*INSTRUCTIONS, MULTIPLE SCHEDULES, AND EXTINCTION:
DISTINGUISHING RULE-GOVERNED FROM
SCHEDULE-CONTROLLED BEHAVIOR*

STEVEN C. HAYES, AARON J. BROWNSTEIN,
JOSEPH R. HAAS, AND DAVID E. GREENWAY

UNIVERSITY OF NEVADA-RENO AND
UNIVERSITY OF NORTH CAROLINA-GREENSBORO

Schedule sensitivity has usually been examined either through a multiple schedule or through changes in schedules after steady-state responding has been established. This study compared the effects of these two procedures when various instructions were given. Fifty-five college students responded in two 32-min sessions under a multiple fixed-ratio 18/differential-reinforcement-of-low-rate 6-s schedule, followed by one session of extinction. Some subjects received no instructions regarding the appropriate rates of responding, whereas others received instructions to respond slowly, rapidly, or both. Relative to the schedule in operation, the instructions were minimal, partially inaccurate, or accurate. When there was little schedule sensitivity in the multiple schedule, there was little in extinction. When apparently schedule-sensitive responding occurred in the multiple schedule, however, sensitivity in extinction occurred only if differential responding in the multiple schedule could not be due to rules supplied by the experimenter. This evidence shows that rule-governed behavior that occurs in the form of schedule-sensitive behavior may not in fact become schedule-sensitive even though it makes contact with the scheduled reinforcers.

Key words: verbal control, contingency insensitivity, rule-governed behavior, schedule-controlled behavior, multiple schedules, button press, adult humans

A focus of research on operant behavior of humans has been the role of verbal stimuli in determining performance. Supporting this focus are findings of the past few years suggesting that many of the differences between human and infrahuman responding may be due to the effects of verbal stimuli on human action (Baron & Galizio, 1983; Hayes, in press-a; Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986; Lowe, 1983). These differences include patterns of schedule performance (Leander, Lippman, & Meyer, 1968; Lowe, Harzem, & Hughes, 1978; Weiner, 1964, 1969) and particularly a marked insensitivity to changes in programmed schedules of reinforcement (Ader & Tatum, 1961; Harzem, Lowe, & Bagshaw, 1978; Matthews,

Shimoff, Catania, & Sagvolden, 1977; Shimoff, Catania, & Matthews, 1981).

One procedure used to evaluate sensitivity to programmed contingencies has been to develop steady-state responding on a given schedule, and then to change the schedule or schedule parameters (e.g., Galizio, 1979; Shimoff et al., 1981). A second approach involves the use of multiple schedules (e.g., Baron, Kaufman, & Stauber, 1969; Hayes et al., 1986), where there is frequent alternation between schedules that are accompanied by distinctive stimuli. Primary among the advantages of the multiple-schedule procedure is that it provides a direct and continuous measure of sensitivity to different schedules (Baron & Galizio, 1983). It is important to assess, however, whether behavioral sensitivity to schedules evident in a multiple-schedule procedure reliably corresponds to that detected in the other procedure. Such comparisons are essential to identifying the conditions under which "schedule sensitivity" is an applicable metric of the effects of verbal control on human responding.

This issue is important because rules might produce behavior of a form that mimics sched-

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Reprint requests should be sent to Steven C. Hayes, Department of Psychology, University of Nevada-Reno, Reno, Nevada 89557-0062.

ule sensitivity. It is known that true schedule sensitivity can be disguised by the presence of an instruction and revealed only after the instruction is withdrawn (Hayes *et al.*, 1986). It is also possible that apparent schedule sensitivity, if it is established by a rule, may be an instance of rule-following, not schedule control. For example, if apparently successful multiple-schedule responding is functionally an instance of rule-following, we may not see sensitivity to the schedule contingencies when subsequently the multiple schedule itself changes.

