CORRESPONDENCE BETWEEN VERBAL BEHAVIOR ABOUT REINFORCERS AND PERFORMANCE UNDER SCHEDULES OF REINFORCEMENT.

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Important advancements have been made in the identification of reinforcers over the past decade. The use of preference assessments has become a systematic way to identify preferred events that may function as reinforcers for an individual’s behavior. Typically, preference assessments require participants to select stimuli through verbal surveys or engagement with stimuli as preferred or non-preferred. Not all studies go on to directly test the effects of the preferred stimuli, and even fewer studies directly test for the effects of the non-preferred stimuli. The present study systematically identified preferred and non-preferred stimuli in adult human subjects by verbal report and then proceeded to test the effects of both verbally reported preferred and non-preferred events on single and concurrent schedules of reinforcement. The results are discussed in terms of contemporary concerns regarding preference and reinforcer assessments.
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INTRODUCTION

One important task for researchers and clinicians who use operant conditioning procedures is to discover a method for identifying reinforcers. The reinforcing event is critical to the development of effective behavioral interventions as well as the maintenance of behavior. For instance, when reinforcers are identified, shaping procedures can then be effectively implemented. This is well known and has important value for applied practitioners as well as basic laboratory researchers (Skinner, 1953; Keller & Shoenfeld, 1950; Pace, Ivancic, Edwards, Iwata, & Page, 1985).

Much of the research on reinforcer identification has been done in the context of preference assessments. In these studies the participants are typically exposed to an array of stimuli and interactions with each are recorded (Quilitch, Christopherson, & Risley, 1977). Based on the duration of engagement (e.g., DeLeon, Iwata, Conners & Wallace, 1999) or frequency of approach to the stimulus (e.g., Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin, 1992) stimuli are classified as preferred or non-preferred, with the assumption that the preferred stimuli may be effective reinforcers and the non-preferred stimuli may be less effective or not at all effective as reinforcers.

Approach based preference assessment procedures include single stimulus or SS (Pace et al, 1985), paired stimulus or PS (Fisher et al., 1992), the multiple stimulus with replacement or MSW (Windsor, Pichè, & Locke, 1994) and the multiple-stimulus-without-replacement or MSWO (DeLeon & Iwata, 1996; Carr, Nicolson, and Higbee, 2000). In the SS-approach procedure stimuli are presented one at a time and an observer records whether or not the individual approaches each stimulus. In the PS-approach
procedure, stimuli are presented in pairs and an observer records which stimulus a participant approaches. In the MSW-approach procedure, the participant is asked to select one item form many in array presented before them. After the item is selected it is replaced during subsequent trials. In the MSWO-approach procedure, the participant is asked to select one item from many presented in an array before them. This item is then removed from the array during subsequent trials and the procedure is repeated until all the stimuli have been selected or no choice is made. Engagement-based preference assessments also include single stimulus and multiple stimulus procedures (DeLeon et al., 1999; Roane, Vollmer, Ringdahl, and Marcus, 1998). In the SS-engagement procedure, a single stimulus is placed before the participant and the duration of time spent with the stimulus is recorded. This duration measure is then compared to that with other stimuli and those with the longest duration measures are considered to be preferred. During the multiple stimulus engagement procedures, two or more stimuli are presented to the participant simultaneously. The duration of time spent with each stimulus is recorded and the stimuli with the longest duration measures are considered to be preferred.

Approach-based procedures have an appeal for many practitioners because they save time, trials are quick and easy to administer, and it is easy for observers to record approach (e.g., Pace et al., 1985). There is, however, a risk of producing false positives, as approach-based measurements may be associated with arbitrary selections (irrespective of preference) and, in some cases, individuals may approach most or all of the stimuli presented (Hagopian, Rush, Lewin, and Long, 2001). Engagement based procedures, on the other hand, are more time consuming, as the observer must record the amount of time spent with each stimulus. However, the engagement-based procedures
may provide a better indication of preference since it makes it possible to assign different
degrees of preference to stimuli based upon the time spent with each.

