

"Spontaneous recovery" following the elimination of the rest period

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A previous study demonstrated that a stimulus associated with the onset of a series of reinforced trials is more resistant to extinction, following a rest period, than are other stimuli presented during acquisition, suggesting that the rest period employed in spontaneous recovery may be unnecessary. Forty-eight pigeons were divided into four groups on the basis of whether a distinctive stimulus was associated with the onset of acquisition and whether or not a 30-min rest period was employed. "Spontaneous recovery" was obtained in a standard control group and, confirming the results of two previous studies, in a group tested with a stimulus associated with the onset of acquisition. In addition, statistically equivalent responding was obtained on the test trial in a group in which the rest period was eliminated.

In a recent study, Burstein and Moeser (1971) demonstrated that a stimulus, or stimulus characteristic, which is associated with the first trial of a series of reinforced acquisition trials is more resistant to extinction, following a rest period, than are other stimuli presented during the acquisition session. As they note, one of the implications of their results is that "the 'rest period' currently viewed as essential for generating the phenomenon of spontaneous recovery may be merely one of an almost infinite number of operations which will generate the apparent increase in response strength associated with spontaneous recovery" (p. 233).

In a later study, Burstein and Mackenzie (1973) confirmed the effects of a first stimulus and suggested that "the rest period may be essential only to the extent that a period devoid of CS presentations is necessary to 'create' a 'first stimulus.'"

As Burstein and Mackenzie note, whether their view is tenable depends upon the outcome of a study in which the distinctive cue used in their experiment is maintained, but the rest period is eliminated. The present study was designed to answer this question.

METHOD

Subjects

The 48 subjects were 5-year or older White King pigeons obtained from the Palmetto Pigeon Plant, Sumter, South Carolina and maintained at 80% ad-lib weight. They were randomly assigned to one of four groups.

Apparatus

A Grason-Stadler operant conditioning station (E1100PE) was used. White noise was piped into the operant chamber from a Grason-Stadler noise generator (E829E) to eliminate the effects of transient noises. A Grason-Stadler multiple stimulus projector (E4580) was modified to present the necessary stimuli.

Procedure

Subjects were magazine and keypeck trained to a white key light in an otherwise darkened chamber. Each subject was given 5 days of acquisition training consisting of 20 trials of 15 sec each, during which the CS light was on. Each response was reinforced by 3 sec access to food (standard Purina Pigeon Pellets). CS trials were separated by 15-sec "blackout" periods during which the operant chamber was completely dark and NO reinforcement was available. On Day 6, all subjects underwent extinction until they reached a criterion of five consecutive trials without a response. Depending upon which group they were in, subjects were either immediately tested or tested after a 30-min rest period in their cage. Two CSs were employed, the red (Wratten filter No. 25) and green (Wratten filter No. 61) lights provided with the Grason-Stadler operant chambers.

Design

The 49 subjects were divided into four groups on the basis of (1) whether or not there was a 30-min rest period (Groups "30" or Groups "0"), and (2) whether or not a distinctive stimulus was presented on the first trial (Groups "D" or Groups "C").

Group C-0. The same (green) CS was presented on each trial of five acquisition sessions and during the extinction phase. Upon meeting the extinction criterion of five consecutive trials without a response, this group was presented with the distinctive (red) stimulus on the next trial. It should be noted that testing this group with the nondistinctive (green) stimulus would merely result in continuing the extinction phase past the designated criterion.

Group C-30. The same (green) CS was presented on all trials of the acquisition, extinction, and test phases. This is the standard spontaneous recovery procedure.

Group D-0. This group was treated identically to Group C-0, except that it was presented with the distinctive (red) stimulus on the first trial of the five daily acquisition schedule.

Group D-30. This group was treated identically to Group D-0, except that a 30-min rest period intervened between the extinction phase and the test phases.

Since both the Burstein and Moeser and Burstein and Mackenzie studies demonstrated that specific colors did not affect the results, color was not counterbalanced in this study.

