A Consideration on the Mechanism of Perceptual Change by Suggestion: Experimental Studies on Length Perception

A CONSIDERATION ON THE MECHANISM OF PERCEPTUAL CHANGE BY SUGGESTION: EXPERIMENTAL STUDIES ON LENGTH PERCEPTION

By

TOHRU HARIU (針生 亨)

(Akita University, Akita)

In Experiment I, the *S*s observed the length of lines through a cylinder. Cognitive patterns of the *S*s about the space inside the cylinder were tentatively manipulated and varied by suggestive procedures. As a result, the observed length of the presented lines changed corresponding to the variation of the *S*'s cognitive patterns. In Experiments II and III, the conditions and the mechanism of the intrusion of suggestive influence into the length perception were further investigated and in Experiment IV, the characteristics of length perception and the changes of it by suggestion were examined in hypnotized *S*s. The results were interpreted to provide evidence for the supposition of the important role and function of cognitive pattern, which was formed on the side of *S* about the experimental situation and which was thought to intervene in the process of the perceptual organization in general, determine directly the characteristics of *S*'s individual perception, and furthermore clarify the mechanism of intrusion of suggestion into perception.

It has been widely known that various perceptual changes, i.e., perceptual distortions, illusions and hallucinations can be produced by suggestive procedures. Heat illusion (Scripture, 1893), visual, auditory, tactile, olfactory and electric illusions (Seashore, 1895), illusions of progressive weights and progressive lines (Binet, 1900), and various kinds of perceptual changes of simillar types were confirmed in the early stage. Since then, many other kinds of perceptual changes, including dramatic and interesting changes produced by hypnotic suggestion, have been reported (reviewed by Hariu, 1970).

Age, intelligence, personality traits, motivation, prestage, group pressure, experimenter's influence etc. have been proposed as factors related by such production of perceptual changes. But the mechanism of production of perceptual change by suggestion has not always been made clear. How suggestions intrude into *S*'s perceptual organization? Through what mechanism perceptual changes are caused by suggestion? It seems necessary that these questions are to be answered adequately in the theoretical frames of perceptual organization in general.

With regard to the functional determinants of perception various theoretical propositions have been made by New Looker, viz., "physiological mechanism", "accentuation", "selective sensitization" and "selective desensitization" "perceptual defence", "value resonance", "vigilance", "primitivation", "availability", "dominance", "hypo-

thesis" etc. (reviewed by Allport, 1955) Among these, the hypothesis theory proposed by Postman and Bruner (1951) seemed to be comprehensive and plausible. However, to investigate more adequately the mechanism of intervention of functional determinants, such as suggestions, it seemed necessary first to notice and examine the functions of *S*'s cognitive pattern which was formed about the stimulus situation concerned and which was supposed to determine directly the characteristics of perceptual organization. Seemingly direct intrusion of suggestion into *S*'s perceptual organization was supposed to be mediated and determined by this intervening process. It was also supposed that indirect suggestions given to *S*'s state (suggested motivation, suggested age, suggested past experiences, suggested personality etc. which have no direct relation to the presented stimulus) would influence on *S*'s perception through forming the characteristic cognitive pattern which is just in line with suggested state. The author has already reported several studies which support these propositions. (1963, 1972, 1973)

The purpose of the present study was to examine further in strictly controlled conditions the role and the functions of *S*'s cognitive pattern in the perceptual changes by suggestion. As the stimulus object straight lines were selected. The reasons for it were as follows: The straight line is simple and easy for us to control the physical conditions of stimulus presentation; furthermore, it is not ambiguous and thought to be comparatively free from the influence of *S*'s individual factors (motivations, past experiences etc.).

Experiment I

The purpose of Experiment I was to examine the role and functions of *S*'s cognitive pattern in the perceptual organization of the stimulus object and changes of it by suggestion. In the experiment, the manipulation of *S*'s cognitive pattern was tentatively attempted by suggestive procedures, and conditions, degree and other characteristics of perceptual changes were examined.

