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ABSTRACT

Person perception is used in this study to refer to the behavioral domain which is also called interpersonal or social perception. This domain typically consists of judgments of other persons' actions, expressions, or intentions. Three groups of 10 children differing on IQ and CA comprised the subject population. One group was gifted, one average, and one retarded. The experimental task consisted of rating the facial expressions in 34 photographs from the Frois-Wittman series. Four hypotheses relating structural complexity of the attitudinal domain person perception to IQ levels were generated. The results suggest that intelligence level is indeed a determinant of person perception. Several other areas for future research are mentioned. (TL)

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Intelligence and the Factorial Structure of Person Perception

by

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INTELLIGENCE AND THE FACTORIAL STRUCTURE OF PERSON PERCEPTION[1]

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Person perception is used in this study to refer to the behavioral domain which is also called interpersonal perception and social perception. This domain typically consists of judgments of other persons actions, expressions, or intentions. Cronbach (1958) has observed that the literature in person perception is typified by the use of global indices describing quite heterogeneous sets of items. He suggested replacing the global index with an analysis of components of the perceptual process. A type of analysis that is suited for multiple components is factor analysis. The usefulness of factor analysis in person perception is based on the supposition that individuals differ in respect to amount of covariation among dimensions of judgment and that this covariance will be revealed through factor structures which differ in complexity. Complexity as used in the present context refers to various characteristics of factor structures including diversity of information across the factors, simplicity and clarity of the factor structure, the completeness of factorization, and goodness of fit to an idealized factor structure.

Other investigators have shown the utility of factor analysis in the assessment of components of person perception. Sternberg (1950) had two industrial interviewers rate the same applicants on the same scales and then subjected the data matrices to separate factor analyses. These yielded quite different factor structures which suggested that the interviewers' cognitive elements as indicated by the factors were independent of the scales used. Todd and Rappoport (1964) compared two models of person perception, the factor analytic model and the implication model of Hays. The question they asked was whether one trait could be implied on the basis of the presence of another trait. They concluded that both models produced psychologically significant implications.

One type of task that has been found to be useful in the investigation of the various components of person perception involves the identification of affect through judgments of photographs of facial expressions. The Frois-Wittman pictures were taken for this purpose (Hulin & Katz, 1935). Frois-Wittman posed for the 72 photographs. They were not intended to be expressions of specific emotions but rather to be characterized by the judgments of the observers. Using Woodworth's scale of facial expressions, Schlosberg (1941) had _Ss_ sort the pictures into bins labeled (1) love, mirth, happiness; (2) surprise; (3) fear, suffering; (4) anger, determination; (5) disgust; (6) contempt; and (7) scattering, for any that did not seem to belong elsewhere. He found that the _Ss_' use of these bins placed the first six categories on a roughly circular continuum which he then reduced to an oval surface with a longer axis of pleasantness-unpleasantness and a shorter axis of attention-rejection. In another study using 30 of the Frois-Wittman pictures, Kauranne (1964) used the semantic differential as the scaling method. She obtained three factors: hate (anger), pleasure, and contempt.

The emphasis in these analyses of person perception has been on the identification of dimensions of judgment. Another aspect of the analysis of person perception, one which has been largely ignored, is the question of determinants of person perception. Hastorf, Richardson, and Dornbusch (1958) call attention to this problem, referring to variables of social psychology such as status, occupation, or facets of individual personality as determinants.

Since these variables are essentially variables of individual differences, in considering determinants one is thus considering the relationship of individual differences to the judgment process. Where components are involved one is relating the components to other aspects of the individual's behavior. A very important difference among individuals is level of intelligence, and person perception as a domain with important cognitive elements should be related to levels of intelligence. Although the author knows of no study that investigates this relationship, the generally enriched environment associated with higher levels of intelligence would lead one to expect that individuals of high intelligence would view other persons in different ways than would individuals of low intelligence. It was the purpose of the present study to investigate the relationship of levels of intelligence to the structure and complexity of components of affect identification using factor analysis. Fifteen variables were used to define a five factor model based on five major dimensions of affect. The factors were a happiness factor consisting of the three variables: happy, joyful, and cheerful; a surprise factor which included surprised, startled, and upset; a fear factor consisting of afraid, scared, nervous; a suffering factor which included: suffering, hurting, aching; and an anger factor consisting of angry, mad, furious. These factors were defined with reference to judgment of affect in the Frois-Wittman pictures and fit rather well to four of the six categories Schlosberg used to describe the pictures; i.e., they were similar with respect to labels.

