ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES 41, 405–425 (1988)

The Effects of "Intrinsic" and "Extrinsic" Reinforcement Contingencies on Task Behavior

W. E. SCOTT, JR.

Indiana University

JIING-LIH FARH

Louisiana State University

AND

PHILIP M. PODSAKOFF

Indiana University

In spite of a substantial number of observations to the contrary, some behavioral scientists have concluded that salient extrinsic reinforcers not only do not maintain or support task behavior, they decrease or extinguish it by somehow destroying or impairing "intrinsic motivation." In this study it was once again demonstrated that when behavior is sustained in a task setting in the apparent absence of salient extrinsic reinforcers, quite subtle but nevertheless palpable response-produced stimulus changes are found to be involved. Moreover, when a signaled extrinsic monetary reinforcement contingency was applied, it not only did not impair the effects of the intrinsic reinforcers, it produced a significant increase in task performance during the time the extrinsic reinforcement contingency prevailed, and it did not produce a decrement in self-reports of task attractiveness nor in performance during a discretionary period in which the contingency had been deliberately withdrawn. We conclude that there is little reason to believe that the design and implementation of effective extrinsic reinforcement contingencies will destroy one's pride in one's work, the intrinsic worth or meaningfulness of the job, or one's "intrinsic motivation" to perform it. © 1988 Academic Press, Inc.

It has been noted that performance in *some* tasks appears to be maintained at high and stable rates in the absence of salient extrinsic reinforcing consequences (Scott, 1966). Such observations naturally raise questions about the status of the law of effect and have led cognitive theorists to postulate that under certain conditions performance is a function of an

All correspondence and requests for reprints should be addressed to William E. Scott, Jr., Department of Management, Graduate School of Business, Indiana University, Bloomington, IN 47405.

0749-5978/88 $3.00

internal state referred to as "intrinsic motivation" (De Charms, 1968; Deci, 1971; Lepper & Greene, 1978). These same theorists have further postulated that the introduction of salient extrinsic reinforcers will, under some conditions at least, produce a decrement in intrinsic motivation.

The postulation of central motivational states poses a number of problems, not the least of which is the difficulty in deducing testable hypotheses that may be regarded as logically appropriate by those advancing the postulates. For example, most theorists have indicated that the decremental effect is more pronounced when the level of intrinsic motivation elicited by the task is higher (Lepper & Greene, 1978). However, the nature of those tasks which will elicit intrinsic motivation and the manner in which they do so has never been clarified. Therefore, in selecting a task for purposes of examining the effects of an extrinsic reinforcement contingency, one may either present subjects with several tasks and note those which most consistently evoke attentional and manipulatory operants, or merely select one which is assumed on the basis of one's own reactions to be intrinsically motivating. If we then introduce an extrinsic reinforcement contingency and fail to observe the decremental effect, the experimenter can be accused of an improper deduction unless he can prove that the task was, indeed, intrinsically motivating for his subjects. This is, of course, an impossible undertaking, and in any case, we have begged the question with which we began: What is there about a task that evokes and sustains behavior at relatively high and stable rates in the absence of an effective extrinsic reinforcement contingency?

Another troublesome deductive problem has to do with the selection of appropriate independent and dependent variables. Given the postulates at hand, a straightforward deduction would seem to be that if we discovered a task that evoked and maintained behavior in the absence of an extrinsic reinforcement contingency, and then introduced one, there should be a decrement in task performance. However, that does not seem to be viewed as an appropriate deduction, and in any event, there is little empirical evidence to support it. To be sure, there have been scattered reports in which the introduction of a "tangible extrinsic incentive" resulted in a decrement in task performance (McGraw, 1978), but there are literally thousands of studies in which the effect has been *facilitative*. Perhaps for this reason, the most common test of the postulates has been one in which subjects *are told that an extrinsic reinforcement contingency will prevail* (it may or may not be actually administered), and then it is withdrawn (or subjects are told that it no longer prevails), at which time the subjects' behavior with respect to the task is observed and compared with their own task behavior prior to the experimental treatment, or with that of control groups who were not exposed to the treatment. The manner in which this hypothesis could be logically deduced from the original postulates is not clear. Apparently most theorists assume that a salient extrinsic reinforcement contingency has two opposing effects. On the one hand, it "increases the probability of the rewarded behavior in that and similar situations" (Lepper & Greene, 1978, p. ix), and on the other, it decreases intrinsic motivation. Presumably, however, the facilitative effect is overriding and for that reason the decline in intrinsic motivation will not be reflected in a decline in rate of responding or in other task operants *while the extrinsic contingency prevails*. However correct or incorrect our interpretation, task performance is often, though not inevitably, facilitated by the introduction of an extrinsic reinforcement contingency, whereas task performance and/or task choice measures observed after the contingency has been withdrawn suggest that under some circumstances the introduction of an extrinsic contingency somehow impairs intrinsic motivation or the on-task behaviors thought to be reflective of it.

