animals were able to do so. Examination of the effect of type of cue redundancy during the initial discrimination training revealed that the *opposite*-trained animals were more distracted than the *same*-trained animals during the *switch test* trials. A significant proportion of *same* animals, 13 out of 16, correctly utilized door cues ($p = .01$), while only half of the *opposite*-trained rats were able to do so. For individual drive groups, the HI-*same* group was the least distracted and the MOD-*opposite* group was the most distracted. For only HI-*same* animals, significantly more rats utilized the door cues than not ($p = .035$). HI-*same* snimals significantly differed from MOD-*opposite* animals in the proportion of rats utilizing the central door cues ($p \leq .05$, Fisher test).

These results suggest that peripheral wall cues, when attended to at all, served to operate as context stimuli rather than information or discrimination stimuli. If the latter were the case, then *opposite*-trained animals would have acquired the original discrimination more slowly due to a more complex task of conflicting compound brightness stimuli. This clearly did not happen. The greater disruption seen for wall switches in the *opposite* group further supports the interpretation that the wall stimuli served as surround stimuli. That is, the switching of wall stimuli for *opposite* animals appears to have decreased the distinctiveness of the door cues. The less distraction to HI-drive animals by wall cue changes also supports the notion that increased drive focuses or narrows the range of attention. As Easterbrook (1959) has stated, an increased field of attention due to decreased drive can also have a disorganizing effect on cue utilization, i.e., producing competing orienting responses to the reinforced response. The present study suggests that spacially distinct redundant cues will be more noticed by organisms operating under lower drive but will not be used as relevant cues for reinforcement-contingent behavior. Previous work in the present laboratory suggests that redundant cues occupying the same physical space will be more utilized as relevant by animals under lower drive conditions.

Table 3
Number of Rats in Each Group (N = 8) Utilizing Door or Wall Cue on Switch Test Trials

Group	Switch	
	Door	Wall
HI-Same	7	1
HI-Opposite	6	–
MOD-Same	6	–
MOD-Opposite	2	–

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(Received for publication March 19, 1973.)

Latency patterns in category judgments*

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Adult human Ss were required to learn a conditional discrimination in which there were three distinct visual stimuli (squares) to be matched with three corresponding response buttons. When Ss had learned the task to criterion, they were presented with a test series of 11 stimuli, including, and spaced symmetrically around, the three training stimuli. Ss were told to place each successive stimulus in one of the three categories represented by the choice of three response buttons. Response latency and category choice were recorded. The prediction that Ss would respond most quickly to stimuli at both ends of the series, and that the stimuli in the middle of the center category would elicit more rapid responses than those that were between the categories, was confirmed.

*Material from this report was presented at the Psychonomic Society meetings in St. Louis, November 1971.

In recent years, there have been a number of adaptation level (AL) studies reporting, among other measures, response latencies. In 1968, Capehart and Pease conducted a study in which the latency pattern was one of the dependent variables of interest. Briefly, their study involved a two-category judgment task, in which Ss were to make light or heavy responses to each weight in a series that followed experience with a "neutral" training weight. They found a significant stimulus effect on the latency, or decision time, measure, with a tendency for short latencies to be associated with the more extreme values of the test series and longer latencies to be associated with the medium stimulus values and peaking at a central value. It appears that the further away from a category boundary a given stimulus falls, the more rapid the response to that stimulus value. It also follows that those stimuli nearer the dividing point for the two categories elicit longer average response time. It should be emphasized that the Ss had only two possible response choices–right or left. This is assumed to encourage the S to establish two judgment categories. Hébert (1968) has replicated these findings, using a brightness dimension. These studies and others (e.g., Hébert & Capehart, 1969) have established latency as a valid and reliable indication of AL. In line with some assumptions involving AL, Capehart, Tempone, & Hébert (1969) have offered theoretical explanations as to the relationship between AL and latency. They suggest that the type of latency gradient found in the previously mentioned studies is based on category responding in which AL functions as a boundary for the categories. The more distant a test stimulus is from the category boundary (AL), the easier it is to categorize, and is, therefore, responded to more rapidly. Capehart et al have labeled this the "distinctiveness assumption."

Two testable approaches to category judgments and latency patterns can be distinguished. First, and most apparent, is the AL approach. When a S is exposed to a specific stimulus series, eventually a point within that series will come to act as a stored reference point, or AL. This stored referent can be thought of as a neutral point, and the other stimuli in the series will be judged as greater or lesser in reference to this neutral value. A second approach to the interpretation of the latency patterns in category judgments can be termed a *category boundary hypothesis.* The hypothesis here is that at some point between categories on a single dimension a boundary must exist to define the categories. It is at these boundary points that the longest average latencies or decision times for category classification will exist.

