Complex stimuli and apparent motion¹

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A novel type of apparent motion was encountered when Ss were shown a single light alternating with four other lights arranged in the form of a diamond. Ss reported the loss of one light in the array as the entire diamond form appeared to move back and forth.

Most studies of the phi phenomena have employed simple stimuli such as two spatially separated points of light. These stimuli are flashed alternately with a brief darkness interval between flashes; thresholds are measured in terms of milliseconds of darkness between flashes at which Ss report seeing motion. Wertheimer (1912) pointed out the complexity of visual experiences that are encountered in phi situations but the subsequent quantification of phi by Korte (1915) was limited to cases with two stimulus lights.

Current studies have increased the complexity of the two light phi experiments. Daly et al (1964), using several lights flashing successively, reported that the radius of a circle produced by apparent motion described a smaller radius than stationary lights. Jeeves (1964) told Ss to expect apparent motion in either two or eight different directions; he found an increase in sensitivity to apparent motion utilizing the eight-directional expectancy.

In these studies Ss were still being shown only two stimulus lights, temporally separated, to induce apparent motion. The present study explores apparent motion in a situation where a single light is alternated with an array of several lights.

Procedure

The 12 adult Ss, tested individually, were seated in a lightproof room 10 ft. from the display panel. The four stimulus conditions are shown in Fig. 1. All Ss were initially shown the first condition which appeared as two stationary flickering lights (simultaneity). E then increased the darkness interval between stimulus flashes until S reported seeing the light move back and forth; all Ss spontaneously reported such movement. After reporting movement, Ss were asked to close their eyes and during this interval E recorded their threshold value from the phi apparatus and returned the inter-stimulus darkness interval to the original level (simultaneity). All thresholds were taken as Ss saw first simultaneity (stationary flickering lights) and then apparent motion (lights appearing to move back and forth). Four thresholds were obtained for each S in each of the four stimulus conditions; after testing on the first condition, the remaining conditions were presented in a random order.

The stimuli consisted of 3/4 in. diameter circles of light. The horizontal and vertical distance between

circles was 4 in. center to center. The lights were orange colored (generated by NE-40 neon tubes); the light passed through a frosted glass plate and 3/4 in. circles cut in a panel of sheet metal painted flat black. All lights in each array were of equal intensity; this was accomplished by varying the load on the circuitry in the display apparatus.

Results

The millisecond thresholds were analyzed by analysis of variance; Fig. 1 includes the means for the various stimulus conditions. The means were compared using Duncan's Multiple Range Tests since the conditions were found to differ significantly ($F=14.49$, $df=3/33$, $p<.01$). This analysis indicated that Condition 2 differed significantly from all other conditions ($p<.01$); such a finding could be expected on the basis of Korte's law that thresholds vary as a function of the distance between the stimuli. It was further found that Condition 3 differed significantly from Condition 1 ($p<.01$) whereas Condition 4 did not differ from Condition 1. As can be seen from the means in Fig. 1, Condition 3 was slightly harder (required more milliseconds of darkness between flashes to induce phi) than Condition 4 although this difference failed to reach statistical significance.

Discussion

The noteworthy aspect of the present study was the novel visual experience obtained under Condition 3. When phi started with this array, the entire diamond outline (four circles of light) appeared to jump back and forth. However, there were in fact five circles of light physically included in the array; it appeared as if one of the lights disappeared as the diamond form moved. On the basis of proximity we had anticipated that only the left circle of the diamond shape would move with the alternating extreme left light; instead, the entire figure moved and Ss reported there were four lights jumping back and forth.

Fig. 1. Stimulus Conditions. Circles with opposite darkened hemispheres were flashed alternately to produce phi. Circles with the same hemisphere darkened, 3 and 4, were lighted simultaneously. Mean threshold values (milliseconds) are also presented for each condition.

Condition 4 produced variable effects; some Ss reported a total motion of the entire array from side to side while others reported movement only between the two left-most circles.

It seems therefore that when multiple lights are used in a phi array, novel visual illusions results which are difficult to predict. The phenomena of "closure" and "good form" may be relevant parameters.

References

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