INDIVIDUAL DIFFERENCES IN MAKING PERCEPTUAL INFERENCES

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Charles A. Kiesler

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INDIVIDUAL DIFFERENCES IN MAKING PERCEPTUAL INFERENCES

By

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AN ABSTRACT

Submitted to the College of Science and Arts, Michigan State University in partial fulfillment of the requirements for the degree of

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ABSTRACT

This study was primarily designed as a replication of an experiment by Binder in which a significant positive relationship was found between the paranoia scale of the MMPI and cautiousness in making a perceptual inference, i.e., allowing a greater number of cues to accumulate before making an inference about the identity of the stimulus. In addition to investigating the relationship obtained by Binder, hypotheses were formulated relating other variables to cautiousness in making a perceptual inference: introversion-extroversion and two cognitive variables, the latter derived from a task requiring the subject (S) to distinguish between descriptive and inferential statements.

The procedure consisted of two phases, learning and test trials. In the former, 41 Ss learned the names of a fixed set of alternative stimuli by the paired-associates method. Then, in the test trials, a sequence of slides was presented in which each successive slide provided more information about the identity of the stimulus. The Ss were instructed to name the stimulus as soon as possible. As more cues accumulated, the identity of the stimulus gradually became less uncertain. As each slide was presented, the Ss had a choice of responding with one of the stimulus-names they had learned or of waiting until more cues had accumulated. Scores were assigned to the Ss in accordance with the point in the sequence at which they were willing to respond, which was considered to be a measure of cautiousness in making perceptual inferences.

None of the hypotheses was supported. A test of the significance of the difference between the correlation obtained in the present study

and that obtained by Binder was performed. Although the difference between the correlations was not statistically significant ($p = .0534$), it was concluded that the results of this study could not reasonably be interpreted as supporting Binder's finding.

Approved Stanley F. King, Major Professor

Date June 6, 1960

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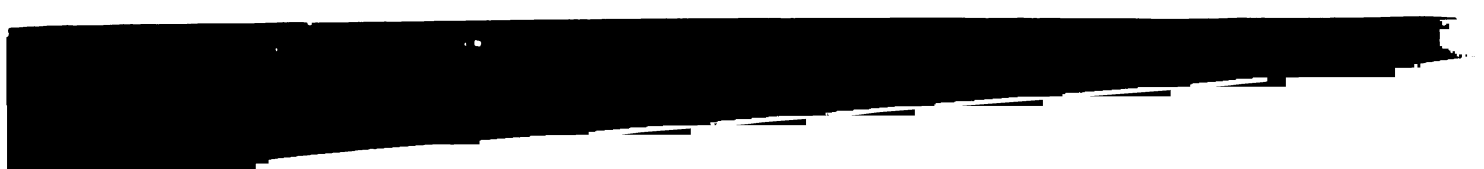

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I. INTRODUCTION

In the visual recognition situation where persons are asked to identify an object, they may differ in both the number of cues which they utilize and the class to which they assign the object. Binder's (1955) model for visual recognition implies that the person responds with a class name when he has enough cues available to satisfy himself as to the identify of the object. For example, suppose a person sees an object approach him on the road. While it is still some distance away, he may say it is a car with some degree of assurance. As it approaches him and more cues become available, he may identify it successively as a Chevrolet, a Chevrolet sedan, and a Chevrolet sedan, Model 210. As the car gets closer and details are more apparent, a larger set of cues is available to him. However, the set of cues available when he identified the object as a car is still available when the response of "Chevrolet" was made but other cues had accumulated. If we label the set of cues available at each successive class-naming response as K_1, K_2, K_3, and K_4, respectively, then we may make the statement:

$$K_1 \subset K_2 \subset K_3 \subset K_4$$

As more cues become available, we can assign the object to a smaller class. A few more cues in our example could conceivably allow a unique specification, e.g., the Chevrolet sedan, Model 210, that the Jones' own. It is obvious that $K_4 \subset K_5$, where K_5 is the number of cues necessary for unique specification. The assumption of

monotonicity of cues implies an inverse monotonicity of possible classes, that is:

$$K_1 \subset K_2 \subset K_3 \ldots\ldots\ldots \subset K_n \longrightarrow C_n \supset \ldots\ldots C_3 \supset C_2 \supset C_1,$$

where K_n is the set of cues necessary for unique specification and C_n is a class with n objects in it.