The structure was defined in this situation by factor analysis of the adjectival variables for each subject. For each individual a factorial structure was thus obtained which could be described in terms of several measures of complexity. As mentioned above complexity refers to the diversity of information across the factors, simplicity of the factor structure, the completeness of factorization, and goodness of fit to an idealized factor structure. Differences in complexity of structure may thus be revealed by the H statistic of information theory, the hyperplane count, the amount of variance of the variables for which the factors account, and an "error" score on a Procrustes rotation.

Four hypotheses were thus generated describing the relationship of the structure complexity of the person perception domain to the dimension of IQ using as a dependent variable a measure based upon the description of affect contained in a series of photographs of facial expressions. (a) Retardates will show less diversity in their person perception than will non-retardates. (b) The factor structure of the non-retardates will be stronger than that of the retardates. (c) The factor structure of the non-retardates will more closely approximate a standard based on a semantic grouping of the scales. (d) The factor structure of the non-retardates will be simpler than that of the retardates.

Method

Subjects

Three groups of 10 children differing on IQ and CA were drawn from four classrooms in the Metropolitan Public Schools of Nashville-Davidson County, Tennessee. The three groups were constituted to be as similar as possible in respect to mental age so that they would be as similar as possible with respect to knowledge of the concepts. The retardates (Group R) were drawn from two secondary special education classrooms, the average children (Group A) were from a "regular" sixth grade classroom and the gifted (Group G) were from a special class for the gifted fourth graders. Each of the groups is described by IQ, MA, and CA in Table 1.

Insert Table 1 about here

Procedure

Two Es were used, one male and one female. The female E ran eight male Ss and seven females while the male E ran seven males and eight females. A discrepancy of more than one between the number of males and females run by a given E in a given [illegible] urred only in [illegible] R in which the male E ran only one male and three females.

All Ss were given a task which consisted of the presentation of a series of 34 pictures of the Frois-Wittman series, each of which is a photograph of a male face varying his facial expressions from picture to picture (Hulin & Katz, 1935). For each picture S was asked to rate the expression of the face on each of 15 bipolar adjectival scales. The adjectives used were from the five factor model: angry, mad, furious, surprised, startled, upset, hurting, aching, suffering, happy, cheerful, joyful, scared, afraid, nervous. Each adjective was placed at one end of a five point Likert-type rating scale. At the other end "not" was prefaced to the adjective to constitute the bipolar scale. Three different orders of presentation were constructed and each of these was used as the basis of two lists. These two were complementary in that "not mad" on one was in the position of "mad" on the other, etc. Hence, six different lists were used, controlling for both position responses and order effects. The bipolar adjectives were separated by five blanks under which "very," "quite," "middle," "quite," "very" were typed. The Ss' responses on each scale were scored with a digit from one to five with ones assigned to "very not" and fives to "very." Each picture thus constituted one observation with 15 variables. Thus, for each S a 15 x15 correlation matrix was computed on the basis of 34 observations. Each S's matrix was then submitted to a principal axis factor analysis procedure which used squared multiple correlations as estimates of the communalitites. The resulting factor matrix was then rotated to a Procrustes solution.

Analysis

Experimental Design. The intended design was a simple three-cell randomized analysis of variance. However, because of sampling limitations an analysis of covariance procedure was needed to remove MA as a confounding variable from each of the dependent variables. An analysis of variance revealed an F ratio between MA for the three groups of 5.28, $p < .025$. For each dependent variable a stepwise multiple regression program was used with MA serving as the independent or predictor variable. The computer print-out included the observed values of the dependent variable, the values for each as predicted from the regression on MA, and residual scores, the difference between the observed and the predicted values. The residual scores were used as the dependent variables in a simple three-cell randomized analysis of variance. A posteriori comparisons were made using Duncan's multiple range test.

Reliability. Because the instrument used was essentially new, it was necessary to investigate its reliability. To do this, 21 children, seven at each of the three intelligence levels (see Table 2) were subjected to a test-retest procedure where they each rated 25 of the original Frois-Wittman pictures on 15 adjectival scales.

Insert Table 2 about here

Experimental Hypotheses. Four hypotheses relating structural complexity of the attitudinal domain person perception to IQ levels were generated.

1. Ware (1959) reported the adaptation of the information H statistic for use in description of a factor structure obtained through factor analysis.

$$H = \sum p_i \log p_i \qquad (1)$$

In information theory, in which a binary digit system is used, H is based on logarithms to the base 2. Hence H has its maximum value of 1.00 when there are two choices of equal probability, i.e., $p_1 = .50$ and $p_2 = .50$. Suppose a factor structure involving seven factors. The information of that factor structure might be said to be maximal when each of the seven factors contributed equally to the variance of the total factor structure. Hence, H will reach its maximum value of 1.00 when $p_1 = p_2 = p_3 \ldots = p_7 = .14$, with a logarithmic base of seven. If another structure should show $p_1 = .34$, $p_2 = p_3 \ldots = p_7 = .11$, H will be less than 1.00. It may be said that the former structure is more informative than the latter.