RESULTS

An analysis of variance revealed no significant differences between groups in response frequency on the

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last five trials of the acquisition series ($F < 1$, $df = 3/44$). There were also no significant differences between groups in response frequency on the first extinction trial ($F < 1$, $df = 3/44$), or in total responses to extinction criterion ($F = 1.34$, $df = 3/44$), or in the number of trials to reach criterion ($F < 1$, $df = 3/44$).

An analysis of variance based upon response frequency on the first test trials revealed that the groups differed significantly ($F = 10.11$, $df = 3/44$, $p < .001$). The difference in response frequency between Groups D-0 and D-30 was not significant ($t = .579$, $df = 22$), as hypothesized. Confirming the results of the two previous studies, these two groups responded significantly more than Group C-30, the standard spontaneous recovery group ($t = 3.01$, $df = 34$, $p < .0025$ for one-tailed hypothesis being tested). Also confirming the findings of the previous study, response frequency was greater in Group C-30, the standard group, than in C-0, the "disinhibition" group ($t = 2.08$, $df = 22$, $p < .025$, one-tailed).

A second analysis of variance was performed for the total response frequency during the test phase, and was found to be significant ($F = 4.99$, $df = 3/44$, $p < .01$). Individual t tests reveal that the sources of significance are substantially the same as for response frequency on the first test trial. The comparison between Groups D-0 and D-30 was not significant ($t = .29$, $df = 22$), further indicating that the elimination of the rest period had no significant effect upon response strength if the test CS had previously been associated with the onset of reinforced acquisition trials. Total response frequency during the test phase for the distinctive first trial CS groups (D-0 and D-30) was significantly greater than for the standard SR group (Control-30) ($t = 2.136$, $df = 34$, $p < .025$ for the one-tailed hypothesis being tested), and greater for the Control-30 group than for the "disinhibition" group (Control-0) ($t = 4.47$, $df = 22$, $p < .001$).

Finally, an analysis of variance performed on the number of test trials to criterion was significant ($F = 4.29$, $df = 3/44$, $p < .01$). Separate t tests reveal that the overall significance can be attributed to the virtually complete lack of responding by the Control-0 group. All comparisons not involving the "disinhibition" group resulted in t values of less than one, while the comparison of Groups D-0, D-30, and Control-30 to Control-0 was significant ($t = 3.22$, $df = 46$, $p < .001$).

Table 1
Mean Number of Test Trial Responses by Groups

Group	First Test Trial	Total Test Responses
C-0	1.00	2.33
C-30	3.42	14.75
D-0	11.33	42.17
D-30	13.42	37.33

DISCUSSION

These results strongly support the view that the response pattern generally associated with the phenomenon of spontaneous recovery can be obtained without the rest period currently considered essential for generating that phenomenon.

Moreover, Groups D-0 and D-30 responded significantly more than the standard spontaneous recovery group, C-30, confirming the results of two previous studies which demonstrated that any distinctive stimulus or stimulus characteristic associated with the onset of an acquisition session was capable of eliciting the apparent increase in responding associated with spontaneous recovery.

Of interest also is the finding that a novel or distinctive test stimulus presented without prior association with the onset of an acquisition session almost completely inhibits responding, confirming the results of the Burstein and Moeser study. This finding, particularly in Group C-0, has some important implications with respect to the concept of a stimulus. Classical Pavlovian theory postulates that a novel stimulus presented during extinction will disinhibit the response being extinguished. The present findings cast doubt upon this view, since Group C-0 did not exhibit disinhibition when presented with a novel stimulus. It would seem that, if there are any reflex-like or automatic effects elicited by a stimulus per se, these effects are dramatically modifiable and that stimuli are responded to in terms of their significance or information value rather than as energy changes per se. From this point of view, the absence of any substantial responding to the novel test stimulus in Group C-0 is due, not to any inhibition which is suppressing responding, but due to the fact that the novel stimulus has no informational significance. However, the present results involve the voluntary response system, and it may be that Pavlovian disinhibition occurs only in classical conditioning paradigms that involve autonomic or involuntary responses.

REFERENCES

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