A NOTE ON "DISTANCE CONSTANCY IN SCHIZOPHRENIC PATIENTS"

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WECKOWICZ, Sommer and Hall (14) in a paper on the size and distance perception of schizophrenic patients relate their results to a theory of the normal perception of size and distance. This paper analyses more fully some aspects of their results, since they provide evidence *against* the theory of perception which Weckowicz *et al.* accept.

Weckowicz's paper (as it will be termed) includes the following account of the theory concerned:

"It (*size constancy*) depends on an ability to take into account the distance of the perceived object. A retinal image of the same size can be produced either by a small object at a near distance or a large object at a far distance, so there is a reciprocity between the perceived distance and perceived size." This hypothesis concerning the relationship between perceived size, *s*, and perceived distance, *d*, has been termed the Invariance Hypothesis, and is most clearly expressed by the formula $s/d = \mathrm{I}$ (the retinal image size). Gilinsky (4) has used this equation as a basic axiom in her system, in which a formula is derived for perceived distance in terms of the actual distance, D, and a constant, A, which represents the hypothetical limit of perceived distance:

$$d = \frac{\mathrm{A.D.}}{\mathrm{A+D}}$$

Weckowicz interprets his results both in terms of the Invariance Hypothesis, and in terms of this concept of a limited subjective space. Now the Invariance Hypothesis is commonly accepted as confirmed, but nevertheless there is much evidence which severely restricts its sphere of validity. Indeed, two of the authors mentioned in Weckowicz's paper, Ittelson (8) and Brunswik (2), have themselves reported experiments in which predictions based on the Invariance Hypothesis were not confirmed. Amongst other investigators reporting contrary results are Gruber (5), Heinemann *et al.* (6), and Hermans (7). Smith (12) also has clearly shown the inadequacies of Gilinsky's formula. Briefly, these authors show that if the size of an object is, say, underestimated, then the distance of the object will *not* necessarily be underestimated also; indeed in some circumstances the distance tends to be overestimated (1, 10, 11). Similarly, if an observer judges an object to be larger than do most observers, then he does not necessarily also judge the distance to be greater than most. As for Gilinsky's formula for perceived distance, experiments show that in many cases estimated distance is related to actual distance in a linear fashion, rather than as the negatively accelerating function in the formula (3).

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Reappraisal of Weckowicz's Results

In Weckowicz's investigation, each subject was required to say when a cart moving away from him appeared to be one-yard away, a further one-yard away, and so on, until twenty successive one-yard judgments had been made. A normal and a schizophrenic group were studied. The median distances judged successively to be equal to one-yard are given in Table II of Weckowicz's paper. Gilinsky's formula can be tested by these data, since the predicted relationship between an increment of actual distance, ΔD, required for a unit increase in perceived distance, and the total perceived distance, d, is given by differentiating Gilinsky's equation:

$$\Delta D = \frac{A^2}{(A - d)^2}$$

Thus a complex relationship between perceived distance and the increment of actual distance, ΔD, is predicted; specifically, ΔD is considered to be a positively accelerating function of d. In fact, however, Weckowicz's results show a linear, rather than a positively accelerating trend. The product-moment correlation between the two variables (assuming that the successive perceived yards summate) is 0·99 for the schizophrenic patients and 0·97 for the normals: $N = 20$, and therefore both correlations are highly significant. In other words, the increment of distance appearing equal to one-yard increases in proportion to the perceived distance under the particular experimental conditions, and this linear trend can account for over 94 per cent. of the variance between the median distance judgments. The discrepancy between these results and Gilinsky's formula may be illustrated in another way. The constant, A, which is supposed to be the limit of perceived under the experimental conditions, may be evaluated using Gilinsky's formula, if we assume that the successive median estimates may be summed. The calculated values of A for $d = 1$, 10, and 20 yards are $A = 8$, 23, and 30 yards respectively for the schizophrenic group; and $A = 19$, 29, and 43 yards for the normal group. A different set of values for A may be calculated from the differential equation, without summing the estimates. It is clear that the calculated values for A are far from equal, and that therefore the concept of a limit to perceived distance, as defined by Gilinsky's formula, is untenable as an explanation of the results.