If the two factor structures above represent two persons' judgments, then the person whose factor structure consists of seven equal factors used more diverse and thus more informative ways of perceiving others than the one

With an initial large factor and several smaller ones. Although there was no relevant study found in the literature, it seems likely that non-retarded children have more diverse ways of perceiving others than do retarded children, whose experiences have presented them with fewer ways of perceiving others. The retardates likely have less balance among the dimensions of judgment, having had fewer and probably more confusing experiences. The first hypothesis is that H is greater for non-retarded children than for retarded children.

2. Another measure of the amount of information in the factor structure is the amount of variation in the factored variables accounted for by that structure, that is, the greater the proportion of the variance possible, i.e., the more complete the factorization, the more information in the factor structure. This might also be presented as a measure of the reliability of the factor structure, the more the variance accounted for the more reliable the structure. The second hypothesis is that the retardates have a weaker structure (and less information therein) than the non-retardates.

3. A procedure used to assess the psychological meaningfulness of a factor structure is the Procrustes rotation. In this procedure an idealized factor structure is constructed, either on the basis of prior evidence or of an a priori hypothesis, and the obtained structure is rotated toward this structure. A goodness of fit score may then be obtained from the difference between the rotated matrix and the target matrix. In this study the target matrix was the five factor model defined earlier, each factor loaded 1.00 by the three appropriate scalar variables and 0.00 by the other twelve. The third hypothesis is that the principal factor matrices of the gifted children and of the average children more closely approximate the idealized matrix than does that of the retardates.

4. Thurstone established some criteria for simplicity of factor structure. One criterion relates to the hyperplane count, which is the number of variables which have loadings of less than .10 on a given factor. In general, the higher the hyperplane count the simpler the structure. In this experiment a person with a high hyperplane count may be said to have used the adjectival scale with some consistency and precision. Consistent concomitant use of three scales would likely produce a factor with high loadings by each of these three variables and low loadings by the other 12. This, too, is a condition which should differentiate between retardates and non-retarded children. Gifted children may use the scales with most precision, hence having the highest hyperplane count, while the retardates may use the scales with least precision and consequently have the lowest hyperplane count. The fourth hypothesis is that the hyperplane count is greatest for gifted children and lowest for retardates, the average children being in between.

Results

Mean test-retest coefficients for the groups used in the reliability analysis are shown in Table 2. These coefficients indicate some consistency in the _Ss'_ use of the fifteen scales over a one-week interval. An analysis of variance revealed no significant differences among the groups with regard to reliability.

In Table 3 the analysis of variance summary table for each of the dependent variables is presented. The dependent variable in each case was the residual score after the variance accounted for by MA was removed from the original measure. There was no significant difference between the groups on the H statistic, providing no indication that the groups differ with respect to the diversity of their cognitive structure in the affective domain.

The second measure is the completeness of factorization. Duncan's multiple range test indicated that the source of the significant F-ratio was differences between the retardates and the non-retardates. The average

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Insert Table 3 about here

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and gifted children did not differ on this measure. This confirmed the hypothesis that retardates have a weaker structure than non-retardates. The same pattern held for the size of the first factor, lending further support to this hypothesis.

For the Procrustes rotation the Duncan test revealed that the non-retardates more closely approximate the idealized matrix than do the retardates. Again, the retardates differed from the other two groups, which in turn did not differ.

The results from the hyperplane count measure deviated from the typical pattern in that the significant F-ratio was found to be due to differences between the average children, and the other two groups, while the retardates and gifted did not differ. This provided only partial support for the hypothesis that the gifted would have the highest hyperplane count and the mentally retarded the lowest.

Discussion

The hypothesis concerning strength of factor structure was confirmed, mean differences being between the retardates and the non-retardates. The average children and gifted children were similar on both the completeness of factorization and on the size of the first factor. While H is an index of the amount of information communicated by a given decision following the information processing model these strength of factor structure measures indicate reliability of the information accumulated. In the ideal state all of the variables would be completely factored. This would represent a measurement process of high reliability. This factor structure might thus be described as being stronger than one less completely factored.

The target matrix of the Procrustes rotation was defined by a semantic grouping of the scales. Hence, the more familiar the child is with the semantic similarities in the adjectives, the more closely his factor structure will approximate the target structure. Thus, confirmation of the hypothesis that non-retardates would do better sugges_s that there is a higher degree of semantic success on the part of these groups.

