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DIMENSIONS OF FUNCTIONAL
PSYCHOSIS

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FUNCTIONAL
PSYCHOSIS

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CHAPTER I

INTRODUCTION*

THE CLASSIFICATION OF PSYCHIATRIC DISEASE

A GENERAL consideration of the methods of classification of pathological processes based on etiology and nosology demonstrates this aspect of medical science as essentially concerned with problems of multivariate analysis. It is the present intention to explore the relations between the various factors involved in the classification of pathology with respect to certain of the current systems of multivariate analysis and to apply these procedures to the nosological analysis of functional psychosis.

That such analysis is warranted is evidenced by the frequent criticism of existing classificatory schemata by many authorities, among whom may be mentioned Henderson and Gillespie (18) and Cameron. It is perhaps sufficient to repeat Cameron's comments in this regard (6, 870-871).

All current attempts at classification of functional personality disorders are unsatisfactory; this is true for the neuroses as well as for the psychoses. No causal organisms have been implicated, hence we cannot fall back upon them as we can in the specific infectious diseases. There are no characteristic organic lesions as there are in the systemic diseases; and the central nervous system exhibits no consistent changes that can be correlated with the syndromes as in neurological disorders. Physiological and biochemical studies do not support the older assumptions that fundamentally different metabolic processes underlie different forms of personality disorder. . . .

It is important for persons working in the abnormal field to realize that the current official psychiatric classifications are not based upon final and convincing scientific evidence. They are children of practical necessities. Decisions as to the group in which a given behavior disorder shall fall depend upon schemata that actually were adopted, both in this country and in Great Britain, by a majority vote of the practicing members of large associations. In some very fundamental respects these systems of classification represent frank compromises between dissident factions, as one can readily observe by reading the successive committee reports.

To give an adequate account of the history of the classification of psychosis would require a history of psychiatry itself. Since one of the primary concerns of this study is the application of objective methods

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of classification, historical discussion will be limited arbitrarily to a brief account of the methods involved in the major classificatory attempts which have achieved prominence in that they have been the most influential in modern psychiatric practice.

One of the first and undoubtedly the most prominent of these systems of classification is that devised and successively revised by Kraepelin (12). His method of classification in its procedural aspects remains as the most popular if not the only method of analyzing the complexities of psychiatric disease and synthesizing these into some type of order. His method may be described as the integrative resolution of the clinical observation of many cases with respect to their etiology, onset, symptomatology, course, and prognosis. Classificatory schemata derived in this manner are usually presented in the form of an essentially heuristic argument, and their ultimate validity is assessed in terms of the amount of agreement between the proposed system and the clinical experience and conceptions of the professional audience. Certainly, integrative clinical observation is well established as an exceedingly valuable method in medical research. However, the potential difficulties inherent in the communication of the subjective analytic and synthetic processes and criteria, and the absence of subsequent objective validation are obvious.

The existing American and British official classifications of mental disease are based on a variant of this procedure. Briefly, both systems have resulted from the preparation of a tentative classification system by a relatively small group of psychiatrists presumably on the basis of an evaluation of preceding classifications, existing theories of psychopathology, and their own clinical experience. These proposals were then formally adopted in both countries by a majority vote of the membership of their respective psychiatric societies. Fleming (15, 16, 17) describes the evolution of the British system in a series of reports concerning the activities of the Clinical Psychiatry Subcommittee of the Royal Medico-Psychological Association. This group deliberated for two and one-half years before submitting their first proposal to the Council of the Association. This was rejected by the Council, and, after another year's deliberation, an entirely different classification was submitted, which was formally adopted by the Association in 1933. Little insight is given into the difficulties of the preparation of the official American classification adopted by the American Psychiatric Association. The system itself is presented by Cheney (8).

It is apparent that these official classifications follow fundamentally

the same procedure as that of Kraepelin with only the additional formalization of the process of acceptance or quasi-validation. To say the least, this is a novel method of testing a scientific theory, although, at the time, appropriate objective methods of analysis were not available. The methods to be described in the next section represent an attempt to minimize the subjective factor, and, while they are discussed in the context of psychiatric disorder, the general logic and methodology appear applicable to disease classification generally.

FACTOR ANALYSIS AND NOSOLOGY

A logical empirical analysis of the complex relations in psychiatric disorders requires an explication of the concepts of symptom, syndrome, etiology, course, and disease with respect to their mutual relations and with respect to the logical requirements of the existing systems of analysis. The general attempt in this section will be to relate these concepts on the basis of a statistical interpretation of syndrome formation. Further, an attempt will be made to demonstrate the applicability of the concepts and techniques of multiple-factor analysis as an appropriate model in the resolution of the initial problems of nosology. The suggestion of this mode of approach is not original; Marzolf (22) and Malamud (21) have recommended its use in the analysis of psychiatric disease. Andrews (1) has applied these techniques in a study of the fundamental parameters of allergy. The principal elements of the logical formulation of this problem are in rather complete agreement with and indebted to that presented by Marzolf (22).

Thurstone (34) and many others have discussed parsimonious description as one of the major objectives of science, i.e., the reduction of the complexity of observable phenomena to a relatively small number of parameters in terms of which the complexity can be described. The diverse phenomena of particular concern in a study of psychosis are those aspects of behavior which in some manner, quantitative or qualitative, are regarded as abnormal. A definition of the term abnormal is considered unnecessary for the present purpose since the major manifestations of psychosis are, in general, recognized as abnormal by most psychiatrists and psychologists. A symptom may be regarded as an aspect of behavior which can be consistently discriminated from other aspects of behavior on the basis of their perceptual or conceptual independence in the mind of the observer. This definition does not exclude the various aspects of normal behavior, but it is easily seen that the domain of investigation can be bounded in a wide variety of ways.

Also, it is not limited in that all possible objective signs or reports of subjective states are relevant within the restriction that the inter- and intra-observer consistency is maintained.

Some process of ordering or classification relates the concept of symptom to that of syndrome. In a more general sense, the ordering of the characteristics or properties of diverse phenomena has been customarily conceived by logicians in two ways. The phenomena are classified as entities either on the basis of invariant conjunction of their respective properties or characteristics or by the establishment of invariant relations between antecedent and consequent events. The latter type of classification has found more favor in general medicine since it has been more fruitful with respect to the criterion of effective therapy. It must be recognized, however, that the success of such analyses is predicated ultimately upon a knowledge of specific etiological factors, e.g., bacteria, endogenous or exogenous toxins, etc. While it seems plausible that the classification of mental disorder may be similarly accomplished, the etiological factors are at present almost completely unknown. It seems necessary to follow the law as expressed by Cattell (7) that nosology necessarily precedes etiology. These two systems of analysis are not independent but will be considered separately with a subsequent rapprochement.

The first system of analysis is that of classification based on the invariant conjunction of properties or characteristics of the phenomena. Each individual or patient may be represented as a collection of the properties or characteristics of his behavior, with the implicit recognition of the individual as a relatively closed or bounded system. The properties or characteristics in this case are the selected symptoms of psychosis, and the conjunction of these may be viewed either with respect to the individual as a whole or with respect to the relations between symptoms. In the first case, attention is centered on the groups of individuals who display identical, or less stringently, similar symptom patterns. This form of analysis inevitably results in a typology. The other mode of analysis relates each symptom to each of the other symptoms as to their mutual presence or absence, and in this way aggregates of symptoms may be found that display the required conjunction. The components of each of these aggregates are related through some common factor such as being manifestations of the same functional entity, consequent events of the same antecedent or complex of antecedents, etc. If, in addition, the aggregates are to some degree statistically or functionally independent, they represent the independent parameters or dimensions which are operative within functional psychosis.