Returning to our example, suppose another less experienced person is placed in the same situation, waits until the automobile is relatively close to him, and then calls it a General Motors car, unable to give a more specific response. Thus, we would have a series of responses, on the one hand, and a single response different from any in the previous series, on the other hand. None of the responses misidentified the object, and in that sense all are "correct." Greater experience with the object allowed an assignment to a smaller class. In the first example, the person was able to use more cues to differentiate this car from other cars, while the same cues could not serve this purpose for the less experienced person in the second example. However, this is a matter of conjecture, and we cannot make the statement with any degree of certainty.

Suppose, on the other hand, we present subjects (Ss) with a series of line drawings which become increasingly complex and which come to look more and more like the automobile in question. The Ss are asked to identify the object as soon as possible. Prior to this, in order to lessen the effect of experience, we could show each S drawings of, say, eight automobiles with their respective names and inform him that the series would end with one of these drawings. Thus, we have a fixed set of alternatives and have attempted to equate Ss'

experience with each alternative. Each step in our series of drawings would eliminate some of the eight possibilities and leave others. After each step, S would have the choice of responding with one of the class names with which he had become familiar or of waiting until more cues had accumulated.

Since the hypothetical series could be continued until there is no reasonable doubt about the identity of the object (in the fixed set of alternatives), there is no question of whether Ss would respond eventually. Also, since incorrect responses could be ignored and the series continued, there is no question of whether Ss respond correctly. Rather the question would be: When in this process of accumulating cues are Ss willing to make an inference concerning the nature of the object?

Binder (1958) refers to the point at which the individual is willing to make an inference as the "recognition response level," and the above example is similar to the technique he has devised to determine this point. The present author prefers to stress the inferential nature of perception and will refer to the variable as "cautiousness in making a perceptual inference" (C). A person who demands a large number of cues before making a perceptual inference would be considered high in C.

Using the above technique, Binder (1958) studied the relationship between C and certain personality variables, as measured by the Minnesota Multiphasic Personality Inventory (MMPI). Only one prediction was supported, a positive relationship between C and the paranoia (Pa) scale. The interpretation of this finding was that the distrust and suspiciousness shown by persons with high Pa scores tended to lead to a perceptual inference only after a relatively large number of cues had accumulated, where uncertainty was low.

Predictions in Binder's study which were not supported were: (a) people with large differences between hysteria and psychasthenia scores (Hy-Pt) are less cautious in making perceptual inferences than those with low Hy-Pt scores; (b) low Pt scorers are less cautious in making perceptual inferences than high Pt scorers.

The purpose of the present research was twofold: (a) to replicate Binder's finding with the Pa scale, and (b) to investigate the relationship of other variables to C.

One variable which may relate to cautiousness in making a perceptual inference is introversion-extroversion. Himmelweit (1946) and Eysenck (1947) characterize the extrovert, as compared to the introvert, as being quick but inaccurate in performance. Himmelweit presented extroverts and introverts with tests which involved a choice between emphasizing speed or accuracy in completing the task. The approach of the extroverts showed a preference for speed, while the introverts were oriented toward accuracy. On this basis, it might be expected that extroverts would be less cautious in making perceptual inferences than introverts.

Bruner (1957) feels that the inferential aspects of perception are very similar in general to the inferences characteristic of cognition. One might expect that a person who demands little information before making a perceptual inference, i.e., low in C, would evidence similar behavior in the cognitive sphere and view inferences as descriptions of a situation, i.e., as fact. This hypothesis was tested using Haney's (1953) Uncritical Inference Test, which consists of a short story, serving as stimulus material, followed by a series of statements designed to test the ability to discriminate between descriptions and inferences. The present author derived the following two scores for this instrument: Acceptance (A), classifying inferential statements as descriptive; and

Circumspection (Cir), classifying descriptive statements as inferential. It seems reasonable to predict that high A scorers would be less cautious in making perceptual inferences than low A scorers, and that people who score high in Cir would be more cautious in making perceptual inferences than those who score low in Cir.

