IMMEDIATE AND SUBSEQUENT EFFECTS OF FIXED-TIME DELIVERY OF THERAPIST ATTENTION ON PROBLEM BEHAVIOR MAINTAINED BY ATTENTION

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Thesis Prepared for the Degree of

MASTER OF SCIENCE

UNIVERSITY OF NORTH TEXAS

August 2009

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The purpose of the current study was to investigate the immediate and subsequent effects of fixed-time attention on problem behavior maintained by therapist attention utilizing a three-component multiple-schedule design. The treatment analysis indicated that fixed-time attention produced a significant immediate decrease in the frequency of physically disruptive behavior (PDB), represented by low frequencies of PDB in Component 2, as well as a continued subsequent effect, represented by lower frequencies of problem behavior in Component 3 when compared to Component 1. The possible behavioral mechanisms responsible for the observed suppression in Component 2 of the treatment analysis are discussed. Evidence of behavioral contrast was observed in Components 1 and 3 of the treatment analysis in conditions in which Component 2 contained a fixed-time schedule of stimulus delivery. In addition, limitations and future research are outlined.
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ACKNOWLEDGEMENTS

First and foremost, I would like to thank my advisor Dr. Richard Smith. You have been an instrumental influence in my life. I am forever grateful for all that you have taught me, both in life and science. Thank you Dr. Manish Vaidya, your enthusiastic approach to the scientific analysis of human behavior is something that I can only hope to emulate one day. Thank you Dr. Einar Ingvarsson, your feedback on this project is greatly appreciated. I would like to thank entire DBA faculty, each and every one of you has made significant contributions in the shaping of this young scientist. To my peers and the many beers we shared, I am thankful for each and every one. I would also like to extend my gratitude to Carla Smith, for your unselfish dedication to the BARC project and each and every one of your BARC kids. To the rest of the BARC posse, thank you for answering the phones and showing up for sessions even though you knew what was coming, you are the model of academic congeniality. I wish you all well in future endeavors. Last, but not least, I would like to thank my best friend and continued supporter Nicole Zeug. The impression that you have made in my life is unprecedented, I would not be the person that I am today without you and for that I am forever thankful.
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CHAPTER I

INTRODUCTION

Noncontingent reinforcement (NCR) is a procedure in which a known reinforcing stimulus is delivered independent of responding, typically utilizing time-based schedules of stimulus delivery (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993). NCR has been proven effective in the treatment of many different topographies of problem behavior of varying behavioral function (Carr, Severtson, & Lepper, 2009). However, there has been some debate regarding the description of NCR procedures. Poling and Normand (1999) maintain that accurate schedule descriptions (e.g., fixed-time schedules or response-independent schedules) serve as better descriptions of NCR procedures, because reinforcement is typically defined functionally—that is, as a contingency between behavior and a change in the environment (stimulus presentation or withdrawal) that increases the future probability of a response occurring in similar situations. Poling and Normand (1999) hold that NCR, as a description of response-independent stimulus delivery, Although Poling and Normand make a valid argument, this debate seems somewhat moot as a casual search of the Journal of Applied Behavior Analysis (JABA) Website shows that both NCR and accurate schedule descriptors are still commonly used in the literature (e.g., Simmons, Smith, & Kliethermes, 2003; Wilder, Normand, & Atwell, 2005). However, to avoid confusion, the current paper uses schedule descriptions (e.g., fixed-time stimulus delivery or response-independent stimulus delivery) from this point forward to refer to applications of NCR.
Early studies utilized response-independent schedules as control procedures (e.g., Buell, Stoddard, Harris, & Baer, 1968; Goetz, Holmberg, & LeBlanc, 1975; Hart, Reynolds, Baer, Brawley, & Harris, 1968). These schedules serve nicely as controls because they involve the continued delivery of stimuli independent of responding, thus breaking down, over time, established reinforcement contingencies while still allowing the evaluation of response-independent stimulus presentation. For example, Buell et al. (1968) utilized a response-independent schedule as a control procedure in the treatment of a preschooler with social deficits. During treatment, reinforcement (i.e., teacher attention) was delivered contingent on appropriate interaction with playground equipment. During reversal conditions (i.e., control), teacher attention was provided at random times, independent of appropriate interaction with playground equipment. The authors found that when teacher attention was contingent on the target behavior, appropriate interaction with playground equipment increased. However, when teacher attention was provided independent of the target behavior, interaction with playground equipment decreased.

More recently, time-based schedules have been utilized as treatment procedures. For example, Mace and Lalli (1991) showed that when attention was provided independent of bizarre speech maintained by contingent attention significant decreases in bizarre speech resulted. This study is significant because it was the first applied study to utilize a stimulus that was functionally related to problem behavior (i.e., maintained problem behavior), within the context of a time-based schedule. Now, the time-based delivery of stimuli identified to reinforce problem behavior is commonplace in
treatments (e.g., Fisher, DeLeon, Rodriguez-Catter, & Keeney, 2004; Fischer, Iwata & Mazaleski, 1997; Kahng, Iwata, Thompson & Hanley, 2000; Sigafoos & Tucker, 2000; Vollmer et al., 1993).

