TRACKING TO PLIANCE: EFFECTS OF PUNISHMENT ON NON-COMPLIANCE

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Inaccurate instructions have been shown to interfere with or override the effects of otherwise effective behavioral contingencies. This effect may be mediated by such factors as the discriminability of current contingencies, histories with accurate and inaccurate instructions, and consequences associated with following instructions. The current experiment investigated the effects of instructions (both accurate and inaccurate) on response patterns when paired with feedback regarding correspondence between responding and instructions, feedback indicating potential point loss for non-correspondence, and point loss for non-correspondence. Inaccurate instructions produced only small and temporary disruptions in response patterns, as did the addition of feedback alone and feedback indicating potential point loss. The introduction of escalating point losses contingent on non-correspondence, ranging from 20%-50% of points earned, produced changes in response patterns that corresponded to the inaccurate instructions. These outcomes indicate that the imposition of direct consequences for noncompliance may alter the effects of other contingencies. Depending on the point at which point losses disrupt responding, such effects may be interpreted in terms of point loss avoidance or, alternatively, maximizing point gains.
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CHAPTER I
INTRODUCTION

Research outcomes have shown that human behavior often differs from the behavior of other species in similarly arranged circumstances. For example, under fixed interval (FI) schedules of reinforcement, non-humans often produce patterns of responding characterized by low response rates following the delivery of reinforcers, followed by a period of gradual acceleration of responding until the next reinforcer delivery (i.e., a “scallop” pattern of responding). This behavior pattern is sometimes seen in human infants, but rarely in adults and then only under certain circumstances (Hyten & Madden, 1993; Wiener, 1969). The reasons for differences in response patterns between humans and non-humans have not been clearly isolated, but researchers have pointed to the role of verbal behavior in mediating human performances (Catania, Mathews, & Shimoff, 1982; Galizio, 1979; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986). For example, studies have shown that human sensitivity to reinforcement schedules can be altered by providing instructions, or rules, that either accurately or inaccurately describe the contingencies by which reinforcers will be available (Joyce & Chase, 1990; Baron & Galizio, 1983; Hackenberg & Joker, 1994; Hayes et. al., 1986).

Rules, or instructions, are verbal descriptions of behavioral contingencies (i.e., relationships between behavior and the events that precede and follow it) (Hineline & Wanchisen, 1989, p. 237). The influence of rules on behavior appears to be a function of the extent that following rules places the person in contact with specific consequences (Catania, Shimoff, & Matthews, 1989, p.120). Thus, rules may come to function as a general class of stimuli if behavior corresponding to rules is more or less effective across a variety of situations. For example, if rule-consistent behavior is generally more effective (i.e., produces more
reinforcement) than rule-inconsistent behavior, then rules may come to effectively mediate behavior across a range of rules and conditions (Malott, 1989 p. 282). Such rules might be said to be “accurate.” For example, Hayes and colleagues found that instructed responding was strengthened when the instructions allowed for more frequent contact with reinforcers (Hayes, Brownstein, Haas, & Greenway, 1986). Alternatively, when no differential contingencies are associated with compliance or non-compliance with rules (i.e., when rule-consistent behavior is neither more nor less effective than rule-inconsistent behavior), rules may eventually lose their effectiveness to mediate behavior (Catania, Shimoff, & Matthews, 1989 p. 121). If a history is established in which rules are typically inaccurate (i.e., rule-consistent behavior produces a decrease in obtained reinforcement) and no additional contingencies are arranged for noncompliance, sensitivity to rules as effective antecedent stimuli would likely be weakened (and, conversely, sensitivity to consequences may be strengthened). For example, in the previously cited study by Hayes and colleagues (1986), instructions that ran contrary to actual contingencies were more likely to produce disruptions in previously stable response patterns.

Some researchers who study rule-governed behavior suggest that instructed performances are insensitive to changes in contingencies, relative to performances that are directly shaped by contingencies. For example, Shimoff, Catania, and Matthews (1981) established low rates of key pressing by college students using differential reinforcement of low rate (DRL) contingencies superimposed over random interval (RI) or random ratio (RR) schedules. Some participants received instructions to press the key slowly; for others, the response patterns were shaped by the operative contingencies. Both groups of students demonstrated schedule-appropriate response patterns when the DRL contingency was superimposed on the RI and RR schedules (i.e., low rates of responding); however, when the DRL contingency was removed or
relaxed, most participants who had received instructions did not show changes in response patterns, whereas most participants whose performances had been shaped by contingencies showed dramatic increases in response rates. Other studies have shown similar outcomes (e.g., Weiner, 1969; Galizio, 1979; Matthews, Shimoff, Catania, & Sagvolden, 1977).

The results of some research suggests that the apparent insensitivity of instructed performances to environmental changes is not a general or robust effect, but may be mediated by a number of factors, such as the discriminability of contingencies and individual histories with instructions. For example, several studies have investigated the interaction between histories with accurate versus inaccurate rules and actual contingency arrangements. For example, Joyce and Chase (1990) conducted a study using either minimal or complete instructions for a task. After establishing stable response patterns using a fixed ratio (FR) schedule, the schedule was changed to an FI schedule. Participants who had been given accurate rules on how to respond most effectively according to the FR schedule did not adjust response patterns following the change to the FI schedules (i.e., their behavior was insensitive to the change in contingencies). They also noted similar outcomes following the establishment of stability in behavior shaped by consequences. Thus, these results suggested that both instructed and shaped performances could be insensitive to changed contingencies. One potential account for the insensitivity to changed contingencies was that the response patterns generated by the FR schedule (either instructed or shaped) did not result in an overall decrease in obtained reinforcement on the FI schedule.

Some researchers have suggested that instructions may produce insensitivity to changes in environmental contingencies to the extent that the instructions generate stereotypic, or invariant, response patterns (Pisacreta, 1998). For example, Hackenberg and Joker (1994) arranged for participants to repeatedly choose between a progressive time (PT) schedule of
reinforcement and a fixed time (FT) schedule. Both schedules arranged for response independent delivery of reinforcers (points). On the progressive schedule, the delay to the next point increased with each point delivered; on the fixed schedule, points were delivered with a constant inter-point interval. Each point delivered on the FT schedule reset the PT schedule to its lowest (initial) value. Initially, the investigators provided instructions that specified optimal control via the schedule requirements (i.e., following instructions produced the greatest possible number of reinforcers per time unit). Subsequently, contingencies changed so that instructions became increasingly inaccurate, in the sense that instruction-consistent response patterns would not result in the greatest number of reinforcers per session. Initially, response patterns suggested insensitivity to the changed contingency (i.e., the participants continued to emit instruction-consistent response patterns. However, as instructions became increasingly inaccurate, response patterns became more variable and eventually became more consistent with contingencies. The authors suggested that instructional control was extinguished, generating variability in response patterns, which permitted contact with and eventual control by the programmed contingencies. Thus, it appears that instructions lost control based on increasing discriminability of their inaccuracy (i.e., they lost control because it became increasingly apparent that instruction consistent responding resulted in a net decrease in obtained reinforcement). Other research also has shown that response pattern variation may occur when response patterns that are consistent with stated rules fail to produce reinforcers (e.g., Hayes, Brownstein et al., 1986).

