A FACTOR ANALYTIC STUDY OF THE SOCIAL BEHAVIOR OF SCHIZOPHRENICS

By

Harry W. Blair

Submitted to the School of Graduate Studies of Michigan State College of Agriculture and Applied Science in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

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AN ABSTRACT

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Approved Donald M. Johnson

From the time that the disorder known today as schizophrenia has been identified, investigators have recognized impairment in social behavior as a prominent aspect of both the etiology and clinical manifestations of the disorder. A diversity of conceptual treatment of the observations in this regard suggested a need for concepts or principles which can facilitate further systematic exploration in the area of social behavior. Among the various methodological alternatives to which a clinical psychologist may resort, factor analysis, considered as a branch of statistical method, offers many advantages, particularly in the establishment of classificatory principles. Several factor analytic approaches are specifically applicable to the problems encountered in clinical psychology research.

The present investigation concerned itself with the study of the empirical relationships among various specific items of personal and social behavior of schizophrenics elicited in a structured situation. It attempted to derive factors or concepts which would more parsimoniously describe this observed behavior, and to then provide a test of the descriptive usefulness of the factors so derived.

The test items were roughly scaled and later reduced to dichotomous scoring categories for the computations of tetrachoric coefficients. The personality variables underlying the test performances were assumed to be essentially of normal distribution. The correlations were based on the test

score distributions of 100 hospitalized schizophrenic patients who were highly variable with regard to subtype classification, age, duration of illness, education, etc. The final matrix of the intercorrelations of 42 variables was subjected to a multiple-group centroid type of factor analysis. Preliminary factorization aided in the most meaningful placement by graphic rotation of the first two factors, which were of the greatest size and import. Six oblique factors were extracted which in some cases were highly related. They were named as follows:

A General social orientation and capacity
B Socio-motoric responsiveness
C Restitutional curiosity
D Nonchalance and lack of preoccupation
E Reactive assertion and reproduction
F Interpersonal confronting

The residual correlations after the extraction of these six factors failed to reveal any remaining group factors of significance.

Computations of factor loadings for case history variables were made, as well as factor loading indices for diagnostic categories. This aided not only in the general interpretation of factors, but also provided a minor test of their usefulness.

A group of 40 hospitalized non-schizophrenics was compared with the schizophrenic subtypes as to mean factor loadings, and no differences were found to be significant. The schizophrenic subtypes also differed significantly in several important respects, particularly in general

social capacity.

Two second-order factors were extracted from the intercorrelation matrix of the six oblique factors. The first of these was based on the highly related triad composed of factors A, B, and F, and was interpreted as a very general social ability which may be differentially impaired by schizophrenic reactions.

The entire investigation was viewed as exploratory and the relationships observed were regarded as tentative in their usefulness. The results of this investigation, however, may open the way for future empirical investigations in this area, as well as assist in the conceptual thinking about schizophrenia.

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Outline of Studies

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INTRODUCTION

Social Behavior in Schizophrenia

Social aspects of etiology and clinical manigestations. During the past fifty years, from the time that Kraepelin first identified the disorder known then as dementia praecox and today as schizophrenia, a deficiency in social behavior has been included in almost every description of the disorder. This was particularly so after Meyer (33) placed emphasis upon the environmental influences in the etiology of schizophrenia, and the psychoanalytic school speculated upon the role of early infantile experiences in its formation.

Many investigators who have concerned themselves with the nature of social behavior in schizophrenic reactions have elaborated upon the loss of social skills, especially that of role-taking. Cameron (6,7,8,9) characterized the behavioral disturbances in schizophrenia as a "social disarticulation" with a progressive loss of the ability to communicate. He further hypothesized that a failure to develop adequate role-taking skills results in a poor adaptation to the cultural pattern. Hunt and Cofer (25) interpreted the apathy of schizophrenics as consisting essentially of a "loss of socially acquired drives", and in general looked upon the symptoms of schizophrenia as "extinctions of socially learned responses". It is to be noted that while these investigators were ap-

parently observing and making interpretations of similar phenomena, namely the overt behavior of schizophrenics, there is an apparent disagreement about the etiology of the social deficiency. Cameron speaks of a "failure to develop" while Hunt and Cofer speak of a "loss" or "extinction" of social responses.

Whether the social deficiencies in schizophrenia are themselves etiological in nature or the result of a more fundamental causative process prior to socialization is an important question which deserves careful study in the future. One possible approach is that of Gerard and Siegel (21) who studied the family backgrounds of 71 schizophrenics and 30 controls. In general, considering both positive and negative findings, it seemed that parental relationships and their social implications were the most important factors. Through parental attitudes, they found, patients were often prohibited from early, or even later social experiences.

Though Myerson (34) dealt with a later stage in the etiological process, he advanced an interesting theory concerning the role of scrutiny and social anxiety in the development of schizophrenia. Presumably this investigator, as well as others, would hold that the individual who later develops schizophrenia brings to his social situation a set of attitudes or reactions arising out of his early family relationships which so structure his interpersonal relationships as to bring on a social maladjustment, and later, specific symptomatic reactions of a schizophrenic nature.

Another possible approach to the understanding of the social deficiencies in schizophrenia, is the analysis of the social reactions of the patient, which may or may not refer to his social development. Various descriptions of schizophrenic reactions have been made, and some similarity is apparent. Wittman and Steinberg (47) spoke of the "shut-in" personality and Slotkin (37) pointed out that the private symbolism of the schizophrenic makes communication with him ineffective. These descriptions seem to suggest a rejection of outside realities, of the social world without, which curtails social interaction.

Levin (30) rejected the concept of "splitting", since he felt that only mature adults could exhibit such a phenomenon wherein parts could act independently of one another. He preferred to think of schizophrenia as involving a loss of cerebral versatility, or a failure in the development of differentiation. This seems to be in accord with Kasanin (28) who considered the disorder as a failure in maturation and development. To maintain equilibrium or security, no matter how poor the level, the schizophrenic engages in defensive techniques which contribute to his general social inadequacy. Sullivan (41) pointed out active attempts on the part of deteriorated schizophrenics to avoid interpersonal relations, and the use of "quasi-communicative gestures" seen in the manneristic hebephrenic. The defensive use of stereotypy is brought out by Fromm-Reichmann (20), who held that

stereotypes screen true emotional reactions. Deutsch (18) and Bartlett (2) commented upon the suggestibility seen in schizophrenics, which may be a technique for superficial adaptation to social demands. Similarly, Deutsch pointed out that passivity is a common feature seen in schizophrenia, but she felt that it may serve to cover the more basic aggressive tendencies.

An interesting approach to the study of spontaneous social behavior in schizophrenics has been made by several investigators who studied the ward behavior of these patients. Rabin (35) and later Maas, Varon, and Rosenthal (32) developed techniques whereby observations are recorded over a specific period of time. Rabin dealt with social responsiveness as it is reflected by the initiation of social contacts by a patient as well as that patient's response to contacts initiated by others. He reported more spontaneous contacts than responsive, but the two types of reactions were correlated positively in any given patient. Such a measure did not, however, distinguish between schizophrenic and non-schizophrenic patients on a ward, but his technique, as well as others of the observational type, would bear further investigation.

The need for precise concepts. In examining the literature pertaining to the social aspects of schizophrenic reactions, it becomes obvious that a common set of concepts is needed in order that research and communication can be facili-

tated. At the present time one must resort to either very stereotyped descriptions, or invent a new terminology--as some have done. Much of what the clinical psychologist observes in a schizophrenic patient, and later incorporates into his impression, is not verbalized and often even intuitive. One often hears the clinicial say that a certain patient "looks like" or "seems" like a schizophrenic, without being able to specify the particular observations on which he is making this evaluation. Perhaps one major reason for the difficulty in setting forth just what it is that we do observe is that the behavioral acts are a function of the interpersonal reactions of which the observer himself is a part. This person that we call a schizophrenic seems to behave differently toward us than does the average person reared in our culture. He lacks many of the social graces that one anticipates from the other, and is frequently unable to deal in superficialities common to social interplay. And, as has been said before, he has little recourse to flexible social roles.

It is not meant that the clinician could not utilize concepts concerning the social deficits of schizophrenics, but at the present time his thinking is to a large degree bound by inadequate, and rather rigid, classificatory concepts. Such concepts tend to concentrate his observations in narrow areas so that a diagnosis might be arrived at with maximum efficiency. Thus, other behavior, particularly that of a social nature, may either be overlooked or "unconsciously" perceived and

incorporated into "intuitive" judgments. To investigate these less formally treated areas would be to reduce the narrowing of vision fostered by Kraepelinian diagnostic classifications. To investigate this area would be a further step toward understanding etiology and treatment, for a complete description of an illness at all levels almost automatically indicates the treatment.

The clinical interview situation provides an excellent opportunity to study the social behavior of schizophrenics, but to make use of such a situation for systematic research, a certain amount of structure is needed. Not only is general structure needed, but the use also of certain manipulatory techniques is desirable so as to invoke responses which may or may not occur if they depended on the chance of spontaneous elicitation. Jones (27) cites several studies of structured interview techniques, and reports that particularly when specific problems are to be answered is this technique successful. Much work has been done in the area of structured interview techniques in psychiatry, with the results that the mental status examination is relatively standard in most clinical settings. Cohen and Flower (17) have presented a proposal for the psychiatric examination which employs a slightly different nosological principle than that of the classical mental status examination. The gross concept of inattention is subdivided into various areas such as patterns of behavior, thought expression, and affect. These attempts

at refinement of observation in psychiatric practice make for progress, but it is advantageous to begin with classificatory principles that have been demonstrated to be more independent and factorially pure with respect to one another. The establishment of such functional wholes depends upon the empirical investigation of the interrelatedness of the variables which comprise the domain of observation.

As pointed out previously, a large portion of the clinical interview consists of the interaction between the interviewer and the interviewee. Each is reacting to the other as a person, and each is "testing" the other at some level of awareness. To understand more of these interactions is an extremely difficult problem, particularly those reactions which the patient sets up and observes in the psychologist. Such understanding could come about only through insight into the patient's personal frame of reference, and vice versa, insight into the patient's personal frame of reference would be gained by an understanding of the way in which he is attempting to structure the interview. The latter might be said to be one of the purposes of an interview, and is little subject to objectification. It is, however, both possible and desirable to study the patient with a more objective and standardized procedure. This not only would have clinical implications, but would lend itself to research on the social responsivity, or lack of it, on the part of the schizophrenics.

Factor Analysis in Clinical Psychology Research

The alternatives. Particularly over the past few decades have applied psychologists become aware of pressing social responsibilities. To meet these needs of society the practitioner has gone forth armed with a pitifully inadequate theoretical framework into many and varied fields. He has developed specialized techniques and tests for specialized purposes, and has gradually cultivated a specialized set of concepts--concepts limited in their communicability and tied down to the techniques from which they arose. Research in these applied areas, and especially in clinical psychology, has been based on these concepts of limited usefulness and it too suffers from lack of communicability. There has been some resort to classical experimental methods making use of variables which are treated by theoretical systems, particularly those of the behavioristic type. While such theories may someday encompass human behavior of a very complex sort, they fail to prove presently useful in the description or prediction of the particular behavior with which the clinician must concern himself. Thus, the clinician who involves himself in such research leads a double life and enjoys only a minimum of inter-facilitation of purposes.

At the other extreme the clinician may avail himself of psychoanalysis. To the degree that he "accepts" (or does not resist) the tenets of this school he may effectively employ them in psychodiagnosis and therapy. If, however, he wishes

to utilize psychoanalytic principles in his research, the clinician is faced with ill-defined and gross concepts which do not easily lend themselves for this purpose.

The alternative to these extremes lies somewhere in between, and here, two possibilities are open. The first, which is more in the nature of deductive approach, is the development of a very broad and flexible theory of human behavior and personality from which testable hypotheses flow. The second possibility is the inductive approach in which the statistical method comes to its fullest realization. Although useful in controlled experiments, statistical methods are chiefly used by the clinician in field studies wherein variables are dealt with in their natural setting, subject to the manifold influences of nature. In general, the function of statistical operations is to abstract and measure variability due to the particular influences in which the investigator is interested. Despite the availability and use of statistical methods, however, there remains the paucity of conceptual development and laws of interaction. The investigator must choose variables somewhat arbitrarily and his results are dependent upon what may prove to be badly-chosen variables.

The place of factor analysis. Factor analysis can be considered as a technique within the general statistical method referred to above. There are, however, certain differences from elementary statistical techniques which place factor analysis in a rather unique methodological position.

This derives from the fact that one of the major goals of science is to observe lawful events and to derive therefrom laws of interaction which facilitate more refined description and prediction. While techniques are available, notably that of analysis of variance, for studying simultaneously the relationship among several variables, they fail to yield information as to the magnitude of such mutual influences. On the other hand, while simple correlational methods reveal the magnitude of relationships, they fail to distinguish the functional wholes of which the observed relationship is an abstraction. In a sense, the investigator who attempts to explain an observed relationship between A and B is searching for a factor, or a source of variation. The same investigator learns more when he establishes the relationship between B and C, and then A and C. This piecemeal approach, however, is inefficient since the inclusion of many more variables into a single investigation can establish the mutual relationship of all of the variables included, in addition to information as to the common sources of variance.

To demonstrate the relationship between variables, or tests and factors, it is helpful to visualize the so-called test space, wherein test vectors are projected from a common point of origin. They are so projected that the cosine of their angular separation between any two tests is equal to the coefficient of correlation between those tests. Factors, then, are merely a system of coördinate axes which have been

systematically imposed upon the structure of test vectors. If the situation is such that test vectors may be represented in two dimensional space, then the entire problem is resolvable into two factors or coördinate axes. The common-factor variance of any test, then, can be completely accounted for by the numerical value of its projections on the two coördinate axes. From this derives the factorial or specification equation which expresses the numerical relationship between a test and the factors from which the test variance derives.

Factor analysis by no means represents a new idea in scientific methodology. Burt (5) pointed out that Pearson was concerned with the underlying structure which could account for the correlation of two events, and in a sense paved the way for factor analysis. Spearman (39) then demonstrated that the mass of intelligence measures employed at that time could be resolved into a general intellective factor. Subsequently Thurstone (43) proposed three types of factors: general, group, and specific, which could more adequately account for the variance in a given test. Further refinements in technique and application have been made by investigators too numerous to mention.

The main value of factor analysis lies in its contribution to the parsimony of description, in that a few descriptive categories can encompass a wide variety of variables. A correlation matrix may contain thousands of values which are

needed to express the relationships among the variables, whereas a factor matrix can yield almost as much information in a matrix which has as many rows as there are tests, and as many columns as there are factors. Providing that factorization has been complete, and the axes are orthogonal with respect to one another, any original correlation may be reproduced by multiplying the corresponding row of the factor matrix by the corresponding column of the transposed factor matrix.

A further contribution to parsimonious description has been made by Thurstone (44) who originated the concept of simple structure. This refers to the location of the factor axes in such a way that some tests are highly loaded on a factor, while others have low or negligible loadings. The latter tests then define a hyperplane through which the factor axis may project. To achieve simple structure in a factor problem it is necessary to carry out a number of rotations of the factor axes until a structure is achieved which meets the criteria. This, of course, may proceed from orthogonally located factors or from those which are already in some sort of oblique reference to one another due to the use of clustering methods of extraction. It is almost certain that the rotated matrix will be non-orthogonal, but at the other extreme, it should not be so oblique that some degree of functional independence is not preserved. Simple structure, then, attempts to define the functioning unities of nature, which, it is important to note, are rarely completely

independent of one another, nor all-embracing with respect to the totality of variables in a particular domain. This is particularly true in the area of personality as Cattell (11, 13) has so well demonstrated.

Factor analytic approaches. The alternative experimental designs offered by factor analysis provide for wide applicability in the social sciences. Of particular interest to the clinical psychologist, and those researchers in the area of personality are the P technique devised and demonstrated by Cattell (12,14), and the Q technique originated by Burt (4) and Stephenson (40). These, of course, are in addition to the more basic R technique employed in the present investigation in which tests are correlated. In Q technique, which is in transposed or inverted relation to R, people are correlated with respect to performance on a wide variety of tests. Thus, such an approach develops descriptive types of individuals who have in common certain test performances. P technique, on the other hand, involves the correlation of a set of variables on one person which is repeated on many occasions, the N being the number of occasions. The use of P technique and certain Q technique designs require the use of ipsative measurements described by Cattell (10) and Guilford (23), as opposed to normative scores used in the R analysis. In ipsative measurements, the scores are expressed in terms of standard scores with respect to the variability within a person instead of a population of persons.

When, as in the case of R technique, evaluations are made in terms of the group distribution, it is precarious to discuss individuals, though it may be more defensible to consider groups of individuals. The precariousness of such an analysis depends upon the degree of disparity between the factor structures arising out of the R type of analysis versus the Q type of analysis on similar data. The number of factors common to the two techniques in a given area is relative to, in the case of Q technique, the wideness of the variety of tests chosen, or, in the case of R technique, the variety of individuals chosen.

PROBLEM

The purpose of this investigation is to study the relationships among various specific items of behavior of schizophrenics in a structured social situation. It will attempt to derive factors or concepts which will economically describe this observed behavior.

The problem includes comparisons to be made among the various schizophrenic subtypes as well as hospitalized non-schizophrenics with respect to the obtained factors. The study, then, strives to test the descriptive usefulness on the group level of the concepts developed by it. It proposes to test whether or not the factorial concepts developed can discriminate among different schizophrenics, and between schizophrenics and non-schizophrenics.