The suppressive effects demonstrated in applications of response-independent stimulus delivery are commonly thought to be a result of two behavioral processes, extinction and satiation/habituation\(^1\) (Vollmer et al., 1993). Extinction is an implicit component of response-independent stimulus delivery, as stimuli are delivered independent of responding, breaking previously established contingencies between operant classes and maintaining reinforcers. Satiation/habituation is also thought to be involved in the reductive effects of response-independent schedules due to prolonged or repeated exposure to reinforcers, reducing the condition of deprivation that has brought the operant to strength (Carr, Bailey, Ecott, Lucker, & Weil, 1998; Hagopian, Crockett, van Stone, DeLeon, Bowman 2000; Kahng, Iwata, Thompson & Hanley, 2000; Vollmer et al., 1993). However, determining if observed suppression is a function of extinction, satiation/habituation, or a combination of processes can be difficult (Hagopian et al., 2000; Lalli, Casey, & Kates, 1997; Vollmer et al., 1993).

Several studies have attempted to identify the role of basic processes in applications of response-independent stimulus delivery (Carr et al., 1998; Hagopian et al., 2000; Kahng et al., 2000; Lalli et al., 1997). For example, Carr et al. (2000) compared the effects of response-independent schedules under varying magnitudes of

\(^{1}\) There is some debate in the field of applied behavior analysis as to whether satiation or habituation most accurately describes inferred decreases in reinforcer effectiveness. In the current paper the terms will be used synonymously as both processes are described as producing similar behavioral effects (i.e., decreased frequencies of responding as a function of repeated or extended contact with a reinforcing stimulus). For a thorough discussion of this topic see Murphy, McSweeney, Smith, and McComas (2004).
reinforcing stimuli. Their results showed that dense response-independent schedules (i.e., those that programmed high magnitudes of reinforcing stimuli) resulted in low response measures; response-independent schedules of moderate values (i.e., those that programmed moderate magnitudes of reinforcing stimuli) resulted in somewhat lower response measures, relative to baseline conditions; and lean response-independent schedules (i.e., those that programmed low magnitudes of reinforcing stimuli) resulted in response measures that were undifferentiated from baseline conditions. The outcomes of this study indicated that response measures varied inversely with the amount of response-independent stimulus delivery, suggesting that satiation/habituation was responsible for the observed suppression.

Marcus and Vollmer (1996) investigated the superimposition of a differential reinforcement of alternative behavior (DRA) contingency on a response-independent schedule of stimulus delivery. The results of this study are particularly interesting in that, when the response-independent schedule was programmed at a relatively dense schedule (i.e., continuous access), very little of the alternative response was observed, suggesting satiation/habituation. However, when the response-independent schedule programmed a leaner schedule of stimulus delivery, higher rates of the alternative response were observed while low measures of the response targeted for reduction were maintained. Thus the results of Marcus and Vollmer (1996) suggest that satiation/habituation and extinction may work in concert to produce the suppressive effects observed in applications of response-independent schedules of stimulus delivery.
One way to obtain information about the processes underlying the effects of response-independent schedules is to observe patterns of behavior when the schedules are terminated. Typically, research on interventions for problem behavior investigates only the immediate effects of behavioral treatments. That is, measures are taken from relatively brief sessions during which the treatment is delivered continuously and with a high degree of fidelity. However, there is a small but growing body of research that has measured the immediate as well as the subsequent behavioral effects of behavioral treatments. These studies investigate subsequent behavioral effects by making use of a three-component multiple-schedule design (Atcheson, 2006; Blevins, 2003; Cherryholmes, 2007; Rapp, 2006; Rapp, 2007; Simmons et al., 2003; Soderlund, 2003). A multiple schedule is an arrangement in which simple behavioral contingencies (typically, reinforcement schedules) are presented sequentially, with each presentation associated with a distinct stimulus (i.e., components are “signaled”). For example, in studies using multiple schedules to investigate immediate and subsequent treatment effects, baseline conditions are presented immediately prior to and following implementation of treatment, with each condition associated with obvious stimulus changes. To date, research in this area has focused on two types of behavioral treatments, response-independent stimulus presentation (Cherryholmes, 2007; Rapp, 2006; Rapp, 2007; Simmons et al., 2003) and response-restriction procedures such as blocking (Atcheson, 2006; Blevins, 2003; Rapp, 2006; Soderlund, 2003).

Much research that has been conducted using multiple (or mixed) schedules has focused on behavior that is automatically maintained (i.e., behavior that persists
independent of social consequences). For example, Simmons et al. (2003) evaluated the immediate and subsequent effects of fixed-time food delivery on mouthing maintained by automatic reinforcement, as determined through an analog functional analysis. The results showed significantly reduced rates of mouthing during the treatment condition (i.e., Component 2) compared to Component 1. The results also showed consistently lower rates of responding in Component 3, compared to Component 1. These results suggest that the treatment had a significant and immediate effect, which persisted for some time following discontinuation of treatment.

