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THE EFFECT OF LYSERGIC ACID DIETHYLAMIDE (L.S.D.) ON SIZE CONSTANCY*

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Size constancy in schizophrenic patients has been investigated by Raush^(5,6), Weckowicz⁽⁸⁾, and Crookes⁽²⁾. Raush has found that paranoid schizophrenics had increased size constancy compared with normals and other schizophrenics. He predicted that in other types of schizophrenia size constancy might be poorer than in normals, however the difference he found was not statistically significant. Weckowicz found that chronic hospitalized schizophrenics, had poorer size constancy than normals and other hospitalized mental patients. Crookes came to the same conclusion.

Osmond and Smythies⁽⁴⁾, have suggested that mescaline, L.S.D., and other psychotomimetic drugs produce perceptual and other mental changes, similar to those found in schizophrenia. These authors regard the L.S.D. and mescaline induced psychoses as "model psychoses" for schizophrenia, further they suggest that schizophrenia may be produced by a toxic substance, likely an adrenaline metabolite, which acts in a similar way as L.S.D. or mescaline. This paper reports the results of a size constancy experiment carried out on 18 volunteers who took L.S.D.

Size Constancy

The literature on size constancy has been summarized elsewhere⁽⁸⁾. It is sufficient to say that size constancy denotes the ability to perceive the size of an object stable within wide limits in spite of the change of the size of the retinal image with the distance from which the object is seen.

The Sample: This experiment was carried out on 18 volunteers, mostly university students, who worked at the hospital as summer relief nurses, 9 males and 9 females. Their mean age was 22 years (range 17-33). None of them had a history of mental disease.

Method:

(a) *Apparatus:* This consisted of a white-painted box, standing on a white painted table with a white screen behind it. A black rod (0.5 cm. in diameter) on the top of the box, could be adjusted to different heights (0-20 cm) from behind the screen. A second white screen in front of the box could be removed and put back again.

There was another white table with a similar white box of similar size and shape and a similar black rod, whose height (0-20 cm.) could be adjusted by pushing a handle in the box. A chin support was fixed on the other side of this second table.

A long corridor lit by electric light, was used. All external light was carefully excluded. In order that visual cues would not change a standard arrangement of all objects used was maintained. The subject sat at this table with his chin in the chin support and his hand on the handle for adjusting the rod on the top of the box 44 cm. in front of him. The other table was placed first at 7.5 m., and second at 15 m. from him.

The experimenter sat behind the screen. The subject was told to adjust

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the black rod on the top of the white box in front of him to the same size as the other black rod, which he saw at a distance. He was told to use both eyes. The experimenter showed the sizes of the rod in standard order, different for 7.5 m. distance and 15 m. distance. Twenty sizes were shown at each distance. While the size of the rod was being changed the screen was put in front of the box to prevent the patient from seeing the movement of the rod. The adjustments of the rod made by the patient were read and recorded by an assistant. Each adjustment was recorded in centimeters as an error, either plus or minus from the standard size displayed to the subject from the distance. (The accuracy was to one decimal point.) These errors were added up and the average error was calculated, which became the score for the subjects. The Standard Deviation of the twenty individual scores round the mean (the average error) was also calculated.

(b) *Procedure:* Thirty-five gamma of lysergic acid diethylamide (L.S.D.) dissolved in a glass of distilled water (which was completely tasteless) or a glass of pure distilled water was given to the subject two hours before the experiment.

A Latin Square design was used. Each subject was his own control, he was tested on three consecutive days. On one occasion he was given L.S.D., on two other occasions he was given pure water. He did not know on which occasion he took L.S.D. The order in which L.S.D. and pure water were given was randomized in blocks of three subjects. (In each block of three subjects, one subject received L.S.D., first followed by two occasions on which he received pure water; one subject received pure water on the first occasion, L.S.D. on the second occasion and pure water on the third occasion; and finally one subject received pure water on the first two occasions and L.S.D. on the third occasion.)

After the experiment the subjects were asked to tell how they felt and whether they thought they had L.S.D. or pure water. All together 54 experiments were carried out. Thirty-six with pure water and 18 with L.S.D.

The Results:

Sixteen out of 18 subjects had a definite reaction to L.S.D. and could tell the occasion when they were given L.S.D. In some subjects the reaction was quite pronounced and lasted several hours. The table below gives the symptoms produced by L.S.D. and their frequency.

