It also creates a further divide between OBM and the experimental analysis of behavior (Mawhinney, 1984).

To illustrate, in a basic paradigm during a VR 2 schedule, only the second behavior should produce a consequence, on average, while all other behaviors should not produce a consequence. In one of the articles reviewed by Latham and Huber (1992), the "VR 2" schedule was not designed according to those guidelines. In Yukl and Latham (1975), the "VR 2" schedule was described as, "…they [participants] would receive $4.00 contingent upon planting a bag of trees *and* correctly guessing the outcome of one coin toss" (p. 295). In order for the schedule to be a VR 2, the consequence should have followed the second behavior on average, however this is not what is reported to have occurred. There are several potential issues that must be addressed. The first is the definition of a behavior in the study. Each bag of trees that the participants planted contained approximately 1,000 seeds; therefore, there were 1,000 complex behaviors to plant one bag.

If planting one bag of trees was defined as the target behavior, it may still be incorrect to call the procedure a VR 2 schedule because the participant had to also guess the correct outcome of a coin toss in order to receive $4.00. The guessing of the outcome of a coin toss could potentially be why the schedule was named a VR 2, because, on average, you would correctly guess once every two guesses (i.e., 50% odds); however calling this schedule a VR 2 is incorrect. The schedule would be best described as a random ratio 2 schedule, although the issue of how a behavior is defined may still persist. The "VR 2" schedule arrangement used by Yukl and Latham (1975) is distinctly different than the VR 2 schedules used in basic paradigms.

The issue of the mislabeling of schedules of reinforcement can be found in OBM articles that were not reviewed by Latham and Huber (1992) or Dickinson and Poling (1996). For example, Deslauriers and Everett (1977) attempted to increase bus riding by delivering tokens that were exchangeable for goods and services in the community (e.g., bus rides, food items) using continuous and intermittent reinforcement. The authors reported using a "VR 3" schedule, which was described as, "…an experimenter…presented a token, on the average, to every third passenger as he or she boarded…" (Deslauriers & Everett, 1977, p. 370). Again, this is an incorrect usage of schedule of reinforcement terminology, because when a VR 3 schedule is used in basic paradigms, reinforcers would be delivered after three responses by an organism, on average, not after a third organism, on average, makes a specified response. Naming the procedure used by Deslauriers and Everett a VR 3 schedule is incorrect and may be misleading.

Another example of an incorrect usage of behavioral terms can be found in a series of studies that assessed the effect an individual's reinforcement history has on escalation (e.g., Goltz, 1992, 1993, 2000; Hantula & Crowell, 1994a, 1994b). Escalation is another term for the

sunk cost effect, which occurs when an increase in an investment of some kind (e.g., a monetary investment) is made even after losses have been incurred (Goltz, 1992; Magalhaes & White, 2016). The series of escalation studies assessed the function an individual's reinforcement history plays in escalation, specifically assessing the partial reinforcement extinction effect in comparison to the effect of extinction following continuous reinforcement (Goltz, 2000). In the initial escalation study, after which the following studies were modeled, Goltz (1992) used an investment task in which participants could invest money into an artificial stock market. Investments could range from $0-$10,000 in $100 increments and would yield a return or loss based on the experimental condition. Returns yielded $10 or $30 per $100 invested depending on experimental group, losses yielded a $10 loss per $100 invested for all groups, and $0 invested did not yield a return or loss for any of the groups. Participants were exposed to two phases: an initial training phase in which returns and losses were pre-determined for each group, followed by an extinction phase in which all investments yielded a loss for every group. Experimental conditions differed on the schedule of returns (continuous or partial), the magnitude of returns (large and small), and the duration of training (long, short, or no training).

The first issue with the incorrect use of technical terms in the series of articles on escalation is the use of the term extinction. Skinner (1953) defined operant extinction as, "when reinforcement is no longer forthcoming, a response becomes less and less frequent…" (p. 69) and further clarified this definition by stating, "[extinction] should not be confused with other procedures designed to have the same effect … punishment… involves different processes…" (p. 71). The escalation studies defined extinction in a number of ways including "… the period of continuous losses, in which all subjects received a loss of $10 per $100 invested…" (Goltz,

1992, p. 564), "…ceased to yield returns and every investment in this market resulted in a loss of $10 per $100 invested" (Hantula & Crowell 1994b, p. 610), and "continuous nonreinforcement" (Goltz, 1993, p. 985). The Goltz (1992) and Hantula and Crowell (1994b) definitions of extinction do not describe operant extinction as defined by Skinner. It may be argued that the Goltz (1993) definition of extinction as non-reinforcement would be considered extinction using Skinner's definition. Although, when analyzing the procedure used by Goltz (1993), the extinction phase was described as "…the period of continuous losses…" (p. 984), which would suggest the procedure used is, again, not extinction as defined by Skinner. The behavioral principle that is being described in the escalation articles is negative punishment (penalty), not extinction.

Considering the potential confusion between extinction and punishment, it may be necessary to use a more precise definition of extinction, such as, "…discontinuing the consequences of responding…" (Catania, 2007, p. 389). According to Catania's definition of extinction, the escalation studies' use of the term would be incorrect. Hantula and Crowell (1994a) did note, "… the term 'extinction' in this context is used to describe a procedure rather than a behavioral effect or outcome" (p. 30), however this is the only acknowledgment of the incorrect usage of the term in the series of articles and it only occurs as a footnote. That is, the term extinction continued to be used incorrectly throughout Hantula and Crowell (1994a) and subsequent escalation articles (e.g., Hantula & Crowell, 1994b), which again, could mislead readers.

A second issue with the terminology used in the escalation articles is the incorrect usage of schedule of reinforcement nomenclature. When referring to the schedules used in the

experiments, most of the escalation articles did not use specific schedule of reinforcement labels (e.g., VR 3), instead more generic terms are used such as, "… continuous returns … partial returns-fixed schedule … partial returns-variable schedule…" (Goltz, 1992, p. 565). However, in Hantula and Crowell (1994b), specific schedule of reinforcement labels such as, "…VI 5 s … VI 10 s …" (p. 610), were used. The procedure used in Hantula and Crowell (1994b) was described as, "… the first investment made after the interval elapsed resulted in a gain…and all other investments resulted in losses…" (p. 610). This procedure is not similar to a VI schedule in basic research. In basic paradigms, interval schedules are defined as, "…some minimum time must elapse before a response is reinforced; early responses have no effect." (Catania, 2007, p. 394). Therefore, in Hantula and Crowell the term VI is being used incorrectly and can mislead the readers. Hantula and Crowell do state that these procedures "produced steady rates of investing" (p. 610), although it may be incorrect to identify behavior that is similar in nature to behavior engendered from a schedule of reinforcement as being produced by that schedule itself. That is, just because a schedule produces patterns of behavior that are similar to patterns of behavior produced by VI schedules, does not mean the schedule is a VI schedule.

Behavioral Contrast

Hantula and Crowell (1994b) were using the escalation investment task to demonstrate a behavioral phenomenon known as behavioral contrast. Reynolds (1961) demonstrated the classic example of behavioral contrast in the experimental analysis of behavior. Reynolds defined behavioral contrast as, "a change in the rate of responding during the presentation of one stimulus in a direction away from the rate of responding prevailing during the presentation of a

different stimulus" (p. 69). The change in each rate of responding is determined by comparing current levels of responding to baseline levels of responding.

Reynolds (1961) demonstrated behavioral contrast by exposing pigeons to various schedules of reinforcement and assessing the change in behavior occurring in the presence of one stimulus associated with an unchanged schedule of reinforcement (target component) while the schedule of reinforcement associated with a different stimulus was changed (varied component). The stimuli were presented using a multiple schedule. A multiple schedule is defined as, "a compound schedule in which two or more component schedules alternate, each during a different stimulus" (Catania, 2007, p. 398). In Reynolds' classic study, the target component was associated with a red or orange key light and had a constant VI 3-min schedule while the varied component was associated with a green or blue key light in which the schedule changed each session (i.e., either a VI 3-min, extinction, time out, or a differential reinforcement of other behavior was used). Results indicated that behavioral contrast effects were observed in the target component (i.e., unchanged VI 3-min) when the varied component was either an extinction or time-out schedule (Reynolds). Since this classic experiment, the typical arrangement to demonstrate behavioral contrast has been a multiple schedule in which the VI schedule in the target component is held constant and the schedule in the varied component changes from a VI schedule to an extinction schedule and back to a VI schedule.

Types of Behavioral Contrast

One of the interesting aspects of behavioral contrast is that when the phenomenon occurs, it can have different properties (Williams, 2002). Molar contrast is the overall average difference

in responding that is observed in the target component when some change has been made to the varied component. Most studies that report behavioral contrast are referring to molar contrast.

Two types of molar contrast that are also of interest are positive and negative contrast. Considering behavioral contrast occurs when the rate of responding during the target component is in a direction away from the rate of responding in the varied component, there can be both positive and negative contrast. Positive contrast occurs when the increase in rate of responding occurs in the target component and a decrease rate in the varied component, whereas negative contrast occurs when there is a decrease rate of responding in the target component and an increased rate of responding in the varied component.

Researchers have also looked at within session analyses to determine how the rate of responding changes during the target component (Williams, 2002). These analyses have found behavioral contrast to be either local or anticipatory in nature. Local contrast usually occurs when the varied component precedes the target component, although these results are not always consistent (Williams, 1979). Anticipatory contrast usually occurs when the varied component follows the target component. Rate increases in the target component tend to be more greatly influenced by the following varied component than the preceding varied component (Williams, 1979; 1981). Contrast is said to be local when the largest difference in responding occurs at the start of the target component, whereas contrast is said to be anticipatory if the largest difference in responding occurs near the end of the target component. Local contrast has been found to decline and stop as the number of training sessions increases and the organism more readily differentially responds to the presented stimuli, whereas anticipatory contrast occurs even as the number of training sessions increases and continues to occur with discriminable stimuli

(Williams). Research suggests that anticipatory contrast is the better explanation for molar contrast (Williams).

Punishment and Behavioral Contrast

Following the classic example of behavioral contrast by Reynolds (1961), Brethower and Reynolds (1962) assessed whether behavioral contrast could be observed if the varied component was switched to a punishment schedule instead of an extinction schedule (i.e., punishment contrast). Pigeons were exposed to a multiple schedule in which each component delivered reinforcement on a VI 3-min schedule. During experimental sessions (i.e., addition of punishment) each response resulted in an electric shock in the varied component. The magnitude of shock varied during each experimental session. Results indicated that punishment did engender some contrast in the target component, although responding was variable and induction (i.e., responding in the target component moved in a direction toward responding in the varied component) was also observed. A potential issue in interpreting these results was the use of different shock magnitudes and the variable responding that each magnitude engendered (Crosbie, Michele, Lattal, Anderson, & Brown, 1997).

The limited number of studies that have used punishment schedules to assess for behavioral contrast since the Brethower and Reynolds (1962) article have yielded varying results (Crosbie et al., 1997; Lattal & Griffin, 1972). Crosbie et al. assessed various punishment conditions in order to determine when punishment contrast and when punishment induction were most likely to occur. Results indicated that while punishment contrast did occur, the results were not always similar to typical behavioral contrast (e.g., response rates in the target component did not return to baseline levels when punishment was removed from the varied component) and

punishment induction was more common. Emmendorfer and Crosbie (1999) found that contrast and induction may occur in some pattern (e.g., induction, contrast, induction), although the exact pattern found was different than patterns found in previous studies (e.g., Brethower & Reynolds). Overall, while punishment contrast has been found to occur, the rate of responding has never been found to consistently replicate the pattern of responding found in typical behavioral contrast paradigms.

Behavioral Contrast and Humans

The majority of studies on behavioral contrast have been conducted with non-human animals (Williams, 2002). The limited number of studies assessing behavioral contrast in humans has demonstrated the phenomenon with various populations including infants (Fagen, 1979; Rovee-Collier & Capatides, 1979), typically developing children (Waite & Osborne, 1972), individuals with intellectual disabilities (O'Brien, 1968), and college students (Crosbie et al., 1997; Edwards, 1979; Weatherly, Melville, & McSweeney, 1996). Responses used to demonstrate behavioral contrast have varied from simple behaviors such as leg kicks in infants (Fagen, 1979; Rovee-Collier & Capatides, 1979) or lever presses (e.g., Crosbie et al., 1997; O'Brien, 1968; Weatherly et al., 1996) to more socially relevant behaviors such as aggression (Koegel, Egel, & Williams, 1980) and speech reading (commonly referred to as reading lips) with children who are deaf (Johnson & Kaye, 1979). Punishment contrast has also been examined with humans and has yielded mixed results (Crosbie et al., 1997; Emmendorfer & Crosbie, 1999).

Boyle, Samaha, Slocum, Hoffmann, and Bloom (2016) assessed various types of behavioral contrast (i.e., positive and negative, preceding and following schedule effects, and

local and anticipatory) with three adults with intellectual and developmental disabilities. This study was the first to assess for preceding and following schedule effects with humans and only the second to assess for anticipatory or local effect with human subjects. Researchers studied whether the adults were able to either place an item in a bowl or insert a peg into a pegboard. Different colors were used as the stimuli that were associated with each component. All of the materials used (e.g., pegs, bowls, the researcher's shirt) in a specific component (i.e., target or varied) were the same color. Therefore, if "yellow" was the stimulus associated with the target component, the bowl, items that were to be placed in the bowl, and the researcher's shirt would all be yellow. The researchers used a three component (the components are labeled A, B, and C in Boyle et al., however, in this manuscript in order to differentiate the components from the experimental design the components will be labeled CA, CB, and CC for component A, B, and C, respectively) multiple schedule in which CA and CC were always the target component and CB was the varied component. The schedule associated with the target components for each participant was a VI 60-s schedule or less (i.e., VI 60-s for one participant, VI 30-s for one participant, and VI 45-s for one participant). The exact schedule was based on training response patterns for each participant. A reversal ABAC design was used in which A was baseline, B was extinction, and C was FR 1. Positive contrast was assessed during the extinction phase in both target components (CA and CC). Negative contrast was assessed during the FR 1 phase in both target components (CA and CC). Preceding effects were identified if contrast was observed in the first target component (CA) and following schedule effects were identified if contrast was observed in the second target component (CC). Within session analyses were conducted to determine if local or anticipatory contrast occurred. The authors reported positive contrast was

likely to occur with a following schedule (i.e., larger positive contrast was observed in the target component that followed the varied component) for two of the participants and negative contrast was likely to occur with a preceding schedule (i.e., larger negative contrast was observed in the target component that preceded the varied component) for one participant. Neither local nor anticipatory contrast was observed.

In three experiments, Tarbox and Hayes (2005) assessed the influence that rule-governed behavior has on demonstrating behavioral contrast in humans by manipulating how accurate the rules that were delivered to participants were and how much information was delivered. Each experiment used a random interval (RI) 15-s schedule component and an extinction component to assess for behavioral contrast. Participants earned points by clicking a computer mouse inside of a white box located on a computer screen after the RI 15-s schedule elapsed. The participant with the most points at the end of each experiment earned a cash prize. Experiments differed on how much information about the experimental rules was given to the participants. In the first experiment, participants were told, "… 'clicking on the white square sometimes gets you points'…" (Tarbox & Hayes, 2005, p. 424). In the second experiment, the experimental rules were always visible to the participants and were accurate. During all RI components the rules read, "…Only click on the big white square one time every 15 seconds. Just wait 15 seconds between clicking it…. That is the best way to earn points." (Tarbox & Hayes, 2005, p. 430) and during the extinction components the rules always read, "…It is impossible to earn points right now. Clicking on the square will not get you points or make the experiment go faster. Stop clicking on the square right now'" (Tarbox & Hayes, 2005, p. 430). In the final experiment, participants were only given rules for the extinction component, which were the same rules that

were provided in the second experiment. During RI components the only rules provided were, "… 'clicking on the white square sometimes gets you points'" (Tarbox & Hayes, 2005, p. 432). Results indicated that the most contrast was observed in the third experiment, when only specific rules about the extinction schedule were delivered. That is, the results indicated that rules about the target component might not be as necessary as rules about varied component in order to demonstrate behavioral contrast with human subjects.

Behavioral Contrast as a Behavioral Technology

Given the considerable amount of behavioral contrast research in the basic literature and replications of the phenomenon with humans, it may be beneficial to assess if there is a potential use for behavioral contrast in applied business settings. That is, can behavioral contrast be a useful behavioral technology? In behavior analysis, a behavioral technology is any behavioral technique or behavioral product that has been completely defined, analyzed, and researched, and is used in applied settings (Baer, Wolfe, & Risley, 1968). Pennypacker (1986) suggested that in order for the field of ABA to be a relevant science, behavior analysts, "... must insure that its technologies are adopted in ways that benefit the culture in unmistakable ways" (p. 148). Despite the call for the transfer of behavioral science into a behavioral technology, the field lacks one universally accepted methodology to follow when making a behavioral technique or a behavioral product into a viable behavioral technology.

Pennypacker and Hench (1997) recommended a potential pathway (i.e., an engineering model) to transfer behavioral science to a useable technology. They suggested that behavior analysts begin by determining and identifying processes and procedures of a potential behavioral technology using basic, translational, and applied research. The next step is to apply for patents

for the procedures and then gain funding for a business plan. The final step would be to demonstrate and market the technology to potential consumers. This technology transfer process can be viewed as a linear process, in which the behavioral technology is developed entirely from behavioral research and behavioral methodologies (Mace, 1994). That is, the beginning of a behavioral technology has its roots in basic, translational, and applied behavioral research that identifies the critical attributes of the process or procedure, which is developed using behavioral methodologies. Once the critical attributes are identified, a systematic procedure is determined based on the results of basic and applied research. The process or product is then tested for efficiency and effectiveness by determining all of the variable attributes that do not violate the systematic procedure. Once the most effective and efficient procedure for the process or product has been determined, it becomes a behavioral technology. Finally, the behavioral technology is marketed and distributed in applied settings.

An example of this linear process in which the entire product is developed from behavioral research and behavioral methodologies can be seen in the development of the Headsprout® reading comprehension program (e.g., Layng, Sota, Leon, 2011; Leon, Layng, Sota, 2011; Sota, Leon, Layng, 2011). Prior to developing the software, the developers conducted an analysis of behavioral research concepts and processes to determine how to develop learners' reading comprehension repertoires (Layng et al.). The developers then tested these behavioral concepts and processes to determine which aspects were the critical attributes (e.g., effective strategies that learners use when they comprehend new material) that were necessary to reading comprehension (Sota et al.). Next, the developers tested the variable attributes of the program (e.g., the most effective way to present the material to ensure learning) while developing the

reading program (Leon et al.). Finally, once the programming was completed the product was available to consumers. The entire process took over three years and over two million dollars to develop (Leon et al.).

Although a linear approach of science-to-technology transfer has been used in ABA, it is not accepted practice in all technological fields. For example, Sismondo (2010) suggested that, ".... technology is relatively divorced from science" (p. 94). Instead of science directing technology, it is more common for existing technology to be the catalyst for the creation of new technology. The role of the scientist can then be to improve the technology by using basic science. Sismondo based this opinion on findings reported by Project Hindsight (Sherwin & Isenson, 1967), which was funded by the Department of Defense to determine the contributing factors of new technology development in order to determine how to best allocate future resources (i.e., funding). Results indicated that 91% of the events that contributed to the development of new technology were from existing technology and only 9% of the events were due to science. Furthermore, of that 9%, only .3% was due to basic science (Sherwin & Isenson).

Even though behavioral technology is different than the technology that was reviewed during Project Hindsight (i.e., weapon systems) (Johnston, 1991), the project's findings may still be beneficial for behavior analysis. Considering the rapid pace in which technology is developed today, it may not be beneficial to develop an entire technology based on basic behavioral research. For example, the Headsprout® program cost over two million dollars and three years to develop. The linear approach may be too costly in terms time, money, and practicality if behavior analysis is going to make useful change in real world applications.

Instead of using the linear approach, it may be more time and cost efficient for behavior analysts to improve upon existing technologies by adding behavioral techniques or products to an existing technology. The possibility of improving existing technologies was suggested by Mace (1994), however he cautioned that reliance on existing technology, "...resulted in impaired effectiveness of applied behavior analysis as a whole..." (p. 531). Mace, however, was referring to technologies that are developed by or associated with "competing" branches of psychology and cautioned about the potential issues that could occur if behavioral principles improved those existing technologies. For example, there could be potential harm to behavior analysis as a field, if behavioral products were used to improve an existing technology that was developed using an underlying theory of behavior from a different branch of psychology (e.g., a cognitive psychology technology). That is, the improvement of the existing technology with behavioral products could potentially decrease the acceptance of behavior analysis, because the technology's effectiveness would increase the acceptance of the competing psychological discipline that the technology is associated with, not behavior analysis. This, however, should not prohibit behavior analysts from using behavioral products to improve existing technologies that are not associated with competing branches of psychology. For example, technologies developed from computer science may benefit from the addition of behavioral products.

Potential for Behavioral Contrast in Business Settings

An example of one existing technology that may benefit from the behavioral contrast phenomenon is gamification. Gamification is, "...[the] use of game design elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011, p. 2). In business, gamification is typically a software platform (e.g., an application, website, or e-learning module) that is designed to

increase some aspect of employee or customer performance. Gamification has been used in organizations to increase different types of employee engagement including on task behavior during training and learning tasks, improving the overall quality of work, and energy consumption (Hamari, Koivisto, & Sarsa, 2014). Consequences for engaging in gamified work tasks have included earning points or badges, receiving feedback on individual performance, and the public posting of individual and group leaderboards (Hamari et al.). A review of 24 gamification studies by Hamari et al. suggested that the effects of gamification are typically positive in nature and lead to increases in desired employee performance.

