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CONTINGENCY-SHAPED AND RULE-GOVERNED BEHAVIOR: INSTRUCTIONAL CONTROL OF HUMAN LOSS AVOIDANCE

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Instructions can override the influence of programmed schedules of reinforcement. Although this finding has been interpreted as a limitation of reinforcement schedule control in humans, an alternative approach considers instructional control, itself, as a phenomenon determined by subjects' reinforcement histories. This approach was supported in a series of experiments that studied instructional and schedule control when instructions either did or did not accord with the schedule of reinforcement. Experiment I demonstrated that accurate instructions control discriminative performances on multiple avoidance schedules, and that such control persists in a novel discrimination. Experiments II and III showed that elimination of instruction-following occurs when inaccurate instructions cause subjects to contact a monetary loss contingency. Experiment IV demonstrated the reinforcing properties of accurate instructions. Skinner's view of rule-governed behavior is consistent with these findings, and can be extended to account for many aspects of instructional control of human operant behavior.

Key words: instructions avoidance, stimulus control, monetary loss, observing behavior, rule-governed behavior, adult humans

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Several experiments have demonstrated that instructions may facilitate the development of schedule control (Baron, Kaufman, and Stauber, 1969; Turner and Solomon, 1962; Wiener, 1962). For example, Ayllon and Azrin (1964), in an experiment with institutionalized subjects, were unable to obtain schedule control until they gave instructions about the desired response. The instructions were effective only when the response they specified was reinforced.

A different result was obtained by Kaufman, Baron, and Kopp (1966) in a laboratory setting. Subjects were exposed to a variable-interval (VI) schedule of monetary reinforcement and one group was given the accurate information that money would be delivered on a VI basis. Other groups were given inaccurate schedule instructions: either that a variable-ratio (VR) or a fixed-interval (FI) schedule would be in effect. The inaccurate instructions exerted substantial control during a 3-hr period. The effects of the schedule instructions were just what would be expected from subjects who had been exposed for many sessions to the specified schedules, in spite of the fact that the VI schedule was programmed for all subjects. In a subsequent experiment, Kaufman *et al.* (1966) examined the effects of false schedule instructions when reinforcement was unavailable throughout the 3-hr period. Responding weakened, but was not completely eliminated during the extinction session. Thus, Kaufman *et al.* found that instructional control was capable of overriding the contingencies, a conclusion confirmed in a similar experiment by Lippman and Meyer (1967).

Several features of the procedures used by Ayllon and Azrin make direct comparison with the Kaufman *et al.* and the Lippman and Meyer experiments difficult. These latter two studies were laboratory experiments conducted with college students; Ayllon and Azrin

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worked with institutionalized patients. Further, the instructions in the laboratory experiments always specified that reinforcement was dependent on responding (although sometimes, in fact, it was not); instructions in the Ayllon and Azrin study did not directly specify a response-outcome dependency. Another, perhaps more important, difference was that the laboratory experiments involved only a single, brief session, and as Kaufman *et al.* pointed out, instructional control of responding may weaken, given sufficient exposure to the programmed contingencies.

The above findings demonstrating the importance of instructional control have generated a theoretical controversy. One approach is represented by accounts of instructional control that emphasize constructs within the domain of a behavioral analysis. Thus, several accounts treat instructions as a form of discriminative stimuli that are associated with characteristic response patterns (Schutte and Hopkins, 1970; Skinner, 1957). Other theorists have focused on the results of the Kaufman *et al.* research, and have interpreted these findings as showing a limitation of reinforcement control in humans. For example, Bandura (1971, 1974) considered instructional variables as vehicles of vicarious reinforcement, similar in principle to modelling effects, and capable of inducing expectancies that influence subsequent behavior. Some theorists have gone to the extent of taking the instructional control literature as supporting the claim that operant conditioning has not been demonstrated in adult humans (Brewer, 1974).

The nonbehavioral approaches to instructional control have stressed apparent weaknesses in the discriminative stimulus account. For example, Dulany (1968) argued that to provide an explanation, discriminative stimuli must be "defined by a history in which a stimulus *gains* control of a response by selective reinforcement of that response in its presence—not by any demonstration of stimulus control." Dulany's point is simply that the instructions-as-discriminative-stimulus hypothesis is *ad hoc*. The criticism can be answered in principle by demonstrating that differential reinforcement does influence instructional control. Dulany notes further that "one can easily demonstrate that a subject will respond selectively to an instruction he has never heard before, much less been selectively reinforced for responding to" (pp. 365-366, note a). Dulany's second criticism, the issue of control by novel stimuli, is applicable only to a simplistic model of discrimination learning. A number of frequently studied paradigms have extended models of discrimination formation. In particular, the matching-to-sample and oddity paradigms demonstrate that a novel stimulus can control behavior in a predictable, lawful way (Nevin, 1973). Accounts of these paradigms have been developed that do not require abandoning the principle of reinforcement. A fundamental aspect of such accounts is the recognition that the controlling stimulus dimension can be represented as a rule or concept (Skinner, 1974; Urcuioli, 1977; Urcuioli and Nevin, 1975). This type of approach may be applied to an analysis of instructional control.

For example, consider Skinner's (1974) distinction between contingency-shaped and rule-governed behavior. Skinner pointed out that rules can exert rapid control over behavior, and that a person following instructions may behave differently from a person who has been exposed to the contingencies described by the instructions. Skinner further suggested that following instructions, heeding warnings, and obeying laws, all examples of rule-governed behavior, are themselves influenced by their consequences. That is, adults have long histories of conditioning, which presumably involve favorable consequences for following instructions. Such an analysis leads to the hypothesis that instruction-following can be controlled by its consequences. This is a testable hypothesis: instruction-following should be influenced by reinforcement, subject to extinction, and should come under discriminative control.

This hypothesis can best be examined in the setting of the long-term operant experiment, where the effects of instructions can be assessed over many sessions. If inaccurate instructions were presented in such a setting, and these instructions led to loss of reinforcement, then a general elimination of instruction-following should occur. Alternatively, if instructions from one source are accurate and from another source are inaccurate, a discrimination should be formed. Subjects should show instructional control with the former source, but only schedule control with the latter. Finally, since instructions are viewed in the present analysis as a complex form of discriminative stimuli, subjects should respond to produce instructions, just as other discriminative stimuli are reinforcing events. The present research is an attempt to examine these predictions using a free-operant avoidance baseline with monetary loss as the aversive event (Baron and Kaufman, 1968).

EXPERIMENT I
MULTIPLE SCHEDULES OF LOSS AVOIDANCE: THE EFFECTS OF ACCURATE INSTRUCTIONS

Before the questions involving inaccurate instructions can be assessed, the role of accurate instructions must be established. In Experiment I, performances generated by a simple multiple schedule were compared with performances when accurate schedule instructions were added. Multiple schedules permit the simultaneous analysis of several different temporal parameters, with and without instructions that specify those parameters.

Method

Subjects

Two male (CB and MB) and four female (CH, DH, WH, and PR) students enrolled at the University of Wisconsin-Milwaukee participated. All were between the ages of 18 and 25 yr and had no more than introductory level exposure to psychology. They were recruited by a campus employment advertisement, which depicted the research as a part-time job in which payment depended on performance. Subjects were informed that average earnings were about $1.80 per 50-min session, but that they could earn as much as $2.00, or as little as nothing at all in a given session. All subjects signed contracts agreeing to remain in the experiment for a minimum of 75 sessions, or until dismissed, and participated in a simulated session before signing the contract. Once the contract was signed, the experiment began. Sessions were scheduled at a rate of eight to 12 per week, each 50 min in duration, with a maximum of four sessions per day.

Apparatus

The subjects worked in a well-lighted, sound-attenuated room, 1.8 m square. They sat facing a table holding a vertical panel containing the lever manipulandum and an array of colored lights. Six lights were spaced evenly across the top of the panel. The leftmost light was green, and indicated when the session was in progress. The rightmost light was red, and served as a signal of monetary loss. The onset of the red light was always accompanied by a tone (1000 Hz, 76 dB) presented through a speaker beneath the table to ensure that the losses were noted.