These two procedures under certain circumstances may yield identical, similar, or divergent results, and while both represent legitimate investigations, it is believed, for reasons to be stated later, that the results of the latter may prove more fruitful for psychiatry. Syndromes will thus be considered, for the moment at least, as aggregates of symptoms which satisfy the criterion of invariant conjunction. The concept of syndrome is seen to be essentially an abstraction or generalization of a behavioral complex resulting from an analysis of symptom conjunction. As in the formation of most abstractions or generalizations, certain aspects of the behavior are disregarded as specific or unique to the situation and as largely fortuitous as far as the generalization is concerned. It is also proposed that there is a concomitant increase in this specificity as progressively higher levels of abstraction are sought.

The invariance of the conjunction, although frequently applied in sciences where a high degree of experimental control is possible, seems too rigid a criterion in most of the biological and social sciences. Such factors as the plurality of cause and effect and the inter- and intra-complexity and diversity of the physiological and psychological matrices are sufficient to reduce the requirements from an invariant to a relative conjunction. Relative conjunction is common in most biological research and is customarily evaluated in the probabilistic terms of modern statistical analysis. Mental disease, either somatogenic or psychogenic, in spite of potential pathological identity does operate within different systems, the differences of which are determined by constitutional and developmental factors. Uncontrolled situational factors may also differentially facilitate or inhibit the appearance of many symptoms. In addition, multiple causation may result in the appearance of the same symptom as a consequent to different antecedents, or similar antecedents may result in somewhat different patterns of consequents as, for example, the effects of identical pathological processes operating at different anatomical foci (23). These factors are only a few of many that could possibly be mentioned which militate against a strict criterion of invariance. They emphasize the necessity for a statistical interpretation of syndrome formation and suggest the proper form of analysis to be statistical in nature.

The second general type of logical classification is that order based on an analysis of the causal relations between antecedent and consequent events. If the state of a system can be completely described at consecutive points in time and a spatial and temporal contiguity of events demonstrated, the relation between consecutive states, antecedent and consequent events, may be described as causally connected.

If, in addition, all observed reoccurrences of the antecedent in similar circumstances are followed consistently by the same consequent, invariant causality is said to have been demonstrated. The logical difficulties inherent in the discovery and proof of causal relations are amply demonstrated by Cohen and Nagel (10) in their criticisms of Mill's canons (25). Bohr (3) has shown this classical conception of causal description to be inadequate in the analysis of nuclear events and has suggested the situation in psychology to be quite analogous. Schlick (30) agrees with Bohr's position on causality as applied to nuclear phenomena. He maintains, however, that the probability of the certainty of more molar phenomena is incomparably greater than the most perfect observations. He thus minimizes the immediate applicability of the uncertainty principle and supports the classic interpretation of causality for the molar case.

He concludes that causality in science is the possibility of extrapolation, by which he means the possibility of the application of a function to the events or states of a system which gives consistent predictions of subsequent states.

The symptoms in psychosis denote states or events which have antecedents and which themselves may be causal antecedents to other symptoms. The joint or higher-order occurrences of symptoms in excess of the frequency which could be attributed to chance imply the existence of some common antecedent or complex of antecedents. Thus an examination of the relative conjunction of symptoms and the subsequent analysis of syndromes may reveal the operation of, and possibly suggest the nature of, etiological factors, although the etiological factors may not themselves have been included in the analysis as variables. It is possible that if the etiology of a specific symptom is relatively well-known, the presence of this symptom in a syndrome would suggest a similar etiology for the associated symptoms which may have been previously obscure.

Medical science has customarily differentiated etiology from the onset and course of a disease. However, these merely represent consecutive states which are causally related. The difficulty in discovering the etiological or initial causal factors results from their latent character, which becomes manifest pathology only after their causal effect has already occurred. The difficulty is further increased since at this time they may be no longer operative or may be completely obscured by the pathology itself. The onset marks the manifestation of the pathology. It should be noted that, in spite of the success achieved in many classes of disease by therapy directed at the initial cause of the disorder, the

possibility remains of other types of disease in which the initial cause may cease to be operative and the perpetuating factors may be quite different in character. While this possibility seems plausible in some forms of mental disorder, it does not deny the very great value of a knowledge of specific etiology for preventive medicine.

These sequential aspects of disease may be included in an analysis of the conjunction of symptoms if each symptom is regarded as present if it has occurred at any time during the entire course of the disease. Certain information such as the possible cyclic appearance of certain symptom sequences is lost by this procedure, and it is not proposed as a substitute for systematic analysis of etiology and course. The same reservations hold with respect to invariant causation as were relevant in the discussion of invariant conjunction. The plurality of cause and effect among other factors also leads to a statistical interpretation of causation at least in the initial analytical stages.

The concurrence of symptoms may be regarded as the conjunction of characteristics or events, or alternately, as covariation. Conjunction implies a sharp dichotomy between the presence and absence of each symptom, i.e., point distributions; covariation implies continua along which the symptoms may be ordered with respect to their intensive characteristics. In either case, the measure of the degree of association between each pair of symptoms is some form of correlation. The latter model seems more representative of reality. If two symptoms are found to be consistently conjunctive with respect to mutual presence and absence, a positive correlation results. Negative correlation indicates the relative exclusion of one symptom by the presence of the other. Lack of correlation implies the independence of symptoms. The degree of correlation indicates the relative improbability of the common occurrence or covariation of two symptoms on the basis of chance and implies, as stated by Mill's (25) fourth canon, that "whatever phenomenon varies in any manner, whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon; or is connected with it through some fact of causation." The maximum value of these correlations will, in general, probably be less than unity since on the basis of a priori knowledge the symptoms of psychosis might well be expected to have complex causation and to be complex themselves.

If a large population of psychotics is assessed as to the presence or absence of each of a series of n symptoms, each of these symptoms may be correlated with every other symptom and arranged in an $n \times n$ table or correlation matrix. The task is then to account in some manner for the $n(n - 1)/2$ correlation coefficients in terms of the postulated

syndromes. This is accomplished by the application of the methods of multiple-factor analysis.

A complete description of the methods of factor analysis would be both impossible and unnecessary, although the principal features will be noted. A detailed account of the theory and methods is given by Thurstone (34) and many of its previous applications to psychology and other sciences are presented by Wolffe (38). Only those methods of multiple-factor analysis as developed by Thurstone will be considered; the applications and implications of other systems of analysis will be largely ignored.

Factor analysis involves two steps in parsimony. The first requires a solution for the minimum number of factors or parameters which can adequately account for all the experimentally obtained correlations. It assumes that the initial measures can be described as linear functions of the factors. This assumption of linearity has been found to give a close first approximation if the variables are monotonic functions of each other. In mathematical terms, this first step involves the determination of the rank of the correlation matrix, which results in a system of n vectors in an r -dimensional space, where each of the n vectors represents one of the initial variables (symptoms) and r is the number of factors. The correlations between the symptoms are given by the scalar product of each pair of vectors.

The second step in parsimony involves a rotation of this system of vectors to a reference frame such that the number of parameters involved in each symptom is minimized. Thurstone has termed this "simple structure." It is this simple structure that is interpreted in the hope of finding scientifically meaningful and useful concepts which constitute the underlying order of the domain being investigated. In the present context, these concepts would be the syndromes. There is no a priori guarantee in any factorial study that either or both of these two conditions of parsimony will be satisfied. That they have been is established on an a posteriori basis.

A recent development in factorial theory has been the study of the second-order domain. As a consequence of empirical experience, it has been found that if simple structure is determined uniquely the reference frame is frequently oblique rather than orthogonal. This gives rise to correlations between the factors which may be analyzed in a manner similar to that applied to the first-order correlations. The meaning of this approach with respect to nosology is that each of the syndromes is considered as a symptom in a more abstract level of conceptualization, and the factors as found from the conjunction of the syndromes may be

referred to as disease entities. This interpretation is in accord with the common view that a syndrome may be merely a manifestation of a disease entity. Other interpretations are possible and will be considered in the interpretation of the second-order domain.

