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The Effects of a Reinforcer on Behavior Maintained by a Second External Reinforcer

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THE EFFECTS OF A REINFORCER ON BEHAVIOR MAINTAINED BY A SECOND EXTERNAL REINFORCER

by

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A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
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Western Michigan University
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A number of studies has shown that providing extrinsic rewards for performing an "intrinsically interesting" task decreases an individual's subsequent interest in that task when the rewards are no longer available (e.g., Deci, 1971, 1972; Lepper, Greene, & Nisbett, 1973). Based on these results, many have argued that extrinsic rewards decrease an individual's "intrinsic motivation." A fundamental premise of this argument is that "extrinsic" and "intrinsic motivation" are functionally different, a distinction that is not supported by a behavioral analysis. This study examined whether similar subsequent decrements in task performance would be observed when a behavior is maintained by one type of external reinforcer and a second type of reinforcer is provided for a period of time and then made unavailable; thereby examining the effects of extrinsic reward on "extrinsic motivation."

Two subjects completed all critical phases of this study. One subject showed a performance decrement following the termination of the second reinforcer. These results indicate that the interference in performance is not limited to situations where extrinsic rewards are provided for performing an "intrinsically interesting" task. Rather, this interference can occur when an extrinsic reinforcer is provided, and later removed, contingent upon performing a task maintained by another extrinsic reinforcer. These results challenge the distinction between "extrinsic" and "intrinsic motivation."
ACKNOWLEDGEMENTS

I would like to thank my parents for the many ways they provided support and encouragement throughout my studies.

Jeanne Marie LaMere
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Western Michigan University, 1990
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CHAPTER I

INTRODUCTION

Behavior that occurs in the absence of obvious reinforcement has been labeled as "intrinsically interesting." Several studies have demonstrated that when external rewards are provided for engaging in such activities, an individual's "intrinsic interest" in the activity decreases (e.g., Deci, 1971, 1972; Lepper, Greene, & Nisbett, 1973). In other words, under some conditions, when the external rewards were no longer available, individuals engaged in the task less often than they did prior to receiving the rewards.

Cognitive psychologists have developed several theories as to why this decrease in "interest" occurs. First, Lepper et al. (1973) claim that this decrement occurs as a result of a change in an individual's perception of the causes of his/her behavior. When behavior occurs in the absence of salient external rewards, the individual perceives the behavior as an end in itself; it is intrinsically motivated. On the other hand, behavior that is followed by salient external rewards is perceived as a means to an end; the end being the external reward. When an intrinsically motivated behavior becomes externally rewarded, the individual perceives a shift in the cause of the behavior. The behavior, which was previously an end in itself, becomes a means to an end. Thus, intrinsic motivation is reduced when external rewards are provided. When these external rewards are removed, the behavior decreases because the perceived cause of the behavior, the external reward, is no longer present.

A second theory which attempts to explain the decrease in performance of an "intrinsically interesting" task following the removal of external rewards was
developed by Deci (1971, 1972, 1980). Like Lepper and his colleagues, Deci also
explains the decrement as a result of a change in the perceived cause of behavior.
However, Deci describes what he believes to be the mechanism underlying this
change in perception. He claims that there are two different "subsystems" of
motivation for behavior, intrinsic and extrinsic. Motivational subsystems consist of
the "set of affective experiences, beliefs, and attitudes about oneself, the environment,
and others, and programs for interaction with one's environment" (Deci, 1980, p.
41). When an individual engages in an activity only for that activity itself, the
intrinsic motivational subsystem is operating. On the other hand, the extrinsic
motivational subsystem is in effect when the individual performs the behavior in order
to obtain external rewards. A change in the subsystem that is in effect, i.e., intrinsic
to extrinsic, occurs when external rewards are provided for performing an activity that
was initially intrinsically motivated. It is this shift in subsystems that results in the
individual's perceiving a shift in the cause of the behavior. That is, the individual
sees that he/she is not engaging in the task because it is "interesting," but rather, the
individual believes that he/she is behaving in order to receive the external reward.
Following the termination of the external rewards, the behavior decreases because
neither source of motivation is present.

Both of the above theories, and the predictions resulting from them, are based on
a fundamental distinction between intrinsically motivated behavior and extrinsically
motivated behavior. However, it is possible that these two types of behaviors are not
functionally different. There are at least two behavioral explanations of how a so
called "intrinsically motivated" behavior is maintained. First, it is possible that a
behavior is reinforced very infrequently, and, as a result, observers typically do not
see the presentation of the reinforcer. Second, behavior that appears to be
"intrinsically motivated" may be maintained by response-produced stimuli (Vaughan
Response-produced stimuli can become reinforcing by being paired with other reinforcers, such as praise and approval. For example, visual stimuli, such as puzzle pieces put together, and auditory stimuli, such as the tone resulting from pressing a piano key, are response products which may become reinforcing as a result of their being paired with social approval from parents and teachers.