The middle four lights were amber, and served as the discriminative and instructional stimuli for the components of the multiple schedule. A cardboard label could be inserted above each light.

The manipulandum was mounted on a shaft protruding from the face of the panel just above the table. A 10-cm lever was attached to the shaft and covered with a rubber handgrip. The lever rested in the vertical position, but could be rotated 90° in either direction. The avoidance response was a 45° clockwise lever turn, which required 23 N of force. Completion of the response produced a 0.5-sec blue feedback light just to the right of the lever whenever a 45° turn was accomplished. Programming and recording equipment were located in an adjacent room, sound-insulated from the subject.

Procedure

Preliminary orientation. Before the first experimental session, each subject read a written description of various aspects of the experimental situation. Subjects were informed that books and magazines, but not purses or packs, or writing materials could be brought into the work area. Further instructions described the functions of the session light, the loss light and tone, and the lever. They were told that each time the loss light came on, they would lose five cents from their earnings, which would otherwise amount to $2.00 during that session. Finally, they were informed that turning the lever to the right would postpone the onset of the loss light:

> By turning the handle to the *right,* you can postpone the next presentation of the red light. Sometimes the response will postpone the red light for only 10 seconds, sometimes for longer, and there may be times when you do not need to turn the handle at all because no red lights are programmed. Remember, all you have to do is to turn the handle to the right, and you

will postpone the red light for some period of time.

The four-ply baseline schedule. Throughout the experiment, the same baseline schedule was programmed for all subjects. The schedule was composed of three 12.5-min free-operant avoidance schedules, each with a different response-loss interval, and a fourth 12.5-min component in which no loss was programmed. On the three avoidance components, 1-sec displays of the red loss light accompanied by the tone were scheduled every 10 sec (the loss-loss interval was always 10 sec). Each response postponed the next loss for either 10, 30, or 60 sec, depending on the component. Each component was presented once per session in random order.

Discriminative and instructional stimuli. Four of the six subjects (CB, PR, DH, and CH) were first exposed to the four-ply schedule with no instructions. The signal lights were arranged to provide a simple multiple schedule, and no information was added about the schedules signalled by any of the stimuli. The leftmost amber light was associated with the No-Loss component, the second light with the 10-sec response-loss interval, the third with the 30-sec interval, and the fourth with the 60-sec interval.

The next phase of the experiment for Subjects CB, PR, DH, and CH, involved the addition of instructional labels to the multiple schedule. The schedules signalled by the four amber lights were shuffled so that the leftmost light signalled the 30-sec interval, the second light the 10-sec interval, the third the 60-sec interval, and the fourth, No Loss. Labelled cards were inserted above the four amber lights in this phase. The label for each light accurately described the temporal properties of that schedule. The label above the light signalling the 10-sec interval read: "10 SEC", the label above the 30-sec and 60-sec schedule lights read "30 SEC", and "60 SEC", respectively. The label above the No-Loss schedule light read "NO LOSS".

In the third phase, lights and components were shuffled and the instruction labels withdrawn. Since Subject DH showed good discrimination of the component schedules without instructions, the second exposure without instructions was eliminated in her case.

The procedures for the remaining two subjects, MB and WH, were the same, except that the first condition was with instructions added to the multiple schedule. Then, the stimuli were shuffled and instructions withdrawn. Subject WH went through this sequence twice.

Stability criteria. To determine when stable performance was reached, stability indices were calculated for rate of responding in each component (Sidman, 1960). The criterion to be met before changing conditions was as follows: the difference between the rate for the last two and the immediately preceding two sessions had to be less than 15% of the mean rate for the four sessions. Before advancing to a new condition, stability was required in each of the four components of the multiple schedule, with a maximum of 15 sessions in any component. When responding approached zero in the No-Loss component, and when conditions were repeated, visual inspection of the data determined when conditions could be changed.

Results

Response rate in each of the components across sessions is presented in Figure 1 for Subjects DH, PR, CB, and CH, the four subjects whose initial exposure to the four-ply multiple schedule was without instructions. The first panel of Figure 1 shows the subjects' initial performances, and reveals that all subjects avoided regularly in their initial session, although rates were somewhat inconsistent and fluctuated from session to session in the early phases of training. Rates tended to stabilize after four to six sessions, although Subject CH did not reach the stability criterion by the fifteenth session. The terminal performances of all four subjects revealed highly successful avoidance. During the last four sessions, Subject DH received two losses, Subject CH, three losses, Subject PR, two, and Subject CB, none.

Without instructions, only one subject, DH, discriminated among all four components of the multiple schedule. By her third session, she showed a relatively high rate in the 10-sec component, a near-zero rate in the No-Loss component, and intermediate, appropriate rates in the 30- and 60-sec components. The other three subjects showed little indication of discriminative control. The terminal performance of Subject CB shows completely undifferentiated responding in the four components, Subjects CH and PR showed some evidence of stimulus control, emitting higher rates in the 10-sec compo-