Other types of analysis are possible given the same basic data. The latent attribute analysis as developed by Lazarsfeld (20) seems to offer interesting possibilities in the general area of nosological analysis. An entirely different type of approach would be the *Q*-technique solution of Stephenson (32), in which individuals are correlated rather than symptoms. A factorial analysis of these correlations would result in types of psychosis rather than the independent dimensions of variation within psychosis. It has already been suggested that the factors obtained by these two methods may be quite similar. This would be true only if the types were determined by the unique action of only one factor. That this would occur seems possible but unlikely. The value of a typology in psychiatry can be determined only by its ultimate role in the understanding of the psychosis and particularly as it sheds light on potentially effective therapy. It is the belief of this author that a more fruitful approach has been outlined. It seems more important to discover and understand the dimensions of independent variation within psychosis considered as a whole and to view mixed types as combinations of more than one of these fundamental factors.

CHAPTER II

THE EMPIRICAL ANALYSIS

THE domain of psychiatry which is being investigated in the present study is that group of symptoms and syndromes which have characterized the functional psychoses, i.e., mania, depression, and schizophrenia. A study which satisfies the essential operational elements of the preceding argument was conducted by Professor T. V. Moore (26, 28), formerly of the Catholic University of America. The scope and vision of his research must certainly be admired, particularly since it is apparent at this time that adequate methods of analysis were not then available. Undoubtedly future methods will in turn qualify the present study. It is not intended that these remarks or the spirit of this entire paper be construed in any manner as a criticism of Professor Moore's salutary efforts. Essentially the present study is an application of the logic and methodology of the analytical procedures of multiple-factor analysis to the general problems of nosology and, in particular, to Professor Moore's data. An attempt will be made in this section to summarize the empirical conditions and procedures of Professor Moore's study so that this paper will be largely self-contained. For a more adequate account and detailed description reference is made to the original papers.

The population which was studied consisted of a group of 367 psychotics at the Mount Hope Retreat in Baltimore, Maryland and at Saint Elizabeth's Hospital in Anacostia, District of Columbia. These patients had been diagnosed in the functional group of psychoses. The term functional is used solely in a definitive sense to exclude particular disorders whose etiologies have been reasonably well-established, and which can be attributed to specific, demonstrable, organic pathology, e.g., the various toxic psychoses, psychoses of syphilitic origin, those due to intracranial neoplasms, etc.

These patients were originally assessed with respect to a group of forty symptoms and tests. Eight of the original variables have been deleted from this study. These were the cognitive tests: Reasoning, Logical Fallacies, Perception, Total Memory, and Memory Ratio; and the variables: Insane Relatives, Number of Previous Attacks, and Alcoholism of Parents. The cognitive tests were eliminated since only 208 of

the population of 367 were tested. This renders the meaning and interpretation of the correlation coefficients of these tests with remaining symptoms quite unknown with respect to the total population. The other variables were eliminated primarily to increase the homogeneity of the study, since the remaining variables were all symptomatic manifestations of psychosis. This does not mean that it is not proper to include such variables in a study of this sort. If the primary emphasis is on suspected etiological factors, separate studies which include many such variables should be made.

The remaining thirty-two symptoms constitute the major symptoms which are ordinarily grouped in the manic-depressive and schizophrenic disorders. A group of observers including the attending psychiatrist, the ward physician, and the ward nurse assessed the symptoms of each patient as to their occurrence during the entire course of the illness. In general, this assessment assumed a binary form, i.e., presence or absence. For those symptoms which were not amenable to a simple dichotomization, in particular, many of the affective symptoms, rating scales based on the symptom frequency, intensity, and duration were established. The scores based on these rating schemata were then appropriately dichotomized. For a complete description of these rating scales reference is made to the original study in which they are reproduced. Each patient's illness was then described by a series of binary scores, either 1 or 0, indicating the presence or absence of each symptom.

The reliability of binary scores obtained in this manner is not discussed other than to report that ratings done independently on a number of cases were in very close agreement. However, an examination of the symptoms under consideration reveals that most of them represent quite overt behavior, and it seems plausible to regard the reliabilities as quite high. The symptoms are described in the next section. In order to avoid excessive quotation, Moore's descriptions have been paraphrased, and the items on the rating scales have been summarized and integrated in each symptom description.

DESCRIPTION OF THE SYMPTOMS

1. *Disorientation in time.*—This symptom was considered as present if the patient did not know the day of the week, the month of the year, and the day of the month within three days.

2. *Disorientation in space.*—If the patient was not aware of his location or of the fact that he was in a mental hospital, this symptom was termed present.

3. *Rational delusions.*—If the patient's delusion was plausible, i.e., within the realm of possible events, and if it was not hypochondriacal in character, the symptom was considered present.

4. *Bizarre delusions.*—This symptom was considered present if the patient's delusion was very obviously not within the realm of possible events. These delusions represented beliefs which were frequently completely absurd.

5. *Hypochondriacal delusions.*—This symptom was considered present if the patient's delusion referred to convictions of the presence of physical disease for which there was no reasonable basis.

6. *Auditory hallucinations.*—This symptom was termed present if there was clear evidence of auditory perception in the absence of objective stimuli at any time during the history of the psychosis.

7. *Visual hallucinations.*—This symptom was termed present if there was clear evidence of visual perception in the absence of objective stimuli during the history of the psychosis.

8. *Tactual hallucination.*—If the patient complained of electric shocks in his skin or other unusual dermal phenomena for which no normal physical cause could be found, this symptom was considered present.

9. *Other hallucinations.*—Hallucinations other than the visual, auditory, and tactual were grouped in this category. It is essentially composed of olfactory, gustatory, and kinaesthetic hallucinations.

10. *Absence of insight.*—This symptom was considered present if the patient had no awareness of the fact that he had a mental disorder.

11. *Shut-in.*—This symptom was termed positive if the patient gave overt evidence of having withdrawn from his immediate environment. The assessment of this was on the basis of ratings on two items. "Does the patient, while not dominantly sad, seem to be concerned with the content of his own mind rather than with what is going on outside?" The possible alternative answers were: "More or less extroverted; Not at all; Occasionally seems to be occupied dreamily with his own interior life; Answers questions readily, but seems to relapse again into his own dreams; Can be drawn to pay attention with difficulty; Wholly occupied with his own thoughts." The other question was "Is the patient's facial expression more or less fixed and masked-like?" The alternate ratings were: "More or less emotional play, Not at all, Occasionally lapses into fixed expressions, Emotional play much reduced, Almost no emotional play, Face absolutely fixed and motionless."

12. *Loss of finer sensibilities.*—The following items were considered in establishing the presence of this symptom: dirty nails, unkempt hair,

dirty hands, dirty clothing, dirty face, unfastened clothes, wets bed, soils bed, wets clothes, soils clothes, open masturbation or smearing dung, use of vulgar language, and other signs. These items were weighted differentially with respect to the degree of departure from accepted standards of behavior.

13. *Mutism*.—This symptom was considered present if the patient refused to talk for long periods. The minimum period was measurable in terms of days.

14. *Negativism*.—The presence of this symptom was determined by the lack of reasonable cooperation, refusal to comply with simple requests, etc.

15. *Refusal of food*.—If the patient had gone through a period of time in which he refused to eat to the extent that he had to be fed by force, this symptom was considered present.

16. *Stereotypism of attitude*.—This symptom was termed present if the patient manifested long periods in which he assumed fixed postural attitudes.

17. *Stereotypism of actions*.—The presence of this symptom was determined by the repetition of peculiar motor actions displayed during any phase of the psychosis.