Whatever one's views of cognitive theorizing, it cannot be denied that some tasks are more likely than others to evoke approach, manipulatory, and other "on-task" operants and to sustain them for longer periods of time in the absence of salient extrinsic reinforcement contingencies. Behaviorists should find these observations as interesting as cognitive theorists, and as a matter of fact, many have, though they have not been driven to the postulation of autonomous inner causes. For example, Scott and his colleagues (Scott, 1975; Scott & Erskine, 1980; Scott & Podsakoff, 1985), following the lead of Berlyne (1967), have pointed out that stimuli eliciting moderate activity in any sensory receptor and the reticular formation can serve to maintain task operants upon which they are contingent. These "sensory" or "intrinsic" reinforcers appear to be weaker than most conventional or extrinsic reinforcers and show a greater propensity to habituate with repetition. However, there are several studies in which it has been demonstrated that a variety of sensory stimuli can maintain operants which produce them (e.g., Berlyne, 1967; Fowler, 1971; Kish, 1966; Scott & Erskine, 1980). If, therefore, task performance is being maintained in the absence of a salient extrinsic reinforcement contingency (one involving the administration of a powerful primary or conditioned reinforcer by another person), a variety of response-produced stimulus changes are, presumably, sustaining it. There are other possibilities, of course. Behaviorists and presumably others know that operants can be maintained at high and stable rates by the *infrequent* though contingent occurrence of conventional reinforcers. Therefore, the absence of a salient extrinsic reinforcement contingency may be more apparent than real, and a prolonged, careful observation would in all likelihood reveal an extrinsic reinforcement schedule in effect. It still remains, however, that palpable stimulus events, heretofore unrecognized as having reinforcement potential, can serve to maintain operant responding, and it may very well be that the variety and type of response-produced stimulus changes allowed by the design of a task are among its most fundamental properties.

Given that some tasks are more intrinsically *reinforcing* than others, there should be some sort of interaction effect when a salient extrinsic reinforcement contingency is introduced across tasks that vary in their intrinsic reinforcing properties. Though the possibility of interaction effects has not been entirely ignored by behaviorists, it has not, until recently, been a pressing concern. "B-MOD" enthusiasts, in particular, have rarely introduced an extrinsic reinforcement contingency unless there was a problem (task performance was not being maintained at a satisfactory level). They have, therefore, had little opportunity to observe an interaction effect, and the most likely assumption is that there is none (an extrinsic reinforcement contingency works equally well for all manner of tasks, subjects, and other conditions), or that there is a simple interaction in which the extrinsic contingency has the greatest effect when the prevailing intrinsic reinforcement contingencies are least effective. Recently, however, behaviorists from many quarters have come to recognize that positive reinforcement contingencies do not always work like they are supposed to, and in particular, that they may sometimes have a *detrimental* effect (Balsam & Bondy, 1983; Scott, 1975; Scott & Podsakoff, 1985).

There are several possibilities. Reinforcing events and any stimuli classically paired with them will elicit respondent behavior which may include species-typical approach and investigatory and consummatory responses, in addition to changes in arousal level and activity in the autonomic nervous system. Any or all of these respondents may be incompatible with, and thus impede task operants maintained, however effectively or ineffectively, by the contingencies prevailing before the announcement of the extrinsic contingency or its actual administration.

Another potential detrimental effect stems from the fact that salient reinforcing events may also serve as discriminative stimuli and in that capacity may evoke operants which are incompatible with task performance. For example, behavior (other than task performance) designed to gain the attention of the reinforcing agent or to otherwise procure the reinforcer (begging, stealing, etc.) may be evoked at the expense of task performance.

The detrimental effects discussed above are usually immediate and transient, if they occur at all. Perhaps the most vexing of the potential detrimental effects, if it can be substantiated, is the delayed and presumably permanent effect which has been brought to our attention by cognitive theorists. Their theory, as we have indicated, is that salient extrinsic reinforcement contingencies destroy or reduce intrinsic motivation. The effect, it is maintained, can be observed after the extrinsic contingency has been withdrawn and may be seen in a reduced tendency to return to the task or in the tendency to perform it at a rate lower than observed before the contingency was introduced. Our translation of the postulate is that the announcement and/or the administration of a salient extrinsic reinforcement contingency may reduce or impair the effectiveness of any intrinsic reinforcement contingencies prevailing by virtue of the design of the task, the detrimental effect being greater, the more powerful the intrinsic reinforcement contingencies. But whatever the interpretation, an interaction effect is hypothesized which is quite the opposite of that which most behaviorists are likely to advance. Therefore, further studies are needed not merely to settle a paradigmatic dispute but also to help us fashion a more effective behavioral technology. If some tasks, by their nature, seem to be more reinforcing than others, we would be in a better position to design tasks if we came to understand their nature (what it is about them that renders them more or less capable of sustaining task operants). And if the effects of extrinsic reinforcement contingencies include those which are detrimental as well as facilitative, our developing behavioral technology would be enormously improved if the detrimental effects and the conditions under which they are likely to occur could be identified.