While the idea to use game elements in non-game contexts is not nested in any psychological discipline (i.e., it is not a psychological technology) there have been numerous studies that have attempted to assess and describe potential reasons why using game elements in non-game contexts increases desired behavior (Hamari et al., 2014). All of the studies reviewed by Hamari et al. assessed the motivational impact of gamification in terms of cognitive psychology or cognitive and social psychology. Despite the lack of explanation of gamification's effectiveness from a behavioral perspective, behavior analysts should not be hesitant to use behavioral products to improve gamification platforms. That is, improving the effectiveness of gamification will not reduce the acceptability of behavior analysis even though the current explanations of gamification are from a competing psychological discipline. Instead behavior analysts should be determining why gamification and other relevant technologies (e.g., electronic pedometers such as FitBit®) are effective from a behavioral perspective, as well as attempting to increase the effectiveness of these technologies with behavioral products. Other disciplines that are not associated with the development of gamification have already attempted to improve the

effectiveness of gamification. For example, economists have attempted to improve existing technologies such as gamification using game theory (Easley & Ghosh, 2013).

If a gamification platform is designed similar to the paradigm used in basic research when behavioral contrast is observed (i.e., tasks that are associated with different stimuli are presented in an alternating fashion and the reinforcement schedule changes for one of the tasks) it may be possible to utilize the behavioral contrast phenomenon in a business setting. The demonstration of behavioral contrast may be beneficial to organizations because when behavioral contrast is observed there is an increase above current steady state behavior without an increase in reinforcement density for one of the tasks. Therefore, by manipulating the reinforcer density of one task there would be an increase in the level of responding on another task. The behavioral contrast phenomenon may allow for employers to increase the level of responding on desired tasks above current rates without increasing rewards (e.g., pay, points, badges). For example, in customer service call centers employees are often tasked with returning customer phone calls and emails. Gamification software could be used to increase the number of phone calls and emails that are returned (i.e., employees could earn points for every customer question answered in timely manner). If the tasks are presented for completion in an alternating fashion, then it may be possible to use the behavioral contrast phenomenon to increase one of the tasks above current steady state levels. For instance, if more emails need to be returned than phone calls at certain time, an employer could reduce the reinforcer density (i.e., points earned) that is associated with returning phone calls and see an increase in emails answered. Prior to assessing if behavioral contrast can improve gamification procedures it would be beneficial to determine a procedure that reliably demonstrates the phenomenon with humans in work tasks.

For example, determining the amount of verbal rules that must be told to individuals in order to reliably observe the phenomenon may be necessary.

Previous Demonstration of Behavioral Contrast in a Business Setting

As previously described, Hantula and Crowell (1994b) used an investment task to demonstrate behavioral contrast, which to date is the only behavioral contrast study that may be considered to be business related. Participants were given the opportunity to invest money in two simulated stock markets (Markets A and B), which were presented using a multiple schedule. The VI schedules were either 5 s or 10 s for the six participants (i.e., three participants had "VI 10-s" schedules and three had "VI 5-s" schedules). Market A was the target component for every participant and Market B was the varied component for every participant. Dollars invested were returned only if the investment occurred after a specified time (i.e., each participant's specific "VI" schedule) and all investments that occurred before the allotted time elapsed resulted in money loss. During experimental sessions, the varied component no longer yielded a return on investment and only resulted in money loss. While results indicated that behavioral contrast was observed, several issues should be discussed.

As previously mentioned, the reference to the use of VI and extinction schedules throughout Hantula and Crowell (1994b) may be incorrect and misleading. The procedure used by Hantula and Crowell differs from the procedure used in basic paradigms. In Hantula and Crowell, the varied component during the experimental phase (i.e., when contrast was observed) was referred to as an extinction schedule, however responses that occurred during the component did have an effect and resulted in a loss, which may have functioned as negative punishment.

Similarly, responses during VI schedules that occurred prior to the schedule elapsing resulted in a loss, which, again, may have functioned as negative punishment.

By mislabeling these terms, Hantula and Crowell (1994b) may have confused readers about the procedures that were used. An example of this confusion may be found in Tarbox and Hayes (2005), who outlined the procedures of various behavioral contrast articles, including the procedure used by Hantula and Crowell. Tarbox and Hayes describe Hantula and Crowell's procedure by stating, "the contrast manipulation consisted of changing one component to extinction. Subjects were not informed…that one 'market' no longer returned money on their investments" (Tarbox & Hayes, 2005, p. 421). This description by Tarbox and Hayes indicates that they were misled by the use of the term extinction and believed the procedure to be one in which operant extinction was being used. This may be evident by Tarbox and Hayes's use of the term extinction and that they did not mention that one market now resulted in a loss.

It is possible that behavioral contrast was observed in Hantula and Crowell (1994b) due to the use of a punishment procedure. However, as outlined above, punishment does not consistently produce behavioral contrast and may create a pattern of contrast and induction as more sessions are completed. Therefore, the demonstration of behavioral contrast may be in question.

Current Study

There were three primary purposes of the current study. The first was to demonstrate positive molar behavioral contrast using typical workplace behaviors (i.e., typing letters and numbers on a computer keyboard). This study differed from Hantula and Crowell (1994b) in that the experimental design used was more similar to the procedures used in basic paradigms. That

is, a multiple schedule was used in which the target component is associated with a VI schedule and the varied component changed from a VI schedule to an extinction schedule and back to a VI schedule. Furthermore, during the VI schedule only the first behavior after the interval elapsed produced a consequence and no behaviors produced a consequence during the extinction schedule.

The second primary purpose was to attempt to correct some of the issues that were identified by Dickinson and Poling (1996), which can occur with OBM studies that use schedules of monetary reinforcement. Specifically, there was no delay between the behavior and the consequence, the behaviors were simple instead of complex, there was no base salary used, and the directions attempted to account for rule-governed behavior. The current study, however, did use a secondary reinforcer (i.e., money) as a consequence. While Dickinson and Poling suggested that a difference between basic research and OBM studies was the use of primary instead of secondary reinforcers, reviews of basic research have found that secondary reinforcers are effective in basic research (Hackenberg, 2009) and, therefore, acceptable as reinforcers for the current study.

Finally, the third primary purpose of the current study was to determine some of the methodological variables that are needed to demonstrate behavioral contrast with typically developing verbal adults. Prior to using behavioral contrast in gamification platforms (or other technologies), specific variables (e.g., task duration, type of directions delivered) that are likely to evoke behavioral contrast should be determined.

GENERAL METHOD

Participants and Setting

Participants were undergraduate students recruited from a Midwestern university. Participants were recruited via announcements in undergraduate classes. Participants were deemed eligible to participate if they (a) were able to type on a computer keyboard with both hands (e.g., did not have a hand cast or a broken finger), or (b) were not two times more proficient in correctly typing one character compared to another character during the initial session (i.e., a participant did not correctly type two times as many letter characters than number characters or did not correctly type two times as many number characters than letter characters). No participants were deemed ineligible based on either of these criteria. Eligibility for the first criterion (i.e., ability to type with both hands) was determined via a questionnaire. Eligibility for the second criterion (i.e., typing proficiency) was determined following the initial session by comparing the total amount of correct characters typed on each task.

Sessions were conducted in a small meeting room adjacent to a Psychology lab located in Wood Hall on WMU's main campus. The meeting room had a small table, a chair, and one computer workstation designated for the study. The computer had an Internet connection in order to access the task and an alphanumeric keyboard.

Independent Variable

The independent variable was the application of a VI 30-s schedule or an extinction schedule on one or both experimental tasks. During the VI 30-s schedule, the first correct response after an aperiodic amount of time was reinforced. The duration of each interval varied during the session but averaged 30 s. The program used to create the VI schedule adhered to the

guidelines described by Fleshler and Hoffman (1962). During the extinction schedule there was a discontinuation of reinforcement for any correctly entered response. That is, correctly entered responses did not produce a consequence. The experimental tasks were presented in a multiple schedule consisting of two components (i.e., a target component and a varied component), one component was associated with letter stimuli and the other component was associated with number stimuli. The components were presented in an alternating fashion, with the target component always presented first followed by the varied component. The stimuli that were associated with the target and varied component differed for each participant (see Experimental Procedures section).

Dependent Variable

The dependent variable was the total correct characters emitted during each task. Correct characters were either letters or numbers depending on which experimental task was presented. The experimental task software recorded the number of correct characters to an external database (see Experimental Task section).

Experimental Task

The experimental task involved two individual tasks presented successively. In one task, a participant copied letter characters (letter task) presented on the screen into a response entry bar using an alphanumeric keyboard. In a separately presented task, a participant copied number characters (number task) presented on the screen into a response entry bar using a number line (i.e., the number line was only used during the first part of Experiment 1) or a number keypad (i.e., the number keypad was used during the end of Experiment 1 and during all of Experiments 2 and 3). The tasks were a simplified recreation of a typing and keyboard training program,

which is used to train unemployed drug misusers to be data entry processors (Silverman et al., 2005). Sessions were 10 min in duration for Experiment 1 and 2 and 30 min in duration for Experiment 3. During Experiment 1 and 2, participants spent 5 min completing the letter task and 5 min completing the numbers task during each session. During Experiment 3, participants spent 15 min completing the letter task and 15 min completing the number task during each session. The order in which the tasks were presented for all experiments (i.e., the letter task presented first [for 5 min during Experiments 1 and 2 and 15 min during Experiment 3] followed by the number task or the number task presented first [for 5 min during Experiments 1 and 2 and 15 min during Experiment 3] followed by letter task) was randomly assigned for each participant (see Experimental Procedures section). The Western Michigan University HSIRB approved all aspects of the study prior to implementation (Appendix A, Appendix B, and Appendix C).

The presentation of each task was identical except for the prompt characters being either the letter task (Figure 1) or the number task (Figure 2).

Figure 1. Example of the letter task page.

Figure 2. Example of the number task page.

Participants had the opportunity to match sets of prompt characters by typing into an entry bar located directly below the prompts. Prompts were presented in a single string consisting of 10 sets of three random characters with a space in between each set (Figure 3). Correctly entered responses (i.e., letters or numbers that matched the prompt) appeared in the entry bar directly below the matching prompt, while incorrectly entered responses (i.e., any keystroke that did not match the prompt character) did not appear on the entry bar. The lack of an effect for incorrect responses was similar to other behavioral contrast studies in the basic literature. For example, in McSweeney, Dougan, Higa, and Farmer (1986) responding on a key that was present but not associated with the current component was ineffective. Once all 30 characters were correctly matched, a new string of 30 characters was automatically generated above a new (i.e., empty) entry bar.

Figure 3. Example of the string of 10 sets of prompt characters and the response entry bar.

On each task screen there was a Base Pay and Pay Earned counter on the upper right hand side of the screen (Figure 4). Only the Pay Earned counter was used during the current study. That is, the Base Pay counter was set at and remained at $0.00 for the course of the study. Participants had the opportunity to earn pay for the first correct character (i.e., a letter or a number) that was entered following the end of the schedule interval (i.e., VI 30-s). The amount that participants had the opportunity to earn differed depending on the study ($0.25 for Experiments 1 and 2 and $0.10 for Experiment 3). When pay was earned, the amount of money displayed in the Pay Earned counter increased while flashing green and a tone sounded (Figure 5).

Figure 4. Example of the Base Pay and Pay Earned counters.

Figure 5. Example of the Pay Earned counter flashing green when pay is earned.

The first screen presented to the participant during each session was a practice screen. The letter practice screen was identical to the letter task except for a "Skip" button under the response entry bar, a clock counting down from 10 min on the top of the page, and a "Hear Audio Cue" button that played the "Pay Earned" tone (Figure 6). First, participants had the opportunity to practice typing letter characters. Once all letter characters were correctly entered (i.e., the string of 30 characters), the practice page switched to the number task. The number practice page looked identical to the number task except for the "Skip" button, the clock, which was continuing to count down (i.e., the clock did not restart when the task switched), and a "Hear Audio Cue" button that played the "Pay Earned" tone. Participants then had the opportunity to practice typing numbers. The task presented alternated from letters to numbers until the "Skip" button was selected or the clock reached 0:00. Once the "Skip" button was selected or the clock reached 0:00, the first task was presented (i.e., either letters or numbers, depending on task order). Tasks did not switch back and forth during the actual experiment. That is, after the

practice page only one task was presented (for 5 min in Experiments 1 and 2 and for 15 min in Experiment 3) followed by the second task being presented (for 5 min in Experiments 1 and 2 and for 15 min in Experiment 3). The practice page switched from task to task so participants could practice both tasks and ask any relevant questions. Participants were not allowed to skip the practice page during the initial session until all directions had been read and all questions had been answered. Following the initial session, participants were able to skip the practice page and move on to the first task by selecting the "Skip" button.

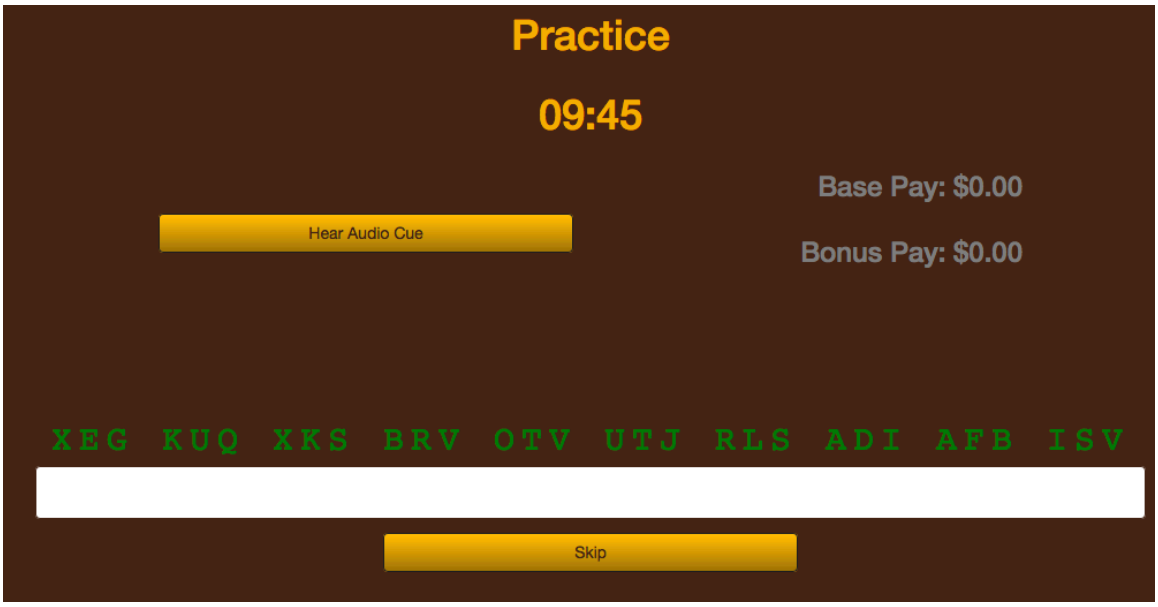

Figure 6. Example of the practice page with letter prompts.

Following the practice page, the first task (either letters or numbers depending on task order) was displayed (for 5 min in Experiments 1 and 2 and for 15 min in Experiment 3). Next a 1 min break page was presented (Figure 7). The break page informed the participant that there was a short break before the next task and a count down clock was displayed. The amount the participant earned during the first task was still visible on the Pay Earned counter. Participants

were able to skip the break page by selecting the “Skip” button. The break page ended either when the “Skip” button was selected or the clock reached 0:00. Following the break page, the second task was presented. The Pay Earned counter reset for the second task and start at $0.00. After the second task was completed, a “Finished” page appeared informing the participant of the total amount earned from the session and thanked the participant (Figure 8).

Figure 7. Example of the break page that was presented between the tasks.

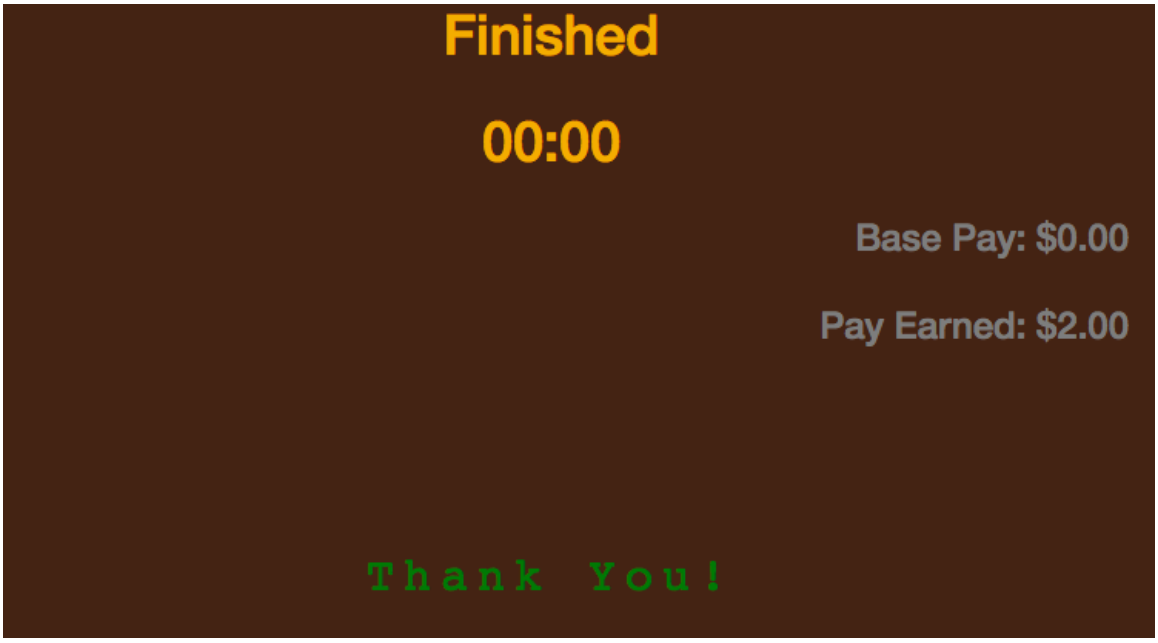

Figure 8. Example of the Finished page that was presented after the end of the second task.

Data from each session were saved to an external database. Data included the participant code number, session number, date, task order (i.e., which task was presented first and second), session duration, variable interval schedule, pay earned amount, total number of characters entered, total number of correct characters entered, total characters entered per min, correct characters entered per min, number of reinforced characters entered for each task, and total money earned for each task.

Experimental Procedures

Participant recruitment. The first author emailed instructors of undergraduate psychology classes and requested permission to give a brief in class announcement in order to recruit participants for the study (Appendix D for Experiment 1 and 2 and Appendix E for Experiment 3). Students expressed interest by completing an individual form in which the

student listed his or her name, email, and telephone number (Appendix F). Following in class announcements, the first author emailed students who expressed interest in participation an online questionnaire (Appendix G) to assess for the first criterion of eligibility (i.e., typing ability). The emailed questionnaire asked students if they were able to type with both hands (e.g., did they have a cast on one hand or a finger). All students who completed the questionnaire reported that they were able to type and therefore meet that criterion of eligibility. If a student had been ineligible he or she would have received an email explaining that they were not eligible for the current study and would have thanked the student for his or her time (Appendix H).

Eligible students received an email informing them of their eligibility for the study (Appendix I). All students whose eligibility was determined after the predetermined number of participants had been reached (i.e., nine participants during Experiment 2) received a waitlist email, which informed the students of their eligibility and that they had been placed on the waitlist (Appendix J).

Study procedures. Invited eligible students scheduled an individual meeting time with the first author (hereafter to be referred to as researcher) by emailing the researcher and signing up for an open session time slot (Appendix I). Prior to the first session, the researcher read the informed consent (Appendix K for Experiment 1 and 2 and Appendix L for Experiment 3) while the participant was asked to follow along on her copy. Once the informed consent was read, the researcher answered any questions the participant had about the study. Finally, the participant signed two copies of the informed consent and the participant kept one copy and the researcher kept the other copy.

Following the informed consent signature, the researcher read the instructions about the experimental task (Appendix M for Experiments 1 and 2 and Appendix N for Experiment 3) to the participant. The instructions explained that the participant would be engaging in two tasks, a letter task and a number task, and would earn pay every session, although sometimes she may not receive any pay during a task. The instructions also explained that any pay earned was tallied in the upper right hand corner of the screen for each task. When money was earned, the Pay Earned counter increased (by $0.25 for Experiments 1 and 2 and by $0.10 for Experiment 3) while the counter flashed green and a tone sounded. Finally, the instructions informed the participant that pay earned would be delivered at the end of each session and could total up to approximately $70 for the entire study. The participant was asked if she had any questions at that time. The researcher answered all questions by restating the instructions. Reading of the informed consent and instruction script occurred in a different room than the room in which the experimental computer was located.

Following the instructions, the researcher set up the computer task while the participant waited outside of the room. This ensured that the participant did not see the task parameters. On the initial task configuration screen, the researcher entered the session information (see the Method section of Experiment 1, 2, and 3 for specific task information) (Figure 9). Once the submit button was pressed, the practice page was only available for 10 min. Therefore, the researcher waited until the participant arrived and had all of her questions answered prior to submitting the information on the task configuration page. Setting up and submitting the task configuration screen took approximately 5 s.

Figure 9. Example of the task configuration page.

The first author determined each participant's specific task order prior to the beginning of the study. The order of the task presentation (i.e., numbers or letters presented first) was determined by a flip of a coin for the first participant. The order of task presentation for the second participant was the reverse order. For example, since the coin flip determined that the order of task presentation for the first participant (Participant 122) was numbers then letters, the order for the second participant (Participant 180) was letters followed by numbers. Presentation order for the third participant was again determined by the flip of a coin and the reverse order used for the fourth participant. The same procedure was used for the remaining participants. The task presented first was always the target component and the task presented second was always the varied component. During experimental sessions the task placed on extinction was always

associated with the varied component. For example, since the order presented to the first participant (Participant 122) was numbers then letters, letters was placed on extinction. The task that was placed on extinction was designated for that participant for all experimental sessions.