18. *Stereotypism of words*.—This symptom was considered positive if the patient was in the habit of continually repeating some word, phrase, or set of phrases, in a silly or aimless manner.

19. *Giggling*.—This symptom was termed positive if the patient frequently responded to questioning by silly giggling or if spontaneous giggling was frequently observed in the ward.

20. *Destructiveness*.—The presence of this symptom was determined by the frequency of destructive outbreaks, e.g., tearing his clothes, smashing dishes, breaking furniture, or general destruction of anything available.

21. *Talking to voices*.—This symptom was considered present if the patient was frequently observed muttering, mumbling, or talking to himself, carrying on conversations with inaudible voices, or gesticulating at invisible persons.

22. *Irritability*.—The assessment of this symptom was made on the basis of the frequency, duration, and intensity of periods of irritability.

23. *Tantrums*.—This symptom was considered present if the patient reacted to frustration by muttering and murmuring, loud and angry talking, crying, screaming, or by falling on the floor, kicking and screaming. The frequency of these occurrences was considered in the assessment of this symptom.

24. *Homicidal tendency*.—The presence of this symptom was determined by an evaluation of the strength of the patient's ideational tendency toward homicide.

25. *Excitement*.—This symptom was termed positive on the basis of ratings of the frequency, intensity, and duration of excessive motor activity, abnormal talkativeness, and the level and speed of speech.

26. *Euphoria*.—The determination of the presence of this symptom was made on the basis of the patient's general happiness or feeling of well-being as expressed by his facial expression, the frequency and degree of his laughter, and his speech. Silly giggling was not considered as indicative of euphoria. The assessment of this symptom was based on the presence of extreme happiness, exultation, exuberance rather than merely mild expressions of well-being.

27. *Depression*.—This symptom was termed positive on the basis of ratings of the degree of sadness as expressed by the facial expression of the patient, his own verbal statements, and independent estimates of his mood.

28. *Anxiety*.—The presence of this symptom was determined by ratings of the anxiety and fears of the patient as expressed by the facial expression, the frequency of his wringing his hands, pacing the floor, striking his head with his hands, and verbal expressions of his fears.

29. *Tearfulness*.—This symptom was termed present on the basis of the frequency and intensity of tearfulness, e.g., eyes glistening with tears, tears rolling down the cheeks, and sobbing.

30. *Retardation*.—The presence of this symptom was determined by the consistent excessive retardation of speech and action.

31. *Neurasthenia*.—This symptom was considered as present on the basis of ratings of an excessive loss of vitality, the appearance of low muscle tone, and an evaluation of whether the patient's speech and action seemed to require more energy than he could command.

32. *Suicidal tendency*.—The determination of the presence of this symptom was made by an assessment of the strength of the ideational tendency toward suicide and the frequency of actual attempts.

THE FACTORIAL PROCEDURES

As described in a preceding section, the assessment of these symptoms in general assumed a binary form, i.e., presence or absence, 1 indicating presence and 0 absence. The distributions of those symptoms for which scaling procedures were used were plotted and arbitrarily dichotomized at the upper limit of the class in which the mean value occurred. The scale, the scaling procedure, and the dichotomic points are

presented in detail by Moore (28). From these procedures, each patient's illness was described by a series of binary scores, indicating the presence or absence of each of the particular symptoms.

The intercorrelations of the symptoms were then calculated using the tetrachoric correlation coefficient. In reality, this correlation matrix was completely calculated on three separate occasions. Moore and his associates computed the correlations twice, the first time using only the first- and second-degree terms of the tetrachoric function, the second time using the higher powers of the function. Thurstone and his assistants independently calculated the coefficients using computing diagrams (9) which take into consideration the higher powers of the tetrachoric function. A comparison of Thurstone's and Moore's second table indicated the few discrepancies to be limited to the second and third decimal places, and these to be of very small magnitude. The correlation matrix computed by Thurstone was used in this factor analysis and is given in Table 1.

The factoring of this matrix proceeded in several steps. Initially, all 40 of Moore's variables were utilized, and nine factors were extracted using the centroid method of factoring (34). The communalities in this analysis were successively estimated from the highest correlation or residual in each column of the correlation matrix and each successive residual table. For the reasons stated in a preceding section, eight of the original variables were deleted, and from the remaining symptoms nine factors were extracted using the multiple-group method of factoring (34, 170). The initial estimates of the communalities used in this analysis were based on the obtained communalities of the centroid analysis. However, since the multiple-group method is particularly sensitive to communality estimates and since the deletion of certain of the original variables affected the initial estimates, a second factoring was done using the obtained communalities from the first multiple-group factoring as the estimates. In this last analysis, seven factors were taken out by the multiple-group method and the last two factors by the centroid method.

Certain difficulties were encountered in the communalities for variables 25, 26, and 27. In all three analyses, the communalities for these symptoms exceeded unity by a small amount. This occurred in both of the multiple-group analyses, although the initial estimates in each case were reduced arbitrarily to .95. It is probable that this was the result of certain inconsistencies in the correlation coefficients caused by the inapplicability of the assumptions of the tetrachoric coefficient. As a consequence, these three vectors have been normalized arbitrarily.

All tables referred to in this section are contained in the *Appendix*. The factor loadings of the symptoms in the arbitrary orthogonal reference frame are given in Table 2. Table 3 contains the distribution of the absolute values of the ninth-factor residuals. All residuals higher than .13 were on variables 25, 26, and 27. Since the communalities for these variables had exceeded unity, the factoring was stopped at this point. An oblique simple structure was obtained using the method of radial rotation (34, 194) and a least squares adaptation of the single-plane method. This oblique simple structure is presented in Table 4.

The transformation from the arbitrary orthogonal matrix to the oblique simple-structure matrix is given in Table 5, the cosines of the angles between the reference vectors in Table 6. The correlations between the primary vectors defined by the intersection of $(r - 1)$ hyperplanes are presented in Table 7.

CHAPTER III

INTERPRETATION AND DISCUSSION

THE major goal of factor analysis is the identification of the scientifically meaningful and useful concepts that constitute the underlying order of the domain which is being investigated. The process by which this is accomplished involves the subjective interpretation in an inductive manner of the factors as given in the reference frame of the simple structure. The logic requires the discovery of a functional unity common to all variables which have significant loadings on any particular factor. The minimum significant loading in this study will be set arbitrarily at .20. In addition, the variance of those variables which do not have significant loadings on the factor in question cannot be attributable to the same source.

In general, in this study the first-order factors represent syndromes or functionally unitary pathological processes and not necessarily disease entities. It is possible, however, that some of these syndromes may appear independently of any other, in which case they would probably be accorded the title of entity. In most cases, however, disease entities represent complex interactions of two or more syndromes. These are expected in the analysis of the second-order domain.

It should be recalled that the symptoms with high loadings on a factor have more of their variance explained by the syndrome than do those with relatively low loadings, and consequently, are more crucial in the identification or interpretation of the syndrome. A bipolar factor, in this instance, denotes the relative exclusion of the symptoms of one sign by the presence of those of opposite sign and also a syndrome which may function in antagonistic directions. An example of this would be the common conception of manic-depressive psychosis.

THE FIRST-ORDER DOMAIN

Factor A

The symptoms which have loadings on Factor A greater than or equal to $\pm .19$ are as shown on the following page.

Inspection of this syndrome demonstrates its composition to be principally hallucinations and delusions, the common characteristic of which would seem to involve some interpretive distortion of reality. Warren (35, 120) defines an hallucination as an "abnormal misinterpretation of

ideational experiences as perceptions. . . . In hallucination the error of perception goes so far as to suppose facts present to a sense which is actually receiving no relevant stimulation; in delusion (an error of judgment rather than of sense perception) there is misinterpretation of the state of affairs but not of the facts immediately present to sense."