METHOD

Sample Characteristics

A rather heterogeneous group of schizophrenics who exhibited a wide range of symptomatic reactions was employed in the study. This was felt to be desirable in order to insure sufficient variability on the various test items. To obtain such a sample, selections were made within a wide age range with marked variability in durations of illness. Since a certain minimum of cooperation was necessary in order to arrive at valid ratings of behavior, extremely uncooperative patients were necessarily excluded. Ratings of general cooperativeness were made for all patients included. Those schizophrenic reactions complicated by neurological disorders, senile changes, and involutional reactions were excluded. Shock therapies, including insulin and electric, must have been completed or otherwise terminated at least one month prior to testing in order to rule out temporary neurogenic effects. Finally, only American born subjects were used, for conceivably early cultural learning is an important determinant of social and interpersonal behavior.

No exclusion was made on the basis of sex or education, and separate factor loadings were computed for several of these conceivably pertinent case history variables. The intercorrelations of these variables with the test items proper did

not, however, contribute to the location of the group centroids or the derived factors. The purpose of this technique was to provide a further aid in the general interpretation of the obtained factors, especially with regard to generalizations to other populations. Further, since such factor loadings demonstrate the relative importance of various case history variables, pre-conceptions regarding their importance were unnecessary. It is perhaps more meaningful to allow them free range rather than to assume their significance and thereby to control them without evidence that they are important determinants in the behavior under consideration. Such assumptions may severely curtail variability and impose serious limitations upon general interpretation.

An attempt was made to select only those cases who demonstrated active symptoms of schizophrenia, even though the test situation at times failed to elicit evidences of such symptoms. The entire sample of one hundred schizophrenics were so diagnosed by the psychiatric staff at Beatty Memorial Hospital. Not all cases used had been formally staffed and diagnosed schizophrenic at the time of this study, but in all cases the investigator agreed with the preliminary psychiatric diagnosis of schizophrenia. The group was composed of transfer patients from another institution as well as direct commitments, all of whom resided in northern Indiana.

A total of 61 males and 39 females were included in the sample, which approximately represents the sex distribution

in the hospital population drawn upon. While the aforementioned statistical control of sex difference will indicate to what degree sex is associated with each factor, a significant loading for sex on any factor will raise the question as to whether the sex difference is an inherent one or a situational reaction to the sex of the investigator. That such a question could not be answered is not considered a weakness of the present study, but a problem beyond its scope.

Table 1 presents the schizophrenic subtype diagnoses by sex, and it is to be noted that the distribution of subtypes between the sexes is somewhat disproportionate. Since there are approximately two-thirds as many females as males, it would be desirable to have that relationship hold in each subtype category. This observation applies more to the Catatonic and Hebephrenic subtypes, since the Paranoids are distributed more proportionately. No attempt was made to avoid the selection of those patients in the Mixed category, and the small number merely reflects the hospital's policy of classifying according to predominant symptomatology where there is a concomitance of symptoms from different subtypes.

A wide range of ages, as seen in Table 2, was employed for reasons already discussed. The median age for females was greater than that for males, which again reflects the population drawn upon. The reason for this may be related to the fact that mental disorders become obvious in males earlier in life as a result of their more active participation in the

TABLE 1

PSYCHIATRIC SUBTYPE DIAGNOSES BY SEX

Subtype	Male	Female	Total
Paranoid	24	19	43
Catatonic	24	8	32
Hebephrenic	6	9	15
Simple	4	0	4
Mixed	0	3	3
Unclassified	3	0	3
Total	61	39	100

TABLE 2

AGE OF SAMPLE BY SEX

Age	Males	Females	Total
14-18	3	0	3
19-23	5	1	6
24-28	13	3	16
29-33	13	4	17
34-38	8	7	15
39-43	4	9	13
44-48	4	6	10
49-53	3	4	7
54-58	4	2	6
59-63	2	2	4
64-68	2	1	3
Total	61	39	100

environment, and their necessity for attaining economic security. A pre-schizophrenic female, or even one with a chronic schizophrenic process may adjust in a limited fashion for years before an acute reaction to stress necessitates hospitalization.

The durations of illness for the sample is reported in Table 3. These figures do not represent merely the duration of hospitalization, but the amount of time intervening between the first outbreak of a schizophrenic psychosis and the present, in so far as it could be determined from the available anamnestic data. Despite the fact that the median number of years of illness is greater for females than that for males, the above discussion concerning age receives support. When the median duration of illness for each sex is subtracted from the median age for that respective sex, females appear to have been older at age of onset. Similar findings are reported by Haas (24), and the U. S. Public Health Service (45), although the latter is based on the rather selected populations of 225 private mental hospitals. The extremely large samples, however, lend significance to the trends reported in these and other sources.

Table 4 shows the years of education for the sample by sex. No important differences seem to exist between the sexes, and in general a wide range was obtained.

A marked sex difference in marital status is apparent in Table 5. This discrepancy, i.e. the predominance of single

TABLE 3

DURATION OF ILLNESS OF SAMPLE BY SEX

Years	Male	Female	Total
< 1	13	2	15
1-4	17	7	24
5-8	13	9	22
9-12	7	8	15
13-16	2	8	10
17-20	4	1	5
> 20	5	4	9
Total	61	39	100

TABLE 4

EDUCATION OF SAMPLE BY SEX

Years	Male	Female	Total
< 8	7	2	9
8	19	10	29
9	2	4	6
10	3	2	5
11	7	2	9
12	17	14	31
> 12	6	5	11
Total	61	39	100

TABLE 5

MARITAL STATUS OF SAMPLE BY SEX

Status	Male	Female	Total
Single	42	7	49
Married	13	18	31
Separated	5	13	18
Widowed	1	1	2
Total	61	39	100

males, is not easily explained, but one might hypothesize that the classical schizophrenic syndrome, including withdrawal and apathy is more foreign to the male role in our culture. A schizoid male would be ill-equipped to compete with his more aggressive brothers, and he may find a mate rather difficult to obtain. Most likely he does not want a mate for the same reason that he is indifferent toward others regardless of sex. On the other hand, the passive and withdrawing nature of schizoid symptoms may enhance the female role in our culture, and such a female would be a desirable marital partner for a male whose aggressive needs require fulfillment.

Lastly, no exclusion was made on the basis of race, and the six Negroes included approximate the distribution of Negroes in the population drawn upon. This is a weakness of the study in that the small number of Negroes prevents any reliable statistical analysis of them in comparison to non-Negroes. Their contribution to the total factor structure, regardless of deviation due to cultural background, would, however, be negligible.

Table 6, Appendix A shows a comparison of the 100 schizophrenics and the 40 non-schizophrenics with respect to the case history variables and cooperativeness ratings. The absent category, duration of illness, was meaningless for non-schizophrenics. This group was composed of hospitalized subjects who were diagnosed as character disorders, or some form thereof, and it was not possible, nor practicable, to fix the

date of onset due to the insidious nature of the disorders. All of the subjects in the non-schizophrenic group were American born, non-psychotic, non-organically impaired, non-toxic, and were not receiving physiological therapies of a convulsive type. As regards sex distribution, it will be noted that too few females were included in the non-schizophrenic group, which may impair the validity of the interpretations of comparisons with schizophrenics. This discrepancy resulted from the non-availability of non-schizophrenic females, since females who are not psychotic are frequently kept at home by relatives. Further, such disorders in females may go unnoticed and be less disabling because of their lesser need to earn a living or adjust to the competition of the working world. The qualifications upon interpretation made necessary by this and other differences between the groups will be considered later in connection with the obtained factor structure.

The Test Scale

The general purpose in the construction of the test scale was to devise items which would divide the group equally with respect to presence or absence of the various behavioral reactions. Included in the test scale (see Appendix B) are certain symptom manifestations which are prominent in the classical clinical syndromes of schizophrenia, as well as some items of behavior which are less formally treated. Among these latter responses are included reactions to problem-

solving tasks of a social nature, and some which deal with the schizophrenic's response to some social act on the part of the examiner. Particularly useful in the selection of items was Bales' (1) categorization of the interaction process. Since his system is designed to record spontaneous interaction in a group situation, the categories served to suggest items, rather than lend them as such. To insure a standardized interview situation, with good continuity, requires a careful selection of items that will, or can be made to occur quite naturally in the course of the interview.

Of further use was Lewis' (31) manual for psychiatric examinations, particularly with regard to suggestions for observing appearance, posture, and movement, as well as other general suggestions. Many items were designed by the investigator and arose out of general clinical experience. At this point a legitimate question arises as to the general hypotheses the investigator had in mind in selecting from his clinical experience those bits of behavior which he chose to include. To answer this question it is necessary to describe the method for devising items. First of all, the domain or gross context from which variables could be abstracted for study consisted of the sequence of behavioral events occurring when a hospitalized schizophrenic is summoned from his ward, met by a representative of the psychiatric staff, and interviewed by this representative for a short period of time. A further limitation or dimension of this general domain of behavior was

the cross-sectional aspect which prevented longitudinal study of the behavior under investigation. With the situation thus defined, it was necessary then to list all possible behavioral acts which were both subject to measurement and typical of the interview situation.

To attempt to rule out the possibility that the investigator was biased in his listing of possible items for study, several other competent clinical psychologists were asked to contribute to the list. Thus, the final test scale, rather than flowing out of specific hypotheses, consisted of a retained assortment of behavioral items which were not excluded previously because they seemed to be measurable, not too foreign to a typical interview situation, and not too dependent upon interpretive judgment for scoring. Some bias in the selection of items cannot be avoided but it was felt that the selection technique employed held the operation of such influences to a minimum.

Certain items were included which arise out of more formal test material. The Kohs blocks were employed, not to measure the ability to build a pattern as is conventional (29), but as a vehicle for interactive behavior. The use of these and other such items represented an attempt to study quantitatively that which is often used qualitatively in the interpretation of formal test results. Certain items attempted to gauge the desire and ability of the subject to imitate the examiner. In one test (Bead Stringing), which was adapted from the

Stanford-Binet Scale (42) the subject was asked if he would like to try it, without the suggestion that he imitate the examiner. The subject was then free to imitate the examiner in varying degrees. In another task he was asked to imitate the examiner, first in a gross fashion (Task Sequence A), and then in a more minute, abstract way (Task Sequence B). Such tasks may involve a number of abilities, including attention, memory, social acuity, etc., and the treatment of data was designed to partial these out by examination of clusters of items.

The Verbal Fluency test was adapted from the verbal fluency factor developed by Johnson and Reynolds (26). The vocabulary test which was also cited by these investigators as a good measure of verbal fluency was not used. Instead, a test was devised that purports to measure the individual's value judgment of words in terms of their social desirability. This test, then, undoubtedly measured something different from, or in addition to, the usual vocabulary test. Most likely, it measured a more restricted area than that of the general vocabulary test--an area of socially oriented word facility.

To measure a conceivably important variable in social behavior a test of attention was devised, based on the attention factor derived by Wittenborn (46). It was necessary to simplify Wittenborn's test so as to adapt it to the present sample, but despite this modification and despite the fact

that other tests were loaded on his attention factor to a lesser degree, it was felt that attention was measured fairly adequately. Since many other items in the scale used apparently involve attention it was anticipated that information would be obtained as to its importance in general social behavior.

Procedure

Each subject was seen individually in the same room, and the situation presented him, consisting of a planned interview and testing, was standard for the entire sample. The test items were administered in approximately the same order as listed. Conversation interspersed among the various test items was, so far as possible, of an innocuous nature, aimed at maintaining continuity of the relationship. Spontaneous conversation of the subject, especially that directed toward learning the nature of the interview, was handled either non-directively or responded to with remarks that had a minimal influence on the test results. The general situation, however, had sufficient warmth and permissiveness to elicit the best possible cooperation and social spontaneity.

It was deemed important to standardize not only the procedure and behavioral sequences of the investigator, but also the physical aspects of the office used for interviewing. For this purpose a check list was employed, and each pertinent object, including the desk and chairs, was placed in the same position prior to each interview.

The rating of each subject was based on that which was most typical for, or representative of the patient for the period studied, unless the rating was based on a response to a specific stimulus. An attempt was made to avoid inferences from the subject's diagnostic classification or history, and the ratings were based on the actual responses during the

period studied. To avoid correlating the investigator's bias as to which items were related, an attempt was first of all made to define each item carefully and to clearly differentiate it from the others. To check on such biases which are bound to exist, however, the degree of inter-rater agreement was computed.

The investigator was fortunate to have available the services of a competent clinical psychologist with specialized experience in behavioral observation and rating procedure. These two functioned as an observer team in the simultaneous ratings of test items with schizophrenic patients selected randomly from the same population as the original sample. The complete procedure consisted of, first, a session devoted to definition of test items, and the special problems created by two observers. It was necessary to have the observer in the testing room, despite the fact that a one-way screen and monitoring device were available. Many of the items measure responses so subtle that an observer outside the room would be unable to observe them adequately. The investigator noted no special reactions to the other observer, and the situation was so structured that the observer was removed from the immediate test setting and out of the direct line of vision of the subject. The observer acted the role of attendant in that he procured patients from the wards and delivered them to the investigator. From this point on he played an impassive role, and in no case was there further communication between him and the subject.

The entire scale of test items was subject to such dual ratings except for item numbers 3 and 15, 'strength of grip in handshake' and 'number of seconds patient stares at examiner'. These items, although involving some slight judgment on the part of the investigator, must remain untested for bias.

Agreement between observers was computed in terms of dichotomous scoring of test items. Of a total of 193 test items so observed the percentage of agreement was 91.2, with a standard error of 2.04%. This type of data was well suited for the computation of a phi coefficient by way of its intrinsically dichotomous nature. The coefficient of correlation so calculated was .82, which is equivalent to the highly significant chi square value of 131.04.

Treatment of Data

The test scale and correlations. The test items in the scale consisted of from two to five response categories which were designed to facilitate scoring. The measurements are at best very gross, and in a relatively unexplored area such as this good scaling procedure is all but impossible. The response categories for each item might be said to represent verbal descriptions of those regions along the continuum of a response variable which are easily perceived as different from an adjacent or previously defined region. For example, test item three attempts to gauge the strength of the subject's grip during the handshake. This continuously distributed

response could be measured by an apparatus (which, incidentally, would remove it from the category of a social response) which would assign it some value along a scale of innumerable points. The number of differences in pressure perceptible to the human observer would, however, be far less, and the number of verbally-differentiable points would be even fewer. Thus, in the item under consideration, it is a simple matter to recognize when the handshake pressure exceeds the examiner's pressure and when it is approximately equal to it, and the two response differences become adjacent categories for scoring the item.

Because of such rough measurement, there can be no comparison either within or between items with respect to the numerical score obtained. Comparison can only be made after each item is reduced to dichotomous scoring categories, a form which is suitable for the computation of tetrachoric correlations. Numerical ratings on each item were, however, made throughout the study in order that the reduction to dichotomous values could be based on the distribution of scores for each item. The use of the tetrachoric correlation technique requires that the cutting point be approximately at the point of the median score, and thus the preservation of numerical score became highly desirable. The same applies to the several tests administered on which a fairly wide range of scores was obtained.

A further requirement when employing tetrachoric correlations is the assumption of a normal distribution of the

variables under consideration. This assumption was more difficult to make for some items than for others. For example, the score for test item six depended upon which one of two available chairs the subject chose upon entering the testing room. The overt behavior upon which the scoring was based was obviously of a discrete and dichotomous nature, but the assumption of a non-discrete and normal distribution was based on the underlying personality variable responsible for the choice. Were no such variable to exist, the factor analysis would not be possible. This variable of personality would presumably cause the choice of a sitting position, for example, somewhere between one inch and twenty-five feet from the examiner. The actual placement of the two chairs represents neither extreme, but something closer to the mean and, it is hoped, on different sides of the distribution.

Due to the relative unreliability of the tetrachoric correlation coefficient, it was decided to exclude from further analysis any test which failed to meet the minimum criterion of 25 percent in either category after dichotomization. Of the original 46 tests, two were excluded for failing to meet this criterion (numbers 39 and 46). Two other tests (numbers 19 and 24) were excluded earlier for reasons of impracticality. The final scale, then, consisted of 42 tests. Table 7, Appendix A shows the percent of plus scores for each test, and includes the two tests excluded from further analysis due to poor distribution.

After reduction to dichotomous values for each test the data were transferred to McBee cards with cut-outs being made for plus scores. The case history data for which factor loadings were desired were also entered on the cards in similar fashion. The sorting of these cards, then, yielded the raw frequencies which were entered in the four-fold tables for computation of tetrachoric coefficients. Since the N was 100, these raw frequencies represented proportions with no further computation being necessary. The graphic solution for tetrachoric correlations was adapted since it resulted in considerable saving of labor and yields two-place accuracy. Use was made of the Thurstone computing diagrams (16) for this purpose.

The factorization. The factoring method employed was the multiple group centroid as described by Thurstone (44) and Cattell (15). As in any factoring method, there are advantages and disadvantages which must be weighed with respect to the material being factored and the purposes of the factorization. The time-saving feature of the multiple group method derives from the fact that successive residuals are not computed after the extraction of each factor as in the non-clustering methods. However, there is the danger of having to repeat a large part of the process due to faulty communality estimates or due to errors which become obvious later than in the more mechanical centroid process with its regular checks.

The most desirable advantage to the multiple group centroid method is the probability that the obtained oblique or unrotated factor matrix will be close to the simple structure position of the rotated matrix. This state of affairs is more true, however, when clustering is tight and relatively independent so that non-cluster variables will have low or negligible loadings on a given factor and will already constitute a hyperplane. The danger in assuming that the unrotated matrix is close to simple structure arises from the fact that some factors may not appear as clusters in the correlation matrix, or that some clusters may represent more than a single factor. The number of such factors should, however, be in the minority, and it is assumed that the majority of the factors are extracted in a correctly rotated position.