It was the purpose of this study to (1) examine the effects of variations in response-produced stimulus events (sensory behavior) on behavior in two tasks varying in level of complexity, and (2) examine both the immediate and delayed effects of announcing and administering an extrinsic monetary reinforcement contingency.

We were interested in the immediate effects of the announcement of an extrinsic reinforcement contingency and an intrinsic (sensory) reinforcement condition on performance, and on self-reports of task attractiveness. We were also interested in the effects of those treatments on the amount of time spent on the assembly task during a discretionary period as well as on total assembly productivity over the course of a second work period.

We hypothesized that there would be significant main effects of the intrinsic reinforcement treatment on self-reports of task attractiveness, on amount of time spent on the assembly task during the discretionary period, and on number of assemblies completed during the second work period. We were uncertain about the effects of this treatment on productivity during the first period since the intrinsic reinforcing events might elicit and/or evoke both respondent and operant responses incompatible with task operants, especially early on. (For this reason, we discriminated between "consummatory" response and "instrumental" response times, and recorded both.)

We further hypothesized that the announcement of the extrinsic reinforcement contingency would have a significant effect on performance during the first period. That leaves open the question of the effects of the announcement and the administration of the monetary reinforcement on self-reports of task attractiveness, on amount of time spent in the assembly task during the discretionary period, and on total productivity (number of assemblies completed) during the second work period. We believe that at least some cognitive theorists would predict that the effect of the extrinsic contingency would be to reduce the amount of discretionary time spent on the task after the contingency had been withdrawn, and that the effect would be more pronounced the more intrinsically motivating (reinforcing) the task. We, on the other hand, hypothesized that the effects of the extrinsic reinforcement contingency would be to (1) increase performance while the contingency was in effect, and possibly (2) bring about a slight reduction in the reinforcing properties of the intrinsic reinforcers through habituation effects. Given those effects, there should be a reduced tendency to return to the task and to perform it when the extrinsic monetary contingency no longer prevails. However, that effect should be more apparent when the task is *less* intrinsically motivating since there should be more opportunity for habituation effects.

Our hypotheses with respect to the effects of variation in task complexity were quite similar to those having to do with variation in sensory or intrinsic reinforcement. Increasing the complexity of the task would almost certainly result in a decrease in rate of output. In fact, the two tasks require different operants and cannot be compared in terms of productivity. However, the effect of the extrinsic reinforcement contingency on self-reports of task attractiveness and discretionary time on the task should be more negative (if one is a cognitive theorist) or more positive (if one is a behaviorist) for the complex task than for the simple task.

METHOD

Subjects

The subjects were 96 male students who were enrolled in multiple sections of an organization behavior course. Subjects were recruited by means of sign-up sheets circulated in class. The experiment was described as involving "task behavior" and there was no mention of any compensation for experimental participation other than that the research requirement of the course could be fulfilled by participants in this study.

Experimental Tasks and Manipulation of Task Properties

Three types of tasks were utilized in this study—a proofreading task, a coding task, and an assembly task. While the proofreading task and the coding task were alternative tasks in this study (see later), the assembly task was the target task in which task complexity and intrinsic (sensory) reinforcement were varied.

Materials for the proofreading task consisted of a handwritten draft of a lengthy paper selected from a physics journal and a typed draft of that manuscript. Subjects were required to proof the typed manuscript and to circle the errors. The mean number of errors per page was five with a range from two to eight.

Materials for the coding task consisted of a series of tables summarizing dollar sales for each of six types of retail outlets in the several counties and major cities in Indiana, and a stack of IBM coding sheets. Subjects were required to transfer the data from the tables to the coding sheets, one for each page of tables.

Materials for the assembly task consisted of 8 in. by 10 in. frames and bags of parts, both of which were made of crescent mat boards. To perform the task, the subjects were instructed to first assemble the pieces in the frame. Then they were instructed to turn the assembly over and record the five digit number written on the back of the assembly on a recording sheet provided. They then stacked the completed assembly, and proceeded to the second assembly, and so on.

The two independent variables in this study—*task complexity* and *sensory reinforcement*—both involved manipulating certain features of the assembly task. Specifically, task complexity had two levels. In the simple task condition, the subjects were asked to assemble a series of assemblies of the same geometric configuration. In the complex task condition, the subjects were asked to assemble a series of assemblies of four different geometric configurations.

There were also two levels of sensory reinforcement. In the high sensory reinforcement condition, a picture was glued to the back of each completed assembly. In the low sensory reinforcement condition, there was no picture on the back of the completed assembly. The pictures varied over trials and covered a variety of topics, such as sports events, sceneries, and male and female models exhibiting various fashions and/or engaged in a variety of activities.