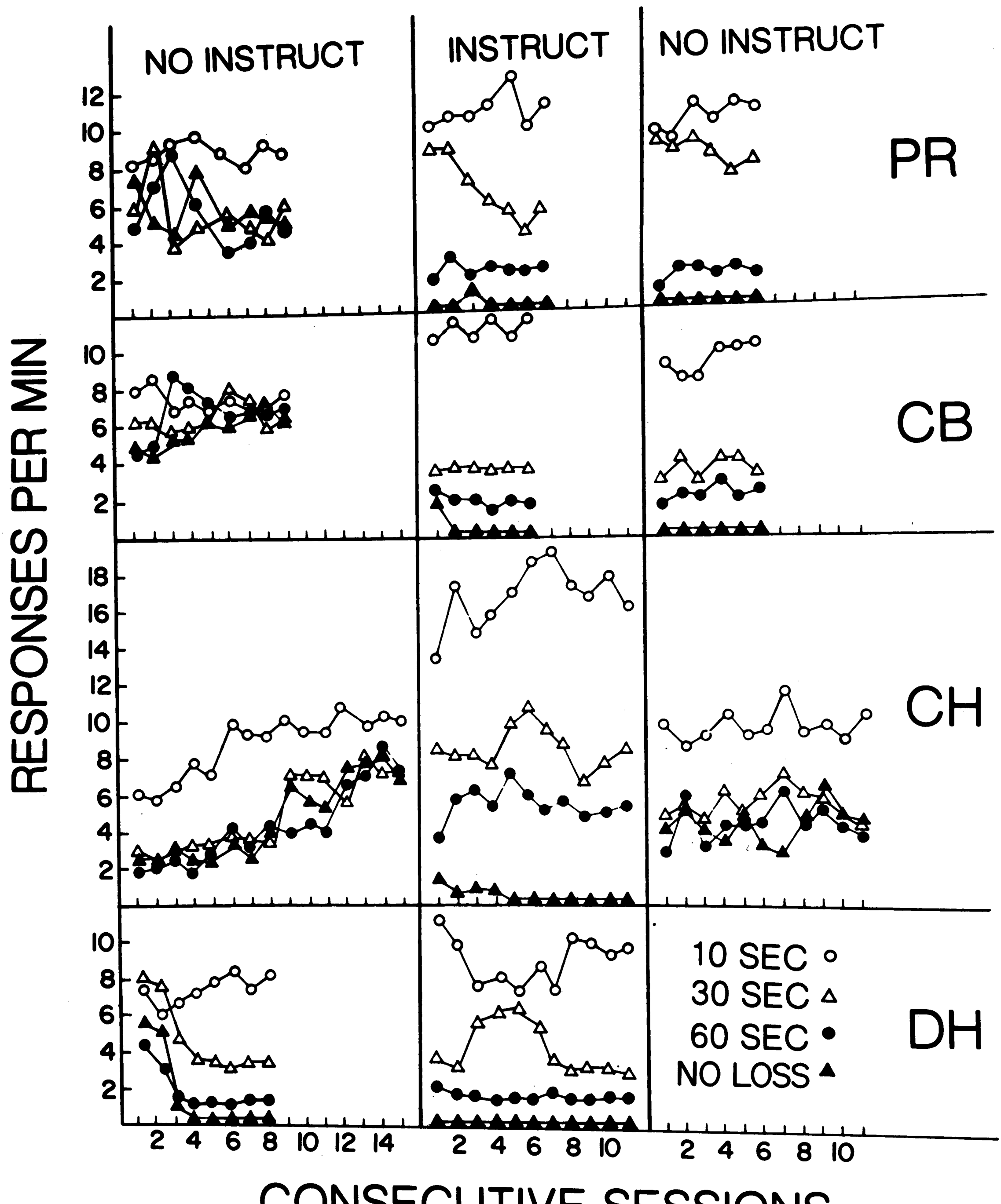

Fig. 1. Responses per minute across the four components for conditions of Experiment I. Shown are the four subjects whose initial exposure was without instructions.

nent than in the other three, but rates in the 30-sec, 60-sec, and No-Loss components were undifferentiated.

Figure 1 also shows the effects of introducing the instructional labels. In the case of the three subjects who had not previously shown complete discriminative control, PR, CB, and CH, the addition of instructions had major effects. Discrimination among all four components was evident within the first instruction

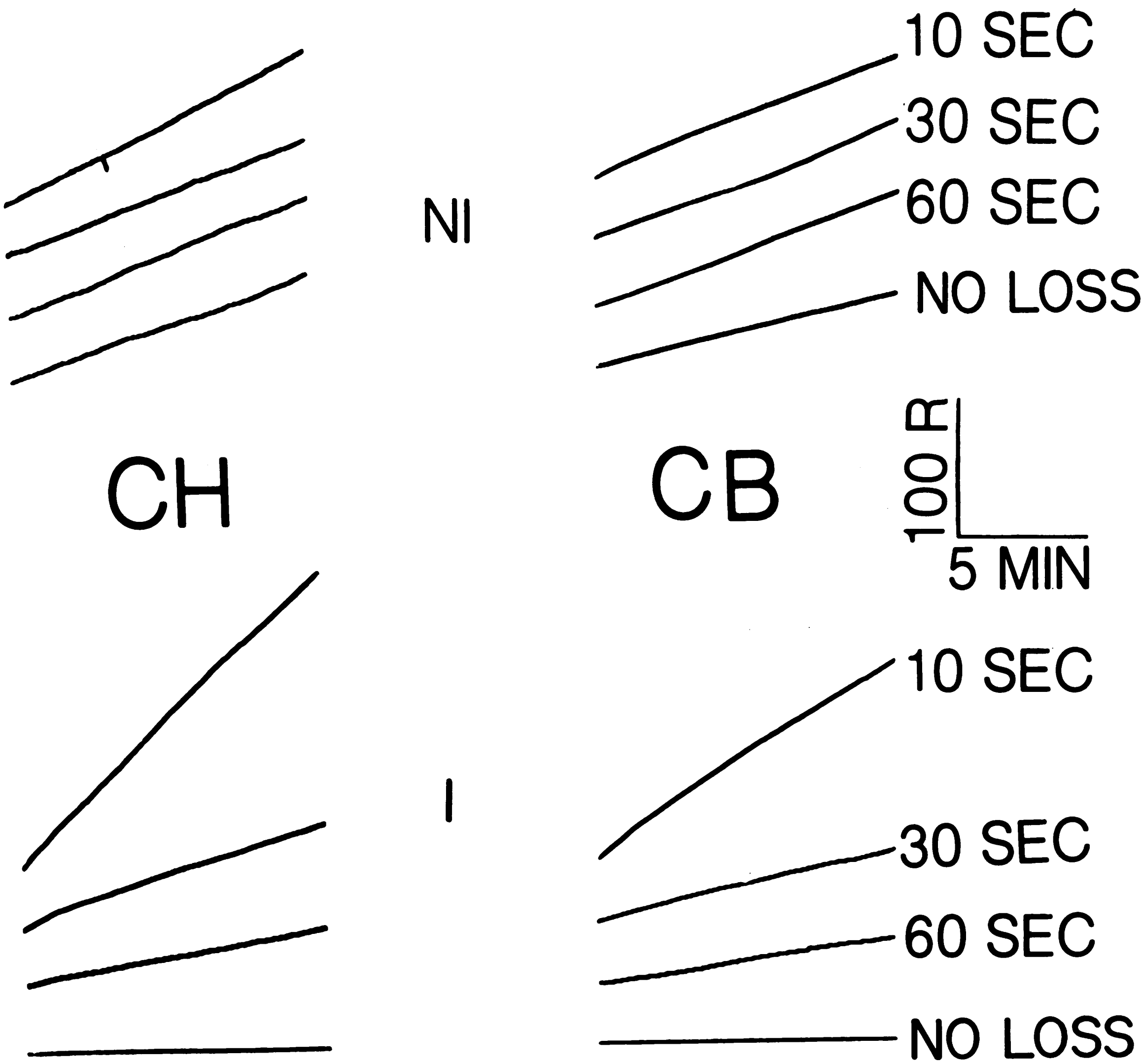

Fig. 2. Cumulative records from Experiment I for Subjects CH and CB. Performances with no instructions (NI) are shown in the top records; the lower records show performances with instructions (I). Pen deflection indicates the delivery of monetary loss.

session. Rates fell in the No-Loss component to near zero, while rates in the 30-sec and 60-sec components became well differentiated and more consistent with the programmed response-loss interval. Although rates, in general, were reduced with instructions, the actual number of losses was as in the earlier phase: DH=3, CH=4, CB=1, and PR=1 total losses, for the last four instruction sessions.

Cumulative records for Subjects CH and CB (Figure 2) further clarify the effects of instructions. Rates without instructions were high, undifferentiated, and regular, but became differentiated with instructions. Differential rates remained regular, with pauses after responding in the 30-sec and 60-sec components indicating development of temporal control.

To examine the after-effects of instructions, the three subjects who had not shown discriminative control without instructions were returned to the initial discrimination. Although the schedules paired with the lights had been shuffled, and the instructions withdrawn, Subjects CB and PR showed clear lasting effects of instructions. For CB, response rates (shown in Fig. 1) remained virtually unchanged. The stimulus shuffling was detected rapidly and there was a rapid adjustment to the new stimulus-schedule pairings. Subject CH, however, appeared unaffected by the prior exposure to the instructions. After instructions were withdrawn, her rates quickly returned to those observed in her initial exposure to the discrimination.

Subjects WH and MB provide an additional analysis of the after-effects of instructions, since they were trained first with instructions and then switched to the uninstructed condition. Figure 3 presents rates of responding for these two subjects. Acquisition of the avoidance response was rapid, and instructional control developed in the first session for both subjects.

When the schedules were shuffled, and the instructions withdrawn, Subject MB rapidly acquired the new discrimination. Subject WH, however, showed no sign of forming the new discrimination. Instructions were inserted again for Subject WH, and as Figure 3 shows, differentiated performance was quickly re-established. After four sessions with instructions, WH was returned to the multiple schedule without instructions, but the discriminative stimuli signalling the various schedules were not shuffled. Nevertheless, when the instructions were withdrawn, the discrimination broke down. Apparently, WH's differential performances were under the exclusive control of the instructions and when they were withdrawn, the light-schedule correlation, itself, exerted no control.