The psychoanalytic school regards both hallucinations and delusions as having a related structure. This would appear to be sustained in Factor A. Fenichel states that "hallucinations are substitutes for perceptions after the loss or the damage of objective reality testing. Inner factors are projected and experienced as if they were external perceptions" (14, 425). Delusions he defines as ". . . misjudgments of reality based on projection. While the elements of hallucinations are limited to perceptual sensations, delusions are built up of more complicated and sometimes systematized ideas" (14, 427).

Code Number	Symptom	Loading
8	Tactual hallucinations	.73
9	Other hallucinations	.73
7	Visual hallucinations	.68
6	Auditory hallucinations	.65
4	Bizarre delusions	.55
5	Hypochondriacal delusions	.47
3	Rational delusions	.45
32	Suicidal tendency	.26
10	Absence of insight	.19

These two sets of definitions seem to be essentially consistent and to point to the close similarity of the dynamics or mechanisms of the two phenomena. Consequently, this syndrome will be denoted by the term "hyper-projection," by which will be meant the gross misinterpretation of reality resulting from the attribution of subjective states of external reality. Projection is qualified by the prefix "hyper," since it may represent the operation of normal, healthy, defense mechanisms which do not generally possess the gross pathological distortion of hallucinations and delusions. Hyper-projection as an explanatory concept primarily unifies these symptoms on a descriptive level. Their role in psychosis is discussed at length by Fenichel (14) and by other authors in their accounts of paranoia, paranoid schizophrenia, paranoid conditions, and paraphrenia in which this syndrome plays a dominant and in some an exclusive role.

Absence of insight, although not usually termed a delusion, is quite consistent with this interpretation. The appearance of suicidal tendency on this factor may represent the projective misinterpretation inherent in such tendencies and also those suicidal attempts committed in response to hallucinatory commands. The order of these symptoms with

respect to their factor loadings is interesting in that distortions of the most primitive and least complex perceptions seem to be almost pure manifestations of projections. As the complexity of the perceptual process and the conceptual elaboration increase, the relative role of projection in the total symptom decreases.

Factor B

The symptoms which have loadings on Factor *B* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
27	Depression	.63
28	Anxiety	.53
15	Refusal of food	.50
30	Retardation	.46
29	Tearfulness	.45
9	Other hallucinations	.26
2	Disorientation in time	.24
10	Absence of insight	-.23

This syndrome is interpreted as depression, the dominant element of which is a mood of pronounced hopelessness, severe dejection, melancholia, and overwhelming feelings of inadequacy and unworthiness. The presence of both anxiety and retardation as functions of a common syndrome opposes the differentiation of the retarded depressions from the anxious or agitated depressions as discussed by Cameron (6, 882). A distinction of this type appears valid for other reasons which will be made explicit in the discussion of the relation of this factor to Factor *I*.

White (37) discusses depression in terms of a triumvirate of cardinal symptoms, viz., difficulty of thinking, psychomotor retardation, and emotional depression. These are presumably directly opposed to the corresponding symptoms of mania, viz., flight of ideas, psychomotor excitement, and emotional excitement or exaltation. Both depression and mania are thus regarded and classified by White and many others as affective disorders of opposite polarity. It will be proposed as a result of this analysis that this interpretation, while theoretically attractive, may not represent the empirical facts. A more complete discussion of this point must be deferred to the interpretation of the second-order domain and the general discussion of results. Briefly, its justification rests upon an evaluation of the dominant aspects of both disorders. The interpretations of Factors *C* and *G* in the first-order analysis suggest the predominant factor of mania to be the sustained state of hyperexcitability and the elation as a secondary, even transient effect. This would seem to cast doubt upon the validity of mania as an affective disorder.

It seems appropriate, however, to stress the affective nature of de-

pression in the interpretation of Factor *B*, particularly with respect to its appearance on Factor *Y* of the second order. Retardation of both action and thought may be viewed as a symptom secondary to, or as a consequence of, the severe emotional disturbance. The presence of anxiety with its associated periods of agitation would support this view. The refusal of food and the disorientation in time are probably due to the preoccupation of the patient with his troubles. The negative loading of absence of insight indicates an awareness of the disorder as such; insight at this level is frequently found in depressives. The presence of other hallucinations is unexplained, although the fact that these hallucinations have an almost exclusively unpleasant content suggests the dominant mood as a possible factor in hallucination formation.

The psychoanalytic interpretation of the mechanism of introjection as the basis of depression will be considered in the interpretation of Factor *Y*.

Factor C

The symptoms which have loadings on Factor *C* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
25.....	Excitement	.82
20.....	Destructiveness	.46
26.....	Euphoria	.41
7.....	Visual hallucinations	.26
3.....	Rational delusions	.24
6.....	Auditory hallucinations	.20

There seems little doubt that this syndrome contains the primary aspect of what has been termed mania, i.e., the sustained manic hyperexcitability. Since it will be seen in the analysis of the second-order domain that mania as a disease entity is a more complex combination of syndromes, the term "mania" will be reserved, and Factor *C* designated as manic hyperexcitability.

The incessant motor activity; the rapid, loud, and excited speech; the flight of ideas; and the elation sustain the description of this syndrome as hyperexcitability. It is difficult to ascertain whether this condition may be the result of the loss of the normal, inhibitory, control factors of action and thought, or whether it may be due to the addition of some catalytic factor which merely accelerates the normal processes. The net effect of either would probably be very similar, and possibly some combination of both may represent the actual situation. The destructiveness of these patients is more an accidental consequence of their hyperactivity than of a volitional or hostile character. The presence of visual

and auditory hallucinations and rational delusions in the more acute phases of the hyperexcitability has been noted by most authorities. Probably the most consistent explanation of these is that the very speed of the individual's processes results not only in his obtaining insufficient and fragmentary evidence on which to base his interpretations of perceptual data, but also in hasty and premature interpretations and conclusions themselves.

The similarity of this syndrome to the toxic effects of certain drugs, in particular some of the cerebral excitants, suggests the possibility of an endogenous toxin as an etiological factor, or, less specifically, that this syndrome may be due to a state of hyper-irritability of the cerebral tissue. Although such similarities are reasonably apparent, there is no evidence which would sustain an identity relation between them, and they should properly be regarded as only suggested hypotheses. Specific drugs which may be mentioned include amphetamine sulphate and cocaine (33). S. Weiss (36) describes the symptoms of chronic cocaine addiction as follows: "The immediate effect of moderate doses of cocaine is a sensation of well-being and of exhilaration. The addict feels optimistic and has unlimited confidence in his own capability. He chatters glibly, usually about inconsequential matters. . . . Larger doses may cause active excitement, motor agitation, and even hallucinatory delusions."

Factor D

The symptoms which have loadings on Factor *D* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
13	Mutism	.64
15	Refusal of food	.64
16	Stereotypism of attitude	.58
14	Negativism	.46
19	Giggling	.40
11	Shut-in	.39
17	Stereotypism of action	.36
4	Bizarre delusions	.27
5	Hypochondriacal delusions	.27
30	Retardation	.22
20	Destructiveness	.22
28	Anxiety	-.30

The syndrome shown in Factor *D* is interpreted as catatonia. Catatonia is used here in the sense described by DeJong (11):

It should be emphasized that human catatonia is a syndrome and not a clinical entity as was thought by Kahlbaum in 1874. Although the syndrome, catatonia, is most often seen in schizophrenia, it is erroneous to identify catatonia completely with dementia praecox, since the syndrome occasionally occurs in the course of a multitude of condi-

tions such as encephalitis, malaria, typhoid fever, general paresis, brain tumor, coli bacillosis, carbon monoxide intoxication, etc.

