The effect of flicker on avoidance acquisition in the bush baby, *Galago senegalensis*

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In a study of the discrimination of intermittent visual stimuli by bush babies, Galago senegalensis, *in a go, no-go two-way shock-avoidance task, it was found that active avoidance to the high-rate flicker, 18/sec, was facilitated as compared with active avoidance to the low-rate flicker, 3/sec. Acquisiton of passive avoidance was superior to acquisition of active avoidance, and flicker rate did not affect passive avoidance differentially.*

Among the many variables that affect the response-producing potential of a stimulus, the characteristics of the stimulus itself have been most extensively investigated in relation to responses that are not dependent upon prior experience in a formal learning paradigm, e.g., in the study of sign stimuli (Tinbergen, 1948), stimuli eliciting the orienting response (Lynn, 1966), and stimuli eliciting preference responding (Long & Tapp, 1967).

Much less attention has been given to a possible relationship between characteristics of the stimuli employed and the responses occurring in the course of learning. The dimension of stimulus intensity is one notable exception, reviewed by Gray (1965) and serving as the basis for the decision model of Grice (1968). In addition, Myers (1964, 1962) has reported that the quality (buzzer vs tone) as well as the intensity of conditioned stimuli affected the avoidance conditioning of rats. Thus, it appears that acquisition of certain behavioral responses may be altered systematically by several stimulus dimensions.

This study reports the effect of flicker rate on the avoidance conditioning of the bush baby, *Galago senegalensis.* Although to the present time the bush baby has seldom been employed in behavioral experiments (however, cf. Jolly, 1964a, b), this prosimian is an important link in the phylogenetic series of insectivore, nonhuman primate, man (Hodos & Campbell, 1969). The data reported here were acquired incidental to a series of studies still in progress on some sensory and behavioral capacities of this species.

SUBJECTS

Four adult, experimentally naive bush babies, two males and two females, were maintained in the laboratory a minimum of 1 month before training was instigated. All Ss were housed individually in 18 x 24 x 30 in. cages and fed an ad lib diet of fresh fruit, horsemeat, and cat chow.

APPARATUS

The testing apparatus was a two-way shock-avoidance box, 2 x 1 x 2 ft, constructed of Plexiglas and with a grid floor. The top and three sides were flat black. A fourth side of clear Plexiglas permitted viewing of the animal during testing through a one-way window. A 0.5-sec scrambled shock of 0.6-2.0 mA could be delivered to the ¼-in.-diam bars of the grid floor. For each S, the shock level was the lowest value that would maintain consistent responding. Masking noise was furnished by a Grason-Stadler white-noise generator.

The stimulus was presented at a 3-in.-diam circular aperture in the center of one long side, and the position of the stimulus served to separate the two halves of the rectangular apparatus. The bottom edge of the aperture was 3 in. above the level of the grid floor. A diffusing surface was fixed over the aperture, and the stimulus source, a Grass PST-2 flash lamp driven by a Grass PS-2 photostimulator, was mounted 2 in. behind this surface. Luminosity of the high flicker rate at the surface was measured by a brightness spot meter at the average value of 70 ft-L. The ambient illumination of the apparatus was approximately .4 ft-L.

PROCEDURE

Since the aim of this study was to record the acquisition of a discrimination between two rates of flicker, and there was reason to believe that the flicker fusion threshold for the bush baby is low (Ordy & Samorajski, 1968), it was necessary to determine the range within which intermittent visual stimulation was not distinguishable from continuous visual stimulation. In a separate study, a flicker fusion threshold in the range of 24-28/sec was established for the bush baby under these conditions of illumination and testing. In order to place the high-rate stimulus well below the fusion threshold, the value of 18/sec was chosen. The rate of flicker for the low-rate stimulus was selected at 3/sec to insure that the difference threshold was exceeded.

Stimuli were counterbalanced with respect to response contingency. Two Ss, A and B, were assigned 18/sec as the go stimulus and 3/sec as the no-go stimulus; the other two Ss, C and D, were assigned the converse stimulus contingencies.

The Ss were trained in the late evening during their normally active period. All Ss were trained one session of 20 trials each day. Two sessions of habituation to the apparatus and one session of stimulus habituation were given prior to initiation of training.

The no-go stimulus was always of 10 sec duration. If the S remained on the same side, the stimulus was terminated at the end of the period. If, however, S crossed to the opposite side during this stimulus period, brief shocks were delivered until S returned to the correct side and the no-go stimulus continued for the remainder of the period.

Following the onset of the go stimulus, Ss were allowed 10 sec to cross to the opposite side. The stimulus was terminated immediately upon such a correct response. It was found in earlier training of other bush babies that this stimulus termination was necessary to prevent persistent recrossing. If S had not crossed at the end of the go stimulus period, a brief shock was delivered and the stimulus terminated simultaneous with the crossing leap.