This type of manipulation could also address some current interpretations of the effects of instructions on sensitivity to schedules of reinforcement. Several accounts of the insensitivity to schedules produced by rules have been offered: Rules generate patterns of responding that preclude effective contact with the schedules (Baron & Galizio, 1983), "insensitivity is a defining property of instructional control" (Shimoff *et al.*, 1981, p. 207), and insensitivity can be due to additional sources of reinforcement involved in instructional control (Hayes *et al.*, 1986; Hayes, Rosenfarb, Wulfert, Munt, Korn, & Zettle, 1985; Hayes & Wolf, 1984; Rosenfarb & Hayes, 1984; Zettle & Hayes, 1982). These interpretations are neither mutually exclusive nor exhaustive, and probably each is valid to some degree. The degree of correspondence between apparent sensitivity to programmed schedules detected in different procedures when rules are present has implications for each interpretation. The view that emphasizes contact with the schedules would seem to predict that a rule that ensures contact with programmed schedules should not interfere with schedule sensitivity, however that sensitivity is assessed. The view that emphasizes inherent insensitivity would predict the opposite. The additional-contingency view would predict some degree of both effects based on the competition between two sources of control.

The present research examined the degree of agreement between the two types of assessment of schedule sensitivity when instructions were given that either were or were not in accord with the prevailing schedule of reinforcement. Instructional effects on control by multiple schedules of reinforcement were compared to behavioral changes that accompanied a shift to extinction in both components of the multiple schedule.

METHOD

Subjects

Subjects were 55 undergraduate college students enrolled in an introductory psychology course at The University of North Carolina at Greensboro. They received credit for partial fulfillment of course requirements as well as points worth chances on money prizes.

Apparatus and Setting

Subjects worked in a small (1.8 m by 2.7 m) room that contained a chair, a table, and the experimental apparatus. The apparatus consisted of a 19-inch color television monitor and a small metal project box holding two normally open momentary contact buttons (Radio Shack 275-618). The monitor and buttons were attached to a microcomputer in an adjoining room. When operating, the monitor projected a 5 by 5 matrix of 4-cm by 3.5-cm boxes with a small plus sign in one of them.

Procedure

Three 32-min sessions were conducted with a 2-min break between each. At the beginning of the first session each subject was given the following written instructions while the experimenter also read them aloud:

This is an experiment in learning, not a psychological test. We are interested in certain aspects of the learning process which are common to all people. During the session you will be alone in this booth until the end of the session. The session will begin when a five by five grid appears on the monitor. The monitor will indicate when the session is over. There will be three sessions today with a short break between each. When the grid appears there will be a plus sign in the upper left-hand corner. To make points, move the plus sign to the lower right-hand corner; then when the monitor indicates, press both buttons to receive your point. Try to see how many points you can get. Each point is worth a chance at two \$20.00 prizes to be given at the end of the semester. Moving the plus sign to the lower right-hand corner involves the buttons and the lights.

Subjects were assigned to one of four groups: Minimal Instructions, Go Slow, Go Fast, or Accurate Rule. (Assignments were random except that additional subjects were added to groups showing more than one type of result, to clarify the effects and to enable better comparisons between groups.) The Minimal In-

structions group ($n = 19$) received no additional substantive instructions. The Go Slow group ($n = 13$) was told:

The best way to push the buttons is slowly with several seconds between each push.

The Go Fast group ($n = 7$) was told:

The best way to push the buttons is rapidly.

The Accurate Rule group ($n = 16$) was told:

When the yellow rectangular square is lit, the best way to push the buttons is slowly with several seconds between each push. When the blue rectangular square is lit, the best way to push the buttons is rapidly.

Instructions for all subjects concluded with:

If you have any questions ask them now because during the session the experimenter will not be able to answer any questions.

The experimenter answered any questions asked by the subjects by simply rereading the relevant portion of the initial instructions.

Training phase: Sessions 1 and 2. After leaving the room, the experimenter started the session. The task was taken from that used by Hayes et al. (1986). At the beginning of the session, the plus sign was in the upper left corner of the 5 by 5 matrix. Moving the plus sign to the lower right corner depended on pushes on the left and right buttons. During Sessions 1 and 2, movements of the plus sign were scheduled on a multiple schedule whose components were differential-reinforcement-of-low-rate 6 s (DRL 6 s)/fixed ratio 18 (FR 18). During the DRL, the first button push after 6 s moved the plus sign and each button had its own clock. Movements produced by pushes on the left button put the plus sign down one row; movements produced by pushes on the right button put the plus sign right one column. During the FR, presses on either the left or the right button counted toward a single ratio. If the 18th response was on the left button, the plus sign moved down; if it was on the right, the plus sign moved to the right. If the plus sign was in the right column, moves further to the right caused the plus sign to reset to the upper left corner. If the plus sign was in the bottom row, moves down also produced a reset. Any combination of four plus-sign movements produced by the left button and four by the right put the plus sign in the lower right corner and resulted in the rein-

forcer message appearing on the screen. If five plus-sign movements were produced by either button, however, the plus sign reset and no points were earned. Subjects could work continuously during each component. There were no pauses following resets or the delivery of points.