Cherryholmes (2007) was the first author to use a multiple schedule to investigate immediate and subsequent effects of a treatment for problem behavior maintained by social positive reinforcement. Cherryholmes conducted an analog functional analysis and found that problem behavior was maintained by therapist-delivered access to food items. During the subsequent treatment analysis food was delivered contingent on problem behavior during Components 1 and 3 of the multiple schedule, while food was delivered on response-independent schedules during Component 2. Results revealed that when food items were presented on a very dense schedule (i.e., continuous delivery), problem behavior was reduced to near zero during Component 2. However, rates of problem behavior during Component 3 were similar to those obtained in Component 1, indicating that the treatment had a significant immediate effect, but failed to produce any subsequent effects. Furthermore, attempts to fade the schedule met with limited success, and extended exposure to extinction was
ultimately necessary to produce clinically significant reductions in problem behavior in the absence of continuous food presentation.

The purpose of the current study was to investigate the immediate and subsequent effects of fixed-time attention on problem behavior that was maintained by therapist attention, utilizing a combined reversal and three-component multiple-schedule design (Atcheson, 2006; Cherryholmes, 2007; Rapp, 2006; Rapp, 2007; Simmons, Smith, & Kliethermes, 2003). First, a functional analysis similar to that described in Iwata et al. (1994) indicated that the problem behavior (e.g., physically disruptive behavior [PDB]) of the participant was maintained by positive reinforcement in the form of therapist attention. Second, a treatment analysis was conducted using a combined reversal and three-component multiple-schedule design. Components 1 and 3 always contained BL contingencies. Component 2 contained either an FT schedule of attention delivery or BL conditions, depending on the experimental condition. The obtained frequencies of problem behavior in Component 2 were compared against the obtained frequencies of problem behavior in Component 1 in order to assess the immediate effects of the treatment. The observed frequencies of problem behavior obtained in Component 3 were compared against the observed frequencies of problem behavior obtained in Component 1 in order to assess the subsequent effects of treatment. Finally, response patterns across components were examined throughout the course of treatment for evidence of longer-term changes associated with exposure to the treatment within the three-component multiple schedule.
CHAPTER II
PRE-TREATMENT FUNCTIONAL ANALYSIS

Participant and Setting

Nicole was an 18-year-old female with profound mental retardation who exhibited physically disruptive behavior. Nicole resided at a large, long-term state residential and training facility for persons with developmental disabilities for 6 months prior to the study. An interdisciplinary team referred Nicole to a specialized program (Behavior Analysis Resource Center [BARC]) for assessment and treatment of problem behavior. All pre-treatment assessments were conducted in a clinic room at the BARC facility. The clinic room was 3.7 m by 3.7 m with a two-way mirror for unobtrusive observation and data collection. The room contained a 1.2 m by 0.8 m table, one stationary chair, one rolling chair, and other supplies as needed. Handheld computers and data collectors were present outside the clinic room during all sessions.

Response Definitions

Physically disruptive behavior (PDB) served as the dependent variable and was operationally defined as pushing or throwing items to the floor from hands or a table, pulling on or tearing items. Tangible delivery, tangible consumption, attention, demands, and compliance served as the independent variables. Tangible delivery was scored anytime the therapist placed a Cheeto on the table following an occurrence of PDB. Tangible consumption was scored when Nicole put a piece of food in her mouth. Attention was scored anytime the therapist talked to the participant for longer than 1 s and was recorded until attention was withdrawn for 1 s. Demand was scored when the
therapist delivered a verbal request to Nicole to complete a task; the therapist employed a three-prompt sequence technique (verbal prompt, visual [modeling] prompt, physical guidance), but only the first (verbal) prompt in the three prompt sequence was scored. Compliance was scored when the participant engaged in the requested behavior prior to the presentation of the third prompt (physical guidance) in the escalating prompting sequence.

Measurement

Trained observers using handheld computers recorded all data. Observers monitored sessions through a one-way mirror installed in the entrance wall of the clinic room. Physically disruptive behavior, tangible delivery, tangible consumption, demands, and compliance were scored using event recording, and attention was recorded as a duration measure.

Interobserver Agreement

Interobserver agreement (IOA) was assessed by dividing the session time into 1-s intervals, dividing the number of intervals in which primary and secondary observers agreed on the occurrence or absence of behavior by the number of intervals in the session, and multiplying the result by 100. IOA was collected for 26.7% of the functional analysis sessions. Mean agreement for PDB was 99.83% (range = 99.3% to 100%). Mean agreement for tangible delivery was 99.83% (range = 99.3% to 100%). Mean agreement for tangible consumption was 99.83% (range = 99.3% to 100%). Mean agreement for therapist attention was 100% (range = 100% to 100%). Mean agreement for demands was 98.28% (range = 93.3% to 100%). Mean agreement for
compliance was 98.25% (range = 93% to 100%). It should be noted that IOA was never collected during any of the three attention conditions.

Experimental Design and Procedure

A functional analysis similar to that described by Iwata et al. (1994) was conducted. Sessions were 10 min in length and were conducted 1-4 times per day, 3-5 times per week, approximately one hour after Nicole returned home from school. Sessions were presented in a multielement format in the following order:

*Alone.* The purpose of alone condition was to assess whether PDB would maintain in the absence of social consequences. In the alone condition, Nicole was in the therapy room by herself. No activities or leisure items were present during this condition. There were no programmed consequences for occurrences of PDB.