As a result of this explanation, Porac and Salancik (1981) concluded that behaviors labeled "intrinsically interesting" are actually maintained by one type of reinforcer, either by an intermittently presented reinforcer or by response-produced stimuli. When external reinforcers are given for engaging in the so called "intrinsically interesting" behavior, the individual is being presented with two types of reinforcers. Therefore, if intrinsically motivated behavior is not functionally different from extrinsically motivated behavior, the decrements in task performance described in the beginning of this paper should also be seen when an "uninteresting" behavior is maintained by one type of external reinforcer and a second type of reinforcer is provided for a period of time and then made unavailable.

One study has been conducted to determine if the addition of a second type of reward reduces performance of a behavior, which is being maintained by another external reward, once that additional type of reward is made unavailable (Porac & Salancik, 1981). These researchers used a between-group design in which one group of college students received money and course credit for engaging in a "boring" activity, while a second group of college students received only money for performing the same task. Later, when both groups were given an opportunity to engage in the activity for money alone, the researchers found that the group that originally received only money was much more likely to continue to perform the behavior. Therefore, the availability of a second type of reward did appear to
interfere with the effectiveness of a single reward. Porac and Salancik concluded that their results call into question the distinction between intrinsically motivated behavior and extrinsically motivated behavior.

One major weakness of the study mentioned above concerns the nature of the rewards chosen. It is possible that these rewards did not constitute true reinforcers. For example, the amount of money given, $0.25 per completed task, was relatively low. Therefore, the money may not have been the variable maintaining the behavior. Also, the course credits given to the subjects in one group were too delayed to be labeled as reinforcers.

The current study was an attempt to determine if intrinsically motivated behavior and extrinsically motivated behavior are functionally equivalent. Like the Porac and Salancik study, this study included the use of two types of external rewards to determine if the removal of a second type of reward would result in the subjects' engaging in the behavior at a lower rate than they did prior to receiving that second type of reward. However, unlike the Porac and Salancik study, this study included the use of rewards that had been demonstrated to function as reinforcers for the subjects.
CHAPTER II

METHODS

Subjects

Six children, ranging in age from 3 to 7 years, participated in this study. Five of the six children were males. These children were enrolled at a preschool, the Child Development Center, in Kalamazoo, Michigan. They were selected from children at the center whose parents signed consent forms allowing them to participate in the study.

Settings

For Subject 1 and Subject 2, all sessions in this study were conducted in a classroom at the Child Development Center. For Subjects 3, 4, 5, and 6, the sessions were conducted in two different settings. The early sessions of the study took place in the classroom setting at the Child Development Center. The later sessions were conducted in a room in the home of Subjects 3, 4, and 5, who were siblings. This setting change was necessary because the parent of these subjects and the parent of Subject 6, a neighbor of these subjects, removed these children from the preschool during the study.

In each setting a large shelf divided the room into two sections. During the sessions one area was set up for the subject and the second area was set up for the experimenter and an observer. In both settings the shelves were large enough such that the experimenter and the observer could not be seen by the subject during the sessions unless the subject walked around the shelf.
In the classroom setting, on the subject section of the room, two tables and two chairs were arranged such that both tables ran perpendicular to the shelf. One chair was placed at each table so that when the subject was seated at one table the other table was behind him/her. On the experimenter section of the room, a table and two chairs were set up where the experimenter and the observer remained during the sessions.

In the home setting, in the subject area of the room, one long table was placed parallel to the shelf. Two chairs were arranged at the table such that when the child sat on one of the chairs he/she faced the second chair. In the experimenter area the experimenter and the observer sat on the floor during the sessions.

Apparatus/Materials

During all of the sessions two tasks were available to the subject. These tasks were placed on the table(s) on the subject section of the room. In the classroom setting one task was placed on each of the two tables, and in the home setting one task was placed on each end of the table.

The first task was a wood box (16" x 14" x 2") with a hole on the top of the side facing up and a second hole in the center of the side facing the subject. This box was tilted by placing a small block under the far side of the box. A marble was also provided, and when it was put in the top hole it would come out the second hole. Approximately five seconds would elapse between the time the marble was dropped in the top hole and the time it would come out of the other hole. The marble would not emerge immediately from the box because several small pieces of wood, placed in the box in a maze-like fashion, slowed the motion of the marble. Because the box was made entirely of wood, the subject could not see the marble while it was inside the box. This task, labeled the "marble box" for convenience, was selected because
of its "monotonous" or "uninteresting" properties.

The second task was a set of "Tinker Toys," wood and plastic pieces that can be put together to build a variety of items. Because this task allowed the subject to engage in an alternative response during the sessions, it was used to prevent a ceiling effect. Without the availability of this task, performance of the "uninteresting" task would likely be continuous regardless of the experimental phase in effect.