Schedules alternated every 2 min. Each schedule was in force for eight 2-min intervals each session. During the DRL schedule, a 4.5-cm by 1.5-cm yellow box was displayed on the monitor screen below the left half of the matrix. During the FR, a 4.5-cm by 1.5-cm blue box was displayed below the right half of the matrix.

This task is more complicated than is typical in human operant research. The details regarding the multiple button, direction of movement, and reset contingencies make a concise schedule description difficult, because the multiple schedule only partially describes the task. We have used this task, however, because it allows schedule comparisons while also maintaining human subjects' interest and involvement. In earlier work in our laboratory we found that simpler tasks did not adequately engage adult human subjects.

During the session, a subject remained in the booth and could be observed through a one-way mirror, and could also be instructed through an intercom system. If subjects did not make any responses during the initial 2 min of the first session, the session was stopped and all instructions were read again. This was done no more than once for any subject.

Extinction phase: Session 3. During each break after Sessions 1 and 2, subjects were told simply, "There are no further instructions." During Session 3, the plus sign would not move regardless of button-pressing patterns, and no points could be earned. The schedule lights, however, continued to alternate as before. If subjects attempted to communicate with the experimenters or to leave the room, they were instructed to remain seated until the session was over.

RESULTS

Apparent schedule sensitivity in the multiple schedule was computed by dividing the total number of responses in the lower rate or "nondominant" component (whether that was the DRL or FR schedule) by the total number of responses in both components during the

Table 1

The rate of responding (in responses per minute) during the last half of Session 2 and the last half of Session 3 (Extinction) within DRL and FR components of a multiple schedule, for each subject in each group, organized by the pattern of responding shown in the multiple schedule.

Minimal Instructions group						Go Slow group				
	S #	Session 2		Session 3		S #	Session 2		Session 3	
		DRL	FR	DRL	FR		DRL	FR	DRL	FR
Nondifferential response pattern in the multiple schedule	1	18.3	6.3	26.6	6.9	20	17.6	17.0	21.6	17.1
	2	8.4	8.1	6.9	7.4	21	12.1	8.4	3.1	1.9
	3	250.8	242.0	228.8	252.8	22	11.3	7.5	9.6	4.9
	4	211.1	217.3	122.6	167.4					
	5	13.1	8.8	16.3	10.4					
	6	13.3	24.1	21.8	25.3					
	7	35.3	49.5	3.5	7.3					
	8	29.9	19.3	7.3	6.8					
	9	10.3	6.3	8.0	6.9					
Inefficient differential response pattern in the multiple schedule	10	12.4	1.6	1.8	0.9	23	11.3	0	1	0.6
	11	12.6	0.5	6.3	3.6	24	10.6	0.9	1.1	2.8
	12	12.1	0.1	0.4	0	25	6.9	0.3	4.1	4.3
	13	14.0	1.8	8.5	1.1	26	6.6	0	0	0
						27	11.3	0.6	0.8	1.5
						28	10.6	0.1	1.9	0.6
						29	10.4	0	1.0	0.1
						30	12.9	0.1	0.8	0.1
						31	9.0	0	0	0
Efficient differential response pattern in the multiple schedule	14	11.3	152.4	36.3	36.5	32	12.0	226.8	4.8	7.3
	15	26.3	263.4	24.6	49.9					
	16	14.3	160.1	11.8	20.5					
	17	13.0	56.4	34.3	27.5					
	18	13.4	206.3	77.1	92.4					
	19	13.6	121.8	27.4	58.0					

last half of the second session. This measure could vary from 0 to 0.5: High apparent schedule sensitivity was defined as a value below the mid-point (i.e., < 0.25), and low sensitivity was defined as a value above the mid-point. Two types of responding could produce high apparent schedule sensitivity. In one type ("efficient differential responding"), subjects earned points in both schedules and showed clearly higher rates on the FR than on the DRL schedule. All but 3 of the 27 subjects showing this pattern responded below 20 responses/minute (r/m) on the DRL schedule and most responded near 12 r/m. Table 1 shows the rate of responding for all individual

subjects during the last halves of Sessions 2 and 3. Under the FR schedule, all but 2 of these subjects responded above 150 r/m. In the second type of apparently schedule-sensitive responding ("inefficient differential responding"), the response rates were low (< 15 r/m) under the DRL schedule (earning points) and even lower under the FR (< 2 r/m) without earning points. This second pattern was apparently schedule sensitive, because low rates of responding in both schedules produced a sequence of events that mimicked those of a programmed multiple DRL/EXT schedule. It has long been known that behavior is controlled by the actual, not the