*Attention.* The purpose of the attention condition was to evaluate if therapist attention functioned as positive reinforcement for PDB. In the attention condition, Nicole was in the room with therapist. Leisure items were available to Nicole for the duration of the session. The therapist was seated in the northwest corner of the therapy room and always had a magazine to read. At the beginning of the session, the therapist gave 5 to 10 s of response-independent attention to Nicole and then said nothing else until problem behavior occurred. Each time Nicole engaged in PDB, the therapist delivered attention in the form of disapproval or concern for 5 to 10 s. If Nicole continued to engage in the problem behavior during attention delivery, the therapist continued to deliver attention until PDB ceased.
Tangible. The purpose of the tangible condition was to evaluate if tangible items functioned as positive reinforcement for PDB. In this condition, Nicole and the therapist were in the therapy room together; no leisure items were available for Nicole. The therapist was seated in the northwest corner of the therapy room and always had a magazine to read. Nicole was given one Cheeto at the beginning of the session. During the condition, the therapist kept a small bag of Cheetos on his lap; Cheetos were always visible. No verbal attention was provided to Nicole during this condition. Following every occurrence of PDB the therapist placed one Cheeto on the table approximately .5 m in front of Nicole.

Play. The play condition served as a control. In this condition, the therapist and Nicole were in the therapy room. Leisure materials were present on the table, and the therapist sat across from Nicole. The therapist interacted with Nicole every 30 s and any time Nicole initiated interaction. All occurrences of problem behavior were ignored, and if problem behavior occurred at the scheduled time of interaction the interaction was delayed by 10 s.

Demand. The purpose of demand condition was to evaluate if the termination of task demands functioned as negative reinforcement for PDB. In this condition, the therapist and Nicole were in the therapy room. The therapist provided a verbal request to Nicole to clap her hands every 30 s. If she did not clap her hands within 5 s, the therapist provided a visual (modeling) prompt. If she did not clap her hands within 5 s following the modeling prompt, the therapist physically guided Nicole to clap her hands. If Nicole engaged in PDB at anytime between the initial
prompt and completion of the task, the demand was terminated and she was told, “You don’t have to,” or “Never mind,” while the therapist backed away from her. The demand was presented again at the next 30-s interval. If Nicole was engaging in PDB at the time a demand was scheduled, the demand was not delivered.

Results

Results of the functional analysis are presented in Figure 1. No problem behavior was observed in the alone, play, and demand conditions. The tangible condition produced a mean frequency of .66 responses per session (range = 0 to 2). The attention condition produced mean frequency of 8.33 responses per session (range =2 to 13). The outcomes of the functional analysis indicated that Nicole’s problem behavior was maintained by positive reinforcement in the form of attention delivery.
CHAPTER III
TREATMENT ANALYSIS

Subject and Setting

Based on the results of the pretreatment functional analysis, Nicole participated in a treatment analysis. The setting was the same as described in chapter II.

Response Definitions

Physically disruptive behavior (PDB) served as the dependent variable and was operationally defined as hitting, pulling, or tearing the therapist’s magazine. The operational definition of PDB used in the treatment analysis differs from the operational definition used in the functional analysis. The definition was changed for two reasons: one, to gain greater experimental control; and two, to reduce the possibility of Nicole inadvertently injuring herself or the therapist. All other response definitions were identical to those used during the functional analysis.

Measurement and Interobserver Agreement

Data collection and IOA procedures were identical to those used during the functional analysis. IOA was collected for 47% of the treatment analysis sessions. Mean agreement for PDB was 95.3% (range = 86.3% to 99.3%). Mean agreement for therapist attention was 94.2% (range = 87.4% to 100%).

Experimental Design and Procedure

Initially, the effect of a FT 5s schedule of attention presentation was evaluated using a combination reversal and three-component multiple-schedule design. Subsequently, escalating values of the FT schedule were evaluated using a three-
component multiple schedule design. Initial BL sessions where 30 min in length, it was observed that after 21 min the frequency of PDB decreased. In order to minimize the effects of satiation/habituation in later components (i.e., Components 2 and 3), subsequent sessions were 21 min in length (only data from the first 21 min of the initial BL sessions are presented). Each session was divided into three 7-min components. In Components 1 and 3 the therapist’s statement “I am just going to be sitting here reading my magazine for a few minutes” served as the discriminative stimulus. There was not a clear stimulus change that was associated with Component 2, but rather there were a host of stimulus changes that occurred at the onset of the component, including the delivery of therapist attention, eye contact, and change of body positions. One session was conducted per day, and all sessions were conducted approximately one hour following Nicole’s return home from school. During the treatment analysis, a magazine was always present on the lap of the therapist.

**Baseline.** Baseline procedures were identical to those used in the attention condition in the functional analysis, with the exception that the sessions were 21 minutes in length. For the purposes of data analysis, sessions were divided in three 7-min components.

**FT Attention Analysis**

**Component 1: Attention.** Component 1 was procedurally identical to the attention condition of the functional analysis, with the exception that sessions were 7 min rather than 10 min in length. At the beginning of Component 1, the therapist gave Nicole 5 s to 10 s of noncontingent attention and then said nothing else until problem
behavior occurred. Every time Nicole engaged in PDB, the therapist delivered attention for 5 s to 10 s in the form of disapproval or concern.

