AN EXPERIMENTAL STUDY ON FIGURAL AFTER-EFFECT
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PROBLEM

In the previous reports (4) I showed the following results.

1) It is possible to investigate the so-called figural after effects, by measuring the strength of the field produced by the prolonged inspection of a figure; i.e., by comparing the stimulus threshold of a light spot (Test II) which is measured after removing the figure away, with the one when there is no figure presented (Test I).

2) There is a certain correlation between the after effect which is measured by the threshold of a light spot and the displacement effect of test figure (T.F.) that coincides with the inspection figure (I.F.).

Displacement of T.F. where I.F. and T.F. are overlapped, has not been sufficiently explained in previous theories of F.A.E. such as by Köhler and Wallach (2), and by Os-good and Hayer (1, 3, 5, 6). I take it necessary to investigate, more closely, change of threshold of a light spot by means of prolonged inspection of a figure.

It seems to me that, even if the presented figure is not moving, the process of figural perception, corresponding to the stimulus figure, shows dynamical and fluid tendency.

Accordingly, the process of its change must be measured, as a matter of course, in the measurement of figural after effect.

In spite of that, I neglected the factor of time in my last investigation.

The aim of this paper is to examine the variation of the threshold of a light spot, varying the length of the inspection time and the interval between the removal of I.F. and the onset of measurement.

APPARATUS

Same to the previous reports.

PROCEDURE

Test I: As a subject sits up at the seat for observation, the experimenter projects a light spot (33 rad-lux) in a given position on the stimulus screen, and then lowers the brightness of the light spot rapidly in a regular speed.

The subject signs as soon as the light spot becomes invisible. The experimenter switches off the light spot and records the brightness at that moment.

Prolonged inspection period I: The experimenter presents inspection figure on the stimulus screen.

It is necessary that the fixation point of I.F. coincides with that of the stimulus screen. The subject keeps fixing his eyes upon the fixation point for sixty seconds.

Test II: As the prolonged inspection period is over, the experimenter removes the I.F. and measure the

threshold in the same way as in Test I.

Prolonged inspection period II: Same to the inspection period I.

Test III: Same to the Test II.

Prolonged inspection period III: Same to the inspection period I.

Test IV: Same to the Test II.

Prolonged inspection period IV: Same to the inspection period I.

Test V: Same to the Test II.

Time interval I: The experimenter presents no inspection figure and the subject fixes his eyes upon the fixation point of the stimulus screen without any light spot for fifteen seconds.

Test VI: As the interval period is over, the experimenter projects the light spot and goes on measuring the threshold.

Time interval II: Same to the Interval I.

Test VII: Same to the Test VI.

Time interval III: Same to the Interval I.

Test VIII: Same to the Test VI.

Time interval IV: Same to the Interval I.

Test IX: Same to the Test VI.

Time interval V: Same to the Interval I.

Test X: Same to the Test VI.

Time interval VI: Same to the Interval I.

Test XI: Same to the Test VI.

Subject: Three subjects consisting of students and members of psychological laboratory in Hokkaido University were used.

PRELIMINARY EXPERIMENT

Purpose: Before starting the main experiment, it is necessary to examine whether repetition of test measurement without inspection period, produces any variance on the measured values of threshold, or not.

Condition: Here, inspection figure is not used but the measurement shown in Test I is repeated eleven times by the arrangement shown in main procedure:

The time interval is 60 seconds for Test I through Test V, and 15 seconds for Test VI through Test XI.

The experimenter examines the trend of the result. In each test, a light spot is presented 10 mm. right of F.P.

Table 1

RESULT OF PRELIMINARY EXP.

Test	Ss.	TGW.	STH.	MRY.
I		24.12	23.18	23.64
II		24.77	23.64	24.35
III		23.21	23.64	24.12
IV		23.46	23.41	23.64
V		25.42	24.12	23.64
VI		24.12	23.41	24.12
VII		24.77	23.85	23.85
VIII		26.81	23.41	24.12
IX		24.12	23.18	23.64
X		23.21	23.64	24.86
XI		24.12	23.41	—
A. V.	24.36	± 0.935	23.54 ± 0.204	24.00 ± 0.166

$\pm$ Confidence interval*

* $\alpha = 0.05$

Results: Shown in Table 1 and in Fig. 2 (with dotted line.) Repetition of the measurement did not produce any particular tendency of either increase or decrease of measured values. (Recognized by trend test of non parametric method.)

Accordingly, we would be able to conclude that this preliminary experiment can serve as a sufficient control experiment for the main experiment in which I.F. is used.

EXPERIMENT A

Purpose: To examine change of measured values by prolonged inspection of a straight line.

Condition: The arrangement of stimulus figure is shown in Fig. 1.A.

Experiment A₁: Prolonged inspection of a straight line. A light spot is presented on the right side of the fixation point.

Experiment A₂: Prolonged inspection of a straight line. A light spot is presented on the left side of the fixation point.

Results: Shown in Fig. 2.

1) We can see that measured value of threshold indicates trend of increase, from Test I to Test V, in Exp. A₁ as well as in Exp. A₂. As is seen in Fig. 2, the curve is comparatively sharp at first, and then becomes an easy grade until at last it looks almost even. (Effect of prolonged inspection.)

2) Measured values of threshold from Test V to Test XI, show evident trend of decrease. The curve drops at first, perpendicularly and then goes an easy slope, and at last, it becomes almost even. (Effect of interval period.)

3) Measured values of both Test

Fig. 1

Fig. 2 Results of Pre. Exp. and Exp. A I and the last part of these eleven tests are involved practically within the range of variation of repetition

in the case of non-figure shown in Preliminary Experiment.