Table 1 (Continued)

Go Fast group					Accurate Rule group				
S #	Session 2		Session 3		S #	Session 2		Session 3	
	DRL	FR	DRL	FR		DRL	FR	DRL	FR
33	77.0	138.4	31.4	151.5	40	12.1	11.5	2.3	0.1
34	146.5	128.4	123.3	84.0					
35	10.9	227.0	12.4	38.1	41	14.1	243.9	16.6	193.6
36	12.9	235.8	42.9	29.1	42	14.5	233.3	17.4	23.0
37	16.9	288.5	77.1	64.5	43	12.8	121.8	15.9	115.1
38	12.8	178.3	52.8	33.8	44	13.3	161.1	4.9	10.1
39	12.4	308.1	222.4	224.6	45	14.0	241.3	17.0	144.4
					46	13.6	324.9	17.0	173.8
					47	13.9	243.3	2.6	16.5
					48	22.6	218.0	16.4	51.6
					49	11.9	177.6	21.0	158.4
					50	11.8	158.0	14.8	136.8
					51	14.4	249.0	17.0	52.3
					52	13.6	209.8	11.5	2.0
					53	15.4	246.4	13.3	35.9
					54	24.0	257.8	51.4	148.3
					55	11.0	167.6	3.3	32.1

programmed, schedules of reinforcement (e.g., Anger, 1956). Subjects showing low apparent schedule sensitivity (termed "nondifferential responders") responded at approximately the same rate in each schedule (whether the rate was high or low) and earned points either in one schedule only or in neither schedule.

The effects of extinction were quantified by dividing the total number of responses during the second half of the third session (the end of the extinction phase) in the schedule with higher response rate (the "dominant schedule") by the total number of responses in the second half of the second session on that schedule. The dominant schedule was used

because this is the component in which subjects in all groups earned points and thus, in which a change of scheduled contingencies would consistently result in a change of contingencies actually encountered. If no change were shown during the extinction phase, the extinction measure would yield a value of 1; lower values would show increasingly greater extinction effects. Values equal to or below 0.5 (i.e., at least a 50% reduction in responding) were considered to show large extinction effects, and values above 0.5 were considered to show small extinction effects. As indicated by these designations, the response patterns in the multiple schedule and in the extinction

Table 2

The number of subjects in each of the four groups showing nondifferential, inefficient differential, or efficient differential responding in the multiple schedule, and the number and percentage of those who subsequently showed large extinction effects.

Group		Pattern shown on the multiple schedule		
		Nondifferential	Inefficient differential	Efficient differential
Minimal Instructions group	Number showing pattern	9	4	6
	Number and % showing large EXT effects	2 (22%)	3 (75%)	6 (100%)
Go Slow group	Number showing pattern	3	9	1
	Number and % showing large EXT effects	1 (33%)	8 (89%)	1 (100%)
Go Fast group	Number showing pattern	2	—	5
	Number and % showing large EXT effects	0 (0%)	—	4 (80%)
Accurate Rule group	Number showing pattern	1	—	15
	Number and % showing large EXT effects	1 (100%)	—	8 (53%)

procedures differed for subjects in the various groups, as follows (see Table 2 for a summary):

In the Minimal Instructions group, 6 subjects showed a pattern of efficient differential responding, and 4 subjects showed a pattern of inefficient differential responding. Of these 10 subjects, 9 showed large extinction effects. The remaining 9 subjects demonstrated nondifferential responding at various rates; 2 of these showed large extinction effects.

In the Go Slow group, 1 subject showed a pattern of efficient differential responding, and 9 subjects showed inefficient differential response patterns. Of these 10 subjects, 9 showed large extinction effects. The remaining 3 subjects responded nondifferentially and at a low rate (< 20 r/m); 1 of these showed a large extinction effect.