Method

Subjects: Thirteen *S*s of undergraduate students who volunteered to serve in the experiment. Seven of them participated in the suggestive experiment and six were assigned to the control experiment.

Apparatus and stimulus materials: An outline of apparatus was shown in Fig. 1. Standard stimulus (*Ls*) was presented on a white sheet of square (20×20 cm) which was located on a panel on the left side of the *S*. On the right side of the subject the stimulus for comparison (*Lc*) was presented, which was also located on a white sheet of square (20×20 cm) and the length of which was able to change from 1 cm to 20 cm. Between *Ls* and the *S*'s eyes a cylinder of 8.8 cm in diameter and 1 cm of depth was hung. *Ls* was observed binocularily through this cylinder. The cylinder was devised to have various kinds of glass fit in or take off. In front of the *S*'s eyes a curtain was

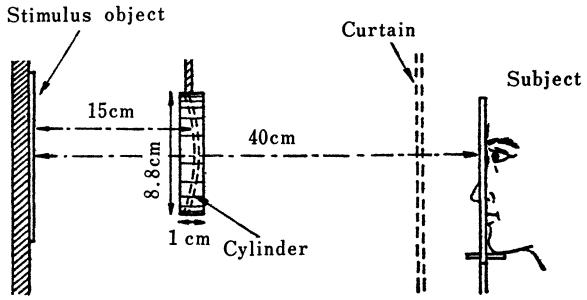


Fig. 1 An outline of apparatus.

hung in order to shut off from *S*'s eyes the manipulation of experimental setting by experimenter, if necessary. *Ls* was drawn in black ink with the width of 0.3 mm. As *Ls* three lines of 4.4 cm, 5.0 cm and 5.6 cm in length were prepared.

Procedures of suggestive experiments. Suggestive patterns as shown in Fig. 2 were pre-exposed for about 20 seconds. Thereafter, *Ls* was presented just at the same place. After the pre-exposure of pattern *a* a line of 5.0 cm in length was presented as *Ls*. After the pre-exposure of pattern *b*, *c*, lines of 5.6 cm, 4.4 cm in length were presented respectively as *Ls*. Before and after the pre-exposure trials of suggestive patterns (*b* or *c*), trials of pattern *a* pre-exposure were performed for comparison. Thus two series of suggestive experiments were performed according to the suggestive patterns prepared (*b* and *c*). In the cylinder a *curved* transparent round glass of no curvature was fitted. The direction of curve of the glass was different with the trials. In the trials of pattern *b* pre-exposure direction of *Ls*)) *S* was used and in the trials

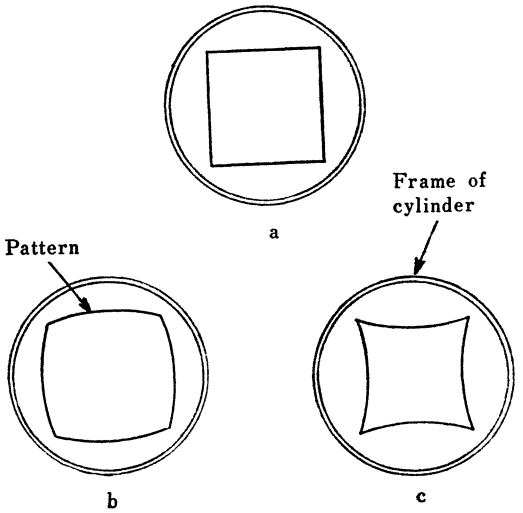


Fig. 2 Suggestive patterns used.

of pattern *c* pre-exposure that of *Ls* ((*S*. Before and after each trial the curtain was shut and *Ss* were not permitted to see any experimenter's operations, i.e., changing of *Ls*, suggestive pattern, glass in the cylinder etc. *Ss* were instructed first to estimate the length of *Ls* if no cylinder had been there and then observe apparent length of *Ls* through the cylinder. These two kinds of judgments were measured by adjusting *Lc* which was located on the right side of *Ls*. Attempts were made to grasp *S*'s cognitive pattern formed about the space inside the cylinder by *S*'s verbal and behavioral expressions during the experiment and introspections reported after the experiment.