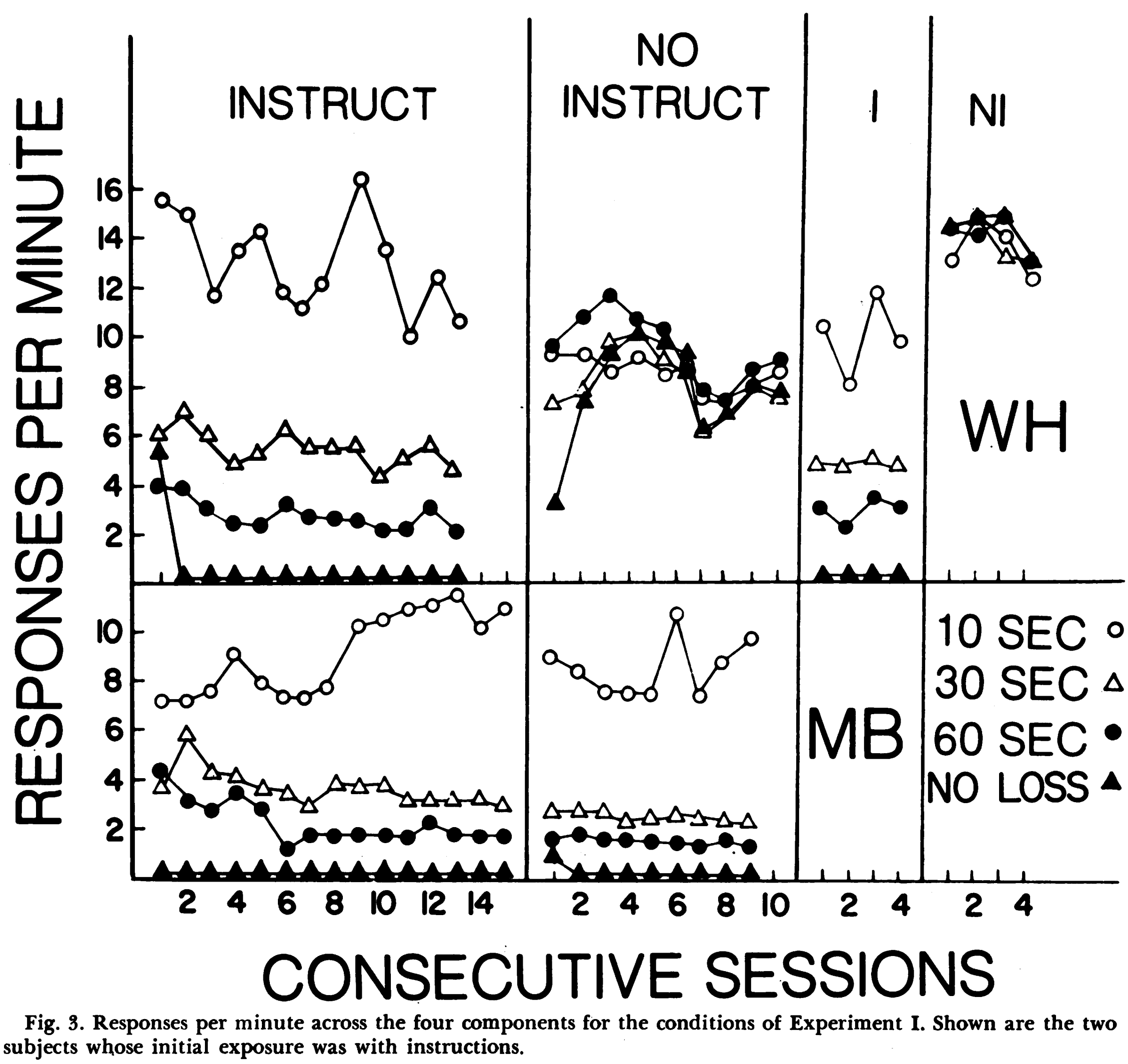

Fig. 3. Responses per minute across the four components for the conditions of Experiment I. Shown are the two subjects whose initial exposure was with instructions.

Discussion

The results illustrate the control that instructions can exert over human operant behavior, and extend the analysis of instructional control to the study of behavior generated by avoidance schedules and to the case where instructions are varied within a single session. The preliminary instructions, which specified that responding affected the delivery of loss, were sufficient to induce regular avoidance almost immediately for all subjects. Even with prolonged exposure to the contingencies, though, only one subject showed discrimination among the four components of the multiple schedule without instructions. These findings agree with previous studies of human performances on multiple schedules (Baron *et al.,* 1969) in showing poor schedule control without instructions and more appropriately differentiated rates when instructions are added.

The present experiment further analyzed the effects of instructions, since following the acquisition of instructional control, subjects were studied with a reshuffled multiple schedule without instructions. Three of the five subjects studied learned the discrimination. For these subjects, learning a discrimination with the aid of instructions facilitated learning a new discrimination without instructions. The mechanism of this facilitation is unclear. Perhaps instructions alerted subjects to the range of the programmed contingencies, or to the signal functions of the stimulus lights. The picture is complicated by the performance of Subjects CH and WH, who showed no lasting after-effects of instructions.

EXPERIMENT II THE ELIMINATION OF INSTRUCTIONAL CONTROL

In Experiment I, the instructions always accorded with the schedule, and instructional control occurred. Experiment II assessed the effects of inaccurate instructions. Given the present procedures, at least two types of inaccurate instructions are possible. One type evokes behavior that leads to point loss, while another type evokes behavior that leads to no clear aversive consequence. In Experiment II, subjects were studied under conditions where behavior evoked by inaccurate instructions led either to programmed loss (Contact), or to no aversive consequence (No Contact). In the No-Contact condition, the four-ply schedule of Experiment I was transformed to a No-Loss schedule in all four components, while leaving the discriminative and instructional stimuli intact. The instructions were inaccurate under these conditions, but the subject who continued to follow them did not come into contact with the discrepancy. The results of the Kaufman *et al.* (1966) study suggest that control should persist. The behavior should remain identical to that observed when the point-loss contingencies with accurate instructions were in effect. An alternative possibility is that with extended exposure to inaccurate instructions, behavior may eventually come under schedule control.

In the Contact condition, an avoidance schedule with a response-loss interval of 10 sec was programmed in all four components. Again, the instructional and discriminative stimuli were left intact. Thus, conditions were established in which instruction following led to losses. Under these conditions, instruction following was expected to decline. Finally, the No-Contact conditions were reinstated after subjects were exposed to the Contact conditions.

Method

Subjects and Apparatus

Four of the subjects studied in Experiment I, MB, CH, DH, and WH, participated. The apparatus and general protocol were unchanged.

Procedure

The last condition of Experiment I was the four-ply multiple schedule without instructions. To recover instructional control, the first phase of Experiment II was a return to the four-ply schedule with accurate instructions. After at least two sessions with instructional control, subjects were studied under the No-Contact condition. The loss programmer was turned off, but the stimulus lights with their accompanying labels still signalled the multiple schedule (reshuffled from the last phase of Experiment I). Again, the component duration was 12.5 min, and the lights appeared once per session in random order. The stability criteria were the same as in Experiment I, except that a minimum of eight sessions was required to permit the observation of relatively long-term effects.

After stability was reached with the No-Contact condition, the Contact condition was introduced. The Contact condition involved the same sequence of lights and labels as the No-Contact condition, but each of the four components was an avoidance schedule with a response-loss interval of 10 sec. Finally, subjects were returned to the No-Contact condition, where all components were No Loss.