In the Go Fast group, 5 subjects showed a pattern of efficient differential responding; 4 of these showed large extinction effects. The remaining 2 subjects showed nondifferential high-rate (> 125 r/m) responding and neither of these showed large extinction effects.

In the Accurate Rule condition, 15 subjects showed a pattern of efficient differential responding. Of these, 8 showed large extinction effects, but 7 did not. One subject produced high-rate nondifferential responding. This subject showed a large extinction effect.

The results suggest a relation between

schedule sensitivity in the multiple schedule and sensitivity to the extinction manipulation, but the relation appears to hold only when differential responding in the multiple schedule could not be directly due to an experimenter-given rule. The relation did not hold when differential responding in the multiple schedule had been occasioned by an accurate experimenter-given rule. This result can be discerned by noting first that the Minimal Instructions, Go Slow, and Go Fast groups all shared the characteristic that differential responding in the multiple schedule could not result directly from experimenter-given rules. Hence, to focus on the effect of instructions on apparent schedule sensitivity, the results for these three groups were collapsed into a single "No Accurate Rule" group in most of the analyses below. The relation between apparent schedule sensitivity on the multiple schedule and subsequent behavior during extinction can then be characterized in several ways for the Accurate Rule and No Accurate Rule groups.

The sensitivity data for each subject in the No Accurate Rule and Accurate Rule groups are shown in Figures 1 and 2, respectively. The difference between the two conditions can be seen most clearly in the lower right quadrants of the figures. Subjects in these quadrants showed high apparent schedule sensitivity in the multiple schedule, but small

Fig. 1. The relation between differential responding in the multiple schedule and subsequent extinction effects on the dominant response for each subject in the No Accurate Rule groups. Individual subjects in the Minimal Instructions group are identified by an "m," the Go Slow subjects by an "s," and the Go Fast subjects by an "f." The ordinate measure indicates apparent schedule sensitivity on the multiple schedule, with lower values denoting greater sensitivity. The abscissa measure indicates the magnitude of extinction effects, with lower values denoting larger extinction effects.

Fig. 2. The relation between differential responding in the multiple schedule and subsequent extinction effects on the dominant response for each subject in the Accurate Rule group. The ordinate measure indicates apparent schedule sensitivity on the multiple schedule, with lower values denoting greater extinction effects. The abscissa measure indicates the magnitude of extinction effects, with lower values denoting larger extinction effects.

extinction effects. In the No Accurate Rule condition, 3 of 39 subjects gave performances falling into this quadrant, whereas in the Accurate Rule condition 7 of 16 subjects did so.

A Pearson product-moment correlation between the two sensitivity measures for the No Accurate Rule subjects yielded a value of 0.69, ($df = 38$, $p < .001$), indicating a strong linear relationship. The results of the same analysis for the three sub-groups of the No Accurate Rule group (Minimal Instructions, Go Slow, and Go Fast, respectively) were 0.55 ($df = 18$, $p < .02$), 0.80 ($df = 12$, $p < .002$), and 0.77 ($df = 6$, $p < .05$). Thus, for these groups, sensitivity to the multiple schedule correlated highly with sensitivity to the extinction procedure. For the Accurate Rule subjects, the value for this same correlation was -0.13 ($df = 15$, $p > .50$), indicating the lack of any significant linear relationship between the two measures of schedule sensitivity within this group. Using a Fisher's z test, a statistically significant difference was found in the correlations between the two measures of schedule

sensitivity for the No Accurate Rule and Accurate Rule groups, $z = 2.54$, $p < .02$.

These results can be summarized differently by categorizing the numbers of subjects showing high and low sensitivity under the multiple schedule and large and small extinction effects. These values are shown in Table 3. In the No Accurate Rule group, 25 subjects showed high schedule sensitivity by the end of their exposure to the multiple schedule (whether or not that performance was efficient), with 22 of these showing large extinction effects. Of the 14 subjects who demonstrated low schedule sensitivity in this group, 11 also had small extinction effects. The results for the Accurate Rule group were quite different: Only 8 of the 15 subjects showing high apparent sensitivity to the multiple schedule showed large extinction effects. Considering only the 40 subjects showing high sensitivity to the multiple schedule, a chi-square comparison between the two groups on the numbers showing large versus small extinction effects yielded a statistically significant difference, $\chi^2(1, N = 40) = 4.30$, $p < .05$. Thus, the relationship between the two mea-

asures of sensitivity differed in the two conditions.