Procedure of control experiment. In the suggestive experiment, some effects of uncontrolled factors still seemed to remain. For example, effects of differences in the length of *Ls*, effect of changing direction of curved glass, possible slight distortion of the image by glass material, serial effect of trials and asymmetry of visual space etc. In order to control these possible uncontrolled factors and clarify only the effects of cognitive pattern differences caused by suggestive procedure, control experiments were further designed. In the control experiment, only pattern *a* was pre-exposed through four trials. The order of presentations of *Ls* and other procedures were quite the same as those of suggestive experiments.

Results

Mean deviations from *Ls* were shown in Fig. 3 and Fig. 4. Estimated and apparent length in the trials of pattern *a* pre-exposure were shown together. The reason for it was that in every trial where pattern *a* was pre-exposed, all subjects judged the estimated and apparent length as the same. It was difficult or unnatural for the *S*s to make clear the distinction between them. Tendencies of underestimation were found both in suggestive and control experiments. These tendencies were, however, interpreted to be caused by some uncontrolled factors in experimental setting and to have no relation to the effects of suggestion, because these tendencies were commonly found and constant in every experiment.

Results of suggestive experiment of pattern b series. Differences in length perception were found among four trials, F (3, 24)=40.00, $p<0.01$. While in the control experiment no differences in length perception were found through four trials, F (3, 20)= 0.18, $p>0.05$. In the trials where pattern *b* was pre-exposed, tendencies of underestimation were larger than those in the trials where pattern *a* was pre-exposed, i.e., perceived length in pattern *b* trials decreased. Between pattern *a* trial and pattern *b* trial (estimated), $t=8.94$, $df=12$, $p<0.01$. Between pattern *a* trial and pattern *b* trial (apparent), $t=3.71$, $df=12$, $p<0.01$. Tendencies of underestimation were found not only in the estimated length but also in the apparent length.

In the trials of pattern *b* pre-exposure, perception of length decreased compared with those in corresponding trials of control experiment. (With the estimated length,

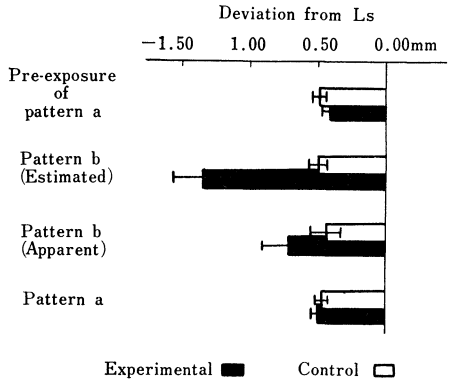


Fig. 3 Results of Exp. I (Pattern *b* series).

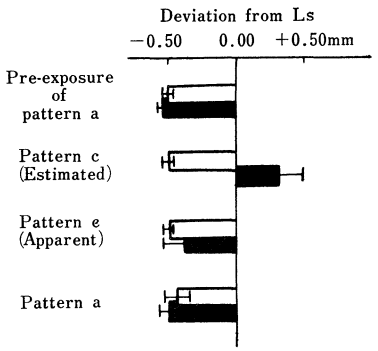


Fig. 4 Results of Exp. I (Pattern *c* series).

t=7.50, df=11, p<0.01. With the apparent length, t=2.78, df=11, p<0.05.) On the other hand, between trials of pattern *a* pre-exposure of suggestive experiment and those of corresponding trials in control experiment no differences were found. (With the first trial, t=2.24, df=11, p>0.05. With the fourth trial, t=1.52, df=11, p>0.05.)