Variation also may occur when strategic instructions, instructions that describe or imply the possibility of multiple possible response patterns, are presented after stable response patterns have been established. For example, Joyce and Chase (1990) conducted a second experiment using a similar preparation to their previously mentioned study. In this study, one group was
given complete instructions on optimal response patterns for the FR40 schedule, while a second
group was only given minimal instructions and behavior was allowed to stabilize according to
the contingency. For both groups, once stable responding occurred, the schedule was changed to
an FI 10-s for 15 min. No subject showed sensitivity to the contingency change. The
experimenters then provided strategic instructions to all participants. These instructions were
labeled strategic because they described multiple possible response patterns that the participant
might engage in to earn points. Participants then returned to the FR 40 schedule until 6
reinforcers (points) were earned, then the schedule was changed to an FI 10-s. This was
followed by another baseline session without strategic instructions, and a second strategic
instruction phase. All but one participant showed variable responding and sensitivity to the
change in contingencies. The experimenters concluded that strategic instructions produced more
variability in responding, and that this variability was an important factor in producing sensitivity
to changes in contingencies.

Hayes, Brownstein, Zettle, Rosenfarb, and Korn (1986) described the competing
contingencies between reinforcement schedules and instructions as tracking and pliance. In
tracking, rules or instructions influence behavior based on a previous history of correspondence
between the rules and natural contingencies. Pliance occurs when rules influence behavior based
on socially mediated consequences for following the rule, per se. In previous studies,
experimenters investigated whether patterns of behavior would “track” contingencies after
establishing patterns of responding using pliance. (Hackenberg & Joker 1994; Newman,
Buffington, & Hemmes 1995; Hayes, Brownstein, Zettle, Rosenfarb, & Korn 1986) These
studies established response patterns consistent with instructions (pliance) and subsequently
evaluated factors that would create contingency consistent responding (tracking).
The current study sought to further investigate the interactive effects of contingencies and rules on operant behavior. First, response patterns were established using minimal, strategic instructions (i.e., instructions that described general contingencies and suggested that more than one response pattern may be effective). Then, the effects of specific, response-based instructions (i.e., instructions that described a specific response pattern) were evaluated when the instructions were accurate (i.e., instruction-consistent behavior produced more reinforcement) and inaccurate (i.e., instruction-consistent behavior produced less reinforcement). Subsequently, the effects of differential consequences for compliance with instructions were assessed. First, feedback was provided that indicated if prior response patterns were consistent or inconsistent with instructions. Second, feedback was provided that indicated if prior response patterns were consistent or inconsistent with instructions and suggested a possible point-loss contingency for response patterns that were inconsistent with instructions. Finally, feedback was provided that indicated if prior response patterns were consistent or inconsistent with instructions and points were deducted from the participant’s earnings. Deductions were based on a percentage of points earned during the previous cycle, and point-loss percentages escalated across phases.

These procedures addressed two general experimental questions. First, is it possible to establish differentiated, contingency-consistent response patterns (tracking) across alternating schedules of reinforcement with minimal strategic instructions? Second, will arranging general contingencies for compliance (or noncompliance) with rules may alter the effectiveness of rules? For example, will the introduction of punitive consequences for noncompliance increase the effectiveness of rules (pliance), even if rule-consistent behavior (i.e., compliance) does not result in an increase in reinforcement?
CHAPTER II

METHOD

Participants

Three undergraduate students currently attending the University of North Texas participated in the experiment. Participants were volunteers from an introductory behavior analysis course. Of the seven participants that started the study, six were female and one was male. Participants were selected from a list of volunteers based on availability. All subjects were between the ages of 19 and 22. Of the 3 participants that completed the study, 2 were female and 1 was male. Gender, age, national origin, and other personal factors were not considered in the recruitment and selection of participants.

Setting and Apparatus

The experiment was conducted in a small, experimental room measuring approximately 2m x 2m. The room contained a chair and a small table, on which was located a desktop PC computer (including standard keyboard and 17” monitor) that served as the experimental apparatus and collected all data. The computer screen displayed instructions (including designation of the currently active key) and feedback (points earned). A one-way mirror located to the left of the participants permitted the experimenter to unobtrusively monitor participants during sessions.

General Procedures

Pre-session procedures. Prior to initiating sessions, the experimenter programmed the computer to conduct the upcoming session. The participant was then led into the room and seated at the chair facing the computer and monitor. The experimenter then gave the following instructions: “Please remove your watch and turn off your cell phone if you have one. All
further instructions will be provided to you by the computer. Please read the instructions carefully. If you need to terminate this session for any reason, press the escape key. When the screen asks for a password, please step out of the room.” If the participant asked for further instructions, the experimenter repeated the relevant part of the previous instructions. If the participant had no further questions, the experimenter exited the room. Displayed on the monitor was the following text: “The session is about to begin. Press any key to continue.” After the participant pressed any key on the keyboard, the monitor displayed instructions as appropriate to the upcoming session.

*Session procedures.* Instructions for the current session (see Baseline and Instructional Phases procedures) and a box indicating the active key were displayed on the computer monitor. The monitor also displayed the instruction “Press any key to start.” After the participant pressed a key, the first 2-min cycle began. The monitor then displayed the current instructions, the active key, and a point counter, which continuously displayed the total number of points earned during that cycle. The P key was always the first active key for the first 2 min of each session. The A key was then activated for a 2-min cycle. Each key was active for 5, alternating 2-min cycles, for a total of 10 min each per 20-min session.

During each 2-min cycle, one of two schedules of reinforcement was in effect. One was a DRL 4-s schedule, in which key presses were reinforced only if at least 4-s elapsed between the prior and current press. This allowed a maximum of 30 points to be earned per 2-min cycle when the schedule was in effect. The other schedule was a conjunctive FR10/Limited Hold 5-s schedule. According to this schedule, cycles were divided into 24 consecutive 5-s intervals (i.e., the first 5-s interval began at the start of the cycle from 0.001s – 5.000s, the next interval was from 5.001s – 10.000s, and the pattern continued through the last interval from 115.001s –
120,000s). The point counter incremented one point contingent on the emission of 10 responses on the active key during any given 5-s interval. No presses made after the tenth press in the same interval counted towards point earnings. The next point could be earned only after the start of the next 5-s interval. This allowed a maximum of 24 points to be earned per 2-min cycle. Schedules alternated in coordination with the active keys within sessions. For example, if the DRL 4-s schedule was in effect during the first cycle of a session (i.e., when the P key was active), then that key-contingency association remained in effect throughout the 20-min session, while the conjunctive FR 10/limited hold 5-s schedule was in effect during A key cycles. The schedules were associated with each key in a semi-random manner, so that no schedule was paired with a key more than 3 sessions in a row. The computer recorded key presses, their temporal location within cycles (at .001 s accuracy), whether specific presses earned a point, and cumulative point totals within cycles. Cumulative point totals and key press totals for the entire session also were recorded. At the end of a cycle, the monitor displayed the current instructions and indicated the new active key along with the instruction “Press any key to start” (see Figure 1). At the end of the 20-min session, the monitor displayed a box asking for a password. At this point the participant exited the room and the experimenter led the participant to a waiting area while the next session and/or feedback for the current session were being prepared.

Post-session procedures. After the session ended and the participant was seated in the waiting area, the experimenter recorded data and paid the participant a penny (in cash) for each point earned during the session. Participants were able to earn up to $2.60 per session. Then, the participant was either led back into the experimental room for the next session, or made arrangements for the next scheduled session with the experimenter. Participants completed no
more than three sessions in a row and never more than 6 sessions in a day. If more than 3 sessions were conducted in one day, at least a 1-hr break occurred between sessions.