Once the task configuration screen information was submitted and the task practice screen appeared, the researcher asked the participant sit down in front of the computer. The researcher again described the task to the participant with the practice screen visible (Appendix O for Experiments 1 and 2 and Appendix P for Experiment 3). The researcher explained that the practice screen looked similar to the letter task except for the timer that was counting down, the "Skip" button, and the "Hear Audio Cue" button (i.e., the actual letter task screen did not have a timer, a "Skip" button, or a "Hear Audio Cue" button). The researcher first demonstrated the letter task by correctly typing out the first three letters that appeared on the screen into the task entry bar. The researcher informed the participant that any letter typed correctly would appear directly under the prompt letter. Next the researcher correctly typed the fourth letter and informed the participant that the program would move the letters along the entry bar automatically and did not need to press the space key. Next, the researcher incorrectly typed a letter character and informed the participant that any incorrect keystroke would not register on the entry bar and did not need to press the backspace or delete key.

The researcher then directed the participant to look at the Base Pay and Pay Earned counters on the upper right hand side of the screen. The researcher informed the participant that only the Pay Earned counter would be used during the current study and that the Base Pay counter would be set at and would remain at $0.00. The participant was also informed that while the Pay Earned counter would accrue money from time to time during the session that did not

mean the participant would always earn money. If money were earned, the amount shown on the Pay Earned counter would increase, the amount earned would flash green, and a tone would sound. The researcher demonstrated the sound by pressing the “Hear Audio Cue” button.

The participant was then told to type letters to practice the task. The researcher informed the participant that the program generated a new string of characters automatically. That is, the participant did not need to press any keys (e.g., enter [return], space bar, tab) other than letter and number keys and that no other key presses would be recognized or functional.

When the first string of letters was completed, the practice page switched to the number task. The researcher informed the participant that the number task looked identical to the letter task, except that number characters were presented. The researcher reiterated that during the actual session the tasks would not switch back and forth and that only numbers or letters would be presented together. The researcher again demonstrated that correctly entered numbers appeared below the prompt number, that incorrect keystrokes did not appear, and that the space bar did not need to be pressed.

The researcher informed the participant that the Pay Earned counter would reset for each task, but she would receive the total amount earned during both tasks at the end of the session. The researcher again asked if the participant had any questions and answered the questions by restating the instructions. Finally the researcher informed the participant that in between the two tasks there would be a short break, which she could skip by pressing the “Skip” button. The researcher told the participant that she could start the first task at any time by pressing the “Skip” button or that she could continue to practice until the clock reached 0:00. Following the

completion of both tasks, the computer screen informed the participant that the session was complete. The researcher paid the participant the money earned during the entire session.

Immediately following the initial session, the researcher assessed for the participant's typing proficiency to determine if the participant met the proficiency eligibility criterion for the study (i.e., the participant would be deemed ineligible if she was able to type more than two times the amount of one character compared to the other character). This criterion was established because task ability does not factor into basic research on behavioral contrast and the researcher wanted to ensure that the procedure in the current study was as similar to basic research as possible. All participants who completed the initial session were deemed to be eligible for the study and were invited sign up for more sessions. If a participant had been ineligible due to the proficiency criterion, she would have received an email following the initial session (Appendix Q) informing her that she was ineligible for the study.

After the final session, each participant was asked the debriefing questions (Appendix R), read the debriefing statement (Appendix S), thanked for her time, and paid the amount earned for the final session. Debriefing questions asked the participant (a) if she preferred one task compared to the other and why, (b) if she thought she performed better on one task compares to the other, and (c) what the she thought was occurring during the study. Debriefing consisted of informing the participant the purpose of the study, explaining the experimental sessions, and answering all questions.

Experimental Design

During baseline sessions, phase changes occurred once steady state responding was observed for a minimum of three sessions or after no change was observed for approximately 10 sessions, whichever occurred first. Steady state responding was said to occur during baseline sessions when, (a) total correct responses for each component in the previous three sessions was within 25% above or below the average correct responses for the previous three sessions in both components combined, and (b) there were no trends or cyclical patterns identified via visual analysis. During experimental sessions, phase changes occurred when contrast was observed for three sessions or after no change was observed for approximately 10 sessions, whichever occurred first. Contrast was said to occur when, (a) the level of responding for the target component was above baseline levels for at least three sessions, (b) no downward trends were identified via visual analysis for at least three sessions for the target component, (c) responding on the varied component was at near zero levels, and (d) no upward trends were not identified via visual inspection for at least three sessions for the varied component. These criteria were adapted from the steady state criteria used in Boyle et al. (2016).

EXPERIMENT 1 METHOD

Participants

Three undergraduate (two female and one male) psychology students participated in Experiment 1. Participants ranged in age from 21 to 24 years old and were all in their senior year of their undergraduate degree. The participants did not receive extra credit for any class for participating in the study.

Experimental Procedures

Following in class announcements in three undergraduate classes, 18 students completed the study interest form (Appendix F) and one student independently emailed the first author expressing interest in study. All 19 students were emailed the online questionnaire (Appendix G) to assess for eligibility for the first criterion (i.e., ability to type with both hands). Of the 19 students who expressed interest in the study, nine replied that they did not have anything that prohibited them from typing and were deemed eligible for the study while the remaining 10 did not return the email. All nine students who were deemed eligible were invited to set up a time to meet with the first author (Appendix I), review and sign the informed consent (Appendix K), and complete the first session. Four of the nine students replied to set up a meeting time and the remaining five did not reply to the email. Of the four students who set up a meeting time, three attended the first meeting and one did not attend. All three students who attended their first meeting met the second eligibility criterion (i.e., typing proficiency). These three students completed Experiment 1.

Once the participants were deemed eligible for the study (i.e., following the analysis conducted after the first session) they were initially invited to sign up for a maximum of three

sessions per day as long as the start of each session was separated by at least one hour from the end of the previous session (e.g., a participant could sign up for a session starting at 2:30 pm on Monday only if the previous session ended at or before 1:30 pm Monday). However at the end of Experiment 1, participants were allowed to sign up for consecutive sessions (i.e., three sessions conducted back-to-back-to-back). This change was conducted in order to assess the effects consecutive sessions had on responding (see Experiment 1 Experimental Design section below).

During Experiment 1, sessions were 10 min in duration (5 min for the letter task and 5 min for the number task) and participants had the opportunity to earn $0.25 for the first correct character (i.e., letter or number) that was entered following the end of the schedule interval (i.e., VI 30-s). During baseline sessions, the task parameters that were entered on the initial task configuration screen were the participant's code number, the session number for the participant, 10 min total session duration (5 min for each task), 30 s for the VI schedule for both component tasks, $0.25 for correct response pay for both tasks, and the participant's specific task order (target component first, then varied component). During experiential sessions, when the varied component task was placed on extinction, the researcher entered the participant's code number, the session number, 10 min total session duration (5 min for each task), 0 s for the VI schedule for the varied component task placed on extinction, 30 s for the VI schedule for the target component task, $0.00 for correct response pay for the varied component task placed on extinction, $0.25 for correct response pay for the target component task, and the participant's specific task order (target component first, then varied component).

Experimental Design

The original intent for Experiment 1 was to use an ABA reversal design, in which during baseline phases (Phase A), both components had a VI 30-s schedule and where during the experimental phase (Phase B) the target component had a VI 30-s schedule and the varied component had an extinction schedule. However, all three participants did not produce typical extinction behavior (i.e., responding on the varied task continued during extinction) during experimental sessions (Phase B) and therefore different experimental designs were implemented to determine how to manipulate the experimental procedure in order to consistently observe typical extinction behavior. The variables that were manipulated were (a) when information was delivered, (b) the type of information delivered, (c) the type of keyboard used during the number task, and (d) the number of sessions that could be completed at one time.

The first variable that was manipulated was when the directions about the task were delivered. Specifically, the timing of verbal instructions that informed the participant when it was possible to earn money during the task, which was originally only delivered prior to the first session. Considering the delay between the first session and the experimental sessions, the researcher posited that the participant could be behaving according to self-developed rules about responding. Therefore the researcher decided to restate rules that were delivered during the instructions (Appendix T), prior to every session. The researcher stated, “Remember you will earn money every session, however you may not earn money on every task. There is a counter on the upper right hand corner that shows the amount of pay earned. If you earn pay, the “Pay Earned” counter will flash green while the amount you earned will increase by $0.25, and a tone will sound. You will get to keep all the money you earn on each task. Remember that you will

not always earn money on every task." This change is referred to as "half instruction" in the following sections. Phases when no instructions were read prior to a session are referred to as "no instructions" in the following sections.

When behavior did not consistently change for all participants following the implementation of the half instructions, a second change was made in which more rules were stated to the participant prior to each session (Appendix U). In addition to the half rules statement the researcher also stated, "You do not have to type if you do not want to. Feel free to use your phone or do other tasks. You will be able to keep all the money you earn for correctly typing the characters and can not lose the money you already earned if you stop typing.", prior to every session. These rules were completely novel to the participants since they were not stated during the instructions or at any other time. This change is referred to as "full instruction" in the following sections.

The next change was made to assess the effect that using a number keypad during the number task would have on responding. This change was not made to evoke typical extinction behavior; instead this change was made to see if responding on the two tasks would be more similar compared to when the number line above the letters was used. When the keypad was used is referred to as "keypad" in the following sections. When the number line above the letter keys was used is referred to as "number line" in the following sections.

The third, and final, change that was made to evoke typical extinction behavior was to run three sessions consecutively back-to-back-to-back instead of only allowing participants to participate in one session per hour and three total sessions per day. During consecutive sessions, once a participant completed a session, he or she informed the researcher and waited outside of

the session room while the researcher immediately entered the parameters for the next session and pressed the submit button. The researcher then paid the participant the amount earned during the previous session and allowed the participant to start the next session. The break in between each session was approximately 1 min in duration. When sessions were conducted back-to-back-to-back, it is referred to as "consecutive sessions" in the following sections. When only one session was conducted per hour, it is referred to as "single session" in the following sections.

For Participant 122 an ABCDEA′A″ design was used and the task order was numbers then letters for the entire study[1]. During the baseline phase (Phase A) both components had a VI 30-s schedule, no instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the first experimental phase (Phase B) the target component had a VI 30-s schedule, the varied component had an extinction schedule, no instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the second experimental phase (Phase C) the target component had a VI 30-s schedule, the varied component had an extinction schedule, half instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the third experimental phase (Phase D) the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the fourth experimental phase

[1] Prior to Session 10, Participant 122 ran a 10 min session in which letters were presented first because the task order was incorrectly entered by the researcher. The participant was paid for that session (i.e., $2.25) and immediately conducted another session with the correct task order (i.e., numbers then letters). Data from this incorrect session are not included in Figure 10.

(Phase E) the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the session, the keypad was used, and only a single session was allowed. During the second baseline phase (Phase A′) both components had a VI 30-s schedule, full instructions were read prior to the start of the session, the keypad was used, and only a single session was allowed. During the final baseline phase (Phase A″) both components had a VI 30-s schedule, full instructions were read prior to the start of the session, the keypad was used, and consecutive sessions were allowed.

For Participant 180 an ABCD design was used and the task order was letters than numbers for the entire study. During the baseline phase (Phase A) both components had a VI 30-s schedule, no instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the first experimental phase (Phase B) the target component had a VI 30-s schedule, the varied component had an extinction schedule, no instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed[2]. During the second experimental phase (Phase C) the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the third experimental phase (Phase D) the target component had a VI 30-s schedule, the varied component had an extinction

[2] Prior to session 7, Participant 180 ran a 5 min session because the researcher incorrectly entered the session duration. The participant was paid the money earned during that session ($1) and immediately ran another session with the correct duration (10 min). Data from this incorrect session are not included in Figure 11.

schedule, full instructions were read prior to the start of the session, the keypad was used, and consecutive sessions were allowed.

For Participant 136 an ABCD design was used and the task order was numbers then letters for the entire study. During baseline phase (Phase A) both components had a VI 30-s schedule, no instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the first experimental phase (Phase B) the target component had a VI 30-s schedule, the varied component had an extinction schedule, half instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the second experimental phase (Phase C) the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the session, the number line above the letters was used, and only a single session was allowed. During the third experimental phase (Phase D) the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the session, the keypad was used, and consecutive sessions were allowed.

EXPERIMENT 1 RESULTS AND DISCUSSION

All three participants failed to demonstrate extinction behavior under experimental conditions used in basic paradigms and therefore did not have the opportunity to demonstrate behavioral contrast (see Table 1 for general information for each participant). Once the typical basic paradigm failed, variables were manipulated to determine how to evoke typical extinction behavior using the experimental task. Results of these manipulations were used to determine the procedures for Experiment 2.

Table 1

Experiment 1 General Participant Information

Participant	Task Order (Target Component-Varied Component)	Total Sessions	Reinforcers Produced (Total Possible)	Money Earned
122	Numbers-Letters	17	225 (225)	$56.25
180	Letters-Numbers	12	153 (153)	$38.25
136	Numbers-Letters	13	162 (262)	$40.50

Participant 122's (Figure 10) correct responding on the varied component task (letters) was consistent during all phases. Correct responding was steady on the target component task (numbers) during Phases A, B, C, and D, but increased when the keypad was used during Phases E and A′A″. Typical extinction behavior did not occur for the varied component task (letters) during any of the experimental sessions (i.e., Phases B, C, D, and E) despite instructions (i.e., half instructions during Phase C and full instructions during Phases D and E) being delivered prior to every session. Participant 122 was the only participant to return to baseline during Experiment 1 (Phase A′A″). The level of responding on both tasks during the return to baseline

phase was similar in comparison to the level of responding observed during the previous phase (i.e., Phase E).

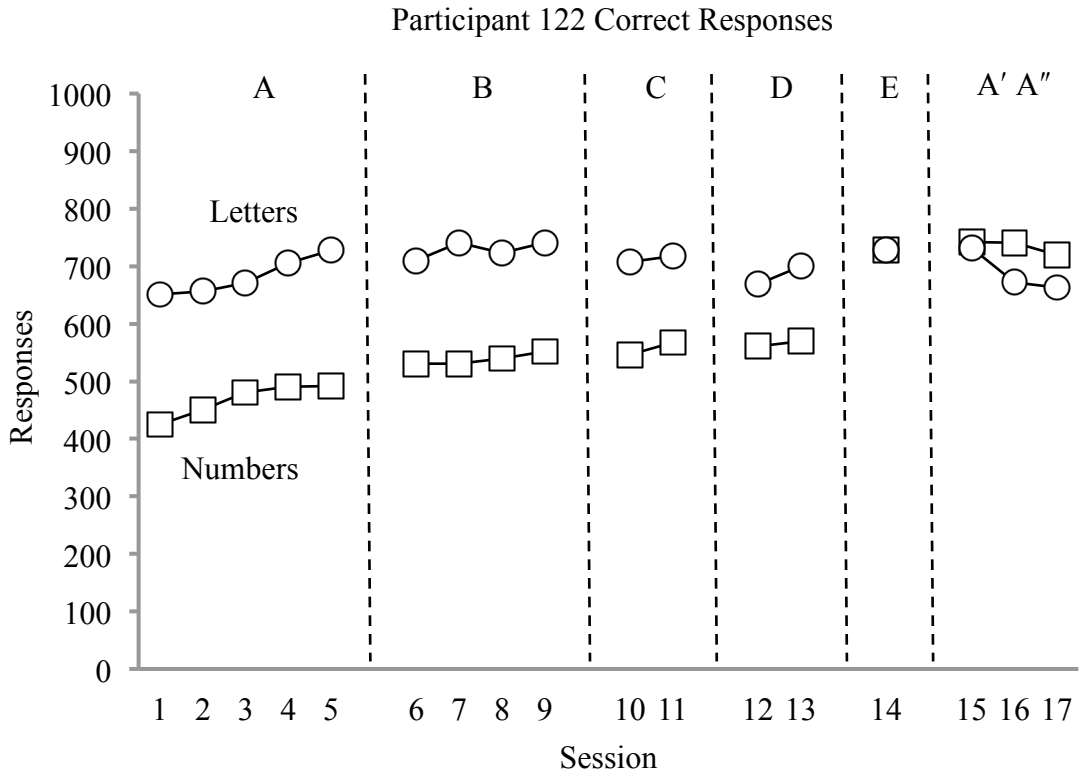

Figure 10. Correct responses during each task for Participant 122. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Correct responding was also consistent for Participant 180 (Figure 11) throughout the study. Levels of responding were fairly equal on both tasks during each phase. Responding on the varied component task (numbers) did not decrease near zero levels when the extinction contingency was added (Phase B), full instructions were delivered (Phase C), or when sessions were conducted consecutively (Phase D).

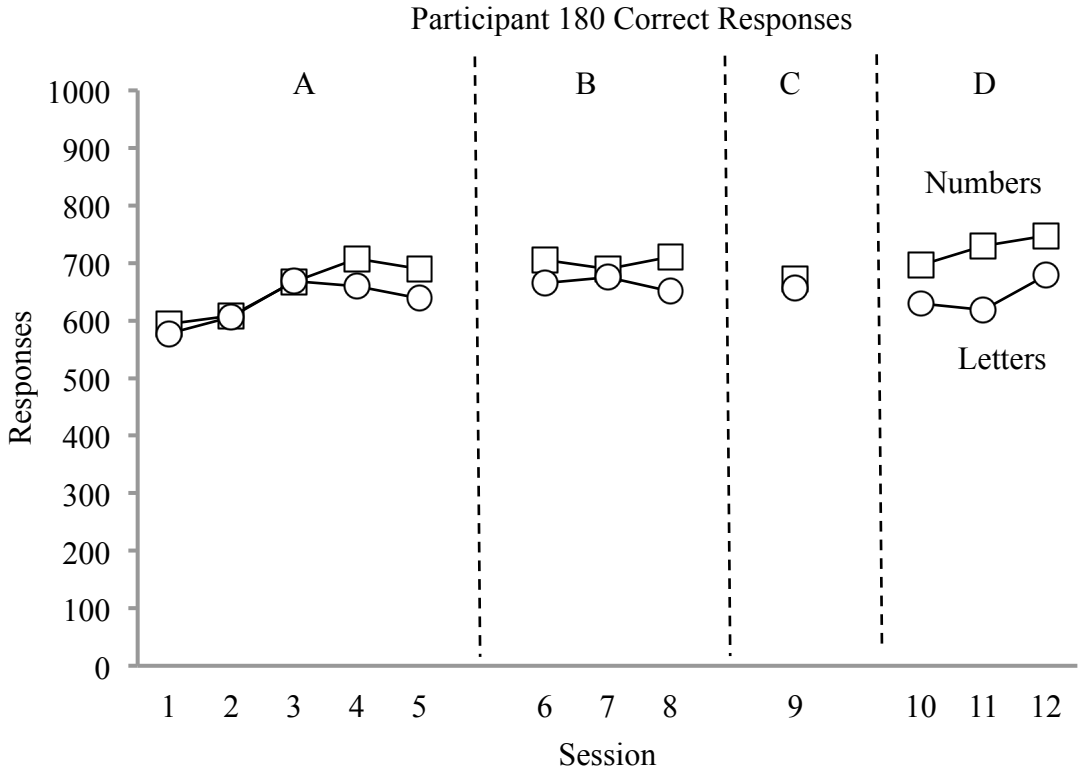

Figure 11. Correct responses for each task for Participant 180. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Participant 136 was the only participant to potentially demonstrate extinction behavior (Phase D) during Experiment 1 (Figure 12). Similar to Participants 122 and 180, delivering the half instructions (Phase B) and the full instructions (Phase C) did not affect responding. Correct responding on the varied component task (letters) did slightly decrease when the full instructions were first delivered (Session 9), however correct responding returned to previous levels during the following session. Furthermore, when correct responding during Session 9 was assessed in 30 s bins (Figure 13) using a within session analysis, the researcher observed that responding did not decrease and remain at zero levels, as is typical during extinction behavior. Instead, responding stopped during the second min (Bin 4) and immediately increased to previous levels

during the next min (Bin 6) and maintained at that level for the remainder of the session. Typical extinction behavior was observed in the varied component task (letters) in Phase D during Session 13 (Figure 14) when sessions were conducted consecutively. Responding decreased to zero levels during the second min (Bin 4) and remained at zero for the remainder of the session. This was the only example of typical extinction behavior that was observed during Experiment 1.

