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2 sec of being confined under shock prior to the raising of the G1 exit door to R2. The response of running down R2 to G2 ended in relief from shock on all trials. This latter procedure was considered the frustration condition. It was found in this study that animals on frustrative nonrelief trials ran significantly *slower* in R2 than they did on relief trials. In a second experiment this "reversed FE" was not evident until approximately 20 trials had occurred, when running to G1 was partially reinforced from the beginning. Lambert & Hammond (in press) argued that this latter finding showed that the slowing down was not simply due to differing nonassociative factors occurring on the two types of trials. That is, they suggested that the "reversed FE" depended on associative factors (expectancy of reinforcement in G1 which could only occur after a number of trials had taken place), as was true in the appetitive case (Roussel, 1952; Amsel & Hancock, 1957; Wagner, 1959). A possible criticism of this argument is that the effect may be due to the interruption of shock on relief trials but not on frustration trials. The present experiment was performed to take into account this criticism of the difference in shock continuities. Here, animals were trained to expect a certain period of relief from shock for the response of running to G1, whereupon they were frustrated in that their expectancy of a particular duration of shock offset was disconfirmed. However, this procedure interrupted the shock and afforded the animals a minimum timeout from shock.

The effect of disconfirming an expectancy of time-out from shock in the double runway*

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In a double-runway apparatus using shock escape as the reinforcement, Lambert & Hammond (in press) showed that the Amselian frustration effect (FE) manifests itself as a marked slowing down in the second runway, when an expected relief from shock is not forthcoming. The present experiment was performed to determine if an animal builds up a particular expectancy of timeout from shock and what the effect might be of disconfirming this expectancy by giving a substantially shorter period of shock relief. The "reversed FE" again appeared when a particular expectancy of timeout from shock was disconfirmed. Also, Runway 1 speeds were seen to decrease when this frustration treatment was introduced.

In an attempt to extend Amselian frustration theory from the appetitive to the aversive realm, Lambert & Hammond (in press) performed an experiment in

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which rats were given 15 trials in a shockable double-runway apparatus where running to a first goalbox (G1) resulted in 8 sec of relief from shock, whereupon shock was again turned on for 2 sec prior to the raising of the exit door of G1, allowing S to run down a second runway (R2) to a second goalbox (G2), where relief from shock was again received. Thereafter, 18 trials were given, half of which resulted in S's receiving no relief. Running to G1 on these trials simply got S

SUBJECTS

Sixteen male albino rats of the Sprague-Dawley strain, weighing 150-175 g, served as Ss. They were housed individually and given ad lib food and water.

APPARATUS

A straight alley similar to that used in Amsel & Roussel's 1952 study was used, but with the addition of an electrifiable floor. The alley was 10 ft long and consisted consecutively of a 1-ft startbox (SB), a 3-ft first runway (R1), a 1-ft first goalbox (G1), a 4-ft second runway (R2), and finally, a 1-ft second goalbox (G2). Guillotine doors separated each of these compartments. The inside dimensions were 4 in. high x 2-5/8 in. wide. The hinged top was of clear Plexiglas. The shocking surface was made of two L-shaped aluminum runners, each of which formed one wall and one half of the floor. A 5/8-in. gap ran down the middle of the runway and separated the floor portion of the runners. Sigma photocells were placed below this gap in the floor, one 3 in. outside of SB

Fig. 1. Mean running times in R2 for the first 12 training trials of Phase 1 and the subsequent testing trials of Phase 2.

and one 3 in. inside of G2; there was also one 3 in. into R2 and one 3 in. into G2. Running times in R1 between the first two and in R2 between the last two photocells were recorded on a Standard Electric timer.

A constant-current shock source, consisting of a 1,200-V ac step-up transformer and a large series resistance, produced a .80-mA current across the shock runners, as measured by the voltage drop across an 110-K-ohm resistor placed between the runners. Shock could be delivered independently to SB and R1 and also to G1 and R2. Lambert & Hammond (1970) showed that this constant-current source could produce efficient shock escape behavior in this apparatus.

