presented in Fig. 2. It is apparent from Fig. 2 that groups experiencing two pellets in G1 were performing at a higher level than groups receiving eight pellets. Analysis of variance over the seven blocks of preshift trials indicated that the G1 reward magnitude variable was statistically reliable for both start speeds (F = 18.06, df = 1/82, p < .01) and running speeds (F = 14.60, df = 1/82, p < .01). The magnitude of G2 reward, however, failed to affect either the start measure (F < 1, df = 1/82) or the running measure (F = 1.10, df = 1/82). It was further revealed that the G1 by G2 Reward Magnitude interaction achieved significance at the .10 level for the start speeds (F = 3.20, df = 1/82) and at the .01 level for the running speeds (F = 7.17, df = 1/82). Orthogonal comparisons of treatment sums indicated that Group 2-8 ran faster than Group 8-8 for both the start measure (F = 18.26, df = 1/82, p < .01) and the running measure (F = 21.09, df = 1/82, p < .01). Group 8-2 was not statistically different from Group 2-2 for either the start measure (F = 2.94, df = 1/82) or the running measure (F < 1, df = 1/82).

Postshift Phase

Alley 1. Mean A1 start and running speeds over blocks of nine trials are shown in Fig. 3. As may be observed, the introduction of delay in G1 produced an immediate decline in both A1 start and running speeds. Analyses of variance over the five blocks of test trials indicated that delay significantly disrupted start speeds (F = 5.90, df = 1/78, p < .05) and running speeds (F = 62.62, df = 1/78, p < .01). The G1 reward magnitude variable was significant in both start and running speeds (F = 13.41, 14.78, respectively, df = 1/78, p < .01). None of the other interactions were significant.

Alley 2. Mean A2 start and running speeds over blocks of nine trials are given in Fig. 4. With the exception of the start speeds for groups receiving two pellets in G1, all no-delay groups showed superior performance to that of the delayed groups. Analyses of variance performed over the five blocks of postshift trials indicated that the effect of G1 reward was statistically reliable for start speeds (F = 17.64, df = 1/78, p < .01) and running speeds (F = 9.14, df = 1/78, p < .01). The G2 reward magnitude variable was not significant for either the start or running measures (Fs < 1, df = 1/78). Delay of G1 reward did not reliably affect start speeds (F < 1, df = 1/78), but did significantly reduce run speeds (F = 4.85, df = 1/78, p < .05). The G1 by G2 Reward Magnitude interaction was significant for both start and run measures (F = 6.25, 4.85, respectively, df = 1/78, p < .05). None of the other interactions were significant.

DISCUSSION

The present data lend support to the notion that as a consequence of the similarity in operations, the double alleyway should yield behavioral phenomena which resemble those obtained under differential conditioning situations with contrasting reward magnitudes. The major finding which related to the "depression" effect was the slower preshift A1 running speeds of Group 2-8 relative to Group 2-2. An "elation" effect, i.e., faster A1 speeds for Group 8-2 relative to Group 8-8, failed to occur. The results are seemingly in agreement with the literature in differential conditioning and in particular with an experiment by Matsumoto reported by Black (1968). With contrasting rewards in two separate alleyways, Matsumoto was able to obtain a "depression" effect but not an "elation" effect. The A2 results were not amenable to a contrast interpretation since it may also be claimed that "elation" or "depression" effects could be obtained on the basis of demotivation due to G1 reward (Seward, Pereboom, Butler, & Jones, 1957).

The effects of constant delay of G1 reward on A2 performance do not support Amsel's (1958) implication that delay of G1 reward may be interpreted as a frustrative event. To this end, it would be expected that A2 performance should be facilitated by the shift to delay of G1 reward. The present data confirm results reported by McHose (1966) who found that in a within-S design, delay of G1 solid food reward did not enhance A2 performance. Within the Amsel theoretical framework, it might be expected that a shift to a constant G1 delay would create an interference of previously conditioned anticipatory goal responses (r_g) with delay-engendered conditioned anticipatory frustration responses (r_g) in A1. In Fig. 3, the rapid decline of A1 speeds upon shift to delay would seem to support this contention. Amsel (1958) has assumed that enhanced A2 performance due to frustrative nonreward in G1 is contingent upon the strength of the conditioned r_g in A1. It might therefore be expected that as a consequence of its rather immediate decremental effects on A1 performance, a sudden shift to constant delay of G1 reward would not result in facilitated A2 performance.

