Inter-phase time intervals in Seward's latent learning experiment¹

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Abstract

Three groups of 22 rats were exposed to the procedures of Seward's latent learning experiment (1949), but differed in the amount of time elapsing between the three phases of the experiment, free exploration, pre-feeding and testing. Two groups, one with a 24 hr. interval between exploration and pre-feeding and the other with a 24 hr. interval between pre-feeding and testing, failed to exhibit latent learning. The former condition is similar to that reported by Gilchrist (1952). A third group run without delays replicated Seward's original findings.

Introduction

In Seward's (1949) investigation of latent learning, food-deprived rats were permitted to explore an un baited T-maze, after which they were placed directly into one goal box and fed ("pre-feeding" phase). The animals were then introduced into the stem of the maze. Seward found that, with highly discriminable goal boxes, a significant proportion of the rats chose the goal box in which they had been fed. This design has been conventionally classified as Type 5 latent learning (MacCorquodale & Meehl, 1954; Kimble, 1961).

The several attempts to replicate and confirm Seward's results have proven confusing. Seward, Dattel, & Levy (1952) failed to find latent learning when they introduced intervals of 14 to 32 min. between pre-feeding and testing phases; however, when the delay was reduced to "a few seconds (p. 277)" in a second experiment, the results were consistent with Seward's earlier study. On the other hand, when Gilchrist (1952) interposed a 24 hr. delay between exploration and pre-feeding, significant indications of latent learning were found. A more recent replication of Seward's procedure using very brief inter-phase time intervals and a maze of a different shape also corroborated the original study (Clifton, Smith, & Carlson, 1964). (A study by Denny & Davis (1951), although usually classified with the Seward design, differs in so many respects—forced trials rather than free exploration, runway trials rather than direct placement, etc.—that it is excluded from the present discussion.)

The literature suggests that relatively small increases in the interval between pre-feeding and testing (when pre-feeding immediately follows free exploration) have a significant effect upon Type 5 latent learning, whereas even an interval of 24 hr. between the last contact with the T-maze during free exploration and the pre-feeding phase (when testing follows pre-feeding immediately) does not alter the effect. The present

study tests this conclusion by directly comparing two conditions of delay with a replication of Seward's original experiment.

Method

The Ss were 66 naive male rats of the Sprague-Dawley strain, 60 to 90 days old. The two modified T-mazes had extension arms at right angles to the cross bar and pointing back toward the start box. Interior dimensions of the maze were as follows: depth throughout, 12 in; alley width, 4-3/4 in; goal and start boxes, 11-3/4 x 7-3/4 in; stem, 23 in; cross arm, 31-1/2 in; and extension arms, 9 in. The mazes were painted flat gray with the exception of the goal boxes, one of which was black with a smooth floor and the other white with 5/8 in hardware cloth placed on the painted floor. Position of the black and white goal boxes was reversed in the two mazes. Cheese cloth was draped from supports 10-1/2 in above the maze, and a 7-1/2 watt frosted bulb located above the choice point under the cheese cloth provided the only light source. The rat's movements in the maze could be controlled by opaque guillotine doors at the start box entrance, on either side of the choice point and at the entrance of each goal box.

Rats were housed three to a cage and were given adaptation and free exploration in the company of cagemates. Each cage of three rats was randomly assigned to one of the two mazes at the outset of the experiment. Pre-feeding and testing was carried out individually. All Ss were placed on a 22 hr. food deprivation schedule seven days prior to the first period of free exploration. Adaptation consisted of 30 min. of unrestricted access to start box and stem each day beginning with the first day of deprivation. On Days 8, 9, and 10, Ss had access to the entire maze for 30 min. The rats were removed directly from any place in the maze except the choice point and the goal boxes. Throughout the first 10 days, Ss were placed in the start box at 21 hr. deprivation. On Days 8, 9, and 10, feeding in the home cage began with a small dish of six .97 gm food pellets to insure familiarity with this size and shape of food.

On Day 11, the three cage mates were randomly assigned to one of three conditions, (1) immediate pre-feed and test, (2) pre-feed immediately but test 24 hr. later, or (3) both pre-feeding and testing after a 24 hr. interval. Rats were paired within each condition on the basis of the pattern of preferences displayed by the first turn and first goal box entry following

release from the start box on Days 8, 9, and 10. One member of each pair was pre-fed in the preferred goal box and the other in the opposite box. Each animal was given five additional minutes of solitary free exploration on Day 11. Those in Group 1 were then taken from the maze, placed in the predetermined goal box with the filled food dish and allowed to eat for 1 min. Upon removal, the rat was immediately placed in the start box and the door opened. Rats in Group 2 were treated in an identical manner except they were returned directly to their cages following pre-feeding in the goal box. They were placed in the start box 24 hr. later. Group 3 returned to their cages at the end of the 5 min. exploration period and received both pre-feeding and testing 24 hr. later. Rats in Groups 2 and 3 were fed at the regular time during the 24 hr. delay period.

Results

On the test trial, 18 rats in Group 1, 13 in Group 2 and 9 in Group 3 turned in the direction of the goal box in which they had been fed previously. The first value (.82) is significantly different from chance by two-tailed sign test ($p = .004$). Both Groups 2 and 3 fail to reach significance, and Groups 1 and 3 are significantly different from each other (.82 vs. .41, $p < .02$).

Discussion

The results for Group 1 replicate and confirm the findings reported by Seward (1949), whereas Group 3 not only fails to yield results similar to those of Gilchrist (1952) but is also different from Group 1 in a direct comparison. In comparing the outcome of Group 3 with Gilchrist's study, it must be noted that the latter does not report obtained proportions of correct choices, since the investigation was concerned with comparisons of running time differences between four groups of 10 rats given 30, 60, 120, and 180 min. of free exploration, respectively. Gilchrist reports only that for all 40 Ss combined, $p < .05$ for a χ^2 -test of correct turns, $p < .02$ for a test of appropriate goal box entries, but $p < .95$ for "perfect runs," which involve both a correct turn and an appropriate goal box entry (p. 201). In the present study there were no discrepancies between

turns at the choice point and goal box entries. If the "perfect run" criterion is utilized, the present study would agree with Gilchrist's in failing to find latent learning.

The latent learning experiment emerges from the present analysis with what appears to be a new restriction on the conditions under which positive results are obtained. The restriction—that the learning must be tested less than 24 hr. after it is presumed to have taken place—is a somewhat unusual one so far as more conventional learning phenomena are concerned. The latter are typically defined as relatively permanent changes in an organism's behavioral dispositions (cf. e.g. Kimble, p. 6) and would therefore be expected to survive at least 24 hr. While the original Seward experiment is quite reliable (the senior author's undergraduate laboratory has twice replicated Seward's results), the sensitivity of the latent learning phenomenon which it demonstrates to inter-phase time intervals suggests processes different from those which determine ordinary learning phenomena.

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