Specifically, the hypotheses formulated for testing were as follows: 1, high Pa scorers are more cautious in making perceptual inferences than low Pa scorers; 2, extroverts are less cautious in making perceptual inferences than introverts; 3, high A scorers on Haney's test are less cautious in making perceptual inferences than low A scorers; 4, high Cir scorers on Haney's test are more cautious in making perceptual inferences than low Cir scorers.

II. METHOD

Subjects

The subjects (Ss) consisted of 53 students enrolled in an introductory course in psychology. All Ss were administered the paper and pencil tests during regular class hours. Of the original sample, 41 Ss (22 males and 19 females) volunteered for the necessary further procedures which required individual administration.

Paper and Pencil Tests

Two paper and pencil tests were used, the first containing an introversion-extroversion scale and a paranoia scale, and the second was the Uncritical Inference Test (Haney, 1953). The introversion-extroversion scale was taken from the Maudsley Personality Inventory (Eysenck, 1959), and the paranoia scale was that contained in the MMPI.* The other fifty-six items of the Maudsley Personality Inventory, twenty-four of which comprise a neuroticism scale, were used as "filler" items for the first test.

Apparatus

A Bell and Howell Robomatic projector was used to project 2 by 2 in. stimulus slides onto a rear projection screen 12 in. square. An automatic timing device allowed control of intertrial interval as well as time of presentation of each slide.

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*The Pa scale was not corrected for K although it was in Binder's study. The possible implications will be discussed later in the paper.

Stimulus Materials

The stimulus objects were taken from Binder (1958), and are presented in Figures 1 and 2. Note in Figure 1 that the progression in level from A to E is accompanied by an increasing number of cues concerning the identity of the object. Stimulus objects A_1 and B_1 contain elements common to all eight E objects, each object at level C contains elements common to four of the E objects, and each object at level D contains elements common to two of the E objects. Care was taken to insure that each element common to a number of objects occupied exactly the same position in the respective slides. The stimulus objects were first carefully drawn by draftsmen and then photographed for the slides used in the experiment.

Procedure

The part of the experiment designed to indicate the level of perceptual inference consisted of two phases, learning trials followed by test trials. During the learning phase, the names of the objects in Figure 2 were learned by the paired-associates method. Note that these objects are identical to those of level E in Figure 1. The eight objects were presented in random order, then the order was reversed. A sequence in which all eight objects appeared was considered to be a trial. Each slide was presented for seven seconds with a seven-second interval between slides. During the first trial, E gave the name of the stimulus object immediately after it appeared. During succeeding trials, S was asked to attempt to give the name of the object. If S had not responded after four seconds, E gave the name. The criterion of learning used was two consecutive trials in which all eight of the stimulus objects were correctly named by S.