The principal psychomotor signs of catatonia, both hypo- and hyperkinetic, are easily recognized in this list of symptoms. The hypokinetic phenomena consisting of diminished motor initiative or its extreme form, catalepsy, and the characteristic negativism are seen in the mutism, refusal of food, stereotypism of attitude, negativism, shut-in, and retardation symptoms. The hyperkinetic are shown in the stereotypism of action, the giggling, and the destructiveness. It is difficult to rationalize the bizarre and hypochondriacal delusions in this setting, although they may represent elaborations or rationalizations of the profound psychomotor disturbances. Anxiety with a negative loading seems reasonable both with respect to the fact that these patients are partially stuporous most of the time and would consequently display few of the overt manifestations of anxiety, and also with respect to the fact that the dominant signs in the non-stuporous phases seem to be aggressive.

It is difficult to assign a single interpretation of catatonia as a syndrome which would unite these seemingly diverse phenomena other than to regard it as a profound psychomotor disturbance. The identification of it as a functional unity not only rests upon considerable clinical evidence but also receives strong support from the research in experimental catatonia. DeJong (11) and Buchanan and Richter (5), among others, have experimentally produced profound motor disturbances in animals which closely resemble catatonic states in humans. These have been produced in a wide variety of ways, among which may be mentioned the injection of bulbocapnine, mescaline, or acetylcholine; bilateral ligation of the carotid artery; bilateral extirpation of the motor and pre-motor areas of the cortex, etc.

These catatonic states can be eliminated by the use of antagonistic drugs such as cocaine or the inhalation of high concentrations of carbon dioxide, which in some instances are themselves sufficient to produce the experimental catatonia. Solomon *et al.* (31) found that the inhalation of 40 per cent carbon dioxide and 60 per cent oxygen by catatonic patients completely eliminated the symptoms of the psychosis for a short time. Injections of cocaine hydrochloride have produced the same results. The facts suggest more than a similarity between experimental catatonia and the catatonia seen in the psychotic conditions. Morgan (29, 347) has suggested “. . . that catatonia is a disease in which, by some manner or means, the cerebral cortex, perhaps a rather restricted part of it

(motor and premotor areas?), is functioning at a very low level of excitability."

Factor E

The symptoms which have loadings on Factor *E* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
18.....	Stereotypism of words	.65
21.....	Talking to voices	.53
17.....	Stereotypism of actions	.51
11.....	Shut-in	.32
19.....	Giggling	.30
16.....	Stereotypism of attitudes	.28
5.....	Hypochondriacal delusions	.21
26.....	Euphoria	-.34
29.....	Tearfulness	-.42
32.....	Suicidal tendency	-.51

Although this syndrome displays the essential features of schizophrenia itself and particularly those manifestations most dominant in the hebephrenic form, its precise interpretation is as elusive as its varied interpretations in the literature would suggest. Bleuler's (23) primary distinguishing criteria are both evident in this factor, viz., the specific disturbances in the association of ideas and the specific disturbances of affectivity. The latter, which are characterized by incongruity of affective response and apathy, are shown in the presence of giggling, stereotypism of attitudes, and shut-in symptoms and in the absence of euphoria and tearfulness. The disturbances in the association of ideas are seen in the stereotypism of words and actions, and the talking to voices. These symptoms, according to most authors, represent distorted symbolisms evidencing the profound ideational dissociation.

The incongruity and apathy of the affect and the dissociation of ideas are the dominant symptoms of hebephrenic schizophrenia. It seems possible that the affective disturbances may represent only one phase of the more general dissociation. Consequently, for purposes of brevity of designation, this syndrome will be termed schizophrenic dissociation.

The high negative loading of suicidal tendency seems reasonable on the grounds that suicidal plans and attempts require a certain depth of affect and organization. The extensive dissociation and apathy characterizing this syndrome would seem to preclude the necessary prerequisites of such an act.

Factor F

The symptoms which have loadings on Factor *F* greater than or equal to $\pm .20$ are as shown on the following page.

The interpretation of this factor would appear rather difficult in terms of any logical consistency in the nature of the symptoms. However, a provocative possibility is suggested which will be tentatively proposed and the validity of which must await further study. In the first analysis of the complete list of forty symptoms the variable, Number of Previous Attacks, had a high negative loading on this factor, which would indicate the syndrome to be associated with the initial attack of the psychosis. This would seem to eliminate the disorientation as a chronic, progressive, deteriorative phenomenon as is frequently seen in the cases of senile psychosis.

Code Number	Symptom	Loading
2	Disorientation in space	.82
1	Disorientation in time	.71
26	Euphoria	.34
29	Tearfulness	.24
10	Absence of insight	.20
5	Hypochondriacal delusions	-.28

It is proposed that this factor be interpreted as a traumatic hysteria resulting from the shock of the initial onset of the psychosis. Another possible term would be simply psychotic shock. Although the evidence is not available, it is expected that this syndrome would be predominantly found in those disorders of acute onset rather than in those whose development is insidious. It would additionally be expected that the majority of the cases would demonstrate a disappearance of this syndrome as the disease progressed.

It is important, as Hoskins (19) has emphasized, to consider the psychosis from the point of view of the patient. A comprehensive study utilizing this approach has been conducted by Boisen (4). To ascertain its relevance for this syndrome, one need but consider the effect on the patient of the sudden onset of the disease, the abrupt change of physical environment from the home to the hospital, or the impact of a society of psychotics. The combined or even the single effect of these conditions may be adequate to produce a severe emotional shock which may in certain patients result in a form of hysteria. The disorientation, inappropriate euphoria, tearfulness, and absence of insight are consistent with the usual manifestations of traumatic hysteria. The appearance of hypochondriacal delusions with a negative loading also seems consistent in that the patient, as a consequence of the shock, may be either too stunned or may have had insufficient time to elaborate or rationalize his condition in delusional, hypochondriacal terms.

Factor G

The symptoms which have loadings on Factor *G* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
22	Irritability	.51
23	Tantrums	.47
21	Talking to voices	.45
9	Other hallucinations	.25
14	Negativism	.21

Factor *G* is interpreted as the syndrome characterized by an acutely lowered threshold of frustration or, to assign a more convenient label, as hyper-irritability. "Irritability" is used in the popular rather than the technical sense of the word to denote the characteristic mood or predisposition to react to frustration by some form of anger, hostility, or aggression. The prefix "hyper" is assigned to qualify the state with respect to the lack of inhibition of this form of response, the relatively trivial character of the thwarted desires or expectations, and the exaggerated intensity of the reaction.

Dollard *et al.* (13) have discussed the frustration-anger-aggression sequence at considerable length, in which they view the anger and aggression as only one of a number of possible forms of reaction to frustration. Its relative occurrence in any particular individual with respect to the other possible reactions is probably the result of many factors, native and acquired, which have been operative in his personality development. It is perhaps sufficient for the present purpose to regard anger as the most probable on the basis of an habitual reaction characteristic of the individual's personality structure.

Alternate possibilities of explanation seem equally plausible. One would be a possible inability of the patient to utilize more complex and socially acceptable forms of reaction as a consequence of the psychosis. Another which is suggested by the relation of Factors *G* and *C*, which will be discussed in the interpretation of the second-order analysis, is the possibility of the lack of normal inhibitory control due to a general hyper-reactivity. Some combination of these factors would appear as the most probable explanation.

It should be noted that the anger or hostility does not necessarily evolve into directed aggression. This is indicated by the presence of tantrums and talking to voices. The latter, it will be recalled, is not necessarily hallucinatory in character, since it includes the patient's mumbling or talking to himself, which may well represent a symbolic,

verbal resolution of aggression. Henderson and Gillespie (18) report the nature of olfactory and gustatory hallucinations which comprise the majority of those classified as other hallucinations to be almost exclusively unpleasant. It seems plausible that the report of such quasi-perceptions may be conditioned by the general irritability of the patient.