The interval between trials was 50 sec, and random crosses during this interval were not followed by shock. The 20 trials of every session were equally divided between go and no-go conditions. The order of stimulus presentation was unique and randomly determined for each session, with the constraint that no more than three consecutive presentations of the same stimulus were allowed. The criterion for termination of training was five consecutive sessions at 90%, or more, correct per session.

RESULTS AND DISCUSSION

Acquisition of the go and no-go responses as a function of flicker rate is shown in Fig. 1. It is evident that acquisition of the no-go response is rapid and is not differentially affected by flicker rate. By contrast, acquisition of the go response is slower, and the combined performance of Ss that had the low-rate stimulus (L), 3/sec, is much retarded as compared to that of Ss having the high-rate stimulus (H), 18/sec. Visual inspection of Fig. 1 suggests that this difference in acquisition of the active response is due largely to an early facilitation of responding to the high-rate stimulus.

A breakdown of error scores by stimulus contingency and rate is shown in Table 1. Comparison of errors of Ss that had high- and low-rate stimuli associated with the go condition is statistically significant ($t = 6.85$, $df = 2$, $p < .05$). No comparable

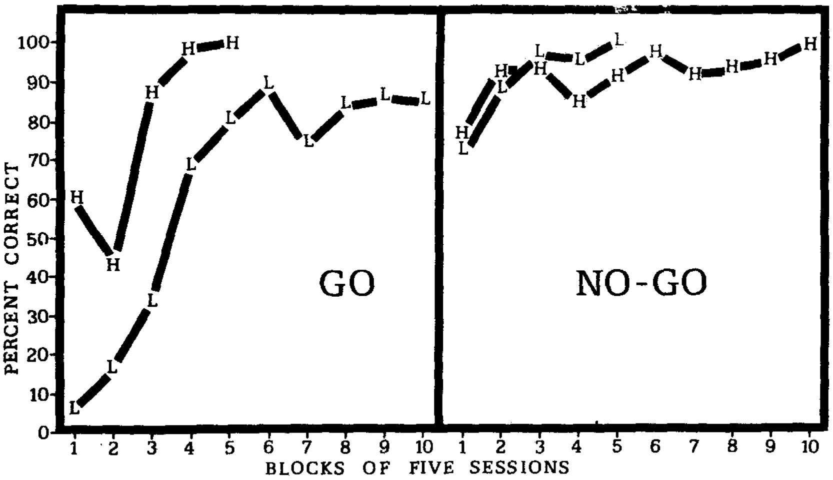

Fig. 1. Acquisition of a discrimination of two rates of intermittent visual stimulation, high (H) at 18/sec and low (L) at 3/sec, by bush babies in a go, no-go task. Each point represents a mean of 100 trials, 50 for each of two Ss.

Table 1
Subject Errors by Condition

Condition	A	B	C	D
	18/Sec		3/Sec	
GO	51	60	156	189
	3/Sec		18/Sec	
NO-GO	28	22	35	36

stimulus effect was present in the no-go conditions.

Two conclusions seem warranted: (1) A passive avoidance response was more readily acquired than was an active avoidance response by the bush baby in this within-S design, and (2) active avoidance, but not passive avoidance, was facilitated by a high-rate stimulus.

The superior performance of Ss in passive avoidance is probably due to the fact that the initial response of this species to stimulus onset, as observed in the stimulus habituation session and throughout training, was immobility. Rapid acquisition imposes a ceiling effect on the measurement of any stimulus effect that might have occurred in the acquisition of the no-go response.

Active avoidance acquisition was facilitated strongly by high-rate flicker as compared to low-rate flicker. These data indicate that flicker rate is yet another stimulus dimension that may systematically affect the course of acquisition. Still, the possibility may not altogether be ruled out that stimulus intensity contributed to the observed effect. Although the individual flashes were of equal intensity and each flash of approximately 15 msec duration, it may be that brightness enhancement (Bartley, 1938, 1951) occurs in the bush baby. If this proves to be the case, this effect might better be interpreted as a special case of stimulus-intensity effect.

One factor argues against the operation of the stimulus-intensity effect in this case. The stimulus-intensity effect is most often observed as either decreased latency of response or increased strength of response to stimuli of higher intensity. In this study, latencies of active avoidance responses to both high- and low-rate stimuli were recorded. The mean latencies for the four Ss were: A, 5.7 sec; B, 6.0 sec; C, 4.3 sec; D, 6.8 sec. Since A and B had high-rate and C and D had low-rate stimuli in the go condition, there is no indication that latency of response was affected differentially by rate of flicker. If the stimulus intensity effect were present, it seems likely that latency, as well as probability of response, should have been altered. Despite this discrepancy, further studies are necessary to determine the possible contribution of stimulus intensity to the demonstrated effect of intermittency.

As emphasized above, the importance of stimulus characteristics in the elicitation of responses outside the formal learning situation has been repeatedly demonstrated. Systematic exploration of the effect of a variety of stimulus dimensions on the learning process in different species may serve to clarify the relationship between unconditioned factors in behavior and the process of learning.

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