Although a considerable amount of research has yielded procedures for assessing
and examining preference, there are a number of remaining matters that are in need of
further analysis. For example, a fundamental problem and major limitation in the
preference assessment literature is that empirical examinations of the effectiveness of
preferred and non-preferred stimuli have not always been examined in relation to the
participant’s subsequent behavior. Approach and engagement based procedures, by
themselves, do not speak for the reinforcing quality of selected stimuli in other contexts.
Measures such as the amount of time spent with a stimulus or approach to a stimulus may
not be predictive of reinforcement effects in other situations (see Morse and Kelleher,

The only way to tell whether a given event is reinforcing to a given organism
under given conditions is to make a direct test. We observe the frequency of a
selected response, then make an event contingent upon it and observe any change
in frequency. If there is a change, we classify the event as reinforcing to the
organism under existing conditions. (p. 72-73)

Although some research has directly evaluated the reinforcing effectiveness via
preference assessment (Pace et al., 1985; Fisher, Thompson, Piazza, Crosland and
Gotjen, 1997; Geckeler, Libby, Graff, and Ahearn 2000), it remains unclear whether
concurrent schedules or single schedules are more appropriate paradigms for assessing
reinforcement effects. The single schedule arrangement involves one response
topography upon some event is contingent on a given schedule of reinforcement.
Concurrent schedules, on the other hand, involve two response topographies. One
response produces a particular consequence, while the other response topography
produces another (e.g., preferred events are produced by one response topography while non-preferred events are associated with the other). Concurrent schedules are considered by some researchers to be more efficient in predicting which stimuli function as a reinforcer. For example, Fisher et al. (1992) suggested that the concurrent schedule “is efficient and allows for comparisons of reinforcers that cannot be accomplished in a paradigm in which operants are evaluated at different points in time.” (p.497). Similarly, Geckeler et al. (2000) asserted that, “concurrent schedules permit a more sensitive assessment of the effects of reinforcer choice than a single operant arrangement” (p.347). However, examining reinforcer identification through the concurrent schedule may have limitations. For instance, results from a study conducted by Roscoe, Iwata, and Kahng (1999) showed that non-preferred stimuli had reinforcing functions in the single schedule, yet these effects were masked in the concurrent schedule arrangement.

Another important area of investigation is the control of motivational variables in preference assessments. Only recently have establishing operations has been taken into account when examining the preference. Gottschalk, Libby & Graff (2000) examined the effects of food deprivation and satiation in a preference assessment while McAdam et al. (2005) examined toy deprivation and satiation in a preference assessment. Both used a paired stimulus presentation procedure in the preference assessment. They found that deprivation conditions increased participants approach to stimuli and that a history of exposure to a particular stimulus can alter its effectiveness as a potential reinforcer.

Given that most of the research on reinforcer selection is conducted with populations with limited verbal skills, measures of approach and engagement are commonly used to identify reinforcers. However, there has been some development of
procedures using verbal responses. Northup (1996) wrote, “little attention has been
directed to the development of assessment methods for verbal children (p. 29),” and
suggested that the inference is made that typically developed individuals can label their
own reinforcers. Although it is assumed that a typically functioning human can verbally
identify his or her own reinforcers, this may not be the case. Also, the verbal
identification of reinforcers alone does not tell us under what conditions they would work
as reinforcers.

There have been a few studies examining verbal surveys (Northup, George, Jones,
Broussard, and Vollmer, 1996; Cohen-Almeida, Graff and Ahearn 2000, Neef et al., 2000
and Northup 2000). The participants in all of these studies were children diagnosed with
ADHD. During verbal surveys, researchers either asked the participants if they liked the
stimulus and required a yes or no answer, or presented a rating scale in which participants
could place events in a ranking order of preference. Results of the Northup et al. (1996,
2000) studies suggest that survey assessment results alone may not reveal differences
between highly preferred and non-preferred stimuli or events. Relative reinforcer value
was not determined by the verbal survey because preference outcomes changed during
the experimental testing phase. However, the Cohen-Almeida et al. study found the
verbal survey advantageous because its application required very little time. A weakness
in their study, however, was the fact that there was no test for the preference assessment
results. More research is necessary to further evaluate the correspondence between events
selected as preferred during verbal assessments and their subsequent effectiveness as
reinforcers.
The present investigation examined the effects of stimuli identified as preferred and non-preferred by typical college students using a verbal assessment procedure. The purpose of the present studies was to examine the correspondence verbal reports about what participants said they like and did not like and the effect of those stimuli on performance maintained by a continuous schedule of reinforcement.
EXPERIMENT I

Method

Participants and Setting

Two students from the University of North Texas, one male and one female in their early 20s participated in the study. Participants were recruited through flyers distributed in campus buildings and screened in an interview before the study began. Those that had no history of course work in behavior analysis and were free to come for daily sessions for a period of 3 or more weeks were selected to begin the study.