TABLE 1

Symptoms	Frequency
Auditory hallucinations.....	3
Visual hallucinations.....	2
Delusional percepts.....	1
Other subjective disorders of visual perception.....	9
Depersonalization.....	3
Thought Disorder.....	8
Paranoid Ideas.....	3
Ideas of Passivity.....	1
Depression.....	3
Elation.....	3
Flatness of Affect.....	5
Anxiety.....	6
Definite disorder of bodily image.....	6
Somatic sensory disturbance.....	10
Tiredness.....	3

TABLE 2

Average error	Distance 7.5 m.		Distance 15 m.	
	L.S.D. Mean	Water Mean	L.S.D. Mean	Water Mean
	+0.4661	+0.2302	+0.3866	+0.0738
Standard Deviation of intra-individual error	1.19	0.98	1.29	1.31

As it is seen from the table even such a small dose of L.S.D. as 35 gamma gives a whole array of mildly psychotic symptoms.

Table 2 presents the results of the experiments with size constancy.

The only significant difference, is that between Standard Deviation (Scatter) of the intra-individual error at the distance of 7.5 m. (The difference of means is 0.21, "t" = 2.1875, $0.05 > p > 0.01$.) In order to check whether this "t" was due to chance an analysis of variance for Standard Deviations of the intra-individual error at the distance of 7.5 m. was carried out. (The results of which are summarized in Table 3.*)

Discussion

Both after taking L.S.D. and after taking pure water the subjects over-estimated the size of the rod at each instance, thus showing a tendency to over-constancy. This over-estimation was slightly higher for both distances after L.S.D., than after pure water, although the difference is not statistically significant (7.5 m., $t = 0.7729$, 15 m., $t = 0.8167$).

There was a significant difference in the intra-individual scatter of error at the shorter distance, after taking L.S.D. (It will be remembered that each subject made twenty estimations of the size of the rod at each distance during each experiment.) Thus, although taking L.S.D., did not influence size constancy, it influenced the scatter of the individual assessments. This latter finding

TABLE 3

ANALYSIS OF VARIANCE OF S.D., OF THE INTRA-INDIVIDUAL ERROR AT THE 7.5 m. DISTANCE

Source of Variance	Sum of Square	d.f.	Mean Square	F.
Subjects.....	2.1567	17	0.1268	
Days.....	0.0136	2	0.0068	
Medication.....	0.5097	1	0.5097	4.9486
Residual**.....	3.3991	33	0.1030	($0.05 > p > 0.01$)
Total.....	6.0791	53		

*The variability compared is the intra-individual variability, the variability of performance of each individual at each testing session and not the inter-individual variability, therefore the "F" test is not applicable. An objection could be raised that Standard Deviation is not a suitable measure of Variability for obtaining a mean value of variability and for the use of "t" test; and that Average Deviation would be more suitable for this purpose. However according to Snedecor (7), the distribution of Standard Deviation differs only negligibly from the normal distribution and therefore the assumption of the normality of distribution can be made. As the measurements are in the same scale, and as the difference in means is negligible there is no need to use Coefficients of Variation.

**The residual mean square was taken as the error term.

agrees with Boardman, Goldstone and Lhamon's findings⁽¹⁾, that the intra-individual variability of the interval estimations increases in volunteers who took L.S.D., although there is no tendency to over-estimation of time-intervals, which they have found in schizophrenics. These workers did not find any increase in the intra-individual variability in performance of schizophrenic patients, however, Weckowicz⁽⁸⁾, has found that schizophrenic patients apart from impaired size constancy, show also a higher intra-individual variability of performance, than do normals and non-schizophrenic patients. The difference between intra-individual variability, reported in this paper occurred only at a shorter (7.5 m) distance, it did not occur at the longer (15 m.) distance, the reason for that may be an overall greater variability of performance at the longer distance, masking the effect of L.S.D.

The results are inconclusive. While 35 gamma of L.S.D. failed to produce impaired size constancy one finds in schizophrenics, it did produce increased intra-individual variability of performance, which occurs in these patients.

A tentative explanation for this is that before a homeostatic mechanism is put out of action or starts functioning at a different level it shows increased "oscillation" round the level, which it "tries" to maintain. Thus the homeostatic mechanism responsible for size constancy, when affected by a noxious agent, shows first an increased variability of performance and then breaks down all together. The Effect of L.S.D. in the doses given in this experiment, and perhaps early schizophrenia could be compared with the first stage, and chronic schizophrenia with the second stage of this process. Our study of L.S.D. experiences suggests that larger doses of L.S.D. might produce an impairment of size constancy, but would make experimentation extremely difficult on account of reduced cooperation.

Summary

1. An experiment of size constancy has been carried out on 18 volunteers who took 35 gamma of L.S.D.
2. The subjects served as their own controls.
3. The effect of L.S.D. was an increase of the variability of performance of each individual.

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Resumé

1. On a étudié chez 18 volontaires les modifications dans l'appréciation de la constance dimensionnelle (size constancy) après administration de 35 gamma de la diéthylamide de l'acide lysergique.
2. Les sujets eux-mêmes ont été utilisés comme leur propre témoin.
3. L'effet de l'acide lysergique apparut être une variabilité accrue de la performance de chaque individu.