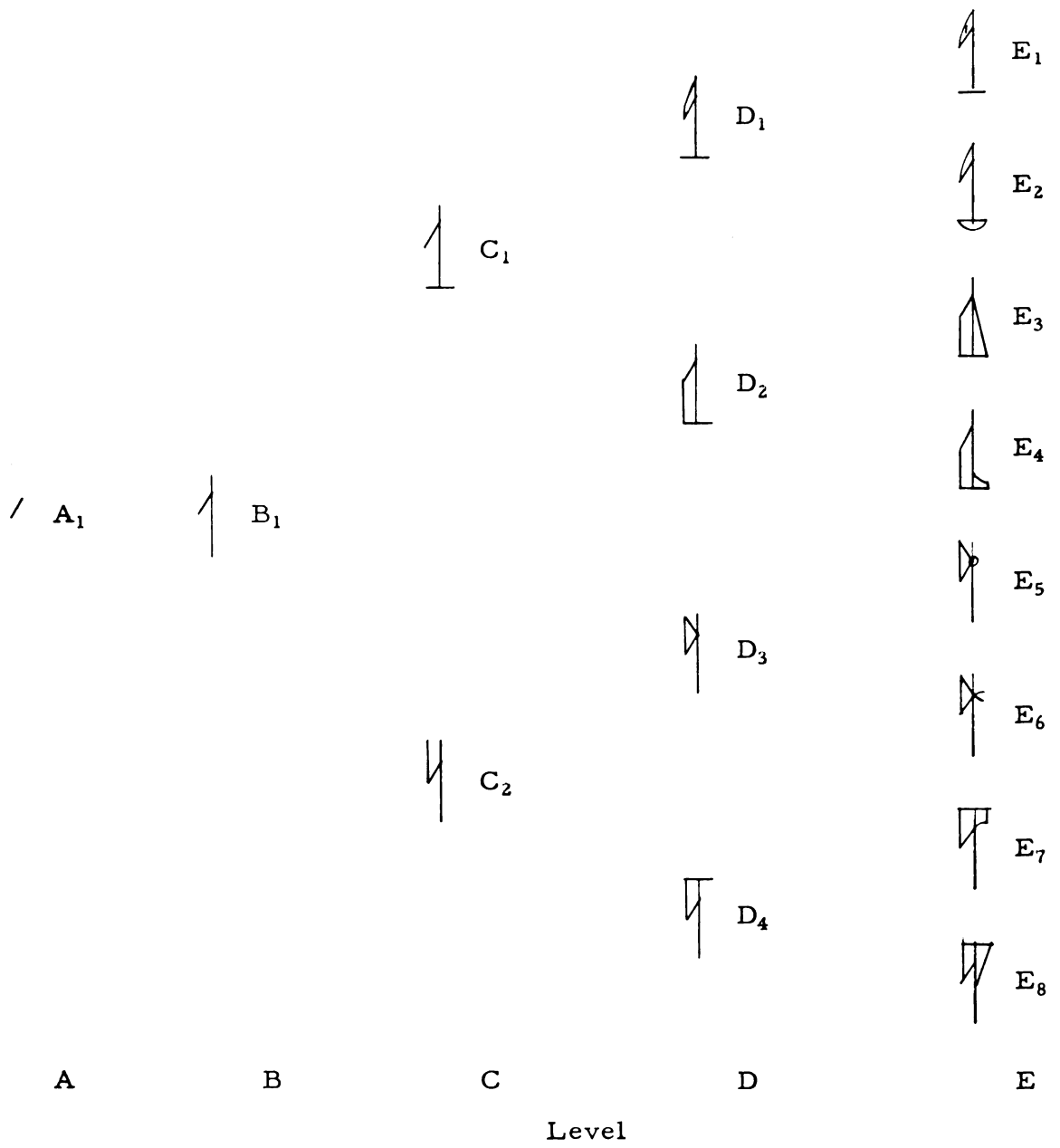

Figure 1. Stimuli Shown During Successive Trials in the Test Phase. (After Binder, 1958)