The method for cluster search in the correlation matrix was a conventional one. First, a pivot test was selected which showed the highest number of correlations over .40. A cluster of tests was then assembled which correlated highly with both the test used as a pivot and the other tests in the cluster. The second and succeeding clusters were formed by selecting a new pivot test from those not already in another cluster. To qualify for inclusion in a cluster a test had to show a high average correlation with same-cluster tests and a low average correlation with each group of tests included in the other clusters. This process was continued until no

further clusters could be established which would meet the criteria of tightness of clustering and of relative independence from other clusters. The average intercorrelations within and between the clusters chosen for final factoring may be seen in Table 12, Appendix A.

It was deemed desirable to perform a complete trial factoring prior to the final factoring in order to provide better estimates of communality, as well as some insight into the number of factors operating. This process was begun by extracting two factors simultaneously and then plotting the test vector space with respect to these two oblique factors. While such a geometric plot could not yield insight into the test space beyond two dimensions, it did provide a clue as to the major clustering of tests. At this point a complete centroid was placed through the correlation matrix in order to give further information as to the test space. With this preliminary knowledge, the process was begun again by extracting two large oblique factors, the first of which was through the largest clustering of test vectors. A residual matrix was then calculated after rotating the first two oblique factors to orthogonality. From this residual matrix, in which some high correlations remained, four more factors were taken in multiple group fashion. Prior to this last step, however, a complete centroid was put through the residual matrix in order to provide information as to the remaining variance to be accounted for. On the basis of this preliminary factorization, six oblique factors were extracted

from the original correlation matrix which had, at this point, adjusted communality estimates based on the factors known to exist.

The multiple group centroid method yields an oblique factor matrix which must be rotated to an orthogonal matrix before residuals can be computed or the amount of communality accounted for can be calculated. This is done by applying the diagonal method of factoring to the factor correlation matrix, or the matrix expressing the cosines of the angular separation between the non-orthogonal factors. The inverse of this obtained triangular matrix yields the rotation matrix which when multiplied by the oblique matrix yields the desired orthogonal matrix. The sum of the squared factor loadings on the orthogonal factors, then, provides a measure of the amount of estimated communality accounted for by each of the oblique factors.

Residuals may be computed by multiplying the orthogonal matrix by itself and subtracting the products from the respective correlations in the original correlation matrix. If the residual correlations are too high, there exists the probability of another factor being present. It was felt desirable, therefore, to put a complete centroid through the residual matrix to provide an estimate of the largest remaining factor. The amount of communality accounted for by this factor is easily obtained since it is orthogonal with respect to the other factors extracted before the residual calculations.

Due to the fact that oblique factors are always correlated to some degree, it is an informative procedure to factor the matrix expressing the cosines of the angular separations of the factors. This matrix is equivalent to the intercorrelations of the factors, and communality estimates should be based on the highest correlation in each column to avoid working with specific factors or error factors which would arise were the communalities expressed as unity. This procedure aids in the understanding of the derived factors and may result in concepts which are more parsimonious for purposes of description. These higher-order factors would be expected to be more functionally independent than the lower order factors developed directly by the study. It is generally true that the higher the order of the factor system the lower the general correlations will be among those factors. Conversely, high correlations among single variables can occur because they can mutually share the effect of the same factors to a great degree.

Factor loading indices. While the factors derived by this study represent concepts and not persons or types of persons, a technique is available for considering the relationship between the factors and persons who have received scores on the tests which comprise the factors. This is similar to the procedure for calculating factor loadings for a particular case history variable such as age, sex, or a diagnosis of paranoid, for example, except that separate

scores for each individual may be obtained. For any given individual the procedure consists of summing the squared factor loadings for those tests which are significantly loaded on a particular factor and for which this individual receives a plus score. In this study a significant factor loading was considered to be .40 or greater. The difference between this technique and that for obtaining factor loadings for case history variables, aside from the fact that the former pertains to individuals, is that factor loading indices are based on all tests which show a significant loading on a factor, including non-cluster tests. Since, then, each individual is assigned a factor loading index for each factor, various criterion groups may be selected out for study. Or, it may be that the investigator would find it desirable to proceed from the opposite end, i.e. selecting extreme groups with respect to factor loading indices on a given factor for the purpose of investigating possible differentia. The use of this technique in this study, however, is limited to specific purposes which are within the defined scope of the study.

Factor loading indices were computed for schizophrenic subtype groups (excluding the total of ten subjects in the Mixed, Unclassified and Simple groups), and comparisons between means were made among these. The operations involved the calculation of the standard error of the mean for each group and the standard error of the difference between the means in each comparison. The t value was obtained by

dividing the latter into the obtained difference between the means involved in the operation. The significances of the t values were obtained from Guilford (22). Since the mean factor loading index for any factor was dependent upon the magnitude of the sum of the squared factor loadings, the mean index was divided by the sum of the squared factor loadings for all significantly loaded tests. This done, the mean factor indices became comparable for all factors, regardless of the number of tests involved or the magnitude of their loadings.

Included in the above analysis among subtypes was the non-schizophrenic group, for which mean factor loading indices were computed. It was deemed desirable to consider non-schizophrenics in relationship to each subtype separately since there is no reason to believe that all types of schizophrenics will be uniform with respect to social behavior, or even as regards any general factors. This method of comparing differences is not only more economical, but it also takes account of and weights items according to their significance in terms of the derived factors. It makes use of the concepts developed by the study, and in a sense tests their usefulness for describing differences among the aforementioned groups.

Since it would be desirable to have some notion as to the discriminating power of each test in the scale, a chi square analysis was done which included the entire samples of

schizophrenics and non-schizophrenics. The analysis was aimed at the examination of differences in the distribution of scores for each test between the two groups. Although this technique yields data on the ability of each test to distinguish between schizophrenics and non-schizophrenics, it fails to indicate the meaning of any particular test in terms of its relationship to other facets of behavior.

RESULTS

Test Scores and Correlations

The dichotomization of the raw data was based on the obtained distribution of scores for each item. The cut-off point for assignment of plus-minus values was placed as closely as possible to the point of the median score for each test. Table 7, Appendix A shows the percent of plus scores for each test after the cut-off point was established, and it is obvious that those tests for which a wide range of scores was obtained were more adequately divided into near-equal halves. Only two tests failed to meet the minimum criterion of 25 percent in the smaller category, namely tests numbers thirty-nine and forty-six. These were excluded from further consideration.

The initial comparison between schizophrenics and non-schizophrenics was made with regard to the distribution of test scores. Table 8 reports the results of a chi square analysis of the distributions of scores for these two groups which was designed to test the null hypothesis of no differences between them. Thus the expected cell frequencies were based on the assumption that the plus-minus scores would be distributed proportionately according to the number of subjects in each group. Due to the fact that some of the cell frequencies in each chi square table were less than 50 it was

TABLE 8

CHI SQUARE COMPARISON OF TEST SCORE DISTRIBUTIONS FOR 100 SCHIZOPHRENICS AND 40 NON-SCHIZOPHRENICS

Test	Per Cent of Scores Plus		Chi Square	Significance (p)
	Schiz.	Non-schiz.		
1	72	90	4.04	.03
2	44	83	15.59	.01
3	57	100	21.93	.01
4	43	98	34.51	.01
5	62	95	12.57	.01
6	61	90	9.33	.01
7	44	83	15.59	.01
8	48	73	5.98	.02
9	44	83	15.59	.01
10	50	95	23.37	.01
11	57	93	14.36	.01
12	48	88	16.04	.01
13	71	75	0.04	.83
14	57	93	14.36	.01
15	45	58	1.71	.19
16	44	85	18.73	.01
17	36	68	10.21	.01
18	59	70	2.90	.09
19	28	73	22.74	.01
20	39	85	11.14	.01
21	36	88	29.43	.01
22	68	78	1.05	.30
23	55	45	0.03	.86
24	34	80	21.93	.01
25	73	100	12.44	.01
26	42	95	30.09	.01
27	47	48	0.00	.99
28	59	68	2.87	.10
29	52	90	16.49	.01
30	53	100	24.78	.01
31	44	93	26.12	.01
32	56	83	8.44	.01
33	51	95	23.45	.01
34	49	93	19.67	.01
35	51	95	23.45	.01
36	38	70	10.14	.01
37	10	30	1.49	.24
40	45	85	18.76	.01

TABLE 8 continued.

Test	Per Cent of Scores Plus		Chi Square	Significance (p)
	Schiz.	Non-schiz.		
41	57	100	21.93	.01
42	25	30	0.42	.52
43	31	55	6.30	.01
44	64	100	16.73	.01
45	52	95	20.28	.01
46	85	85	0.00	.99

necessary to employ Yates' correction for continuity.[1] This involved a subtraction of .5 from each of the discrepancy values representing the differences between observed and expected cell frequencies. The tests of significance for each chi square value revealed that 32 tests or seventy-six percent discriminated well between schizophrenics and non-schizophrenics. These 32 chi square values were of such magnitude that they could be expected to occur by chance alone only once in 100 times or less. Thus, as regards these 32 tests, the null hypothesis was rejected, and the assumption may be made that the groups arose from different populations with respect to the test performances involved.

Table 9 shows the obtained correlation matrix for the 42 tests employed in the analysis. Four tests of the original 46 had been previously eliminated due either to impracticality or failure to meet the distribution criterion of 25 percent in the smaller category. Tests 12 and 29 have been reflected in the matrix to avoid negative column sums, and their names were changed so as to agree with the signs of the correlation coefficients in their respective rows and columns. The communality estimates which appear in the diagonals are based on the results of preliminary factoring and will be explained later. Preliminary factoring made use of communalities equivalent to the highest correlation coefficient in each column.

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[1]Snedecor, G. W., Statistical Methods. Ames, Iowa: Collegiate, 1937, p. 161.

TABLE 9

INTERCORRELATION MATRIX OF 42 TESTS

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22	23	25	26	27	28	29	30	31	32	33	34	35	36	37	38	40	41	42	43	44
1	RESPONDS TO E.'S CHANGE OF FACE	(92)	85	43	61	18	00	03	40	27	83	15	26	-01	43	04	26	08	27	09	54	16	32	10	29	44	44	-06	10	54	49	62	47	38	42	38	21	27	62	30	-10	30
2	OFFERS HAND IN RESPONSE TO E.	85	(81)	15	50	44	08	10	58	23	59	19	-01	-02	49	07	42	46	26	20	35	28	29	12	46	52	35	-04	22	33	58	42	57	29	34	46	08	20	57	00	03	26
3	USES PRESSURE IN HANDSHAKE	43	15	(67)	53	37	02	25	16	12	29	29	23	04	47	02	50	30	40	39	12	37	02	30	53	40	33	20	26	40	59	44	44	30	38	43	16	52	35	22	17	44
4	LOOKS AT E. DURING HANDSHAKE	61	60	53	(68)	42	25	19	40	26	67	23	34	53	47	23	58	23	53	29	31	37	12	08	36	67	38	17	24	47	51	55	55	65	54	70	24	53	35	17	40	44
5	STATES NAME PREFERENCE	18	44	37	42	(56)	29	12	53	32	33	11	08	-15	55	28	44	26	55	20	44	47	20	08	36	63	26	-08	17	37	52	44	53	53	37	42	29	20	11	-04	20	44
6	SITS NEAR E.	00	08	02	25	29	(43)	08	11	01	10	20	24	-10	02	43	01	21	21	-15	-03	29	10	-08	16	09	22	01	01	-04	36	40	25	05	-12	32	26	24	-05	-10	16	40
7	REMOVES SITTING OBSTACLE	03	10	25	19	12	08	(46)	05	30	00	16	24	23	00	20	08	00	18	-03	04	08	15	-07	28	30	16	08	21	26	30	36	15	-03	15	16	-25	14	12	00	16	35
8	RESPONDS TO TACK ON E.'S CHAIR	40	58	36	40	52	11	05	(56)	30	48	17	-06	00	97	02	43	25	06	26	15	04	50	-13	38	66	12	-17	16	43	57	45	55	16	27	46	30	27	47	07	00	22
9	MAKES INITIAL VERBAL RESPONSE	27	23	12	26	32	01	30	30	(27)	25	06	12	-17	43	20	17	23	33	27	19	21	30	24	27	30	16	02	21	26	36	23	21	35	22	23	34	07	25	39	37	19
10	NO LOCOMOTOR RETARDATION	23	59	29	67	33	10	00	18	26	(74)	34	13	09	41	10	19	27	37	07	17	20	35	07	40	63	44	-10	28	48	34	49	35	39	46	40	53	40	47	-03	10	35
11	RESPONDS TO CIGARETTE OFFER	15	19	29	23	11	20	16	17	06	34	(40)	10	-11	16	09	06	44	27	00	20	09	30	-02	11	19	-12	-05	32	15	54	56	26	18	50	37	15	57	29	25	03	37
12	CROSSES LEGS	26	-01	23	34	03	24	24	-26	12	13	10	(65)	48	11	-16	31	11	48	11	55	04	40	-02	35	30	18	04	31	19	35	43	14	16	15	27	11	51	35	00	14	42
13	RELAXES BODY	-01	-02	04	33	-15	-10	28	00	-17	09	-11	43	(45)	-18	-28	-02	-20	-06	35	29	12	-03	-30	15	18	-06	09	03	-19	03	20	00	19	16	27	07	00	04	11	25	12
14	RESPONDS TO COMPLIMENT	45	44	47	47	55	02	00	47	43	41	16	11	-18	(48)	34	37	31	34	32	39	44	28	16	46	54	19	-06	20	52	30	32	37	44	35	32	36	23	46	07	03	36
15	CONFRONTS E.'S STARE	09	07	02	23	28	43	20	02	20	10	09	-16	-28	39	(46)	02	18	10	35	-07	18	04	-09	17	02	06	-02	-33	04	-05	-06	31	06	13	00	18	02	15	02	22	-02
16	FOLLOWS GAZE OF E.	26	42	50	38	44	01	03	43	17	19	06	31	-02	37	02	(58)	21	55	47	19	-12	07	-01	58	37	29	21	40	33	42	23	28	35	27	46	01	26	19	07	29	40
17	RESPONDS TO WEATHER REMARK	08	46	30	23	26	21	00	25	28	27	44	11	-24	31	18	24	(55)	22	30	28	21	42	09	39	22	27	14	16	22	40	40	58	31	42	72	16	38	10	16	19	50
18	ATTENDS TO PHONE CONVERSATION	27	26	40	53	55	21	13	06	33	57	27	48	-06	39	10	55	22	(77)	33	36	22	11	19	53	52	62	40	16	54	57	50	25	46	57	40	08	53	09	15	20	61
20	HELPS E. FIND MATCH	07	20	39	29	20	-15	-03	26	27	07	00	11	-33	52	53	47	30	33	(51)	06	-08	09	20	20	05	25	-16	-05	10	16	05	26	36	39	20	-05	18	24	18	27	25
21	RESPONDS TO INTERRUPTING QUESTION	34	33	12	31	44	-08	04	13	19	17	20	55	29	39	-07	19	29	36	06	(60)	29	16	28	23	19	30	-10	13	22	45	27	31	27	23	41	52	06	35	25	-11	42
22	CONTINUES STORY AFTER INTERRUPTION	16	28	37	37	47	29	08	04	21	20	04	04	12	44	18	-12	21	22	-00	29	(62)	11	11	20	48	33	20	03	02	33	28	46	25	02	44	36	32	10	24	21	43
23	REMARKS ABOUT BABY PICTURE	32	29	02	12	20	10	15	50	30	35	30	40	-03	23	04	07	42	11	00	16	14	(57)	10	22	62	25	-13	39	14	21	50	28	16	33	24	21	39	44	38	33	18
25	RETRIEVES DROPPED PENCIL	10	12	30	08	08	-08	-07	-15	21	07	-02	-02	-30	16	-14	-01	44	14	20	28	11	10	(67)	04	00	37	-05	22	20	10	12	-12	10	02	10	24	15	-15	54	-20	29
26	EXPRESSES POLITICAL OPINION	29	46	53	36	36	16	20	32	27	40	11	33	15	46	17	53	34	55	20	28	20	22	01	(62)	36	39	-06	16	30	23	53	20	32	16	25	21	25	33	13	40	29
27	HELPS E. RECALL NAME	44	52	40	67	63	04	30	66	30	62	19	30	18	54	02	37	22	52	15	14	08	62	00	36	(64)	26	-03	36	51	20	62	58	50	54	57	35	77	18	07	50	47
28	WILLING TO ATTEMPT DIFFICULT TASK	49	35	33	38	26	22	16	02	16	44	-12	18	-06	14	06	29	27	62	25	30	33	26	37	31	24	(58)	16	09	27	59	35	47	41	51	41	27	44	27	29	29	61
29	REJECTS E.'S HELP	-06	-09	20	17	-08	01	00	-17	02	-10	-05	09	04	-06	-02	21	19	40	-16	-10	20	-13	-05	-06	-05	(49)	13	-15	13	-10	-16	25	05	07	-06	30	27	02	10	26	
30	REACTS TO CRITICISM	20	22	26	23	17	01	21	16	21	28	32	31	03	20	33	00	16	16	-05	05	03	09	22	16	06	09	15	(55)	15	32	39	09	26	19	31	10	43	32	22	20	31
31	IMITATES E.'S BEAD STARING	54	33	40	17	37	-04	26	43	26	48	15	19	-14	52	09	33	22	59	10	22	02	19	28	30	61	28	-15	-03	(53)	51	50	48	51	52	56	-11	35	21	00	06	50
32	VARIES READING RATE WITH E.	49	58	39	61	52	36	30	67	36	34	59	35	03	30	-05	42	40	51	16	46	35	21	10	28	60	54	13	32	51	(70)	73	71	59	50	69	32	66	43	-10	18	73
33	RE-ENACTS TASK SEQUENCE (GROSS)	62	42	44	55	49	10	36	43	23	49	66	48	20	32	-06	28	40	50	05	27	28	50	12	53	68	35	-10	39	60	73	(68)	46	52	51	67	35	65	32	15	16	58
34	RE-ENACTS TASK SEQUENCE (MINUTE)	47	57	44	55	53	25	15	55	21	55	26	19	00	37	31	28	58	25	26	31	16	28	-18	20	58	47	-15	04	48	71	46	(71)	62	67	71	26	36	20	08	33	58
35	GOOD ATTENTION	38	29	30	65	53	05	-03	16	35	34	18	16	19	44	06	35	31	46	35	27	25	16	10	32	50	41	25	26	51	59	52	52	(59)	60	64	17	38	25	-05	44	60
36	VERBALLY FLUENT	42	34	38	64	37	-12	15	27	22	46	38	15	16	33	13	27	42	57	39	23	02	33	02	16	59	51	05	19	52	50	51	67	60	(60)	69	10	43	26	14	41	62
37	GOOD SOCIAL VOCABULARY	38	46	43	70	42	32	16	46	23	40	31	27	27	32	00	46	72	40	20	41	44	24	10	25	57	41	07	31	56	69	67	71	64	64	(75)	50	60	19	01	43	80
38	REJECTS DULL PENCIL	21	08	16	24	24	26	-26	30	34	33	15	11	07	36	18	01	16	08	-05	52	36	29	24	21	35	27	-06	10	-11	32	35	26	17	10	30	(49)	38	30	28	10	33
40	NEAT PERSONAL APPEARANCE	27	20	52	63	20	24	19	27	07	40	57	51	00	23	02	26	38	53	18	06	32	39	15	25	77	44	30	43	35	66	65	36	38	43	60	38	(66)	39	14	22	60
41	PRESENCE OF MOOD MODULATION	62	37	35	36	11	-05	12	47	25	47	29	35	04	46	15	19	10	09	24	33	10	49	-15	33	18	27	27	32	21	43	32	20	25	26	19	30	34	(53)	01	03	10
42	CURIOUS ABOUT TAIL UNDER BOX	30	00	22	17	-09	-10	00	07	39	-03	25	00	11	07	02	07	16	15	18	25	29	38	54	13	07	28	02	22	00	-10	15	08	-05	14	01	28	14	-01	(53)	27	17
43	REMEMBERS E.'S NAME	-10	03	17	40	20	16	16	00	37	10	03	14	25	03	22	29	19	20	27	-11	21	33	-20	40	50	29	10	20	06	18	16	33	44	41	43	10	22	03	27	(42)	53
44	UNDERSTANDS SITUATION	30	26	49	44	49	40	33	22	19	35	37	42	12	36	-03	40	50	61	25	42	43	18	29	24	47	61	26	31	50	73	58	57	60	62	80	33	60	10	17	33	(81)
45	GIVES PARTING RESPONSE	47	44	51	30	31	08	07	37	44	35	29	14	-22	56	10	13	36	25	26	30	29	26	28	30	38	28	-16	35	31	61	33	36	45	10	40	46	47	51	-08	06	44