In sum, four different versions of the assembly task were created for this study, each of which corresponded to a combined level of task complexity and sensory reinforcement. They were:

A. the complex picture assembly task (high task complexity and high sensory reinforcement)

B. the complex plain assembly task (high task complexity and low sensory reinforcement)
C. the simple picture assembly task (low task complexity and high sensory reinforcement)
D. the simple plain assembly task (low task complexity and low sensory reinforcement).

Monetary Reinforcement

There were two conditions of monetary reinforcement in this study. In the *announced piece-rate reinforcement condition,* the subjects were told that for each assembly they completed, they would be paid at a fixed rate. The rates were set differently for the subjects in the simple task condition vs the subjects in the complex task condition because a pilot study showed that subjects in these two conditions performed at different rates. To make the average payment approximately equal across the two conditions, the rates were set at 8 cents for each complex assembly completed and 6 cents for each simple assembly completed.

In the *unannounced reinforcement condition,* the subjects received no mention of reward prior to engaging in the task. At the end of the work period they received payments which equaled the amount paid to their yoked partners in the announced piece-rate condition.

Procedure

Upon arrival at the laboratory, the subject was greeted by a male experimenter in the waiting room and then asked to sign an informed consent document if the subject agreed to participate in the experiment. The informed consent document described the study as collecting baseline data for several standard laboratory tasks to be used in future research projects. All subjects agreed to participate in the study.

The experimenter then led the subject to an observation room in which there was a chair and a table set against the wall. One of the four versions of the assembly task materials was placed on the table, depending on the treatment condition of the subject. A large number of assemblies were always furnished so that no subject could complete them in the time allowed. All subjects were then given the following instructions:

> There are two work periods in this experiment. In the first work period I would like you to perform this assembly task for about fifteen minutes. The instructions for the assembly task are on the table, but in addition, I would like to tell you how to perform it and then demonstrate how it is to be performed. It is important that you perform this task exactly as I show you.

After the above instructions, the experimenter demonstrated the manner in which the subject was to perform the assembly task for two trials, and then answered any questions that the subject had about the assembly task. Afterward, subjects in the announced piece-rate reinforcement condition were given the following instructions:

> In this work period, you will have a chance to earn some money. For each assembly you complete in the next fifteen minute period, you will be paid 6 (8) cents. You will receive the money in cash as soon as this work period is over. Do you have any questions? You may begin.

Subjects in the unannounced reinforcement condition received no mention of monetary rewards. They were simply told: "Do you have any questions? You may begin."

At the end of the 15-min work period, all subjects were stopped. Subjects in the announced piece-rate condition were paid according to the number of units completed. Subjects in the unannounced reinforcement condition received no mention of reward at this time. Then, all subjects were asked to fill out a semantic differential scale for the assembly task (Scott, 1967; Scott & Rowland, 1970). Subjects in the unannounced reinforcement condition were then told that the experimenter had forgotten to mention that the project team had some research funds available and was able to pay the subject a fixed amount of money for this participation. The subjects in this condition were then paid the same amount as their yoked partners, which was on the average about $1.50 for the 15-min period. (*All* subjects were paid $2.00 for their participation in the second observation period, as noted later.) The experimenter then announced that the first stage of the experiment was over and led the subject to a different room for the second work period.

There were three tables in the observation room for the second work period. Materials for the proofreading task, the coding task, and the assembly task were placed on three adjacent tables arranged in a semicircle. Control boxes housing a row of three green lights were also placed on each table. The type of assembly task assigned to each subject in this period was identical to the one the subject had performed in the first period.

The procedures for the second period of the experiment were identical for all subjects. The subject was first asked to be seated in front of the table, and then received the following instructions:

> For this second work period, I would like you to perform these three task activities for a total of about thirty minutes. At the end of this work period, you will be paid two dollars for your participation. Do you have any questions? Now, I would like to tell you how to perform each task and then demonstrate how they are to be performed. Again, it is important that you perform each task exactly as I show you.

The experimenter then told the subject that the assembly task was very similar to the one they just performed, and they should perform it in the same manner. He then proceeded to explain and demonstrate the manner in which they were to perform the coding and proofreading tasks. After the demonstration, the subject received the following task sequencing instructions:

> The task you are to perform at any given time will be indicated by the lights on each box. As the labels under the lights indicate, each green light is associated with one particular task. All three boxes will have the same light or lights illuminated. When the green light for a given task is on, you should perform that task. When it is not on, you should not perform that task. If the light goes off while performing a given task, you should stop performing that task and immediately switch to the task for which the green light has been turned on, and so on. If, for example, the light for the task which you are performing goes off and the lights for the other two tasks come on, you are to stop performing the task you're on and switch to one of the other tasks. You may perform whichever of the remaining tasks you like and switch between them whenever you like. On the other hand, should one or more lights come on in addition to the light for the task you are performing, you may continue to perform that task or switch to another or alternate between them so long as the green lights are on. Do you have any questions? OK! You should begin performing the appropriate task when a light comes on. When all task lights are turned off, you should stop performing. At that time, I'll come in and have you complete some questionnaires.