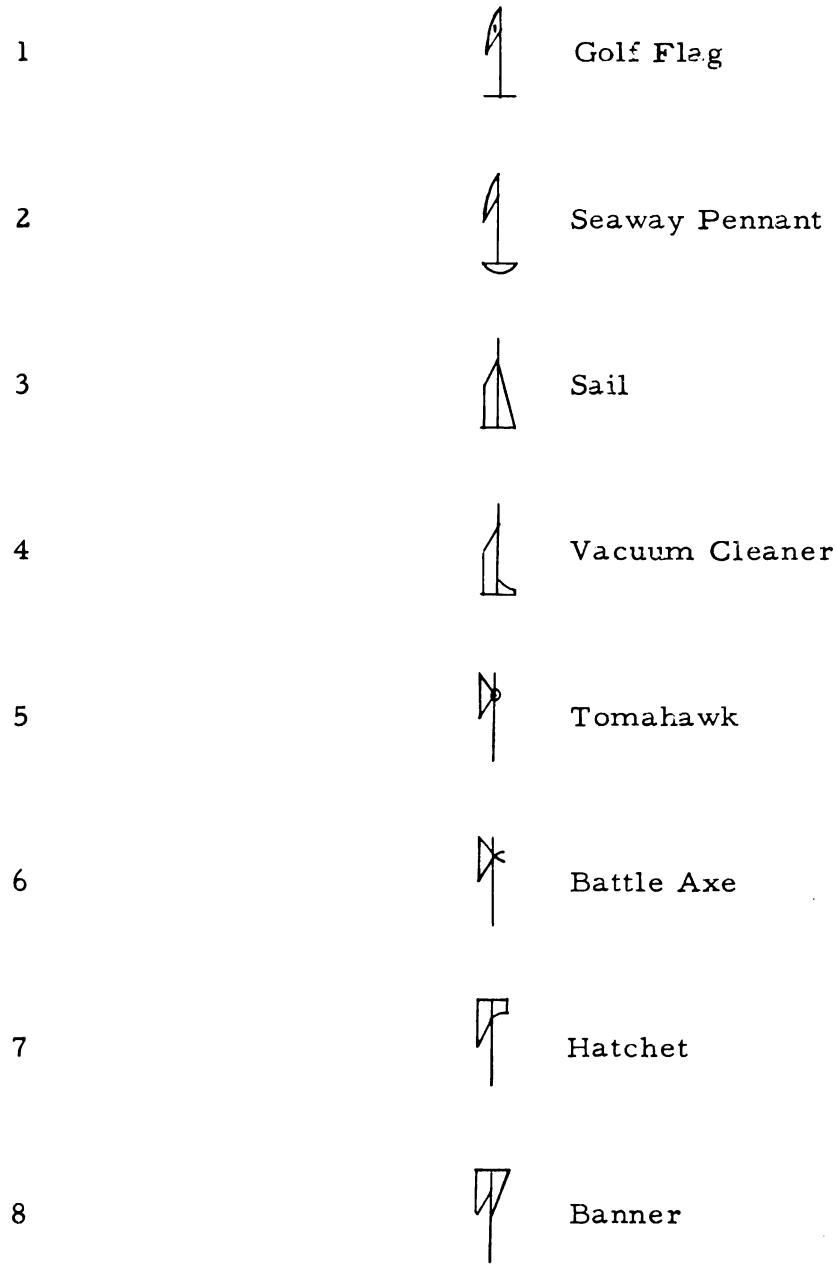

Figure 2. Stimulus Objects Shown During Learning Trials and Their Respective Names. (After Binder, 1958)

After the Ss had learned the names of the objects to criterion, the test trials commenced and the Ss were given the following instructions:

> "Now I will show you some other figures. The first figure in each trial will be one part of one of the objects you have already learned. In each of the succeeding trials, there will be one other part of the same object added until, finally, at the end of the sequence you will be shown the whole object. As soon as you can recognize which of the objects we are leading up to, tell me its name. Try to determine which of the objects we are leading up to as quickly as possible. Each of the figures will be shown only a very short time, so be alert! Remember that each slide will be presented for only a brief exposure and that a slide with more information will follow it after a short interval. It is important that you respond immediately upon recognizing the object represented. I will notify you when each new trial is to begin. At each new trial, a different object will be represented in the sequence. Do you have any questions before we begin the first trial?"

Each S was presented with four sequences of five slides each. Each successive slide in a sequence contained a greater amount of information about the stimulus object with which the sequence was to end. Each of the slides was on for two seconds with a seven-second interval between slides.* For any particular S, the four trials would consist of the following in random order:

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*In Binder's experiment, each figure was presented for 1 1/4 seconds with a nine-second interval between figures.