Sessions took place at the University of North Texas in the Department of Behavior Analysis in a small room devoted to experimental research. The experimental room contained a chair and three computer desks located along three walls. One desk in the room had a chair placed in front of it. The computer on this desk was equipped with a monitor, mouse, and headphones. Each participant sat alone in the experimental room during the 20-min session.

Apparatus

The apparatus used in the present experiment was originally developed by Michael Flyger and Jesús Rosales-Ruiz (1997) and later modified by Richard Anderson (2004). The apparatus consisted of a Pentium® computer, headphones, a numeric keypad, mouse, and 12 inch monitor. Graphics and text were presented on the monitor screen. Sounds were delivered through headphones and consisted of cultural expressions (e.g. Homer Simpson saying “Doh”) as well as short sounds experienced in daily human life (e.g. children laughing, glass breaking, horns honking, etc.). Participants responded by
pressing the number keys 1-9 on the numeric keypad and by clicking the computer mouse on icons located on the screen.

**Dependent Variable**

Rate of responding served as the dependent variable. Response rates were analyzed in two ways. First, the moment-to-moment changes in rate of responding were displayed in cumulative records for each participant. Second, overall response rates were compared across sessions. The overall rate was calculated by dividing the total number of target responses by the number of min in the session.

**Independent Variable**

The independent variable consisted of the delivery of preferred and non-preferred sounds (as reported by the participant in a reinforcer assessment) in a continuous schedule of reinforcement.

**General Procedure**

Sessions were conducted once per day (excluding weekends). The experimenter requested participant’s jewelry, watches, cell phones, and backpacks prior to entry into the experimental room and participants reclaimed their items upon completion of the experimental session. Participants were alone during experimental sessions. Sessions lasted 20 min. The participants received five dollars per 20-min session. Payment was given to each participant in a cumulative sum at the end of the study.

There were two phases in the study. (1) Preference assessment: participants listened to sound clips and divided them into preferred and non-preferred sounds. (2) Reinforcer assessment: the effects of both preferred and non-preferred sounds on the rate
of a selected target response were analyzed. Participant response rates were recorded and analyzed via cumulative record on computer software entitled Statview®.

Preference Assessment

Upon entering the experimental room, the experimenter asked the participant to sit in the chair facing the computer. The computer was turned on. The experimenter told the participant the following: “You will use the computer mouse to click on speaker icons. If you see any other options, just use the computer mouse to click.” The participant was then asked to put on the headphones. Before leaving the room, the experimenter told the participant to click on the start button (a rectangle was on the screen with the word “start” in it) with the computer mouse. Clicking on the start icon produced a speaker icon in the center of the screen. After the speaker icon was clicked a short sound was heard through the headphones. After the sound ended text appeared on the screen. The text read “Do you like this sound?” Directly underneath this text were two boxes, the box on the far left contained the word “yes” and the other on the far right contained the word “no”. Clicking on one of these boxes produced the speaker icon again, initiating a new trial with a different sound. This process continued until all 250 sounds were surveyed (see figure 1). A sound bank was created based on participants’ choices. The assessment was repeated twice and results from the second assessment were used for later testing.

Reinforcer Assessment

The experimenter directed the participant to sit in the chair facing the computer at the start of the session. The experimenter said the following: “you can press any of these keys here,” while gesturing with the index finger at 1-9 on the computer’s numeric keypad and then said, “if you see an icon appear on the screen, then you can click on it
with the mouse.” The experimenter then made sure the participant put on the headphones and prompted the participant to use the mouse to start. The experimenter left the room. The computer screen had a start icon which, when clicked with the computer mouse, produced a 3 x 3 grid that corresponded to the numeric keypad on the computer’s keyboard. The grid had 9 shaded squares that resembled the keys 1-9 on the computer’s numeric keypad. The grid was approximately 8 cm in area and each shaded square on the grid was approximately 2 cm. The squares on the grid appeared three-dimensional and each of the them were separated by 0.5 cm. The entire grid was enclosed by a border (see figure 2).

Initially, all of the squares or buttons on the grid appeared “popped-out.” Pressing any key in the left column (i.e., 1, 4, or 7) produced the corresponding grid-square to change from appearing “popped-out” to appearing “pressed in.” Pressing any key in the middle (i.e., 2, 5, or 8) or right columns (i.e., 3, 6, or 9) before pressing a key in the left column did not produce any change in the grid-squares. After pressing a key in the left column, pressing a key in the middle column changed the corresponding button from appearing “popped out” to appearing “pressed in.” Pressing keys in the right column before pressing a key in the middle column did not produce any changes. After keys were pressed in the left and the middle column, a key press on the right column produced the corresponding grid-square to appear “pressed in”. After the 3 left-to-right key presses produced the “pressed in” change, only key presses on the left column produced the appearance of a “pressed in” button, and the left-to-right cycle repeated.