Experimental Conditions

The experiment consisted of five phases: Baseline (A), Instruction (B), Instructions with Feedback (C₁), Instructions with Feedback Showing Possible Point Loss (C₂), and Point Loss (D).

**Baseline (A).** In baseline, pre-session, session, and post-session procedures were followed as described above. The session instructions for all Baseline sessions were as follows:

“Pressing the active key rapidly or slowly during the next 2 minutes will earn you points. Only presses on the active key will count. Try to earn as many points as possible. You may press the escape key to terminate the session early.”

**Instruction (B).** During the instruction phase, pre-session, session, and post-session procedures were followed as described above. The session instructions for all Instruction sessions were one of the following:

“Pressing the active key during the next 2 minutes will earn you points. For this session, press more frequently on the P key (when active) than on the A key (when active). Only presses on the active key will count. Try to earn as many points as possible. You may press the escape key to terminate the session early.”

Or

“Pressing the active key during the next 2 minutes will earn you points. For this session, press more frequently on the A key (when active) than on the P key (when active). Only presses on the active key will count. Try to earn as many points as possible. You may press the escape key to terminate the session early.”
For 50% of sessions instructions corresponded with the actual schedules (“accurate” instructions) and during the other half the instructions were inconsistent with the actual schedules (“inaccurate” instructions). Between sessions in this phase one of three contingency changes could occur. Sometimes, the instructions were identical to the previous session but the schedule-key associations changed. Sometimes, the instructions changed, but the schedule-key associations remained identical to the previous session. Finally, sometimes both the instructions and the schedule-key associations changed for the next session.

*Instructions with Feedback (C1).* The feedback phase was identical to the instruction phase except that at the end of each session, participants were provided with a printed form stating if response rates for that session were consistent or inconsistent with the session’s instructions. Each of the five 4-min combined cycles (2 min on each key) were listed separately (see Figure 2).

*Instructions with Feedback (C2).* This phase, subsequently referred to as Feedback(2), was identical to phase C1 with an additional point loss column added on the feedback form. All boxes in the point loss column displayed values of 0 during this phase (see Figure 3).

*Point Loss (D).* This phase was identical to the Feedback(2) phase (C2) except that, if the participant’s performance was inconsistent with the instructions (e.g., when told to press more frequently on “P” key than “A” key, the participant pressed more frequently on “A” key than “P” key) for any given 4-min combined cycle, a point loss was incurred for that combined cycle. This point loss varied between sessions, but not between cycles. Ranges of point loss were between 20% and 50% of points earned per combined cycle. Point losses increased by 10% per combined cycle after 3 sessions of stable responding during inaccurate instructions at the previous point loss value. The participant was informed of how many points he/she earned for
pressing keys as well as how many points he/she lost (if any) for inconsistent responding by using the modified version of the feedback form with point loss column (see Figure 3). The participant was then paid an amount equal to the net amount of points earned.

Sequence of Experimental Phases and Sessions

Conditions were conducted according to an A-B-C₁-C₂-D pattern. In order to prevent the possible confound of establishing an early history with accurate or inaccurate instructions, individual sessions were presented semi-randomly, with no more than 3 consecutive sessions with either accurate or inaccurate instructions. In addition, the first two sessions of each experimental phase included one accurate instruction session and one inaccurate instruction session. Phase changes occurred when participants maintained stable responding across three inaccurate sessions during the current phase. Stability was achieved when press rates and/or point earnings varied by less than 20% across three sessions in which inaccurate instructions were provided. Each time point loss increments were increased during the Point Loss phase, the first two sessions of the increased point loss percentage included one accurate instruction session and one inaccurate instruction session.
CHAPTER III

RESULTS

Baseline

Figure 4 shows baseline data for all three participants. The panels on the left side of the figure depict key presses per cycle (kpc), and the panels on the right side of the figure depict points per cycle (ppc). B1 and B2 denote contingency associations with active keys. During B1, the DRL 4-s schedule was associated with the A key and the FR10/Limited Hold 5-s schedule was associated with the P key. During B2, the DRL 4-s schedule was associated with the P key and the FR10/Limited Hold 5-s schedule was associated with the A key.

The top graphs in Figure 4 show baseline data for participant THSU3. During the initial cycle of session 1, THSU3 made 443 kpc on the active key during the DRL 4-s schedule, and 663 kpc on the active key during the FR10/Limited Hold 5-s schedule. Data show that this participant emitted response patterns that earned points on both reinforcement schedules during the first cycle of session 1. By the end of session 1, response frequencies had differentiated between schedules with 19 kpc while the DRL 4-s schedule was in effect and 625 kpc while the FR10/Limited Hold 5-s schedule was in effect. When contingency associations with the active keys were switched for session 2, a slight disruption in the established response pattern occurred as seen by the increase in kpc during the first cycle of the DRL 4-s schedule. The participant made 59 key press responses on the active key during this cycle; however, response measures returned to low levels by cycle 2, in which 25 responses were made on the active key. Session 3 yielded a mean of 23.4 points per cycle (ppc) while the DRL 4-s schedule was in effect, with a range from 22 to 25 ppc. When the FR10/Limited Hold 5-s schedule was in effect THSU3
earned 24 ppc for each cycle. Based on a variance of only 6.2% per combined cycle (2 min on the DRL 4-s schedule and 2 min on the FR10/Limited Hold 5-s schedule) it was determined that the participant had exhibited stable response patterns during session 3. Response variances were calculated by taking the combined cycle with the least points earned in a session, dividing by the combined cycle with the most points earned in that session, and subtracting from 100%. THSU3 earned 237 points during session 3, which was 91.2% of total available points (260).

The middle graphs in Figure 4 show baseline data for participant THSU4. This participant made 629 active key responses during the first cycle on the DRL 4-s key and 615 active key responses during the first cycle on the FR10/Limited Hold 5-s schedule, earning 22 points on the FR10/Limited Hold 5-s schedule but no points on the DRL 4-s schedule. Data show that this participant was able to acquire a response pattern that earned points on both reinforcement schedules by the fourth cycle of session 1, at which time kpc while the DRL 4-s schedule was in effect decreased to 30. As with THSU3, response frequencies for THSU4 showed disruption when contingency associations with the active keys changed. This is indicated by a decrease in active key responses during the first cycle of session 2 when the FR10/Limited Hold 5-s schedule was in effect. The participant made 662 active key responses during this cycle, compared to 715 made during the last cycle of session 1. Session 3 yielded a mean of 24.6 ppc while the DRL 4-s schedule was in effect, with a range of 23 to 26 points earned. This participant also earned 24 points during every cycle when the FR10/Limited Hold 5-s schedule was in effect during session 3. Based on a variance of only 6% per combined cycle, it was determined that the participant had exhibited stable response patterns during session 3. THSU4 earned 243 points during session 3, which is 93.5% of total available points (260).
The bottom graphs in Figure 4 show baseline data for participant THSU7. During session 1, active key presses while the DRL 4-s schedule was in effect initially occurred at 328 presses; however, by cycle 4, only 20 active key presses were emitted during this schedule component. THSU7 earned 21 points on the FR10/Limited Hold 5-s during the first cycle of session 1, and 1 point on the DRL 4-s schedule. As with the previous participants, data for THSU7 showed response differentiation between schedules by cycle 4 of session 1, with 30 active key presses during the DRL 4-s schedule and 725 active key presses during the FR10/Limited Hold 5-s schedule. Unlike the previous 2 participants, THSU7 did not maximize point earnings on the FR10/Limited Hold 5-s schedule until the second cycle of session 2. Disruption of response patterns occurred when schedules associated with active keys were switched between sessions 1 and 2, with 60 active key presses during the DRL 4-s schedule in the first cycle of session 2. Contingency-key associations switched again between sessions 2 and 3 for THSU7, but the data show no visible signs of disruption in response patterns. Session 3 yielded a mean of 24 ppc while the DRL 4-s schedule was in effect, with a range from 22 to 26. THSU4 earned 24 points during each cycle while the FR10/Limited Hold 5-s schedule was in effect during session 3. Based on a variance of only 8% per combined cycle it was determined that the participant had emitted a stable response pattern during session 3. THSU7 earned 240 points during session 3, which was 92.3% of total available points (260).