After the above instructions, the subject performed the proofreading task for 10 min, the assembly task for 5 min, and finally the coding task for approximately 6½ min, as cued by the green lights.[1] Following this performance, the experimenter began the "discretionary" period by turning on the green lights for all three tasks; this period lasted for 8 min. During this period, the experimenter unobtrusively recorded the amount of time the subject spent on the assembly task. At the end of this period, the experimenter entered the observation room, stopped the subjects, and asked them to complete some self-report measures before dismissing them.

Dependent Variables

Several classes of dependent variables were collected in this study, including task reinforcement, task performance, and self-reports of task complexity. Task reinforcement, as an index of the amount of "intrinsic motivation" embodied in a task, was measured in two different ways. The primary measure was the amount of discretionary time spent on the assembly task. The second measure consisted of self-reports of task attrac-

[1] The purpose of having all subjects perform the three tasks before allowing access to all of the tasks during the discretionary period was to allow them the opportunity to experience at least one complete cycle for each task. Our pilot studies indicated that the times described above on each task were sufficient to do that.

tiveness. These self-reports were obtained at the completion of the first work period by using the following semantic differential scales (Scott, 1967; Scott & Rowland, 1970) set against the concept ASSEMBLY TASK: interesting–boring, exciting–dull, bad–good, attractive–repulsive, and superior–inferior. Self-reports of task complexity were measured in a similar manner by using the following bipolar adjectives: difficult–easy, complex–simple, and varied–routine.

The primary measure of task performance was the number of assemblies completed in a given period of time. It should be noted that if the subject did not assemble the pieces correctly, the pieces would not fit the rectangular hole and the subject would not be able to turn the frame over to complete a trial.

In addition to the above overall measure of performance, the amount of time taken to complete each assembly was also recorded by use of a multiple channel event recorder. This time was further broken down into two components: *instrumental response time* and *consummatory response time*. The former refers to the amount of time taken to actually assemble the pieces together to form a rectangle. The latter refers to the amount of time taken to record the number on the back of a completed assembly. Since the sensory reinforcer (picture) also appeared on the back of each picture assembly, the consummatory response time for the picture assembly task includes the amount of time taken to record the number as well as the time to view the picture.

RESULTS

Performance Effects—First Period

A $2 \times 2 \times 2$ ANOVA was utilized to assess the effects of sensory reinforcement, task complexity, and the announcement of the monetary reinforcement contingency on the number of assemblies completed in the 15-min work session of the first period. The means, standard deviations, and the results of the ANOVA are summarized in Table 1. It was found that the announcement of piece-rate monetary reinforcement had a significant main effect on performance [$F(1,88) = 13.20, p < .001$]. Subjects in the announced extrinsic reinforcement condition completed more assemblies than subjects in the unannounced extrinsic reinforcement condition. It was also found that subjects who performed the complex assembly task completed significantly fewer assemblies than those in the simple assembly treatment [$F(1,88) = 70.8, p < .001$]. Subjects in the complex assembly condition also reported the task to be more complex (mean = 2.72) than subjects in the simple task condition (mean = 1.62) [$F(1,88) = 36.16, p < .001$]. Sensory reinforcement, however, was found to have no significant effect on number of assemblies completed, although

TABLE 1

MEANS AND RESULTS OF ANALYSIS OF VARIANCE OF NUMBER OF ASSEMBLIES COMPLETED IN THE FIRST WORK PERIOD (15 MIN)

Task complexity	Sensory reinforcement	Mean score: Reinforcement piece-rate	Mean score: Contingency unannounced	Source	Analysis of variance: *df*	*MS*	*F*
				Main effects			
Complex	High	17.7	13.6	Task complexity (T)	1	1917.10	70.80*
				Sensory reinforcement (S)	1	52.50	1.90
Complex	Low	17.5	15.0	Reinforcement contingency (R)	1	356.50	13.20*
Simple	High	25.3	22.1	Interaction effects			
				T × S	1	17.50	0.65
Simple	Low	28.8	23.3	T × R	1	7.60	0.28
				S × R	1	0.84	0.03
				T × S × R	1	23.00	0.85
				Error	88	27.10	

* $p < .001$.

subjects tended to perform *fewer* assemblies in the picture assembly condition than subjects in the plain assembly condition. None of the interaction effects were significant.

Another way that sensory reinforcement might affect task performance is through its effect on consummatory response time. Table 2 shows the means, standard deviations, and the results of the ANOVA on average consummatory response time across all trials. The results indicate that subjects in the picture assembly condition tended to have longer consummatory response times than subjects in the plain assembly condition [$F(1,88) = 5.48, p < .05$]. This result suggests that sensory reinforcers in the form of pictures may have evoked or elicited responses that were incompatible with the behavior required in noting and recording the assembly number and/or the behavior required on the next assembly, or both.

