Sequential variables as determinants of human performance with attitudinal reinforcements*

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The present experiments were undertaken to investigate the effects of variables which have proven important in sequential theory upon performance when attitudinal stimuli and human Ss were used. Ss were presented with either long or short N-lengths (the number of consecutive nonrewarded trials followed by a rewarded trial). The long N-length group proved to be more resistant to extinction than the short N-length group, but the significance level was marginal ($F = 2.36$, $df = 1/38$, $p < .13$) for a timed measure of extinction, while it was highly significant for a verbal report measure of extinction ($F = 8.58$, $df = 1/38$, $p < .006$). Two additional groups were run, one being continuously reinforced (RR) and the other receiving 50% reinforcement, but with all of its nonrewarded trials preceding its reinforced trials (NR). Group NR was more resistant to extinction than Group RR.

Recently, Capaldi (1967; in press) has proposed that sequential variables are of utmost importance in determining resistance to extinction (Rn) following partial reward (PR) in instrumental learning. Capaldi has identified several important sequential variables, of which two are pertinent for present purposes. N-length (the number of consecutive nonreinforced trials followed by a reinforced trial) and the initial nonreinforcement effect (INE) are the variables which were studied in the present experiment. When the learning rate (F) (Hull, 1943) is high, Capaldi has argued that animals which have a longer N-length conditioned in acquisition will show more Rn than animals which have a shorter N-length conditioned. Additionally, Godbout, Ziff, & Capaldi (1968), contrary to other learning theorists (Amsel, 1958; Amsel, Hug, & Surridge, 1968), have argued that a schedule which presents all nonreinforced trials prior to reinforced trials would produce a partial reinforcement effect (PRE).

*This research is based on a doctoral dissertation submitted to Purdue University in partial fulfillment of the requirements for the PhD degree. The author wishes to express his gratitude to Dr. Donn Byrne for his assistance throughout the project. Grateful acknowledgement is also made to Drs. D. R. Brown, E. J. Capaldi, and D. A. Nelson, who served as members of the doctoral committee.

The usefulness of a theoretical formulation is enhanced as the theory proves to be more and more comprehensive. Whereas empirical validations of the theory within the context of its original formulation are by far the most important, it is helpful if the theory shows generality to other populations of Ss and experimental situations. In testing the generality of theoretical constructs with other Ss and experimental situations, additions to a theory formulated to account for the behavior of the new population of Ss is possible. A pertinent example is interpersonal attraction. In formulating a reinforcement theory of attraction, Byrne and his associates (Byrne, in press; Byrne & Clore, 1970) have borrowed from learning theory. One of the aims of the present study is to investigate the effects of sequential variables upon performance, when human Ss and reinforcements from attraction research are utilized. Further encouragement for testing sequential variables in an attraction context is found in the fact that in a number of experiments specifically dealing with interpersonal attraction, sequential effects have played an important part in mediating attraction (Byrne, Lamberth, Palmer, & London, 1969; Griffitt, 1969; Korte, 1970; Lamberth, 1969).

Litchfield & Duerfeldt (1969) investigated the effects of sequential variables with children as Ss. Their results were somewhat mitigated by difficulties encountered with getting the Ss to extinguish because of explicit instructions to perform. The present study attempted to circumvent the problems they encountered and to introduce reinforcements from the stimuli of attraction research.

It was hypothesized that a group given long N-lengths in acquisition would show greater Rn in extinction than a group given short N-lengths in acquisition and that a group given all of its nonrewarded trials prior to its rewarded trials would show a PRE.

METHOD

The Ss were 72 undergraduate psychology students at Purdue University. The apparatus was a gray Masonite panel, 30 x 30 in., with a lever in the center which could be depressed 15 in. At the upper right of the panel was a ready light with a slit under it, through which reinforcements were delivered. The lever was wired to two clocks. When the ready light came on, Clock I was activated. When the S began to depress the lever, Clock I was terminated and Clock II was activated. When the lever reached the bottom of the channel through which it passed, Clock II was terminated. The Ss were told that this was a learning task and that when the ready light came on, they were to make some response involving their hands. The instructions were purposely ambiguous because of the difficulty other researchers have had in getting Ss to extinguish when explicit instructions to pull the lever have been given (e.g., Litchfield & Duerfeldt, 1969).

Four experimental conditions were established, one continuously reinforced group (RR) and three 50% PR groups. The first PR group (NR) received five nonrewarded trials followed by five rewarded trials. Two groups had N-length varied. Group 12 had two conditionings of an N-length of one and four conditionings of an N-length of two. Group 37 had one conditioning of an N-length of three and one of seven. All groups were given 20 extinction trials. The schedules are shown in Table 1.