Results of suggestive experiment of pattern c series. Differences in length perception were found among four trials, $F(3, 24)$=60.96, p<0.01. In the trials of pattern *c* pre-exposure the results were just reversed and were almost symmetrical to those of pattern *b* series. Perceived length in the trials of pattern *c* pre-exposure increased (Between pattern *a* trial and pattern *c* trial (estimated), t=11.23, df=12, p<0.01. Between pattern *a* trial and pattern *c* trial (apparent), t=2.34, df=12, p<0.05.) In the results of control experiment no differences were found through four trials, $F(3, 20)$=0.47, df=10, p>0.05. In the trials of pattern *c* pre-exposure perception of length increased as compared with those of corresponding trials of control experiment. (With the estimated length, t=10.03, df=11, p<0.01. As to the apparent length, however, no statistically significant increase was found, t=1.66, df=11, p>0.05.)

S's cognitive pattern about the space inside of the cylinder. In the trials of pattern *a* pre-exposure, *S* regarded the space inside the cylinder as transparent glass of almost no degree of curvature. In the trials of pattern *b* pre-exposure, all *S*s believed the glass in the cylinder to be convex lens of high degree. And in the trials of pattern *c* pre-exposure, the glass in the cylinder was believed to be concurve lens of high degree*. *S*s believed their perceptions of the lines were fairly distorted by these "lens". *S*s reported not only changes of length but also changes of width, color, light and shade of presented lines. Some of them complained of dizziness or headache caused by observation through "the lens of high degree".

* Of course, in reality convex lens and concurve lens do not always distort the image in such a way as conceived by the *S*'s

Discussion

In this experiment, suggestive manipulations of *S*'s cognitive pattern about the space inside the cylinder were attempted. As a result, it was confirmed that *S*'s perception of the presented line changed, corresponding to the changes of *S*'s cognitive pattern formed about the space inside the cylinder. The changes were occurred not only on imaginative level as shown by estimated length, but also on phenomenologically real level as shown by apparent length. Furthermore, it was shown that perceptual changes of the presented line occurred in the direction which was contextually consistent with the *S*'s cognitive pattern concerned. Estimation of line length decreased when *S*s conceived the glass in the cylinder as "convex lens". And contrarily, the estimation of line length increased when the glass was conceived as "concurve lens".

As a study of somewhat similler type, that of Underwood (1960) may be noticed. Underwood examined the geometrical optical illusion under the conditions of suggested positive and negative hallucinations of illusion provoking patterns. As a result, no illusions were caused or eliminated in hypnotized *S*s, of course, nor in nonhypnotized *S*s. Only in the deeply hypnotized *S*s, some effects of suggested hallucinations were found. In the present study, however, perceptual changes by suggestion were easily caused in the nonhypnotized *S*s. The reason for it was thought to be that the carefully considered suggestive procedures were used in order not to be contextually inconsistent in the formation of *S*'s cognitive pattern in line with the aimed perceptual change. In the suggestive procedures of Exp. III, in which, as it would be reported later, little attention was paid to the contextual consistency of cognitive pattern formation on the part of the *S*s (procedures of Underwood were thought to be this kind), no perceptual changes were caused even in hypnotized *S*s.

Experiment II

In Exp. II the suggestive condition was slightly changed from that of Exp. I, and *S*'s cognitive patterns and perceptions were examined.

Method

Subjects: Ten undergraduate students served as *S*s. Six of them participated in suggestive experiment and four were assigned to control experiment.

Apparatus, stimulus materials and procedure: Experimental condition differed only in one point from that of Exp. I. In the cylinder *plane* transparent round glass of no curvature was fitted instead of *curved* glass. Other procedures were quite the same as those of Exp. I.

Results

Mean deviations from *Ls* were shown in Fig. 5 and Fig. 6.