Sensitivity to the extinction manipulation should not be thought of as a unitary decrease in responding, for responding established by the dominant and nondominant schedules showed somewhat different effects. Nondominant responding tended to increase during extinction for subjects in the No Accurate Rule group. This increase was seen in 7 of 13 inefficient differential responders and in 9 of 12 efficient differential responders. During extinction, both dominant and nondominant schedules are in fact identical, and response rates converged. For the differential responders in the No Accurate Rule group, nondifferential responding in extinction occurred due to both a great decrease in responding during the dominant schedule and an increase in the previously very low rates of responding in the nondominant schedule. For the nondifferential responders, nondifferential responding in extinction occurred due to approximately 25% decreases in responding during both the dominant and nondominant schedules. When total responding in both components was used as the metric of sensitivity to the extinction manipulation, the same basic relation between the differential and nondifferential responders emerged in the No Accurate Rule group as when dominant responding was used as the metric (as can be calculated from Table 1). Thus, behavioral change produced by the extinction manipulation was greater in the differential than in the nondifferential responders in the No Accurate Rule group regardless of the basis for calculating change.

DISCUSSION

In infrahumans, schedule sensitivity can be defined quite readily by the degree to which behavior covaries with schedules of reinforcement. For verbal organisms, however, the picture is more complex because patterns of behavior can be established that are in the form of schedule-sensitive responding, but are instances of rule-following. Throughout this paper we have used the term "apparent schedule sensitivity," because humans may behave in ways that appear to be schedule sensitive but are, nevertheless, not controlled by the relevant schedules. Mere differential responding,

even if it is in formal accord with the schedules, does not suffice to define behavior as schedule sensitive. When the behavior could be rule-governed, only behavior that can be shown to be reliably sensitive to *changes* in the described contingencies should be thought of as truly schedule sensitive.

There are currently several accounts of schedule insensitivity due to rules: Rules are said to generate patterns of responding that preclude effective contact with the schedules (Baron & Galizio, 1983); insensitivity has been taken as a defining property of instructional control (Shimoff *et al.*, 1981); and it has been proposed that insensitivity may be due to additional contingencies introduced by instructional control (Hayes *et al.*, 1986). The accounts are not mutually exclusive and each could be correct to some degree. The first two, however, are contradicted somewhat by the current data. If rules produce insensitivity to programmed schedules of reinforcement because they preclude effective *contact* with these schedules, it would have to be explained why contact with extinction in one component of a multiple schedule or in the extinction phase of this experiment did not constitute effective contact with the schedules. That is, the insensitivity seen in Go Slow or Go Fast conditions during the multiple schedule, or in those groups and in the Accurate Rule group during extinction, cannot be attributed to a lack of contact with the contingencies. Conversely, if insensitivity were a defining property of instructional control, it would have to be explained why some subjects in the Accurate Rule condition did show extinction effects despite exposure to and apparent control by the rule.

The data seem most readily interpreted in terms of the interaction between two distinct types of responding: contingency-shaped responding and rule-governed behavior. Rules may be thought of as antecedent verbal stimuli (Hayes, 1986; Skinner, *in press*). The presence of verbal stimuli introduces additional contingencies for responding (Hayes *et al.*, 1986; Zettle & Hayes, 1982). When rules and direct contingencies are involved, responding can be sensitive to either or both of the two different sets of contingencies involved. Behavior under the control of a rule may occur in the same *form* as schedule-sensitive behavior and yet be purely an instance of rule-fol-

lowing not controlled by the particular programmed consequences. That is, when apparently schedule-sensitive behavior is in correspondence with given rules, responding may be differential but not truly schedule sensitive. The "sensitivity" shown in a pigeon and a verbal human may be different, despite formal similarities. The problem is one of determining the functional basis for the observed behavior. In some of the subjects in the Accurate Rule condition, control with the contingencies transferred control of responding from the given rule to the point contingency. In other subjects this did not occur, and control over responding remained with the rule. Unlike the No Accurate Rule subjects, whether this transfer of control would occur could not be predicted from the pattern of responding in the multiple schedule, because either set of contingencies (the point contingencies or those responsible for rule-following) could produce this pattern of responding.

