The frustration effect as a function of training magnitude: Within- and between-Ss designs[1]

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One group of rats (Group D) received differential reward conditioning in the first alley (A1) of the double-alley apparatus prior to the administration of nonrewarded (N) test trials in both S+ and S–. Nondiscrimination groups always received the magnitude associated with S+ (Group 8C) or with S– (Group 1C) for Group D prior to the administration of N trials in A1. Speeds with which Ss ran to the second alley following N in A1 were independent of training magnitudes both within Group D and between Groups 8C and 1C.

Previous studies have shown that, in the double-alley apparatus, rats regularly rewarded in the first goalbox (G1) run faster in the second alley (A2) following omission of G1 reward than do Ss never rewarded in G1 (Barrett, Peyser, & McHose, 1965; Wagner, 1959). This facilitative effect of contextual nonreward (N) has been attributed by Amsel (1958) to the occurrence of frustration (RF) on N trials that augments the general drive level of the organism. Within frustration theory, the vigor of RF, and the resultant drive increment, is assumed to vary directly with reward expectancy (rg). One implication of this assumption is that as the amount of reward regularly received on rewarded (R) trials increases, so should A2 speeds following nonreward in G1.

The relationship between R-trial magnitude and N-trial speeds has been investigated using both within- and between-Ss methods of varying R-trial magnitude. In the between-Ss design, different groups of Ss have been trained on different R-trial magnitudes of G1 reward prior to the omission of reward in G1. In the within-S design, one group has received differential reward conditioning in the first alley with large reward associated with one stimulus, S+, and small reward with the other stimulus, S–, prior to the omission of reward, on test trials, in both S+ and S–. The resultant literature yields no unequivocal conclusion regarding the nature of the relationship between R-trial magnitude and N-trial speeds. Thus, between Ss, Krippner, Endsley, & Tacker (1967) obtained data supportive of frustration theory, while others have not (Barrett et al, 1965; McHose & Ludvigson, 1965). Within Ss, data consistent (Peckham & Amsel, 1967) and inconsistent (McHose, Meyer, & Maxwell, 1969) with frustration theory have been reported. The present study was concerned with whether or not the between- and within-Ss designs would yield discrepant results with respect to the relationship between R-trial reward amount and N-trial speeds. The design of the study provides a direct comparison between the two methods within one common set of procedural techniques.

METHOD

Thirty male albino rats, 90 days old at the beginning of the experiment, received 96 acquisition and 96 postshift trials in a modified L-shaped double-alley apparatus previously described (McHose et al, 1969). The apparatus provided for the presentation of either a black or a white first alley (A1) and goal (G1) section that could be aligned with a gray startbox (S1) and that preceded a gray orienting chamber (S2), intermediate between G1 and the gray second alley (A2). Doors separated S1 from A1, A1 from G1, G1 from S2, S2 from A2, and A2 from G2. Opening the door separating S1 from A1 initiated a clock that stopped with S's interruption of a photobeam located 12 in. into A1. Clock and photoelectric circuitry also provided traversal times over the first 6-in. segment of A2.

All Ss were placed on a 23-h food-deprivation cycle 12 days prior to the 1st experimental day (Day 13). On Days 11 and 12, approximately 1 g of 45-mg Noyes pellets, identical to the subsequent reinforcement pellet, was incorporated in Ss' daily diet. On these days, Ss were also allowed to explore the S1 and A1 portions of the apparatus for 5 min.

During the acquisition period, Group D always received eight pellets in G1 on each S+, e.g., black, A1-G1 trial and one pellet on each S–, e.g., white, A1-G1 trial. The brightness of S+ was counterbalanced within Group D. Ss received four trials per day, with A1-G1 brightness varied according to the following repeating cycle: BWBW, WWBB, WBBW, BBWW, BWWB. Groups 1C and 8C always received one and eight pellets, respectively, in G1 in the acquisition period. Within these groups, half of the Ss always ran in the black A1-G1, and half ran in the white A1-G1. Acquisition conditions were unchanged during the postshift period, with the exception of the administration of N trials to all groups. Group D received two N trials in S+ and two N trials in S– in each block of 16 trials, while Groups 1C and 8C received four N trials in each block of 16 trials. Trials were administered to Ss in squads of eight, with the running order of Ss within a squad randomized from day to day. The intertrial interval was approximately 6 min. All Ss always received two pellets of reward in G2.

On any trial, the first start door opened after S had oriented toward the door for 3 sec. The door separating G1 from S2 was opened as soon as S withdrew from the (empty) goalcup in G1; the second start door opened after a 3-sec orientation by S.

Starting times in A1 and in A2 were reciprocated, yielding A1 and A2 starting-speed measures.

RESULTS

Group mean A2 postshift starting speeds for Groups D, 8C, and 1C are plotted in Fig. 1. Speeds following reward (R) in G1 are plotted separately from those obtained following nonreward (N) in G1, and for Group D, speeds following both R and N are further differentiated according to whether the R or N event occurred in S+ (8D) or in S– (1D).

Looking first at N-trial data, it may be seen in Fig. 1 that, at the end of training, performance on N trials was unrelated to the amount of reward received on R trials. Thus, although Group D displayed faster speeds following N in S– (1D) than in S+ early in the postshift period, Conditions 8D and 1D yielded equivalent performance levels in the later stages of training.