Factor H

The symptoms which have loadings of Factor *H* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
12.	Loss of finer sensibilities	.64
28.	Anxiety	.43
24.	Homicidal tendency	.41
32.	Suicidal tendency	.33
8.	Tactual hallucinations	.33
20.	Destructiveness	.28
15.	Refusal of food	.27
6.	Auditory hallucinations	.21
10.	Absence of insight	-.22
26.	Euphoria	-.43

The primary aspect of this syndrome seems to be the deterioration of social values characterized by an egocentric indifference to the normal proprieties of behavior. Insufficient evidence is available to discuss this deterioration in terms of the general dementia or terminal degeneration which was used by Kraepelin in establishing the various types of schizophrenia as sub-groups of the same disease process. A. Meyer (24) regards the deterioration seen in schizophrenia as a habit deterioration, which seems consistent with the evidence in Factor *H*.

The abandonment of the term "dementia praecox" and the adoption of "schizophrenia" was first necessitated by the inadequacy of the praecox qualification, since it was found that these disorders were not exclusive afflictions of the young. The second revision, as discussed by Cameron (6, 886), is now in progress; the notion of schizophrenia as inevitably terminating in dementia is being discredited by a growing body of evidence showing the dementia as characteristic of only a small proportion of the cases. The demonstration of Factor *H* as an independent syndrome in psychosis is further confirmation of this.

The extent of the loss of social value is seen in the various symptoms constituting this syndrome. The loss of finer sensibilities refers to the acquired habits or values of cleanliness, personal appearance, and hygiene. The loss of regard for the value of human life itself is seen in the homicidal and suicidal tendencies and the refusal of food. Destructiveness would indicate a decrement of the value of the property of others. Anxiety and some presence of insight would indicate their egocentric

preoccupation. That this syndrome would preclude euphoria is not surprising. The presence of tactual and auditory hallucinations is not clear with respect to the deterioration.

Factor I

The symptoms which have loadings on Factor *I* greater than or equal to $\pm .20$ are as follows:

Code Number	Symptom	Loading
31.....	Neurasthenia	.53
14.....	Negativism	.47
10.....	Absence of insight	.27
3.....	Rational delusions	.27
32.....	Suicidal tendency	.25
11.....	Shut-in	.23
19.....	Giggling	-.23
28.....	Anxiety	-.29

The appearance of this syndrome in a study in which the population consisted entirely of hospitalized, diagnosed functional psychotics seems somewhat surprising, since the most plausible interpretation would class it as a disorder associated more commonly with the psychoneuroses. The syndrome would appear to be very similar to, if not identical with, what in other contexts has been termed neurasthenia. This disorder is characterized predominantly by excessive mental and physical fatigue, depression of the energy level, and resistance to any form of activity. Most authorities, including Henderson and Gillespie (18) and Bartley and Chute (2), have ascribed these to the debilitating effects of prolonged, severe, emotional conflict. The condition seems to represent a state of mental exhaustion or, to borrow a concept from physics, a condition of static inertia.

The symptoms which have loadings on this factor seem consistent with such an interpretation. Neurasthenia as a symptom is self-evident. Negativism, in this instance, appears as a resistance to any form of energy expenditure. It will be recalled that absence of insight was used in the restricted sense that the patient had no awareness of the fact that he had a mental disorder, which is common in neurasthenic conditions. The rational delusions may possibly be the consequence of the lack of application of the energy required to maintain correct conceptualization. The withdrawn state shown in the presence of the symptom, shut-in, may also be viewed as the lack of energy required for social intercourse. Suicidal tendency probably represents an escape from the patient's condition. Giggling and anxiety with negative loadings are understandable, since both require the active expenditure of energy.

Anxiety and absence of insight seem crucial in the differentiation of

the depressed conditions, Factor *B*, and the neurasthenic since both appear with opposite signs on the two factors although the factors themselves are highly correlated. This may provide insight into the distinction between the agitated or anxious depressions and the retarded, or perhaps more properly, the neurasthenic depressions. This point will be discussed later.

THE SECOND-ORDER DOMAIN

The correlations between the primary vectors, Table 7, were analyzed. The resulting oblique simple-structure matrix is presented in Table 9 in the *Appendix*. Third- and higher-order analyses are theoretically possible, but the instability of empirical data and the usual lack of overdetermination of the structure in the second order, in general, preclude such analyses. For this reason, the correlations between the second-order factors are not viewed with any confidence and are, consequently, not presented.

The interpretation of the second-order factors is accomplished in a manner similar to that described for the first order. Two of the four factors, *X* and *Z*, are found to be familiar entities in the standard classificatory systems and will not be discussed at length. It should be emphasized that the labels assigned to the first-order factors are brief descriptive terms. The complete interpretation of these syndromes and their constituent symptoms should be kept in mind in the interpretation of the second-order factors.

Factor W

The first-order syndromes which have significant loadings on Factor *W* are as follows:

Factor	Syndrome	Loading
G.....	Hyper-irritability	.61
C.....	Manic hyperexcitability	.56
H.....	Deterioration	.22
I.....	Neurasthenia	-.26

Factor *W* is quite obviously mania and seems to represent predominantly a condition of sustained hyperexcitability. Hyper-irritability as a lowered frustration threshold seems justified in terms of the hyperexcitability. The relation of the anger displayed in the irritability to the euphoria in these patients, in whom the prevailing emotion may instantly shift to the other, would seem to minimize the affective component of mania with respect to the general hyperexcitability which dominates not only the emotional aspect but the entire psychic life.

Not only does the absence of depression as a negative component in this factor challenge the common classification of mania and depression

as affective disorders of opposite polarity; but also, since depression seems most consistently interpreted as a disorder of affect, further support in the denial of mania as an affective disorder is obtained. In fact, the emphasis upon affective states in general as a major classificatory dimension inherent in the Kraepelinian system is not supported in this study. The negative loading of neurasthenia is also consistent with the foregoing discussion since one of its main characteristics is a lowered state of excitability. Deterioration of social value is found in cases of acute and hyperacute mania but may represent only a temporary or transient condition caused by the fact that the patient is too busy, too distractible to be concerned with his personal care or the rights of others.

Factor X

The first-order syndromes which have significant loadings on Factor X are as follows:

Factor	Syndrome	Loading
E.....	Schizophrenic dissociation	.68
F.....	Traumatic hysteria	.45
A.....	Hyper-projection	.40
H.....	Deterioration	.19

This factor is consistent with the current conception of hebephrenic schizophrenia and is so interpreted. Disturbances of the association of ideas, incongruity and apathy of affect, the disorientation, hallucinations, delusions, and deterioration are all characteristic of hebephrenia. It is interesting to note that the relative importance of these syndromes in the clinical picture is preserved in the order of the factor loadings.

Factor Y

The syndromes which have significant loadings on Factor Y are as follows:

Factor	Syndrome	Loading
I.....	Neurasthenia	.63
B.....	Depression	.51
G.....	Hyper-irritability	-.37
A.....	Hyper-projection	-.52

The interaction of the syndromes which have positive loadings on this factor, neurasthenia and depression, seems sufficient to account for the major types of depression, the anxious or agitated and the retarded. Formation of these types will be considered in the next section. Those with negative loadings, the hyper-irritability and hyper-projection, constitute the dominant characteristics of the paranoid disorders. The fact that this factor is bipolar suggests the operation of opposing mechanisms or processes, and also a classification of paranoid-depressive

psychosis as better founded in empirical fact than the customary manic-depressive.