RESULTS

The leftmost panel of Figure 4 shows performances on the four-ply schedule with accurate instructions. The instructional control

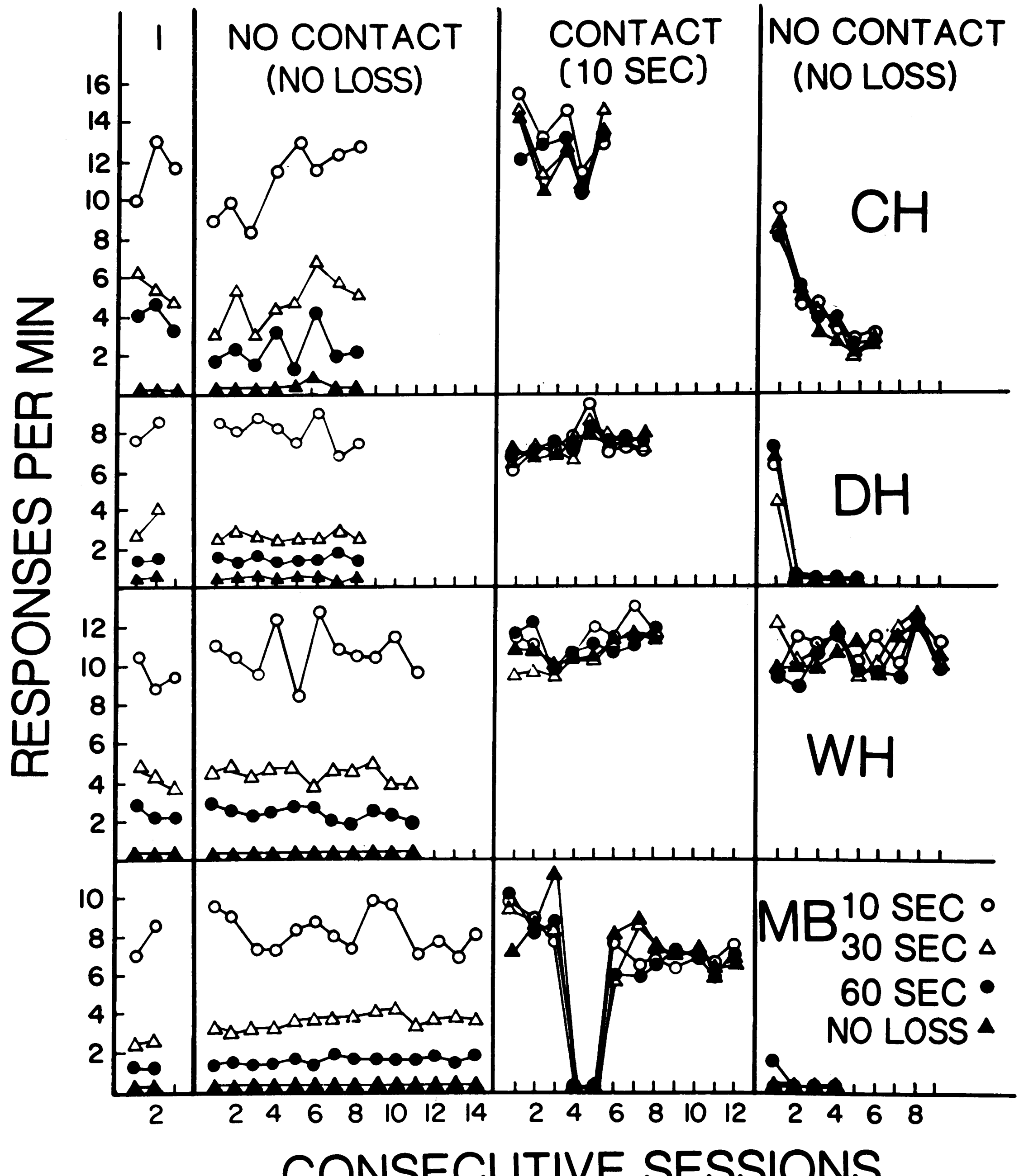

Fig. 4. Responses per minute across the four components for the various conditions of Experiment II.

observed in Experiment I was rapidly reestablished. The second panel shows performances under the No-Contact conditions, when no point-loss was programmed in any component. In spite of the withdrawal of the avoidance contingency, subjects remained under instructional control. Response rates in the four components were virtually identical to those in the previous phase. Throughout the eight sessions of No-Contact exposure for Subjects CH and DH, the 11 sessions for Subject WH, and the 14 sessions for Subject MB, there was no trend toward reduction in rates. Rather, differentiated rates and temporal control were observed throughout.

The third panel of Figure 4 shows performances in the Contact condition, where the 10-sec response-loss interval was in effect in all components. There was an immediate breakdown of instructional control for all four subjects. Rates were equivalent across components as early as the first session, and stabilized at the levels previously associated only with the 10-sec response-loss interval. Thus, responding in the Contact condition was controlled by the programmed avoidance schedule, not by the instructions. Accompanying exposure to the Contact conditions was an increase in losses. During the initial sessions, loss rates were higher than at any other point in the experiment, but by the final four sessions, subjects were again avoiding well: CH=5, DH=4, WH=0, and MB=13 total losses during the last four sessions.

A key question in Experiment II was whether the elimination of instructional control would persist after the Contact condition was removed. As the fourth panel of Figure 4 shows, instruction-following did not reappear in any subject during the second exposure to the No-Contact condition. The rates of three of the four subjects declined, appropriately to the No-Loss schedule, while those of the fourth subject, WH, were high and undifferentiated characteristic of performance under the immediately preceding condition. Extinction was abrupt for Subjects MB and DH; the high rates seen during the Contact condition were reduced to near zero within two sessions. Rate reductions for Subject CH were more gradual, with rates dropping to about three responses per minute during the first three sessions and stabilizing at that level. The high rates generated by the Contact condition persisted for Subject WH, whose rates showed no sign of declining after nine sessions. In spite of Subject WH's lack of adjustment to the contingencies, there was no evidence for reinstatement of instructional control; the undifferentiated rates observed here were in marked contrast to her performance during the initial exposure to the No-Contact condition.

Discussion

The results showed the role of contact with schedule-instruction discrepancies in weakening instructional control. In the No-Contact condition, the four instruction labels were superimposed on a No-Loss schedule. Instruction-following under these conditions led to unnecessary responding, but because no losses were received, instructional control was maintained with no sign of weakening. However, in the Contact condition, when instruction-following led to exposure to the loss contingency, instructional control was rapidly eliminated. The elimination of instruction-following persisted when the No-Contact condition was reinstated. This last finding is particularly important, since it shows that subject reactions to the instructions were irreversibly altered after exposure to the Contact condition. Subjects now "disbelieve" the instructions, and the schedule assumes control of behavior. But contact with schedule-instruction discrepancies is necessary for the elimination of instruction-following, not simply the existence of such a discrepancy. Instruction-following is controlled by its consequences.

Although control by the avoidance contingencies developed rapidly in the Contact condition, it was not always maintained. Subject MB nearly ceased responding during Sessions 4 and 5, which is difficult to understand, either in terms of the instructions or the contingencies. The transitory nature of this reaction suggest that it may have represented an emotional response to the increased monetary loss during the early stages of the loss of instructional control.

Control by the contingencies was also evident when subjects were switched from the Contact condition back to the No-Contact condition. Three of the four subjects showed reductions in response rate and two subjects, MB and DH, stopped responding altogether within three sessions. Subject WH, however, showed no reduction in rates during this period. While her performance revealed no indication of instructional control, her high and undifferentiated rate of responding showed a lack of adjustment to the No-Loss schedule. Perhaps the notion of contact may be invoked here also, since in WH's terminal performance during the Contact condition no losses were encountered. Such successful avoidance performance may insulate the subject from the contingencies (Baron and Galizio, 1976), just as instruction-following in the No-Contact condition did, thus rendering the response highly persistent.

EXPERIMENT III STIMULUS CONTROL OF INSTRUCTION FOLLOWING

An important property of operant behavior is that it can be brought under discriminative control with differential reinforcement procedures. If instructional control is influenced by subjects' reinforcement histories, then a stimulus associated with the elimination of instructional control should come to inhibit instruction following. If instructions remain accurate in the presence of some other stimulus, so that instruction-following is reinforced, that stimulus should control a high probability of instruction-following. In Experiment III, these possibilities were tested by programming two novel stimuli in conjunction with the four instructional stimuli. In the presence of the other stimulus, the instructions were inaccurate, first under the No-Contact condition, then under the Contact condition, and finally, again under the No-Contact condition.