*Component 2: FT Attention.* Component 2 was conducted immediately following Component 1. In Component 2, the therapist delivered attention according to a predetermined fixed-time (FT) schedule. Attention was always delivered at the start of Component 2. Initially, 5 s of attention was delivered on a FT 5 s schedule; thus, the initial schedule resulted in continuous delivery of attention. Following initial reversals, the FT schedule of attention delivery was gradually faded. Fading values were determined using a method proposed by Kahng et al. (2000). The initial value was based on the average interresponse time (IRT) derived from the first component of the previous three sessions. Based upon this calculation the initial fade value was set at FT 15 s. FT values were gradually increased from 15 s to 420 s, in the following order 15 s, 30 s, 60 s, 120 s, 180 s, 240 s, 300 s, 360 s, 420 s. The FT value was increased after 3 consecutive sessions in which the rate of problem behavior was less than .5/min in the second component. If Nicole did not meet the criterion for advancing the FT schedule after 10 consecutive sessions at a given FT value, the previous FT schedule was reimplemented.

It should be noted that the form of attention delivered during the second component differed from the type of attention delivered in the first and third components. Whereas reprimands were delivered contingent on problem behavior in Components 1 and 3, the therapist typically discussed daily events with Nicole and
asked her questions about her day (i.e. “Did you have a good day today?” “Did you have a good lunch today?” “Did you get to play basketball today?”) in Component 2.

*Component 3: Attention.* Component 3 was conducted immediately following Component 2. Procedures were identical to Component 1.

**Results**

The results of Nicole’s treatment analysis are displayed in Figure 2. Open circles represent data values from Component 1, closed squares represent data values from Component 2, and open triangles represent data values from Component 3.

In the initial BL, frequencies were undifferentiated across all three components. The mean frequency, per component, of PDB across Component 1, 2, and 3 respectively, was 12.79 (range = 6 to 29), 11.23 (range = 0 to 24), and 12.38 (range = 1 to 30).

Following the initial baseline, a multiple-schedule evaluation of FT 5 s attention was conducted. The mean frequency of PDB in Component 1 was 34.18 (range = 26 to 43). The mean frequency of PDB in Component 2 was 2.8 (range = 0 to 8). The mean frequency of PDB in Component 3 was 24.36 (range = 7 to 38). Thus, the FT 5 s schedule of attention (Component 2) produced a significant decrease in the frequency of PDB, relative to Components 1 and 3. There was also a decrease in the frequency of PDB in the third component, relative to the first. In all but 2 of the 11 sessions, response frequencies obtained in the third component were lower than those of the first component.
Following the initial implementation of the FT 5s condition, BL conditions were reinstated. The mean frequency of PDB in Component 1 was 32.2 (range = 26 to 36). The mean frequency of PDB in Component 2 was 28.2 (range = 20 to 39). The mean frequency of PDB in Component 3 was 36.2 (range = 28 to 52). Thus the frequency of PDB was relatively stable across all components.

Following the 2nd BL condition, FT 5 s was reinstated in Component 2. The mean frequency of PDB in Component 1 was 34.17 (range = 25 to 41). The mean frequency of PDB in Component 2 was 3.0 (range = 1 to 6). The mean frequency of PDB in the Component 3 was 39.33 (range = 33 to 44). Thus, the FT 5 s schedule of attention again produced a significant decrease in the frequency of PDB, relative to the first component. However, the frequency of PDB in the third component was higher than the frequency of PDB in the first component. In fact, the frequency of PDB was lower in the third condition, relative to the first condition, in only one session. This pattern of responding was the opposite of that observed in the initial FT 5 s condition, during which the frequency of responding was typically highest in the first component.

Following the second implementation of the FT 5s condition, BL conditions were reinstated. The mean frequency of PDB in Component 1 was 35.67 (range = 26 to 45). The mean frequency of PDB in Component 2 was 30.33 (range = 26 to 40). The mean frequency of PDB in Component 3 was 20.17 (range = 14 to 27). There was an overall decreasing trend in the frequency of responding across the three components (i.e., the highest frequency of responding was observed in Component 1, a lower frequency of responding was observed in Component 2, and the lowest frequency of responding was
observed in Component 3). This pattern of responding is consistent with a within-session reinforcer abolishing effect due to satiation or habituation (Smith & Iwata, 1997). This pattern of responding had not been observed in previous implementations of BL conditions.

Following the third implementation of BL conditions, an extended FT 5 s condition was implemented to further investigate differences in response patterns observed during the first and second FT 5 s conditions. The mean frequency of PDB in Component 1 was 30.84 (range = 17 to 43). The mean frequency of PDB in Component 2 was 1.58 (range = 0 to 5), a significant decrease relative to Component 1. The mean frequency of PDB in Component 3 was 29.53 (range = 14 to 44). The extended evaluation of the FT 5 s condition showed no systematic difference between obtained frequencies of PDB in Components 1 and 3.