All three participants were able to acquire response patterns that earned over 90% of available points by session 3.

Instructions

Figure 5 shows data for all three participants during the instructions phase. The panels on the left side of the figure depict kpc, and the panels on the right side of the figure depict ppc.
1A, 2A, 1NA, and 2NA denote contingency associations with active keys and accurate or inaccurate instructions. During 1A and 1NA sessions, the DRL 4-s schedule was associated with the A key and the FR10/Limited Hold 5-s schedule was associated with the P key. During 2A and 2NA sessions, the DRL 4-s schedule was associated with the P key and the FR10/Limited Hold 5-s schedule was associated with the A key. Also, during 1A and 2A sessions accurate instructions were given, while during 1NA and 2NA sessions, inaccurate instructions were provided.

The top graphs in Figure 5 show data from the instruction phase for THSU3. During the first session accurate instructions were provided (1A). Response frequencies during the FR10/Limited Hold 5-s schedule ranged from 531 to 581 per cycle, with a mean of 565.2 kpc. Comparatively, response frequencies during the final session of baseline ranged from 548 to 780 kpc during the FR10/Limited Hold 5-s schedule, with a mean of 625.6 kpc (Figure 3). The mean variation from the last session of baseline to the first session of instruction (mean presses during the first instruction session divided by mean presses during the last baseline session) was 9%.

Session 2 of the instruction phase provided the first contact with inaccurate instructions for participant THSU3. The DRL 4-s schedule was associated with the active key during the first cycle of this session (2NA). THSU3 made 70 active key responses during the cycle, earning 19 points. During the remaining cycles when the DRL 4-s schedule was active, a mean of 24.5 kpc were made. Similar results occurred during the eighth cycle of instruction phase, also a 2NA cycle. During this cycle, the participant responded 62 times on the active key during the initial cycle of the session (DRL 4-s), and had a mean of 25.75 presses during the next 4 cycles.

During all 1NA sessions in the instruction phase, the latency to the first press during the initial cycle (FR10/Limited hold 5-s) averaged 5.47 s, resulting in decreased point earnings in the initial
cycle of each 1NA session during instruction phase. Overall, kpc varied between 475 and 614
during the FR10/Limited Hold 5-s schedule, and between 70 and 15 during the DRL 4-s
schedule. Point earnings per cycle ranged from 22 to 24 points during the FR10/Limited Hold 5-
schedule and from 16 to 25 points during the DRL 4-s schedule with the exception of 1 cycle,
when 10 points were earned out of 15 responses made.

The middle graphs in Figure 5 show data from the instruction phase for THSU4. During
the first session accurate instructions were provided (2A). Response frequencies during the
FR10/Limited Hold 5-s schedule ranged from 502 to 711 per cycle, with a mean of 597.2 kpc.
Comparatively, response frequencies during the final session of baseline ranged from 615 to 725
kpc during the FR10/Limited Hold 5-s schedule, with a mean of 687.6 kpc (Figure 3). The mean
variation from the last session of baseline to the first session of instruction was 13.2%. During
the first DRL 4-s cycle of this session, 626 key presses were made. Response frequencies
returned to baseline levels by the fourth cycle and 24 active key responses were made in both the
fourth and fifth cycles of the session. Session 2 of the instruction phase provided the first contact
with inaccurate instructions for participant THSU3. The FR10/Limited Hold 5-s schedule was
associated with the active key during the first cycle of this session (1NA). THSU3 made 521
active key responses during the cycle, earning 19 points. During the remaining cycles when the
FR10/Limited Hold 5-s schedule was active, THSU3 emitted a mean of 589 kpc, resulting in a
mean of 24 ppc. Latency to first press during 1NA sessions did not vary significantly for THSU4
compared to other instructional sessions. During the fifth session of the instruction phase,
(2NA) THSU4 made 117 presses during the initial DRL 4-s cycle. The mean number of presses
during the remaining 4 cycles was 22.25. Overall, kpc varied between 711 and 481 during the
FR10/Limited Hold 5-s schedule, and between 626 and 20 on the DRL 4-s schedule. Point
earnings per cycle ranged from 23 to 24 points during the FR10/Limited Hold 5-s schedule and from 18 to 25 points during the DRL 4-s schedule, with the exception of 1 cycle when 1 point was earned (117 responses were emitted).

The bottom graphs in Figure 5 show data from the instruction phase for THSU7. During the first session inaccurate instructions were provided (2NA). Response frequencies during the FR10/Limited Hold 5-s schedule ranged from 353 to 563 per cycle, with a mean of 473.2 kpc. Comparatively, response frequencies during the final session of baseline ranged from 622 to 659 kpc during the FR10/Limited Hold 5-s schedule, with a mean of 641.8 kpc (Figure 3). The mean variation from the last session of baseline to the first session of instruction was 26.3%. THSU7 earned 24 points during each cycle of the last session of baseline, and earned from 21 to 24 ppc during the first session of the instruction phase (mean = 22.8 ppc). During the first DRL 4-s cycle of this session, THSU7 emitted 187 active key responses. Response frequencies returned to baseline levels by the second cycle and press frequencies ranged from 24 to 34 over the last 4 cycles (mean = 28.25 kpc). After this initial exposure to inaccurate instructions, latency to first press during the initial cycle of all sessions increased for THSU7. Delay to first press ranged from X s to Y s, with a mean of Z s. These delays resulted in a point loss during the initial FR10/Limited Hold 5-s schedule of all type 1 sessions (1A and 1NA), with earnings ranging from 22 to 23 ppc. During this phase, kpc varied from 343 to 656 during the FR10/Limited Hold 5-s schedule and from 21 to 76 during the DRL 4-s schedule (excluding the initial inaccurate instruction cycle, in which 187 presses were emitted). During the third cycle of the seventh session of instruction phase, the participant emitted 57 responses in the first 15 s, and then emitted 19 responses (earning 18 points) throughout the remainder of the cycle. Earnings ranged from 21 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 18 to 26 ppc
during the DRL 4-s schedule (excluding the first inaccurate instruction cycle, where 13 points were earned).

Feedback

Figure 6 shows data for all three participants during the feedback phase. The panels on the left side of the figure depict kpc, and the panels on the right side of the figure depict ppc. As in the instruction phase, the 4 session types were 1A, 2A, 1NA, and 2 NA. These session types maintained the same contingency-key associations as in the instruction phase.

The top graphs in Figure 6 show data from the feedback phase for THSU3. Press frequencies throughout this phase were similar to those observed during the instruction phase, ranging from 454 to 628 kpc during the FR10/Limited Hold 5-s schedule and from 20 to 44 kpc during the DRL 4-s schedule. Points earned ranged from 22 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 19 to 26 ppc during the DRL 4-s schedule.