All sessions were video taped by a camera hidden among items on the shelves described above. During the sessions the observer and experimenter observed the subject by watching a television monitor located on the experimenter side of the shelf. The observer recorded the total amount of time the subject spent engaging in each activity by using a recording apparatus consisting of a small desk top attached with four alarm clocks, only three of which were used in this study. One clock was wired to an on/off switch. This clock, used to keep track of total session time, was switched on when the session started and turned off when the session was over. The other three clocks were wired to separate buttons. When a button was pressed, the corresponding clock started timing, and when the button was released, the clock stopped timing. Two of these clocks were used to keep track of the time the subject spent engaging in the two activities. When the subject began engaging in a particular task, the corresponding button was pressed, and it was held down as long as he/she continued engaging in that activity.

Dependent Variable

The dependent variable in this study was the percent of total session time that the subject spent engaging in the marble box task. Engaging in a task was defined by the subject's manipulating it or looking at it. If the subject moved out of the view of the camera, even if he/she was holding part of an activity, no activity was scored. Also,
a response was not scored if the subject was holding part of the activity but looking at something other than the task, for example looking toward a door or window. In addition, a response was not scored if the subject was manipulating a reinforcer or interacting with the observer and/or experimenter.

Two individuals, one graduate psychology student and one undergraduate psychology student, served as observers during this study. Training consisted of providing the observers with a definition of the response and a written list of observation rules. In addition, the observers were provided with an opportunity to score video tapes of subjects from a previous similar study (Dickinson, 1985/1986). Observers were considered adequately trained when agreement, described below, between present observations and previous observations of the tape reached 90%. Both observers reached this criterion after scoring one 15-minute session tape.

Interobserver agreement checks were conducted by the experimenter and one of the observers. For every subject, approximately two sessions per week were rescored. Video-taped sessions were randomly selected and observed on the same television monitor used during the initial observations. Percent agreement was calculated using the frequency ratio method, dividing the smaller time recorded by the larger time and multiplying by 100.

Procedure

General Procedure

At the beginning of each session, the experimenter conducted a reinforcer-selection procedure designed by Dickinson (1985/1986). Several potentially reinforcing items (small toy farm animals, small toy dinosaurs, pennies, rubber spiders, and stickers) were presented to the subject. The child was then asked by the
experimenter which item he/she liked the "best," the "next best," and so on. Next, the child was asked which items he/she wanted to keep. The subject was allowed to take any item he/she selected. Both the verbal ranking and the items kept were recorded by the experimenter, and this information was used to select the reinforcers which were used in the various phases of this study.

Following this reinforcer-selection procedure, the experimenter asked the subject which of the two tasks he/she would like to "play with" first. When the experimenter walked behind the shelf, the session clock was turned on. At the end of 15 minutes the session was terminated, and the experimenter told the subject that they were out of time for the day. A session was terminated early if the subject stated that he/she did not want to play anymore. If a session was terminated before 10 minutes had elapsed, data from the session were not included in the analysis.

During all phases except baseline, reinforcers were delivered periodically by the experimenter. The experimenter walked around the shelf, handed the item to the subject, and allowed the subject to look at it for several seconds. After the subject looked at the item, it was placed in a paper bag that had the subject's name on it. The experimenter then returned to the other side of the shelf and allowed the subject to continue with the tasks on the tables. At the end of the session, the subject was allowed to keep the bag containing all the reinforcers he/she had earned.

Detailed Procedure

Baseline

During this phase, no reinforcers were delivered. The subjects could engage in either task, but no consequences were presented. This phase was included to ensure that the marble box task was, in fact, considered "uninteresting" by the subjects. In
addition, it was included to demonstrate that the rewards provided in the later phases functioned as true reinforcers.

**Single Reinforcement #1**

During this phase, when a subject engaged in the marble box task he/she received one type of reinforcer on a variable interval 2-minute (VI 2') schedule. The reinforcer provided for a particular subject was selected because it was often ranked high by that subject during the reinforcer-selection procedure.

Prior to each session during this phase, the experimenter provided the subject with the following instructions: "If you play with the marble box, every so often you will get a _______ [name of the reinforcer]; but you may play with any toy on the table(s)."

**Single Reinforcement #2**

During this phase the subject received a different reinforcer for performing the marble box task, and the reinforcer delivered during the previous phase was no longer provided. This reinforcer was also delivered according to a VI 2' schedule. As with the previous reinforcer, the particular item provided to a subject was selected because that subject frequently ranked it high during the reinforcer-selection procedure. During this phase each subject received the same instructions as in the previous phase.