For the first five trials of acquisition, Ss who had not pulled the lever were asked by the E, "Why not

Table 1
Schedules of Reward for Four Conditions in Acquisition

Group	Trial																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
RR	R	R	R	R	R	R	R	R	R	R										
NR	N	N	N	N	N	R	R	R	R	R										
12	R	N	N	R	N	N	R	R	R	N	R	R	N	R	N	N	R	N	N	R
37	R	R	R	R	N	N	N	R	R	R	N	N	N	N	N	N	N	R	R	R

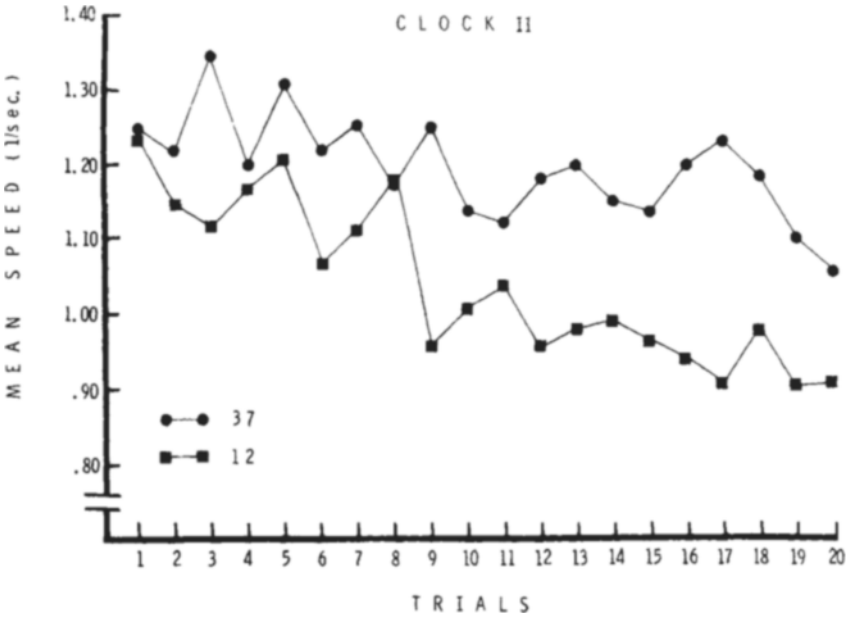

Fig. 1. Mean extinction speeds for groups receiving long (37) and short (12) N lengths in acquisition.

try pulling the lever?" If a S did not pull the lever within 30 sec after Trial 5 of acquisition, he was discontinued from the experiment.[1] In extinction, if a S failed to pull the lever within 30 sec, the experiment was terminated, and a time of 30 sec for Clock I and 15 sec for Clock II was assigned.

Reinforcements were homogeneous similar attitudes, i.e., statements about a single attitudinal topic, typed on cards and delivered through the slit in the apparatus. Six attitudes previously rated by separate Ss as being important topics (Byrne, in press) were used. Any one S recieved only statements involving one attitudinal issue, upon which he had expressed an extreme choice (i.e., a 1, 2 or 5, 6). On nonreinforced trials the Ss received nothing.

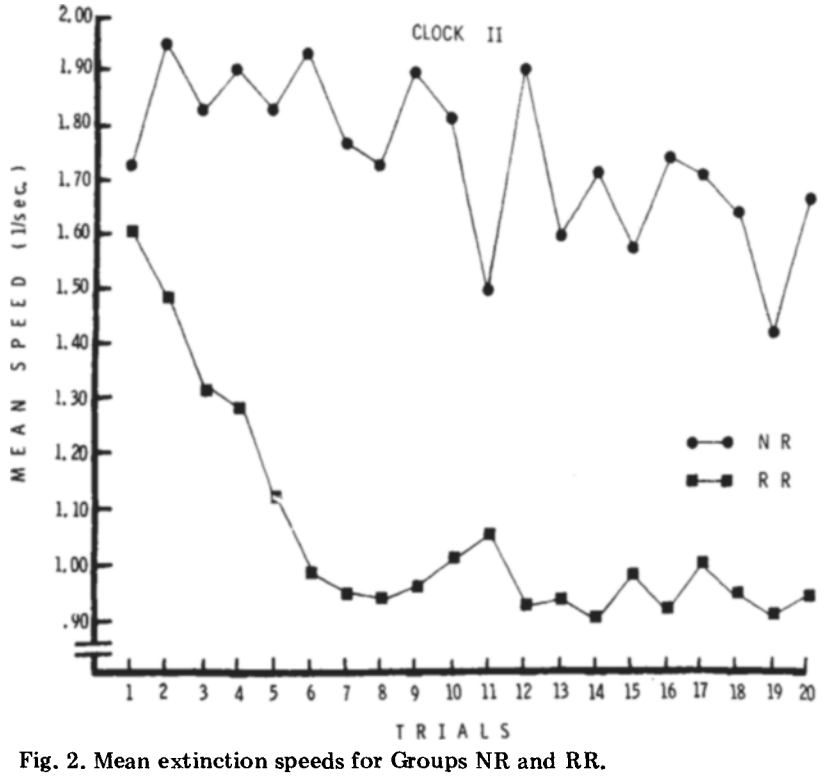

Fig. 2. Mean extinction speeds for Groups NR and RR.