Following the 3rd implementation of the FT 5 s condition, the FT schedule of attention was gradually faded from FT 5 s to FT 420 s. In the FT 15 s condition, the mean frequency of PDB in Component 1 was 31.76 (range = 13 to 70). The mean frequency of PDB in Component 2 was 3.33 (range = 0 to 8). The mean frequency of PDB in Component 3 was 23.11 (range = 2 to 38). In the FT 30 s condition, the mean frequency of PDB in Component 1 was 25.33 (range = 24 to 27). The mean frequency of PDB in Component 2 was 0.67 (range = 0 to 2). The mean frequency of PDB in Component 3 was 27 (range = 1 to 50). In the FT 60 s condition, the mean frequency of PDB in Component 1 was 23 (range = 20 to 29). The mean frequency of PDB in Component 2 was 0.33 (range = 0 to 1). The mean frequency of PDB in Component 3
was 10.33 (range = 3 to 23). In the FT 120 s condition, the mean frequency of PDB in Component 1 was 57.33 (range = 37 to 75). The mean frequency of PDB in Component 2 was 0.0. The mean frequency of PDB in Component 3 was 18.33 (range = 2 to 31). In the FT 180 s condition, the mean frequency of PDB in Component 1 was 43 (range = 36 to 55). The mean frequency of PDB in Component 2 was 0.67 (range = 0 to 2). The mean frequency of PDB in Component 3 was 25.33 (range = 10 to 40). In the FT 240 s condition, the mean frequency of PDB in Component 1 was 42.25 (range = 18 to 77). The mean frequency of PDB in Component 2 was 4.63 (range = 0 to 13). The mean frequency of PDB in Component 3 was 19.5 (range = 1 to 41). In the FT 300 s condition, the mean frequency of PDB in Component 1 was 45.36 (range = 30 to 62). The mean frequency of PDB in Component 2 was 3.91 (range = 0 to 12). The mean frequency of PDB in Component 3 was 31.18 (range = 21 to 48). In the FT 360 s condition, the mean frequency of PDB in Component 1 was 46 (range = 43 to 49). The mean frequency of PDB in Component 2 was 0.33 (range = 0 to 1). The mean frequency of PDB in Component 3 was 23.67 (range = 15 to 35). In the FT 420 s condition, the mean frequency of PDB in Component 1 was 41.67 (range = 38 to 46). The mean frequency of PDB in Component 2 was 1.0 (range = 0 to 3). The mean frequency of PDB in Component 3 was 30.33 (range = 18 to 39).

The general pattern of responding observed during the fade of the FT schedule was consistent with the first implementation of the FT 5 s condition. Observed frequencies of PDB were generally the highest in Component 1; in 41 of the 46 fading sessions frequencies observed in the first component where the highest of the session.
Frequencies of PDB observed in Component 2 were significantly lower, relative to Components 1 and 3. Frequencies of PDB observed in Component 3 were lower than those observed in Component 1, but higher than those observed in Component 2. However, it should be noted that there was an increase in the frequency of PDB observed in Component 1 as the fade progressed (see Figure 1).

Figure 3 depicts the mean frequency of PDB per 1-min bins across components obtained in BL conditions. The general pattern of responding was similar across implementations of BL conditions. It should be noted that there was an overall lower frequency of responding during the first implementation of BL conditions (sessions 1-13) when compared to the two other implementations of BL conditions.

Figures 4-6 depict the mean frequency of PDB per 1-min bins across components obtained in the FT 5s condition and fade of the FT schedule. The general patterns of responding were similar across FT values. It should be noted that the first min of Components 1 and 3 produced, on average, the highest frequency of responding, followed by a general decrease in the frequency of PDB across the component. The FT schedules implemented in Component 2 produced significant reductions in PDB, relative to Components 1 and 3.
The purpose of the current study was to investigate the immediate and subsequent effects of fixed-time attention on problem behavior maintained by therapist attention utilizing a three-component multiple-schedule design. The results of the pretreatment functional analysis indicated that PDB was maintained by therapist attention. The subsequent treatment analysis, which utilized a three-component multiple schedule, indicated that fixed-time attention produced a significant immediate decrease in the frequency of PDB, represented by low frequencies of PDB in Component 2, as well as a continued subsequent effect, represented by lower frequencies of problem behavior in Component 3 when compared to Component 1.

It is likely that the suppression observed in Component 2 during the FT conditions was due to a combination of satiation/habituation and extinction. Satiation/habituation may have been largely responsible for the immediate and sustained decrease in the frequency of PDB in the FT 5 s condition, when the schedule of attention was nearly continuous. However, it is probable that extinction was responsible for the response suppression as the FT schedule was faded to leaner values. As schedules were faded, the decreased amount of attention provided during Component 2 would not be expected to produce satiation or habituation effects.

As with other studies evaluating the immediate and subsequent effects of behavioral treatments (e.g., Atcheson, 2006; Blevins, 2003; Cherryholmes, 2007; Rapp, 2006; Rapp, 2007; Simmons et al., 2003; Soderlund, 2003), evidence of behavioral
contrast was observed in Component 3 in the current experiment. Weatherly, Melville, Swindell, and McMurry (1998) defined behavioral contrast as “an inverse relation between the rate of behavior in one component of a multiple schedule of reinforcement and the conditions of reinforcement in another component” (p. 47). Behavioral contrast is typically observed in experimental arrangements that involve a multiple schedules of reinforcement, in which one of the schedules constitutes either a decrease or increase in the frequency of reinforcement, relative to the other components (Nevin & Shettleworth, 1966). No prior studies utilizing multiple schedules of reinforcement to evaluate the immediate and subsequent effects of behavioral treatments (e.g., Atcheson, 2006; Blevins, 2003; Cherryholmes, 2007; Rapp, 2006; Rapp, 2007; Simmons et al., 2003; Soderlund, 2003), have discussed the outcomes in the context of the basic literature on behavioral contrast.