Preliminary Factorization

Factoring was begun by locating two clusters by methods previously described, and extracting two oblique factors based on these clusters. At this point no attention was directed toward the content meaning of the factors in terms of the clusters of tests. A graphic representation of the test space was then made with respect to the two oblique factors, in order that more perspective might be had for the entire problem. While such a two-dimensional representation was limited, it nevertheless seemed quite clear that the entire test space was rather circumscribed, and that perhaps a large group factor or even a general factor existed. To aid in the estimation of the magnitude of such a first factor, a complete centroid was placed through the original test correlations, and the loadings on this factor are presented in Table 10.

Factoring was then begun anew by repeating the process of extracting two oblique factors in multiple-group fashion. The first of these was close to the location of the complete centroid, but both were based on clusters that seemed to have apparent meaning. Further clusters were difficult to distinguish in the original correlation matrix due to the dominating effect of these two rather large group factors, and so it was decided to calculate a residual matrix. This would remove the effects of these two factors and would allow the effects of additional factors to appear more sharply. Since the first two factor reference axes were not orthogonal with respect

TABLE 10

LOADINGS ON THE PRELIMINARY FACTOR EXTRACTED BY A COMPLETE CENTROID THROUGH CORRELATION MATRIX

Test No.	Content	Loading
32	Varies reading rate with E.	.80
37	Good social vocabulary	.79
4	Looks at E. during handshake	.77
27	Helps E. recall name	.77
33	Re-enacts task sequence (gross)	.77
44	Understands situation	.77
34	Re-enacts task sequence (minute)	.70
40	Neat personal appearance	.69
3	Uses pressure in handshake	.67
18	Attends to phone conversation	.65
35	Good attention	.65
36	Verbally fluent	.65
2	Offers hand in response to E.	.64
10	No locomotor retardation	.64
1	Responds to E.'s change of pace	.63
5	States name preference	.61
14	Responds to compliment	.60
28	Willing to attempt difficult task	.59
26	Expresses political opinion	.56
45	Gives parting response	.56
17	Responds to weather remark	.55
31	Imitates E.'s bead stringing	.55
8	Responds to tack on E.'s chair	.54
16	Follows gaze of E.	.51
41	Presence of mood modulation	.50
23	Remarks about baby picture	.49
21	Responds to interrupting question	.48
9	Makes initial verbal response	.46
22	Continues story after interruption	.44
12	Crosses legs	.43
30	Reacts to criticism	.42
11	Responds to cigarette offer	.41
38	Rejects dull pencil	.41
43	Remembers E.'s name	.38
20	Helps E. find match	.32
7	Removes sitting obstacle	.26
42	Curious about tail under box	.26
6	Sits near E.	.24

TABLE 10 continued.

Test No.	Content	Loading
25	Retrieves dropped pencil	.21
15	Confronts E.'s stare	.17
29	Rejects E.'s help	.11
13	Relaxes body	.06

to one another, it was necessary to rotate them to orthogonality before calculating the residuals. This was done by multiplying by the inverse of the matrix derived by diagonally factoring the matrix expressing the cosines of the angular separation of the oblique factors. The orthogonal matrix so derived was then simply multiplied by its transpose, which yielded the product matrix which was subtracted from the original correlation matrix.

The residual matrix so obtained revealed the presence of significant correlations, and thus the presence of further factors. After reflecting the many negative column sums, a complete centroid was extracted from the matrix, which provided information as to the largest remaining factor. This factor accounted for 10 percent of the estimated communality of the original matrix and 20 percent of the new estimated communality of the residual matrix. Subsequently four oblique factors were extracted from the residual matrix in multiple group fashion. Since the first of these was already in orthogonal reference to the factors derived before the calculation of the residual matrix, it was necessary to include only the last four factors in the process of rotation to orthogonality.

The cluster search in the residual matrix was complicated by what appeared to be doublet factors based on the interrelationships of only two tests. Since the tetrachoric correlation coefficient may be unreliable, these relationships were

ignored so far as locating a new factor was concerned. However, if a third test could be incorporated into the cluster without causing the loss of too much in the way of tightness of clustering and relative independence from other clusters, a cluster of three tests was formed. This occurred in all of the remaining clusters each of which was composed of three tests. Cattell (15) warns the investigator of the pitfalls to be encountered as a result of the location of centroids on the basis of small clusters. The danger lies in the fact that the clustering may be due to error variance which is carried through to the factor space with no way available to discover its nature. To guard against this, several criteria were adhered to. In the first place, it became more obvious after prolonged cluster search that groups of no more than three tests would make acceptable clusters mathematically, regardless of meaning. Only those clusters were accepted which not only were important in terms of variance accounted for, but also in the meaning which was interpreted from the clustering. Further, an attempt was made to work with those tests which showed the higher residual communalities, and whose original estimates of communality arose from the correlations with tests included in the clusters being formed.

The clusters were determined in decreasing order of importance in terms of the magnitude of the average intercorrelations, and it appeared that beyond the four clusters decided upon little of a worthwhile nature remained. Further cluster

extractions would most probably have resulted in tests with communalities-accounted-for in excess of unity, and thus factors probably based on correlated errors. Such spurious factors based on error will probably be small in relation to real factors and thus it is advisable to regard less important clusters with suspicion, especially if they have little meaning in terms of experience.

Final Factorization

One of the more advantageous products to be harvested from the preliminary factorization process was the information concerning each test's communality, or the amount of variance it was sharing with other tests due to common factors. At this point it was possible to re-estimate communality by summing the squared factor loadings for each test in the orthogonal matrix. This resulted in the increase of some estimates of communality over the original estimates, while others were reduced, and many remained unchanged. The communality estimates of ten tests were markedly reduced (ranging from .05 to .18) due to the fact that preliminary factorization failed to reveal common variance to the extent suggested by original communality estimates. Most of these tests had significant relationships with very few other tests, or as little as one other test. In such an exploratory project as this, very small group factors, and specific factors had to be ignored. Further, the danger was present that correlated

errors were manifesting themselves. Thus, in Table 9 the diagonal entries are based on this re-estimation process which, it is felt, resulted in more accurate communalities, better designed for the specific purposes of this investigation.

Table 11, Appendix A shows the specific test clusters which were employed to locate the factor axes in the final factorization. At this point the names for the factors had not yet been devised, but they appear in this table for purposes of convenience. The clusters are those which were identified in the preliminary factorization. In Table 12, Appendix A are seen the average intercorrelations within and between clusters used in the final factorization. The rather circumscribed test space has been previously alluded to and it is obvious in this table that the clusters, in some cases, are highly related to one another. The diagonals of this matrix express the average intercorrelations among within-cluster tests, and provide a measure of the tightness of the clustering. It is desirable to locate clusters whose average correlations within the cluster are twice as great as the average correlations with other clusters, but in this problem this was not possible. This must qualify the interpretations made, and in itself can be interpreted, as will be seen later. The test loadings on the six oblique factors extracted in multiple-group fashion are arranged in clusters for convenient reference in Table 13. In this oblique matrix the interre-

TABLE 13

TEST LOADINGS ON SIX OBLIQUE FACTORS

Tests		Factors					
No.	Name	A	B	C	D	E	F
37	Good social vocabulary	.84	.49	.26	.46	.51	.40
33	Re-enacts task sequence (gross)	.80	.58	.31	.44	.53	.42
32	Varies reading rate with E.	.80	.68	.27	.41	.57	.45
44	Understands situation	.80	.29	.53	.47	.50	.46
34	Re-enacts task sequence (minute)	.77	.58	.21	.22	.41	.59
27	Helps E. recall name	.76	.59	.16	.30	.50	.37
4	Looks at E during handshake	.76	.61	.31	.48	.56	.48
36	Verbally fluent	.73	.42	.33	.26	.36	.20
35	Good attention	.73	.35	.23	.28	.43	.34
40	Neat personal appearance	.72	.35	.36	.28	.46	.25
31	Imitates E's bead stringing	.68	.49	.23	.13	.46	.20
17	Responds to weather remark	.50	.29	.43	.07	.38	.35
11	Responds to cigarette offer	.44	.26	.05	.09	.20	.22
43	Remembers E's name	.41	-.01	.18	.14	.36	.31
7	Removes sitting obstacle	.28	.10	.04	.27	.21	.22
1	Responds to E's change of pace	.61	.91	.42	.29	.44	.12
2	Offers hand in response to E.	.55	.85	.23	.15	.72	.32
10	No locomotor retardation	.59	.77	.24	.17	.39	.29
8	Responds to tack on E's chair	.56	.66	.03	.03	.49	.36
41	Presence of mood modulation	.34	.65	.05	.35	.39	.11
14	Responds to compliment	.52	.59	.18	.13	.58	.49
45	Gives parting response	.46	.58	.16	.11	.42	.26
23	Remarks about baby picture	.42	.52	.36	.26	.14	.18
25	Retrieves dropped pencil	.12	-.02	.75	-.02	.15	-.02
42	Curious about tail under box	.04	.12	.67	.18	.19	-.06
28	Attempts difficult task	.51	.38	.59	.20	.45	.29
9	Makes initial verbal response	.36	.34	.39	.07	.25	.29
38	Rejects dull pencil	.28	.29	.39	.34	.17	.37
29	Rejects E's help	.04	.00	.22	.01	.16	-.05
12	Crosses legs	.35	.18	.08	.80	.39	.09
21	Responds to interrupting question	.37	.37	.41	.72	.26	.16
13	Relaxes body	.16	.00	-.12	.54	.08	-.29
30	Reacts to criticism	.35	.29	.26	.38	.36	-.08

TABLE 13 continued.

Tests		Factors					
No.	Name	A	B	C	D	E	F
26	Expresses political opinion	.41	.46	.28	.37	.77	.37
3	Uses pressure in handshake	.55	.62	.42	.19	.75	.22
16	Follows gaze of E.	.45	.42	.17	.23	.73	.25
18	Attends to phone conversation	.65	.22	.48	.38	.67	.46
20	Helps E. find match	.24	.25	.31	-.08	.47	.20
15	Confronts E's stare	.03	.09	.02	-.25	.09	.63
6	Sits near E.	.19	.05	.02	.03	.08	.62
5	States name preference	.61	.41	.15	.18	.52	.61
22	Continues after interruption	.34	.19	.34	.20	.20	.51

lationships may be seen in Table 14, Appendix A which gives the cosines of the angular separation among the factors. These values are equivalent to the correlations among the factors. Since this matrix is symmetrical it may be treated as a triangular matrix which simplifies the process of diagonal factoring. The inverse of the resultant matrix, after the diagonal factorization of the oblique factor correlations, is the rotation matrix which is seen in Table 15. Through matrix multiplication of the oblique and rotation matrices, the orthogonal factor matrix was obtained.

Table 16 which presents the test loadings when the factor axes are rotated to orthogonality also shows, in the last column, the amount of communality accounted for in each test by the six factors. A consideration of these values is a guide in the determination of the adequacy of the factoring. It is, however, more convenient to gauge this from an examination of the amount of communality accounted for by the factors. Table 17, Appendix A shows the amount of estimated communality accounted for by the factors, both in trial factoring in which the highest column sums were employed, and in the final factoring which made use of adjusted communality estimates. An indication is also gained as to the relative importance of each factor in terms of the amount of test variance it influences.

The sum of the original communality estimates was 25.80, while that for the adjusted estimates was 23.73. Since the

TABLE 15

ORTHOGONAL ROTATION MATRIX FOR THE SIX OBLIQUE FACTORS

	A	B	C	D	E	F
A	1.000	-.909	-.338	-.485	-.330	-.616
B	0	1.351	-.028	.041	-.652	.168
C	0	0	1.062	-.046	-.280	.115
D	0	0	0	1.107	-.157	.341
E	0	0	0	0	1.480	-.335
F	0	0	0	0	0	1.188

TABLE 16

TEST LOADINGS ON SIX ORTHOGONAL FACTORS

Tests		Factors						h^2
No.	Name	I	II	III	IV	V	VI	
37	Good social vocabulary	.84	-.10	-.02	.11	.01	.06	.73
33	Re-enacts task seq. (gr.)	.80	.06	.04	.11	-.01	.11	.67
32	Varies read. rate with E.	.80	.19	.00	.08	.00	.14	.70
44	Understands situation	.80	-.34	.28	.12	.06	.16	.88
34	Re-enacts task seq. (min.)	.77	.08	-.05	-.12	-.12	.29	.71
27	Helps E. recall name	.76	.11	-.10	-.02	.01	.02	.60
4	Looks at E. during handsh.	.76	.13	.06	.17	.02	.22	.63
36	Verbally fluent	.73	-.10	.09	-.06	-.12	-.14	.59
35	Good attention	.73	-.19	-.01	-.04	.06	-.01	.57
40	Neat personal appearance	.72	-.18	.13	-.04	.07	-.10	.58
31	Imitates E.'s bead str.	.68	.04	.00	-.18	.05	-.18	.53
17	Res. to weather remark	.50	-.06	.28	-.17	.08	.10	.38
11	Res. to cigarette offer	.44	-.05	-.10	-.11	-.05	.00	.22
43	Remembers E.'s name	.41	-.39	.05	-.05	.33	.06	.44
7	Removes sitting obstacle	.28	-.12	-.05	.17	.10	.13	.15
1	Responds to E.'s pace	.61	.68	.21	.04	-.31	-.08	.98
2	Offers hand in res. to E.	.55	.65	.03	-.08	.24	.02	.79
10	No locomotor retardation	.59	.50	.03	-.08	-.21	-.07	.65
8	Res. to tack on E.'s chair	.56	.38	-.18	-.21	.10	.04	.55
41	Presence of mood modulation	.34	.57	-.08	.25	-.03	.02	.51
14	Res. to compliment	.52	.32	.00	-.09	.23	.23	.49
45	Gives parting response	.46	.37	.00	-.08	.03	.04	.36
23	Remarks about baby picture	.42	.32	.23	.09	-.41	.13	.52
5	Retrieves dropped pencil	.12	-.14	.76	-.12	-.01	-.07	.63
42	Curious about tail in box	.04	.13	.69	.15	-.03	.00	.52
28	Attempts difficult task	.51	.05	.44	-.04	.05	.08	.47
9	Makes initial verbal res.	.36	.13	.28	-.10	-.09	.16	.27
38	Rejects dull pencil	.28	.14	.31	.23	-.19	.42	.46
29	Rejects E.'s help	.04	-.04	.22	-.02	.16	-.11	.09
12	Crosses legs	.35	-.07	-.04	.72	.20	.07	.69
21	Res. to interrupting quest.	.37	.16	.30	.61	-.21	.23	.72
13	Relaxes body	.16	-.15	-.18	.53	.01	-.30	.45
30	Reacts to criticism	.35	.07	.15	.25	.10	-.22	.27

TABLE 16 continued.