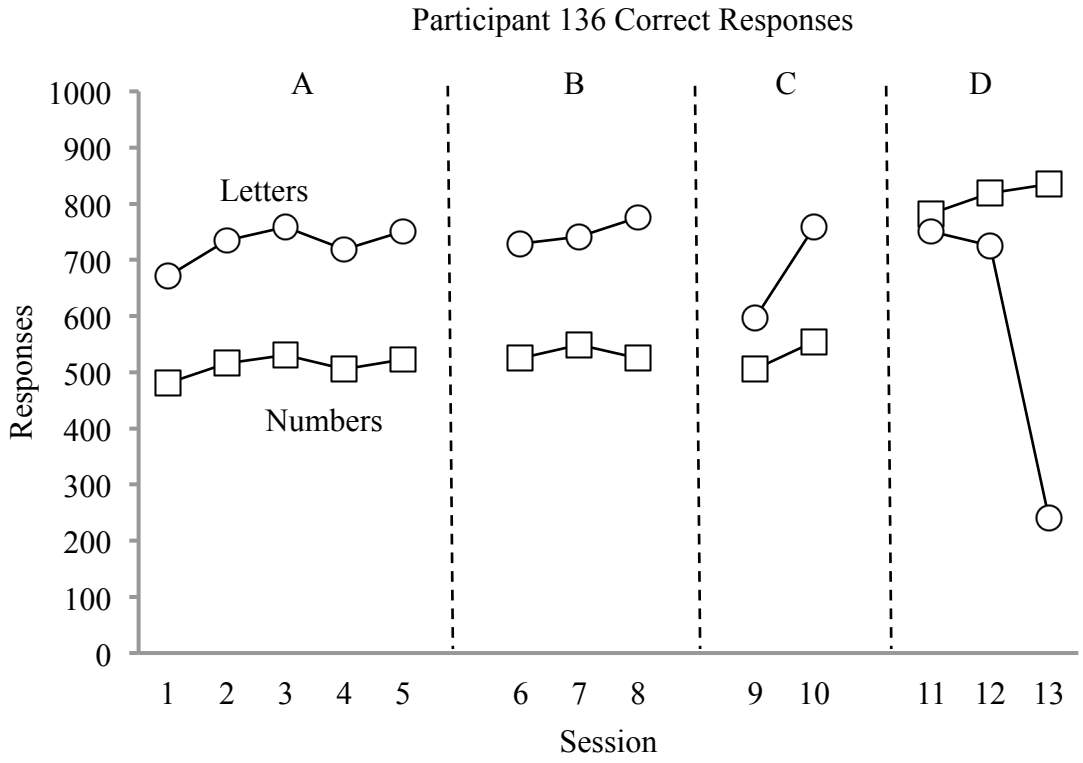

Figure 12. Correct responses during each task for Participant 136. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

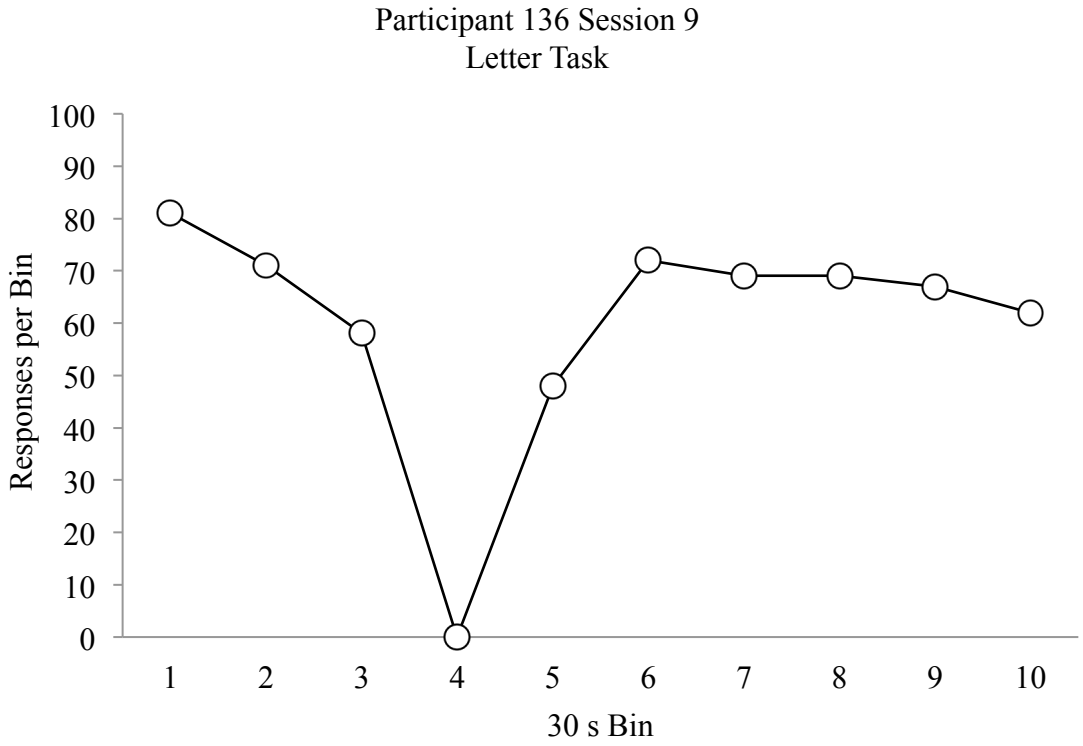

Figure 13. Correct letter responses during Session 9 in 30 s bins for Participant 136.

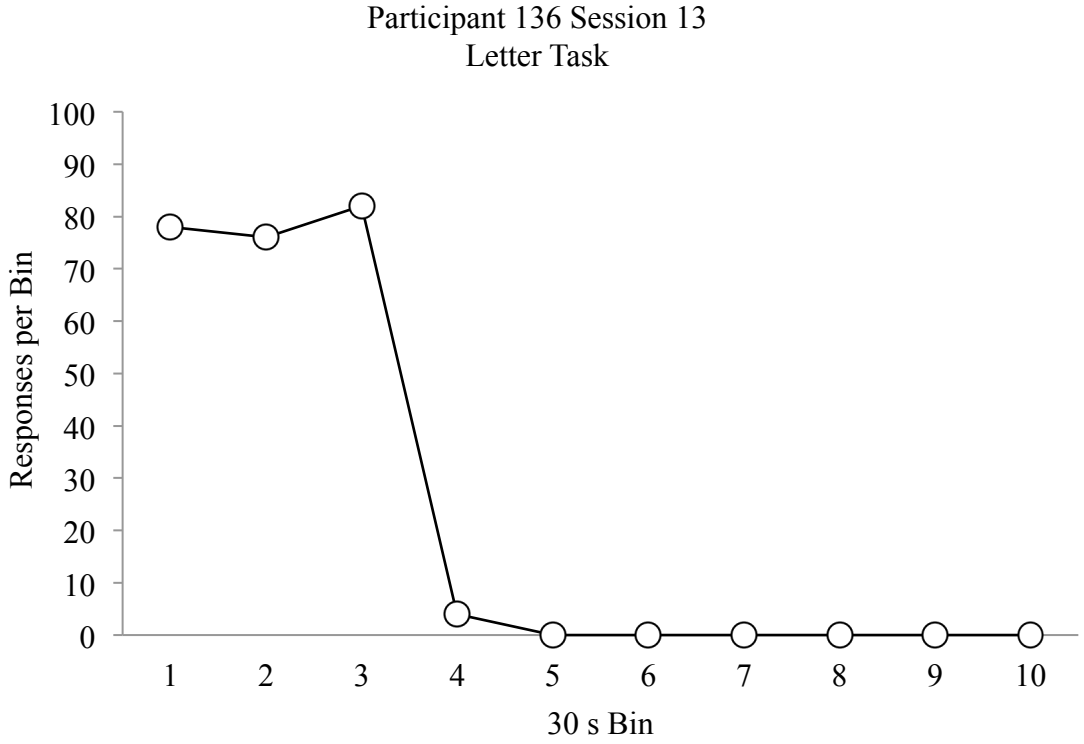

Figure 14. Correct letter responses during Session 13 in 30 s bins for Participant 136.

For Participants 122 and 136, responding on the number task was consistently at a lower level than responding on the letter task when the number line was used. Therefore, in order to assess if the level of responding on the number task would be more similar to the level of responding on the letter task, use of the keypad was assessed (see Table 2 for average responding on each task during each phase). During Phases A, B, C, and D for Participant 122, the average correct responses during the number task was much lower than the average correct responses during letter task. When the keypad was introduced (i.e., Phases E and A′A″), average correct responses during the number task became equal to responding during the letter task. For Participant 136, average correct responses during the number task was much lower than the

average correct responses during letter task until the keypad was introduced (Phase D). Once the keypad was used responding on the number task increased above responding on the letter task. Unlike Participant 122 and 136, Participant 180's average correct responses during the number task was similar to the average correct responses during letter task when the number line used and when the keypad was used.

Table 2

Experiment 1 Average Responding and Steady State Thresholds Met

Participant	Phase	Average Number Task Responses	Average Letter Task Responses	Steady State Criterion Met
122	A	467.80	682.00	25%
122	B	538.50	728.75	*NA*
122	C	556.50	712.50	*NA*
122	D	565.50	684.50	*NA*
122	E	729.00	729.00	*NA*
122	A′A″	734.33	689.00	10%
180	A	653.60	630.00	10%
180	B	702.00	663.67	*NA*
180	C	672.00	656.00	*NA*
180	D	724.34	642.00	*NA*
136	A	511.00	726.80	25%
136	B	533.00	748.34	*NA*
136	C	530.00	677.50	*NA*
136	D	812.00	572.00	*NA*

The introduction of the keypad also reduced the steady state threshold met for Participant 122 during the second baseline phase (Table 2). During the first baseline phase (Phase A) responding on each task was within the 25% criterion threshold, (i.e., total correct responses for each component in the previous three sessions was within 25% above or below the average correct responses for the previous three sessions of both tasks combined) however, during the

second baseline phase (Phase A′A″) the 10% criterion threshold was met. Therefore, responding levels on each task were more similar when the keypad was used versus when the number line was used. Participants 180 and 136 did not participate in a second baseline phase and therefore their steady state thresholds could not be compared.

The experimental conditions did not have an effect on any of the participant's typing accuracy (Table 3). Participant 122 did demonstrate some slight improvement as the experiment continued (i.e., accuracy was more variable during Phases A and B than in Phases C, D, E, or A′A″). Typing accuracy for participants 180 and 136 was consistent regardless of the phase.

Table 3

Experiment 1 Typing Accuracy

Participant	Phase	% Correct (Number Task)	% Correct (Letter Task)	% Correct (Overall)	% Correct Range (Overall)
122	A	86.95	92.54	89.74	84.98- 93.69
122	B	88.56	95.37	91.96	86.34-96.34
122	C	87.50	95.13	91.31	84.13-95.60
122	D	95.05	94.60	94.82	93.66-96.45
122	E	92.40	92.87	92.63	92.40-92.87
122	A′A″	94.34	93.33	93.83	91.06-96.06
180	A	94.98	97.50	96.24	92.84-99.31
180	B	95.15	96.93	96.04	92.10-98.11
180	C	97.67	99.09	98.38	97.67-99.09
180	D	95.82	95.13	95.47	94.06-96.72
136	A	96.73	95.26	95.99	93.85-99.07
136	B	98.82	96.94	97.88	96.61-99.82
136	C	97.89	96.47	97.18	98.25-96.14
136	D	97.04	94.46	95.75	91.95-97.99

The results of Experiment 1 suggest the originally planned procedures did not produce typical extinction behavior. Extinction behavior was only observed when Participant 136 participated in three consecutively conducted sessions (Phase D). These results were not replicated with Participant 180 when three experimental sessions were conducted consecutively. However, a potential reason why conducting three sessions consecutively evoked extinction behavior for Participant 136 but not Participant 180 may be found in the debriefing questionnaire. Participant 180's answer to the third debrief question (i.e., "What do you think was occurring during the task?") was, "Seeing if students would stop typing on the [varied task] due to not being rewarded after a few sessions." Participant 180 then verbally stated that he continued to respond to 'be different', which could explain why typical extinction behavior was not observed.

For Participants 122 and 136, average responding on the number task was much lower in comparison to average responding on the letter task when the number line was used versus when the keypad was used. For example, the steady state threshold met by Participant 122 in Phase A was 25%, whereas the steady state threshold met in Phase A′A″ was 10%. Because differential task ability is not a variable considered in the basic literature, it can be considered a confounding variable in the current study and, therefore, should be controlled for in subsequent experiments. Based on these results, Experiment 2 was conducted in order to assess if behavioral contrast was more likely to occur when sessions were conducted back-to-back-to-back and the number keypad was used.

EXPERIMENT 2 METHOD

Participants

Six undergraduate (three female and three male) psychology students participated in Experiment 2. Participants ranged in age from 20 to 31 years old and were in their sophomore year (one participant), junior year (four participants), and senior year (one participant) of undergraduate training. One participant received extra credit in a class for her participation.

Experimental Procedures

Following in class announcements in two undergraduate classes (different classes than the classes recruited in for Experiment 1), 41 students completed the study interest form (Appendix F). All 41 students were emailed the online questionnaire (Appendix G) to assess for eligibility for the first criterion (i.e., ability to type with both hands). Of these 41 students who expressed interest in the study, 16 replied that they did not have anything that prohibited them from typing and were deemed eligible for the study, while the remaining 25 did not return the email. The first seven students who were deemed eligible were invited to set up a time to meet with the first author (Appendix I), review and sign the informed consent (Appendix K), and complete the first session. The remaining nine were emailed the waitlist email (Appendix J) and did not participate in the current study (these students were the first students emailed about Experiment 3). All seven students who were invited to set up a time to meet the first author replied to the email to arrange a meeting time for the first session. Of the seven students who set up a meeting time, six attended the first meeting. All six students who attended their first meeting met the second eligibility criterion (i.e., typing proficiency). Five participants completed

Experiment 2 and one participant did not (see Experiment 2 Results and Discussion for detailed information).

During Experiment 2, sessions were 10 min in duration (5 min for the letter task and 5 min for the number task) and participants had the opportunity to earn $0.25 for the first correct character (i.e., letter or number) that was entered following the end of the schedule interval (i.e., VI 30-s). Once participants were deemed eligible for the study (i.e., following the analysis conducted after the first session), they were invited to sign up for one session block, which consisted of three sessions conducted consecutively back-to-back-to-back. Participants could complete up to three session blocks (nine sessions) per day. During baseline sessions the task parameters that were entered on the initial task configuration screen were the participant's code number, the session number, 10 min total session duration (5 min for each task), 30 s for the VI schedule for both component tasks, $0.25 for correct response pay for both tasks, and the participant's specific task order (target component first, then varied component). During experiential sessions, when the varied component task was placed on extinction, the researcher entered the participant's code number, the session number, 10 min total session duration (5 min for each task), 0 s for the VI schedule for the varied component task placed on extinction, 30 s for the VI schedule for the target component task, $0.00 for correct response pay for the varied component task placed on extinction, $0.25 for correct response pay for the target component task, and the participant's specific task order (target component first, then varied component).

Experimental Design

Experiment 2 used an ABA reversal design. During baseline phases (Phase A), both components had a VI 30-s schedule, full instructions were read prior to the start of the first

session of a session block, the keypad was used, and consecutive sessions were allowed. During the experimental phase (Phase B), the target component had a VI 30-s schedule, the varied component had an extinction schedule, full instructions were read prior to the start of the first session of a session block, the keypad was used, and consecutive sessions were allowed. When a participant completed the first session of a block, he or she informed the researcher that the "Finished" page had appeared and waited outside of the room while the researcher entered the parameters for the next session and pressed the submit button. The researcher then paid the participant for the amount earned during the previous session and allowed the participant to begin again. The break in between each session was approximately 1 min in duration. This process was repeated again until the block was completed.

EXPERIMENT 2 RESULTS AND DISCUSSION

Of the six participants (see Table 4 for general information for each participant) in Experiment 2, only one participant (Participant 110) demonstrated behavioral contrast using procedures similar to basic paradigms. Four other participants (Participants 173, 190, 116, and 160) failed to exhibit typical extinction behavior and therefore did not demonstrate behavioral contrast. The final participant (Participant 145) did not finish the study due to attrition. After completing the first session block (i.e., Sessions 2, 3, and 4), Participant 145 missed a scheduled session block and then stopped replying to emails.

Table 4

Experiment 2 General Participant Information

Participant	Task Order (Target Component-Varied Component)	Total Sessions	Reinforcers Produced (Total Possible)	Money Earned
173	Letters-Numbers	16	207 (207)	$51.75
145	Numbers-Letters	4	72 (72)	$18.00
190	Letters-Numbers	16	206 (207)	$51.50
110	Letters-Numbers	25	342 (342)	$85.50
116	Numbers-Letters	19	234 (234)	$58.50
160	Numbers-Letters	16	207 (207)	$51.75

Participant 110 was the only participant in Experiment 2 that potentially demonstrated positive molar behavioral contrast (Figure 15). During baseline, responding on the varied component task (numbers) was steadily increasing during the first and second baseline session blocks (Sessions 2, 3, and 4, and Sessions 5, 6 and 7, respectively) and leveled off during the third baseline session block (Sessions 8, 9, and 10). Responding during the target component

(letters) was fairly consistent throughout baseline and was slightly down trending during the third baseline session block.

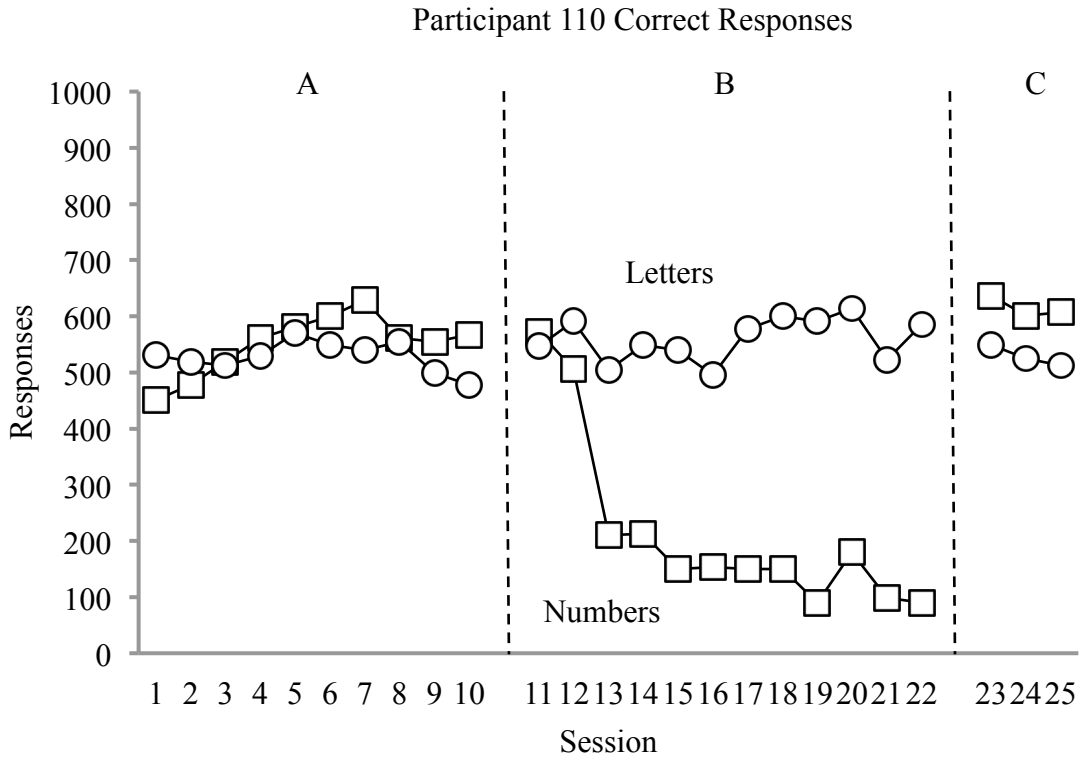

Figure 15. Correct responses during each task for Participant 110. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Extinction behavior on the varied component task (numbers) was observed during the final session (Session 13) of the first experimental session block (Sessions 11, 12, and 13) (Figure 16). Responding on the varied component task remained low during the three remaining experimental session blocks, although responding never extinguished completely. Within session analyses of these sessions (Sessions 14-22) showed that some responding occurred during the first min (Bins 1 and 2) and then reduced to zero for remainder of the session (e.g., Figure 17).

Occasionally, some minimal responding occurred following the second min of the session, however, responding always returned to zero in the following bin (e.g., see Figure 16).

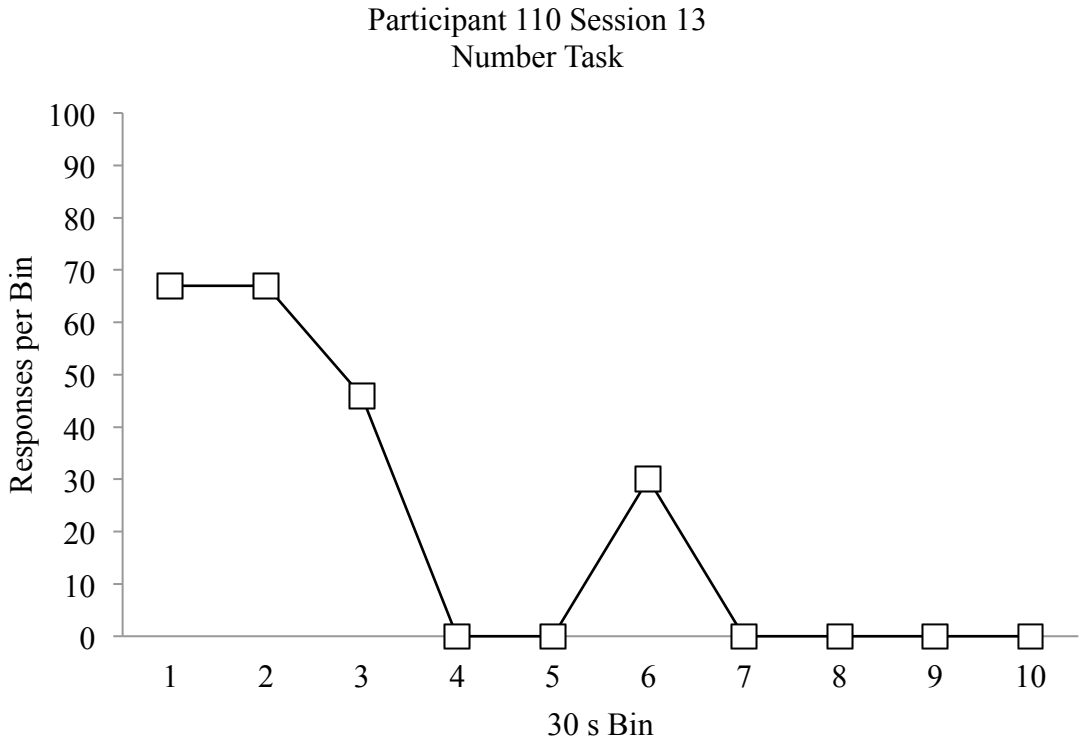

Figure 16. Correct number responses during Session 13 in 30 s bins for Participant 110.