The middle graphs in Figure 6 show data from the feedback phase for THSU4. Press frequencies throughout this phase were similar to those observed during the instruction phase, ranging from 518 to 643 kpc during the FR10/Limited Hold 5-s schedule and from 20 to 69 kpc during the DRL 4-s schedule. As in the instruction phase, press frequencies during the initial cycle of each 2NA session (DRL 4-s) were elevated at the start of the cycle. Points earned ranged from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 19 to 26 ppc during the DRL 4-s schedule.

The bottom graphs in Figure 6 show data from the feedback phase for THSU7. Press frequencies throughout this phase were similar to those observed during the instruction phase, but showed less variation, ranging from 496 to 596 kpc during the FR10/Limited Hold 5-s schedule and from 22 to 28 kpc during the DRL 4-s schedule. Points earned ranged from 23 to
24 ppc during the FR10/Limited Hold 5-s schedule and from 21 to 28 ppc during the DRL 4-s schedule.

Feedback(2)

Figure 7 shows data for all three participants during the Feedback(2) phase. The panels on the left side of the figure depict kpc, and the panels on the right side of the figure depict ppc. As in the instruction phase, the 4 session types were 1A, 2A, 1NA, and 2 NA. These session types maintained the same contingency-key associations as in the instruction phase.

The top graphs in Figure 7 show data from the feedback(2) phase for THSU3. Press frequencies throughout this phase were similar to those observed during both instruction and feedback phases, but showed less variation, ranging from 445 to 561 kpc during the FR10/Limited Hold 5-s schedule and from 20 to 45 kpc during the DRL 4-s schedule. Points earned ranged from 22 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 18 to 27 ppc during the DRL 4-s schedule.

The middle graphs in Figure 7 show data from the feedback(2) phase for THSU4. Press frequencies throughout this phase were similar to those observed during both instruction and feedback phases, but showed less variation, ranging from 541 to 605 kpc during the FR10/Limited Hold 5-s schedule and from 22 to 54 kpc during the DRL 4-s schedule. As in the instruction phase, press frequencies during the initial cycle of each 2NA session (DRL 4-s) were elevated at the start of the cycle. Points earned ranged from 22 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 18 to 27 ppc during the DRL 4-s schedule.

The bottom graphs in Figure 7 show data from the feedback(2) phase for THSU7. Press frequencies throughout this phase were similar to those observed during instruction and feedback phases, ranging from 245 to 579 kpc during the FR10/Limited Hold 5-s schedule and from 22 to
28 kpc during the DRL 4-s schedule. Points earned ranged from 11 to 24 ppc during the FR10/Limited Hold 5-s schedule and from 22 to 28 ppc during the DRL 4-s schedule. During the first session of this phase, the repeat key function on the computer keyboard was not disabled, and the participant used this function during 3 of the 5 cycles during the FR10/Limited Hold 5-s schedule. The repeat key function permits the user to repeat key strokes at a rate of approximately 21 per-s by pressing and holding any operative key for approximately 1-s. This keyboard function was disabled before the start of the second session. Data for these cycles are shown, but press frequencies and points earned were not used in determining variation in responses. Total responses during the fifth cycle of session four (while the FR10/Limited Hold 5-s schedule was in effect) were low due to a 64-s pause during the cycle.

Point Loss

Figure 8 shows data for participant THSU3 during the point loss 20% phase. The top panel of the figure depicts kpc, and the bottom panel of the figure depicts ppc. As in the instruction phase, the 4 session types were 1A, 2A, 1NA, and 2 NA. These session types maintained the same contingency-key associations as in the instruction phase. Press frequencies during the first four sessions of the phase remained similar to those observed during the previous phases, ranging from 394 to 583 kpc during the FR10/Limited Hold 5-s schedule, and from 21 to 44 kpc during the DRL 4-s schedule. Point earnings also were similar to previous phases during this time ranging from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule, and from 21 to 27 ppc during the DRL 4-s schedule. Response variation increased during session five, which was the third point loss session with inaccurate instructions. Press frequencies ranged from 0 to 407 kpc during the FR10/Limited Hold 5-s schedule, and from 0 to 576 kpc during the DRL 4-s
schedule. Point earnings ranged from 0 to 24 ppc during the FR10/Limited Hold 5-s schedule, and from 0 to 21 ppc during the DRL 4-s schedule.

Figure 9 shows points earned per session for all subjects during the point loss phase. The red line on each graph shows the mean number of points that would be earned if the participant’s behavior was consistent with instructions during inaccurate instruction sessions. The value of the line was calculated based on mean points earned by the participant while the DRL 4-s schedule was active during previous conditions. Responses on the FR10/Limited Hold 5-s schedule were not considered because response frequencies on the key associated with that schedule decreased to below 25 kpc for all participants during inaccurate instruction sessions in this phase (i.e., if responding was consistent with instructions, maximizing point earnings on the DRL 4-s schedule precluded earning more that 3 points on the FR 10/Limited Hold 5-s schedule). Open symbols represent gross points earned and closed symbols represent net points earned (gross points earned less points lost for response patterns inconsistent with instructions). Square symbols represent points earned during accurate instruction sessions and circles represent points earned during inaccurate sessions. The top panel shows data for THSU3. These data show that, during accurate instruction sessions, points earned per session were stable and consistent with previous phases, ranging in values from 235 to 248. During the first two sessions in the inaccurate instructions condition, gross point earnings were consistent with previous conditions (session 1 earnings = 235, session 2 earnings = 248); however, because responding during these sessions was inconsistent with instructions, the point loss contingency was enacted, resulting in net earnings of 188 and 198, respectively. Subsequently, both gross and net points earned decreased and remained stable at levels that were consistent with mean points earned by this participant while the DRL 4-s schedule was active during previous conditions. This
participant’s response patterns remained consistent with instructions throughout the remainder of this condition and never again produced point losses.

Figure 10 shows data for participant THSU4 during the point loss phases ranging from 20 – 40%. As in the instruction phase, the 4 session types were 1A, 2A, 1NA, and 2 NA. These session types maintained the same contingency-key associations as in the instruction phase. The top left panel of the figure depicts kpc during 20% point loss. Press frequencies during the 20% point loss sessions of the phase remained similar to those observed during the previous phases, ranging from 545 to 620 kpc during the FR10/Limited Hold 5-s schedule, and from 23 to 63 kpc during the DRL 4-s schedule. The top right panel depicts ppc during the 20% point loss phase. Point earnings remained consistent with previous phases and ranged from 22 to 28 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule.

The middle left panel of the figure depicts kpc during the 30% point loss phase. Press frequencies during this phase remained similar to those observed during the previous phases, ranging from 510 to 612 kpc during the FR10/Limited Hold 5-s schedule, and from 18 to 60 kpc during the DRL 4-s schedule (excluding cycle 5 of session 2, during which only 2 kpc were made during the DRL 4-s schedule). The middle right panel depicts ppc during this phase. Point earnings remained consistent with previous phases, ranging from 18 to 26 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule. During both 20% and 30% point loss phases, press frequencies were elevated during the first cycle of each 2NA session.