Treatment Effects After First Period

As indicated earlier our primary indicators of the effects of the reinforcement treatments on "intrinsic motivation" were self-reports of task attractiveness obtained at the end of the first period and "discretionary time" on the assembly task in the second period. These two measures were found to be significantly correlated ($r = 0.41, p < .001$). A $2 \times 2 \times 2$ multivariate analysis of variance was therefore utilized to assess the effects of task complexity, sensory reinforcement, and the administration of monetary reinforcement contingency on the two measures. The results revealed two significant main effects: one due to sensory reinforcement [$F(2,87) = 5.00, p < .008$] and the other to task complexity [$F(2,87) = 3.71, p < .03$]. However, neither the main effect due to monetary reinforcement nor any of the interaction effects were significant.

Two univariate analyses of variance were further performed on each of the two indices. Table 3 presents the means, standard deviations, and results of the ANOVA on discretionary time in the assembly task. The results corroborated the multivariate findings and indicated that both sensory reinforcement and task complexity had significant main effects on discretionary time on the assembly task. Subjects who performed the picture assembly spent more discretionary time on the assembly task than those who performed the plain assembly [$F(1,88) = 8.20, p < .01$]. Subjects who performed the complex assembly task spent more discretionary time on it than those who performed the simple assembly task [$F(1,88) = 7.40, p < .01$].

Table 4 contains the means, standard deviations, and results of the ANOVA on the self-reports of task attractiveness. It was found that self-reports of task attractiveness were more positive in the high-sensory reinforcement condition than in the low-sensory reinforcement condition

TABLE 2

CONSUMMATORY RESPONSE TIME MEAN SCORES AND ANALYSIS OF VARIANCE (IN SECONDS)

		Mean score			Analysis of variance		
Task complexity	Sensory reinforcement	Reinforcement piece-rate	Contingency unannounced	Source	*df*	*MS*	*F*
				Main effects			
Complex	High	9.33	11.52	Task complexity (T)	1	9.96	2.58
				Sensory reinforcement (S)	1	21.19	5.48*
Complex	Low	8.82	9.15	Reinforcement contingency (R)	1	61.47	15.89**
Simple	High	8.64	9.92	Interaction effects			
				$T \times S$	1	6.03	1.56
Simple	Low	7.54	10.14	$T \times R$	1	2.77	0.72
				$S \times R$	1	0.42	0.11
				$T \times S \times R$	1	15.07	3.90
				Error	88	3.87	

* $p < .05$.
** $p < .001$.

TABLE 3
DISCRETIONARY TIME MEAN SCORES AND ANALYSIS OF VARIANCE

		Mean score			Analysis of variance		
Task complexity	Sensory reinforcement	Reinforcement piece-rate	Contingency unannounced	Source	*df*	*MS*	*F*
				Main effects			
Complex	High	6.11	5.32	Task complexity (T)	1	70.20	7.40*
				Sensory reinforcement (S)	1	78.10	8.20*
Complex	Low	5.21	3.68	Reinforcement contingency (R)	1	2.60	.27
Simple	High	4.37	4.71	Interaction effects			
				T × S	1	6.78	0.71
Simple	Low	1.87	2.53	T × R	1	16.60	1.74
				S × R	1	0.26	0.027
				T × S × R	1	1.69	0.18
				Error	88	9.52	

* $p < .01$.

[$F(1,88) = 5.34$, $p < .03$]. The main effect due to task complexity was nonsignificant, although an examination of cell means revealed that subjects who performed the complex assembly task tended to report the task as more attractive than those who performed the simple assembly task.

In summary, the above results indicated that both task complexity and sensory reinforcement had a positive effect on self-reports of task attractiveness and discretionary time in the task. The announcement and administration of the monetary reinforcement contingency, however, had no significant effect on either measure; nor was a significant interaction effect observed.

Another important effect of our experimental treatments can be seen in the performance of the assembly task during the follow-up period in which subjects were required to perform the task for 5 min, and could have performed it for an additional 8 min at their discretion. A $2 \times 2 \times 2$ ANOVA was conducted to assess the effects of the experimental treatments on the number of assemblies completed in this 13-min work period. The means, standard deviations, and results of the ANOVA are shown in Table 5. The results reveal that sensory reinforcement had a significant effect on performance [$F(1,88) = 7.40$, $p < .01$]. Subjects who performed the high sensory reinforcement condition completed more assemblies than subjects in the low sensory reinforcement condition. There was also a trend for subjects in the complex assembly treatment to complete fewer assemblies than subjects in the simple assembly treatment, although this effect was not significant ($p < .08$). None of the other main or interaction effects were significant.