The present study was designed to provide a situation in which the two notions would not make the same predictions. A design in which Ss are trained to use *three* distinct responses, rather than two, is proposed. This would encourage the Ss to establish *three categories* instead of two. (All previous AL studies have nominally used two-category situations.)

The AL prediction for this three-category situation would be the same as it was for the two-category problem. In their theoretical interpretations of AL, Capehart et al (1969) make provisions for only a single reference point, i.e., one AL, in a single sensory dimension. The AL prediction would be that some value near the center of the testing dimension would come to act as an internal referent or neutral point. Those stimuli closest to this AL would be associated with the longest latencies, and the more distant stimuli from AL would be associated with shorter latencies. The form of the latency gradient would be quadratic, as in the above reported studies.

On the other hand, the category boundary hypothesis would predict quite a different latency pattern with a three category task. Three response classes require the use of two-category boundary lines. The present prediction calls for a bimodal latency pattern or quartic trend, that is, a latency curve in which those stimuli at the extreme ends of the testing series display the shortest latencies, with increasing latencies for stimuli near the category boundaries and decreasing again at the center of the middle category.

METHOD

Subjects

The Ss were 44 students in an introductory psychology course at Colorado State University. Conditions were assigned at random to Ss as they arrived for the experiment.

Apparatus

Stimuli were a series of squares projected onto a screen. There were three training stimulus slides (projected image on 2 in. sq, 3 in. sq, and 4 in. sq. In addition, there were three sets of 11 stimulus slides which, when projected on the backside of a 20 x 20 in. translucent screen, showed white squares of 1.75, 2.00, 2.25, 2.50. 2.75, 3.00, 3.25, 3.50, 3.75, 4.00, and 4.25 in. sq. In front of the screen before S was a response panel which consisted of three keys that were equidistant from a starting mark.

Procedure

The Ss entered the experimental room one at a time and were seated in front of the screen. They were told that a series of squares would be presented and that they were to respond by first guessing which of the three keys went with each of the stimuli. Half of the Ss were given instructions emphasizing the need for *accurate* responses. The other half received instructions in which *speed* was emphasized.

A training period was then started. The Ss were presented with randomly determined orders of the three stimuli corresponding to the center of each "category" (2.00, 3.00, and 4.00 in. sq) until they reached criterion. Criterion was defined as seven consecutive correct choices. At criterion, E ceased informing Ss as to whether their responses were correct or not. The E continued with the three training stimuli for 6 more trials and then, without changing the pace, he began presenting all 11 test stimuli, including the 3 training values, in a counterbalanced sequence. This test period continued through three cycles of one presentation of each stimulus per cycle, or 33 trials. Latencies, defined as the time from onset of the stimulus to the pressing of response key, and the category choices were recorded automatically for each stimulus.

RESULTS

An analysis of variance of response latencies to the training stimuli showed no significance, $F(2,84) = 1.20$, but there was a significant difference due to instructions, $F(1,42) = 5.80$, $p < .05$. The lack of significance due to stimuli during training indicates that the three training stimuli were so distinguishable from each other as to avoid confusion in recognition.

For the test stimuli, the accuracy Ss showed significantly longer latencies than did Ss in the speed instructions, $F(1,42) = 8.27$, $p < .01$. The main effect of stimuli was significant, $F(10,420) = 9.69$, $p < .001$. A trend analysis was done on the stimulus variable to see if the predicted latency patterns were present. Two trends were found to be significant in the analysis of the data for all 44 Ss. A quadratic trend was found to be significant,

$F(1,420) = 74.50$, $p < .001$, and the quartic trend, predicted by the category boundary hypothesis, was also significant, $F(1,420) = 5.30$, $p < .025$. A graph of these latency data can be seen in Fig. 1.

Figure 2 shows the proportion of responses that each stimulus received for each category. As can be seen, the training procedure was successful in establishing three distinct categories. There was virtually no competition between Categories 1 and 3, "small" and "large," when Ss were categorizing the test stimuli. However, there was slight overlap of Categories 1 and 2 and Categories 2 and 3.

The point of subjective equality (PSE) was calculated (Corso, 1967, pp. 233-235) for the proportion of responses for Categories 1 and 2 and Categories 2 and 3. The PSE for the "medium" and "small" categories fell at 2.32 in. sq, and the PSE for the "medium" and "large" categories fell at 3.38 in. sq. These PSE estimates indicate a slight response shift, i.e., decentering, toward the small end of the series.

DISCUSSION

As evidenced by the category choice data, the Ss did use three categories effectively in responding to the individual stimuli. The significant quartic trend, as best illustrated in Fig. 1 for Ss in the accuracy instruction group, is exactly what the category boundary prediction called for.