The bottom left panel of the figure depicts kpc during the 40% point loss phase. During the first session of the phase, press frequencies were similar to those observed during previous phases, ranging from 512 to 575 kpc during the FR10/Limited Hold 5-s schedule and from 22 to
38 kpc during the DRL 4-s schedule. During the second cycle of session 3 for this phase (2NA) response frequencies began to vary significantly from previous sessions. THSU4 emitted between 19 and 26 kpc during the FR10/limited Hold 5-s schedule and between 522 and 568 kpc during the DRL 4-s schedule. This variability continued until session 19, when response frequencies became stable, ranging from 1 to 4 kpc during the FR10/Limited Hold 5-s schedule and from 22 to 27 kpc during the DRL 4-s schedule. These frequencies were consistent with the inaccurate instructions provided during this phase. Response frequencies remained consistent with instructions until session 24 of this phase (1NA). During this phase, response frequencies were inconsistent with the instructions, ranging from 90 to 163 kpc during the FR10/Limited Hold 5-s schedule and from 25 to 51 kpc during the DRL 4-s schedule. By session 28, response frequencies during NA sessions stabilized and ranged from 2 to 4 kpc during the FR10/Limited Hold 5-s schedule, and from 26 to 28 kpc during the DRL 4-s schedule. These frequencies remained stable during the last 3 NA sessions of the point loss phase. The bottom right panel depicts ppc during the 40% point loss phase. As with kpc, point earnings began to vary significantly from previous phases by session 2 of this phase. THSU4 earned 0 points during all cycles of session 2. Point earnings became variable after session 2, ranging from 0 to 27 ppc during the DRL 4-s schedule and from 0 to 24 ppc during the FR10/Limited Hold 5-s schedule. Point earnings stabilized during session 19 (1NA) with 0 points earned during the FR10/Limited Hold 5-s schedule and a range of 23 to 27 ppc during the DRL 4-s schedule. As with previous phases, kpc during the initial cycle of 2NA sessions were significantly higher than frequencies during subsequent cycles of the session. (see Figure 11)

The middle panel of Figure 9 shows points earned per session for THSU4 during the point loss phase. These data show that, during accurate instruction sessions, points earned per
session were stable and consistent with previous phases, ranging in values from 221 to 248 points per session. During 20% and 30% point loss conditions in the inaccurate instructions condition, gross point earnings were consistent with previous sessions, ranging from 221 to 245 points per session; however, because responding during these sessions was inconsistent with instructions, the point loss contingency was enacted, resulting in net earnings of 193 to 196 points per session during 20% point loss and 155 to 169 points per session during 30% point loss. During the 40% point loss condition, responding became variable, with gross point earnings ranging from 0 to 223 points per session and net earnings ranging from 0 to 134 points per session. On the eleventh session of inaccurate instruction during the 40% point loss condition, response patterns stabilized and became consistent with instructions. Response patterns again showed variability during sessions 13 and 14 of the 40% point loss condition, but again stabilized during session 15. Subsequently, both gross and net points earned during inaccurate instruction sessions remained stable at levels that were consistent with mean points earned by this participant while the DRL 4-s schedule was active during previous conditions. This participant’s response patterns remained consistent with instructions throughout the remainder of this condition and never again produced point losses.

Figures 12 and 13 shows data for participant THSU7 during phases in which point losses ranged from 20 – 50%. As in the instruction phase, the 4 session types were 1A, 2A, 1NA, and 2NA. These session types maintained the same contingency-key associations as in the instruction phase. The top left panel of the figure depicts kpc during 20% point loss. Press frequencies during the 20% point loss sessions of the phase remained similar to those observed during the previous phases, ranging from 442 to 586 kpc during the FR10/Limited Hold 5-s schedule, and from 23 to 28 kpc during the DRL 4-s schedule. The top right panel depicts ppc during the 20%
point loss phase. Point earnings remained consistent with previous phases and ranged from 22 to 27 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule.

The bottom left panel of the figure depicts kpc during the 30% point loss phase. Press frequencies during the 30% point loss remained similar to those observed during the previous phases, ranging from 489 to 610 kpc during the FR10/Limited Hold 5-s schedule, and from 25 to 28 kpc during the DRL 4-s. The bottom right panel depicts ppc during the 30% point loss phase. Point earnings during this phase remained consistent with previous phases, ranging from 23 to 28 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule.

The top left panel of Figure 13 depicts kpc during the 40% point loss phase. During this phase, press frequencies were similar to those observed during previous phases, ranging from 436 to 579 kpc during the FR10/Limited Hold 5-s schedule (excluding cycle 2 of session 6 where no responses were made). During the DRL-4s schedule, two increases in responding occurred during the first cycles of sessions 7 and 11, with frequencies of 55 and 51 ppc respectively. Press frequencies during the remaining cycles were similar to previous phases, with a range of 22 to 28 kpc during the DRL 4-s schedule. The top right panel depicts ppc during the 40% point loss phase. Point earnings during this phase also remained consistent with previous phases, ranging from 22 to 28 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the FR10/Limited Hold 5-s schedule (with the exception of the second cycle of session 6, during which no points were earned).

The bottom left panel of the figure depicts kpc during the 50% point loss phase. Press frequencies during the 50% point loss remained similar to those observed during previous phases
until session 4. During the first three sessions press frequencies ranged from 385 to 547 kpc during the FR10/Limited Hold 5-s schedule, and from 24 to 28 kpc during the DRL 4-s. Starting in session 4, press frequencies became consistent with instructions, with frequencies varying as a function of instructions during the FR10/Limited Hold 5-s schedule (range = 0 to 496 kpc). Press frequencies during the DRL 4-s schedule remained consistent with previous sessions, with a range from 25 to 28 kpc (with the exception of the first cycle of session 60, during which 49 kpc were made). The bottom right panel depicts ppc during the 50% point loss phase. Point earnings during this phase remained consistent with previous phases, ranging from 24 to 28 ppc during the DRL 4-s schedule and from 23 to 24 ppc during the first three sessions in the FR10/Limited Hold 5-s schedule and from 0 to 24 ppc after session 3.

The bottom panel of Figure 9 shows points earned per session for THSU7 during the point loss phase. These data show that, during accurate instruction sessions, points earned per session were stable and consistent with previous phases, ranging in values from 239 to 254 points per session. During 20%-40% point loss conditions in the inaccurate instructions condition, gross point earnings were consistent with previous sessions ranging from 234 to 253 points per session; however, because responding during these sessions was inconsistent with instructions, the point loss contingency was enacted, resulting in net earnings of 198 to 200 points per session during 20% point loss, 174 to 177 points per session during 30% point loss, and 141 to 152 points per session during 40% point loss. After only one exposure to the 50% point loss condition, responding became stable at levels that were consistent with mean points earned by this participant while the DRL 4-s schedule was active during previous conditions. This participant’s response patterns remained consistent with instructions throughout the remainder of this condition and never again produced point losses.
Figure 14 shows delay to first press for the initial cycle of all sessions. THSU7, unlike THSU3 and THSU4, did not show increased press frequencies during the initial cycle of 2NA sessions, but maintained a consistent delay to first response after initial exposure to inaccurate instructions during the instruction phase. Delays ranged from 3.615 s to 5.706 s, with the exception of sessions 41 and 54, when delays to first press were 1.876 s and 1.883 s, respectively.
CHAPTER IV
DISCUSSION

Several conclusions can be drawn based on the outcomes of this study. First, all participants were able to acquire response patterns consistent with operative contingencies within the first two sessions without explicit instructions. That is, response patterns quickly differentiated according to key-contingency associations without either instructions to respond differentially or programmed discriminative stimuli associated with those key-contingency associations. Therefore, it is reasonable to conclude that the performances observed during the training phase of this study were directly shaped by the programmed contingencies.