**Dual Reinforcement**

In this phase, when the subject engaged in the marble box task, he/she received the first type of reinforcer on a VI 2' schedule. In addition, the second type of reinforcer was delivered on a concurrent VI 2' schedule. This concurrent schedule
was arranged such that the two types of reinforcers were not intentionally given at the same time. Both items were delivered together only if the two intervals happened to elapse at the same time.

During this phase the following instructions were given to the subject: "Just like before, when you are playing with the marble box, every so often you will get a _______ [first type of reinforcer]. Also, when you play with the marble box, from time to time you will get a _______ [second type of reinforcer]; but like before you may play with any toy on the table(s)."

**Single Reinforcement**

During this phase one of the two reinforcers continued to be provided on the VI 2' schedule, while delivery of the other reinforcer was discontinued. The purpose of this phase was to assess the effects of removing a second reinforcer on task performance that is maintained by a different reinforcer.

The instructions provided during this phase were the same as those provided during the previous single reinforcement phases.

**Dual Reinforcement**

The instructions and conditions present during the first dual reinforcement phase were reintroduced.

**Single Reinforcement**

In this phase, the instructions and conditions present during the previous single reinforcement phases were again introduced. This phase was again presented to assess the effects of removing a reinforcer on the behavior maintained by another reinforcer.
CHAPTER III

RESULTS

Interobserver Agreement Data

As stated earlier, for each subject, approximately two sessions per week were rescored. The number of sessions rescored and the percent of total sessions that were rescored are contained in Table 1.

Table 1

Number and Percent of Sessions Rescored for Each Subject

<table>
<thead>
<tr>
<th>Subject</th>
<th>Number of Sessions Rescored</th>
<th>Total Number of Sessions</th>
<th>Percent Rescored</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>15</td>
<td>53.3%</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>48</td>
<td>41.7%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>7</td>
<td>57.1%</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>47</td>
<td>57.4%</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>43</td>
<td>65.1%</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>19</td>
<td>52.6%</td>
</tr>
</tbody>
</table>

For each rescored session, percent agreement was calculated for each task. Percent agreement was calculated using the frequency ratio method, dividing the smaller time recorded by the larger time and multiplying by 100. Appendix B contains the original scored values, the rescored values, and the percent agreement for all rescored sessions. This information is displayed by subject and by task. Overall,
the average percent agreement across all subjects was 94.5% for the marble box task and was 94.9% for the "Tinker Toy" task. The average percent agreement scores by subject are as follows: Subject 1, 94.8%; Subject 2, 96.2%; Subject 3, 91.2%; Subject 4, 95.3%; Subject 5, 93.7%, and Subject 6, 94.2%.

As can be seen in Appendix B, low percent agreement scores were obtained for several sessions. However, in many of these instances the low percent agreement was not due to large absolute difference in the recorded scores. That is, when the subject spent a small amount of time engaging in a particular task, small recorded differences result in a small percent agreement. For example, in 18 of the rescored sessions, a percent agreement of less than 85% was obtained. In nine of these 18 sessions, the absolute difference was less than 10 seconds. In three of these sessions, the absolute difference was between 10 and 30 seconds, and in four sessions the difference was between 30 and 60 seconds. In one session, the difference was 70 seconds and in another the difference was 106 seconds. These two high discrepancies were likely due to an observer misreading the position of the minute hand on the task clock.

Subject Data

As stated previously, the purpose of this study was to determine if the performance of a behavior, maintained by the presentation of one type of reinforcer, would decrease if a second type of reinforcer was provided for a period of time and then made unavailable. Thus, the critical comparison is between the performance of subjects during the initial phase in which the particular reinforcer was provided, and their performance under the same single reinforcement condition but following exposure to the dual reinforcement phase. This comparison indicates if performance on an "extrinsically motivated" task is affected by an additional extrinsic reward.
Two subjects (Subject 4 and Subject 5) remained in the study long enough to be exposed to the critical phases, and as described below, different results were obtained for these subjects. Because of this, the results obtained with each subject will be described separately.

**Subject 1**

**Baseline**

As stated earlier, the baseline phase was included for two reasons. First, it was included to ensure that the marble box task was, in fact, considered "uninteresting" by the subjects. Second, the baseline phase was needed to demonstrate that the rewards provided in the later phases were functioning as true reinforcers.

Overall, Subject 1 engaged in the "Tinker Toy" task at a higher rate than the marble box task during baseline—an average of 45.1% and 14.1% of a session respectively. However, as can be seen from Figure 1, during three of the ten sessions (Sessions 7 through 9) he spent more time performing the marble box task than the "Tinker Toy" task, although both were performed at relatively low rates. Although there was a change in task preference during these sessions, the overall low rate of performance of the marble box task indicates that this task was "uninteresting" to Subject 1.