METHOD

Subjects and Apparatus

Two male subjects, SS and BK, served. The apparatus was the same, except that two new stimulus lights, purple and orange, were added to the panel just below the amber stimulus lights.

Procedure

The four amber lights plus instructions were presented concurrently with either of two novel stimuli. The presence of the orange light characterized the four different avoidance components of Experiment I with the instructions always accurate (Sa). In the presence of the purple light, the instructions were inaccurate (Si), first with the No-Contact condition (*i.e.,* no loss in any component), then with the Contact condition (*i.e.,* Response-loss interval of 10 sec in all components), and finally, with the No-Contact condition again. Each stimulus combination and its associated component occurred once per session, for 6.25 min, in random order. Thus, in each session subjects were exposed to each instruction twice, once in the presence of Sa, and once in the presence of Si.

RESULTS

Figure 5 shows performances of Subjects BK and SS during Experiment III. For each condition, rates in the presence of Sa are presented in the panel to the left of rates in the presence of Si.

The first panel of Figure 5 shows performances when the four instructions were accurate during Sa and the No-Contact condition prevailed during Si. Both subjects showed instructional control in the presence of both Sa and Si, with no reduction of rates in the Si components despite the No-Loss schedule.

The middle panel of Figure 5 shows the effects of introducing the Contact condition in the presence of Si. Instructional control was immediately eliminated in the presence of Si, but not in the presence of Sa. Both subjects rapidly increased responding to the same level in all Si components. There was an early breakdown in the precision of instructional control for both subjects in the Sa components. For example, both subjects showed moderate rates of responding in the Sa-No-Loss component during the first session, although before the Contact condition was introduced, both had near-zero rates in this component. This "disinhibition" was transient, lasting no more than a few sessions. The terminal performances show clearly that avoidance responding was under instructional control in the presence of Sa, and controlled by the response-loss interval in the presence of Si.

The outcome of the second exposure to the No-Contact conditions in Si is shown in the right panel of Figure 5. Unlike the initial exposure to the No-Contact condition, both subjects quickly adjusted to the No-Loss schedule programmed in the Si components. Both stopped responding in the Si components within three sessions. Although instruction-following ceased in the Si components, it continued in the Sa components.

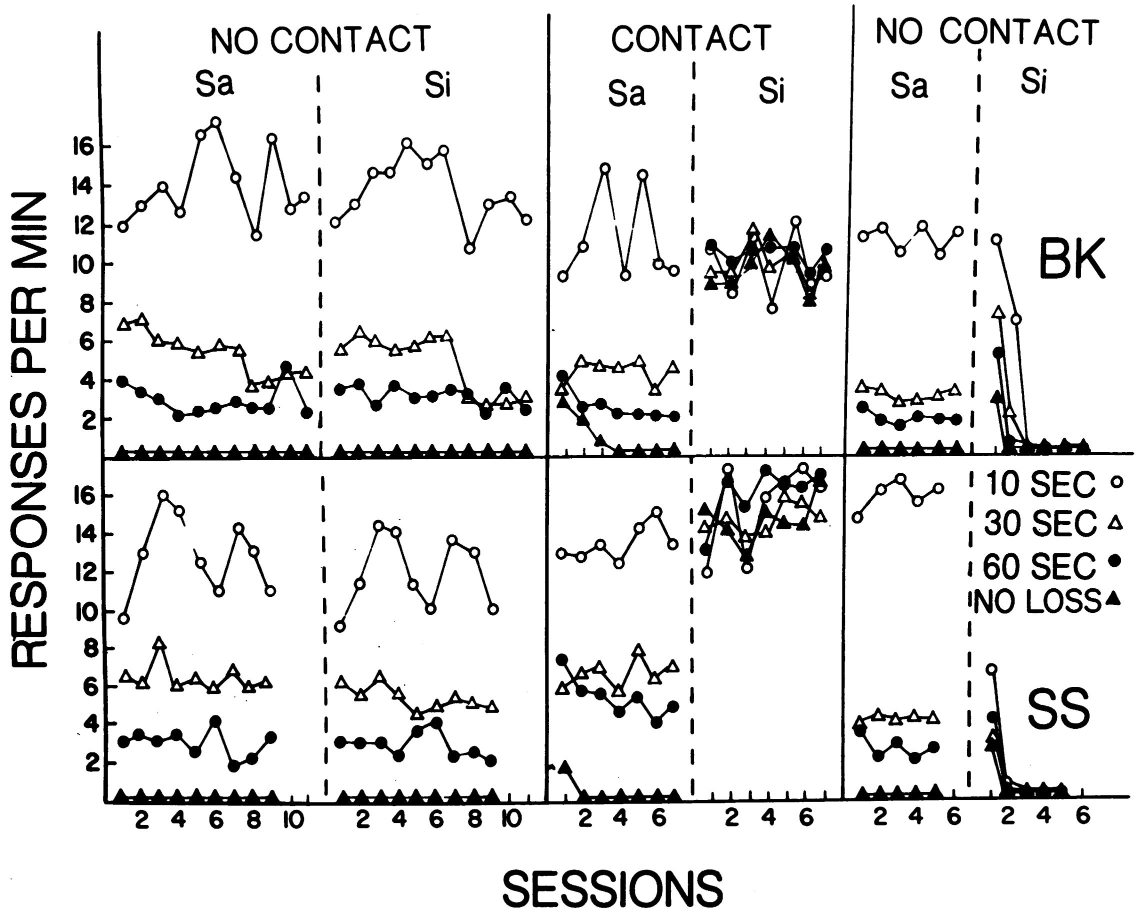

Fig. 5. Responses per minute for Subjects BK and SS for the various conditions of Experiment III. For each condition, responding in the Sa and Si components are presented separately.

Discussion

Experiment III showed that instruction-following can be brought under discriminative control. In the first phase, where instructions remained accurate in Sa, but No-Contact inaccuracies were introduced in Si, both subjects maintained differentiated rates and persisted in responding in spite of the No-Loss schedule programmed in Si. When the 10-sec loss condition was introduced in Si, instruction-following was eliminated in that component, but although temporarily disrupted, persisted in Sa, where instructions remained accurate. The stimulus control of instruction-following persisted when subjects were returned to the No-Contact condition in Si. Both subjects showed rapid extinction of avoidance responding in all Si components, in spite of the contradictory suggestion to respond provided by the instructions. Performances in the Sa components remained unaffected.

EXPERIMENT IV
THE REINFORCING PROPERTIES OF SCHEDULE INSTRUCTIONS

Wyckoff (1969) showed the reinforcing properties of simple discriminative stimuli by examining concurrent schedules in pigeons, where one response was reinforced with food, and another was maintained by the onset of discriminative stimuli signalling when food was available. Baron and Galizio (1976), using a similar procedure, showed that an observing response was maintained by human subjects when it produced time-correlated stimuli on an avoidance or FI baseline. Experiment IV adapted the Wyckoff procedure, where observing converts a mixed schedule to a multiple schedule, for use with humans, with instructions rather than simple discriminative stimuli.

In Experiment IV, subjects were exposed to the same four-ply avoidance schedule as previously, but the lights with instruction labels were not illuminated unless an observing response was emitted. The prediction was that observing would be maintained under such conditions. However, in a later phase, the Contact condition was combined with the response-dependent instructions. Since the instructions did not provide accurate information during this condition, observing was expected to weaken.

METHOD

Subjects

Two of the subjects from Experiment I, PR and CB, were studied in Experiment IV, and a third subject, a female student (GW), was added to the experiment.

Apparatus

The apparatus was the same as before, except that turning the lever to the left, which previously had no effect, was designated the observing response.