Second, the introduction of inaccurate instructions resulted in response pattern disruptions for all participants. For participants THSU3 and THSU4, instructions continued to influence response patterns during the initial cycle of each inaccurate instruction phase. These participants emitted response patterns consistent with instructions provided during the initial cycle of each session, but quickly changed patterns if responding did not produce points. This can be seen during 2NA sessions as a spike in responding during the initial cycle. Also, during 1NA sessions, mean delay to first press for THSU3 was 5.472-s, with a range of 4.576-s to 6.174-s (except for session 40 in which THSU3 responded rapidly during the first 2 FR10/Limited Hold 5-s schedule cycles and then more rapidly during the DRL 4-s schedule). For THSU4, mean delay to first press during 1NA sessions was 5.035-s with a range of 2.14-s to 6.79-s. Thus, it appears that instructions continued to function as discriminative stimuli (SD) for response patterns even after exposure to inaccurate instructions, but the failure to produce points functioned as feedback that rapidly changed response patterns within the initial seconds of
inaccurate instruction cycles. After initial exposure to inaccurate instructions, THSU7 began each session with a delayed response, regardless of the instructions (see Figure 13). If the response produced a point, THSU7 continued to emit a response pattern consistent with the DRL 4-s contingency; if the response did not produce a point, THSU7 subsequently emitted a response pattern consistent with the FR 10/Limited Hold 5-s contingency. Therefore, a history with inaccurate instructions appears to have “neutralized” the effects of instructions and response patterns came under control of consequences, rather than antecedent instructions. Behavior patterns for all participants suggest that instructional influence over behavior was weakened by previous exposure to reinforcement contingencies for those behaviors.

Third, feedback on performance, in the form of computer printouts, did not disrupt or strengthen behavior patterns for any of the participants. Participants’ behavior patterns remained stable even when the feedback form was altered to indicate potential point loss. These results indicate that post-session feedback—even when that feedback indicated a potential point loss—did not function as a punisher for non-compliant behavior. Alternatively, it may be that the reinforcing function of within-session feedback on point earnings was sufficiently powerful to override any punitive effects of negative feedback.

Fourth, participants displayed varying patterns of responding when patterns inconsistent with instructions produced a loss of points. For all participants, initial exposure to the punishment contingency (20% point loss) did not result in disruption of behavior response patterns. However, after a second exposure to point loss, response patterns for THSU3 began to show variation. THSU3 began to emit patterns that were consistent with instructions even when the instructions were inconsistent with the key-contingency associations. By responding in accordance to the instructions when instructions were inaccurate, the participant was only able to
earn 67% of the available points. That is, response patterns that were consistent with instructions could produce approximately 140 points, whereas schedule-consistent responding could produce approximately 208 points (260 points earned for schedule-consistent responses less 52 points deducted according to the point-loss contingency). This type of response pattern suggests that the participant responded in a way to minimize point loss even when doing so produced an overall net decrease in points received. In a post study interview, the participant indicated that she was not calculating the point loss percentage, but wanted to avoid losing points that she had already earned.

THSU4 showed no disruption in response patterns during the 20% point loss phase and only a temporary disruption during one session of the 30% point loss phase. A change in response patterns began to emerge when point loss reached 40%, with response patterns showing significant variability compared with previous phases. After repeated exposure to the 40% point loss, behavior patterns became consistent with instructions. After 2 sessions when response patterns were consistent with inaccurate instructions, response patterns again showed variability and became consistent with key-contingency associations. Response patterns remained stable for several sessions, but subsequently began to vary again until finally becoming consistent with instructions. In a post-study interview, THSU4 indicated that the long break (3 weeks) after the second session in which responding was consistent with inaccurate instructions impaired his ability to perform the task optimally. This participant also reported misunderstanding the instructions that only active key responses would produce points and, therefore, made multiple responses on the non-active key in an attempt to maximize point earnings while maintaining response patterns that were consistent with instructions.
By responding in accordance to the instructions when instructions were inaccurate, THSU4 was only able to earn 90% of the available points. That is, whereas response patterns that were consistent with instructions could produce approximately 140 points, schedule-consistent responding could produce approximately 156 points (260 points earned for schedule-consistent responses less 104 points deducted according to the point-loss contingency). Thus, THSU4’s outcomes suggest that point loss, per se, functioned to alter response patterns (i.e., that the point-loss consequence had aversive properties independent of those associated with its overall impact on points earned). This subject did maintain contingency-consistent responding longer than THSU3, which indicates that point loss functioned as a weaker consequence than for THSU3.

THSU7 showed no significant variation in responding during 20% or 30% point loss. Response patterns remained stable during 40% point loss with the exception of the second cycle of the sixth session during which only 2 responses were made on the active key during the FR 10/Limited Hold 5-s schedule. After contact with the point loss contingency during the 50% point loss phase, THSU7 began to respond consistently with instructions, without displaying significant variation in response patterns. In a post study interview, THSU7 indicated using the computer printed feedback forms to calculate the percentage of points earned after each session. When asked about the consistency of points earnings during the DRL 4-s schedule, THSU7 described a strategy of using 7/8th music timing to track time between presses.

THSU7’s outcomes differ from other participants. This participant generated behavior patterns that resulted in near maximization of earnable points throughout the experiment. There was no evidence that the point loss contingency, per se, affected this participant’s behavior until it resulted in an overall limitation in net points earned. By changing to instruction-consistent
responding at the 50% point loss phase, THSU7 was able to earn 7% more points than by responding in a schedule-consistent manner. That is, whereas response patterns that were consistent with instructions could produce approximately 140 points, schedule-consistent responding could produce approximately 130 points (260 points earnable for schedule-consistent responding less 130 points deducted based on the point loss contingency). Thus, THSU7 emitted response patterns that yielded the highest point earnings throughout all phases of the study.

Across all participants, compliance with instructions produced response patterns that produced points exclusively during the DRL 4-s schedule. By responding in this manner, participants were able to maximize point earnings while maintaining instruction compliant behavior. This allowed for earnings up to 28 ppc during the DRL 4-s schedule, compared to only 24 ppc during the FR10/Limited Hold 5-s schedule. This suggests that maximizing point gains impacted response patterns on a molar level even for participants who responded to minimize point loss on a molecular level. Several studies have schedule arrangements similar to those employed in the current study. For example, Hayes and colleagues conducted a series of studies on the effects of instructions using alternating FR and DRL schedules (Rosenfarb et al. 1992; Hayes, Brownstein, Zettle, Rosenfarb, & Korn 1986; Hayes Brownstein, Haas, & Greenway 1986). Others have used alternating FR and FI schedules (Joyce & Chase 1990; Cerutti 1994) or Random Ratio (RR) and Random Interval (RI) schedules (Matthews, Catania, & Shimoff 1985). A common outcome of previous studies is that they did not demonstrate rapid and universal differentiation in response patterns across schedules during baseline condition. However, in the current study, all participants showed schedule-consistent response patterns within 3 sessions during the baseline condition. There are at least two tenable accounts for these divergent findings.
First, during the baseline condition of the current study, participants received the instruction “Pressing the active key rapidly or slowly during the next 2 minutes will earn you points. Only presses on the active key will count. Try to earn as many points as possible. You may press the escape key to terminate the session early.” This instruction was strategic in the sense that it specified aspects of the contingency (earning as many points as possible), the response dimensions of interest (presses on the active key, fast or slow responding), and provided a subtle prompt to emit variable response patterns (pressing the active key rapidly or slowly during the next 2 minutes will earn you points”). It has been shown that after response patterns become consistent with instructions and show no sensitivity to changes in contingencies, providing strategic instruction (i.e. contingency-specifying, versus response-specifying instructions), produces behavior patterns more sensitive to changes in contingencies (Joyce & Chase 1990). Therefore, it is possible that the rapid differentiation in response patterns observed during baseline for all current participants, as well as the resistance to control by inaccurate rules seen for THSU 4 and TSHU 7, may, at least in part, be a function of the type of instructions provided.