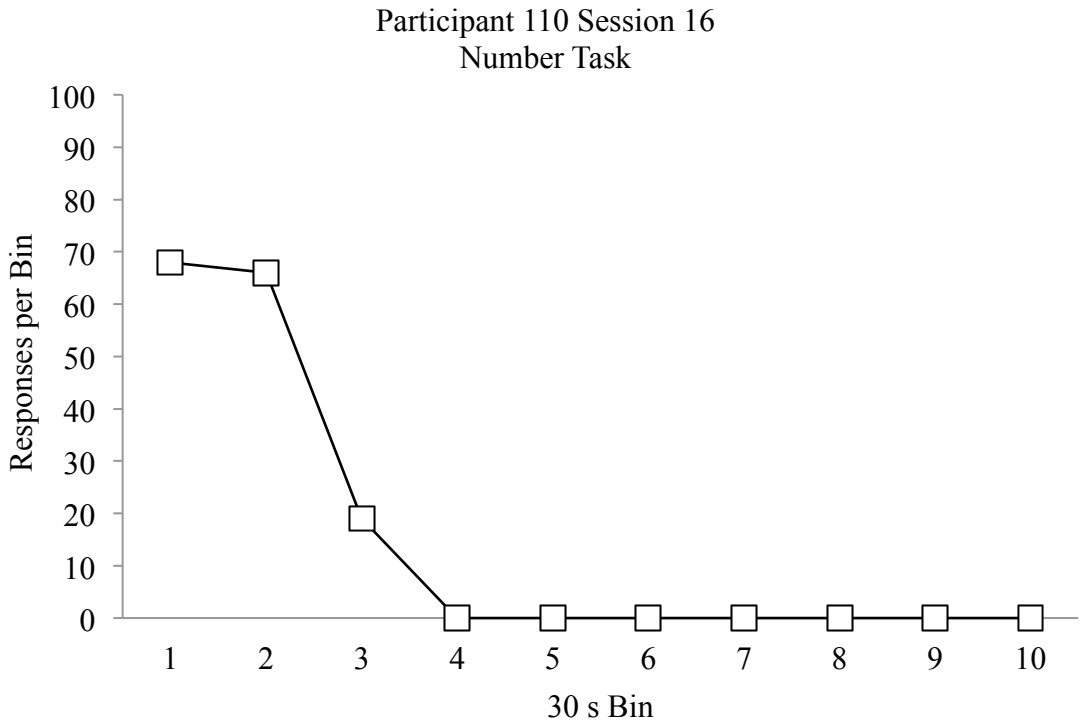

Figure 17. Correct number responses during Session 16 in 30 s bins for Participant 110.

Correct responding on the target component task (letters) remained at or above baseline levels during the during all experimental session blocks. Average correct responding during the experimental phase (i.e., all session blocks) was 559.58 versus 528.20 and 528.67 during the first and second baseline phases, respectively. Overall responding on the letter task during the experimental phase increased by 6% compared to the initial baseline phase. During the third experimental session block (Sessions 17, 18, and 19) average correct responding on the target component was higher (589.33) than any other block during the initial baseline phase (520, 553, and 510.67 for the first, second, and third baseline blocks, respectively). Responding on the letter task during the third experimental session block was 13%, 6%, and 15% greater compared to the first, second, and third baseline blocks, respectively. Therefore, it is possible to that positive

molar behavioral contrast was observed during the experimental sessions, because responding decreased on the varied component and responding increased, compared to baseline levels, on the target component. During the second baseline phase, correct responding on both tasks returned to levels that were similar to the levels observed during the initial baseline phase. Anticipatory contrast was not consistently observed during the experimental sessions (Figure 18).

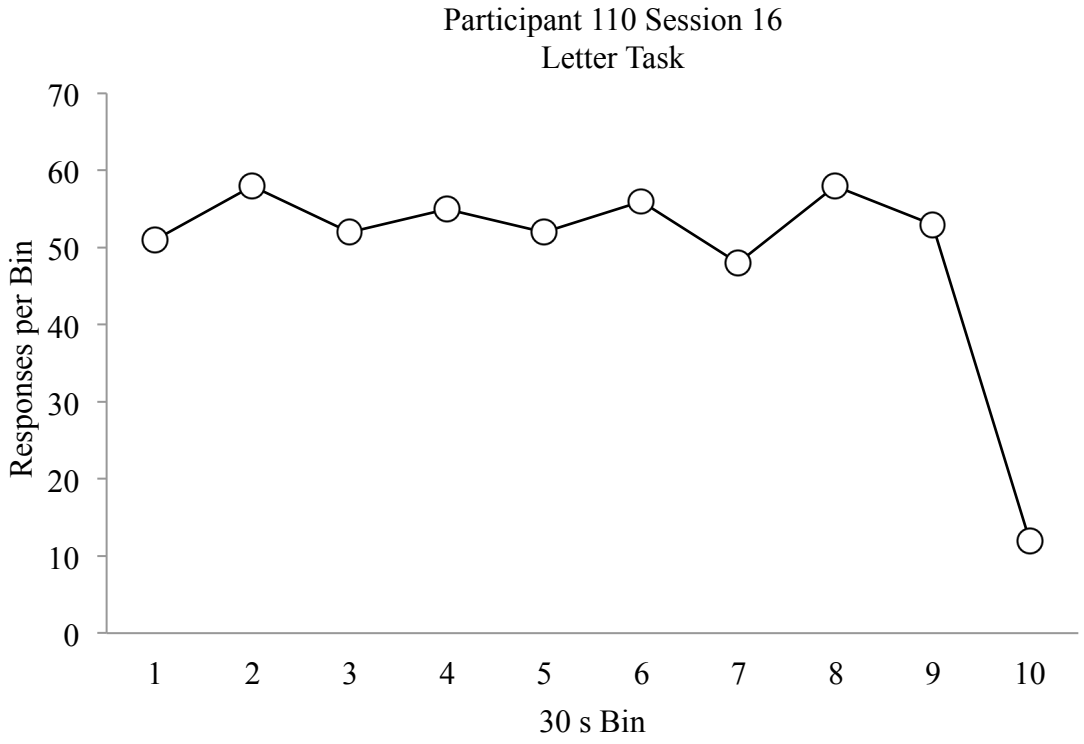

Figure 18. Correct letter responses during Session 16 in 30 s bins for Participant 110.

The remaining four participants (Participants 173, 190, 116, and 160) did not exhibit typical extinction behavior and therefore did not demonstrate behavioral contrast (see Figures 19, 20, 21, and 23 for Participants 173, 190, 116, and 160, respectively). Correct responding on both

the target component task (letters) and the varied component task (numbers) was consistent during all three phases for Participant 173 (Figure 19) and for Participant 190 (Figure 20).

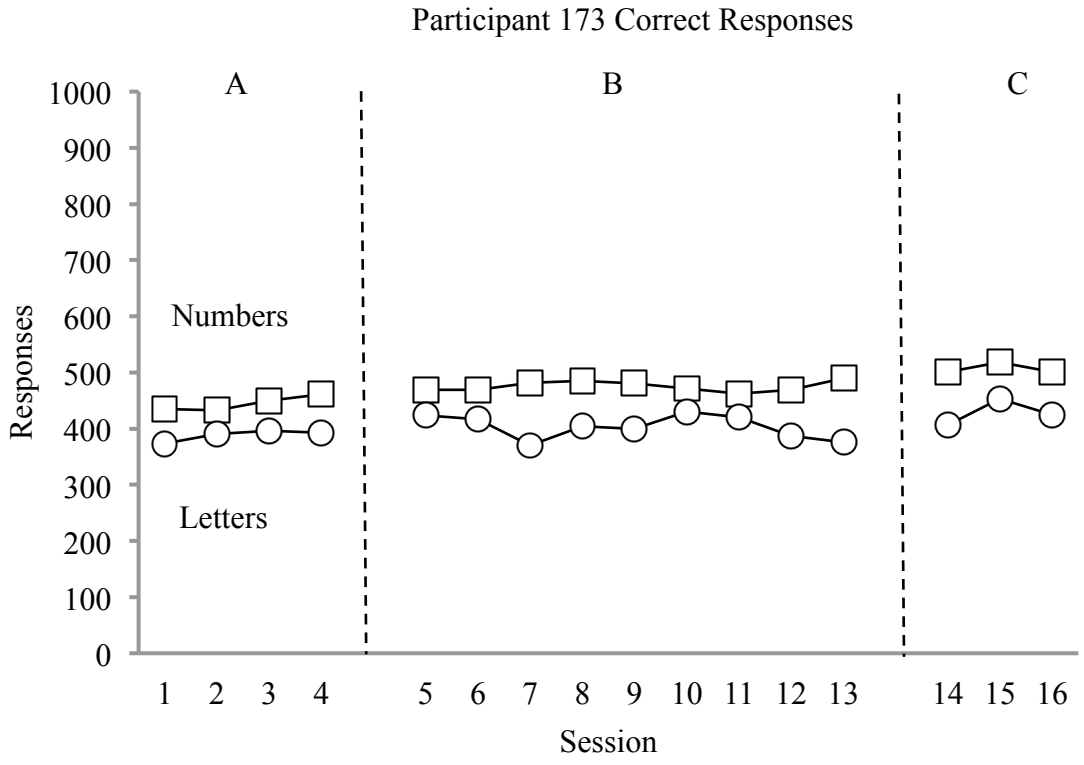

Figure 19. Correct responses during each task for Participant 173. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

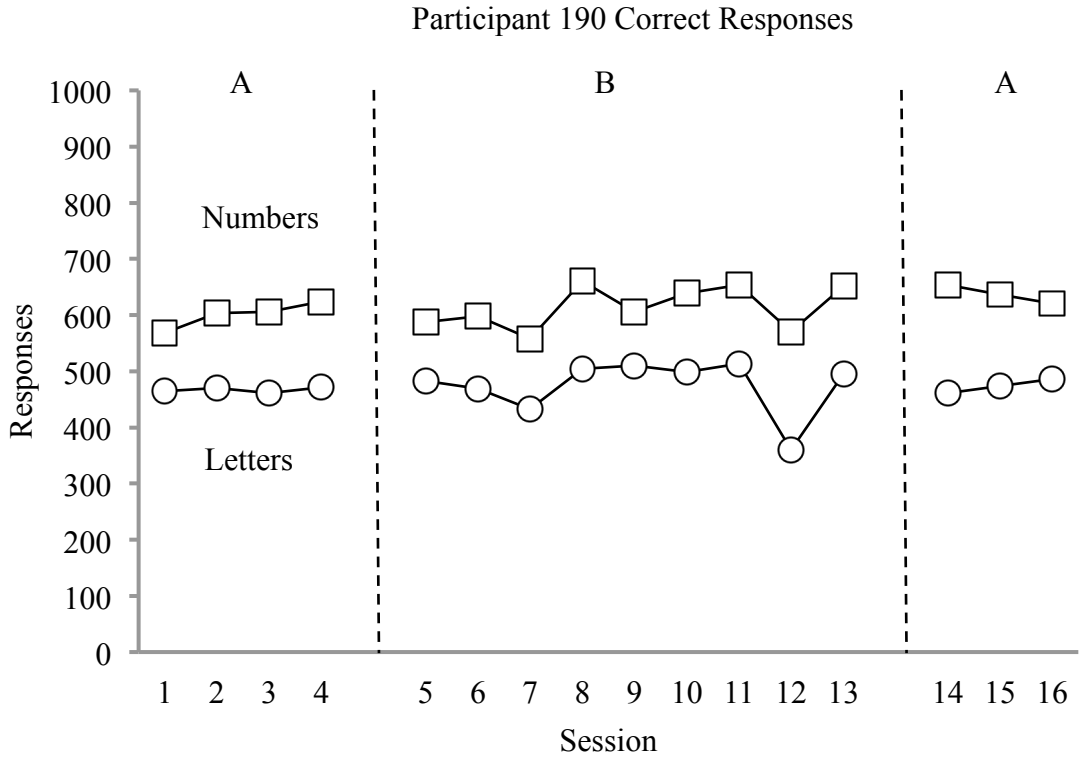

Figure 20. Correct responses during each task for Participant 190. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Participant 116's (Figure 21) level of correct responding on the varied component task (letters) was on a downtrend during the third experimental session block (Sessions 11, 12, and 13). However, a within session analysis determined responding was not reducing to zero levels and that correct responding was instead occurring at a lower rate (e.g., Figure 22). That session block (Session 11, 12, and 13) was the third session block that the participant conducted that day and, therefore, the reduction in responding may have been due to fatigue. Correct responding levels returned to previous levels during the next session block. Other than Sessions 12 and13, correct responding on both tasks was consistent for the entire study.

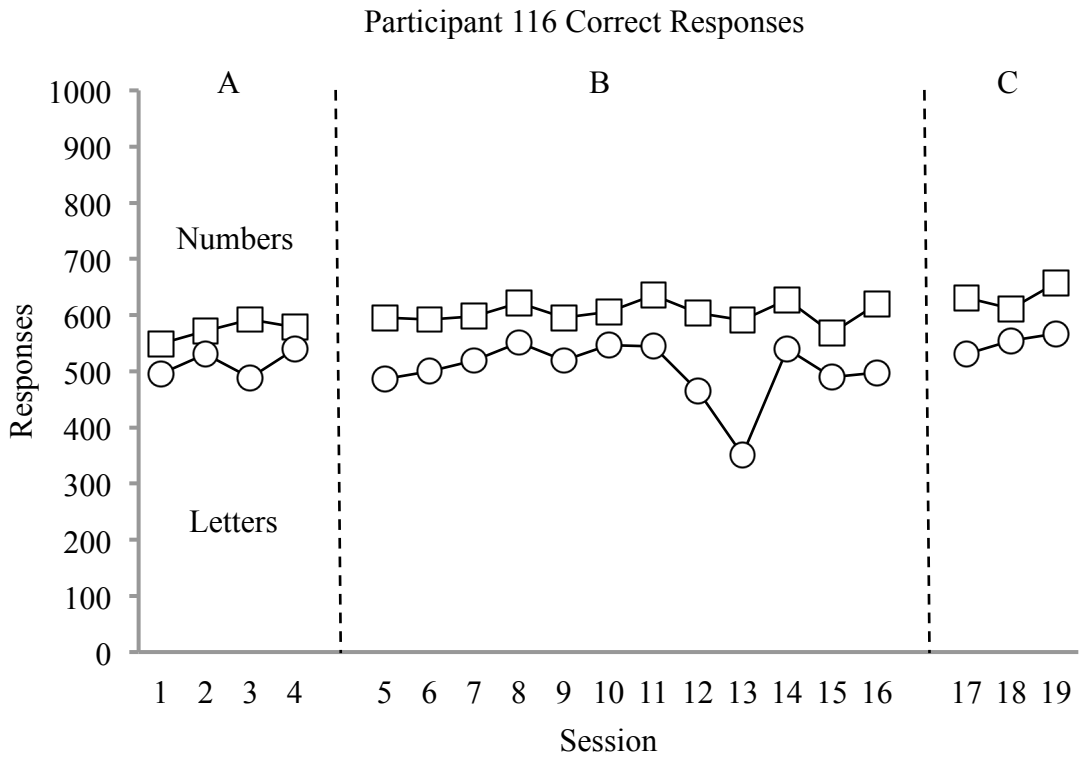

Figure 21. Correct responses during each task for Participant 116. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

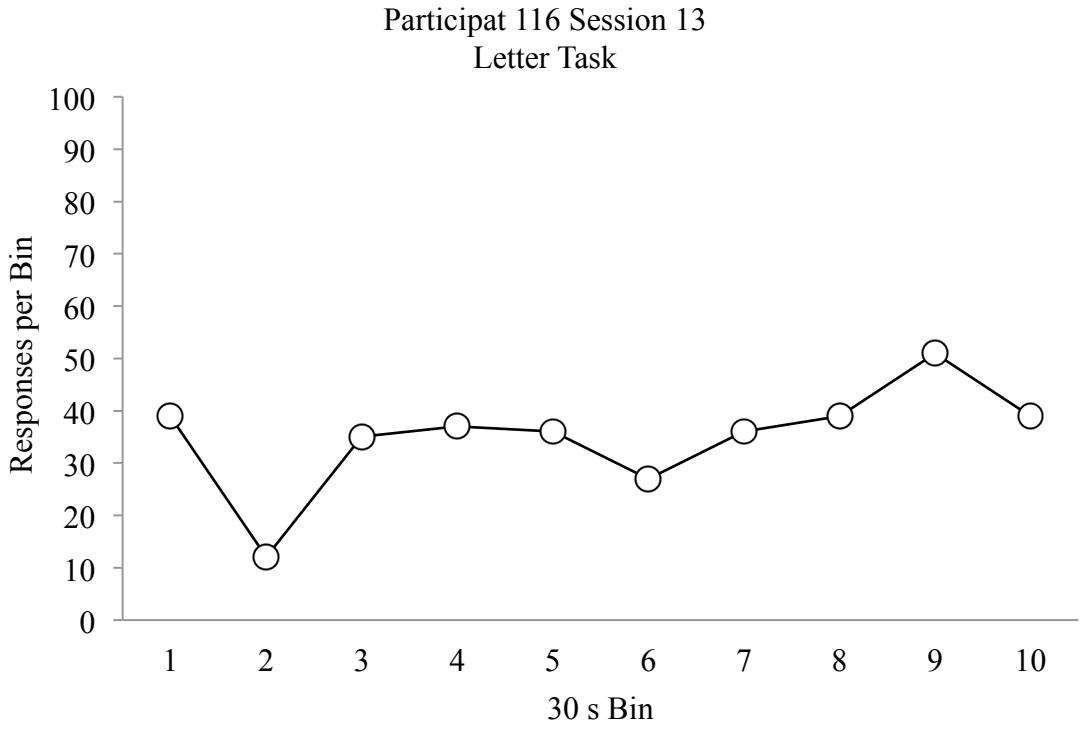

Figure 22. Correct letter responses during Session 13 in 30 s bins for Participant 116.

Participant 160's (Figure 23) correct responding during the varied component task (letters) was trending downward during the second and third experimental block sessions (Sessions 8, 9, and 10 in the second experimental session block and Sessions 11 and 12 in the third experimental session block); however, again, within session analyses suggested that this was not due to typical extinction behavior. Instead, correct responding on the letter task was more variable during these sessions compared to previous sessions (e.g., Figure 24). Correct responding on the target component (numbers) was level during all three phases.

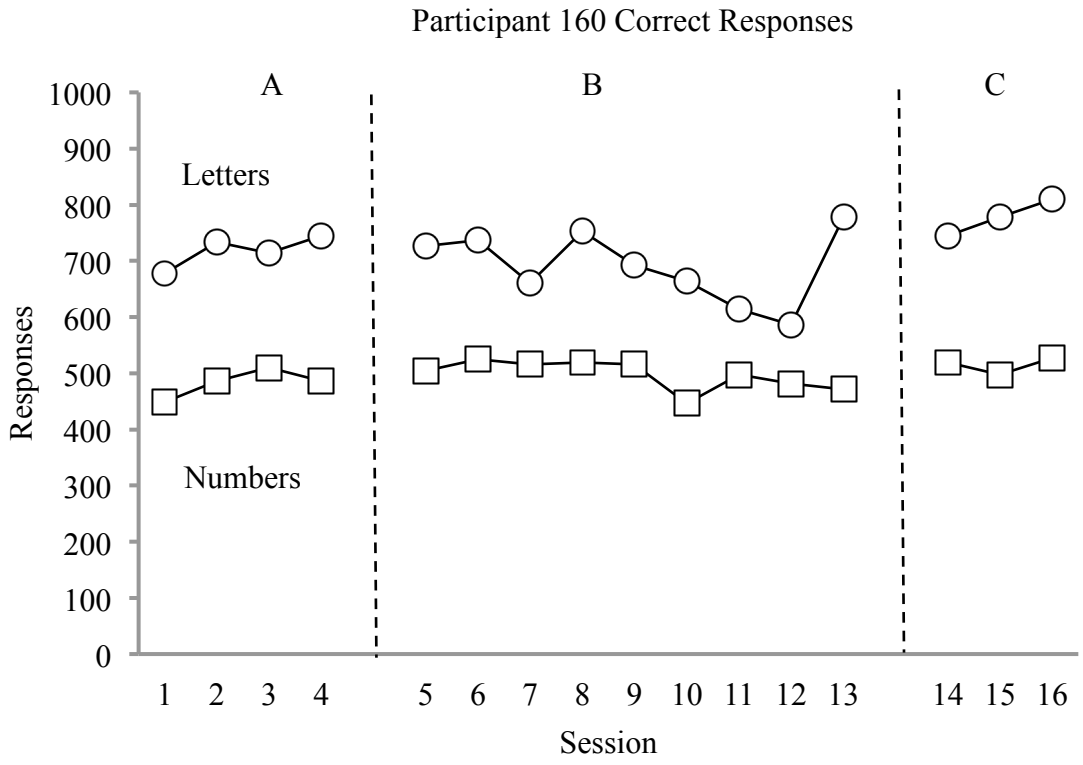

Figure 23. Correct responses during each task for Participant 160. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

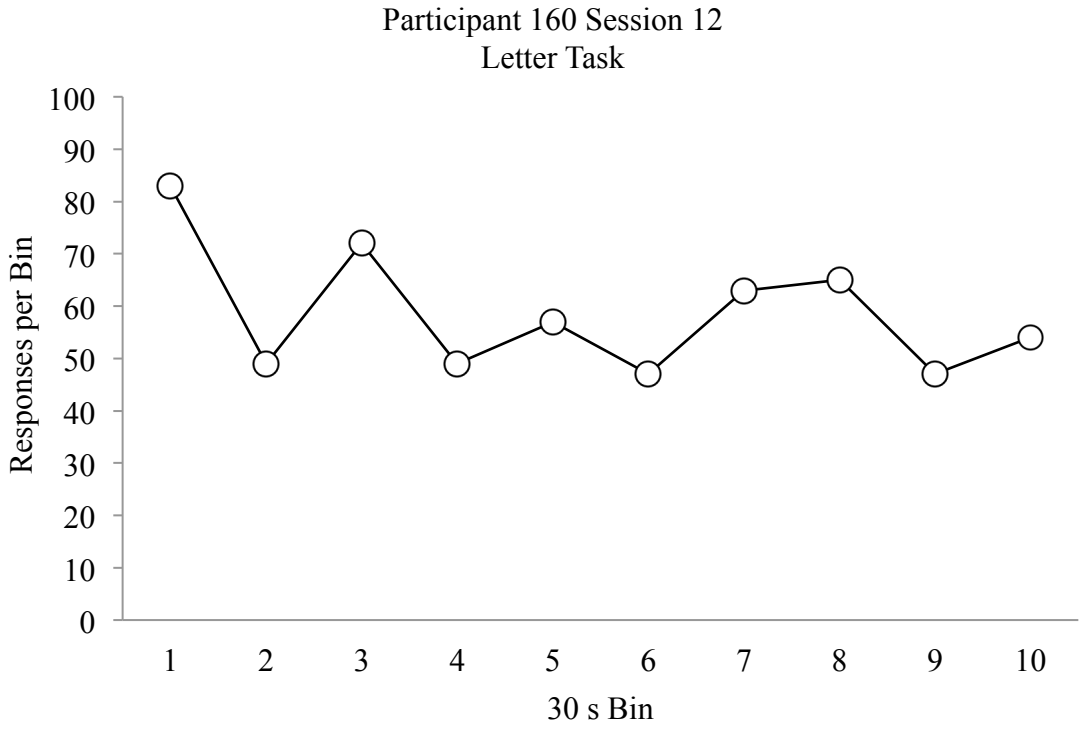

Figure 24. Correct letter responses during Session 12 in 30 s bins for Participant 160.