Tests		Factors						h^2
No.	Name	I	II	III	IV	V	VI	
26	Expresses political opinion	.41	.25	.15	.22	.57	.16	.65
3	Uses pressure in handshake	.55	.34	.24	-.05	.38	-.11	.63
16	Follows gaze of E.	.45	.16	.02	.05	.57	-.06	.56
18	Attends to phone conv.	.65	-.29	.28	.09	.44	.14	.81
20	Helps E. find match	.24	.12	.24	-.21	.38	-.02	.32
15	Confronts E.'s stare	.03	.09	.01	-.29	.10	.63	.50
6	Sits near E.	.19	-.11	-.04	-.06	.01	.61	.43
5	States name preference	.61	.00	-.06	-.09	.23	.32	.54
22	Continues after interrup.	.34	-.05	.24	.05	-.07	.47	.40

total variance of the correlation matrix was 42.00, these figures constitute sixty-one percent and fifty-seven percent of the total variance, respectively. The decrease in the amount of total variance under consideration was due to the adjustment of communality estimates so as to exclude consideration of very small group factors and specific factors. Thus, while the six factors accounted for 95.7 percent of the re-estimated communality, they accounted for only 54.0 percent of the total variance of the correlations. The remainder of the variance was due largely to the operation of specific factors which would not be disclosed in this analysis. The operation of error, however, would considerably reduce the number of meaningful specific factors.

The further purpose of placing the factors in a position of functional independence with respect to one another was to allow for calculation of residuals. When the orthogonal matrix was multiplied by its transpose (rows and columns transposed) the product matrix was obtained. These test loading products were then subtracted from their respective positions in the correlation matrix to yield the residual matrix seen in Table 18, Appendix A. The great majority of these values were less than .10, indicating that at least the large group factors had been extracted. There were, however, several significant correlations remaining, which raised the question of the presence of another factor. The diagonals of this matrix were those actually calculated, and further

factoring had to employ new estimates based on the highest residual correlation in each column.

The process of test vector reflection was lengthy due to the many negative column sums, with the result that almost half of the tests have negative loadings on the complete centroid placed through the residual matrix, as seen in Table 19. Only two of the tests appear to have significant loadings on this factor, and over half of them are loaded .20 or less. These findings are, of course, partly due to the nature of the complete centroid method which deals in the overall relationships. While not necessarily a meaningful factor, the complete centroid does provide an estimate of the largest remaining factor in the residual matrix. The complete centroid accounted for 7.6 percent of the estimated communality, and this figure plus the 95.7 percent accounted for by the other six factors total more than 100 percent. This discrepancy was caused by re-estimating communalities in the residual matrix in accordance with the highest residual correlation in each column, which, in most cases resulted in an increase in value for each communality.

The complete centroid check, having suggested the presence of another factor, resulted in the formation of a new test cluster which included the tests of appreciable loading on the complete centroid. After elimination from the cluster of those tests which correlated poorly with it, the cluster decided upon included the four most highly loaded tests. Further,

TABLE 19

ORTHOGONAL LOADINGS ON THE SEVENTH FACTOR EXTRACTED BY A COMPLETE CENTROID THROUGH RESIDUAL MATRIX

Test No.	Content	Loading
40	Neat personal appearance	.44
23	Remarks about baby picture	.42
30	Reacts to criticism	.36
11	Social response to cigarette offer	.35
18	Attends to phone conversation	-.33
31	Imitates E.'s bead stringing	-.29
1	Responds to E.'s change of pace	-.26
6	Sits near E.	.24
29	Rejects E.'s help	.24
33	Re-enacts task sequence (gross)	.23
21	Responds to interrupting question	-.23
32	Varies reading rate with E.	.21
38	Rejects dull pencil	.21
20	Helps E. find match	-.21
36	Verbally fluent	-.21
7	Removes sitting obstacle	.20
43	Remembers E.'s name	.20
35	Good attention	-.20
27	Helps E. recall name	.18
45	Gives parting response	.18
25	States name preference	-.18
22	Continues story after interruption	.17
41	Presence of mood modulation	.16
42	Curious about tail under box	.16
4	Looks at E. during handshake	-.15
8	Responds to tack on E.'s chair	.14
10	No locomotor retardation	-.14
13	Relaxes body	.13
39	Confronts E.'s stare	-.13
3	Uses pressure in handshake	.12
12	Crosses legs	.12
37	Good social vocabulary	.12
16	Follows gaze of E.	-.12
28	Willing to attempt difficult task	-.12
14	Responds to compliment	-.11
17	Responds to weather remark	.10
44	Understands situation	.10
34	Re-enacts task sequence (minute)	-.09

TABLE 19 continued.

Test No.	Content	Loading
2	Offers hand in response to E.	-.08
25	Retrieves dropped pencil	-.08
9	Makes initial verbal response	.07
26	Expresses political opinion	-.03

they seemed to have some meaning and empirical justification for clustering. To arrive at the oblique loadings for this factor it was merely required to extract it from the original correlation matrix. The orthogonal loadings were derived by extracting it from the residual matrix which would locate the factor axis in orthogonal reference to the other six factors. The sum of the squared factor loadings equaled only 2.6 percent of the estimated communality, and thus the factor seemed of little importance. The oblique matrix showed high loadings, but the reason for this became obvious when it was learned that this seventh oblique factor was highly related to factor A. The cluster tests were related to A-cluster tests almost as much as they were interrelated among themselves, and some of the highly loaded tests on the seventh factor were even more highly loaded on factor A. Thus, it appeared that it would not be meaningful to distinguish this factor, but to treat it as a special aspect of factor A. That some specific meaning may be applied to it will be discussed below.

The Obtained Factors and Interpretations

Even without regard to the special limitations of the present investigation the problem of factor naming is an extremely complex one. The task is not made easier by the lack of concepts in this area, either through theoretical formulations or empirical studies such as this one. The special limitations of this study are the relatively small number of cases, and perhaps more serious, the lack of a sound theoretical

framework with which to integrate the results. The latter, however, should not act as a deterrent to research in this domain, for the need of concepts is pressing. That any research in a new area is necessarily exploratory is a function of the group of variables chosen for study. It is a natural result that some factors will be well tested while others will be viewed with lesser clarity, and may even mislead the investigator. This fact is intimately associated with the naming of factors, and emphasizes a plea for the tentativeness of the entire project. Finally, it should be borne in mind that the unrotated factors are in unknown proximity to reference axes which would best meet the criteria for simple structure. As has been previously discussed, the multiple-group method, with its special heed to the experiential meaning of clusters, usually results in a solution close to that of simple structure. In this problem it is felt that the preliminary factorization accomplished this in regard to the locations of factors A and B. The other factors, seemingly of less importance and of less clarity, might be better measured by tests other than those included in the present study. The present matrix is a transient one which may never be employed again, even though other matrices may take account of the present one in their design. With these limitations upon interpretation in mind the factor meanings may now be considered. Reference is made to Table 20 for this purpose since the emphasis here is upon the qualitative content of factors.

TABLE 20

FACTOR LOADINGS OF .40 OR HIGHER THAT LED TO THE NAMES FOR FACTORS

Factor		Test (By Magnitude of Loading)
Symbol	Name	
A	General social orientation and capacity	Good social vocabulary Re-enacts task sequence (gross) Varies reading rate with E. Understands situation Re-enacts task sequence (minute) Helps E. recall name Looks at E. during handshake Verbally fluent Good attention Neat personal appearance Imitates E.'s bead stringing Responds to weather remark Responds to cigarette offer Remembers E.'s name
B	Socio-motoric responsiveness	Responds to E.'s change of pace Offers hand in response to E. No locomotor retardation Responds to tack on E.'s chair Presence of mood modulation Responds to compliment Gives parting response Remarks about baby picture
C	Restitutional curiosity	Retrieves dropped pencil Curious about tail under box Willing to attempt difficult task
D	Nonchalance and lack of pre-occupation	Crosses legs Responds to interrupting question Relaxes body
E	Reactive assertion and reproduction	Expresses political opinion Uses pressure in handshake Follows gaze of E. Attends to phone conversation Helps E. find match

TABLE 20 continued.

Factor		Test (By Magnitude of Loading)
Symbol	Name	
F	Interpersonal confronting	Confronts E.'s stare Sits near E. States name preference Continues story after interruption

Factor A. This is by far the largest and most important factor derived in this study, and alone it accounts for almost half of the estimated communality of the entire matrix of correlations. Caution is needed in interpretation, however, due to the extreme obliqueness of some of the factors with respect to each other. This may result in a somewhat artificial differentiation of concepts which only some knowledge of their descriptive and predictive usefulness can resolve. Factor A seems to involve a general social orientation and capacity, but not necessarily (in this sample) the actual carrying out of social acts on a motoric basis. Involved in this factor are the abilities to make social value judgments and to learn social concepts. The ability under consideration seems further to involve the comprehension of social events, and the imitation of another. Verbal fluency seems to be involved, as does the capacity for attention and comprehension. More along interpersonal lines are the awareness of self in respect to others, a readiness to react pleasantly, and to play a role in conformity to the other person. Somewhat less important, at least in terms of this factor, is the ability to be superficial. The recognition of social obligations or "manners" may also be involved.

In summary, factor A is interpreted as involving the capacity to react socially, and to bring intellectual resources to bear with some objectivity as a result of attention and understanding. It further involves the capacity

to exert a social neutrality with reserve potential and readiness. The name invented for this factor, then, is General social orientation and capacity.

Factor B. This factor seemed to be essentially motoric in nature, i.e., with reference to its unique aspects. The correlation of .67 between the reference axes of factors A and B attested to the difficulty of differentiating between them semantically. It is probable that it requires the ability measured by factor A for an individual to be highly loaded on B. The two most highly loaded tests were obviously motoric responses which have to do with sociability. The next most highly loaded test also had this significance when it was realized that more than pure psychomotor performance was being measured. The subject was asked to put on the room light, and his score was the number of seconds taken to return to his chair--or to re-enter the interpersonal or social situation. Further, it would seem that this factor is getting at social sensitivity, and the finer modulations of motoric and affective responses. Involved also are responses to social nuances. This factor, therefore, was named Socio-motoric responsiveness.

Factor C. The naming of this factor required much in the way of speculation, as opposed to the more direct interpretation of the above factors. While the amount of communality it accounted for was slightly greater than the remaining factors, too few tests were significantly loaded to

clearly demarcate its identity. In this or any other factor, however, it was necessary to examine the loadings of all tests in the battery on the factor under scrutiny. It may well be an important factor, but more complete testing of it would be necessary. The most highly loaded test, 'Retrieves dropped pencil', was probably impure in its measurement. In the light of the other tests comprising the factor, it would seem that the subject picked up, or looked for, the pencil out of curiosity. Since the factor was derived from a group of schizophrenics, many of whom were in the active and early stages of the disorder, there would seem to be some restitutional significance present. Fenichel (19) spoke of the type of restitutional activity designed to regain lost object relationships, particularly on the part of catatonics. Such patients, fearing the loss of objective reality, and of relationships to objects, attempt to cling to, and seek objects. A certain amount of automatic obedience may also be involved, which may partially account for the retrieving of the dropped pencil. It will be noted that the tests with loadings above .40 involve some sort of concrete object. Whether or not catatonics are more heavily loaded on this factor will be seen later, but such a situation is not anticipated. Catatonics are a heterogeneous group and it is not likely that this specific activity would be common to all, or even to many.

Pursuing the theme of caution with regard to factor interpretation, it must be emphasized that significant loadings

on this factor by non-schizophrenics will neither prove nor disprove the interpretation of restitution. This refers particularly to the situation where non-schizophrenics do not contribute to the location of the factor by way of test correlations. Moreover, if such a factor did arise from the test performances of non-schizophrenics, its interpretation would not take into account the possible restitutional aspects of curiosity seen among some schizophrenics. It was with caution, and with due appreciation of the probable restricted value of this factor that it was named Restitutional curiosity.

Factor D. The above statements concerning the tentativeness of factor C's interpretation, apply to this factor as well, and more so to these than factors A, B, E, or F. The two most highly loaded tests here seemed to be related to tension, and may have been reactions against tension. The third test 'relaxes body' in this context might be interpreted also as a reaction to felt tension, in which the subject gave the appearance of being bodily relaxed. Examining other tests and factors, it appeared that some social capacity was part of the picture, but that "sociability" may have been lacking. For a tense person to give the appearance of relaxation, it would be almost prerequisite to have some understanding of the situation. Some tests having to do with interaction between subject and examiner had low or negative loadings on this factor, which pointed toward nonchalance on the part of the

subject highly loaded on this factor. Again it must be emphasized that these speculations apply to schizophrenics and may be of an entirely different significance in other populations of people. This factor was named Nonchalance and lack of preoccupation.

Factor E. This factor along with A and B form a highly related triad which must be considered when interpreting the significance of each. Based apparently on the capacity represented by factor A, and related to the socio-motoric responsiveness of B, this factor seemed to involve a special kind of response. Though 'uses pressure in handshake' and 'follows gaze of E.' were motoric responses, they, as well as the others, required somewhat more in the way of spontaneity. They were initiated by the examiner, but the response was not delimited to the extent of B-factor tests. Here also some assertiveness seemed to enter the picture, particularly since the responses were not as clearly prestructured. Imitation and reproduction of the examiner's role was felt to be involved, which seem to de-emphasize the role of spontaneity. Some subjects with high loadings on this factor may have been attempting to gain or retain control of the situation, possibly due to anxiety, and the reactions may be quite superficial as opposed to a consistent personality trait. This, however, is purely speculative. The name Reactive assertion and reproduction was invented for this factor.

Factor F. Although related to the above mentioned triad of factors A, B, and E, this factor seemed to be getting at a somewhat more independent aspect of social behavior which had to do with confronting the other. Not highly related to attention as such, there seemed to be a type of social attentiveness involved, particularly when the entire pattern of test loadings was considered. At the same time the individual highly loaded on this factor seemingly maintained a certain degree of independence as seen in the loading of 'Continues story after interruption', and the low negative loadings on the two most highly loaded "curiosity" tests. This factor was named, therefore, Interpersonal confronting.

Seventh factor. The difficulty of distinguishing this factor has been previously discussed in connection with the treatment of residuals. In the oblique position this factor was so highly related to factor A that it did not seem justified to consider it separately. An examination of the oblique test loadings suggested that this factor involved a special type of orientation to social interaction and reality in general, which may be on a higher level than the general capacity represented by factor A. The most significant loadings came from 'Neat personal appearance', 'Remarks about baby picture', and 'Reacts to criticism'. These were not the three most highly loaded tests on the factor, but they were more highly loaded on the seventh factor than on any other. Due, however, to the lack of clarity of this factor, it was not named.

Factor Loadings for Individuals

Schizophrenic subtype. Since the factors were derived from the test performances of the schizophrenic group, it was important to have some notion as to the relationships of the major subtypes to the factor structure. Table 21 shows a breakdown into three major subtypes of schizophrenia which includes 90 of the 100 subjects. Ten other subjects were classified in groups too small for comparative purposes. In this comparison it should be pointed out that factor loadings were computed on the basis of the correlations between subtype and cluster tests only. An examination of the matrix reveals only two loadings with probable significance, and two others which approach significance. All of these occurred on factors A and B, and in general confirm the conventional psychiatric appraisal of the subtypes with respect to social behavior. Paranoids are more highly loaded on these two factors than either of the other subtypes, suggesting that they retain a relatively good social capacity, and are relatively more responsive motorically to social stimuli. The trend of catatonics, however, is toward greater social understanding (Factor A) than their behavior (Factor B) would indicate. This trend is consistent with the notion that stuporous catatonics most often comprehend the events in their environment, despite a lack of overt response to them. And, as any psychiatric text will point out, they often are able to reconstruct

TABLE 21

SIX FACTOR OBLIQUE MATRIX FOR SCHIZOPHRENIC SUBTYPE

Diagnosis	Oblique Factor					
	A	B	C	D	E	F
Paranoid type	.42	.36	-.20	.05	.23	.13
Catatonic type	-.09	-.30	.07	-.18	-.22	-.10
Hebephrenic type	-.56	.12	-.13	.11	-.05	-.13

the events occurring about them after the stupor has terminated. The fact that the trend in the factor loadings is not pronounced to the extent of significance is probably due not only to the heterogeneity of the catatonic group studied, but also to the necessity for excluding patients in severe stuporous states.

The finding for hebephrenics with regard to the discrepancy in loadings for factors A and B tends toward the reverse of that found for catatonics. The trend here is for hebephrenics to show some motoric responsiveness in the presence of poor social understanding and orientation. These findings tend to confirm the speculations of Sillman (36), who pointed out that with hebephrenics thought and motor expression become confused. With catatonics, he believed, motor expression is not regulated by ideation, so that it is excessively released or inhibited. Thus, he felt, and the findings of this study tend to agree, that schizophrenia involves a loss of integration of ideation and motility.

Case history variables and cooperation. While negligible factor loadings by case history variables would have added to the generality of the factors in terms of other populations, the fact that several significant loadings were obtained, as seen in Table 22, can add to the validity of interpretation. The first to be considered is the sex variable. The fact that all loadings are negative may exceed the expectations of chance, but generalizations concerning the relationship between sex and

TABLE 22

OBLIQUE FACTOR LOADINGS FOR CASE HISTORY VARIABLES AND COOPERATIVENESS RATING

Case History Variable	Oblique Factor					
	A	B	C	D	E	F
Sex, female	-.21	-.04	-.29	-.23	-.47	-.12
Age, < 36	.15	.06	.51	.17	.39	.01
Living with spouse	.13	-.09	.00	-.17	-.24	-.12
Education, > 10 years	.30	-.04	.11	-.01	.28	.12
Duration of illness, <7 years	.22	-.03	.41	.11	.37	.12
Very cooperative	.79	.46	.11	.02	.67	.55

social behavior in schizophrenia cannot be made. Rather, the specific correlations responsible for this must be examined. For example, the correlation between female sex and 'Expresses political opinion' is significantly negative, and another test 'Follows E's gaze' almost approaches negative significance. These correlations account for the negative loadings for females on factor E. Sex differences in the expression of political opinion is a cultural truism, which apparently schizophrenia does not destroy. On examining other specific correlations it was found that the females in this study were slightly less attentive, picked up the dropped pencil less frequently, and were more reluctant to state a name preference. As regards factor loadings, however, it may be said that these schizophrenic females were less assertive than the males. On the seventh factor, discussed above, it was found that female sex was positively related to tests important to the factor: 'Helps E. recall name' and 'Responds socially to baby picture'. The latter also seems to be a cultural phenomenon which may be preserved in schizophrenia.