$A_1B_1C_1D_1$ and E_1 or E_2

$A_1B_1C_1D_2$ and E_3 or E_4

$A_1B_1C_2D_3$ and E_5 or E_6

$A_1B_1C_2D_4$ and E_7 or E_8

The S received a score on the sequence in accordance with the level at which he responded. If he responded at level A with only the minimum number of cues, he received a score of one on the sequence. If he responded at level E with the maximum number of cues present, then he would receive a score of five on the sequence.

III. RESULTS

On each sequence, S was given a score between 1 and 5, depending on whether he responded on the A, B, C, D, or E levels. Each S was presented with four sequences and consequently had a total possible score of 20. A score of 20 for a particular S would indicate he was highly cautious in making a perceptual inference and had withheld his inference until the maximum number of cues had accumulated. Conversely, a score of 4 would indicate S was very low in C and had responded on each sequence with only the minimum number of cues available.

The range of scores obtained was from 6 to 20, with a mean of 14.5 and a standard deviation of 3.33. In Binder's study, the mean was 11.5 and the standard deviation 4.1. This indicates that in Binder's experiment the Ss were significantly less cautious in making a perceptual inference than in the present experiment ($t = 3.47$; $p < .001$).

The results will be presented as they bear on each hypothesis. In Table 1 can be found the correlations between "cautiousness in making a perceptual inference" (C) and each of the predicted variables.

Hypothesis 1. The obtained correlation between the Pa scale and C was .08. While in the predicted direction, the r is obviously not significantly different from zero. In Binder's experiment, the correlation between Pa and C was found to be .49. Using Fisher's z_r transformation (Walker and Lev, 1953), where $z_r = 1/2 \log_e \frac{1 + r}{1 - r}$ and $z = \frac{z_{r_1} - z_{r_2}}{z_{r_1} - z_{r_2}}$, one may test the significance of the difference between two correlations. Although the obtained difference between the two correlations does not quite reach a satisfactory level of significance

Table 1

Product-Moment Correlations Between Perceptual Inference (C) and Other Variables Stipulated in Hypotheses

	Pa	Extroversion	A	Cir
Perceptual Inference (C)	.08	-.05	-.15	-.07

(p = .0534), the results of this experiment cannot reasonably be interpreted as support for Binder's findings.

In order to further explore the relationship between Pa and C, and since the assumption that the perceptual inference scores came from a normally distributed population was doubtful, each C score was subtracted from the total possible score (20) and a log transformation performed. The correlation between Pa scores and the transformed C scores was found to be .07, clearly insignificant. Thus, there is no indication that a skewed distribution masked a significant linear relationship between Pa and C. A summary of the product-moment correlations between the transformed C scores and each of the predicted variables is presented in Table 2.

At this point it might be asked: To what extent does the paranoia scale really measure paranoia? Comrey (1958) factor-analyzed the MMPI Pa scale and found thirteen items which he considered represented a relatively "pure" paranoia scale. The product-moment correlation between the "pure" paranoia scale and the full Pa scale was found to be .396, a value extremely low considering that all of the items in the "pure" factor were also in the full scale. The "pure" factor was also correlated with C resulting in an r of .02, which is very close to the r obtained between Pa and C. This further substantiates the previously indicated lack of relationship between Pa and C, even though the range of scores on the "pure" factor would restrict the correlation coefficient (twenty-six of the forty-one Ss had a zero score on the "pure" paranoia factor).

Hypothesis 2. The correlation between extroversion and C was -.05, in the predicted direction but clearly insignificant. The correlation between extroversion and the transformed C scores was .10. The change in

Table 2

Evaluation of Hypothesized Relationships: Log Transformation on C Scores

	Pa	Extroversion	A	Cir
Perceptual Inference (C)	.07	.10	.18	.16

direction of the correlation coefficients is to be expected since, in transforming the C scores, each score was subtracted from the total possible score. The results do not support the hypothesis that extroverts are less cautious in making perceptual inferences than introverts.

Hypothesis 3. The correlation between A (classifying inferential statements as descriptive) and C was -.15, again in the predicted direction but not significant. The correlation between A and the transformed C scores was .18. The results do not support the hypothesis that Ss who tend to classify inferential statements as descriptive on Haney's Test are less cautious in making perceptual inferences.

