Studies of the Intensity of the Projected After-image: II. Reliability of the Method of Measurement

STUDIES OF THE INTENSITY OF THE PROJECTED AFTER-IMAGE: II. RELIABILITY OF THE METHOD OF MEASUREMENT

By

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It is the purpose of this experiment to investigate the reliability of the method for measuring the intensity of the projected negative after-image which was presented in the first paper of this serial studies. The result which was obtained by means of test-retest for ten subjects indicates that the method is highly reliable and that the intensity is a logarithmic function of stimulation time.

PROBLEM

In the first paper of this serial studies the intensity of the projected negative after-image was operationally defined as the intensity of the light of the projection ground which just erased the after-image and the apparatus and the method for measuring the intensity were presented. The results obtained from the previous experiment on the influence of the various stimulation times upon the intensity of the after-image indicated that the method was valid[1].

It was noticed in that paper that it was necessary for naive subjects to be accustomed to this situation of the measurement by some trials before the experiment started. Some researcher raises a question as to usefulness of this method because of the necessity of the training. Thus, the purpose of this experiment is to investigate the reliability of the intensity of the light of the projection ground as a measure of the intensity of the after-image.

In fact, the intensity of the after-image varies considerably with each subject. But this does not raise the problem of the reliability. The question should be to see a consistency in repeated measurements with the same subject. Then, the correlation between the data obtained on an initial test and a retest of the same subject by means of the same procedure after a certain time interval should be obtained to study the reliability.

As part of this experiment, data are also collected with which to estimate the intensity of the after-image as a function of stimulation time. Therefore the purpose of this experiment is twofold. Immediate concern is to detect a sufficient stimulation time so as to be able to measure the intensity of the after-image and to investigate whether the intensity is a logarithmic function of the stimulation time as shown in the previous paper[1].

Method

Apparatus: The apparatus is essentially similar to that described in the first paper except the part of device for controlling the brightness of the projection ground. It was reported that the variations in the brightness of the projection ground were obtained by the adjustment of the autotransformer which was connected between the bulb and the source of electricity. In the present experiment the adjustment of the distance between the square glass and the bulb is utilzied instead of the adjusement of the autotransformer to control the brightness. This is simply made to avoid the change of color of the glass due to the variation of the voltage supplied to the bulb.

The brightness of the stimulus to develop the after-image is kept constant at 48 mL through the experiment. The stimulus is a twenty centimeters square transluminated milk glass. The light source is a 200-watts frosted bulb. The distance between the stimulus and the subject's eye is 100 centimeters.

All the experiments are carried out in the dark room.

Subjects: All subjects are freshmen at Iwate University. Ten male students were employed. All of them are strictly naive for this situation of the measurement and have normal visual acuities.

Procedure Subject is given the following instruction: "Look at the fixation point on the surface of the milk glass. Several different inspection times will be given. After the fixation time I will put off the light behind the glass and you will see something colored and squared. It is a negative after-image. Then, keep observing it on the glass. And I will put on the dim light and gradually make up its brightness. Your after-image will be grayish and get thinner and thinner according as the brightness of the glass increases. I want you to make a sign for me when the after-image completely vanishes."

Subject is then given one measurement for each of five different durations of the stimulation time, 5, 10, 20, 40, and 80 seconds. The order of the presentation of the series of the different stimulation time is randomized. Two or three minutes' rest interval is put between the measurements. The same procedure is repeated for the subjects who are employed in the initial experiment 72 hours later to obtain the reliability of the test-retest method.

Binocular vision is used in this experiment.

Results

The Pearson's product-moment correlation coefficients are obtained to ascertain the reliability of the test-retest method. They are .78 ($p<.05$), .86 ($p<.05$), .89 ($p<.05$), .85 ($p<.05$), and .71 ($p<.05$) for the duration of stimulation 5, 10, 20, 40, and 80 seconds respectively.

Table 1 and Figure 1 indicate the test-retest group results and also show that the intensity of the projected after-image is the logarithmic function of the stimulation time.