Previous research has shown that instructions about particular schedules of reinforcement can produce performances that mimic responding in other animals under similar schedules (e.g., Kaufman, Baron, & Kopp, 1966; for a recent review, see Baron & Galizio, 1983). The present findings indicate that such behavior may be controlled by a different set of functional variables. Even the measure of extinction effects used in the present study, for example, is not necessarily an adequate measure of extinction effects produced directly by contingencies, because some of the changes in responding could have been due to rules. Thus, interpretation of any measure of sensitivity in humans must be tempered by the possibility of verbal sources of control over the behavior.

It may be suggested that the greater resistance to extinction shown in the Accurate Rule condition could be due to point reinforcement for rule-following in the multiple schedule having been greatest in this group. Nondifferential responders in the No Accurate Rule conditions, however, received fewer reinforcers than did differential responders and yet tended to show small extinction effects. Thus, point-reinforcement of rule-following could not account for the total pattern of differences in extinction among the various groups. Another explanation of the extinction data may be that high extinction effects were related to detection of deception in the first two sessions.

Table 3

The number of subjects in the No Accurate Rule and Accurate Rule groups showing large or small extinction effects and high or low apparent schedule sensitivity to the multiple schedule (for cutoffs, see text).

Apparent schedule sensitivity	Extinction effects			
	No accurate rule		Accurate rule	
	Large	Small	Large	Small
Low	3	11	1	0
High	22	3	8	7

That is, the lack of correspondence between a rule and the experienced consequences may be discriminative for the abandonment of rule control. This account requires, however, that the Minimal Instructions group, too, be regarded as deceived. This does not seem plausible.

These data raise concerns about the use of rules to establish contact with contingencies in applied settings. Behavior therapy research, in particular, has spent a great deal of time both determining proper rules and devising techniques for instructing clients accordingly. Adequate rules are difficult to find in many clinical situations, however (Azrin & Hayes, 1984). Rules may not capture the subtleties of a situation that would be apparent if the behavior were controlled by the direct contingencies (Skinner, 1974). Even if adequate rules are available, the present data suggest that the use of rules may introduce additional variables that may compete with control by direct consequences. For example, instructing a client about how to behave in a socially skillful manner may subsequently interfere with the modulating effect of the degree of social success the resulting repertoires produce. For these reasons, instructions should be used with considerable care, especially when control by the direct contingencies is desirable and when noninstructional means of behavior change are available.

Perhaps prolonged direct experience with a situation may produce a shift from control by rules to control by the direct contingencies. For example, if the Accurate Rule condition were run for several days, then extinction might subsequently emerge more readily. The type of rule may be an important factor. Rules that are fairly general seem to allow for more behavioral variability and more contingency

sensitivity than do specific rules (e.g., Olson & Hayes, 1984). Paradoxical rules seem to show much the same effects, perhaps because they cannot be followed literally (Ascher & Turner, 1980; Hayes, in press-b). Rules that do not instruct a particular pattern of behavior but establish behavioral precursors might also be less likely to produce insensitivity. For example, "keep your eye on the ball" may be a successful rule because it brings the behavior of a batter into contact with the environment in a way that may permit discriminative control to emerge over the swing itself. Rule-following that occurs because of specified or implied nonarbitrary consequences of responding—"tracking"—seems to induce less insensitivity than does "pliance"—rule-following produced by socially mediated arbitrary consequences for a correspondence between the rule and relevant behavior (Hayes *et al.*, 1985, 1986; Hayes & Wolf, 1984; Rosenfarb & Hayes, 1984; Zettle & Hayes, 1982). Finally, rules that describe ways of testing contingencies may produce behavior more sensitive to contingencies in their domain. Unfortunately, even such strategic rules have been shown to induce insensitivity to contingencies outside of their domain (Catania, Shimoff, & Matthews, in press).

Thus, the verbal community may have at its disposal a variety of methods of verbal control that maximize or minimize an insensitivity effect. It may be that we use only specific, socially laden instructions aimed at particular responses when in fact insensitivity has no cost to the culture, and may even have a benefit (Shimoff *et al.*, 1981). For example, "Thou shalt not commit adultery" is a rule that under some circumstances might produce problems for an individual, but it may have considerable benefit for the social fabric of the verbal community that enforces it.

Distinguishing rule-governed from contingency-shaped human behavior is not an easy task. The present data suggest that reliance on the form of response patterns, rather than on their controlling variables, can lead to incorrect categorization of these two types of responding.

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