When the participant pressed the particular left-to-right sequence 1-5-3, two events immediately happened: (a) a chime, called the “hopper sound,” was played; and
(b) a speaker icon appeared just below the grid. When the icon was clicked, using the computer mouse, a sound was played.

Experimental Design

An A-B-A-B design was used to compare the effects of preferred versus non-preferred sounds on the rates of the 1-5-3 sequence. After completing the preference assessment and shaping of the target response were complete, each instance of the 3-key target response was followed by a sound. In one condition, (A), the sequence 1-5-3 was followed by a preferred sound. In the other condition, (B), each instance of the three-key target response was followed by a non-preferred sound.

Results

Preference Assessment

Figure 3 depicts the number of sounds selected as preferred and non-preferred across the two participants. Participant FLSP04 (top) selected 172 sounds surveyed as preferred and 78 sounds were non-preferred in the first assessment. During the second assessment FLSP04 selected 171 sounds as preferred and 79 as non-preferred. The percent of agreement across assessments was % for the non-preferred sounds and 74.2% for the preferred sounds. Participant ADSP04 (bottom) selected 138 sounds as preferred and 112 non-preferred in the first assessment. During the second assessment 122 were preferred and 128 were selected as non-preferred. The percent of agreement across assessments was 75.8% for the non-preferred sounds and 73.2% for the preferred sounds.

Reinforcer Assessment

Figure 4 displays cumulative records for both participants across all sessions. The number on the bottom left of the cumulative records indicates the session number.
Experimental conditions are labeled directly above of each cumulative record. During session 1, in the preferred sounds condition, FLSP04 responded at a relatively constant rate after the first correct response (pressing the keys 1-5-3). The overall rate of responding was 13.45 response per minute (rpm) (response rates are reported in appendix E table 2). During session 2, the non-preferred sounds condition, the rate of responding was constant at the beginning and the end of the session, but decreased at about the 13th min of the session. The rate of responding was 17.45 rpm. When preferred sounds were reintroduced in session 3, the participant responded uniformly with an overall response rate of 21.15 rpm. During session 4, the return to non-preferred sounds condition, a reduction in rate of responding, as well as transitory decrease in the middle of the session. The overall response rate was 16.25 rpm.

Participant ADSP04’s cumulative records are presented on the bottom row of figure 4. During session 1, in the preferred sounds condition, the cumulative record shows a rapid acquisition of the target response and constant rate of responding. The overall response rate was 22.7 rpm. During sessions 2, the non-preferred sounds condition, the record shows a constant but slower rate of responding. The overall rate of responding was 16.25 rpm. When preferred sounds were reintroduced in session 3 the participant responded at a constant high rate again. The overall response rate was at 22.15 rpm. During session 4, the return to non-preferred sounds condition, there was a reduction in responding with an overall response rate of 19.6 rpm.

Discussion

Results from the preference assessment show that the amount of sounds chosen as preferred and non-preferred remained stable for participant FLSP04 across assessments
while participant ADSP04 decreased the number of preferred events in the second assessment. During the reinforcer assessment, data for both participants showed lower rates of behavior during conditions that involved the delivery of non-preferred sounds in comparison to the rates of responding in conditions that involved the delivery of preferred sounds. Despite these reductions in response rate, it should be noted that responding maintained throughout sessions in the non-preferred conditions. This indicates that the events used in the non-preferred sounds condition functioned as reinforcers; however, they were less effective reinforcers than the preferred sounds as measured by the rate of responding.

The results of the present research suggest that the preference assessment was unable to clearly separate the effects of two different groups of sounds (preferred and non-preferred). However, the assessment provided an indication of the relative effectiveness of preferred versus non-preferred sounds as reinforcers. In a post experiment debriefing, when participants were asked why they continued to respond in when they were hearing sounds they did not like, one participant commented that some of the sounds were “not so bad, I guess.” These outcomes suggest that the assessment should use a rating scale which would allow participants to rate stimuli across a wider range of preference values might be used to provide a more sensitive measure of relative preference than the current binary (yes/no) choice.