Results of suggestive experiment of pattern b series. No statistically significant

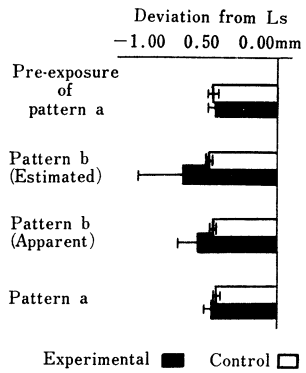


Fig. 5 Results of Exp. II (Pattern *b* series).

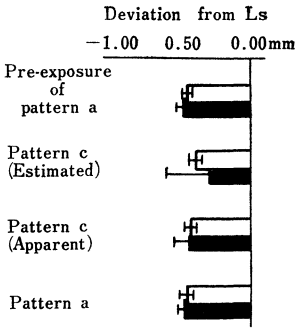


Fig. 6 Results of Exp. II (Pattern *c* series).

differences were found among four trials, $F(3, 20)=1.67$, $p>0.05$. Also differences between the results of suggestive experiment and those of control experiment were not significant. Needless to say, there were no differences in the results of four trials in control experiment, $F(3, 12)=1.26$, $p>0.05$.

Results of suggestive experiment of pattern c series. No statistically significant differences were found among four trials, $F(3, 20)=1.18$, $p>0.05$. The results of four trials in control experiment were also not significant, $F(3, 12)=1.26$, $p>0.05$. Furthermore, differences between the results of suggestive experiment and those of control experiment were not significant.

S's cognitive pattern about the space inside the cylinder. Two kinds of cognitive patterns were found. Four *S*s conceived the inside space of the cylinder as fitted in by a piece of round transparent plane glass of no curvature. Other two *S*s conceived it as a kind of lens which more or less distorted the image of presented objects. As the results were shown in average (Fig. 5 and Fig. 6), characteristic individual differences might not be clarified. Accordingly, the results were shown individually in Fig. 7 and

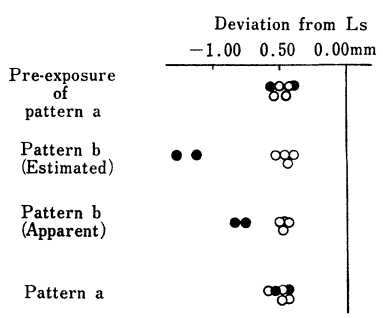


Fig. 7 Results of Exp. II Results of individual *S*s (Pattern *b* series).

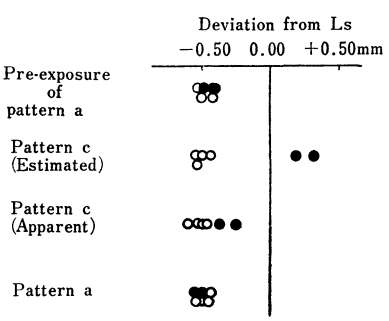


Fig. 8 Results of Exp. II Results of individual *S*s (Pattern *c* series).

Fig. 8 It was found that there were two kinds of patterns and that these different patterns in the results corresponded well to the *S*'s characteristic patterns of cognition about the space inside the cylinder.

Discussion

In the suggestive conditions of Exp. II, one of components which constituted the suggestive conditions of Experiment I was slightly changed. The plane glass was fitted in the cylinder instead of the curved glass. This condition seems to be, from the generally accepted idea, contextually less sufficient than that of Experiment I and contain a little ambiguity in forming the firm cognitive pattern in which the empty space inside the cylinder was conceived as some lens. As a result two kinds of cognitive patterns were formed by the *S*s. Perceptual organization varied in accordance with the kind of cognitive patterns formed on the part of the *S*s. By the *S*s who conceived the round glass in the cylinder as some lens, length perception of presented line changed by suggestion, while on the *S*s who believed the glass as transparent round glass of no curvature, suggestive procedures had no effect.

Experiment III

For further explorations of the relationships between suggestion, cognitive pattern formation and perceptual organization, in Exp. III, suggestive conditions were changed furthermore, and cognitive patterns formed on the part of the *S*s and the perceptions of the stimulus objects through them were examined.