The results of the current study are similar to those described by Weatherly et al. (1998), who utilized a three-component multiple schedule to examine within- and across-component behavioral contrast. In BL, all three components of the multiple schedules included the same-programmed schedule of reinforcement (i.e., VI 30 s). BL conditions produced a similar steady pattern of response across all three components. When extinction was implemented during Component 2, a systematic within-component decrease in responding was observed in Components 1 and 3 (Weatherly et al., 1998). Similarly, during BL conditions of the current study the frequency of responding was consistent across all three components with no systematic trends observed across successive implementations of BL conditions. However, when FT schedules were
introduced in Component 2, systematic within-component decreases developed in Components 1 and 3. This pattern of responding became more prevalent as the experiment progressed, but was observed in all conditions in which a FT schedule was programmed in Component 2.

The patterns of responding in Components 1 and 3 (i.e., a gradual decrease in the frequency of responding across the component) in the current study have been described as positive local (Weatherly et al., 1998) or positive transient (Nevin and Shettleworth, 1966) behavioral contrast. Weatherly et al. (1998) defined local contrast as “a higher (positive local contrast) rate of responding or a lower (negative local contrast) rate of responding early in the constant component of a contrast condition relative to baseline responding” (p. 48). The specific mechanisms responsible for the development of such patterning is not well understood at this time.

Interestingly, the current study showed consistent changes in response patterns in components that followed (Component 3) and preceded (Component 1) the FT schedule. The effect in Component 1 is consistent with “anticipatory contrast” (Williams, 1992), in which changes in response levels or patterns are observed in multiple schedule components that precede the component in which contingencies are changed. In the current study, this effect developed as the participant gained experience with the FT contingency during Component 2. Such effects could complicate interpretations of the subsequent effects of interventions in three-component multiple schedules. In previous research, the interpretation of subsequent effects of treatment has been based on relative measures between Components 1 and 3. However, if
systematic changes in responding are produced in Component 1 due to exposure to Component 2, ongoing Component 1 measures may not be adequate comparisons against which to judge subsequent effects of treatment. Occasional returns to baseline conditions across all components might provide useful information about the extent to which Component 2 contingencies are responsible for changes in both subsequent and prior components. Thus, although the apparent anticipatory contrast observed in the current study increases the complexity of interpretation, it may offer a glimpse into another potentially interesting effect of treatment: effects that occur during periods before treatment is implemented. Future research should attempt to determine if and to what extent anticipatory contrast is observed in applied contexts.

Another interesting effect observed in the current experiment was the transient nature of changes in Components 1 and 3. In addition to changes in level, distinct decreasing trends in responding developed within Components 1 and 3. Future research should evaluate the extent to which local contrast effects are apparent in these experimental arrangements, as evaluation of these patterns might help to obtain information about the processes underlying the effects of behavioral treatments. For instance, Rapp (2007) utilized a three-component multiple schedule design to identify sources of matched (substitutable) reinforcement for the treatment of automatically maintained behavior. His results showed that the delivery of matched stimulation in Component 2 resulted in lower levels of responding in Component 3, suggesting that the stimulus delivered in Component 2 functioned as an abolishing operation (Michael, 2004). It is possible that inspection of within-component patterns of responding would
permit further evaluation the potency of the matched stimulation relative to the “automatic” reinforcer. If, following access to the matched stimulus, the pattern of response in the third component indicated negative local contrast (i.e., a gradual increase in the frequency of responding across the component), it could be said that the matched stimulation served as a more potent reinforcer, functionally abolishing the effectiveness of the automatically reinforcing consequence. On the other hand, if the pattern of responding in the third component showed positive local contrast (i.e., a gradual decrease in responding across the component), it could be argued that the “automatic” reinforcer was more potent.

Future research should evaluate the subsequent effects of behavioral treatments utilizing mixed schedules of reinforcement. For example, the study conducted by Cherryholmes (2007) is the only study to have evaluated the immediate and subsequent effects of behavioral treatments utilizing a mixed schedule of reinforcement. The results of that study indicated that when the FT value was successful at suppressing responding in Component 2, there was a gradual increase in the frequency of responding in Component 3 during mixed schedule arrangements. The results reported by Cherryholmes should be contrasted with the current study in which the highest frequency of response recorded in the third component of the treatment analysis was primarily observed in the first minute of that component (see figures 4-6). The results reported by Cherryholmes indicate that programming mixed schedules in daily behavior plans could prove advantageous for clinical practice. In particular, it may be useful to use a mixed schedule when it is necessary to temporarily terminate
treatment conditions (e.g., at the end of Component 2 in the current arrangement), as the absence of a distinct stimulus associated with the withdrawal of treatment may preclude discrimination of changed contingencies. Future research should investigate the clinical benefit of these types of schedules.