During this phase, four sessions were terminated early by the subject. One of these sessions lasted less than 10 minutes, and as a result, data from this session were not included in the analysis. In addition, on one occasion during baseline, this subject came to the room for the session, but following the reinforcement selection procedure, he stated that he did not want to stay to play. He took the items he
Figure 1. Subject 1 Session Data.
selected during the procedure and left the room. Thus, a session was not conducted during that time.

**Single reinforcement #1**

During this phase, Subject 1 received stickers contingent upon performing the marble box task. Oddly, when the subject was told of the contingency, the amount of time he spent engaging in the marble box task decreased, and the amount of time he spent on the "Tinker Toys" increased. As can be seen in Figure 1, during three of the five sessions in this phase, he did not engage in the marble box task at all. It was only during Session 14 that he spent a significant proportion of time engaged in the marble box task—54.2%.

In addition, on three occasions during this phase, Subject 1 came to the room for a session but asked to leave following completion of the reinforcement selection procedure. Sessions were not conducted during these times. At this point, the next logical step would have been to use a different item to determine if it would function as a reinforcer. However, because Subject 1 stopped coming to the sessions at all, he was dropped from the study.

**Subject 2**

**Baseline**

During baseline, Subject 2 spent an average of 7.7% of a session engaging in the marble box task and an average of 86.8% of a session engaging in the "Tinker Toy" task. The low rate of performance on the marble box task indicates that this task was "uninteresting" for Subject 2.
Single reinforcement #1

When rubber spider-like creatures were provided contingent upon the subject's engaging in the marble box task, the percent of time he spent on this task increased to an average 33.5% of a session. At the same time, the percent of time he spent on the "Tinker Toy" task decreased to an average 23.9% of a session. The overall increase in performance on the marble box task indicates that the spiders functioned as reinforcers.

As shown in Figure 2, during several sessions of this phase, Subject 2 spent very little time engaging in either of the two tasks. For example, during Session 14 he spent 28.9% of the session engaged in the marble box task and 0% of the session performing the "Tinker Toy" task. Similarly, during Session 19, he spent 17.6% of the session performing the marble box task and 0% of the session with the "Tinker Toy" task. These low rates of performance can be accounted for by the fact that during sessions such as these, Subject 2 often spent much of the time playing with the reinforcers rather than the two tasks.

Single reinforcement #2

In this phase, Subject 2 received stickers contingent upon performing the marble box task. The rubber spiders delivered in the previous phase were no longer provided.

The average amount of time that Subject 2 engaged in the marble box task was maintained at 36.4% of a session. This level is close to that obtained in the previous reinforcement phase—33.5%. Thus, the stickers functioned as reinforcers during this phase.
Figure 2. Subject 2 Session Data.
In addition, during this phase, the percent of time Subject 2 spent on the "Tinker Toy" task further decreased to an average 8.4% of a session. In six out of the eight sessions he did not engage in this task at all.

**Dual reinforcement**

During this phase, Subject 2 received both stickers and rubber spiders contingent upon engaging in the marble box task. As shown in Figure 2, during the first eight sessions of this phase performance of this task was maintained close to the level observed in the previous two reinforcement phases. However, starting with Session 39, performance dropped to 0% of a session for four sessions. At that point, the subject's performance became extremely variable.

A possible reason for the observed change was provided by the subject's mother. Prior to Session 39 she stated that the subject's birthday was coming up and that she and her son were saving the reinforcers he was earning so that they could provide them to his classmates as treats on his birthday. His birthday coincided with the time when his performance on the marble box task dropped during this phase. Apparently, the process of saving the items for his birthday influenced the reinforcing effectiveness of these items.

The subject was dropped from the study when his performance continued to be extremely variable.

**Subject 3**

**Baseline**

During this phase, Subject 3 engaged in the marble box task an average of 15.9% of a session and the tinker toy task an average of 32.0% of a session. Although the
subject performed the marble box task for 49.5% of the first session, the low rate of performance of this task during the remaining sessions indicates that the task was "uninteresting" to this subject. This pattern of performance can be seen in Figure 3.

Following Session 7, the subject was terminated from the study. This decision was made because of a time constraint that was introduced when the move was made to the home setting. Having the experiment conducted in the home setting was an inconvenience to the parent. Because of this inconvenience, when this move was made it was with the understanding that it would only be for a couple of months--enough time to finish Subjects 4 and 5 who were much further along in the study. The experimenter decided Subject 3 would not likely be able to complete the remaining six phases during this period of time, and therefore, the subject was terminated from the study.

Subject 4

Baseline

During baseline, Subject 4 spent an average of 5.5% of a session engaged in the marble box task. For seven of the nine baseline sessions, he never performed that task at all. These data indicate that the task was "uninteresting" to Subject 4.