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The magnitude of the frustration effect as a function of the number of previously reinforced trials[1]

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Responding in a double runway following the cessation of reinforcement in the first goalbox was studied as a function of either 35 or 75 prior reinforcements in the first goalbox. Second runway speeds showed a greater increase for the 75-reinforcement group. Results were discussed in terms of frustration theory.

A common, if not universal, finding in the animal learning literature is a nonmonotic relationship between number of reinforced trials and subsequent resistance to extinction. Both North & Stimmel (1960) and Birch (1961) have employed Amsel's (1958) concept of frustration to account for this nonmonotonicity. According to Amsel, r_f-s_f (frustration) varies as a function of the level of r_g-s_g. Birch (1961) hypothesizes that at high levels of r_g-s_g cessation of reinforcement leads to the elicitation of r_f-s_f of sufficient magnitude to cause emotional responses incompatible with instrumental responding. This formulation, of course,
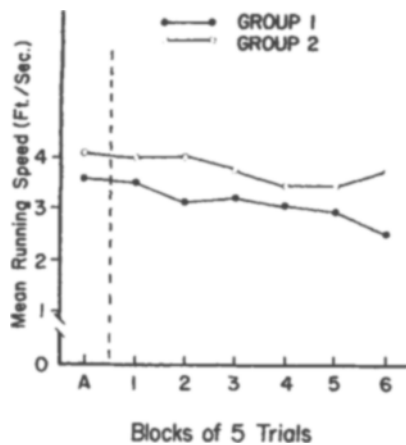
Fig. 1. Mean running speeds, Runway 1, during last day of reinforcement and 6 days of nonreinforcement in Goalbox 1.

supposes that the magnitude of r_f-s_f increases as a function of the number of reinforced trials. The present study investigates this question with a double runway situation.

SUBJECTS
The Ss were 20 male albino rats of the Cheek-Houston strain which were 300 days old at the beginning of training. The Ss were individually caged.

APPARATUS
The apparatus was a double, straight-alley runway to be described more fully in a subsequent report. The experiment was conducted in a highly sound-resistant room with dim overhead lights.

PROCEDURE
Pretraining consisted of 14 days of 1-min per day handling of each S. Following handling the Ss were allowed 1 h of ad lib feeding on Wayne Lab Chow. The amount of food was gradually reduced from 20-22 g to 15-17 g. The latter amount was given the Ss for 1 h throughout the remainder of the experiment. Next, the Ss were given 5 days of introduction to the runway. On Days 1 and 2, the Ss were allowed 3 min of free exploration of the runway with the photoelectric cells on and all doors open. On the third, fourth, and fifth days the retrace doors and the door into the second runway were closed after the S had passed through them. On Days 4 and 5, six Noyes 45-mg pellets were available in Goalbox 1 (GB1) and four pellets were available in GB2. The same amount of reinforcement was used throughout training.

Following pretraining the Ss were randomly divided into two groups of 10 each. G1 received 35 trials with reinforcement in GB1 and 30 trials with no reinforcement in GB1 (NRGB1) but reinforcement continued in GB2. G2 received 75 trials with reinforcement in GB1

and 30 NRGB1 trials. Ss had five trials per day with an approximately 8-min ITI throughout the experiment. A trial consisted of placing the S into Runway 1 breaking a photoelectric beam. When the S entered GB1 it was allowed 15 sec in the area. Following this the door to Runway 2 opened activating a clock which was stopped by S cutting a photoelectric beam 1 ft into Runway 2. The S was also confined in GB2 for 15 sec. Start, running, and goal latencies were obtained in both runways. At the completion of a daily trial session, the Ss were returned to their home cages and allowed 1-h access to the lab chow. Water was available at all times throughout the experiment.