Future research should also compare the immediate and subsequent effects of behavioral treatments (e.g., DRO and FT schedules of stimulus delivery) targeting as implemented for both socially and automatically maintained behavior. Although these treatments might have similar immediate behavioral effects, they could produce vastly different subsequent effects. For instance, Rapp (2006) compared the effects of response-independent matched stimulation vs. response blocking in the treatment of automatically maintained stereotypic behavior (i.e., tapping). The results of the study indicated that, although both treatments produced a similar immediate behavioral effect, the subsequent effects of treatment were vastly different. Stereotypic behavior occurred at consistently lower levels following response-independent delivery of matched stimulation, whereas it occurred at consistently higher levels following response blocking. These results suggest that response-independent delivery of matched stimulation served as an abolishing operation, whereas response blocking served as an establishing operation (Michael, 2004). Continued research in this area could provide valuable clinical information and shed light on the underlying behavioral processes of behavioral treatments.

There are several limitations to the current study that need to be addressed. First, only one individual participated in the current study. In order to assess the
Generalizability of the findings, replications of the methods described are necessary. Secondly, the treatment analysis of the current study was conducted over a period of eight months, with sessions being conducted 3-5 days per week. It is possible that the treatment analysis would have been expedited if another method of fading the FT schedule were used (e.g., Kahng et al., 2000). Therefore, future research should evaluate the utility of other methods of fading when attempting to while assessing the immediate and subsequent effects of response-independent schedules of stimulus delivery. Thirdly, the results of the current study should be viewed with caution due to the pattern of responding observed in the 3rd implementation of BL conditions. In this condition, there was an overall decreasing trend in the frequency of responding, with the highest frequency observed in Component 1, a lower frequency in Component 2, and the lowest frequency in Component 3. This pattern of responding is consistent with a within-session reinforcer abolishing effect due to satiation or habituation (Smith & Iwata, 1997). Baseline patterns of responding such as the those observed in the 3rd implementation of BL conditions are particularly problematic in interpreting the immediate and subsequent effects of behavioral treatments, as the observed pattern of responding in this particular baseline condition produced a pattern of responding that was similar to the observed pattern of responding in the treatment conditions (i.e., the frequency of problem behavior was lower in Component 3 when compared to Component 1). This tempers the confidence with which conclusions about the relationship between treatment (during Component 2) and subsequent effects can be made. Therefore, future research should attempt to arrange experimental conditions
that would preclude such patterns of responding in BL conditions. Lastly, the form of attention delivered during Component 2 (treatment) differed from the type of attention delivered during Components 1 and 3 (BL). Whereas reprimands were delivered contingent on problem behavior in Components 1 and 3, the therapist typically discussed daily events with Nicole and asked her questions about her daily life in Component 2. Recent research has shown that different types of attention (e.g., reprimands and comments unrelated to the target behavior) maintain different levels of problem behavior (Kodak, Northup, & Kelly, 2007). Thus, it is possible that the results obtained in the current study would have been different (i.e., a more pronounced subsequent effect would have been observed) if the same form of attention had been used during all three components of the treatment analysis. It is unclear whether or to what extent the use of a different form of attention in the current study enhanced or impaired the immediate and subsequent effects of FT attention. Future research could evaluate the differential effects of response-independent delivery of various forms of attention on attention-maintained problem behavior.

The use of three-component multiple schedules seems to hold promise for identifying the subsequent and, perhaps prior, effects of interventions designed to change socially and personally important behavior. The results of the current study highlight some complexities encountered in this type of investigation, showing not only changes in subsequent measures of behavior as a function of intervention, but apparent changes in behavior during periods just before the implementation of treatment procedures. Future research should continue to investigate the utility of complex
schedules to identify direct and indirect effects of behavioral interventions, as well as to help elucidate the behavioral mechanisms underlying those effects.
Figure 1. Results of the functional analysis for Nicole. Data are presented as frequency of PDB during each session for all conditions.
Figure 2. Results on Nicole’s treatment analysis. Data are presented as frequency of PDB for each component. Component one is represented by open diamonds, component two is represented by filled squares, and component three is represented by open triangles.
Figure 3. Results of baseline. Data are displayed as the mean number of responses per one-min bins. Closed diamonds represent BL sessions 1-13. Closed squares represent BL sessions 25-29. Closed triangles represent BL sessions 36-41.
Figure 4. Results of the FT 5s conditions. Data are displayed as the mean number of responses per one-min bins. Closed diamonds represent FT 5s sessions 14-24. Closed squares represent FT 5s sessions 30-35. Closed triangles represent FT 5s sessions 42-61.
Figure 5. Results of the FT schedule fade for FT 15s – FT 180s. Data are displayed as the mean number of responses per one-min bins. Open circles represent the FT 15s condition. Closed squares represent the FT 30s condition. Closed triangles represent the FT 60s condition. Open squares represent the FT 120s condition. Open triangles represent the FT 180s condition.
Figure 6. Results of the FT schedule fade for FT 240s – FT 420s. Data are displayed as the mean number of responses per one-min bins. Open circles represent the FT 240s condition. Closed squares represent the FT 300s condition. Closed triangles represent the FT 360s condition. Open squares represent the FT 420s condition.
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