In addition to time, another measure of extinction, suggested by Litchfield & Duerfeldt (1969), was employed. At the end of extinction, Ss were asked if they expected to receive more cards. A response of yes was given a score of 4. If the S said no, he was asked when he quit expecting to receive cards: early, in the middle, or late during the series in which he did not receive cards. Scores of 1, 2, or 3, respectively, were given for Ss who quit expecting cards at these three points.

Female Ss were run by a female E and male Ss were run by a male E because, in pilot work, evidence was obtained which indicated that the results were not stable if Ss were run by an opposite-sex E.

RESULTS AND DISCUSSION

The major hypotheses for this experiment concerned resistance to extinction, with particular emphasis upon the separate comparisons between Group 12 vs Group 37 and Group RR vs Group NR.

The comparison between Groups 12 and 37 on Clock II[2] is shown in Fig. 1. An inspection of Fig. 1 indicates that Group 37 was more resistant to extinction than Group 12, as predicted by sequential learning theory. However, analysis of variance indicated that this was not a statistically reliable result ($F = 2.36$, $df = 1/38$, $p < .13$). In pilot work, three different studies were run, and each time Group 37 proved to be more resistant to extinction than Group 12. Thus, additional support for the greater resistance to extinction of Group 37 is given by the four studies, each of which showed a trend for Group 12 to extinguish faster than Group 37. The second measure of extinction, the Ss' verbal report, also indicated that Group 37 was more resistant to extinction than Group 12 ($F = 8.58$, $df = 1/38$, $p < .006$). Taken together, the evidence for greater Rn for Group 37 than for Group 12 is consistent across four experiments and two measures of extinction but is still not unequivocal.

As in the study reported by Litchfield & Duerfeldt (1969), the verbal report measure of extinction for Groups 37 and 12 indicated strong support for the operation of sequential variables when humans are used as Ss. The failure of speed to show an acceptable level of significance is perhaps not surprising. An inspection of Fig. 1 indicates that there is a fairly large absolute difference in speed between the two groups. Obviously, the data indicate a large amount of

variability. Given the problems of using a simple performance task, and giving the Ss sufficient latitude to reduce their speed of responding or to stop responding in extinction, it is apparent that modification in the task will be necessary to produce unambiguous data. We are presently redesigning the performance measure to include a masking task. It is hoped that this refinement will reduce the variability observed in the present experiment.

The second major hypothesis was that Group NR would show more Rn than Group RR. The results for Clock II in extinction for these two groups are shown in Fig. 2. There is a strong difference between the groups ($F = 5.58$, $df = 1/26$, $p < .03$). Over the full 20 trials of extinction, the Groups by Trials interaction is not quite significant ($F = 1.57$, $df = 19/494$, $p < .06$). However, it seems apparent that the interaction is not significant because Group RR extinguished so rapidly that during the majority of trials the curves are essentially parallel to each other. Further evidence is available when only the first 10 trials of extinction are considered. Here the Groups by Trials interaction is significant ($F = 2.37$, $df = 9/234$, $p < .02$). The verbal report measure was not significant ($F = .5013$, $df = 1/26$, n.s.).

Taken as a whole, the results of the present experiment lend support to the importance of sequential variables when humans are used as Ss. It would seem that the results presented by Litchfield & Duerfeldt (1969), in addition to the results presented here, indicate that sequential theory has generality beyond the organisms and the specific situations with which the theory was originally formulated. It is entirely possible that there are other types of situations in which sequential variables may prove valuable as explanatory tools.

With regard to a reinforcement interpretation of attraction, the present results, in addition to those results employing a discrimination learning task (e.g., Byrne, Young, & Griffitt, 1966; Golightly & Byrne, 1964; Lamberth & Craig, 1970), as well as the present performance task (Lamberth & Gay, 1969), lend further support to the reinforcing qualities of attitudinal stimuli. With two different learning tasks and several different experimental manipulations (e.g., asymptotic performance, positive and negative reinforcement, differential magnitude of reinforcement, and magnitude shifts) attitudinal reinforcers have functioned in a manner analogous to more traditional reinforcers. The correspondence of behavioral consequences between attitudinal reinforcers and other types of reinforcers is encouraging for a theoretical view of attraction which emphasizes the importance of reinforcement.

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NOTES

1. Five Ss in Group 37, two Ss in Group 12, one S in Group RR, and one S in Group NR were discontinued.

2. A variety of pilot experiments were run on the apparatus prior to the present experiment. In virtually all cases, it was found that Clock II showed less variability and seemed to be a more stable measure than Clock I. Intuitively, this seems reasonable, as the S must see the ready light, react to it, and begin to pull the lever while Clock I is running. Individual differences in each of these reactions will add to the variability of the measure. Additionally, an interesting phenomenon was observed by the Es. Because the instructions were purposely somewhat ambiguous, Ss in the partial reward groups engaged in idiosyncratic "superstitious behavior." Especially during the early part of training, they might be rewarded on a trial upon which they had clapped their hands or hit the table, and this behavior was retained through several more trials. This led to increased variability on Clock I but not on Clock II. For these reasons, only the results for Clock II will be presented.