PROCEDURE

The experiment consisted of two phases: first, an acquisition phase in which the rat received 18 sec of shock relief 100% of the time in G1. On all trials in the first phase S was placed in the SB with the door adjoining R1 down. When the rat was facing the door, the door was raised and shock was turned on simultaneously to the SB and R1 runners. The runners in G1 did not have shock applied to them, and as soon as the rat entered G1, the entrance door was lowered and the rat was given 18 sec of shock relief. The exit door from G1 to R2 had been closed up to this point. After this 18-sec period, shock was delivered to the G1 and R2 runners and 2 sec later the exit door from G1 to R2 was raised. The rat was thus confined in G1 during shock presentation for 2 sec following the relief period. These durations were timed by E with a stopwatch. The rat then proceeded to G2, running on the electrified R2 runners. The G2 runners never had shock applied to them. During this first phase of the experiment, there were 12 trials of the type described above. In the second, or test phase, only 50% of the trials were run as described above (the

full relief treatment). On the other half of the trials, upon entrance into G1, the retracing door was closed, and the rat received only 2 sec of shock relief before the onset of shock for 2 sec prior to the raising of the door to R2 (the partial relief or frustrative treatment). These relief and frustration trials were alternated in a semirandom order following a pattern used by Wagner (1959), i.e., RFRF, FRFR, FRRF, RFFR, FFRR. There were 20 trials during the second phase. It should be emphasized that the amount of shock received in G1 was the same on both types of trials and that in each case the rat was receiving shock before it started to run down R2. The intertrial interval was 1 min, during which the animals were placed in a metal detaining box.

RESULTS

Mean running times in R2 for the 12 trials of the first, or training, phase and the subsequent full relief (R) and the partial relief, or frustration (F), trials are shown in Fig. 1. It will be seen that running times are slower in R2 following frustration than following relief in G1. The difference between the mean speed on all R trials of the second phase and the mean speed on all F trials of the second phase was significant (Wilcoxon matched-pairs signed-ranks test, $T < 30$, $p < .05$), but this difference, as was found by Lambert & Hammond (in press), was in the opposite direction from that which is typically found in studies of frustrative nonreward. Also of interest is Fig. 2, which shows mean running times in R1 for the last block of trials of Phase 1 and the subsequent five blocks of trials of Phase 2. Here it is seen that there is a progressive slowing down of responding in R1 during the partial relief phase. The difference between the mean speeds in R1 during the first phase of training trials and the mean speeds in R1 during the second phase of test trials was significant (Wilcoxon matched-pairs signed-ranks test, $T < 20$, $p < .01$).

DISCUSSION

The results of this experiment indicate that an explanation of Lambert & Hammond's (in press) "reversed FE" in terms of a simple difference in shock offset-onset hypothesis is not adequate. Here, shock offset-onset was present on both types of trials, and the slowing down after frustrative nonrelief still appeared. Also, these results seem to indicate that animals acquire a particular expectancy of shock relief duration and that the disconfirmation of such an expectancy is frustrating. It must be admitted, however, that the experiment may show only that 2 sec of relief from otherwise continuous shock is equivalent to no relief at all. The finding that R1 speeds decrease when the

Fig. 2. Mean running times in R1 for the last block of four training trials of Phase 1 and the remaining five blocks of four trials of Phase 2.

partial relief phase is introduced seems to indicate that something similar to that which occurs in R1 in the appetitive case is operative in the aversive case as well. In the typical appetitive FE study, R1 speeds are also seen to decrease during the partial-reward phase. The explanation put forth for this phenomenon is one that implicates a response inhibition mechanism. This mechanism, the "fractional anticipatory frustration response," is said to be due to the conditioning of the stimulus properties of frustration to the instrumental response of running, thus inhibiting forward locomotion. Lambert & Hammond (in press) argued that if the FE is operationally defined as any reaction of the organism to frustrative nonreinforcement, then their findings conceptually extended the frustration theory of Amiel to shock escape behavior. But a reasonable answer to the question of why animals run more slowly rather than faster following frustrative nonrelief is still not apparent.

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