Procedure

The four-ply schedule with added, accurate, instructions used in Experiment I, was programmed throughout most of Experiment IV. However, the signal lights were no longer response independent. Rather, a counter-clockwise turn of the lever (45°, 23 N of force) was required to produce the lights. During various phases of the experiment, the observing responses produced the lights for 10, 20, or 30 sec. For Subjects CB and PR, a descending sequence was used. Since Subject GW was naive to the situation, her behavior was stabilized with response-independent instructions before her exposure to the response-dependent instructions. An ascending sequence of display durations was then used. Two-session stability criteria were used to determine length of exposure to the various conditions. In order to ensure that constant-component durations did not provide cues to the programmed component, variable-duration components were used in Experiment IV, with a mean duration of 5 min. When subjects had completed the sequence of display durations, the observing response was made ineffective; that is, the instruction lights were no longer displayed consequent on an observing response. Thus, subjects were exposed to a mixed schedule during the Observing Extinction phase.

In order to recover observing behavior after the Observing Extinction phase, subjects were returned to the response-dependent instructions conditions with a 10-sec display duration. After stability was reached, the baseline schedule was altered so that a response-loss interval of 10-sec was programmed in all components, but instructions varied as before and were response-dependent with a 10-sec display duration. This was the Contact condition of Experiments II and III, but the instructions were response-dependent, instead of response-independent.

Immediately after Experiment I for Subjects CB and PR and immediately after stability was reached with the response-dependent instructions for Subject GW, the following typewritten instructions were presented to the subjects:

> Starting today, things will be somewhat different, the four amber lights will no longer automatically come on. However, if you want to see the amber lights, you can turn them on by turning the handle to the *left*. Turning the handle to the left will produce the amber lights for a period of time.

RESULTS

Table 1 and Figure 6 summarize the results of Experiment IV. In Table 1, mean responses per minute for the last two sessions of each condition are presented. Subject GW showed instructional control when instructions were response independent, and all three subjects showed instructional control with the introduction of the observing contingency, and through the various display durations. The basis for the instructional control was high and regular rates of observing shown by all three subjects. Figure 6 shows observing rates for the last two sessions at each display duration, and rates were maintained at all three durations, and were inversely related to the duration of the display. However, the actual time the display was presented was less, in spite of the higher observing rates, in the 10-sec component. For Subject PR, the display was on 75% of the session during the 10-sec display condi-

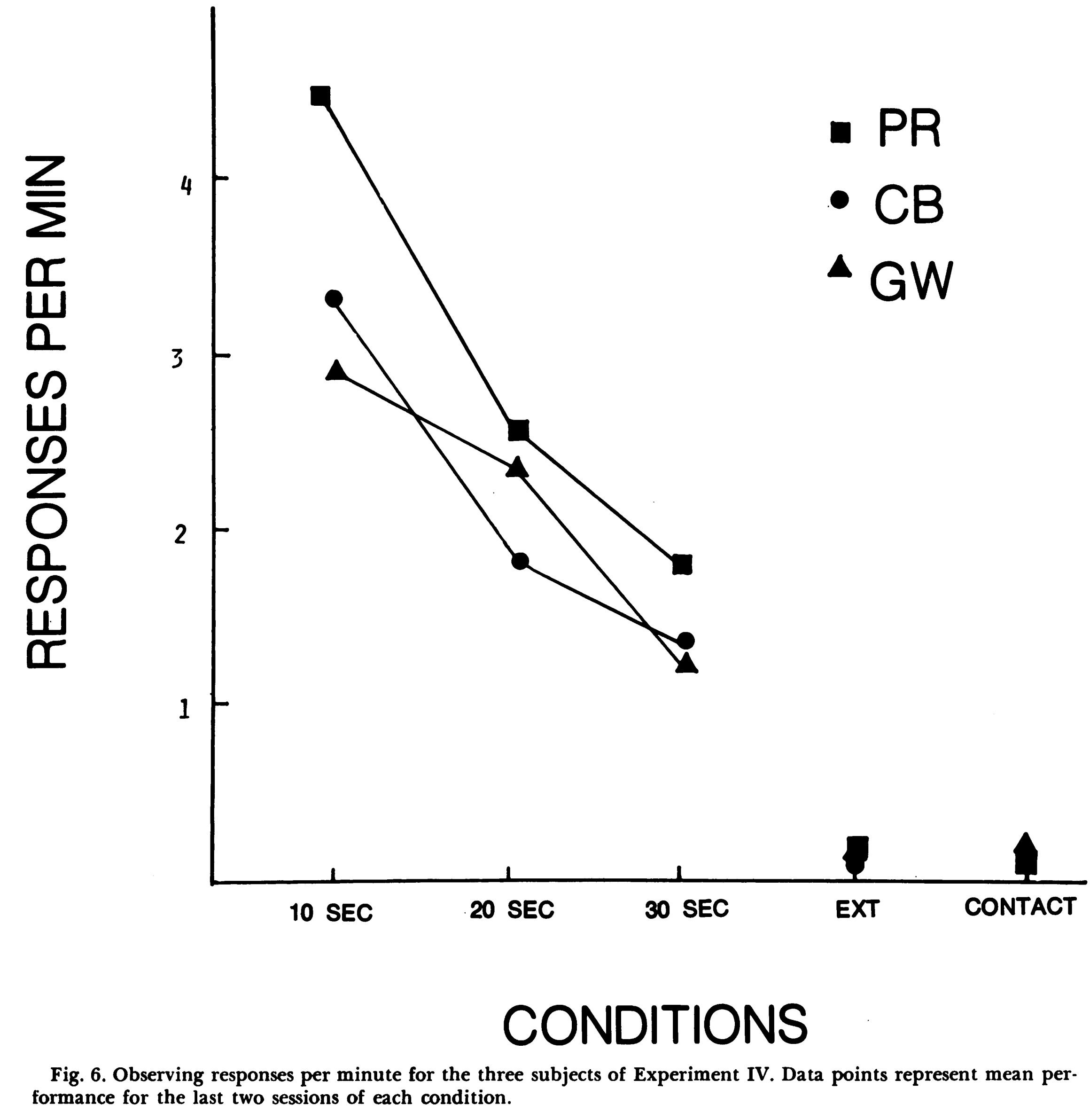

Fig. 6. Observing responses per minute for the three subjects of Experiment IV. Data points represent mean performance for the last two sessions of each condition.

tions, compared to 83% during the 20-sec and 30-sec display conditions. Similar results were obtained for Subjects GW and CB, who produced the display during, respectively, 33% and 28% of the 10-sec sessions, 40% and 45% of the 20-sec sessions, and 45% and 45% of the 30-sec sessions. As in the previous experiments, there were few losses: five for CB, 10 for PR, and seven for GW, during the last two sessions of the 10-sec display condition.

When the Observing Extinction conditions were introduced, observing rates dropped to near zero in all three subjects, and avoidance responding on the mixed schedule generated by these conditions was less well differentiated, although, as Table 1 shows, all three subjects tended to show higher rates in the 10-sec component. Subjects tended to receive more losses during these conditions: CB=7, PR=12, and GW=9, for the last two sessions of Avoidance Extinction.

All three subjects showed rapid recovery of observing when the observing dependency was reinstated with a 10-sec display duration, and this was accompanied by a reinstatement of instructional control (although the reinstate-

Table 1

Mean avoidance responses per minute for the last two sessions of the conditions of Experiment IV.

Conditions		Subjects		
		GW	CB	PR
Response-independent instructions	10 sec	7.6	—	—
	30 sec	3.5	—	—
	60 sec	2.4	—	—
	EXT	0.2	—	—
Response-dependent instructions: 10-sec display	10 sec	8.9	9.8	10.1
	30 sec	3.4	4.2	2.9
	60 sec	2.1	2.0	1.5
	EXT	0.0	0.0	0.0
Observing extinction	10 sec	6.5	9.5	9.0
	30 sec	4.5	6.9	8.8
	60 sec	4.3	7.3	3.7
	EXT	3.4	8.6	4.4
Response-dependent inaccurate instructions: 10-sec display	10 sec	7.5	9.6	11.7
	30 sec	8.1	8.6	12.0
	60 sec	7.6	9.0	12.3
	EXT	7.9	7.6	12.1

ment was uninstructed). When the Contact condition was introduced, instruction-following was eliminated, and as Figure 6 shows, observing responses were near zero in all three subjects during this condition.