Single reinforcement #1

As can be seen in Figure 4, when Subject 4 received stickers contingent upon performing the marble box task, the amount of time he spent on this task increased immediately. During the phase, Subject 4 engaged in this activity an average of 68.3% of a session. This increase indicates that the stickers functioned as reinforcers.
Figure 3. Subject 3 Session Data.
**Single reinforcement #2**

In this phase, Subject 4 received rubber spider-like creatures contingent upon performing the marble box task. The stickers provided in the previous phase were no longer provided.

During this phase, Subject 4 continued to engage in the marble box task at a high rate spending an average of 72.5% of a session performing the task. Thus, the rubber spiders also functioned as reinforcers.

**Dual reinforcement**

In this phase, both types of reinforcers, stickers and rubber spiders, were delivered to Subject 4 contingent upon his engaging in the marble box task.

As expected, the amount of time Subject 4 spent performing this task remained high during this phase. He spent an average of 65.0% of a session engaging in this task. Also, during this phase he did not engage in the "Tinker Toy" task at all.

**Single reinforcement #1**

During this phase, delivery of the rubber spiders was terminated, but the stickers continued to be provided.

In the first session of this phase, the amount of time the subject engaged in the activity immediately dropped to only 15.4% of the time. However, this initial decrement lasted only one session. As can be seen in Figure 4, the percent of time Subject 4 engaged in this task increased over the course of the next four sessions and remained high over the remaining sessions of this phase. Excluding the first session of this phase, the subject engaged in this task an average of 61.4% of a session.
Also, during the first session of this phase the percent of time Subject 4 spent on the "Tinker Toy" task increased to 61.0%. Over the next three sessions, while performance on the marble box task increased, performance on the "Tinker Toy" task decreased.

**Dual reinforcement**

In this phase the subject again received both types of reinforcers, stickers and rubber spiders, contingent upon performing the marble box task. This phase was initiated in an attempt to replicate the addition and subsequent removal of the second reinforcer.

Starting in the third session of this phase, Subject 4 no longer performed the marble box task at a high rate. During the final five sessions, he spent an average of 10.7% of a session performing the task. This drop in task performance indicated that the stickers and rubber spiders were no longer functioning as reinforcers. At this point, Subject 4 was terminated from the study.

**Subject 5**

**Baseline**

During baseline Subject 5 engaged in the marble box task an average of 14.7% of a session. This average is somewhat inflated due to the fact that the subject engaged in the task 99.4% of the time during Session 3.

In spite of the fact that the subject spent 99.4% of Session 3 engaging in the marble box task, it can be concluded that the marble box was "uninteresting" to this subject. This is indicated by the overall low rate of performance of this task. As
shown in Figure 5, during six of the eight session of this phase, Subject 5 did not engage in this task at all.

**Single reinforcement #1**

During this phase, Subject 5 received pennies contingent upon performing the marble box task. As shown in Figure 5, the amount of time she spent engaging in the marble box task did not immediately increase when this contingency was introduced. However by the third session of this phase, Session 11, Subject 5 engaged in this task at a high rate. This high rate was maintained over the remaining sessions of this phase.

Overall, Subject 5 spent an average of 65.7% of a session performing the marble box task. Therefore, the pennies were functioning as reinforcers.

**Single reinforcement #2**

In this phase, Subject 5 received stickers contingent upon performing the marble box task. The pennies provided in the previous phase were no longer provided.

During this phase, Subject 5 continued to engage in the marble box task at a high rate. She performed the task an average of 77.3% of a session, indicating that the stickers were also functioning as reinforcers.

**Dual reinforcement**

During this phase, both types of reinforcers, pennies and stickers, were delivered contingent upon performing the marble box task.

As expected, the amount of time Subject 5 engaged in the task remained high, averaging 75.9% of a session.
Figure 5. Subject 5 Session Data.

- Baseline
- Pennies
- Stickers
- Both
- Stickers
- Both
- Stickers

Percent of Time on Task

Sessions

Marble Box
“Tinker Toys”
Single reinforcement

During this phase, Subject 5 continued to receive stickers contingent upon performing the marble box task, but the pennies were no longer provided.

In this phase, Subject 5 continued to engage in the marble box activity at a high level, averaging 74.2% of a session. In addition, as can be seen in Figure 5, there was no indication of a decrement in task performance during any session in this phase.

Dual reinforcement

Subject 5 again received both types of reinforcers, pennies and stickers, in an attempt to replicate the presentation and subsequent removal of the second reinforcer.

During the first session of this phase, Subject 5 continued to engage in the marble box task at a high level. However, as can be seen in Figure 5, the time she spent on this task decreased during the next four sessions. In general, this decrease was not due to a switch to the other task (with the exception of Session 36), but rather to an increase in off-task behavior. Specifically, Subject 5 was observed to spend more time manipulating her obtained reinforcers. During the last two sessions of this phase, the time she spent on the marble box task increased to previous levels.

Overall, Subject 5 engaged in the marble box task an average of 49.7% of a session during this phase.