As regards age, the fact that those subjects under 36 were fairly highly loaded on factor C, Restitutional curiosity, seems to support the interpretation of that factor. Restitutional symptoms are more in evidence during the early stages of the illness according to Fenichel (19) where the ego still grasps for reality. There was also a trend for the younger subjects to be more assertive, but the loading did not reach significance.

Education showed no significant loadings, but it is worth noting that this variable was more highly loaded on factor A than the other case history variables under consideration. On the one hand this finding suggests that the amount of education a subject received is related to his general social capacity, but that general social capacity involves more than mere academic achievement. Examining the loadings for duration of illness, it will be noted that those schizophrenics whose illness was of less than seven years duration were more highly loaded on factor C, which again tends to support the restitutional aspect of that factor. The fact that younger patients have, in general, been ill for a shorter period does not detract from the relationships of these variables to factor C considered separately. Approaching significance also is the loading of duration on factor E. It would seem generally that the shorter the illness the greater is the preservation of the élan vital which characterizes the normal social being.

The ratings of general cooperativeness which were made on all subjects proved to have significant loadings on four of the six oblique factors. Most striking was the relationship between cooperation and the triad composed of factors A, B, and E. It is to be admitted at the outset that cooperation is a rather vague concept which defies denotative definition, at least as employed here. Rather, the rating depended on the investigator's clinical impression of cooperation and therefore was not included in the somewhat more definitive test

scale. Thus, it was highly subject to the halo effect carried over from test ratings having to do with compliance, attentiveness, and general responsivity. In view of this, the loadings on the above factors were not unexpected, and little is gained in the way of interpretation. However, one speculation should be made. If a given patient had a high loading on factor A, and related factors, it was probable that his comprehension of the situation caused him to cooperate, i.e., the examiner represented an official of the hospital from which, let us assume, he desired release. If this were true, a minor test of the validity of factor A was had.

In regard to the moderately high loading of cooperation on factor F it can be said that "confronting" as meant here does not apparently involve a hostile approach to the situation. Evidently a subject was able to confront the examiner, maintain some independence, and yet be cooperative--a rather high-level social ability.

In reference to the discussion of the loadings for sex, it was brought out that females had consistently low negative factor loadings on all factors except E, which was significantly negative. Since proportionately more males are included in the non-schizophrenic group, the examination of differences on factor E should be qualified in light of this discrepancy. At this point the question might be raised as to whether schizophrenic and non-schizophrenic females can be viewed as homogenous with respect to sex differences in

behavior. It is felt that, due to the heterogeneity of schizophrenics in general, the variable of sex may be abstracted from the diagnostic context for purposes of exploring sex differences.

The dichotomous distributions for age were matched perfectly for the two groups, and the other case history variables can be ignored, not only because of the slight differences, but also because they have no significant factor loadings. The most striking difference between the groups in this table is in cooperation, for which all non-schizophrenic subjects received high ratings. This variable could not be controlled since no relatively uncooperative non-schizophrenics were available in the hospital population. Further, such patients, if they were available, would probably not be representative of hospitalized non-schizophrenics in general. Cooperation is most probably, however, a result, and not a cause of the ability represented by the factors to which it is related. To the extent that this is so, it would be artificial to attempt to control this variable.

Factor loading indices. A factor loading index was computed for each subject, of both groups, on each of the factors. The method employed in this operation has been previously discussed. Table 23 shows the obtained results in terms of the mean factor loading indices for schizophrenic subtypes and non-schizophrenics. It will be remembered that this analysis makes use of all tests significantly loaded on a factor as

TABLE 23

MEAN FACTOR LOADING INDICES FOR SCHIZOPHRENIC SUBTYPES AND NON-SCHIZOPHRENICS

Diagnosis	Oblique Factor					
	A	B	C	D	E	F
Paranoid	4.58	2.60	0.45	1.03	1.18	0.81
Catatonic	3.13	1.87	0.57	0.71	0.94	0.67
Hebephrenic	1.89	1.92	0.45	0.70	0.92	0.64
Non-schiz.	6.48	3.50	0.72	1.27	1.96	1.14

opposed to the computations of factor loadings for diagnostic categories which considered only those tests in clusters which located the centroids. In this table only raw means are reported, and comparisons can be made only within columns since the means are not comparable from factor to factor. Table 24, Appendix A shows the means of the previous table which have been weighted by simply dividing by the respective sums of the squared factor loadings of the significantly loaded tests on each factor. The divisor for each factor was, of course, equivalent to the maximum obtainable factor loading index for that factor. Figure 1 following this table presents the material graphically, and aids in grasping the total picture.

The differential factor loadings among schizophrenic subtypes have been previously interpreted, and in this regard the two foregoing tables and Figure serve only to lend clarification to those trends. The major purpose for computing the factor loading indices was to compare schizophrenics and non-schizophrenics in as accurate a manner as possible within the context of the present study. The number of non-schizophrenics was only 40, but there seemed little value in exceeding this number when the schizophrenic subtype groups included only 43 paranoids, 32 catatonics, and 15 hebephrenics. Further, there was little variability in factor loading indices for non-schizophrenics, which resulted in extremely small standard errors of the means for each factor. Table 25, which shows the t ratios for the differences between mean factor

TABLE 25

t RATIOS FOR DIFFERENCES BETWEEN MEAN FACTOR LOADING INDICES AMONG DIAGNOSTIC CATEGORIES

Diagnostic Categories	d.f.	Oblique Factor					
		A	B	C	D	E	F
Par. vs. Cat.	73	2.95**	2.58**	1.13	2.68**	1.33	1.38
Par. vs. Heb.	56	4.63**	1.71	0.00	2.42*	1.09	1.18
Cat. vs. Heb.	45	1.99*	0.12	0.75	0.07	0.08	0.21
Par. vs. Non-schiz.	81	5.95**	4.48**	3.10**	2.59**	6.11**	4.03**
Cat. vs. Non-schiz.	70	8.61**	6.45**	1.41	5.34**	6.49**	5.70**
Heb. vs. Non-schiz.	53	9.24**	4.18**	1.82	4.59**	4.71**	3.82**

* Significant at .05 level of confidence

** Significant at .01 level of confidence

loading indices among the diagnostic categories, includes the number of degrees of freedom for each comparison.

Perhaps the most important finding reflected by this table is the importance of factor A for differentiating between the diagnostic categories which were paired for comparison. In each case the t ratio was highly significant except for the comparison between catatonics and hebephrenics which met only the minimum criterion for significance. This suggests that general social orientation and capacity is significantly impaired by a schizophrenic psychosis, and further, that the extent of this impairment is relative to the type of reaction syndrome developed. The fact that hospitalized non-schizophrenics were employed suggests that the ability measured by factor A transcends mere residency in a mental hospital. What is not known, however, is whether this impairment seen in schizophrenics is due to psychosis or schizophrenia, if such a distinction can be made. Data obtained from non-psychotic schizophrenics or non-schizophrenic psychotics would aid in the clarification of this unknown aspect of factor A.

All of the comparisons of the differences between means among non-schizophrenics and schizophrenic subtypes were highly significant in favor of non-schizophrenics, except on factor C. While the mean factor loading index for non-schizophrenics on factor C was higher than for any schizophrenic subtype, only in the comparison with paranoids did this difference

reach significance. The possible meaning of this factor, Restitutional curiosity, in schizophrenia has been discussed at length, and it was suggested that the behaviors encompassed by this factor may have a qualitatively different significance outside of schizophrenia. The trends of the data suggest that the meaning of this factor may even be specific to catatonics, but no reliable evidence to support this is forthcoming. These findings emphasize the danger of interpreting behavior in isolation without regard to its relativity. The interpreter's point of view is important here in much the same way as in the case of severe anxiety symptoms which, on the one hand suggest psychopathology, but on the other, a favorable prognosis.

The tenuousness of this investigation has been frequently emphasized, particularly with reference to the factor analytic solution and the interpretation of the obtained factors. This caution is urged even more strongly in the interpretation of factor loading indices beyond very broad generalizations. The concepts represented by the factors may or may not be those which differentiate usefully among individuals, even for purposes of description. The fact that significant differences were obtained so consistently suggests that the factors may be useful for description, but little can be said here beyond the observation that schizophrenics and non-schizophrenics behave differently in this situation. The behavior measured was largely social and interpersonal in nature, and it is likely

that its impairment in schizophrenia is intimately associated with the etiology of the disorder. Within schizophrenia there were differences in this behavior and it is likely that this too is related to etiology, but in a more specific way.

The Higher Order Factors

The entire problem of the organization of variables is a complex one, and one which transcends the technique of factor analysis. Factor analysis has, however, taken upon itself the classical problem of level of analysis and has much to offer toward its clarification. Psychology as a science has had much difficulty in deciding upon levels of analysis and units of measurement which would prove useful for purposes of description of behavior of the sort in which it is interested. Many and varied attempts have been made to employ units ranging along a size continuum from the minute units of measurement employed by the physical and biological sciences to the gross units used by sociology. The variables employed in this study, for example, may be in some cases very complex as to composition of lower-order variables, while others are more pure with respect to the variables which they organize. And so it is with factors which may show extreme variability as to their makeup, and the variable constellations which they represent. From the point of view of the things which are organized the organizer is a relatively independent influence, but the organizer is itself organized into an even

larger context upon which it may be highly dependent. The analogy may be made to the construction of an outline wherein the sub-categories are organized by the larger categories, and the latter by even larger ones. Factor analysis attempts to build up toward the larger categories as opposed to a strictly hypothetical-deductive system which begins with them. At the present stage of research in personality it is more desirable to discover the larger functional unities, and both approaches may complement one another in this respect. One empirical investigation employing factor analysis cannot, however, establish these larger wholes with any sense of finality. Many investigations within the same and related domains are necessary, particularly if the choice of variables is not guided by theoretical formulations. Higher order factors, then, must be regarded as being as tentative as those factors which they organize.

To establish the second-order factors in the present study, the matrix of oblique factor intercorrelations was factored. This was done by inserting the highest value in each column in the diagonals as communality estimates. Only one cluster could be clearly identified and this was extracted as a group centroid. Based on the cluster of factors A, B, and E, this second-order factor accounted for 76 percent of the estimated communality. Residuals were computed in the usual manner, and a complete centroid was placed through the residual matrix. This latter factor accounted

for only 11 percent of the original estimated communality, and suggested that little remained in the way of group factors. Table 26 shows the orthogonal matrix for these second-order factors. Factor II seems to have little meaning, particularly in its unrotated, orthogonal location with respect to factor I.

Factor I has been anticipated in previous discussions at which time the usefulness of the triad of factors A, B, and E was examined. Not only do these factors show high loadings on factor I, but the other factors are also loaded to the point of significance. Thus, this second-order factor would appear to be general in nature, in that it organizes much of the observed variability. While such a factor must be considered tentative, certain speculations may be made. This factor may broadly define an area of general social ability which arises from the socialization process and early cultural learning common to all human beings in our society. It may be that this same study, if repeated on normals, would not reveal separate factors similar to A, B, and E, but would derive a larger general factor, similar to factor I directly from the data.

It may be further speculated that this broad general factor is differentially impaired in schizophrenia, and some evidence for this is reflected in the differential loadings for schizophrenic subtypes among the A-B-E triad of factors. This raises interesting questions concerning the etiology of

TABLE 26

FACTOR LOADINGS FOR TWO ORTHOGONAL FACTORS DERIVED FROM INTERCORRELATIONS OF SIX OBLIQUE FACTORS

Oblique Factors	Orthogonal Factors		h^2
	I	II	
A	.81	-.10	.67
B	.82	-.17	.70
C	.40	.24	.22
D	.43	.32	.29
E	.80	.10	.65
F	.43	-.37	.32
Σa_{ij}^2	2.50	0.35	2.85

this impairment in schizophrenia, and the roles of the parents who act as agents for the transmission of much of what is learned in the way of social and cultural responses.

It may well be that factor I represents an over-abstraction which has little value for description, but on the other hand it may prove useful for higher-level categorization. Substantiation would be necessary, however, for whatever purpose it may serve.

Suggestions for Future Research

A factor analytic study such as this represents an attempt to discover new relationships. This was an exploratory study because the observed relationships, regardless of their reliability, are of unknown usefulness, except for the circumscribed descriptive comparisons made earlier. The choice of the variables themselves is open to question, since such a wide variety of things may be observed. The use of specific hypotheses in further studies can give meaning and organization to the variables employed. Thus, at all stages of the present research, many questions are raised.

The present method should be contrasted with some of the more conventional procedures in clinical psychology, for example, the use of objective tests, since further research is suggested. The present study made no *a priori* assumptions about the interrelatedness of variables and set out to study the relationships of items of behavior which had little

conceptual treatment. It would be important to bridge the gap between the more time-honored categories, such as those of the Wechsler-Bellevue Scale subtests and the MMPI divisions, and the present categories represented by the factors. Many objective tests have not been shown to be factorially pure, and a breakdown of their items with the inclusion of such items as were employed in the present investigation, would result in test procedures which transcend those of the present.

Assuming that the social behavior of schizophrenics is a fruitful area for research, and the literature concerning etiology would suggest that it is, other methods might be devised for observation. This may take varied forms, whether it be observations of spontaneous ward behavior, or behavior in a planned group situation, or even techniques similar to the one employed here in which a good deal of deliberate structure was had. Each of these techniques would involve different sets of variables which is desirable from the point of view of enlarging our understanding. Methodology should by no means be limited to the use of factor analysis, since more deductive methods may help to build sorely needed theories applicable in clinical psychology in general, and psychopathology in particular.

There would be some value, however, in further factor analytic studies in the same general area in order to test for the presence of the factors derived by the present study. The present factors might serve to suggest variables which

would provide more extensive tests of the factors. This would serve to purify the factors by exclusion of poor tests and inclusion of tests which are better measures of the source traits represented by the factors. On the basis of such further exploration and purification, the complex procedure of rotation to simple structure would be justified. Even more practical in this regard would be an analysis employing Q technique in which the emphasis would be on types of individuals who share similar patterns of reaction. If relatively pure types of individuals were thusly established, the way would be open for an intensive study of etiological factors associated with each type. Since the etiology of schizophrenia seems to be closely associated with the early social life of the individual, it would be more logical to study criterion groups which are more pure with respect to the behavior being investigated. While some homogeneity of social behavior is seen in the Kraepelinian diagnostic groupings, it is not unreasonable to attempt better categorization in this regard.

Because of the extensiveness and probable validity of the second-order factor I, which arose out of the clustering of first-order factors A, B, and E, there would be much value in testing its usefulness. It would be desirable to trace the etiological factors associated with high and low loadings on this factor. Of more immediate practical import would be information as to response to treatment and prognosis of schizophrenic criterion groups composed on the basis of their factor

loadings. In this regard, such criterion groups would permit a study of post-hospital adjustment, which is associated closely with social behavior.

In general, there would seem to be little value in furtner investigations designed to demonstrate differences in the factor loadings or factor loading indices between an amassed group of schizophrenics and any other diagnostic group. This study deliberately placed approximately half of the subjects in each of the dichotomous categories, in order to differentiate among schizophrenics. Schizophrenics as a group are not homogenous, either in symptomatic reactions, response to treatment, or in post-hospital adjustment. The clinician must concern himself with the possible differentiae which may be related to, and aid in the prediction of these reactions. To this end he needs conceptual categories which will aid in the construction of criterion groups with which to study these reactions. This study has empirically demonstrated certain relationships among variables which may not only aid in such investigations, but lead to a more systematic approach to categorical thinking about schizophrenia.

SUMMARY AND CONCLUSIONS

A review of previous work in schizophrenia revealed that impairment in social behavior is a prominent aspect of the clinical manifestations of the disorder, and that it may be closely associated with its etiology. A diversity of conceptual treatment of these observations suggested a need for concepts which can facilitate further systematic exploration in this area. Among the various methodological alternatives to which the clinical psychologist may resort, factor analysis, considered as a branch of statistical method, offers many advantages. Several factor analytic approaches are particularly applicable to the problems encountered in clinical psychology research.

This investigation commenced with a selection of 46 behavioral items which seemed to be of social import, and subject to some sort of measurement. All of the responses were elicited in an interview situation, which included some more-formalized tests. The test items were roughly scaled and later reduced to dichotomous scoring categories for the calculations of tetrachoric correlations. The correlations were based on the test score distributions of 100 schizophrenic subjects who were highly variable with regard to subtype classification, age, duration of illness, education, etc. The final matrix of the intercorrelations of 46 variables was subjected to the

multiple-group centroid type of factor analysis. Preliminary factorization aided in the most meaningful placement of the first two factors, which were of the greatest size and import. Six oblique factors were extracted which in some cases were highly related. They were named as follows:

A General social orientation and capacity
B Socio-motoric responsiveness
C Restitutional curiosity
D Nonchalance and lack of preoccupation
E Reactive assertion and reproduction
F Interpersonal confronting

The residual correlations after the extraction of these six factors failed to reveal any remaining group factors of significance.

Computations of factor loadings for case history variables were made, as well as factor loading indices for diagnostic categories. This aided not only in the interpretation of factors, but also provided minor tests of their usefulness.