The fourth hypothesis was partially confirmed, the significant F-ratio on hyperplane count being primarily a function of differences between the average and the other two groups. The retardates as well as the gifted use the scales with more consistency than the average children. This finding was somewhat surprising. It may be, however, that the retarded and the gifted groups were similar on this measure, but for different underlying reasons. The gifted perhaps do indeed use the scales with more consistency and precision, thus, accounting for their high hyperplane count. On the other hand, it may be that the retardates are relatively unencumbered by subtle nuances of meaning, use the scales in a straightforward way, and hence have a high hyperplane count. Yet were subtle nuances of meaning the operative factor it would seem that the gifted would be most encumbered and have the lowest hyperplane count, which is not the case. To discriminate between differences due to subtlety and precision is impossible on the basis of the obtained data. At this point the hyperplane count must be regarded as ambiguous in psychological significance.

The results of the present study suggest that intelligence level is a determinant of person perception. Individuals do differ with respect to the amount of covariation among dimensions of judgment of affect as revealed in factor analysis and an important factor for these differences apparently is level of intelligence. These results apparently controvert Ware's conclusions based on his and other studies that there is no evidence relating complexity or diversity of individual perceptual spaces and intelligence (Ware, 1959). Ware found no differences in cognitive complexity of the semantic meaning space across high, average, and low intelligence Ss; however, it should be noted that he used Ss of similar CAs rather than similar MAs as were used in the present study. On the basis of the results obtained in this study it would now seem fruitful to apply the present measures to other psychological areas to see if underlying cognitive differences persist across domains.

The positive results of the present study suggest, too, that a developmental investigation of person perception would be profitable. One might employ a nine cell two-way factorial design varying across both MA and IQ, as used by Harter (1965) in assessing the relative contributions of MA and IQ in discrimination learning set. Using this design, CA effects can be assessed by a correlation involving all Ss. One could, thus, obtain data pertaining to the developmental differentiation of the underlying cognitive structures involved in person perception.

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Footnotes

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2. Now at Institute III: Exceptional Children and Adults, University of South Florida, Tampa, Florida.

Table 1

IQ, MA, and CA of the Experimental Groups

		R	A	G
IQ	$\overline{X}$	76.70	99.80	132.60
	S.D.	4.50	5.11	2.50
MA	$\overline{X}$	147.30	146.60	152.40
	S.D.	3.44	5.30	3.38
CA	$\overline{X}$	192.80	146.20	114.90
	S.D.	12.64	4.35	2.43

Table 2

Description of Reliability Subjects with Means and Standard

Deviations of Reliability Coefficients

		R	A	G
IQ	$\bar{X}$	68.0	100.0	128.1
	S.D.	11.1	3.6	4.1
MA	$\bar{X}$	127.6	146.0	150.1
	S.D.	19.9	3.8	5.8
CA	$\bar{X}$	188.9	146.1	117.3
	S.D.	17.1	4.2	5.9
r*	$\bar{X}$	.450	.538	.556
	S.D.	.123	.174	.139

*Pearson product moment correlations were completed for each of the scales and the mean of these 15 scores was taken as the best estimate of the reliability for each individual. The mean of these means is reported in the table. The F-ratio between groups was 0.88.

Table 3

Analysis of Variance of Dependent Variables

Source	df	MS	*F*	*F*.95
H Stastic				
Groups	2	.022	1.73	3.35
Within Groups	27	.013		
Total	29			
Completeness of Factorization				
Groups	2	23.15	17.29	3.35
Within Groups	27	1.34		
Total	29			
First Factor Size				
Groups	2	10.76	3.89	3.35
Within Groups	27	2.76		
Total	29			
Procrustes Error				
Groups	2	27.27	11.80	3.35
Within Groups	27	2.31		
Total	29			
Hyperplane Count				
Groups	2	38.35	4.82	3.35
Within Groups	27	7.96		
Total	29			

Abstract

This study investigated the relationship between intelligence and the factorial structure of person perception. Ten retardates of secondary school age, 10 sixth-graders of average intelligence, and 10 gifted fourth-graders were the subjects. Each was asked to rate a series of 34 pictures from the Frois-Wittman series on 15 adjectival scales, each being bipolar and representing a different affect. The groups were significantly different ($p<.05$) on 4 analyses of the principal-axis factor analysis and Procrustes rotation: total variance accounted for by the factor analysis; size of the first factor; hyperplane count; and congruence between the obtained principal-axis solution and a target matrix. It was concluded that intelligence is a determinant of person perception.