Discussion

When accurate instructions depended on an observing response, observing was readily acquired. The functional relationship between the display duration and the rate of observing supported the conclusion that the instructional stimuli were the source of reinforcement for the observing response. Further support was provided by the rapid extinction of observing when the response no longer produced the instructions. Finally, the elimination of observing when the instructions were no longer accurate shows that instructions were reinforcing only when avoidance behavior was under instructional control. These results thus support the view of instructions as discriminative stimuli, in the sense that both instructions and simple discriminative stimuli can serve as reinforcers in the observing paradigm. Of additional interest was the rapid loss of instructional control when the Contact condition was introduced, once again demonstrating that instruction-following is controlled by its consequences.

The source of the reinforcing properties of discriminative stimuli has long been of theoretical interest. One explanation, which has found support in infra-human studies with observing procedures, is that the reinforcing properties are acquired through direct classical conditioning. This explanation appears unlikely in the present context. Although subjects received slightly fewer losses with the instructions, the differences were quite small. An alternative viewpoint is that discriminative stimuli are reinforcing because they permit more efficient behavior. Certainly in the present study, the addition of instructions resulted in fewer avoidance responses overall, but when the additional effort of the observing response is considered, especially with the 10-sec display duration, total work for two of the three subjects actually increased with instructions. This increased effort is clearly seen when avoidance response rates obtained in the Observing Extinction condition (GW=4.7, CB=8.0, PR=6.5 responses per minute overaged across components) are compared with total responding (observing and avoidance) in the 10-sec display conditions (GW=6.9, CB=7.0, and PR=8.1 responses per minute averaged across components). Thus, the most viable hypothesis regarding the reinforcing properties of instructions is the information hypothesis (Hendry, 1969), which asserts that stimuli that reduce uncertainty about forthcoming events are reinforcing. The instructions provided information about the schedule then in effect, and this may have been sufficient to establish them as reinforcers.

GENERAL DISCUSSION

Taken together, the four experiments support the view of instructional control as involving rule-governed behavior, and illustrate mechanisms by which subjects' reinforcement histories influence subsequent rule-governed behaviors. The rapid induction of avoidance by the preliminary instructions and the initiation of discriminative control by the instructional labels in Experiment I were consistent with Skinner's (1974) analysis of the properties of rule-governed behavior. Instructional control was shown to be influenced by the consequences of following instructions (Experiment II). Given differential reinforcement, instruction-following was brought under stimulus control (Experiment III). Finally, instructions were shown to possess reinforcing properties, a characteristic shared by simple discriminative stimuli (Experiment IV).

The view of instructional control as rule-governed behavior that is controlled by its consequences both explains the present findings, and accounts for much of the literature reviewed earlier. Studies showing that instructions facilitate the acquisition of schedule control (*cf.* Baron, Kaufman, and Stauber, 1969; Scobie and Kaufman, 1969; Turner and Solomon, 1962) can be incorporated into the present framework by positing that instructional control is at high strength when subjects first enter a psychology experiment. This assumption is warranted by the present results, as well as by research on the social psychology of the psychology experiment (Orne, 1962). Thus, when instructions are presented that specify responses relevant to the experiment, subjects execute those behaviors, and may give the appearance of having come under schedule control.

Consider now the case where inaccurate instructions have been studied. These studies have yielded particularly awkward results from the perspective of the reinforcement theorist. In one of the experiments reported by Kaufman *et al.* (1966), some subjects were instructed that monetary reinforcement was available on an FI basis, and others were told that it was programmed on a VR schedule. Although the actual schedule of reinforcement was a VI, both groups behaved as specified by the instructions: subjects given VR instructions responded at high rates, while those given FI instructions showed scalloping. However, instructional inaccuracies in the Kaufman *et al.* experiment are most analogous to the No-Contact inaccuracies of the present research. On the schedules programmed in the Kaufman *et al.* study, responding at a high rate or showing a scalloped response pattern was frequently reinforced, so there was never contact with the schedule-instruction discrepancy. The present results showed that instruction control can be maintained indefinitely when such contact is absent. A similar analysis of the Lippman and Meyer (1967) study, where subjects were given VR instructions but reinforcement was scheduled on an FI basis, reveals that no contact with the schedule-instruction discrepancy need have occurred. Thus, the Kaufman *et al.* experiment, as well as the Lippman and Meyer study, can be understood in terms of the persistence of instructional control in the absence of contact with schedule-instruction discrepancies.

One difficult finding for the present model is the third experiment by Kaufman *et al.*, where subjects were exposed to a single session in which no monetary reinforcement was programmed, but were given instructions that a VR schedule was in effect. These conditions resemble the Contact conditions of the present study, and as expected, there was some weakening of instructional control in this phase of the Kaufman *et al.* study. However, the breakdown of instructional control was neither as complete or as rapid as that observed in the present study. But on the avoidance baseline, subjects that persisted in following instructions experienced immediate loss, while on the extinction schedule of Kaufman *et al.*, although instruction-following did not lead to reinforcement, it was not punished. Perhaps with the less-aversive consequences of continued instruction-following in the Kaufman *et al.* study, more than a single session would be required to extinguish instructional control completely. Indeed, Ayllon and Azrin (1964) found that instructional control was weakened greatly over sessions with a similar procedure.

The present findings have considerable implications for the analysis of human operant behavior. For the researcher studying the simple operant behavior of adult humans, caution seems indicated. Since some verbal interaction between subject and experimenter is nearly unavoidable, care is needed to ensure that the behavior under examination is under schedule, and not instructional control. Mathews, Shimoff, Catania, and Sagvolden (1977) suggested that inadvertant instructional control may account for many cases of poor schedule control in humans (Streifel, 1972; Schmitt, 1974; Weiner, 1970). Thus, in cases where schedule control of simple responses is of interest, minimal instructions should be employed.

The analysis of instructional control itself warrants more study. The rapid acquisition of discriminative control with instructions, and its persistence when instructions were withdrawn, demonstrates the power of instructional control. But such persistence of control does not always lead to more efficient behavior, as was forcefully demonstrated in the initial No-Contact exposures of the present research. Under these conditions, steady rates of avoidance responding were maintained for many sessions in spite of the uniform No-Loss contingency. Other instances where human behavior is apparently in discord with the prevailing contingencies may be explained by the persistence of instructional control (*cf.* Herrnstein's, 1966, analysis of human superstitions).

The finding that instruction-following may be brought under external stimulus control may have particular implications for the analysis of social behavior. Consider the instructions presented in Experiment III as verbal statements or appeals originating from different sources. After the experience of the contact condition, the probability is low that communications from the inaccurate source would influence other's behavior. On the other hand, the present subjects continued to follow instructions in the presence of the stimulus associated with accurate instructions. Bandura (1969) argued that communicator's influence depends on the likelihood that the source's behavioral recommendations will lead to favorable consequences. The present research supports Bandura, and its methodology might be profitably used for further examination of such issues.

The present analysis provided a behavioral account of some of the phenomena associated with instructional control. The potency of instructional control can be interpreted not as a limitation of reinforcement control of human behavior (*cf.* Brewer, 1974), but rather as an instance of reinforcement history affecting rule-governed behavior. Many questions raised by this type of analysis remain to be answered. For example, the initial acquisition of instructional control can be addressed only through developmental research. The details of how reinforcement affects rule-governed behavior, and the conditions necessary for control by instructions and rules of other forms remain incomplete, but the present research shows the utility of an experimental analysis of these phenomena.

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