Hypothesis 4. The correlation between Cir (classifying descriptive statements as inferential) and C was -.07, not significant and not in the predicted direction. The r between Cir and the transformed C scores was .16. The results provide no support for the hypothesis that Ss who tend to classify descriptive statements as inferential on Haney's test are more cautious in making perceptual inferences.

Additional Analyses

In an effort to arrive at a more sensitive test of each of the hypotheses, a comparison was made between the mean C score of Ss with high scores on the other variables (Pa, Extroversion, A, and Cir) with those Ss with low scores. For this purpose, each S was ranked on each variable. The Ss were then divided on each variable as close to the median as possible. The mean C score of those Ss falling in roughly the upper 50% of each distribution was compared with the mean C score of those falling in the lower 50%. Table 3 presents this analysis. For each variable, the two mean C scores were so close that tests of significance were not deemed necessary. These results further indicate the lack of relationship between C and each of the variables for

Table 3

Comparison of High and Low Groups (Pa, Extroversion, A, and Cir) on Perceptual Inference (C)

	Pa		Extroversion		A		Cir	
	H*	L	H	L	H	L	H	L
Mean C score	14.6	14.4	14.6	14.4	14.2	14.8	14.7	14.2

*H, high group (upper half of distribution); L, low group (lower half of distribution).

which predictions were made. It might be noted that in Binder's experiment, he found a significant difference between the mean C scores of the high and low Pa groups ($t = 2.43$, $p < .05$).

Hanley (1956) has investigated the role of response set "acquiescence", the tendency to agree to test items independent of content, and its possible effects on correlations obtained in personality research. In the present study, a "yes" answer on the test including the Pa and extroversion scales contributed to a high score 75% of the time. It was felt that "acquiescence" should be investigated for two reasons, the first practical and the second theoretical. If there were a relationship between C and "acquiescence", the correlation coefficients between C and each of the other variables could conceivably be depressed; and the variance attributable to this response set should be partialed out when computing the predicted relationships. On theoretical grounds, one might posit a relationship between the tendency to acquiesce and a lack of cautiousness in making perceptual inferences (low in C). The r between C and "acquiescence" was found to be .06, clearly insignificant, indicating: a) that the response set "acquiescence" had little, if any, effect on the obtained relationships between C and the predicted variables; and b) a lack of support for the hypothesized relationship between the tendency to agree to test items regardless of content and a lack of cautiousness in making perceptual inferences.

For the reader's information, a table of intercorrelations among the variables considered in this study is presented in Appendix A.

IV. DISCUSSION

The results do not support Binder's finding of a positive relationship between the Pa scale of the MMPI and cautiousness in making perceptual inferences (C), nor do they support the hypotheses concerning the relationship of C to the other variables investigated in this experiment. The results will be discussed in the order that they were previously listed.

This experiment was not an exact replication of Binder's study. There are at least two differences in method between the present research and Binder's. In Binder's experiment, each figure in the sequence was presented for $1\frac{1}{4}$ sec. with a 9 sec. interval between figures; in the present research each figure was presented for 2 sec. with a 7 sec. interval between figures. It is felt that this difference in timing is too small to account for the difference in results. In Binder's experiment, the Pa scale was corrected for K; in the present research it was not.

The K scale was designed by Meehl and Hathaway (1946) as a suppressor variable to detect test-faking behavior on the MMPI. Low scores represent faking bad, relatively speaking, and high scores represent defensiveness, i.e., faking good. However, Meehl and Hathaway state that if the K scale measures the defensive, lying, or self-deceptive test-faking attitudes it was derived to measure, the correlations between K and each of the scales on the MMPI should be consistently negative and of some magnitude. They found the correlation between K and Pa to be -.07 for normal males and -.02 for normal females, leading one to suspect that for the Pa scale the influence of K as a suppressor variable is very slight. When one is correlating a particular variable with Pa and

corrects for K, it is obvious that the correction would affect the obtained correlation coefficient. However, since the K correction does not seem to be related to the Pa scale in the same manner that it is related to the other scales of the MMPI, it is difficult to see how such a coefficient could be interpreted. Correction for K could depress or inflate a correlation depending on whether K was related to the other variable. It is conceivable that the significant correlation obtained by Binder was entirely due to a relationship between K and C.