Like the present findings, previous research has shown that participant selected low-preferred events have maintained responding sufficiently. A study by Roscoe et al. (1999) revealed that rates of participant responding were maintained when the events used as reinforcers were low-preferred items in a single schedule of reinforcement. While
the effects of low-preferred events were evaluated on the rate of behavior, there was no similar test for the preferred events in a single schedule. However, when a concurrent schedule arrangement was used in which one behavior produced access to preferred events and another behavior produced access to low-preferred events most responding was allocated to the response which produced the preferred event.

A limitation to the present experiment was that only one 20-min session took place in each condition. In the future, experimental conditions should be longer than one session to see if preferred and non-preferred sounds equally maintain behavior across sessions.
EXPERIMENT II

Introduction

Experiment I evaluated the effects of contingent preferred and non-preferred sounds on the rate of responding. Although non-preferred sounds were less effective as reinforcers, they nevertheless maintained a considerable rate of responding. Perhaps this was due to the preference assessment procedure. It may that the pool of non-preferred sounds contained both sounds that the participants did not as well as some sounds that were moderately preferred. Experiment II employed a verbal preference assessment that allowed more choices. A rating procedure (not at all, a little, neutral, somewhat, totally) was used instead of a binary procedure as in experiment I. The present study compared the reinforcing effects of stimuli identified via this assessment under both concurrent and single schedules of reinforcement with one participant.

Method

Participants and Setting

Three new participants were recruited through an advertisement in the university newspaper. Participant selection was the same as in experiment I. Two females and one male college students in their early 20’s were selected to participate in this study. The present experiment was conducted in the same setting as experiment I.

The apparatus, experimental procedure, independent variable, dependent variable, and general procedure were identical to those as that used in experiment I.

Preference Assessment

The general procedure was the same as in the previous experiment; however, when the participant clicked on the speaker icon and heard a sound, the text “how much do you
like this sound?” appeared on the screen. Directly underneath this text were five boxes. The boxes displayed the following options from left to right: “not at all” “a little” “neutral” “somewhat” “totally” (see figure 3). Clicking on one of these boxes produced the speaker icon to appear again, initiating a new trial with another sound. The participants surveyed 345 sounds (as opposed to 250 in experiment I) during each assessment. A sound bank was created based on the participant’s clicks on the “totally” (preferred) and “not at all” (non-preferred) icons. All sounds that received other ratings were discarded. The assessment was conducted twice and results from the second were used in for later testing.

*Left-to-Right Key Press Shaping*

After the preference assessments were completed, a shaping procedure was implemented to facilitate the acquisition of the target response. The experimenter directed the participant to sit in the chair facing the computer at the start of the session. The experimenter said, “you can press any of these keys here,” while gesturing with the index finger at 1-9 on the computer’s numeric keypad and then said, “if you see an icon appear on the screen, then you can click on it with the mouse.” The experimenter then made sure the participant put on the headphones and prompted the participant to use the mouse to start. The experimenter left the room. The computer screen displayed a start icon which, when clicked with the computer mouse, produced a 3 x 3 grid that corresponded to the numeric keypad on the computer’s keyboard.

As in the previous experiment, pressing the numerical keys 1-9 in the left-to-right order only produced changes in the 3 x 3 grid displayed on the computer screen. However, once there was *any* left key, middle key, and right key press, two events
immediately happened: (a) a chime was played, and (b) a speaker icon appeared just below the grid. When the icon was clicked, using the computer mouse, a participant-selected preferred sound was played.

**Reinforcer Assessment: Single Schedule**

The reinforcer assessment consisted of selecting and provided consequences for a particular three key sequence (i.e. 4-5-6). To select a particular three key sequence the experimenter identified left-to right left-to-right sequence that occurred most often during the shaping procedure. The apparatus was then programmed to deliver the hopper sound and speaker icon only after the target response e.g., 4-5-6) was pressed. When the speaker icon was clicked a sound from the sound pool was played. Any other left-to right sequence of responding still produced the “pressed in” effect, however, there was no access to any events unless the particular target response was pressed.

**Reinforcer Assessment: Concurrent Schedule**

As in previous experimental condition, the experimenter directed the participant to sit in the chair facing the computer. The experimenter said the following: “Up to now you have been pressing 4-5-6 in order to hear sounds, now you can also press the numbers 1-2-3 as well.” The experimenter then made sure the participant put in the headphones and left the room. One of the three-key sequences was the target response selected for use in the single schedule reinforcer assessment (4-5-6). To select the other three key sequence the experimenter identified a response that occurred regularly (1-2-3) during shaping. The response pattern 4-5-6 produced a sound from the non-preferred sound pool when the speaker icon was clicked, and the response pattern 1-2-3 produced a sound from the preferred sound pool when the speaker icon was clicked. Any other left-to
right sequence of responding still produced the “pressed-in effect; however, there was no access to any events unless one of the two target responses were pressed.