A simple analysis of variance was performed to investigate the presence of a

Table 1.　Means and standard deviations of test-retest of the
intensity of the negative after-image.　The brightness of
the stimulus is kept constant at 48 mL level.

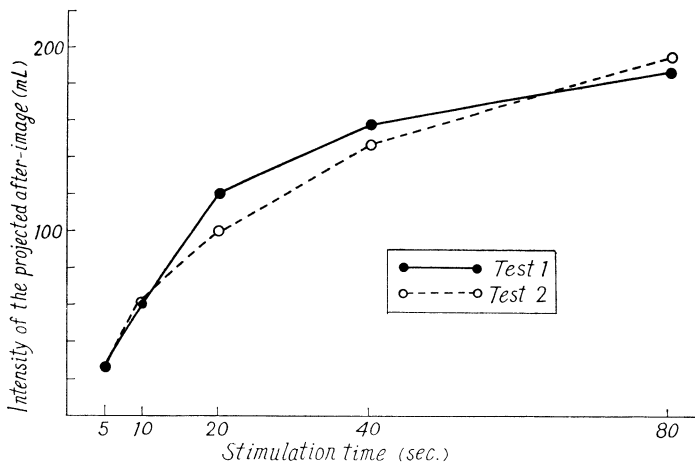| Stimulation Time (sec.)	Mean		SD	
	Trial 1	Trial 2	Trial 1	Trial 2
5	25.7 mL	25.3	15.4	6.0
10	60.8	61.6	30.4	34.6
20	120.8	100.1	62.9	37.6
40	159.2	148.0	68.6	33.5
80	192.4	201.2	126.4	72.4

Figure 1.　Graph showing the influence of the varying stimulation time upon the intensity of the projected after-image.

trend among the effects.　The results of this analysis of variance are given in Table 2. The Table indicates that there is a significant trend between the stimulation time and the intensity of the after-image.

Table 2.　Summary of analysis of variance of the intensity of
the projected after-image.

Source	SS	df	MS	F	F (4, 95; 0.01)	ρ (%)
A	79066135	4	19766533.75	16.97**	3.51	39.22
e	110673645	95	1164985.74			60.78
T	189739780	99				100.00

DISCUSSION

This experiment indicates that the method for measuring the intensity of the after-

image mentioned in the first paper is very reliable. The Pearson's product-moment correlation coefficients for the duration of the stimulation timefr 5, 10, 20, 40 and 80 seconds are all significant. The subjects who are strictly naive for this situation of the measurement do not have any difficulty in reporting their judgments. This significant reliability on the naive subjects indicates that the method should prove to be a very useful for many kinds of studies.

The coincidence of both the curves of the present experiment and the previous experiment which are shown in the logarithmic form further adds to our knowledge that the intensity of the light of the projection ground which just erases the after-image is a reliable measure.

Under the condition of such brightness of the stimulus in this experiment a relatively short stimulation time of 5 seconds is enough to develop a reliable measure. Subject's reports indicate that 20 seconds is an optimal stimulation time. It is felt that the subjects are fatigued with continuance to inspect the stimulus when the stimulation time is over 40 seconds. The high correlation coefficient of .89 also indicates that the stimulation time of 20 seconds is optimal to produce the measure.

REFERENCES

(1)   Onizawa, T., Studies of the intensity of the projected after-image: I. Method and the influence of stimulation time. *Tohoku Psychol. Folia*, XXII, 1964, 90–93.

ZUSAMMENFASSUNG

Es wurde die Zuverlässigkeit der Messungsmethode der Intensität des projektierten negativen Nachbildes, wie sie in der ersten Abhandlung dargestellt wurde, experimentell untersucht. Aus den Versuchen, die mit Hilfe von Versuch-Wiederholungsversuch an 10 Versuchspersonen angestellt wurden, ergab sich, dass die Methode sehr zuverlässig ist, und die Intensität eine logarithmische Funktion der Reizzeit ist.