A group of 40 non-schizophrenics was compared with the schizophrenic subtypes as to mean factor loading indices, and most differences were found to be significant. Significant differences between schizophrenics and non-schizophrenics were obtained on all factors except C, but were more apparent on factors A and B. Paranoids were more similar to non-schizophrenics, than either catatonics or hebephrenics. Differences among the schizophrenic subtypes suggested that they must be considered separately in regards to social ability and socio-motoric responsiveness.

Two second-order factors were extracted from the intercorrelation matrix of the oblique factors. The first of these was based on the highly related triad of factors A, B, and E, and was interpreted as a very general social ability which may be differentially impaired by schizophrenic reactions.

The entire investigation was viewed as exploratory and the relationships observed were regarded as tentative in their usefulness. The method of direct observation as employed in this study, however, is to be emphasized, and it lends a certain face validity to the relationships found. The results of this investigation, thus, may open the way for future empirical investigations in this area and assist in conceptual thinking about schizophrenia.

BIBLIOGRAPHY

1. Bales, R. F. Interaction process analysis. Cambridge: Addison-Wesley Press, 1950.

2. Bartlett, M. R. Suggestibility in paranoid patients. J. gen. Psychol., 1944, 30, 97-102.

3. Bellak, L. Dementia praecox. New York: Grune and Stratton, 1948.

4. Burt, C. L. Correlations between persons. Brit. J. Psychol., 1937, 28, 59-96.

5. Burt, C. L. Alternative methods of factor analysis and their relations to Pearson's method of principal axes. Brit. J. Psychol., 1949, 2, 98-122.

6. Cameron, N. Reasoning, regression, and communication in schizophrenics. Psychol. Monogr., 1938, 50, No. 1.

7. Cameron, N. A study of thinking in senile deterioration and schizophrenic disorganization. Amer. J. Psychol., 1938, 51, 650-665.

8. Cameron, N. Schizophrenic thinking in a problem-solving situation. J. ment. Sci., 1939, 85, 1012-1035.

9. Cameron, N. The functional psychoses. In J. McV. Hunt (Ed.), Personality and the behavior disorders. Vol. 2. New York: Ronald Press, 1944. Pp. 861-921.

10. Cattell, R. B. Psychological measurement: ipsative, normative, and interactive. Psychol. Rev., 1944, 51, 292-303.

11. Cattell, R. B. The description and measurement of personality. New York: World Book Co., 1946.

12. Cattell, R. B., with Cattell, A. K. S., and Rhymer, R. M. P-technique demonstrated in determining psycho-physiological source traits in normal individuals. Psychometrika, 1947, 12, 267-288.

13. Cattell, R. B. Personality: A systematic and factual study. New York: McGraw-Hill, 1950.

14. Cattell, R. B. On the disuse and misuse of P, Q, Qs, and O techniques in clinical psychology. J. clin. Psychol., 1951, 7, 203-214.

15. Cattell, R. B. Factor analysis: an introduction and manual for the psychologist and social scientist. New York: Harper, 1952.

16. Chesire, L., Saffir, M., and Thurstone, L. L. Computing diagrams for the tetrachoric correlation coefficient. Chicago: Univer. of Chicago Press, 1933.

17. Cohen, B. and Flower, B. H. Clinical findings in dementia praecox. Amer. J. Psychiat., 1940-41, 97, 319.

18. Deutsch, Helene. Forms of emotional disturbance; relationship to schizophrenia. Psychoanal. Quart., 1942, 11, 301-321.

19. Fenichel, O. The psychoanalytic theory of neurosis. New York: Norton, 1945.

20. Fromm-Reichmann, Frieda. Preliminary note on emotional significance of stereotypies in schizophrenics. Bull. Forest. San., 1942, 1, 17-21.

21. Gerard, D. L. and Siegel, J. The family background of schizophrenia. Psychiat. Quart., 1950, 24, 47-73.

22. Guilford, J. P. Psychometric methods. New York: McGraw-Hill, 1936.

23. Guilford, J. P. When not to factor analyze. Psychol. Bull., 1952, 49, 26-37.

24. Haas, M. Sex incidence, annual curves and incidence of schizophrenia. Arch. f. Psychiat., 1938, 108, 552-561. (Cited in (3)).

25. Hunt, J. McV., and Cofer, C. N. Psychological deficit. In J. McV. Hunt (Ed.) Personality and the behavior disorders. Vol. 2. New York: Ronald Press, 1944. Pp. 971-1032.

26. Johnson, D. M., and Reynolds, F. A factor analysis of verbal ability. Psychol. Rec., 1941, 4, 183-195.

27. Jones, E. S. Subjective evaluations of personality. In J. McV. Hunt (Ed.) Personality and the behavior disorders. Vol. 1. New York: Ronald Press, 1944. Pp. 139-169.

28. Kasanin, J. S. Developmental roots of schizophrenia. Amer. J. Psychiat., 1945, 101, 770-776.

29. Kohs, S. C. Intelligence measurement. New York: Macmillan, 1923.

30. Levin, M. Misunderstanding of the pathogenesis of schizophrenia, arising from the concept of "splitting". Amer. J. Psychiat., 1937, 94, 877.

31. Lewis, N. D. C. Outlines for psychiatric examinations. (3rd Ed.) Utica: State Hospital Press, 1943.

32. Maas, H. S., Varon, E., and Rosenthal, D. A technique for studying the social behavior of schizophrenics. J. abnorm. soc. Psychol., 1951, 46, 119-123.

33. Meyer, A. Fundamental conceptions of dementia praecox. Brit. Med. J., 1906, 2, 757. (Cited in (3)).

34. Myerson, A. Scrutiny, social anxiety, and inner turmoil in relationship to schizophrenia. Amer. J. Psychiat., 1948, 105, 401-409.

35. Rabin, A. I. Social contacts of psychiatric patients--some preliminary observations. Psychiat. Quart. Suppl., 1945, 19, 177-183.

36. Sillman, L. R. The dynamics of schizophrenia. J. nerv. ment. Dis., 1947, 105, 61-72.

37. Slotkin, J. S. Nature and effects of social interaction in schizophrenia. J. abnorm. soc. Psychol., 1942, 37, 345-368.

38. Snedecor, G. W. Statistical methods. Ames, Iowa: Collegiate, 1937.

39. Spearman, C. General intelligence objectively determined and measured. Amer. J. Psychol., 1904, 15, 201-293.

40. Stephenson, W. The inverted factor technique. Brit. J. Psychol., 1936, 26, 344-361.

41. Sullivan, H. S. Conceptions of modern psychiatry, the first William Alanson White Memorial Lectures. Psychiat., 1940, 3, 1-117.

42. Terman, L. M., and Merrill, M. A. Measuring intelligence. New York: Houghton Mifflin, 1937.

43. Thurstone, L. L. The vectors of mind. Psychol. Rev., 1934, 41, 18-21.

44. Thurstone, L. L. Multiple factor analysis. Chicago: Univer. of Chicago Press, 1947.

45. U. S. Public Health Service Publication No. 233. Patients in mental institutions 1949. Washington: U. S. Gov't. Printing Office, 1952.

46. Wittenborn, J. R. Factorial equations for tests of attention. Psychometrika, 1943, 8, 19-35.

47. Wittman, M. P. and Steinberg, D. L. Prodromal factors in schizophrenia. Amer. J. Psychiat., 1944, 100, 811-816.

APPENDIX A

TABLE 6

COMPARISON OF SCHIZOPHRENIC AND NON-SCHIZOPHRENIC GROUPS WITH RESPECT TO CASE HISTORY VARIABLES AND RATINGS OF COOPERATIVENESS

Category	Percent of Cases	
	Schizophrenic	Non-schizophrenic
Sex, female	39	20
Age, < 36	50	50
Living with spouse	31	38
Education, > 10 years	51	40
Very cooperative	52	100

TABLE 7

PERCENT OF PLUS SCORES BY TESTS

Test No.	Percent Plus	Test No.	Percent Plus
1	72	25	48
2	44	26	34
3	57	27	73
4	43	28	42
5	62	29	47
6	61	30	49
7	44	31	52
8	48	32	53
9	44	33	44
10	50	34	56
11	57	35	51
12	48	36	49
13	71	37	51
14	57	38	38
15	45	39	10
16	44	40	45
17	36	41	57
18	52	42	25
20	28	43	31
21	69	44	64
22	36	45	52
23	68	46	85

TABLE 11

CLUSTERS DETERMINING GROUP CENTROIDS

Cluster		Test	
Symbol	Name	No.	Name
A	General social orientation and capacity	27	Helps E. recall name
		31	Imitates E.'s bead stringing
		32	Varies reading rate with E.
		33	Re-enacts task seq. (gross)
		35	Good attention
		36	Verbally fluent
		37	Good social vocabulary
B	Socio-motoric responsiveness	1	Responds to E.'s pace
		2	Offers hand in res. to E.
		8	Res. to tack on E.'s chair
		41	Presence of mood modulation
C	Restitutional curiosity	25	Retrieves dropped pencil
		28	Attempts difficult task
		42	Curious about tail in box
D	Nonchalance and lack of preoccupation	12	Crosses legs
		13	Relaxes body
		21	Res. to interrupting question
E	Reactive assertion and reproduction	3	Uses pressure in handshake
		16	Follows gaze of E.
		26	Expresses political opinion
F	Interpersonal confronting	5	States name preference
		6	Sits near E.
		15	Confronts E.'s stare

TABLE 12

AVERAGE INTERCORRELATIONS WITHIN AND BETWEEN CLUSTERS

	A	B	C	D	E	F
A	.58	.39	.17	.22	.36	.21
B	.39	.59	.12	.14	.38	.14
C	.17	.12	.45	.08	.20	.04
D	.22	.14	.08	.47	.18	-.01
E	.36	.38	.20	.18	.56	.17
F	.21	.14	.04	-.01	.17	.38

TABLE 14

COSINES OF THE ANGULAR SEPARATION BETWEEN THE SIX OBLIQUE FACTORS

	A	B	C	D	E	F
A	1.00	.67	.34	.43	.63	.45
B	.67	1.00	.24	.27	.66	.30
C	.34	.24	1.00	.18	.39	.10
D	.43	.27	.18	1.00	.35	-.02
E	.63	.66	.39	.35	1.00	.38
F	.45	.30	.10	-.02	.38	1.00

TABLE 17

COMMUNALITY ACCOUNTED FOR BY SIX OBLIQUE FACTORS

Oblique Factor	Percent of Estimated h^2	
	Trial factoring	Final with adj. h^2
A	45.76	49.69
B	11.05	12.05
C	8.72	9.48
D	7.17	7.94
E	7.52	8.30
F	7.33	8.20
Total	87.55	95.66

TABLE 18

RESIDUAL MATRIX AFTER EXTRACTION OF SIX FACTORS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	06																																										
2	15	02																																										
3	08	08	04																																									
4	06	00	08	05																																								
5	08	04	-01	-10	02																																							
6	02	03	02	00	-03	00																																						
7	-01	01	13	-06	-10	-06	01																																					
8	12	-01	08	-04	12	00	-05	01																																				
9	11	-05	-14	-06	08	-14	23	08	00																																			
10	06	-02	-14	14	04	08	-06	-03	-05	04																																		
11	04	-01	10	-07	-16	10	05	-04	-08	04	18																																	
12	14	-15	04	-06	-14	16	-02	-11	04	06	03	04																																
13	01	04	04	21	-12	06	16	06	-06	05	-15	-11	02																															
14	01	-12	01	-01	10	-14	-14	01	18	00	-05	-05	-10	01																														
15	05	-07	-01	10	01	03	16	-13	05	08	06	-02	04	10	04																													
16	04	-06	-03	01	06	-02	-13	08	05	-04	-04	02	-11	-03	-01	01																												
17	20	18	-05	-15	-04	05	-13	00	00	01	23	04	-12	01	05	-04	17																											
18	16	-02	-07	00	03	-02	-15	-17	08	23	03	08	-17	-03	00	05	-23	02																										
19	-08	-12	00	11	-03	-18	-07	04	12	-08	-08	12	-21	06	22	13	06	00	01																									
20	-13	11	-07	-16	26	-22	-14	06	-04	-12	13	03	01	15	-05	04	08	04	04																									
21	-05	13	22	-01	15	-05	-07	-04	-05	04	-04	-13	22	14	-10	20	-06	-12	-17	-10	02																							
22	-32	-05	-20	-29	02	-01	04	24	-01	-13	14	29	-01	-01	-02	06	20	08	-02	-29	-04	06																						
23	-04	12	04	00	07	-05	-05	-03	00	03	-02	-05	-16	16	-03	-05	15	-12	-02	15	-08	-06	04																					
24	02	-06	00	-08	-04	03	01	01	10	18	01	-07	07	02	04	03	08	02	-13	-01	-01	13	-04	13																				
25	-07	03	-03	08	15	-11	10	17	04	12	-15	05	07	10	-03	01	-13	08	-15	-12	24	29	00	03	04																			
26	03	01	-04	-05	-04	04	-04	-12	-17	11	-30	04	-01	-17	-03	02	-12	15	-01	-01	02	-07	-02	07	-04	06																		
27	06	-08	06	16	-04	07	08	-15	-02	-15	-04	07	04	-08	03	10	05	-15	-28	-10	20	-10	22	-17	-03	34	14																	
28	-04	-02	-04	-04	04	11	10	02	10	06	22	01	-14	05	-15	15	00	-12	-17	16	-02	43	04	-10	21	-14	05	16																
29	10	-04	-04	02	-01	-07	12	01	03	04	-16	04	-20	17	07	-01	-13	13	-13	12	-11	-05	04	05	-01	-07	21	-24	00															
30	-12	02	10	17	-01	15	07	06	03	-21	21	02	-07	-20	-16	03	01	02	-04	04	00	-21	05	-14	-03	11	12	04	00	00														
31	08	-05	-01	-11	-07	20	11	-01	-08	00	23	07	06	-13	-13	-13	00	-03	13	-14	-06	11	02	14	07	-08	-12	05	-01	05	01													
32	-05	11	07	-08	-02	-07	-06	05	-13	04	-10	-04	03	-11	07	01	17	-19	10	01	08	-13	-16	-08	-05	-07	-12	-12	-01	05	-18	00												
33	09	-01	-06	13	07	-11	-26	-19	12	01	-15	-09	01	11	09	02	-07	-09	17	07	01	-05	-01	05	-09	05	20	02	01	00	-05	-02	02											
34	-02	03	02	04	00	-18	-02	-08	-05	04	05	-03	04	04	20	02	04	12	24	-01	-19	01	-17	-02	01	12	00	-08	00	-04	-05	19	05	01										
35	-06	07	02	04	-11	12	-12	04	-05	-03	01	-12	08	-04	-02	04	31	-14	04	04	12	-04	02	-11	-06	-01	04	01	02	02	-01	07	01	05	02									
36	-16	-12	01	-14	02	-01	-37	20	07	04	08	-12	11	14	-02	-02	-05	-14	-08	02	-02	-16	05	00	15	-03	-05	00	-18	-01	03	-08	02	-07	04	01								
37	-06	-10	11	03	-22	15	-06	-05	-18	07	26	27	-13	-08	06	-08	-03	-04	-04	15	04	16	-07	-03	26	03	21	15	-16	14	10	-14	-14	-15	-01	23	08							
38	02	-16	01	-02	-08	-05	05	10	04	00	14	04	-07	13	15	-05	03	04	17	-03	01	15	-02	02	-14	11	31	12	01	03	-01	-04	12	04	-07	08	22	02						
39	03	-11	01	06	00	-06	02	16	18	-13	32	-08	17	03	05	03	-02	-03	03	-04	06	14	06	-04	10	-04	-12	06	00	-17	07	04	-04	07	-01	00	05	-08	01					
40	01	-05	-06	12	-15	00	-05	-12	27	12	-15	-06	18	-15	16	-07	-14	-34	07	-13	04	40	-34	14	23	06	01	07	22	-08	-14	06	05	11	05	07	-17	14	24	02				
41	01	02	10	-20	-04	13	03	-04	-14	05	05	02	-02	01	-10	06	00	-15	04	00	00	-12	-04	-13	-07	08	16	01	02	12	-08	-02	-04	01	08	-02	-06	01	-03	-17	01			
42	05	-07	12	-04	00	00	-01	-05	21	-02	10	05	-18	18	00	-15	12	05	08	12	14	-04	14	01	-01	-06	-17	14	-05	07	-06	-04	18	-14	06	24	20	16	-13	00	20			

TABLE 24

WEIGHTED MEAN FACTOR LOADING INDICES FOR SCHIZOPHRENIC SUBTYPES AND NON-SCHIZOPHRENICS

Diagnosis	Oblique Factor					
	A	B	C	D	E	F
Paranoid	.65	.66	.33	.60	.50	.57
Catatonic	.45	.47	.42	.60	.40	.48
Hebephrenic	.27	.48	.33	.68	.39	.45
Non-schiz.	.92	.88	.53	.88	.83	.81