Similar to Experiment 1, the experimental manipulation did not have an effect on typing accuracy (Table 5). The lowest percentage of typing accuracy was observed during Participant 145's final session prior to leaving the study (55.59%) on the number task. Interestingly, Participant 110 (the only participant to demonstrate extinction behavior) committed the highest level of incorrect responding on the varied component during the second session (Session 12) of the first experimental session block (Figure 25). The following session (Session 13) was the first session in which typical extinction behavior was observed and therefore the increased incorrect responding may have been an extinction burst (i.e., responding increased to a higher level than the five previous baseline sessions).

Table 5

Experiment 2 Typing Accuracy

Participant	Phase	% Correct (Number Task)	% Correct (Letter Task)	% Correct (Overall)	% Correct Range (Overall)
173	A	97.71	97.03	97.37	96.35-98.42
173	B	98.55	97.07	97.81	92.27-99.74
173	C	99.09	99.39	99.24	98.43-99.80
145	A	85.99	95.36	90.67	55.69-97.96
190	A	93.69	93.37	93.53	88.37-97.43
190	B	93.72	90.55	92.13	81.97-96.00
190	C	94.32	93.01	93.67	91.15-96.32
110	A	90.34	93.92	92.13	87.74-96.65
110	B	91.99	94.51	93.25	79.91-100
110	C	93.94	94.00	93.97	92.76-95.31
116	A	97.94	95.29	96.62	94.57-98.79
116	B	98.00	96.55	97.28	95.12-99.26
116	C	97.33	94.32	95.83	93.72-97.38
160	A	97.13	95.49	96.31	93.90-97.70
160	B	97.83	94.66	96.25	90.57-99.24
160	C	98.16	97.03	97.60	96.53-98.86

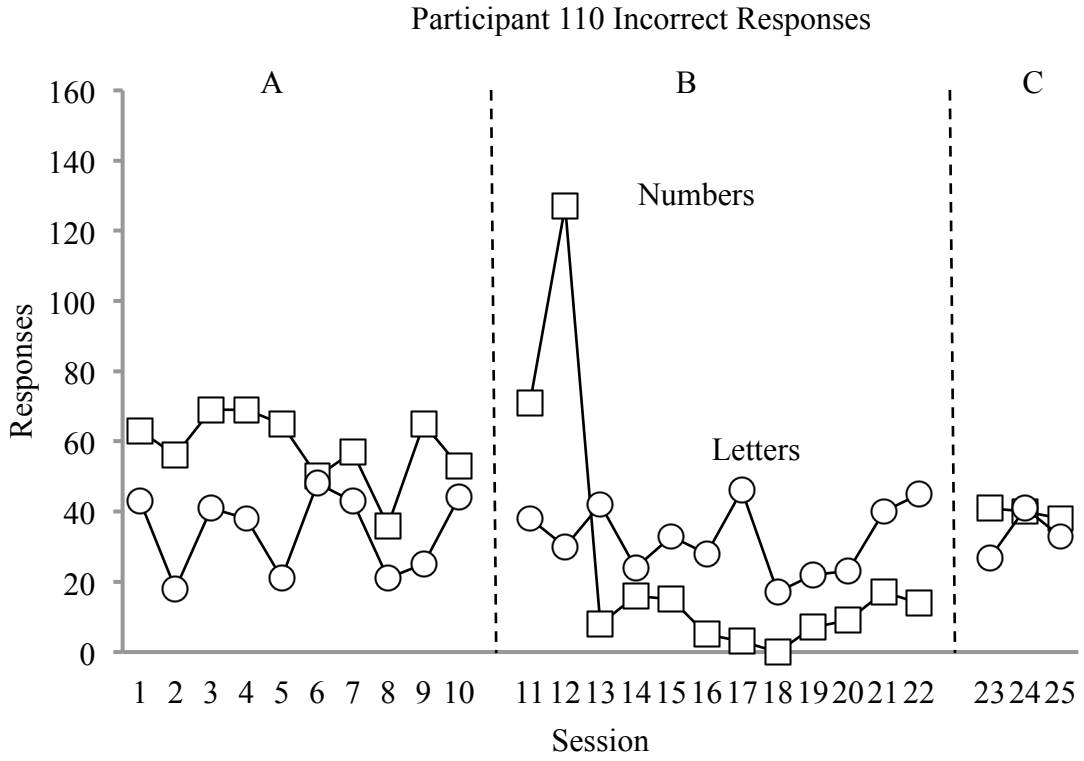

Figure 25. Incorrect responses during each task for Participant 110. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Four of the five participants who completed the study (Participants 173, 190, 110, and 116) had higher average correct responding during the number task compared to the letter task for all phases (except for Participant 110 when responding on the varied component task [numbers] was lower due to extinction behavior during experimental sessions) (Table 6). Participant 160 had consistently higher average correct responding during the letter task versus the number task. Steady state levels for all participants met or were lower than the 25% thresholds during both baseline phases (Table 6).

Table 6

Experiment 2 Average Responding and Steady State Thresholds Met

Participant	Phase	Average Number Task Responses	Average Letter Task Responses	Steady State Criterion Met
173	A	444.50	388.00	10%
173	B	475.00	402.78	*NA*
173	C	506.67	428.00	20%
145	A	435.75	306.75	*NA*
190	A	600.25	466.75	20%
190	B	613.78	474.00	*NA*
190	C	637.00	473.67	20%
110	A	550.10	528.20	10%
110	B	213.58	559.58	*NA*
110	C	614.67	528.67	20%
116	A	572.50	513.50	20%
116	B	604.42	500.58	*NA*
116	C	633.00	551.00	20%
160	A	482.50	717.25	25%
160	B	497.22	690.11	*NA*
160	C	514.67	777.67	25%

Although the paradigm used in Experiment 2 engendered behavioral contrast with one participant, it failed to reliably produce typical extinction behavior with four other participants. A potential reason why this was not occurring could have been the short duration of each session. Therefore, the researcher posited that increasing the duration of the tasks could reduce responding levels during extinction sessions. Specifically, the researcher wanted to assess if extending the task duration to 15 min each (30 min session) would evoke typical extinction behavior. Furthermore, if the extended task duration did not reduce responding levels, the

researcher wanted to attempt to replicate the results of Tarbox and Hayes (2005) by explicitly telling the participants not to type during the extinction phase and assess if behavioral contrast was more likely to occur.

EXPERIMENT 3 METHOD

Participants

Three undergraduate (three female) psychology students participated in Experiment 3. Participants ranged in age from 19 to 21 years old and were in their junior year (2 participants) and senior year (1 participant) of undergraduate training. All participants received extra credit in a class for participating in the study.

Experimental Procedures

The nine students who were waitlisted during Experiment 2 were the first to be contacted about participating in Experiment 3. Of these nine students, three returned the email to set up an initial meeting. One of these three attended the meeting, while the other two did not attend the meeting. The student who attended the meeting was deemed eligible for the study and was one of the participants in Experiment 3. Following an in class announcement in an undergraduate class (a different class than the classes recruited in for Experiment 1 and 2), six students completed the study interest form (Appendix F). All six students were emailed the online questionnaire (Appendix G) to assess for eligibility for the first criterion (i.e., ability to type with both hands). Of these six students, four replied that they did not have anything that prohibited them from typing and were deemed eligible for the study, while the remaining two did not return the email. The four students who were deemed eligible were invited to set up a time to meet with the first author (Appendix I), review and sign the informed consent (Appendix L), and complete the first session. Two of the invited students replied to the email and set up a time to meet the first author. Both of these students attended the first meeting, met the second eligibility criterion (i.e., typing proficiency), and participated in Experiment 3.

Experiment 3 sessions were 30 min in duration (15 min for the letter task and 15 min for the number task) and participants had the opportunity to earn $0.10 for the first correct character (i.e., letter or number) that was entered following the end of the schedule interval (i.e., VI 30-s). Participants were able to sign up for 3 sessions a day, with no time restriction between sessions (i.e., participants were able to sign up for a single session or up to three sessions conducted consecutively). During baseline sessions the task parameters that were entered on the initial task configuration screen were the participant's code number, the session number for the participant, 30 min total session duration (15 min for each task), 30 s for the VI schedule for both component tasks, $0.10 for correct response pay for both tasks, and the participant's specific task order (target component first, then varied component). During experiential sessions, when the varied component task was placed on extinction, the researcher entered the participant's code number, the session number, 30 min total session duration (15 min for each task), 0 s for the VI schedule for the varied component task placed on extinction, 30 s for the VI schedule for the target component task, $0.00 for correct response pay for the varied component task placed on extinction, $0.10 for correct response pay for the target component task, and the participant specific task order (target component first, then varied component).

Experimental Design

Experiment 3 used an ABA reversal design or an ABCA reversal design. The second experimental phase (Phase C) was only conducted if typical extinction behavior was not observed during the first experimental phase (Phase B). An ABA reversal design was used for Participant 300 and an ABCA reversal design was used for Participants 356 and 317. During the baseline phases (Phase A), both component tasks had a VI 30-s schedule, full instructions were

read prior to the start of the first session of the day, the keypad was used, and three sessions per day were allowed. During the first experimental phase (Phase B) the target component task had a VI 30-s schedule, the varied component task had an extinction schedule, full instructions were read prior to the first session of the day, the keypad was used, and three sessions per day were allowed. During the second experimental phase (Phase C) the target component task had a VI 30-s schedule, the varied component task had an extinction schedule, the participant was told, "Since you will not earn money during the second task, do not type during that task", the keypad was used, and three sessions per day were allowed.

EXPERIMENT 3 RESULTS AND DISCUSSION

None of the participants exhibited behavioral contrast during Experiment 3 (see Table 7 for general information for each participant). Participants 356 and 300 (Figure 26 and 27, respectively) both demonstrated typical extinction behavior, however behavioral contrast was not observed. Participant 317 (Figure 29) did not demonstrate extinction behavior (even when instructed not to type) and, therefore, could not demonstrate behavioral contrast.

Table 7

Experiment 3 General Participant Information

Participant	Task Order (Target Component-Varied Component)	Total Sessions	Reinforcers Produced (Total Possible)	Money Earned
356	Letters-Numbers	13	578 (580)	$57.80
300	Numbers-Letters	17	795 (841)	$79.50
317	Numbers-Letters	18	888 (899)	$88.80

Participant 356's (Figure 26) correct responding on the varied component task (numbers) during the first experimental phase (Phase B) was stable compared to correct responding on the varied component task during the first baseline phase (Phase A). Therefore, the "Do not type on the varied task" instructions were delivered during the second experimental phase (Phase C). While correct responding did reduce to zero during the varied component task when the "do not type" instructions were delivered, correct responding on the target component task (letters) remained at a stable level compared to previous phases. Therefore behavioral contrast was not observed.

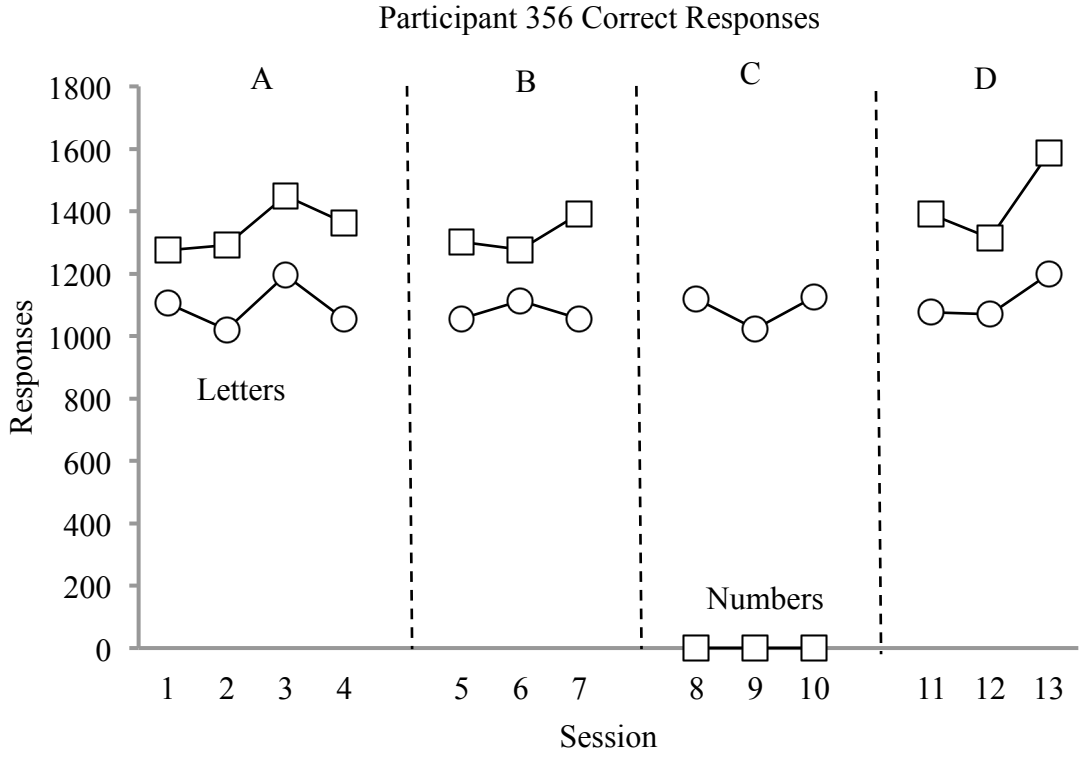

Figure 26. Correct responses during each task for Participant 356. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

Participant 300's (Figure 27) correct responding on both tasks was variable and on a downward trend during the initial baseline phase (Phase A). Correct responding on the varied component task (letters) reduced from 1404 correct responses during Session 5 to 240 correct responses during Session 6. Despite the low levels of responding during Session 6, the participant still earned approximately 93% of the available reinforcers. The researcher posited that this was occurring because the participant had prior knowledge of interval schedules, although this was never confirmed. After Session 6, correct responding on the varied task remained somewhat stable but at a lower level compared to previous levels of responding. Correct responding on the target component task (numbers) was also on a downward trend

during the initial baseline phase, although correct responding on the target component task was more variable than correct responding during the varied component. During Sessions 7 through 10, the participant earned approximately 98% of available reinforcers on both tasks. Due to the variable data, the steady state criterion threshold of 25% was not met and a phase change occurred since 10 baseline sessions had occurred.

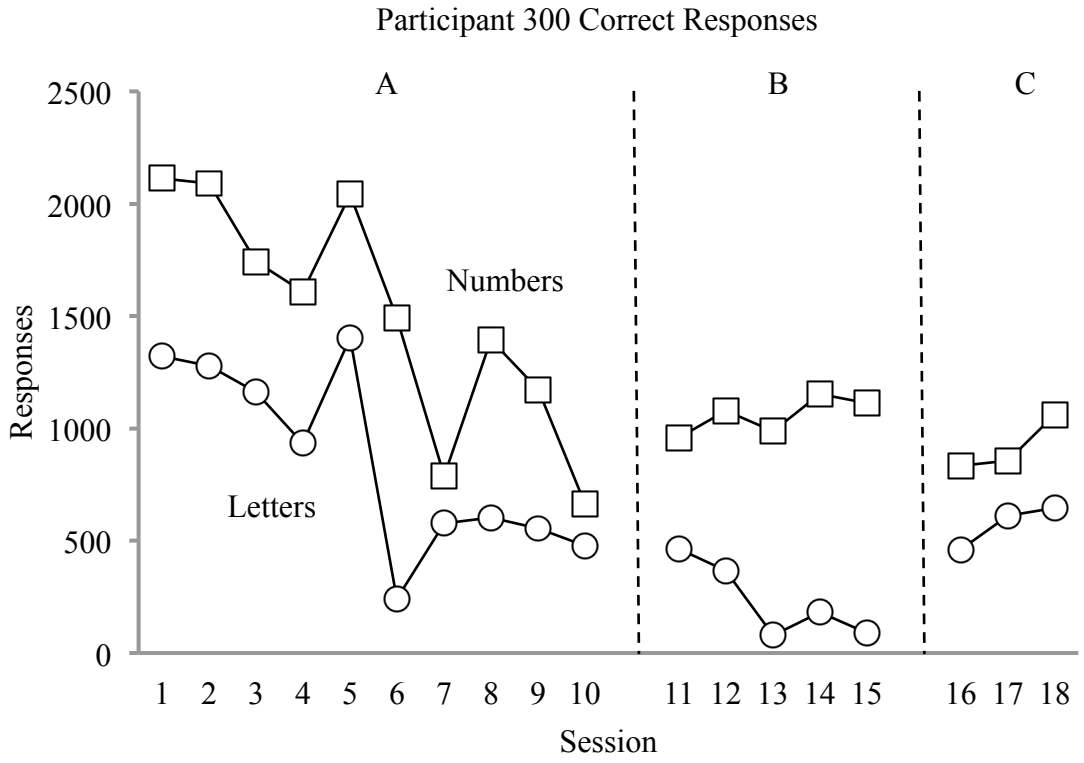

Figure 27. Correct responses during each task for Participant 300. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

During the experimental phase (Phase B), typical extinction behavior was observed on the varied component (letters) (e.g., Figure 28), however correct responding on the target component (numbers) remained stable at a lower level than the level that was originally observed during the first part of the baseline phase. Despite the lower level of responding, the participant

still produced 100% of available reinforcers during the experimental phase (Phase B). Therefore, the researcher concluded that it was extremely unlikely that correct responding would increase to levels that were necessary in order for it to be said that behavioral contrast occurred (i.e., correct responding on the target component task would have had to more than double) and the phase was ended. During the second baseline phase (Phase A) correct responding on the varied component task (letters) returned to levels that were observed at the end of the first baseline phase and correct responding on the target component task (numbers) remained at a similar level to correct responding during the experimental phase (Phase B).

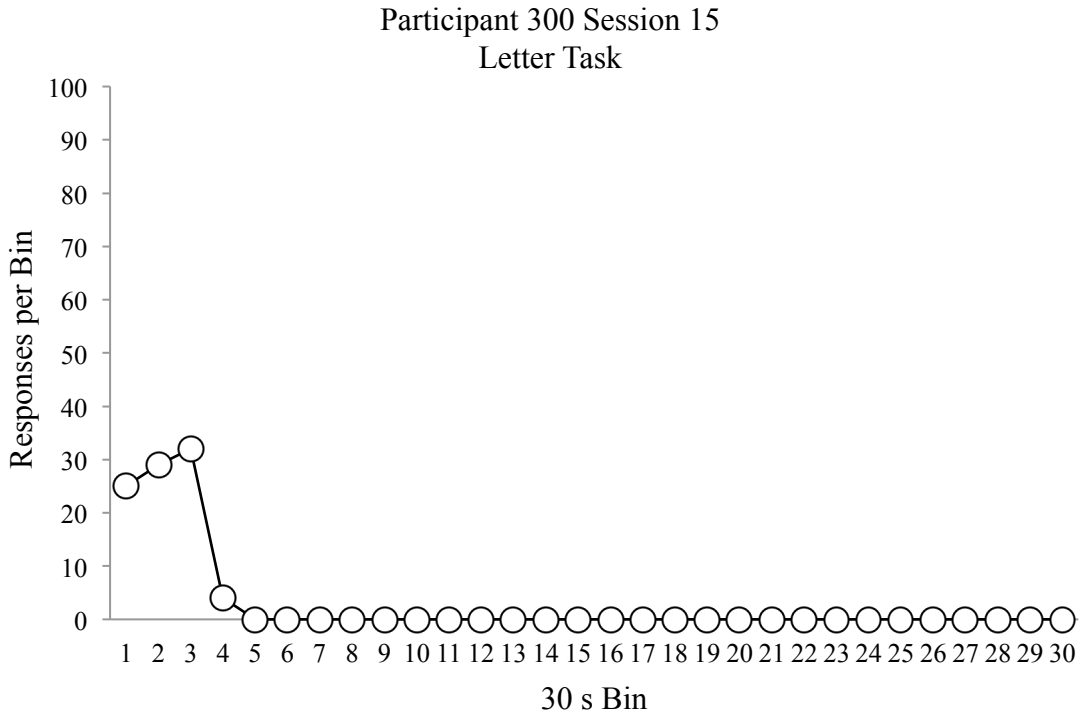

Figure 28. Correct letter responses during Session 15 in 30 s bins for Participant 300.