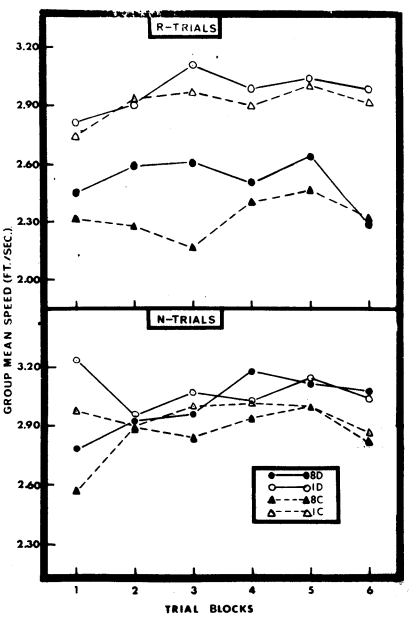

Fig. 1. Mean A2 speeds on reinforced and nonreinforced trials over the postshift period.

Similarly, while Group 1C speeds were above those for Group 8C early in the postshift period, N-trial performance was nearly equal for these groups in the later stages of training. Analysis of variance of early (Blocks 1-3) vs late (Blocks 4-6) data for Conditions 8D and 1D yielded a significant ($p < .05$) Blocks by Conditions interaction ($F = 7.02$, $df = 1/9$). A subsequent paired comparison (one-tailed t test) between Conditions 8D and 1D over Blocks 4-6 did not approach statistical significance. Similar analysis of the data for Groups 8C and 1C yielded a Blocks by Groups interaction approaching significance ($F = 3.36$, $df = 1/18$, $.05 < p < .10$), and subsequent paired comparisons for the 8C vs 1C comparison over Blocks 4-6 failed to approach statistical significance.

While speeds on N trials did not vary with R-trial magnitude, R-trial speeds were faster following small as compared with large G1 reward, both within and between Ss. Analysis of the data for Groups 8C and 1C on R trials over early (Blocks 1-3) and late (Blocks 4-6) stages of the postshift period yielded a significant ($p < .01$) groups effect ($F = 19.43$, $df = 1/18$). Similar analysis of the within-Ss R-trial data (8D vs 1D) yielded a significant ($p < .01$) G1 magnitude effect ($F = 28.06$, $df = 1/9$).

Finally, two aspects of the A1 data should be noted. First, Group D ran significantly ($p < .01$) faster in the S+ A1-G1 alley than in the S− discriminandum. Second, the A1 performance levels of Groups 8C and 1C did not significantly differ.

DISCUSSION

In the present study, Group D displayed nearly equivalent A2 speeds following N in S+ as compared with S−, and the speeds of Groups 8C and 1C following N in G1 did not differ. Thus, performance following frustrative nonreward did not depend on R-trial reward magnitude, either within or between Ss. These results are, of course, inconsistent with a basic assumption within Amsel's (1953) frustration theory, viz, that frustration varies with reward expectancy (rg).

Since the present study did not include a group never rewarded in G1, it is not possible to determine whether *any* speeds following N in G1 were elevated by a frustration-drive component. Thus, it is possible that Group 8D did not display differential frustration in S+ as compared with S−, because no frustration, in an absolute sense, occurred. Following this reasoning, the present within-S data and previous similar findings (McHose et al, 1969), because of some procedural detail, may be irrelevant to the expectancy-frustration assumption within frustration theory. However, this same reasoning may be applied to within-S data apparently supportive of frustration theory (Peckham & Amsel, 1967). Indeed, the observation that N-trial speeds for Group D in the present study were above those attained by Groups 8C and 1C on N trials strongly suggests that the former speeds are elevated by an absolute frustration-drive increment, since a number of previous studies have shown that N-trial speeds for conditions like those of 8C and 1C are elevated relative to a never-rewarded control group (Barrett et al, 1965; Daly, 1968; McCain & McVean, 1967; Wagner, 1959).

Two previous between-Ss studies relevant to the relationship between R-trial magnitude and N-trial speeds have, like the present study, produced results inconsistent with the direct positive relationship implied within frustration theory (Barrett et al, 1965; McHose & Ludvigson, 1965). Unlike the previous studies, however, the present data afford a better test of the theory since Ss in Groups 8C and 1C experienced only one specific amount of reward on R trials. Between Ss, only the Krippner et al (1967) data provide support for the R-trial magnitude/N-trial speed relationship implied within frustration theory, and the generality of these data are questionable in view of the fact that A2 speeds following R in G1 did not vary with R-trial magnitude, an anomalous result in this literature (cf. Barrett et al, 1965; McHose & Ludvigson, 1965; Peckham & Amsel, 1967).

It would appear that the present data, in conjunction with previous findings, most reasonably lead to the conclusion that N-trial speeds do not increase as R-trial reward magnitude increases, and that within- and between-Ss paradigms yield equivalent results in this aspect. If this conclusion is warranted, it would seem prudent to develop a new frame of reference within which to view the various double-alley phenomena, since the assumption of an rg-frustration dependency is central to frustration theory.

Finally, the present R-trial data, consistent with previous data (Barrett et al, 1965; Daly, 1968; McHose & Ludvigson, 1965), show A2 speeds to be inversely related to the amount of reward received in G1, both within and between Ss. While more elaborate interpretations of this effect (cf. Daly, 1968) may eventually prove warranted, the present data and previous similar findings may simply reflect an absolute magnitude effect, such that A2 speeds decrease as G1 reward increases, independent of any relationship between present and previous G1 reward magnitude.

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NOTE

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