The data from Table III of Weckowicz's paper are also in clear disagreement with Gilinsky's prediction. This table gives the median increments of distance appearing equal to one-yard for different values of the *actual* distance from which the judgments were made. In this case, the predicted relationship is obtained by stating the differential of Gilinsky's formula in terms of the actual distance, D:

$$\Delta D = \frac{(D + A)^2}{A^2}$$

This is also a positively accelerating function, and again this prediction is not confirmed. For the empirical relationship between ΔD and D is not a positively accelerating function for either group. The relationship is linear for the schizophrenic group, with a product-moment correlation of 0·99 ($N = 29$, and therefore highly significant); while the relationship for the normal group shows a clear *negatively* accelerating trend.

Weckowicz *et al.* report, in addition, two correlations between "size constancy" and "distance constancy". The former measure refers to the perceived size of a rod at 7·5 m. distance and at 15 m. distance, indicated by the

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observer's adjustment of another rod in front of him. It is assumed, presumably, that the perceived size of this near rod is equal to its actual size, so that its setting gives the equal perceived size of the further object directly. "Distance constancy" refers to the actual distance reported by the observer as eight successive one-yard intervals, and sixteen one-yard intervals respectively. The size estimates were obtained within four weeks of the distance estimates, and are reported in detail in a separate paper by Weckowicz (13). The inter-subject correlations between the two perceptual variables, for the schizophrenic group, are stated to be "in the direction predicted by the theory". Assuming that the theory referred to is the Invariance Hypothesis, it must be pointed out that this Hypothesis predicts a high, *linear* correlation between perceived size and perceived distance, with visual angle constant: and the empirical correlations reported by Weckowicz are neither large nor linear. Ordinal correlations for 7·5 m. distance and 15 m. distance were respectively rho = 0·47 and rho = 0·39. But in any case, the Invariance Hypothesis cannot make *any* prediction with regard to these particular empirical correlations, since they do not fulfil the conditions necessary for the application of the Hypothesis. In the first place, the size and distance judgments were made with different stimulus-objects (rods and a cart, respectively), with different visual projection sizes. Moreover, the "distance constancy" measure used by Weckowicz is inappropriate, since it is not equivalent to perceived distance. A more appropriate measure would have been the number of perceived one-yard intervals within the actual distance concerned (7·5 m. or 15 m.), using the summed increments.

The empirical correlations should not, then, be regarded as evidence confirming the Invariance Hypothesis. Indeed, there is no report in the literature (known to the writer) of a positive, linear, inter-subject correlation between perceived size and perceived distance, with stimulus conditions constant. However, if the correlations obtained by Weckowicz cannot be accounted for in terms of the Invariance Hypothesis, they require some other explanation. Weckowicz's own observations suggest a simple one. Since schizophrenia tends to involve a deterioration in the ability to judge both size and distance accurately, and since it is reasonable to suppose that the *degree* of schizophrenic deterioration should be reflected in both size and distance judgments, some correlation between the two indices is to be expected for the schizophrenic group. Unfortunately, control data for the normals were not obtained in this respect. It is suggested, then, that the correlations obtained by Weckowicz support his hypothesis that schizophrenia involves the deterioration of perceptual functions, but that this does not imply that perceived size and distance are necessarily correlated in a positive linear fashion for normal observers.

A further aspect of the results supports this view. The normal group tended to give slightly greater size judgments for objects at 15 m. distance than at 7·5 m. distance (13). This "overconstancy" has been observed by other investigators such as Jenkin (9). But when estimating distance, the normal group tended to *underestimate* the distance far more at 16 yards than at 8 yards.

The discussion may be summarized by observing that Weckowicz's legitimate conclusions with regard to some of the possible effects of schizophrenia should not be confounded by relating them to a limited and speculative theory of size and distance perception.

Summary

Weckowicz *et al.* have shown that schizophrenia tends to involve impairment in the ability to make perceptual judgments. The present paper denies,

however, that Weckowicz's results support the Invariance Hypothesis or Gilinsky's theory of size and distance perception. Indeed, some aspects of the results are shown to be incompatible with these theories.

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