SUMMARY AND DISCUSSION

When we "enrich" a task as we did here, by designing in response-produced (i.e., contingent) sensory reinforcers, our subjects reported the task to be more interesting, exciting, good, and attractive; spent more time on the task during a discretionary period; and completed a greater number of assemblies in the second work period than subjects in the "unenriched" task. These results are in accord with Skinner's (1953) suggestion that organisms, human and otherwise, may be reinforced by simply making the world behave, and with the results of a large number of studies (Kish, 1966; Scott, 1966; Scott & Erskine, 1980) in which it has been shown that response-produced changes in sensory stimulation have reinforcing properties. Therefore, it seems clear that when one happens upon a task that is "intrinsically motivating" in the sense that it evokes and sustains operant behaviors in the absence of salient extrinsic rewards, it is more fruitful to look for nonobvious or intrinsic reinforcers which are contingent upon performing and which do not require monitoring, judgement, or any other type of intervention by another person.

TABLE 4
SELF-REPORTS OF TASK ATTRACTIVENESS MEAN SCORES AND ANALYSIS OF VARIANCE

		Mean score			Analysis of variance		
Task complexity	Sensory reinforcement	Reinforcement piece-rate	Contingency unannounced	Source	*df*	*MS*	*F*
				Main effects			
Complex	High	4.05	3.67	Task complexity (T)	1	1.13	1.04
				Sensory reinforcement (S)	1	5.80	5.34*
Complex	Low	3.88	3.27	Reinforcement contingency (R)	1	1.60	1.47
Simple	High	3.63	4.07	Interaction effects			
				T × S	1	1.04	0.96
Simple	Low	3.38	2.92	T× R	1	1.40	1.29
				S × R	1	1.93	1.77
				T × S × R	1	0.67	0.61
				Error	88	1.09	

* $p < .05$.

TABLE 5
MEANS AND RESULTS OF ANALYSIS OF VARIANCE OF NUMBER OF ASSEMBLIES COMPLETED IN THE SECOND WORK PERIOD[a]

		Mean score			Analysis of variance		
Task complexity	Sensory reinforcement	Reinforcement piece-rate	Contingency unannounced	Source	*df*	*MS*	*F*
				Main effects			
Complex	High	15.67	12.58	Task complexity(T)	1	112.67	3.10
				Sensory reinforcement (S)	1	266.67	7.40*
Complex	Low	13.83	10.75	Reinforcement contingency (R)	1	48.17	1.30
Simple	High	18.00	17.58	Interaction effects			
				T × S	1	54.00	1.50
Simple	Low	12.50	13.42	T × R	1	66.67	1.86
				S × R	1	2.67	0.07
				T × S × R	1	2.67	0.07
				Error	88	35.94	

[a] This includes the 5-min required time on the assembly task and the 8-min discretionary time period discussed above.
* $p < .001$.

It remains, however, that in this study the built-in sensory reinforcement did not result in an increase in performance in the first work period (in fact, there was a decrement in performance, although it was not significant). We believe that this may be a common finding, although it would require a fine-grained analysis to reveal it. As indicated earlier, reinforcing consequences, intrinsic or otherwise, are expected to elicit a variety of respondents, including increases in arousal, species-typical approach, investigatory and consummatory responses, and quite possibly investigatory and manipulatory operants, any one or all of which might intrude upon task performance or be incompatible with subsequent task operants. Though our measure of consummatory responding was admittedly crude, we did find that in the high-sensory reinforcement condition, there was a significant increase in consummatory response time, thus precluding a significant increase in task performance.

As noted earlier, we introduced the task complexity treatment since we had reason to believe that a task that requires a greater variety of operants is likely to be more intrinsically reinforcing, and because cognitive theorists have hypothesized that salient extrinsic reinforcement contingencies are more disruptive when the task is more complex or requires a greater number of operants, especially of the pre-current problem-solving type. As anticipated, subjects performing the complex task treatment produced fewer assemblies than those performing the simple task treatment across all other conditions, but before one speculates about this presumed negative finding, there is a question about the comparability of the performance measures for the two tasks. As in most studies, the manipulation of task complexity in this study entailed a change in their response requirements. Consequently, performance or the rate of responding in the two tasks is not directly comparable. So we have to look elsewhere for the potentially reinforcing effects of "enriching" the task by increasing its complexity (altering response requirements). One place might be in the self-reports of task interest or task attractiveness. However, there were no significant differences in the self-reports of task attractiveness across the task complexity treatments, though the trend was in the expected direction. Another place to look is in the amount of discretionary time spent on the task in the second work period, and in this case the differences were quite significant. Subjects performing the complex assembly task showed a greater propensity to return to it during the discretionary period than subjects performing the simple assembly task. Thus, we conclude that while we may reduce, quantitatively, the level of performance by increasing task complexity, such a treatment may make it more intrinsically reinforcing in the sense that subjects will continue to perform it over longer time intervals in the absence of an effective extrinsic reinforcement contingency.