Each of the categories generally shows the latency pattern as predicted by the category boundary hypothesis. In the first, or small, category, as the stimuli are reduced in magnitude, they apparently become progressivly less ambiguous and produce correspondingly faster responses. The same effect is observed in the large category. In the middle category, the center stimulus is most distinctive, in terms of the criterion of "mediumness," and shows the shortest latency in that category. On the other hand, the AL prediction is not supported.

However, it may be possible to make an interpretation of the results that combines the predictions of both AL and the category boundary hypothesis. First, it can be noted that the center stimulus, 3.00 in. sq, in the medium category, although showing the shortest average latency in that category, does not elicit nearly as rapid responses as those stimuli that are the same distance from their boundaries in the small and large categories, i.e., 2.00 and 4.00 in. sq, respectively. The category boundary hypothesis cannot alone account for the general elevation of the middle category, especially the central value, 3.00 in. sq.

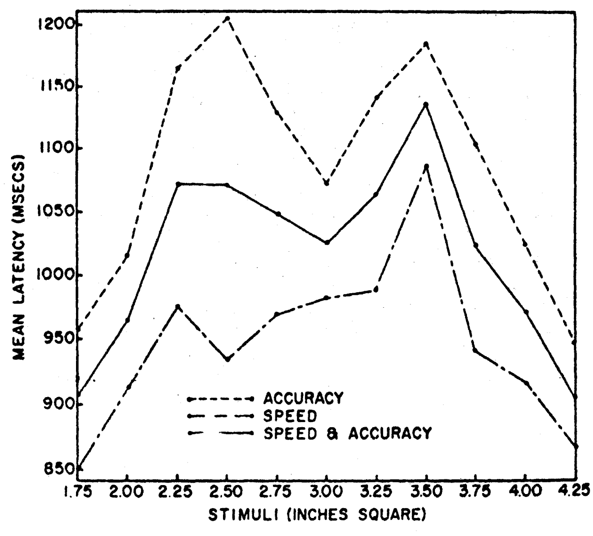

Fig. 1. Mean latency values for test stimuli in accuracy and speed instruction conditions and the combined averages.

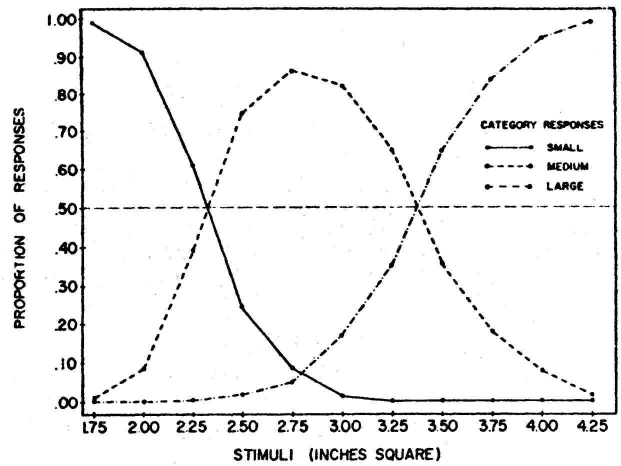

Fig. 2. Proportion of responses elicited by test stimuli for each of the three categories.

A possible explanation is that an AL effect is being manifested in conjunction with the category boundary effects. This would account for the elevation of the average latencies for the middle category, and more specifically, this AL effect would explain why the 3.00-in.-sq stimulus elicits slower responses than the 2.00- and 4.00-in.-sq stimuli. A second possible indication that AL is operating with the category boundary effects is the decentering of responses as illustrated by the category choice data. On the physical scale, the fourth and eighth stimuli, i.e., 2.50 and 3.50 in. sq, are the ones that fall between the categories and would be expected to function as the ambiguous category boundary values. However, the choice data for the categories indicates that there occurred a slight response shift toward the small end of the testing series. This shift, as indicated by the PSE values, is a psychophysical phenomenon that is discussed in detail in Capehart et al (1969) and displayed in many AL studies, including Capehart & Pease (1968) and Hebert & Capehart (1969). The category boundary hypothesis makes no provision for this "decentered" responding, and this points to the value and even the necessity of a combined AL category boundary interpretation in multiple (three or more) category situations.

The relationship between category judgments and the dependent measure of latency seems to be complex. The category boundary hypothesis, although well supported in this experiment, does not handle some of the characteristics of the data. AL theory presently does not have an adequate explanation for situations involving more than two-category problems and therefore is not sufficient to predict or interpret multiple category situations.

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(Received for publication March 12, 1973)