Participant 317's (Figure 29) correct responding was variable on both tasks during the first three sessions of the initial baseline phase (Phase A). During the next four sessions (Sessions 4 to 7) correct responding on the varied component task (letters) stabilized, while correct responding on the target component (numbers) remained variable. During the final three sessions of the initial baseline phase, correct responding on both tasks reduced to and remained at near zero levels (e.g., see Figure 30). Similar to Participant 300, despite the low levels of responding, Participant 317 still earned approximately 94% of the available reinforcers on both tasks during Sessions 8, 9, and 10. The first session in which minimal responding occurred for Participant 317 (Session 8) was later on the same day that Participant 300 had a low level of responding (Session 6) and still nearly produced all available possible reinforcers. It is possible that the participants were in contact with each other. During debriefing questions with Participant 317, she confirmed that she believed that a 30 s interval schedule was in effect, however she did not state if she learned this information from Participant 300 or if she was in contact with Participant 300.

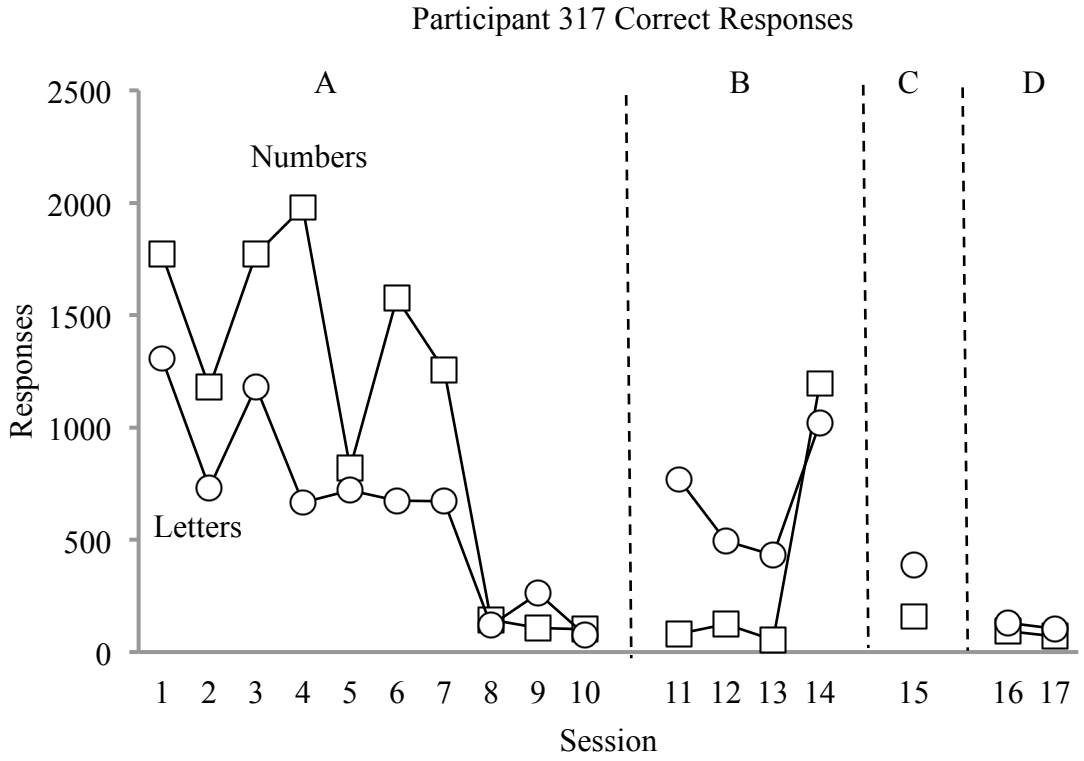

Figure 29. Correct responses during each task for Participant 317. Responses during the letter task are represented as circles and responses during the number task are represented as squares.

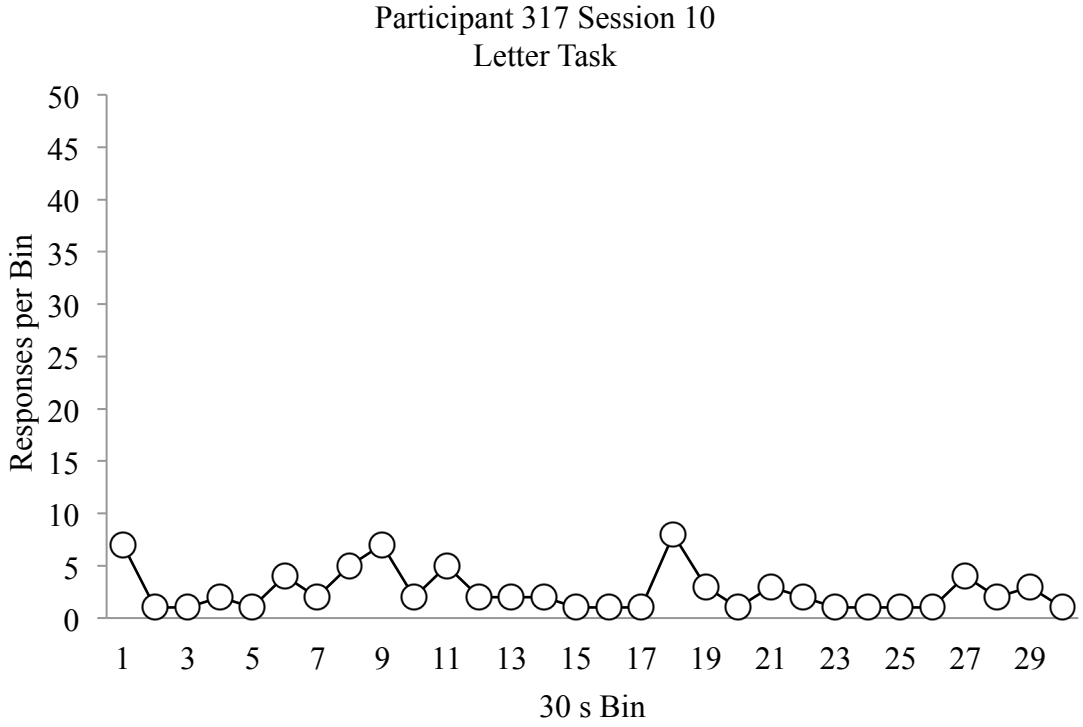

Figure 30. Correct letter responses during Session 10 in 30 s bins for Participant 317.

Despite the minimal responding, the researcher wanted to assess the effects that the extinction schedule would produce. During the first session (Session 11) in the experimental phase (Phase B), an extinction burst was observed for the correct responding on the varied component task (letters) (Figure 29). Correct responding on the varied component task began to trend downward during the next two sessions, while correct responding on the target component task remained at a stable level compared to the last three sessions of baseline. During the fourth and final session (Session 14) during the first experimental phase, responding on both tasks increased. Since extinction behavior was not occurring, the researcher implemented the next experimental condition (Phase C) in which specific rules about typing were delivered. Despite these rules, the participant continued to respond on the varied component task. After reviewing

these data, the researcher determined that extreme rule-governed behavior could have been occurring and decided to return the participant to baseline and end the study. It was later determined, via the debriefing questions, that the participant continued to respond because she believed the researcher was deceiving her with the instructions. During the final baseline phase (Phase A), responding on both tasks returned to similar near zero levels that were observed during the final three sessions (Sessions 8, 9, 10) of the initial baseline phase.

Similar to Experiments 1 and 2, the procedures had little effect on typing accuracy (Table 8). Typing accuracy for Participant 356 and 300 was consistent throughout the study, regardless of the phase. Participant 317 was highly inaccurate during the first few sessions. For example, during Session 1 she typed 391 incorrect responses during the letter task and 201 incorrect responses during the numbers task. However, as overall responding levels decreased, so did the number of incorrect responses.

Table 8

Experiment 3 Typing Accuracy

Participant	Phase	% Correct (Number Task)	% Correct (Letter Task)	% Correct (Overall)	% Correct Range (Overall)
356	A	97.34	96.34	96.84	95.90-98.34
356	B	97.53	97.06	97.29	95.83-99.01
356	C	*NA*	97.62	97.62	96.88-98.33
356	D	97.71	97.89	97.80	97.06-98.37
300	A	97.05	95.78	96.42	93.42-98.31
300	B	98.11	97.60	97.86	95.74-100
300	C	97.77	98.34	98.05	97.60-99.03
317	A	88.90	85.15	87.02	73.64-94.12
317	B	87.36	89.39	88.38	72.66-94.31
317	C	96.34	93.75	95.05	93.75-96.34
317	D	91.04	90.70	90.87	85.12-96.27

Due to Participant 300 and 317's variable correct responding, average correct responding on each task for both participants was inconsistent (Table 9). Neither participant was able to meet the steady state threshold of 25% during the first baseline phase. Participant 356's average correct responding was consistent throughout the study, with average responding on the number task being slightly above the average responding on the letter task (Table 9). Participant 356 met the 20% steady state threshold during the initial baseline phase and the 25% threshold during the second baseline phase.

Table 9

Experiment 3 Average Responding and Steady State Thresholds Met

Participant	Phase	Average Number Task Responses	Average Letter Task Responses	Steady State Criterion Met
356	A	1344.50	1092.75	20%
356	B	1323.67	1075.00	*NA*
356	C	*NA*	1089.33	*NA*
356	D	1430	1115.33	25%
300	A	1510.60	854.80	*Did Not Meet Criterion*
300	B	1058	235.60	*NA*
300	C	916.33	572.33	*Did Not Meet Criterion*
317	A	1069.90	640.40	*Did Not Meet Criterion*
317	B	363.25	678.50	*NA*
317	C	158.00	390.00	*NA*
317	D	81.50	116.00	*Did Not Meet Criterion*

Considering the inconsistent responding exhibited by Participants 300 and 317, it may not be possible to assess their results in terms of true behavioral contrast. For example, Participant 300's correct responding on the target component (numbers) during the experimental phase (Phase B) moved in a direction away from responding on the varied component (letters); however, it is not considered behavioral contrast because correct responding on the target component task was not above baseline levels and steady state behavior did not occur during baseline. Therefore, despite correct responding during the experimental phase looking similar to behavioral contrast, it cannot be considered to be true behavioral contrast.

After Participant 356 did not demonstrate typical extinction behavior, she was instructed not to type during the varied task. This manipulation was similar to the procedure in Tarbox and Hayes (2005), in which instructions on the experimental task screen informed the participant not

to behave (i.e., click the mouse) during the task. While this instruction was effective in reducing responding on the varied component task to zero levels for Participant 356, behavioral contrast was still not observed.

GENERAL DISCUSSION

There were three primary goals of the current study. The first was to improve upon Hantula and Crowell (1994) by demonstrating positive molar behavioral contrast using typical workplace behaviors and procedures similar to basic research. Positive molar behavioral contrast was potentially observed for one participant (Participant 110) because responding on the target component task moved in a direction away from responding on the varied component task during experimental sessions and the level of responding on the target component task was increased compared to baseline levels. Considering, however, none of the remaining 10 participants who completed the study demonstrated behavioral contrast, the first goal was not completely met.

The second primary goal of the current study was to attempt to account for the schedule of monetary reinforcement issues identified by Dickinson and Poling (1996). The procedures used in the current study accounted for the delay issue (i.e., there was no delay between behavior and consequence in the current study), the complex behavior issue (i.e., the behavior used was simple), and the base pay issue (i.e., base pay was not used). However, since responding on the varied component task during the experimental phase did not extinguish for a majority of the participants (Participants 122, 180, 136, 173, 190, 116, and 160), it is unclear if the procedures addressed the last issue identified by Dickinson and Poling (i.e., accounting for rule-governed behavior). It is possible that responding continued to occur on the varied component task during experimental sessions because rule-governed behavior was not fully accounted for. There are at least two possible explanations for why this could have occurred. The first possible explanation is that the directions were not as accurate or clear about the contingencies as the researcher had intended the directions to be. The directions that were stated prior to every session during the end

of Experiment 1 and all of Experiments 2 and 3 included, "You will earn money every session, however you may not earn money on every task. You do not have to type if you do not want to." Since responding did not decrease during the experimental phase, it is possible that these instructions were not effective or clear enough to produce extinction behavior.

A second possible explanation is that responding continued to occur on the varied component task during the experimental phase because participants developed their own rules about responding. Dickinson and Poling (1996) cautioned that, "...strong rule-governed behavior may interfere with the generation of contingency-shaped behavior" (p. 85). During the debriefing questions in the current study, the researcher asked participants why they continued to respond during the extinction phase. Several participants (i.e., Participants 116, 122, 136, 356) informed the researcher that they 'believed' they were supposed to type during the study, regardless of whether or not money was earned, and did not want to negatively affect the outcome of the study. Therefore, it is possible responding on the varied component task did not extinguish because of participant's self-developed rule-governed behavior about how to behave during the study.

The final primary goal of the study was to determine the methodological variables that are needed to consistently demonstrate behavioral contrast with typically developing verbal adults (e.g., task duration and the amount and type of directions). Considering behavioral contrast was not reliably observed with the procedures used in the current study, this goal was not met. However, since the study found that it was possible to observe positive molar behavioral contrast (with one participant) using typical workplace behaviors and procedures similar to basic research, it may be beneficial to continue this line of research in order to identify the

methodological variables that are needed to consistently demonstrate behavioral contrast with workplace behaviors. For example, researchers could assess whether behavioral contrast is more or less likely to be observed under different VI schedules (e.g., VI 10 s).

Identifying the methodological variables that are needed to consistently demonstrate behavioral contrast is the first step in using the phenomenon as a behavioral technology. Once necessary variables have been identified, it can be determined if behavioral contrast can be integrated into existing business technologies, such as gamification platforms. Using behavioral contrast as a behavioral technology may be a way to improve the effectiveness of gamification software platforms because desired behavior will increase above current steady state levels on one task when the reinforcer density on another task is manipulated. Therefore, employers would be able to increase employee performance on desired tasks without increasing the amount of rewards that are delivered (e.g., customer service representatives increasing the number emails returned).

In addition to further assessment on the methodological variables that are needed to consistently produce behavioral contrast, it may be beneficial to assess the effects of the study's procedures with a population that more closely represents the target population (i.e., not using undergraduate students from psychology courses). For example, if the goal is to use the behavioral contrast phenomenon within a gamification platform, it may be beneficial to assess the procedures with actual employees or using individuals recruited from an online job posting service (e.g., Amazon Mechanical Turk®). Using the current procedures with a different population may yield different results than the current study. For example, it is possible employees will not have self-developed rules about how to respond during a psychology study.

This would be different from the current study, considering at least four participants reported that they continued to respond on the varied component task during the experimental sessions because they 'believed' they were supposed to respond.

One secondary goal of the current study was to assess if either local or anticipatory contrast would be observed. Similar to Boyle et al. (2016), neither local nor anticipatory contrast was consistently observed in the current study. For Participant 110 (i.e., the only participant who potentially demonstrated behavioral contrast), within session analyses of responding on the target component task during the experimental phase showed that responding was fairly consistent across the entire session. Interestingly, however, during Sessions 13, 14, 15, 16, and 21 responding dropped to near zero levels during the final bin (i.e., the final 30 s of the task) (e.g., Figure 18). This could suggest that local contrast was occurring during these sessions. However, within session analyses showed that similar responding was occurring on both the varied component task and the target component task during the return to baseline phase (Sessions 23, 24, and 25). Therefore, it is unlikely that local contrast was occurring during the experimental phase because similar responding continued during the next baseline phase. A possible explanation of why this responding was observed could be the participant's history with the task. Specifically, the participant always received the maximum amount of money ($2.25) on each task (i.e., when pay was available). Therefore, after conducting numerous sessions, it is possible that responding would sometimes cease when the "Pay Earned" counter reached $2.25, because the maximum amount that could be earned had been reached. Another possible explanation is that a ceiling effect was occurring. It is possible that anticipatory contrast was not observed because the tasks selected for the study, typing letters and numbers, were occurring at the highest

possible level for Participant 110 and increased responding was, therefore, not feasible. Future researchers may assess if using alternative tasks in which participants are not likely to perform at high levels during baseline (e.g., aversive tasks) is more likely to produce positive molar contrast and anticipatory contrast.

Another secondary goal of the current study was to attempt to replicate Tarbox and Hayes (2005). This goal was developed when extinction behavior was not reliably observed in Experiments 1 and 2. Similar to Tarbox and Hayes, the researcher wanted to assess if delivering a rule about not responding on the varied component task during the experimental phase would be effective in evoking extinction behavior and if behavioral contrast would be observed. Two participants (Participants 356 and 317) did not exhibit extinction behavior during the experimental phase and were directed not to respond during the varied task (i.e., Participants 356 and 317 were told, "Since you will not earn money during the second task, do not type during that task.") prior to each experimental session. Despite these directions, Participant 317 continued to respond on the varied component task (i.e., she ignored the directions). Participant 356 stopped responding on the varied component task; however, behavioral contrast was not observed because responding on the target component task remained stable as compared to previous levels of responding. Therefore, the current study was unable to replicate the behavioral contrast observed in Tarbox and Hayes when participants were specifically told not to respond on the varied task.

The current study was able to demonstrate positive molar behavioral contrast with one participant, however, the study failed to demonstrate the phenomenon with the remaining 10 participants who completed the study. Considering that it is possible to observe the behavioral

contrast phenomenon using typical workplace behaviors and procedures similar to basic research future research may be warranted. The study also demonstrated that is possible to account for some of the issues that were identified by Dickinson and Poling (1996). Future research may also identify the methodological variables that are needed to reliably observe behavioral contrast using workplace behaviors and may determine if the behavioral contrast phenomenon can be a behavioral technology.

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APPENDIX A

Initial HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: October 26, 2017

To: Heather McGee, Principal Investigator
Brandon Ring, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 17-10-21

This letter will serve as confirmation that your research project titled "Behavioral Contrast in a Simulated Organizational Task" has been **approved** under the **expedited** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., ***you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study***)." Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **October 25, 2018**

1903 W. Michigan Ave., Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276
CAMPUS SITE: 251 W. Walwood Hall

APPENDIX B

Second HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Institutional Review Board
FWA00007042
IRB00000254

Date: February 7, 2018

To: Heather McGee, Principal Investigator
Brandon Ring, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 17-10-21

This letter will serve as confirmation that the change to your research project titled "Behavioral Contrast in a Simulated Organizational Task" requested in your memo received February 2, 2018 (to repeat parts of initial instructions to participants throughout the study) has been approved by the WMU Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **October 25, 2018**

Office of the Vice President for Research
Research Compliance Office
1903 W. Michigan Ave., Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276
WEBSITE: wmich.edu/research/compliance/hsirb

CAMPUS SITE: 251 W. Walwood Hall

APPENDIX C

Third HSIRB Approval Letter

WESTERN MICHIGAN UNIVERSITY

Institutional Review Board
FWA00007042
IRB00000254

Date: March 5, 2018

To: Heather McGee, Principal Investigator
Brandon Ring, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 17-10-21

This letter will serve as confirmation that the changes to your research project titled "Behavioral Contrast in a Simulated Organizational Task" requested in your memo received February 26, 2018 (to increase session length to 30 minutes each; to reduce amount earned to $0.10 per correct character; to increase total duration of participation to ~7 hours; to modify session instructions; to revise consent document and recruitment materials to reflect the changes) have been approved by the WMU Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: **October 25, 2018**

Office of the Vice President for Research
Research Compliance Office
1903 W. Michigan Ave., Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276
WEBSITE: wmich.edu/research/compliance/hsirb

CAMPUS SITE: 251 W. Walwood Hall

APPENDIX D

In Class Recruitment Announcement Script for Experiments 1 and 2

To be read aloud by the student investigator or a research assistant in undergraduate classes

"Hello, my name is _____ and I am here today to tell you about a research opportunity that can earn you up to $70.00 and will be conducted in Wood Hall."

"The study will record participants' letter and number typing behavior under different conditions. The task is similar to a typing and line training program that is used to train data entry processors. Participants will have the opportunity to earn $70.00 and will attend between 9 and 30 sessions for approximately 4 hours total."

****(Do not read the following line unless the instructor has agreed to give extra credit. If the instructor has agreed to give extra credit, say how much is available)****

"*You will also be able to earn _____ points of extra credit in this class if you complete the entire study."*

"Your participation is completely voluntary and you may withdraw from the study at any time. If you do withdraw, you will be able to keep all the money you have earned up to that point. Your willingness to participate in the study or your withdrawal from the study will not affect your grade in any course and your identity will remain confidential."

"If you are interested in learning more about the study, please list your contact information on the individual participant recruitment slips, which I will collect in a few minutes. You can also contact me at brandon.m.ring@wmich.edu. I will email you by the end of the day today to talk more about your potential participation. Thank you for your time.

APPENDIX E

In Class Recruitment Announcement Script for Experiment 3

To be read aloud by the student investigator or a research assistant in undergraduate classes

"Hello, my name is _____ and I am here today to tell you about a research opportunity that can earn you up to $70.00 and will be conducted in Wood Hall."