Turning now to the effects of introducing an extrinsic reinforcement contingency, it was found that the announcement of a salient extrinsic reinforcement contingency produced a significant increase in the level of performance, which was sustained throughout the period in which the contingency was in effect. This is, of course, contrary to the hypothesis that a salient extrinsic reinforcement contingency will produce a decrement in the condition called intrinsic motivation, and the behavior presumably brought about by it. Moreover, the combination of the announcement of the extrinsic monetary contingency and the delivery of the monetary reinforcement at the end of the first period did not produce a decrement in the self-reports of task attractiveness. Indeed, the trend was in the opposite direction. The combined announcement of the monetary reinforcement contingency and the administration at the end of the first period also had no decremental effect on the amount of discretionary time spent on the task in the second period or in the number of assemblies completed in the 13-min time interval in which they were either required or had the opportunity to perform the assembly task.

In this study we found *no* evidence of the truth value of the most general form of the postulate that "extrinsic rewards" (i.e., salient and response contingent reinforcers administered by others) impair something called intrinsic motivation and the behavior presumably governed by it. Nor did we find any evidence in support of the more limited versions of the postulate such as (1) the extrinsic reward has to be signaled (announced rather than simply administered), expected, and salient if it is to have the detrimental effect, (2) the detrimental effect can be seen most clearly in the reduced tendency to return to the task after the contingency has been withdrawn, and perhaps in no other way, and (3) the detrimental effect will be more significant the more intrinsically motivating (reinforcing) the task.

There is a great deal of evidence here and elsewhere that appropriately scheduled extrinsic reinforcers such as money will maintain task behaviors at high and stable rates so long as the contingency prevails. There is also a great deal of evidence that task operants will show a significant decline when the extrinsic contingency is withdrawn. Moreover, there is a great deal of evidence in addition to that produced in this study that the decline will be *less,* not more, precipitous when the task design allows for the production of the contingent stimulus events we have come to call sensory or intrinsic reinforcers. We therefore conclude that when the extrinsic reinforcement contingencies are poorly designed and administered, allowing for a great deal of "discretion" (i.e., the extrinsic reinforcers will continue at the same level of density though operants other than those required for task performance are emitted for significant periods of time) as many are in formal organizations, task design which allows for the provision of intrinsic reinforcement contingencies is an important consideration. Finally, there is little reason to believe that the design and implementation of a more effective extrinsic reinforcement schedule will destroy one's pride in one's work, the intrinsic worth or meaningfulness of the job, or one's predilection to perform it. On the contrary, there is every reason to believe that all of those behaviors, both respondent and operant, will be facilitated.

REFERENCES

Balsam, P. D., & Bondy, A. S. (1983). The negative side effects of reward. *Journal of Applied Behavior Analysis*, **16**, 283–296.

Berlyne, D. E. (1967). Arousal and reinforcement. In D. Levine (Ed.), *Nebraska symposium of motivation*. Lincoln: University of Nebraska Press.

De Charms, R. (1968). *Personal causation: The internal affective determinants of behavior*. New York: Academic Press.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, **18**, 105–115.

Fowler, H. (1971). Implications of sensory reinforcement. In R. Glaser (Ed.), *The nature of reinforcement*. New York: Academic Press.

Kish, G. B. (1966). Studies of sensory reinforcement. In W. Honig (Ed.), *Operant behavior: Areas of research and application*. New York: Appleton-Century-Crofts.

Lepper, M. R., & Greene, D. (1978). Divergent approaches to the study of rewards. In M. R. Lepper & D. Greene (Eds.), *The hidden cost of rewards*. Hillsdale, NJ: Lawrence Erlbaum Associates.

McGraw, K. O. (1978). The detrimental effects of reward on performance: A literature review and a prediction model. In M. R. Lepper & D. Greene (Eds.), *The hidden cost of reward*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Scott, W. E., Jr. (1966). Activation theory and task design. *Organizational Behavior and Human Performance*, **1**, 3–30.

Scott, W. E., Jr. (1967). The development of semantic differential scales as measures of "morale." *Personnel Psychology*, **20**, 179–198.

Scott, W. E., Jr. (1975). The effects of extrinsic rewards on "intrinsic motivation": A critique. *Organizational Behavior and Human Performance*, **13**, 339–351.

Scott, W. E., Jr., & Erskine, J. A. (1980). The effects of variations in task design and monetary reinforcers on task behavior. *Organizational Behavior and Human Performance*, **25**, 311–335.

Scott, W. E., Jr., & Podsakoff, P. M. (1985). *Behavioral principles in the practice of management*. New York: John Wiley.

Scott, W. E., Jr., & Rowland, K. M. (1970). The generality and significance of semantic differential scales as measures of "morale." *Organizational Behavior and Human Performance*, **5**, 576–691.

Skinner, B. F. *Science and human behavior*. New York: Free Press.

RECEIVED: August 28, 1986