Method

Subjects: Eight undergraduate students took part in the experiment as the *S*s. Four of them participated in the suggestive experiment. The other four *S*s were assigned to the control experiment.

Apparatus, stimulus materials and procedures were quite the same as those of Exp. I, except one point. In the cylinder no glass was fitted.

Results

Mean deviations from *Ls* were shown in Fig. 9 and Fig. 10. General tendency of underestimation found in the results of Exp. I and Exp. II reduced almost to zero. As the only difference in condition of Exp. III was the use of no glass inside the cylinder, the reduction of underestimating tendency was thought to be caused by the removal of glass in the cylinder. Among the results of four trials of two suggestive experiments, pattern *b* series and pattern *c* series, no differences were found. In suggestive experiment of pattern *b*, $F(3, 12)=0.11$, $p>0.05$. In suggestive experiment of pattern *c*, $F(3, 12)=0.34$, $p>0.05$. Of course, in the results of two control experiments no

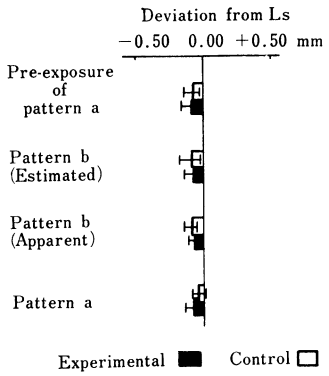


Fig. 9 Results of Exp. III (Pattern *b* series).

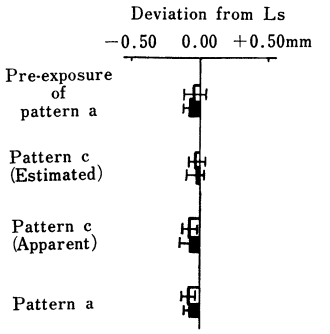


Fig. 10 Results of Exp. III (Pattern *c* series).

differences among four trials were found, $F(3, 12)=0.55$, $p>0.05$; $F(3, 12)=0.40$, $p>0.05$. Furthermore, no statistically significant differences were found between the results of suggestive experiment and those of corresponding trials in control experiment.

S's cognitive pattern formed about the space inside the cylinder. All *S*s without exception regarded with confidence the space inside the cylinder as empty.

Discussion

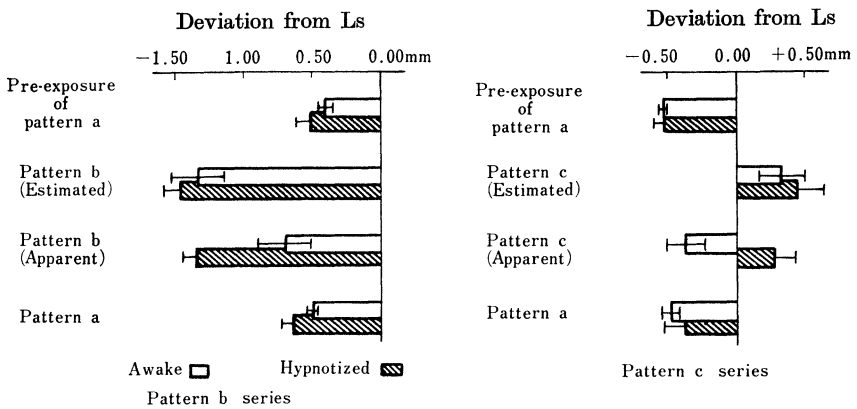
In the suggestive conditions of Exp. III, one of components which constituted the suggestive procedures of Experiment I was further changed, i.e., the glass in the cylinder was removed. This condition seems, as the generally accepted idea, to be contextually more insufficient and contain more inconsistencies in forming of cognitive pattern in which the empty space inside the cylinder was conceived as some lens. Accordingly, all *S*s without exception formed the cognitive pattern that the inside space of the cylinder was empty and firmly believed they looked at the presented line directly without any distortion. As a result, no room was found for the suggestive procedure to intrude into *S*'s perception.