Experimental Design

An A-B-A design was implemented. When the preference assessment and the shaping acquisition phases were complete, each instance of the 3-key target response was followed by a preferred sound (A), and then each instance of the three-key target response was followed by a non-preferred sound (B).

An A-B-C-B design was implemented with one participant. Condition C (the concurrent schedule analysis) was implemented when a participant did not show clear difference in rates of responding across conditions A and B. Condition C was followed by a reversal to condition B.

Results

Preference Assessment

Figure 6 depicts the results for the two preference assessments delivered to all three participants. The figure shows consistency in the number of sounds selected along the scale of preference for both of the assessments. RBSP05 selected the option “a little bit” most frequently during the assessments. SASP05 selected the option “totally” most frequently during the assessments and BHSP05 selected the option “some what” most frequently during the assessments. A total of 55 sounds (20 preferred, 35 non-preferred) were used in a reinforcer assessment for RBSP05. A total of 82 sounds (25 preferred and 17 non-preferred) were used in the reinforcer assessment for BHSP05. A total of 189 sounds (127 preferred and 32 non-preferred) were used in a reinforcer assessment for participant SASP05. The percent of agreement across assessments for RBSP04 was
58.3% for non-preferred sounds and 39.1% for preferred sounds. For SASP04, percent agreement across assessments was 46% for non-preferred sounds and 60% for preferred sounds. The percent agreement across assessments for BHSP5 was 27.2% for non-preferred sounds and 37% for preferred sounds.

**Reinforcer Assessment**

Figure 7 presents cumulative records for participant RBSP05. The number on the bottom left of the cumulative records indicates the session number. Experimental conditions are labeled above the cumulative records. The acquisition of all left to right responses is displayed in the first session cumulative record. The left-to-right responses were quickly selected and maintained at a constant rate. The overall rate was 13.6 rpm. During the FR-1 with preferred sounds condition (session 2), the target response was quickly acquired and maintained at a constant rate. The overall response rate was 14.7 rpm. In session 3, data show a pattern of responding similar to the previous session. The overall rate of responding was 17.55 rpm. During FR-1 with non-preferred sounds, there was a reduction in overall response rates. In session 4 the overall rate of responding was 9.05 rpm and in session 5 the overall rate of responding was 11.3 rpm and session 6 had an overall response rate of 8.8 rpm. During the final condition, FR-1 with preferred sounds, there was a return to steady overall responding. Response rates were 15.1 rpm and 17 rpm respectively (Refer to Table 2 for a complete view of participant’s rpm).

Cumulative records are shown for participant SASP05 in figure 8. In the first session the target response was quickly selected and maintained at a constant rate. The overall rate was 13.5 rpm. During FR-1 with preferred sounds condition (session 2), the target response was quickly acquired and steady responding followed. The overall
response rate was 14.4 rpm. In session 3 responding was steady with an overall response rate at 16.9 rpm. During FR-1 with the non-preferred sounds variable rates of responding were observed across sessions. The overall rate of responding in session 4 was 27.85 rpm. In session 5 the response rate was 13 rpm and the response rate was 10.7 rpm session 6. Session 7 began with a constant rate of responding but acceleration was observed near the end of the session. The overall response rate was 15.8 rpm. During the final condition, FR-1 with preferred sounds, the data show a return to steady responding across both sessions 8 and 9. Overall response rates were 13.5 rpm and 12.2 rpm respectively (Refer to Table 3 for a complete view of participant’s rpm).

Figure 9 displays the cumulative records for participant BHSP05. In the first session the target response was quickly selected and maintained at a constant rate, the overall response rate was 16.75. During FR-1 with preferred sounds condition (session 2), the target response was acquired quickly then maintained at a constant rate. Overall response rates were 12 rpm. In session 3 the overall response rate was 16.8 rpm and the response rate was 16.25 rpm in session 4. During the FR-1 with the non-preferred sounds there was no change in rates of responding. Overall response rates were 13.35, rpm 14.05, rpm and 15.45 rpm during these three sessions. Thus, no effect on the rate of behavior as a function of the delivery of preferred and non-preferred sounds was observed. During the next condition, participant BHSP05 experienced a concurrent schedule involving FR-1 preferred sounds for one target response (1-2-3) and FR-1 non-preferred sounds for another target response (4-5-6). In session 9, data show steady rates of responding for 1-2-3 button presses and almost no responding for the target response of pressing 4-5-6. Overall response rates were 16.05 rpm for the 1-2-3 response,
(preferred sounds) and 0.1 rpm for the 4-5-6 response (non-preferred sounds). During FR-1 with non-preferred sounds (sessions 10 and 11) data show patterns of responding and rates similar to previous single schedule conditions. Response rates for the two sessions were 17.5 rpm and 18.7 rpm. (Refer to Table 4 for a complete view of participant’s rpm).