"The study will record participants' letter and number typing behavior under different conditions. The task is similar to a typing and keypad training program that is used to train data entry processors. Participants will have the opportunity to earn $70.00 and will attend between 9 to 30 sessions for approximately 7 hours total.

****(Do not read the following line unless the instructor has agreed to give extra credit. If the instructor has agreed to give extra credit, say how much is available)****

"*You will also be able to earn _____ points of extra credit in this class if you complete the entire study."*

"Your participation is completely voluntary and you may withdraw from the study at any time. If you do withdraw, you will be able to keep all the money you have earned up to that point. Your willingness to participate in the study or your withdrawal from the study will not affect your grade in any course and your identity will remain confidential."

"If you are interested in learning more about the study, please list your contact information on the individual participant recruitment slips, which I will collect in a few minutes. You can also contact me at brandon.m.ring@wmich.edu. I will email you by the end of the day today to talk more about your potential participation. Thank you for your time.

APPENDIX F

Study Interest Form for All Experiments

Name	WMU Email	Telephone Number

Name	WMU Email	Telephone Number

Name	WMU Email	Telephone Number

Name	WMU Email	Telephone Number

Name	WMU Email	Telephone Number

Name	WMU Email	Telephone Number

APPENDIX G

Initial Email and Eligibility Questionnaire for All Experiments

Thank you for your interest in the Performance on Typing and Keypad Under Varying Schedule Conditions Study! Before you start in the study, we need to determine your eligibility. Please read the question below and respond to this email with your answer.

Thank you and have a great day!

Sincerely,
Brandon Ring

1. Does anything limit you from typing on a computer keyboard (e.g., a broken hand or finger, severe arthritis)? Yes No

APPENDIX H

Ineligibility Email for Typing Ability for All Experiments

Thank you for your interest in the Performance on Typing and Keypad Under Varying Schedule Conditions Study. Unfortunately, you did not meet the criterion to be eligible for the study. If you have any questions or concerns, please do not hesitate to respond to this email.

Thanks,
Brandon Ring

APPENDIX I

Eligibility Email for All Experiments

Thank you for your interest in the Performance on Typing and Keypad Under Varying Schedule Conditions Study! You have been deemed eligible for the study! The first step in the process is to schedule a meeting so we can go over the informed consent, and I can answer any questions you may have. Then you can begin your first session immediately after we read over the informed consent. This first meeting should take about 30 minutes. Please indicate which of the following time slots would work for you to come in to Wood 1532 and learn about the study. If you have any questions or concerns, please do not hesitate to respond to this email.

Time slot 1: [time to be inserted here]
Time slot 2: [time to be inserted here]
Time slot 3: [time to be inserted here]
Time slot 4: [time to be inserted here]
Time slot 5: [time to be inserted here]

Thanks,
Brandon Ring

APPENDIX J

Waitlist Email for All Experiments

Thank you for your interest in the Performance on Typing and Keypad Under Varying Schedule Conditions Study! You are eligible to participant in the study, however we are currently at our maximum number of participants. You will be placed on a waitlist to join the study in case other participants decide to leave the study. You will be placed on the waitlist in the order in which you emailed me. If you have any questions or concerns, please do not hesitate to respond to this email.

Thanks,
Brandon Ring

APPENDIX K

Informed Consent for Experiments 1 and 2

Western Michigan University
Department of Psychology

Principal Investigator:	Heather M McGee, Ph.D.
Student Investigator:	Brandon M Ring, M.A.
Title of Study:	Performance on Typing and Keypad Under Varying Schedule Conditions Study

You have been invited to participate in a research project titled, "Performance on Typing and Keypad Under Varying Schedule Conditions Study". This project will serve as Brandon Ring's dissertation for the requirements of the Ph.D. degree. This consent document will explain the purpose of this research project and will go over all of the time commitments, the procedures used in the study, and the risks and benefits of participating in this research project. Please read this consent form carefully and completely and please ask any questions if you need more clarification.

What are we trying to find out in this study?
The purpose of this study is to examine how productive individuals are on simulated typing and keypad training tasks under different pay schedules.

Who can participate in this study?
In order to participate in the current study, you must be able to type on a computer keyboard and number keypad with both hands. You must also be able to type letters and numbers at a similar rate, using an alphanumeric keyboard.

Where will this study take place?
The study will be conducted in room 1532 and room 1512 in Wood Hall.

What is the time commitment for participating in this study?
You must be available for 9-30 sessions lasting 10 minutes each, for a total time of approximately 4 hours.

What will you be asked to do if you choose to participate in this study?
You will be asked to participate in two separate tasks. In one task, you will copy letter characters into a response bar using a computer keyboard. In a separately presented task, you will be asked to copy number characters into a response bar using a number keypad.

What information is being measured during the study?
We will be recording the number of correct characters that are typed (letters and numbers), the number of incorrect characters that are typed, and the amount of money that you earn. Following the end of the study, you will meet with the student investigator and be debriefed on the study.

What are the risks of participating in this study and how will these risks be minimized?

The nature of this computer-based task is one that requires little physical effort, and should not expose you to risks greater than those you experience when using a computer in your daily life. During sessions you may become tired or experience minor physical discomfort or stress. To minimize these risks, you may take breaks whenever you like.

What are the benefits of participating in this study?
Data from your participation may enhance knowledge in the scientific community by providing information on typing and keypad performance under varying schedules. You may also learn about research through participation in this study. Findings from laboratory studies can be applied in traditional work settings.

Are there any costs associated with participating in this study?
There are no costs associated with participating in this study other than the time it takes to complete the study.

Is there any compensation for participating in this study?
You will have to opportunity to earn up to $70.00 if you complete the entire study. You will have the opportunity to earn money during each session, although the amount earned during each session may vary.

Who will have access to the information collected during this study?
The principal investigator, the student investigator, and the research assistants will have access to the information collected during this study. All participants will be issued identity code numbers, which will be used to identify all data. One master list containing all participant's names and identifying code numbers will be kept and will only be available to the principle and student investigator. When the data from the study are presented or published, pseudonyms will be used to identify each participant.

What if you want to stop participating in this study?
You can choose to stop participating in the study at any time for any reason. You will not suffer any prejudice or penalty by your decision to stop your participation. You will experience NO consequences either academically or personally if you choose to withdraw from this study. The investigator can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the primary investigator, Brandon Ring, at 201-675-0216 or brandon.m.ring@wmich.edu. You may also contact the Chair, Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

_____

Please Print Your Name

_____ _____

Participant's signature Date

APPENDIX L

Informed Consent for Experiment 3

Western Michigan University
Department of Psychology

Principal Investigator:	Heather M McGee, Ph.D.
Student Investigator:	Brandon M Ring, M.A.
Title of Study:	Performance on Typing and Keypad Under Varying Schedule Conditions Study

You have been invited to participate in a research project titled, "Performance on Typing and Keypad Under Varying Schedule Conditions Study". This project will serve as Brandon Ring's dissertation for the requirements of the Ph.D. degree. This consent document will explain the purpose of this research project and will go over all of the time commitments, the procedures used in the study, and the risks and benefits of participating in this research project. Please read this consent form carefully and completely and please ask any questions if you need more clarification.

What are we trying to find out in this study?
The purpose of this study is to examine how productive individuals are on simulated typing and keypad training tasks under different pay schedules.

Who can participate in this study?
In order to participate in the current study, you must be able to type on a computer keyboard and number keypad with both hands. You must also be able to type letters and numbers at a similar rate, using an alphanumeric keyboard.

Where will this study take place?
The study will be conducted in room 1532 and room 1512 in Wood Hall.

What is the time commitment for participating in this study?
You must be available for 9-30 sessions lasting 30 minutes each, for a total time of approximately 7 hours.

What will you be asked to do if you choose to participate in this study?
You will be asked to participate in two separate tasks. In one task, you will copy letter characters into a response bar using a computer keyboard. In a separately presented task, you will be asked to copy number characters into a response bar using a number keypad.

What information is being measured during the study?
We will be recording the number of correct characters that are typed (letters and numbers), the number of incorrect characters that are typed, and the amount of money that you earn. Following the end of the study, you will meet with the student investigator and be debriefed on the study.

What are the risks of participating in this study and how will these risks be minimized?

The nature of this computer-based task is one that requires little physical effort, and should not expose you to risks greater than those you experience when using a computer in your daily life. During sessions you may become tired or experience minor physical discomfort or stress. To minimize these risks, you may take breaks whenever you like.

What are the benefits of participating in this study?
Data from your participation may enhance knowledge in the scientific community by providing information on typing and keypad performance under varying schedules. You may also learn about research through participation in this study. Findings from laboratory studies can be applied in traditional work settings.

Are there any costs associated with participating in this study?
There are no costs associated with participating in this study other than the time it takes to complete the study.

Is there any compensation for participating in this study?
You will have to opportunity to earn up to $70.00 if you complete the entire study. You will have the opportunity to earn money during each session, although the amount earned during each session may vary.

Who will have access to the information collected during this study?
The principal investigator, the student investigator, and the research assistants will have access to the information collected during this study. All participants will be issued identity code numbers, which will be used to identify all data. One master list containing all participant's names and identifying code numbers will be kept and will only be available to the principle and student investigator. When the data from the study are presented or published, pseudonyms will be used to identify each participant.

What if you want to stop participating in this study?
You can choose to stop participating in the study at any time for any reason. You will not suffer any prejudice or penalty by your decision to stop your participation. You will experience NO consequences either academically or personally if you choose to withdraw from this study. The investigator can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the primary investigator, Brandon Ring, at 201-675-0216 or brandon.m.ring@wmich.edu. You may also contact the Chair, Human Subjects Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner. Do not participate in this study if the stamped date is older than one year.

I have read this informed consent document. The risks and benefits have been explained to me. I agree to take part in this study.

_____

Please Print Your Name

_____ _____

Participant's signature Date

APPENDIX M

Experimental Task Overview Instructions for Experiments 1 and 2

“For this study you will be asked to copy prompt letters and numbers in two separate tasks. Each task is 5 minutes long, for a total of 10 minutes. On the computer screen, there will be two tasks that are presented to you, one that shows random strings of letters and one that shows random strings of numbers. All you have to do is copy the letters or numbers that you see by typing into a response bar. The program will take care of all other key presses, such as hitting the space bar, the enter key, or caps lock, so all you have to do is copy the letters or numbers that are presented to you. You also do not have to worry about hitting the backspace key because any incorrect letter or number that you enter will not register on the screen. So again, the only thing you have to worry about is copying letters and numbers.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“While you are typing letters or numbers you will sometimes receive money for typing a correct character on each task (letters and numbers). You will not receive money for every correct character you type, but you can earn money from time to time. You will earn money every session, however you may not earn money on every task. There is a counter on the upper right hand corner that shows the amount of pay earned. If you earn pay, the “Pay Earned” counter will flash green while the amount you earned will increase by $0.25, and a tone will sound. You will get to keep all the money you earn on each task. Remember that you will not always earn money on every task. There is also a Base Pay counter on the upper right hand side of the screen. This counter will remain at $0.00 for the current study. That is, you will not be receiving any base pay, only pay for typing correct letters and/or numbers. You can earn up to $70.00 if you complete the entire study.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“When we go to the computer, the first screen you will see is a practice page. I will walk you through these instructions again once we are at that page. It is important to note that on the practice page the tasks will switch from letters to numbers and back to letters again. This will only occur on the practice page. Once the actual experiment starts, only one task will be presented at a time, and each task will be presented for 5 minutes. In between the tasks there will be a break page that is one minute long. If you would like to skip this page, you can do so by hitting the “Skip” button, and the next task will start. Once the tasks are finished you will see a “Finished” page. Once this comes up, please let me know.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“Please note that if you do not reach the “Finished” page, we will not be able to retrieve your data and will not be able to pay you because we will not know how much you made. Therefore, if you hit any buttons (e.g., the escape button) to try to end your session early or try to leave before the session is completed, you will not receive your money for the session. Please wait here until I call you to come into the other room.”

APPENDIX N

Experimental Task Overview Instructions for Experiment 3

“For this study you will be asked to copy prompt letters and numbers in two separate tasks. Each task is 15 minutes long, for a total of 30 minutes. On the computer screen, there will be two tasks that are presented to you, one that shows random strings of letters and one that shows random strings of numbers. All you have to do is copy the letters or numbers that you see by typing into a response bar. The program will take care of all other key presses, such as hitting the space bar, the enter key, or caps lock, so all you have to do is copy the letters or numbers that are presented to you. You also do not have to worry about hitting the backspace key because any incorrect letter or number that you enter will not register on the screen. So again, the only thing you have to worry about is copying letters and numbers.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“While you are typing letters or numbers you will sometimes receive money for typing a correct character on each task (letters and numbers). You will not receive money for every correct character you type, but you can earn money from time to time. You will earn money every session, however you may not earn money on every task. There is a counter on the upper right hand corner that shows the amount of pay earned. If you earn pay, the “Pay Earned” counter will flash green while the amount you earned will increase by $0.10, and a tone will sound. You will get to keep all the money you earn on each task. Remember that you will not always earn money on every task. There is also a Base Pay counter on the upper right hand side of the screen. This counter will remain at $0.00 for the current study. That is, you will not be receiving any base pay, only pay for typing correct letters and/or numbers. You can earn up to $70.00 if you complete the entire study.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“When we go to the computer, the first screen you will see is a practice page. I will walk you through these instructions again once we are at that page. It is important to note that on the practice page the tasks will switch from letters to numbers and back to letters again. This will only occur on the practice page. Once the actual experiment starts, only one task will be presented at a time, and each task will be presented for 15 minutes. In between the tasks there will be a break page that is one minute long. If you would like to skip this page, you can do so by hitting the “Skip” button, and the next task will start. Once the tasks are finished you will see a “Finished” page. Once this comes up, please let me know.”

“Do you have any questions?”

****Researcher: Answer question(s) by restating the instructions****

“Please note that if you do not reach the “Finished” page, we will not be able to retrieve your data and will not be able to pay you because we will not know how much you made. Therefore, if you hit any buttons (e.g., the escape button) to try to end your session early or try to leave before the session is completed, you will not receive your money for the session. Please wait here until I call you to come into the other room.”

APPENDIX O

Practice Page Instructions for Experiments 1 and 2

“This is an example of what the letters task will look like. The only difference is on the actual task page there will not be a timer, a “Skip” button, or the “Audio Cue” button.”

“First I am going to show you what the task looks like.”

****Researcher: Type the first three letters****

“As you can see, when you type a correct letter, the letter appears directly under the prompt letter”

****Researcher: Type the fourth letter****

“As you can see you do not need to press the space bar; the letters will move automatically”

****Researcher: Type an incorrect letter****

“Now I am typing an incorrect letter. As you can see, nothing is appearing. Therefore, if you make a mistake, do not worry about hitting the backspace or delete key.”

****Researcher: Point to Pay Earned counter****

“When you earn money for typing a correct character, the amount you earn will show up here on the Pay Earned counter and flash green every time. There will also be a sound that plays when money is earned. For this study, you will not be able to earn any Base Pay. Therefore, the only money you will earn will be show on the Pay Earned counter. Remember that you will only sometimes earn money, not all the time.”

****Researcher: Play audio cue****

“So when you hear that sound, what does it mean?”

****Researcher: Wait for the participant to say, “I earn money” If they do not say, “I earn money”, tell them that they will earn money and ask if they understand****

“That’s right!! Now you try and type a few letters to practice.”

****Researcher: Once the participant has entered all the letters and the numbers task appears, stop the participant****

“When you hit that last letter, the screen will generate a new string. Therefore, you do not have to hit the return or enter button. Since this is the practice page, the numbers task will appear next. Please remember that during the actual task, only one task (letters or numbers) will appear for 5 minutes. Only after the first 5 minutes will the next task appear. Do you understand?

****Researcher: Make sure the participant answers in the affirmative. Wait until after they type the last letter character and the number task appears****

"This is an example of what the numbers task will look like. The only difference is on the actual task page there will not be a timer, a "Skip" button, or the "Audio Cue" button."

"The task works the same way as the letters task in that you only need to type numbers. You will not have to hit the backspace, enter, or space bar."

"The "Pay Earned" counter will reset for each task, but you will receive all the money you earn for both tasks at the end of the session."

"Remember, do not hit any buttons to try to close the program. If the "Finished" page does not appear at the end, we will not know how much you made and will not be able to pay you. Do you understand?"

****Researcher: Make sure the participant answers in the affirmative****

"Do you have any questions?"

****Researcher: Answer questions by restating the instructions.****

"After the first task there will be a break page for 1 minute that you can skip by pressing the "Skip" button, if you would like. You can continue to practice until the timer runs out or press the "Skip" button to begin the first task."

APPENDIX P

Practice Page Instructions for Experiment 3

"This is an example of what the letters task will look like. The only difference is on the actual task page there will not be a timer, a "Skip" button, or the "Audio Cue" button."

"First I am going to show you what the task looks like."

****Researcher: Type the first three letters****

"As you can see, when you type a correct letter, the letter appears directly under the prompt letter"

****Researcher: Type the fourth letter****

"As you can see you do not need to press the space bar; the letters will move automatically"

****Researcher: Type an incorrect letter****

"Now I am typing an incorrect letter. As you can see, nothing is appearing. Therefore, if you make a mistake, do not worry about hitting the backspace or delete key."

****Researcher: Point to Pay Earned counter****

"When you earn money for typing a correct character, the amount you earn will show up here on the Pay Earned counter and flash green every time. There will also be a sound that plays when money is earned. For this study, you will not be able to earn any Base Pay. Therefore, the only money you will earn will be show on the Pay Earned counter. Remember that you will only sometimes earn money, not all the time."

****Researcher: Play audio cue****

"So when you hear that sound, what does it mean?"

****Researcher: Wait for the participant to say, "I earn money" If they do not say, "I earn money", tell them that they will earn money and ask if they understand****

"That's right!! Now you try and type a few letters to practice."

****Researcher: Once the participant has entered all the letters and the numbers task appears, stop the participant****

"When you hit that last letter, the screen will generate a new string. Therefore, you do not have to hit the return or enter button. Since this is the practice page, the numbers task will appear next. Please remember that during the actual task, only one task (letters or numbers) will appear for 15 minutes. Only after the first 15 minutes will the next task appear. Do you understand?

****Researcher: Make sure the participant answers in the affirmative. Wait until after they type the last letter character and the number task appears****

"This is an example of what the numbers task will look like. The only difference is on the actual task page there will not be a timer, a "Skip" button, or the "Audio Cue" button."

"The task works the same way as the letters task in that you only need to type numbers. You will not have to hit the backspace, enter, or space bar."

"The "Pay Earned" counter will reset for each task, but you will receive all the money you earn for both tasks at the end of the session."

"Remember, do not hit any buttons to try to close the program. If the "Finished" page does not appear at the end, we will not know how much you made and will not be able to pay you. Do you understand?"

****Researcher: Make sure the participant answers in the affirmative****

"Do you have any questions?"

****Researcher: Answer questions by restating the instructions.****

"After the first task there will be a break page for 1 minute that you can skip by pressing the "Skip" button, if you would like. You can continue to practice until the timer runs out or press the "Skip" button to begin the first task."

APPENDIX Q

Ineligibility Email for Typing Proficiency for All Experiments

Thank you for attending the first session of the Performance on Typing and Keypad Under Varying Schedule Conditions Study. Unfortunately, you did not meet the criterion to be eligible for the study. If you have any questions or concerns, please do not hesitate to respond to this email.

Thanks,
Brandon Ring

APPENDIX R

Debriefing Questions for All Experiments

1. Did you prefer one task over another task? If yes, which one and why?
2. Do you feel you were better at one task than another task?
3. What do you think was occurring during the task?

APPENDIX S

Debriefing Statement for All Experiments

"Thank you for participating in the study! I want to briefly explain to you what occurred. We were investigating something called behavioral contrast, which is a phenomena found to occur with non-human animals and has only been studied a few times with humans. We were assessing to see how your responding would change in the unchanged task when the consequence for the changed task was no longer provided. With non-human animals, the responding in the unchanged task (**Researcher: say what the target component was for this participant**) would increase compared to baseline levels when (**Researcher: say what the varied component was for this participant**) no longer gave any consequence."

Researcher: Ask if the participant has any questions and answer the question(s).

"In this study there were three phases, an initial baseline phase, the experimental phase, and a return to baseline phase. During both of the baseline phases the pay for each task paid about the same amount of money. We expected your responding to be about equal in each of these tasks. During the experimental phase, the (**Researcher: say what the varied component was for this participant**) task no longer gave any money. We expected that the responding on this task would reduce to zero while the responding on the (**Researcher: say what the target component was for this participant**) task would increase compared to baseline levels."

Researcher: Ask if the participant has any questions and answer the question(s).

"Thank you for your time, you have completed the study!"

APPENDIX T

Half Instructions for Experiment 1

"*Remember you will earn money every session, however you may not earn money on every task. There is a counter on the upper right hand corner that shows the amount of pay earned. If you earn pay, the "Pay Earned" counter will flash green while the amount you earned will increase, and a tone will sound. You will get to keep all the money you earn on each task. Remember that you will not always earn money on every task."*

APPENDIX U

Full Instructions for All Experiments

"*Remember you will earn money every session, however you may not earn money on every task. There is a counter on the upper right hand corner that shows the amount of pay earned. If you earn pay, the "Pay Earned" counter will flash green while the amount you earned will increase, and a tone will sound. You will get to keep all the money you earn on each task. Remember that you will not always earn money on every task."*

"*You do not have to type if you do not want to. Feel free to use your phone or do other tasks. You will be able to keep all the money you earn for correctly typing the characters and can not lose the money you already earned if you stop typing."*