Experiment IV

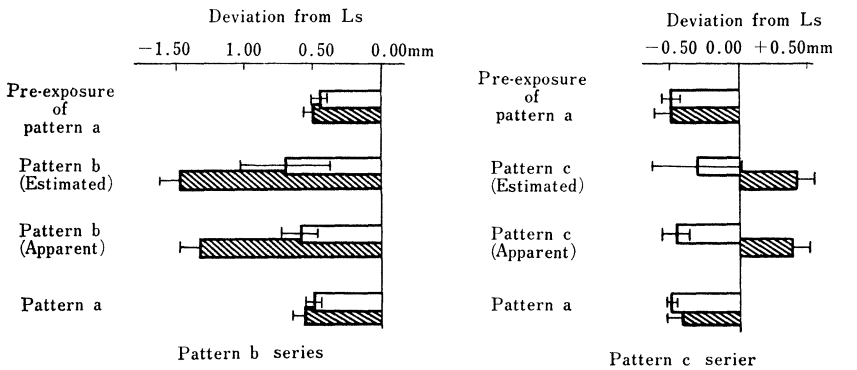
In Exp. IV, the characteristics of perceptual organization and the changes of it by suggestive procedures were investigated in the hypnotized *S*s.

Method

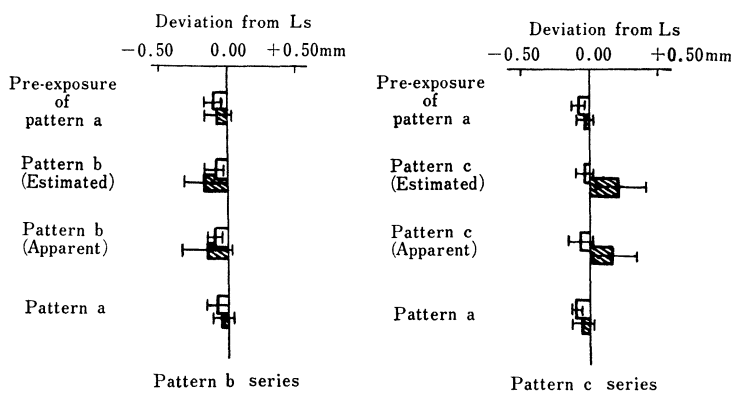
Subjects: The *S*s were four undergraduate students who volunteered to serve in the experiment. The same subjects participated successively in every experimental session.



EXPERIMENTAL COND. I



EXPERIMENTAL COND. II



EXPERIMENTAL COND. III

Fig. 11 Comparisons of the results of hypnotized *S*s with those of the nonhypnotized *S*s.

Apparatus, Stimulus materials and Procedures were quite the same as those of Exp. I, II, III, except that the *S*s were deeply hypnotized before entering the experimental session.

Results and Discussion

Results of hypnotized *S*s were compared with those of nonhypnotized *S*s and shown in Fig. 11. In the condition of Exp. I, the results of hypnotized *S*s were almost the same as those obtained by the nonhypnotized. The only difference to be noticed was that hypnotized *S*s made not so clear distinction between estimated length and apparent length. In the condition of Exp. II, the results of hypnotized *S*s remained the same as those obtained in the condition of Exp. I. No different kinds of results which were observed in the results of nonhypnotized *S*s were found. In the condition of Exp. III, slight influence of the suggestive procedure was noticed in some *S*s (however, statistically not significant), while by the nonhypnotized *S*s the influence of suggestive procedure in this condition was firmly rejected.

S's cognitive pattern formed about the space inside the cylinder. Spontaneous expressions (verbal or behavioral) by hypnotized *S*s, were not sufficient (most *S*s were passive or inactive). Accordingly, it was not always successful to ascertain in all *S*s their cognitive patterns formed about the space inside the cylinder.