Discussion

Results from the preference assessment show that the number of sounds ranked as preferences for all three participants remained quite stable across assessments. The sounds used in the reinforcer assessment were markedly fewer than the number used in experiment I due to the filtering out of all the sounds not rated as “not at all” or “totally” preferred. During the reinforcer assessment, preferred sounds shaped and maintained responding for all three participants; however, the non-preferred sounds had mixed effects. Data for RBSP05 showed higher rates of responding during conditions involving preferred sounds relative to non-preferred sound conditions. Results for participant SASP05 showed constant responding for preferred sounds but variable responding within a session and across sessions when non-preferred sounds were presented as consequences. Data for BHSP05 showed no apparent effect on the rates of responding due to changing conditions. During the concurrent schedule BHSP05 responded at high rates to hear preferred sounds and rarely responded in the component involving non-preferred sounds. Upon returning back to the single schedule, BHSP05 responded at constant rates to hear non-preferred sounds.

Overall, these results show that the verbal assessment further differentiated participants’ preferences for those sounds. However, this did not increase
the correspondence between the type of sounds and the schedule performance of the participants in the experimental task. Interestingly, for subject BHSP05 the results of the preference assessment matched the performance in the concurrent schedule. However, although the behavior that produced preferred sounds increased and the behavior that produced non-preferred sounds in the concurrent schedule decreased, the non-preferred sounds equally maintained behavior in the single schedule just as the preferred sounds did.

Previous findings show that events identified as non-preferred in the concurrent schedule can function as reinforcers when used in the single schedule (e.g. Roscoe et al., 1999). This suggests that while concurrent schedules seem to reveal more correspondence between preferred and non-preferred events and the rates of responding in the reinforcer assessment (Fisher et al., 1992), this does not speak for the reinforcing effects of the non-preferred events used in single schedules (see DeLeon, Iwata, Goh, and Worsdell, 1997; Roscoe et al., 1999; Taravella, Lerman, Conrucci, and Roane 2000).
General Discussion

The quest for finding a procedure to identify reinforcers is of obvious importance to operant researchers and clinicians. Several techniques have been developed (e.g., Pace et al. 1985; DeLeon et al., 1997; Fisher et al., 1992; Roscoe et al., 1999) but not all have proven to be thoroughly effective. If a stimulus is simply selected as preferred by an individual via preference assessment, this does not mean the stimulus will function as a reinforcer for the individual’s behavior. Likewise, the stimuli classified as non-preferred by the individual may actually function as a reinforcer for their behavior. This is an important piece of information for operant researchers and clinicians as it may be useful while managing contingencies for teaching and training procedures.

Previous studies have examined differences in stimulus presentation methods in order to see if one method was more efficient than another at revealing reinforcers. This line of research (Fisher et al., 1992; DeLeon et al., 1997; Roscoe et al., 1999) suggests that some reinforcer identification procedures were better than others at predicting which stimuli would function as reinforcers. Unlike past research, the present research does not suggest that a change in stimulus presentation in preference assessments will reveal more correspondence between preference and reinforcers. This may be due to the fact that participants in the present studies were typical verbal adults and measures such as approach and engagement were not used. Future research should examine such procedures with typical verbal adults to assess whether or not the procedures would better predict which stimuli would function as the reinforcers that would produce the highest response rate.
The results of this research support assertions such as testing the reinforcing properties of events directly under the conditions that they plan to be used in (Skinner, 1953; Pace et al., 1985). Similarly, Morse and Kelleher (1970) suggested that a reinforcer or a punisher could not be defined by its properties as a stimulus alone, but by the way such a stimulus was scheduled to follow the behavior. Reinforcers seem to be contextual and continuously changing, making a prediction about which events will be reinforcing a real challenge. In order to create a methodology for reinforcer identification, not only stimulus selection, but other variables such as the schedules of reinforcement delivery, response cost, and deprivation variables should be analyzed. (Skinner, 1953; Morse & Kelleher, 1970; Pace et al, 1985).
Table 1
*Total Responses per Session and Response Rate per Minute for Both Participants of Experiment I*