The current study also used a unique multiple schedule preparation by alternating between a DRL 4-s and an FR 10/Limited Hold 5-s. This preparation precluded the possibility that a single response pattern could produce point gains on both schedules. That is, a response pattern that produced points during the DRL 4-s schedule could not produce points during the Fr 10/Limited Hold 5-s schedule and vice-versa. The schedule arrangements in studies using multiple schedules alternating between FR and FI schedules (Joyce & Chase 1990; Cerutti 1994), RR and RI schedules (Matthews, Catania, & Shimoff 1985), or FR and DRL schedules (Rosenfarb et al. 1992; Hayes, Brownstein, Zettle, Rosenfarb, & Korn 1986; Hayes Brownstein,
Haas, & Greenway 1986) did allow for single patterns of responding that produced
reinforcement on both schedules. For example, a single response pattern (e.g., steady, high-rate
responding) can produce a high rate of reinforcement on both FR and FI schedules. Given high
rates of responding in both FR and FI components, the only negative effect of participants’
insensitivity to contingency changes is a decrease in overall response efficiency (i.e., an increase
in the ratio of responses per reinforcer in the FI component). Similarly, in an alternating FR and
DRL schedule, low rates of responding can produce reinforcers during both schedules, although
the rate of reinforcement during the FR schedule would be minimal. Data from some studies
indicating that when behavior patterns consistent with inaccurate instructions prevent contact
with reinforcers, behavior becomes more sensitive to contingencies (Hayes, Brownstein, Haas, &
Greenway 1986; Hayes, Brownstein, Zettle, Rosenfarb, & Korn 1986) suggest another account
for the divergent outcomes between the current and some previous research. The schedule
arrangements in the current study may have increased participants’ sensitivity to contingency
changes by preventing contact with point gains if response patterns were consistent with
inaccurate instructions. To speak loosely, the discriminability between schedule components in
the current study may have been enhanced because responding that was consistent with one
schedule arrangement produced zero points during the alternate schedule. Therefore, it is
possible that the unique schedule arrangement, or some combination of the schedule arrangement
and instructions provided during baseline, increased sensitivity to schedule changes for the
participants in the current study.

In previous studies, no programmed contingencies were arranged for response patterns
inconsistent with instructions. This study provided individualized feedback based on response
patterns and, during the final phase, implemented point-loss contingencies for response patterns
that were inconsistent with instructions. Outcomes suggested that, although feedback that response patterns were inconsistent with instructions did not produce significant disruptions in response patterns, the point loss contingency was sufficient to produce a change from schedule-consistent responding to instruction-consistent responding for some participants, even when instruction following decreased point earnings. Future research should attempt to identify the variables that establish the effectiveness of consequences to disrupt responding when doing so results in a net decrease in obtained reinforcement.

In the current study, only information and instructions about pre-session procedures (e.g., the investigator asked participants to remove their watches, turn off cell phones, etc.) were presented directly by the experimenter. Strategic instructions, instructions detailing response patterns, and feedback on point earnings / point loss were provided by the computer. Based on the results of some studies indicating that the effects of instructions or feedback that are delivered directly by experimenters can be magnified (e.g., Milgram, 1973), it is possible that some participants may have shifted to instruction-consistent responding earlier if instructions and/or feedback had been provided directly by the experimenter. Future research might investigate this possibility.

This study did not provide a basis for understanding some of the variations in response patterns observed across participants. It is not clear why some participants emitted response patterns that seemed to be controlled by minimizing point loss, while one participant emitted patterns that were more consistent with maximization of point gains. Alternative forms of feedback, such as more detailed or immediate descriptions of points lost, might produce more consistent outcomes across participants. The design of the study also does not permit a determination of the individual effects of variables including the provision of strategic
instructions and the juxtaposition of schedules that produce mutually exclusive response patterns (versus schedules that provide reinforcement for common patterns of responding). Procedures that permit these variables to be presented singly and in conjunction might provide evidence about the extent of their individual and combined influence. For example, the use of VR (or RR), instead of an FR (limited hold), schedules may impact participants’ sensitivity to instruction changes.

The current experimental arrangement provides a platform for further investigating these and other questions that remain unanswered. For example, providing bonus points for response patterns consistent with inaccurate instructions, in conjunction with point loss for behavior patterns inconsistent with inaccurate instructions, could provide more information on the relative influences of maximizing point gains versus minimizing point loss. The removal of the point loss contingency following the emergence of instruction-consistent response patterns could provide information about the long-term impact of point loss on response patterns. In addition, the current preparation of schedules that require mutually exclusive response patterns to obtain reinforcers is ideal for studies that are interested in the pliance versus tracking issue. Hopefully, one contribution of the current study will be to provide an experimental arrangement that permits more sensitive and detailed analyses of these and other environmental factors that impact the effects of instructions on human behavior.
Figure 1. Display screen between (top) and during (bottom) each cycle.
Your instructions during this 20 minute session were to press more frequently on the P key than on the A key.

During the first 4 minute cycle your performance was consistent with the instructions. 45
During the second 4 minute cycle your performance was consistent with the instructions. 47
During the third 4 minute cycle your performance was consistent with the instructions. 49
During the fourth 4 minute cycle your performance was consistent with the instructions. 46
During the fifth 4 minute cycle your performance was consistent with the instructions. 48

Total Points 235

Figure 2. Feedback form.
Session 20

Your instructions during this 20 minute session were to press more frequently on the P key than on the A key.

During the first 4 minute cycle your performance was consistent with the instructions.
Points Earned: 45 Points Lost: 0

During the second 4 minute cycle your performance was consistent with the instructions.
Points Earned: 47 Points Lost: 0

During the third 4 minute cycle your performance was consistent with the instructions.
Points Earned: 49 Points Lost: 0

During the fourth 4 minute cycle your performance was consistent with the instructions.
Points Earned: 46 Points Lost: 0

During the fifth 4 minute cycle your performance was consistent with the instructions.
Points Earned: 48 Points Lost: 0

Total Points: 235

Figure 3. Feedback form with point loss column.
Figure 4. Baseline data for all participants.
Figure 5. Instruction phase data for all participants.
Figure 6. Feedback phase data for all participants.
Figure 7. Feedback(2) phase data for all participants.
Figure 8. Point loss data for participant THSU3.
Figure 9. Net vs. gross points earned in accurate and inaccurate sessions during point loss for all participants.
Figure 10. Point loss data for participant THSU4.
Figure 11. Keypresses during 2NA sessions for THSU4.
Figure 12. Point loss data for participant THSU7 during 20% and 30% point loss.
Figure 13. Point loss data for participant THSU7 during 40% and 50% point loss.
Figure 14. Delay to first press of each session for THSU7.
REFERENCES