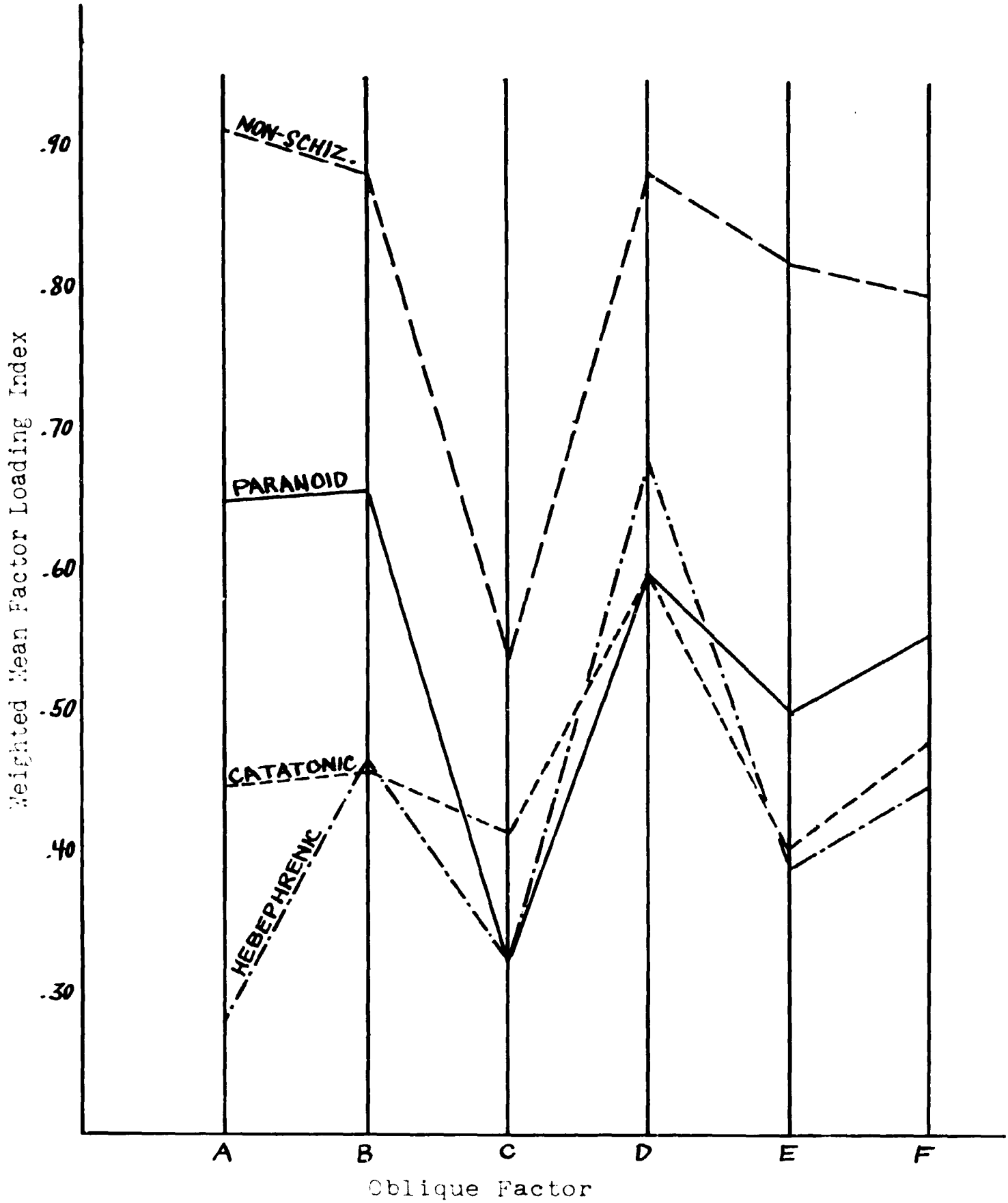

Fig. 1. Weighted mean factor loading indices by diagnostic group.

APPENDIX B

SCALE OF TESTS USED IN ANALYSIS

1. Response to E.[1] quickening his pace.

   While walking with P. to examining room, E. quickens his pace.
   1. P. keeps up with E. with little or no lag.
   2. P. attempts to keep up to E. but with noticeable lag.
   3. P. makes some attempt to keep up, or at least notices E.'s quickened pace, but shows markedly inadequate response.
   4. P. makes no apparent attempt to change his pace.

2. Response to E.'s offer of hand.

   E. offers hand immediately upon P.'s entrance.
   1. P.either precedes E. or offers hand in response to E. with no delay.
   2. P. delays offering hand, but not markedly, and with no obvious sign of lack of comprehension.
   3. P. delays markedly in offering his hand, with or without signs of non-comprehension.
   4. P. does not respond to offer of E.'s hand.

3. Strength of grip in handshake.

   1. Strength of grip exceeds E.'s.
   2. Strength of grip is about equal to E.'s.
   3. Strength of grip is noticeably less than E.'s.
   4. Little or no grip is exerted by P.

4. Orientation of S.'s glance when shaking hands.

   When shaking hands, E. looks at P.
   1. P. returns E.'s glance entirely, or almost entirely, throughout handshake.
   2. P.'s glance is directed part of the time at E., and partly at self or room.
   3. P.'s glance only fleetingly directed toward E.
   4. P.'s glance directed away from E., or downward, almost constantly.

---

[1] The designation "E." is employed throughout as an abbreviation for Examiner, as is the designation "P" for Patient.

5. Name patient wants to be called.

After E. introduces self and confirms P.'s name, E. asks what P. wishes to be called.

1. P. responds with either first name, last name (with or without Mr., Mrs., or Miss), or with nickname,
2. P. attempts to give some answer but with delay or indecision.
3. P. says "I don't care" or something similar, or does not respond.

6. Seat taken by patient.

Two identical soft chairs are available to P., one being obviously closer to E.'s chair behind the desk. If P. asks which seat, after being invited to sit down, he is told "either one."

1. Closer seat chosen.
2. Further seat chosen.

(For purpose of a standard seating arrangement, P. is asked to sit in the seat closer to E. if he chooses the further one, by means of the following statement: "Oh, I guess it would be better if you sat here," indicating closer chair.)

7. Obstacle to sitting.

On each of the chairs is a small box arranged so that it is possible to sit without moving the box, but in so doing the sitting position would be cramped.

1. P. removes the box, either giving it to E., or putting it on the desk.
2. P. pushes box to one side so that there is more sitting room.
3. P. sits without disturbing box.
4. P. sits on box.

8. Response to tack on E.'s chair.

Fastened to E.'s chair is a thumb tack (arranged so that E. apparently sits on it and can produce it.) E. jumps slightly, picks up tack and remarks "I wonder how that tack got on my chair."

1. P. laughs or consoles E. in some manner.
2. P. laughs very mildly, smiles, or shows some consolation of non-verbal nature.
3. P. notices situation, but shows no specific reaction of enjoyment or consolation.
4. P. shows no apparent response.

9. Initial verbal response of P.

After P. is seated and E. orients toward P., he says nothing for about ten seconds.
1. P. gives socially constructive response: Starts conversation, raises E.'s status, etc.
2. P. asks a question.
3. P. says nothing.
4. P. is socially destructive in remarks.

10. Speed of locomotion.

Time in seconds to walk specified distance. (P. is asked to put on room light.)

11. Response to offer of cigarette.

E. asks "Would you care for a cigarette?", at the same time offering an open pack in his hand.
1. P. accepts with "thank you" or equivalent indication, or declines with similar nicety.
2. P. accepts without response, or declines with inadequate response.
3. P. grabs, or accepts in some other way neglecting recognition of gift from other, or merely refuses by no action at all.

12. P.'s legs crossed or "open" during initial stages.

During the early stages of the interview E. observes predominant position of P.'s legs.
1. Separated and uncrossed.
2. Touching and uncrossed.
3. Loosely crossed, i.e. foot, ankle, or lower calf of one leg crossed over other leg.
4. Tightly crossed, i.e. upper calf or knee of one leg crossed over other leg.

13. Bodily position of P. during initial stages.

1. Slouched, or overly-relaxed.
2. Normally relaxed posture.
3. Stiff posture.

14. E. compliments P.'s personal appearance.

E. says "I notice that you keep yourself looking neat."
1. P. thanks E., or apologizes for appearance.
2. P. nods or otherwise recognizes E.'s comment.
3. P. reacts inadequately or not at all.

15. Response to E.'s staring at P.'s eyes.

E. looks at P.'s eyes, waits until P. fixates on E.'s eyes, measures number of seconds until P. looks elsewhere.

16. Response to E.'s sudden looking outside.

E. suddenly turns head at a time when P. is oriented toward him, at the same time turning swivel chair slightly, and looks out the window to his back.

1. P. follows E. with his glance with little or no delay.
2. P. slowly follows E.
3. P. looks at E., or shows some reaction other than above.
4. P. shows no noticeable reaction.

17. Response to remark about weather.

After looking outside, E. returns and orients to P., and gives an opinion on the weather.

1. P. agrees or disagrees, and elaborates with own opinion or comment.
2. P. accepts E.'s comment, but does not elaborate further than a word or two of agreement or disagreement.
3. P. gives some non-verbal recognition of E.'s comment.
4. P. shows no noticeable reaction.

18. Memory of E.'s statement of number over phone.

E. dials artificial number on phone and says in normal voice (loud enough for P. to hear.) "Oh, say, that number you wanted was 213------O.K." After E. hangs up he pauses a moment, then asks P. in puzzled tone "What number was that I told him?"

1. P. tells number correctly.
2. P. tells number incorrectly.
3. P. doesn't know number.

19. Response to E.'s staring at P.'s feet.

E. stares at P.'s feet at a moment when P. is oriented toward E.

1. P. makes some comment re: E.'s act.
2. P. looks at own feet or at E.
3. P. shows no apparent reaction.

20. Response to E.'s need of match.

With an open book of matches on desk right beside P., so that P. could see them clearly, E. puts a cigarette in his mouth and feels his pockets, obviously in search of a light.

1. P. lights E.'s cigarette.
2. P. indicates location of matches or pushes them toward E.
3. P. reacts by watching E. but does not seem to comprehend, or does nothing.
4. P. shows no reaction.

21. P. tells story, E. interrupts with question.

E. asks P. to tell him what he does in the hospital. When P. starts talking, E. asks the following question in the middle of one of P.'s sentences: "How old are you?"

1. P. responds immediately with age, correct or not.
2. P. delays noticeably, but responds with age or "I don't know".
3. P. does not respond with age.

22. Continuance of story after interruption.

After E. interrupts P.'s story with a question, E. remains silent allowing P. to continue unfinished story (or sentence).

1. P. picks up story in coherent fashion after E.'s question.
2. P. continues story but resumption has poor continuity with last section before interruption.
3. P. makes an attempt to continue but can't remember where he was.
4. P. makes no attempt to continue the same story.

23. Response to baby picture.

E. shows a photo of a baby to P., saying it is his niece.

1. P. examines the photo, giving some appropriate response verbally.
2. P. looks at the photo, but makes no comment or a very inadequate one.
3. P. shows no interest response.

24. Sympathy response.

E. has a bandage on his finger, and shows finger to P. saying that he just got a bad cut.
1. P. shows consoling reaction, or asks for details.
2. P. may look at finger but shows no sympathy reaction.

25. Response to pencil dropped on floor.

E. arranges pencil so as to be able to unobtrusively cause it to drop on the floor between E. and P., but closer to P.
1. P. picks the pencil up and gives it to E.or puts it on desk with no delay.
2. P. delays picking it up but does so.
3. P. notices pencil drop, or even searches with glance, but does not pick it up.
4. P. shows no reaction, except perhaps normal response to noise.

26. Response to E.'s political opinion.

E. says, after leading the discussion around to current events, "Well, there's a lot of political news lately. Personally, I'd like to see _____ elected."
1. P. agrees or disagrees, and states his own opinion.
2. P. merely agrees or disagrees.
3. P. acknowledges by verbal comment, neither his own opinion, agreement nor disagreement.
4. P. shows no verbal reaction.

27. E. asks for verbal assistance in recalling something.

E. says "Let's see--what's the attendant's name on your ward?"
1. P. responds with little delay with name, correct or incorrect, or says "I don't know," with an explanation.
2. P. does not respond or does so very inadequately, such as "I don't know", with no qualification.

28. Kohs Design A.

Before showing task, E. asks "I have a very difficult task here that most people can't do. Do you want to try it?"
1. Yes, or like response.
2. P. says "I don't know" or hesitates.
3. No, or like response.

29. Kohs Design B.

After P. accepts task, the construction of Koh's design XI, E. asks "Do you want me to help you?"
1. Yes, or like response.
2. P. says "I don't know" or hesitates.
3. No, or like response.

30. Kohs Design C.

After working with P., E. disrupts two of P.'s blocks saying "these don't belong there," with a firm voice.
1. P. asserts self with verbal comment, or accepts the criticism verbally.
2. P. reacts, but does not respond verbally.
3. P. does not react.

31. E. strings beads from Stanford-Binet Scale and asks P. if he would like to try it.

E. strings 7 beads, square, round, alternating.
1. P. responds with correct number and pattern.
2. P. uses same pattern.
3. P. uses same number.
4. P. strings beads, but uses neither E.'s number nor pattern.
5. P. does not respond.

32. E. reads a list of numbers varying his rate, after P. is asked to read with E., as closely as he can.

(See Test Instructions.)
1. P. varies closely with E.
2. P. attempts to vary rate, but inadequate.
3. P. makes slight attempt to vary rate, but with little or no success.
4. P. does not attempt to vary rate.

33. Task Sequence A.

E. says "Watch closely what I do."
(1) E. then takes paper from table between E. and P., (2) puts on window sill, (3) opens window to left of paper, (4) takes paper, (5) closes window, and (6) returns paper to original location.
E. says "Do what I did."

1 point for each error of omission, addition, and sequence.

34. Task Sequence B.

E. says "Watch closely what I do."
E. puts his hand on the desk, (1) palm up, (2) turns palm down, (3) makes a fist on the desk, (4) extends two fingers on the desk, and (5) returns to the palm down position.
E. says "Do what I did."

1 point for each error of omission, addition, and sequence.

35. Attention Test.

(See Test Instructions.)

36. Verbal Fluency.

(See Test Instructions.)

37. Social Vocabulary.

(See Test Instructions.)

38. Pencil task with dull point.

E. presents a simple design, and asks P. to copy it. The pencil given is so dull that it will make a mark if held upright, but not at an angle.

1. P. reaches another pencil which is closer to E.
2. P. asks for another pencil, or the one near E, or says "I can't write with this pencil" (notices before starting.)
3. P. complains of dull point, or that pencil won't write.
4. P. goes ahead with dull point.

39. Change of instructions.

E. presents a simple design asking P. to copy it (above), and as soon as he has well begun, E. puts another simple design alongside and asks P. to copy it. "Now copy this one."

1. P. changes immediately to new design.
2. P. continues with old design for a while, but changes to new design before completion of first.
3. P. does not change to new design, or not until completing the other.

40. Personal Appearance.

(Person and dress)
1. Clean, well-kempt.
2. Careless, but not slovenly.
3. Untidy, unkempt.
4. Dirty and slovenly.

41. Modulation of Mood.

1. Labile, over-reactive.
2. Normal modulation, moderate mood changes.
3. Tendency to flattening, dullness.
4. Flat, apathetic.

42. A box is sitting in obvious view of P., out of which an animal's tail is exposed.

E. makes no attempt to direct P.'s attention to it, and it is present throughout the interview.
1. P. physically investigates box.
2. P. asks about box.
3. P. notices box and makes attempt to discover its nature by repeated glances, but does not ask about it.
4. P. obviously notices it but does not ask about it.
5. P. apparently does not notice box.

43. Memory of E.'s name.

E. introduced self at the beginning of the interview, giving last name. Asks if P. remembers his name.
1. P. gives correct name.
2. P. gives wrong name, but similar.
3. P. gives wrong name, and dissimilar.
4. P. does not remember E.'s name.

44. Understanding of total situation.

E. asks "Why do you think I called you down here?"
1. P. gives a logical, realistic response.
2. P. gives an improbable, but fairly realistic response.
3. P. gives an unrealistic response or says "I don't know".

45. Parting response of P.

E. says "I guess that's all for today--thanks for your cooperation."

1. P. offers hand, or otherwise spontaneously gives a parting response.
2. P. gives a minor non-verbal parting response, such as nod or smile.
3. P. gives little or no apparent parting response.

46. Passage through door.

E. and P. approach door together at the termination of the interview.

1. P. precedes E. through door.
2. P. waits for E. to go through first.

Test Instructions

Kohs Design:

28. A. - (Before design is presented) "I have a very difficult task that most people can't do. Do you want to try it?"

29. B. - (After P. accepts task) "Do you want me to help you?"

30. C. - (After working with P.) E. disrupts two of P.'s correct blocks, saying "these don't belong there", with a firm voice.

31. Bead Stringing:

E. strings beads, asking P. "Would you like to try it?" (7 beads, square, round alternately.)

32. Number Reading:

"I am going to read some numbers. I will give you the same list and I want you to read along with me. Keep up with me as closely as you can."

33. Task Sequence(A and B)
34.

"Watch closely what I do" -- "Do what I did."

35. Attention Test:

"After each group of 3 numbers in the first column is a plus or minus mark, or a blank space. The idea is to put a plus mark if the first number is the largest of the three, and a minus mark if the third number is the largest. Otherwise it is left blank in the answer space. I will show you how it works. (E. gives six samples.) Now you will begin with column 1 and put in the right marks. I will read the letter first so you can keep track of where we are, and then I will read the number. Remember, plus if the first number is largest, and minus if the last number is largest. Otherwise leave the answer space blank. Ready?"

36. Verbal Fluency:

"I want you to write as many different words as you can on this paper. Any kind of words will do. I will tell you when to stop."

37. Social Vocabulary:

"I am going to read a list of words and I want you to tell me after I read each one whether they are good or bad socially. Say yes if they are words that are friendly or desirable socially and say no if they are unfriendly or undesirable socially."

* 1. Friend
2. Ridicule
3. Disagree
* 4. Greet
5. Withhold
* 6. Conversation
* 7. Trust
* 8. Compliment
9. Reject
* 10. Congratulate
11. Argue
12. Aloof
* 13. Approve
14. Secluded
* 15. Group
* 16. Help
17. Criticize
18. Glare
* 19. Thank
* 20. Smile
* 21. Sympathize
22. Accuse
* 23. Wave
24. Ignore
25. Force
26. Nag
* 27. Admire
28. Disturb
29. Shove
* 30. Respect

* Words considered socially positive