Initial stimulus duration and the temporal range of apparent movement¹

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The range of interstimulus intervals permitting the detection of apparent movement was investigated as a function of the duration of the initial stimulus. It was found that the interval ranges increased as duration increased from 50 msec. and declined thereafter with increasing durations up to 10 sec. The temporal course of events was discussed in relation to the microgenesis of form.

In an earlier study (Pollack, 1966) figure-ground contrast was shown to affect the temporal range of apparent movement in that the greater the contrast the greater was the range. It would be expected, therefore, that the duration of the initial stimulus would also affect the range. Sgro (1963) using flashing red lights found that the range of temporal movement as well as the threshold duration for movement declined as stimulus duration increased from 5 msec. to 100 msec. The light in his situation, however, was transmitted rather than reflected and configuration was not a factor. Since our own earlier study, which employed light reflected from geometrical forms, clearly demonstrated the influence of figure-ground contrast and shape, variables which determine form configuration, it was expected that stimulus duration would also play a role because of its effect on the configuration of form. Therefore, as form is built up during a short temporal interval (Flavell & Draguns, 1957; Pollack & Chaplin, 1962) the temporal range of apparent movement would be expected to broaden to a maximum and then decline as prolonged viewing of the figural stimulus produces adaptation and subsequent breakdown of figure-ground articulation. Both Kragh (1955) and Flavell & Draguns (1957) reported that the articulation of simple form is complete with an exposure duration of around 150 msec.

Subjects²

Two adult Ss, a male (S₁) and a female (S₂) served as trained Ss in all conditions of the experiment.

Apparatus

The apparent movement sequence was produced by using a three-channel electronic tachistoscope (Scientific Prototype Corporation, Model GA). Illumination as measured at the eyepiece by a Macbeth Illuminometer was 5.0 ft. c. for all channels.

Procedure

Since Graham (1951), reporting on earlier work by Neuhaus, indicated that the duration of only the initial stimulus was critical, the final stimulus duration was kept constant at 50 msec. The initial stimulus, a white square 12.7 mm on a side placed 6.35 mm to the left of the center of a black field was presented for 50, 150, 1000, 2000, 5000, and 10,000 msec. in separate series

of trials. The final stimulus was also a white square, 12.7 mm on a side, placed 6.35 mm to the right of the center of a black field. The interstimulus distance subtended a visual angle of 39'40" and the total display subtended an angle of 3°. A blank blackfield intervened for a variable interval ranging between 10 msec. and 150 msec. between the two stimuli. Viewing was binocular.

Upper and lower apparent movement thresholds were obtained from both Ss for each of the initial stimulus durations, using the method of limits. Each apparent movement range was based on 32 measures, from 2 runs, separated by at least a week, of 8 ascending and 8 descending series, run in counterbalanced order.

In each sequence, Ss were shown instances in which the stimuli were clearly successive, moving, or clearly simultaneous. They were told to say "two" when the figures were successive or simultaneous or "one" when a single figure was seen to move from left to right.

Results and Discussion

Separate one-way analyses of variance on each S yielded significant changes in mean temporal range as a function of initial stimulus duration for S₁, $F=450.11$, $df=5$ and 187, $p<.01$, and for S₂, $F=9.33$, $df=4$ and 156, $p<.01$. Examination of the means for each S at each duration indicated an increase in temporal range between initial stimulus durations of 50 msec. and 150 msec. and a decline thereafter (See Fig. 1). A test for trend for each S was carried out and yielded significant deviations from linearity for both Ss. For both Ss both quadratic and cubic trends were significant but the

Fig. 1. Temporal range of apparent movement as a function of initial stimulus duration.

logarithm of the appropriate quadratic equation yielded curves which better fit the data. The equation for S_1 : $\text{Log } Y = 1.55475 + .13199 (\text{Log } Z) - .09188 (\text{Log } Z)^2$; for S_2 $\text{Log } Y = 1.4625 + .31448 (\text{Log } Z) - .16720 (\text{Log } Z)^2$ where $Z = X/50$. The expectation that temporal range would be maximal at that point in time when the micro-genetic buildup of form is completed was confirmed.

The data indicated quite clearly that when stimuli with definite shapes from which light is reflected are used, temporal range of apparent movement increases as initial stimulus duration increases up to around 150 msec. and then decreases. Range of apparent movement, therefore, depends upon those stimulus conditions which promote maximal contour strength (high figure-ground contrast and optimal duration) under conditions which promote attraction displacement of contours (Pollack, 1966), i.e. parallel contours. The similarity of these data to those obtained for backward figural masking is striking (Pollack, 1965) and probably indicates a common underlying sensory mechanism.

Comment on Beck by Jacob Beck

The Chi-square test reported by Beck (1966) is questionable because of the fact that judgments were repeated by the same Os. An over-all comparison of the constancy exhibited by adults with that exhibited by children may be obtained by classifying an O as exhibiting constancy if in the majority of the five targets presented the O matched the target in light and in shadow to the same gray, and as failing to exhibit constancy if the O judged the target in shadow as darker in the majority of cases. When the targets were presented together on a chart, 11 adults exhibited constancy, four adults failed to do so; four children exhibited constancy, 11 children failed to do

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Notes

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so. A two-tailed Fisher test shows that the probability of the observed values under the null hypothesis is .026 (Finney, 1948). When the targets were presented singly, the difference between the number of adults and children classified as exhibiting constancy did not differ significantly.

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