A possibility exists of a difference in experimental atmospheres. Smock (1955) has found that Ss under psychological "stress" conditions respond earlier (are less cautious) than Ss under "security" conditions. If Ss found Binder's experimental situation more "stressful" (e.g., due to the manner in which the instructions were given), then one would expect the mean C score to be significantly lower than in the present research. As indicated previously, this was true ($t = 3.47$; $p < .001$). It may be that the relationship between Pa and cautiousness in making perceptual inferences is contingent upon a relatively high level of stress.

The hypothesis regarding extroversion and C was based on data derived from the performance of hysterics and dysthymics, whom Eysenck considers to be equivalent to extroverts and introverts, respectively. Sigal, Star, and Franks (1958) tested this assumption by administering the Maudsley Personality Inventory to groups of hysterics and dysthymics. The groups were not differentiated by the introversion-extroversion scale, which casts doubt on the practice of using the hysteric-dysthymic and extrovert-introvert concepts as interchangeable. The question becomes one of whether the MPI scale actually measures introversion-extroversion.

The hypotheses concerning the relationships of A and Cir to C rest on two assumptions: (a) Haney's test measures what it purports

to measure, and (b) the inferential aspects of perception and cognition are comparable (Bruner's position). Assuming the adequacy of the present research, then at least one of these is incorrect. Theoretically one would expect a strong negative relationship between A and Cir. Appendix A shows that the correlation between A and Cir was .08, which casts considerable doubt on assumption (a). Assumption (b) warrants further empirical exploration.

V. SUMMARY

This research was designed as a replication of an experiment by Binder (1958) in which a significant positive correlation was found between the paranoia (Pa) scale of the MMPI and cautiousness in making a perceptual inference, i.e., allowing a greater number of cues to accumulate before making an inference about the identity of the stimulus.

Subjects (Ss) learned the names of a fixed set of alternative stimuli by the paired-associates method. They were then presented with sequences of slides in which each successive slide provided more information about the identity of the stimulus with which the sequence was to end. The Ss were instructed to name the stimulus as soon as possible. The identity of the stimulus gradually became less uncertain. As each slide was presented, the Ss had a choice of responding with one of the stimulus-names they had learned or of waiting until more cues had accumulated. A score was assigned to each S in accordance with the level of uncertainty at which he was willing to respond, which was considered to be a measure of his cautiousness in making perceptual inferences.

The following hypotheses were formulated for testing. 1. People who score high on the Pa scale, because of a general distrust and suspiciousness, are more cautious in making perceptual inferences than those who score low on the Pa scale. This was a replication of Binder's experiment. 2. Extroverts are less cautious in making perceptual inferences than introverts. This hypothesis was suggested by Himmelweit's (1946) and Eysenck's (1947) characterization of the extrovert as being quick but inaccurate in performance. 3. People high in the tendency to classify inferential statements as descriptive (i.e., view inferences as descriptions on Haney's test) are less cautious in making

perceptual inferences than people low in this tendency. This hypothesis and the following one were suggested by Bruner's (1957) view that the inferential aspects of perception are very similar to the inferences characteristic of cognition. 4. People high in the tendency to classify descriptive statements as inferential are more cautious in making perceptual inferences than people low in this tendency.

None of the above hypotheses was supported. A test of the significance of the difference between the correlation obtained in the present study and that obtained by Binder was performed. Although the difference between the correlation coefficients was not statistically significent ($\underline{p} = .0534$), it was concluded that the results of this experiment could not reasonably be considered as supporting Binder's finding.

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APPENDIX

Intercorrelations Among All Research Variables

	Pa	Cir	A	Extroversion
C	.08	-.07	-.15	-.05
Pa		-.24	.12	-.11
Cir			.08	.08
A				.14