Single reinforcement

In this phase, delivery of the pennies was again discontinued. The stickers continued to be provided contingent upon the subject's engaging in the marble box task.
The amount of time Subject 5 spent on the marble box task remained high—an average of 71.4% of a session. Again, as shown in Figure 5, there was no indication of a decrement in task performance following the termination of one of the reinforcers.

**Subject 6**

**Baseline**

During this phase Subject 6 performed the marble box task an average of 10.0% of a session and the "Tinker Toy" task and average of 70.8% of a session. During seven of ten baseline sessions, he did not engage in the marble box task at all, indicating that this task was not "interesting" to him.

**Single reinforcement #1**

During this phase, rubber spider-like creatures were provided to Subject 6 contingent upon performing the marble box task. During the first session of this phase, he performed this task 75.8% of the session. However, as shown in Figure 6, during the next four sessions performance on this task dropped steadily, even though performance of the "Tinker Toy" task remained at 0%. During these sessions, the subject spent much time looking toward the shelf that concealed the experimenter.

At this time, a shaping procedure was introduced to try to increase the amount of time spent on the marble box task. First, whenever the subject looked toward the marble box task, he was provided with a reinforcer. However, because of the distance between the subject and the experimenter, it was difficult for the experimenter to deliver the object immediately. Therefore, a noise was paired with this object. Metal pieces were placed in a metal can along with the rubber spiders.
Figure 6. Subject 6 Session Data.
When the subject looked at or approached the task, the experimenter would shake the can, producing the noise, and deliver the rubber spider. Once the response of looking toward the task was being maintained, the experimenter began to deliver the reinforcers only when the subject began to manipulate the marble box task. As can be seen in Figure 6, this procedure resulted in a gradual increase in the percent of time Subject 6 engaged in the task. However, during this phase the subject was removed from the preschool, and the move was made to the home setting. As stated earlier, a time constraint was imposed with the move to the home setting. At this time the experimenter decided that Subject 6 would not likely be able to complete the remaining five phases of the study during the time available. As a result, Subject 6 was terminated from the study.

Summary of the Results

Of the six subjects who participated in this study, only two remained in the study long enough to be exposed to the critical phases. That is, only Subject 4 and Subject 5 were exposed to the dual reinforcement phase followed by the termination of one of the reinforcers. Interestingly, whereas Subject 4 showed a decrement in performance following the termination of the second reinforcer, Subject 5 showed no such decrement. However, for Subject 4 the observed decrement was transient. Performance on the task was low during the first session of the phase but increased over the next four sessions to reach previous levels.
CHAPTER IV

DISCUSSION

The purpose of this study was to determine if intrinsically motivated behavior is functionally equivalent to behavior maintained by extrinsic events. As mentioned earlier, it is possible that so-called "intrinsically motivated" behavior is actually maintained by external consequences--intermittent reinforcers or response-produced reinforcers. If this is the case, then features that are characteristic of intrinsically motivated behavior should also be observed with extrinsically motivated behavior.

One feature often observed with intrinsically motivated behavior is a decrement in performance when an external reward is provided for a period of time and then discontinued. Performance levels have been observed to fall below the level observed prior to the introduction of the external reward. Thus, if intrinsically motivated behavior and extrinsically motivated behavior are not functionally different, similar decrements should be observed when an additional reward is provided for performing a task already maintained by an extrinsic reward, once that additional reward is discontinued.

Of the two subjects completing the critical phases of this study, one demonstrated a performance decrement following the termination of the additional reward. However, this observed decrement was temporary, lasting only one session. The other subject showed no such decrement.

These findings resemble those obtained by Dickinson (1985/1986). Dickinson's study involved similar subjects and experimental arrangements, but the focus was on the effects of extrinsic rewards on performance of an intrinsically interesting task. In
the study, children were provided with the opportunity to play with several toys. Later, each subject was provided with rewards for engaging in his or her preferred task. Subsequently, the rewards were discontinued, and the effects on task performance were observed. Two subjects completed all phases in the Dickinson study. As with the current study, one subject demonstrated temporary decrements in performance when the rewards were terminated, whereas the second subject demonstrated no such decrements.

This similarity in results between the current study and the Dickinson study suggests that intrinsically motivated behavior may not be different from extrinsically motivated behavior. An important implication of the obtained results is related to task interest. Because a decrement was observed with extrinsically motivated behavior, such performance decrements cannot be considered as evidence that extrinsic rewards destroy an individual's intrinsic interest in a task. In the current study, performance on an uninteresting task was reinforced. Thus, the decrements must have resulted from a factor other than a decrease in intrinsic interest in the task.

