RELATIVE SIZE VS. FAMILIAR SIZE IN THE PERCEPTION OF REPRESENTED DEPTH

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The monocular cue of distance—familiar size—has recently received considerable attention due largely to concerted attempts to 'explain' the perception of depth—and in general, all perception of the world around us—in terms of learning and past experience.[1] This empiristic enterprise, which is by no means new to the history of perception, is certainly one legitimate approach to the problem but the evidence in favor of it is still far from conclusive. Regardless of whether a particular 'cue' is ultimately a product of past experience, we can learn much more about its operation and its limitations, if we attempt to relate its present effects to its stimulus-characteristics, than if we dismiss the measurable characteristics of the stimulus and simply ascribe its power to the life-history of the observer.[2] Since familiar size is the only cue of depth that requires, by its very definition, reference to past experience, it seems important to determine its applicability and limitations. This is particularly true since, as has been suggested elsewhere, another monocular distance cue has frequently been confounded with familiar size; namely, that of 'relative size,' a cue which need not invoke past experience.[3]

Familiar size requires a complex array of intervening variables for its explanation. Probably the simplest version would be that a given retinal image will, by its shape and size, evoke a trace or a memory of a specific object at a specific distance, and this trace then determines the distance at which the object is perceived. One retinal image is all the stimulus that is required for the operation of this cue.

Relative size, on the other hand, requires two similar or identical shapes of different size; when that occurs, the larger tends to appear nearer than the smaller. Here a pair of figures is required, and the pair must be similar or identical. This explanation does not refer to past experience; it simply states that images of the same shape but of different size are stimuli for a depth relationship.

Very many of the experiments purporting to demonstrate the operation of familiar size in 'immediate' perception (as opposed to judgment, reflection, or whatever) are open to reinterpretation in terms of relative size.[4] A playing card casting a large retinal image is seen as being nearer than a playing card casting a small one, a situation which has been repeatedly interpreted as evidence for familiar size and, therefore, for past experience as a determinant of immediate perception of depth.

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[1] A. H. Hastorf, The influence of suggestion on the relationship between stimulus-size and perceived distance, *J. Psychol.*, 29, 1950, 195-217; C. B. Hochberg and J. E. Hochberg, Familiar size and the perception of depth, *J. Psychol.*, 34, 1952, 107-114; Hochberg and Hochberg, Familiar size and subception in perceived depth, *J. Psychol.*, 36, 1953, 341-345.

[2] J. E. Hochberg, Psychophysics and stereotypy in social perception, *Emerging Problems in Social Psychology* (in press).

[3] Hochberg and Hochberg, *op. cit.*, *J. Psychol.*, 36, 1953, 343.

[4] W. H. Ittelson and F. P. Kilpatrick, Perception, *Sci. Amer.*, 185, 1951, 50-56. Hochberg and Hochberg, *op. cit.*, *J. Psychol.*, 36, 1953, 342.

Before we accept this as evidence for such a position, it should be noted, however, that such results may be perfectly well explained in terms of the relative size. Because of the considerable difference between the two cues, it seems necessary to determine further whether such a cue actually exists as separate from familiar size.

In the present experiments, we ask whether relative size operates, as a separable cue in the *representation* of depth, in simple two-dimensional line drawings.

Experiment 1. In our first experiment, 4 stimulus-cards, 40 in. wide and 30 in. high, were presented in balanced order to 24 *Ss*. Each card bore two figures, one small one and one large one, 8 in. apart. These are the figures that appeared on the 4 cards: Card 1 had a large circle and a small circle; Card 2 had a large square and a small square; Card 3 had a large circle and a small square; and Card 4, a large square and a small circle. In each case, the large figure was 16 in. across, while the smaller figure was 4 in. across. Each stimulus-card was presented for 100 sec.; the *Ss* were shown the possible two-dimensional and three-dimensional phases of the line drawings, and then instructed to indicate whether, with a passive attitude, the two figures appeared in the same or different planes. Thirty-three signals (sounds) randomly spaced were given during the presentation and the *Ss* were instructed to

TABLE I

DEPTH RESPONSES TO PAIRS OF GEOMETRIC STIMULUS-FIGURES

Experiment		Stimulus-cards			
		1	2	3	4
1	% 3-dimensional responses	56.5	58.5	38.5	40.5
	Means, 1+2, 3+4	57.5		39.5	
	Significance of difference	$P<.01$, $N=1980$			
2	% large figure nearer	54.2	64.4	51.9	40.4
	Significance of difference from 50%	$P<.01$	$<.01$	—	$<.01$
	No. = 1710				

indicate the mode of appearance of the figure which *immediately preceded the signal.* Thus, the relative perceptual response-probabilities were indicated by the random time-intervals taken, and proportions of two- and three-dimensional responses were obtained for the stimulus-cards.[5]

In terms of a cue of relative size, Cards 1 and 2 should yield more three-dimensional responses than Cards 3 and 4 (in which the stimuli are pairs of figures of different shape). As Table I shows, they clearly did. Even if the concept of familiar size could apply to geometrical line drawings, we cannot in any case readily apply it alone to explain these results, because if it were at all applicable here, it should be just as applicable to Cards 3 and 4, as to Cards 1 and 2, since it should operate with respect to each figure in the pair irrespective of their relationship. We must now inquire whether the direction of the three-dimensional responses are in accordance with what would be predicted in terms of relative size.

Experiment 2. In Experiment 2, the procedures and stimulus-cards of the first experiment were repeated, with new groups of *Ss* (83 in number). These were

[5] J. E. Hochberg and E. McAlister, A quantitative approach to figural "goodness," *J. Exper. Psychol.*, 46, 1953, 361-364.

given the additional instructions to indicate within the three-dimensional phases, whether the left or the right figure appeared to be nearer.

In terms of the cue of relative size, the larger figure should appear nearer than the small one in Cards 1 and 2. They did. If this were due to the operation of familiar size, we would expect at least similar results to hold with respect to Cards 3 and 4, but again, as Table I shows, they did not—in fact, for Card 4, the relationship is significantly reversed.

For the two shapes employed, we can say that figure pairs of the same shape, but different size, are cues for the perception of a difference in depth, with the larger of the two appearing to be nearer.

In short, relative size seems to be an at-least formally separable monocular cue of depth, which, aside from its own predictive applications, must be carefully separated from any situation in which experimenters are attempting to demonstrate the operation of past experience in perception.