4) Trends of the results of both Exp. A₁ and Exp. A₂ bear such a striking resemblance as there can be hardly seen any significant difference between them.

EXPERIMENT B

Purpose: To examine change of measured values by prolonged inspection of a curved line.

Condition: Exp. B₁: Prolonged inspection of a curved line. A light spot is presented on the right side of the fixation point (inside of a curved line).

Exp. B₂: Prolonged inspection of a curved line. A light spot is presented on the left side of the fixation point (outside of the curved line). (Fig. 1.B.)

Results: Shown in Fig 3.

1) Results of Exp. B₁ and Exp. A are much alike: the measured values in Test I through Test V tell us trend of increase, while those after Test V inform us that of de-

crease.

2) It appears that the amount of increase of measured value seen in Exp. B₁ is larger than that in Exp. A.

3) Result of Exp. B₂ is diametrically opposite from that of Exp. B₁'s: from Test I to Test V, measured value shows decreasing trend, while, after Test V, it shows increasing one.

4) In Exp. B₁, as well as in Exp. B₂, measured values of Test I and the last part of the test are almost involved within the range of variation of repetition of the measured value in the case of non-figure.

EXPERIMENT C

Purpose: To examine change of measured values by prolonged inspection of a circle.

Condition: Exp. C₁: Prolonged inspection of a circle. A light spot is presented on the left side of the fixation point (inside of the circle).

Exp. C₂: Prolonged inspection of a circle. A light spot is presented on the right side of the fixation point (outside of the circle). Fig. 1.C.)

Results: Shown in Table 2.

Table 2
RESULTS OF EXP. C

Test	Ss.	TGW.		STH.		MKY.	
		Exp. C ₁	Exp. C ₂	Exp. C ₁	Exp. C ₂	Exp. C ₁	Exp. C ₂
I		24.12	23.85	24.12	23.85	23.64	23.85
II		29.98	22.76	29.98	22.12	26.06	23.18
III		37.21	20.97	29.20	21.70	25.77	22.76
IV		39.68	20.62	29.98	21.70	25.77	23.18
V		35.63	20.57	30.79	21.30	27.07	22.02
VI		34.26	23.18	26.71	22.76	24.35	22.37
VII		31.58	24.12	25.11	23.18	23.85	22.96
VIII		27.75	23.41	24.12	23.64	23.41	23.41
IX		24.65	24.35	23.64	24.12	23.18	23.85
X		23.64	24.86	24.65	23.85	23.18	23.64
XI		—	24.35	24.65	23.41	—	—

1) Result of Exp. C₁ bears much resemblance to that of Exp. B₁, although the amount of increase of measured value of Exp. C₁ by the effect of inspection is far greater than that of Exp. B₁.

2) Result of Exp. C₂ is quite like that of Exp. B₂. Amount of decrease of measured value of Exp. C₂ seems rather greater than that of Exp. B₂.

3) Considering the case of non-figure as a fixed standard, results of Exp. C₁ and Exp. C₂ of I.F. are diametrically opposite to each other, while the former shows greater change than the latter.

DISCUSSION

The result of the experiment mentioned above, corresponds fairly well with that of my previous reports. That is, we can say that the present experiment showed the whole field process which was partly revealed by the previous experiment.

Generally speaking, such field process as is shown by stimulus threshold of a light spot presented in a fixed position of the stimulus field, is considered as follows: A field which shows no change as time passes in non-figure case has a kind of state-preserving dynamic stability. And when some figure is presented in this field, the stability breaks down and the state changes. As for the change, it seems to be a sudden change at first, and gradually it becomes an easy grade until at last it reaches a state of a new dynamic stability. However, such state of dynamic stability caused by a presented figure starts to change again as soon as the figure is removed until the old state is recovered.

In this way, if the whole field

changes in proportion to the length of the inspection time (by presenting a figure), it is expected that both apparent form and apparent size of the figure will change accordingly.

This is one of the possible explanations of figural after-effect when test figure is superimposed upon inspection figure, which has formerly been explained as a result of adaptation or self-satiation.

EXPERIMENT D

Purpose: To investigate the after effect of a curved line I.F. upon a straight line T.F.

Condition. Exp. D₁: Same to the Exp. B₁.

Exp. D₂: Same to the Exp. B₂.

But in both experiments, during interval time not only the fixation

Fig. 3 Results of Exp. B and Exp. B

point but also a straight line (Fig. 1.A.) is presented on the stimulus screen.

Results: Shown in Fig. 3.

1) The process observed in Test 1 through Test V of Exp. D₁ and D₂ is nearly the same as that of Exp. B₁ and B₂.

2) The process observed in Test VII through Test XI is similar to that of B₁ and B₂. However, the level reached in Test XI is different from that in Test I, and rather equal to that in Test V of Exp. A. (In Exp. B, level in Test XI is equal to that in Test I.)

DISCUSSION

According to the results of those experiments from Exp. A to Exp. C, we considered about the cause of the figural after effect (displacement effect) when I.F. and T.F. coincide with each other. The result of Exp. D tells us that we can also explain the after effect of a curved line I.F. upon a straight line T.F.. That is, as shown in Exp. A, prolonged inspection of a straight line brings some change in the field of its circumference, and this effect is symmetrical, so that there appears no apparent distortion in the shape of a prolongedly inspected straight line. On the

contrary, however, in Test VI of Exp. D, though I.F. presented just before is a straight line, the whole field is not symmetrical, because of an effect by a curved line which was presented earlier than the straight line. As a result, the distortion (so called Gibson effect) appears toward the opposite direction. However, if this straight line stimulus is presented for several seconds, the whole field would soon become symmetrical and the distortion of the figure should disappear quickly.

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