RESULTS
One S in Group 2 was injured during the experiment and was discarded. Figures 1 and 2 represent the mean running speeds for the last day of reinforcement in GB1 (A) and the NRGB1 days for Runway 1 and Runway 2, respectively. Analysis of variance for running speeds in Runway 1 yield a significant between-groups effect ($F = 8.07$, $df = 1/17$, $p < .025$), a significant between-trials effect ($F = 15.19$, $df = 4/68$, $p < .001$), and a significant Trial by Group interaction ($F = 36.65$, $df = 4/68$, $p < .001$). The differences appeared to be due to the fact that Group 1 ran progressively faster across the five trials while Group 2 remained relatively stable across the trials. For the last day of acquisition in Runway 2, the between-groups effect was not significant ($F = 2.46$, $df = 1/17$, $p > .10$), the between-trials effect was not significant ($F = 2.19$, $df = 4/68$, $p > .05 < .10$), while the Trials by Group interaction was significant ($F = 2.79$, $df = 4/68$, $p < .05 > .025$). Again, the significant interaction appeared to be due to the fact that G1 increased in speed within the day while G2 did not.

Following the shift to NRGB1, analysis of variance for running speeds, Runway 1, yielded a significant between-groups effect ($F = 5.46$, $df = 1/17$, $p < .05$), a significant between-trials effect ($F = 48.58$, $df = 29/493$, $p < .001$), and a significant Trial by Group interaction ($F = 1.82$, $df = 29/493$, $p < .01$). A similar analysis for NRGB1, Runway 2, yields a significant between-groups effect ($F = 7.52$, $df = 1/17$, $p < .025$), a significant between-trials effect ($F = 4.05$, $df = 29/493$, $p < .001$), and a significant Trials by Group interaction ($F = 1.57$, $df = 29/493$, $p < .05$).

DISCUSSION
The between-group differences observed during NRGB1 in Runway 1 can be best attributed to preexisting group differences. Both groups showed a decline in running speed with G1 declining at a slightly faster rate. To the extent that Runway 1 speed
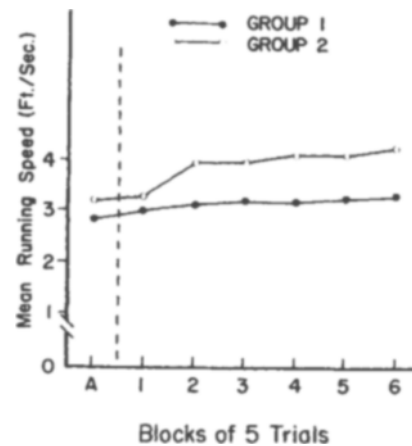

Fig. 2. Mean running speeds, Runway 2, during last day of reinforcement and 6 days of nonreinforcement, in Goalbox 1.

decrements are analogous to the usual runway extinction data, the more highly trained group (G2) extinguished at a slower rate. The Runway 2 NRGB1 data demonstrate an increased speed of running following cessation of reinforcement for both groups with a relatively greater increase for Group 2. While a concept of "demotivation" (e.g., Barrett et al, 1965) might explain the increased speed of running during NRGB1 for both groups, it is difficult to see why a group with a larger number of reinforcements should show a differential increase in Runway 2 speeds if the amount of reinforcement in GB1 were the determiner of the increased speed. Although, in general, the Runway 2 results might be interpreted as supporting frustration the most dramatic break between Groups 1 and 2 occurred after five trials of NRGB1 and not immediately after the beginning of NRGB1; and (2) the fact that the differences between the groups increased sharply between Trials 5 and 10 and then remained fairly constant through Trial 30 of NRGB1. One might expect r_f-s_f to habituate if that was what was responsible for the difference in the two groups.

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