One possible factor responsible for the decrements may simply be exposure to an additional source of reinforcement. Exposure to a second source of reinforcement may interfere with the effect that the original source of reinforcement has on the behavior. That is, the second source of reinforcement may interfere with the effectiveness of the original reinforcer. This effect, labeled "overjustification," was considered the cause of the decrements observed in the Porac and Salancik (1981) study cited in the beginning of this paper.

Another possible cause of the decrements was suggested by Dickinson (1985/1986). Dickinson claimed that, depending on an individual's history with respect to external contingencies, such contingencies may have coercive elements. That is, if external contingencies have, in the past, been employed to get an individual
to engage in undesirable tasks or have been associated with punishment for noncompliance, the external contingencies may be coercive in nature. Post-reward performance decrements may result when this coercive element exists. However, it is unclear as to whether this is the case in the current study. In this study, when the second reinforcer was discontinued, the first contingency was still in effect. Why the one removal of only one contingency would result in the decrement is unclear. However, informal observation of the two subjects does indicate that the coercion may have played a role in the obtained results. Specifically, during interactions with the subjects it became obvious that in the home setting as well as in the preschool, Subject 5 was much more compliant than Subject 4. Because of this, it is possible that external contingencies were used in a more coercive manner with Subject 4 than with Subject 5.

One weakness of this study concerns the number of subjects completing the critical phases. Only two subjects completed these phases, and the results were mixed. Thus, future research is needed involving many more subjects to determine the conditions under which such decrements occur.
APPENDICES
Appendix A

Human Subject Institutional Review Board Research Protocol Clearance
RESEARCH SHOULD NOT BEGIN UNTIL THE PROTOCOL HAS BEEN REVIEWED AND APPROVED BY THE HUMAN SUBJECTS INSTITUTIONAL REVIEW BOARD, WHICH MEETS ON A REGULAR MONTHLY BASIS. PROTOCOLS MUST BE RECEIVED BY THE HSIRB CHAIR AT LEAST SEVEN DAYS PRIOR TO A REGULARLY SCHEDULED MEETING IN ORDER TO BE ACTED ON AT THAT MEETING. PLEASE TYPE EACH RESPONSE - EXCEPT SIGNATURES. REFER TO THE WESTERN MICHIGAN UNIVERSITY POLICY FOR THE PROTECTION OF HUMAN SUBJECTS TO DETERMINE THE APPROPRIATE LEVEL OF REVIEW.

PRINCIPAL INVESTIGATOR: Jeanne Marie LaMere
DEPARTMENT: Psychology

Home Phone: 327-1375  Office Phone: 
Home Address: 6838 Argile  Office Address: 

PROJECT TITLE: The Effects of an External Reward on Behavior Maintained by a Second External Reward

SUBMISSION DATE: April 1986 PROPOSED PROJECT DATES May 1986 to August 1986
APPLICATION IS: New Renewal Continuation Supplement

SOURCE OF FUNDING: 

Jeanne Marie LaMere
Signature of Investigator

STUDENT RESEARCH (Fill out if applicable)

Name of Student: Jeanne Marie LaMere  Phone: 327-1375
Address: 6838 Argile
The Research is: Undergraduate Level  Graduate Level
Faculty Advisor: Jack Michael  Department: Psychology

Jack Michael
Signature of Faculty Advisor
Research involves subjects who are: (check as many as apply)

1. **children**
   - approximate age 4-5
2. **mentally retarded persons**
   - check if institutionalized
3. **mental health patients**
   - check if institutionalized
4. **prisoners**
5. **pregnant women**
6. **Other subjects whose life circumstances may interfere with their ability to make free choices in consenting to take part in research**

LEVEL OF REVIEW: Please indicate here if you think that the research project is exempt from review, subject to expedited review, or subject to full review.

- **Exempt** (Forward application to IRB Chair)
- **Expedited** (Forward applications to IRB Chair)
- **Subject to Full IRB review** (Forward applications to IRB Chair)

Comments:

Your application was reviewed and the Human Subject Institutional Review Board (HSIRB) has determined that:

1. The proposed activities, subject to any conditions and/or restrictions indicated in Remarks below, have (a) provided adequate safeguards to protect the rights and welfare of human subjects involved, (b) established appropriate procedures and/or documents to obtain informed consent, and (c) demonstrated that the potential benefits of the research substantially out-weigh the risks.

2. The proposed activities, for reasons indicated in Remarks below do not provide adequate protection for the rights and welfare of the human subjects.

At its meeting on 5/7/86, the HSIRB (approved) (provisionally approved - see remarks) this application with regard to the treatment of human subjects. The HSIRB categorized this application as:

1. Involving subjects at no more than minimal risk.
2. Involving subjects at more than minimal risk.

REMARKS: Copy letter to be deonted from informed consent.

[Signature] [Date]
Appendix B

Interobserver Agreement Data
Number of Seconds Spent Engaging in Each Task as Recorded by the Original Observer and the Second Observer

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