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Table 1

Group	N	Number Achieved Criterion	Number of Trials to Criterion
1	7	0	
2	6	1	130
3	6	2	110, 130
4	7	5	40, 80, 90, 140, 200

RESULTS

Two animals, one in Group 2 and one in Group 3, had to be withdrawn from the experiment because of sickness. The results with the remaining 26 animals are shown in Table 1. A Kruskal-Wallis one-way analysis of variance reveals significant variance between groups ($H = 12, p < 0.01$).

DISCUSSION

The rats found it easiest to discriminate between the stimuli differing such that one was rotated relative to the other (Group 4). They experienced increasing difficulty with reversal and inversion (Group 3), inversion (Group 2), and reversal (Group 1), in that order. This hierarchy of difficulty corresponds exactly to that established under different circumstances for children and under yet other circumstances for adult humans by Kinsbourne & Hartley (1968). The generality of this hierarchy excludes verbal mediation as the crucial factor. It is consistent with the view that differences in orientation are not interchangeable, but that there is a hierarchy of salience such that certain orientational disparities are more readily observed, remembered, or in the present instance, used as basis for a working hypothesis to determine the variable relevant to reinforcement. A hierarchical search (Johnson, 1967) is one way of conceptualizing such results.

Discrimination of orientation by rats

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Learning to discriminate along the dimension of orientation, rats experienced decreasing difficulty depending on whether the figures were reversed, inverted, reversed and inverted, or rotated, relative to each other, a hierarchy identical to that previously established in humans.

Though rats can easily learn to discriminate horizontal lines from vertical, they cannot discriminate opposing obliques (Lashley, 1938) except in a situation specially designed to attract their attention to the orientational aspects of the total display (Kinsbourne, 1967). However, rats' ability to learn to discriminate the orientation of two-dimensional figures appears not to have been studied. Children have a notorious tendency to treat different orientations of a two-dimensional figure interchangeably, particularly when these are in mirror-image relation to each other (Rudel & Teuber, 1963; Huttenlocher, 1967). Kinsbourne & Hartley (1968) showed that children's relative difficulty in coping with orientation of a "p"-like ("lamb chop" of Wechsler & Hagin, 1964) shape was consistently maximal for mirror-image reversed pairs, less for inversions, least for rotations. The hierarchy of confusions made by adults given brief exposures of arrays of the same materials similarly conformed to this sequence. They suggested a hierarchical search model to accommodate their findings. The question arises, is this hierarchy of relative confusibility a characteristic of human

information processing or does it represent a more widely applicable strategy? In particular, does the postulated hierarchical search necessarily depend on verbal mediation? To resolve these questions, we confronted rats with the task of discriminating "lamb chop" shapes for reward.

METHOD

Twenty-eight male hooded rats were divided into four groups of seven each, matched for learning ability on a light-dark discrimination task. The experimental task was to discriminate, for food reward, pairs of "p" shapes. Each group was presented with a different pair of stimuli, as follows:

- Group 1 $\begin{smallmatrix} + \\ \uparrow \end{smallmatrix} q$
- Group 2 $\begin{smallmatrix} + \\ \uparrow \end{smallmatrix} b$
- Group 3 $\begin{smallmatrix} + \\ \uparrow \end{smallmatrix} d$
- Group 4 $\begin{smallmatrix} + \\ \uparrow \end{smallmatrix} \cap$

Twenty trials were run on each of a series of consecutive days until attainment of a 9 out of 10 correct criterion or a total of 200 trials.

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