In the results described above, it was noticed that hypnotized subjects confused the apparent length with the estimated length, while nonhypnotized *S*s made clear distinction between them. This result seems to suggest that in the perceptual organization of hypnotized subjects the distinction between imagination level and reality level is not so clear.

In spite of the conditional difference between Exp. I and Exp. II, results of hypnotized *S*s differed not so much as those of nonhypnotized. This result seems to suggest that the hypnotized *S*s were generally comparatively indifferent to the delicate changes of outer stimulus situation. Further, it was shown in Exp. III, even as to the hypnotized *S*s, suggestive procedures which lacked the contextual considerations and did not succeed in forming of *S*'s cognitive pattern in line with the aimed perceptual change were not effective.

Summary and Conclusion

Considering the mechanism of perceptual change by suggestion, the importance of *S*'s cognitive pattern which was supposed to intervene in the perceptual organization of the *S*s and determine directly the characteristics of *S*'s perceptions was noticed.

The purpose of the present studies was to examine the role and functions of *S*'s cognitive pattern in the perceptual change by suggestion.

In the experiment *S*s observed the length of lines through a cylinder. Congitive

patterns about the space inside the cylinder were tentatively manipulated and varied by suggestive procedures.

The following results were obtained: 1) Length perception of a presented line changed in accordance with the changes of *S*'s cognitive pattern about the space inside the cylinder. The caused perceptual changes were not only of imagination level such as estimated length but also of reality level as apparent length. 2) The directions and the characteristics of length perceptions or changes of them were contextually well consistent with the cognitive patterns formed by the *S*s. 3) Under the ambiguous suggestive situation, *S*'s cognitive patterns about the space inside the cylinder were divided into two kinds and the individual results were also divided into two kinds. 4) In the condition where *S* held about the cylinder such cognitive pattern as having no relations to the perceptual distortion of the presented stimulus, no influences of suggestion were found. In the conditions of Exp. III, *S* rejected firmly the suggestion and the perceptual change by it. 5) In the hypnotized *S*s, perception of line length changed in the same way as those observed in nonhypnotized *S*s. But hypnotized *S*s showed a tendency to confuse the estimated length with the apparent length and were more or less indifferent to changes of outer situation.

The results were interpreted to provide evidence for the supposition mentioned in the introduction.

References

Allport, F.H. **1955** *Theories of perception and concept of structure.* New York: Wily & Sons.

Bruner, J.S. **1951** Personality dynamics and the process of perceiving. (In Blake, R.R. & Ramsy G.V., Eds.: *Perception. An approach to personality.* New York: Ronald Press.)

Binet, A. **1900** *La suggestibilité.* Paris: Schleicher Fréres.

Hariu, T. **1963** On the change of size and length perception by suggestion. *Jap. J. Hypnosis,* **8**, 3–23. (in Japanese)

Hariu, T. **1970** Hypnosis and perception. (In Uchiyama, K. et al., Eds.: *Lectures on hypnosis.* Volum 3, Chapter 4, Reimei-shobo, Inc.) (in Japanese)

Hariu, T. **1972** Mechanism of perceptual change by suggestion: Case reports. *Memoirs of The Faculty of Education, Akita University,* 65–86. (in Japanese)

Hariu, T. **1973** Mechanism of perceptual change by suggestion: An analysis of hypnotic induction procedure. *Memoirs of The Faculty of Education, Akita University,* 54–69. (in Japanese)

Postman, L. **1951** Toward a general theory of cognition. (In Rohrer, J.H. & Sherif, M., Eds.: *social psychology at the crossroads.* New York: Harper & Brothers.)

Scripture, E.W. **1893** Tests on school children. *Educ. Review,* **5**, 52–61.

Seashore, C.E. **1895** Measurements of illusions and hallucinations in normal life. *Stud. Yale. Psychol. Lab.,* **2**, 1–67.

Underwood, H.W. **1960** The validity of hypnotically induced visual hallucinations. *J. abnorm. & soc. Psychol.,* **61**, 39–46.

(Received August 31, 1973)