**FLSP04**

<table>
<thead>
<tr>
<th>Condition/session</th>
<th># of responses</th>
<th>Response rate per minute</th>
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</thead>
<tbody>
<tr>
<td>A-preferred sounds/1</td>
<td>269</td>
<td>13.45</td>
</tr>
<tr>
<td>B-non-preferred sounds/2</td>
<td>349</td>
<td>17.45</td>
</tr>
<tr>
<td>A-preferred sounds/3</td>
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<tr>
<td>B-non-preferred sounds/4</td>
<td>325</td>
<td>16.25</td>
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**ADSP04**

<table>
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<th>Condition/session</th>
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<th>Response rate per minute</th>
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</thead>
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<tr>
<td>A-preferred sounds/1</td>
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<td>22.7</td>
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<tr>
<td>B-non-preferred sounds/2</td>
<td>325</td>
<td>16.25</td>
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<tr>
<td>A-preferred sounds/3</td>
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<td>22.15</td>
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<tr>
<td>B-non-preferred sounds/4</td>
<td>352</td>
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Table 2
*Total Number of Responses per Session and Response Rate per Minute for Participant RBSP05*

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<tr>
<th>Condition/session</th>
<th># of responses</th>
<th>Response rate per minute</th>
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</thead>
<tbody>
<tr>
<td>Acquisition of L-to-R/1</td>
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<td>13.6</td>
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<td>Preferred sounds/2</td>
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<tr>
<td>Preferred Sounds/3</td>
<td>351</td>
<td>17.55</td>
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<tr>
<td>Non-preferred Sounds/4</td>
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<tr>
<td>Non-preferred Sounds/5</td>
<td>226</td>
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<tr>
<td>Non-Preferred sounds/6</td>
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<td>8.8</td>
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<td>Preferred Sounds/7</td>
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<tr>
<td>Preferred Sounds/8</td>
<td>340</td>
<td>17</td>
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Table 3
*Total Number of Responses per Session and Response Rate per Minute for Participant SASP04*

<table>
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<tr>
<th>Condition/session</th>
<th># of responses</th>
<th>Response rate per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition of L-to-R/1</td>
<td>270</td>
<td>13.5</td>
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<tr>
<td>Preferred Sounds/2</td>
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<td>Preferred Sounds/3</td>
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<td>Non--preferred Sounds/4</td>
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<td>15.8</td>
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<tr>
<td>Preferred Sounds/8</td>
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<td>13.5</td>
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<td>Preferred Sounds/9</td>
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<td>12.2</td>
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Table 4  
*Total Number of Responses per Session and Response Rate per Minute for Participant BHSP05*

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<th>Condition/session</th>
<th># of responses</th>
<th>Response rate per minute</th>
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<td>16.75</td>
</tr>
<tr>
<td>Preferred Sounds/2</td>
<td>240</td>
<td>12</td>
</tr>
<tr>
<td>Preferred Sounds/3</td>
<td>336</td>
<td>16.8</td>
</tr>
<tr>
<td>Preferred Sounds/4</td>
<td>325</td>
<td>16.25</td>
</tr>
<tr>
<td>Non-preferred Sounds/5</td>
<td>267</td>
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<tr>
<td>Non-preferred Sounds/6</td>
<td>281</td>
<td>14.05</td>
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<td>Non-preferred Sounds/7</td>
<td>309</td>
<td>15.45</td>
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<td>Concurrent Schedule/8</td>
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<td>16.05 (preferred)</td>
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<td></td>
<td>2 Non-preferred</td>
<td>0.1 (non-preferred)</td>
</tr>
<tr>
<td>Non-Preferred Sounds/9</td>
<td>350</td>
<td>17.5</td>
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<tr>
<td>Non-Preferred Sounds/10</td>
<td>374</td>
<td>18.7</td>
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Figure 1. A diagram of the preference assessment apparatus from Experiment I.
Figure 2. A diagram of the reinforcer assessment apparatus from Experiment I.
Figure 3. A diagram of the preference assessment apparatus from Experiment II.
Figure 4. Preference assessment results for participants in Experiment I.
Figure 5. Cumulative records for participant’s responding in Experiment I.
Figure 6. Preference assessment results from Experiment II.
Figure 4. Cumulative response records for participant RBSP05.

Figure 7. Cumulative records for participant RBSP05.
Figure 8. Cumulative records for participant SASP05.
Figure 9. Cumulative records for participant BHS05.
REFERENCES