The mechanisms which are proposed to account for this factor are projection and introjection. In discussing projection, Meduna and McCulloch (23, 153) state that "only depressions show the converse, and the failure to project frequently portends suicide. Regardless of its cause, a projected mental or emotional ineptitude becomes a paranoid trend." Fenichel (14, 397), in this regard, concludes: "Thus, the introjection at the basis of depression really is the opposite of the defense mechanism of projection. . . ." Factor *Y* appears to confirm these observations, which support the proposal of a projective-introjective process at the basis of a paranoid-depression classification of psychosis. The theoretical attractiveness of this classification and differentiation of a paranoid-depressive psychosis appears equal to, or greater than, that underlying the affective classification and differentiation of a manic-depressive psychosis which, in itself, seems questionable from the previous discussion of Factor *W*. An intensive analysis of the role and operation of these mechanisms in these disorders considered as bipolar conditions is certainly suggested; it may well result in a more fundamental understanding of these psychoses.

Factor Z

The first-order syndromes which have significant loadings on Factor *Z* are as follows:

Factor	Syndrome	Loading
D	Catatonia	.71
F	Traumatic hysteria	.35
G	Hyper-irritability	.33
H	Deterioration	.32
B	Depression	-.42

Factor *Z* is interpreted as catatonic schizophrenia. The dominance of the profound psychomotor disturbances of the catatonic syndrome in this form of schizophrenia is evident. Traumatic-hysteria seems consistent in terms of the acute onset which is frequent in catatonic schizophrenia. The hyper-irritability is characteristically found in the excited stages of catatonia. The deterioration is found in a certain proportion of the cases. The negative loading of depression is difficult to explain, although emotional depression is seldom seen in catatonic schizophrenia. Hoskins (19) regards the catatonic's reaction to be one of an active struggle to solve his inner conflicts on a reality level which is quite opposed to the depressive picture.

DISCUSSION

The syndromes and disease entities found in this study are, on the whole, rather similar to those in the current psychiatric literature. Since this similarity was neither necessarily anticipated nor a necessary consequence of the theory, the conclusion is indicated that the clinical methods in their approach represent subjective analyses whose logical aspects are roughly similar to that of the more formal statistical analysis. It also indicates that the primary concern in classificatory attempts has been with respect to the syndromes or functionally unitary pathological processes within psychosis rather than with the establishment of a typology of psychotics.

An awareness of the nature of such analyses must be maintained if they are to be useful in clinical diagnosis. Much of the dissatisfaction accompanying the inability to assign individual cases to sharply defined categories merely reflects this lack of awareness in that typological diagnoses are attempted in a non-typological system. The multitude of mixed types encountered in both classificatory systems and in clinical practice evinces the independent operation of these various syndromes. The individual patient should be regarded as a psycho-physiological matrix in which these independent factors may occur in varied combinations and intensities. Diagnoses of this form would be more consistent with the facts of psychosis and should consequently prove more satisfactory.

Nevertheless, certain syndromes and certain combinations of syndromes do frequently occur which have attained the status of pathological types. This would suggest the necessity for a theoretical analysis of the operation and interaction of these syndromes. The official American classification (8) recognizes four forms of dementia praecox (schizophrenia): simple, hebephrenic, catatonic, and paranoid. The British system (16) classifies these under dementia praecox as a subdivision of schizophrenic psychoses and adds paraphrenia as another sub-division. The catatonic and hebephrenic forms have been found as separate factors in the second-order analysis. The paranoid type of psychosis was represented on another second-order factor. Whether this represents paranoid schizophrenia is not clear although a certain similarity is evident. Paranoia, paranoid schizophrenia, paranoid conditions, and paraphrenia are all similar and probably represent slightly different combinations of several syndromes with the hyper-projection syndrome which, in each condition, is dominant. Simple schizophrenia

did not appear in this analysis probably because few cases of this type are disordered enough to be hospitalized.

Mania as a disease entity was also demonstrated in the second-order analysis as a combination of two of the functionally unitary pathological processes. This has been discussed in detail elsewhere.

Depression has been clinically separated into two major types, viz., the anxious depressions and the retarded depressions. The first of these may be the result of the independent action of the syndrome seen in Factor *B* in the first-order analysis. The second probably can be regarded as the joint action of this factor and the neurasthenic syndrome. Anxiety, which is the primary differentiating symptom of these two disorders, has a positive loading on one syndrome and a negative loading on the other. A simple linear combination of the two would result in the disappearance of the anxiety as an overt symptom and leave a dejected, retarded, fatigued, withdrawn picture which corresponds to what is termed retarded depression. A better term for this condition would seem to be neurasthenic depression. The fundamental identity of the underlying processes of both syndromes is demonstrated in the second-order analysis.

The net effect of this study has been the demonstration of the applicability of the logic and techniques of multiple-factor analysis as a primary analytical method in nosology. Factor analysis, or some similar procedure such as latent structure analysis, does provide the means for the objective resolution of other similar studies both in psychiatry and in general medicine.

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APPENDIX

TABLE 1

TETRACHORIC CORRELATIONS BETWEEN THE VARIABLES*

1	2	3	4	5	6	7	8	9	10	11	
1		829	184	390	120	286	147	182	216	343	511
2	829		197	368	-186	386	276	162	360	360	328
3	184	197		238	305	490	437	411	283	348	169
4	390	368	238		483	684	562	643	671	518	355
5	120	-186	305	483		282	326	372	420	211	345
6	286	386	490	684	282		740	695	697	231	418
7	147	276	437	562	326	740		631	683	195	180
8	182	162	411	643	372	695	631		775	175	063
9	216	360	283	671	420	697	683	775		270	196
10	343	360	348	518	211	231	195	175	270		261
11	511	328	169	355	234	418	180	063	196	261	
12	389	316	169	197	-010	348	275	367	078	-017	513
13	243	286	062	337	201	336	136	117	145	220	602
14	361	349	326	430	200	408	247	214	264	399	541
15	276	338	050	283	088	207	-070	065	107	106	557
16	420	376	142	489	238	452	282	153	349	216	751
17	441	284	031	390	324	406	261	189	255	120	542
18	483	285	345	441	131	485	358	288	350	212	481
19	415	265	070	427	327	398	274	271	221	218	541
20	171	179	136	161	059	322	243	087	115	077	345
21	313	398	359	334	206	435	368	335	346	320	514
22	207	262	210	313	-041	298	215	227	326	249	166
23	063	060	013	199	062	054	227	113	113	152	084
24	174	034	-054	311	043	258	111	213	343	196	060
25	-026	208	172	062	-109	161	227	036	148	180	047
26	174	105	077	061	-118	-033	127	-116	122	115	-499
27	-438	-263	-081	-486	-068	-382	-365	-407	-208	-532	-319
28	-171	-010	-054	-342	-091	-102	-089	-168	-123	-385	-366
29	-156	142	004	-202	-005	-136	-034	-137	-092	-305	-339
30	-124	031	047	-375	006	-122	-084	-141	-057	-259	120
31	209	049	137	-257	-022	016	-008	-111	-075	128	336
32	-160	-212	-060	-070	073	014	041	128	025	-269	-059

* All entries were multiplied by 1,000 to eliminate decimal points.

TABLE 1—Continued

	12	13	14	15	16	17	18	19	20	21	22
1	389	243	361	276	420	441	483	415	171	313	207
2	316	286	349	338	376	284	285	265	179	398	262
3	169	062	326	050	142	031	345	070	136	359	210
4	197	337	430	283	489	390	441	427	161	334	313
5	-010	201	200	088	238	324	131	327	059	206	-041
6	348	336	408	207	452	406	485	398	322	435	298
7	275	136	247	-070	282	261	358	274	243	368	215
8	367	117	214	065	153	189	288	271	087	335	227
9	078	145	264	107	349	255	350	221	115	346	326
10	-017	220	399	106	216	120	212	218	077	320	249
11	513	602	541	557	751	542	481	541	345	514	166
12		452	350	561	279	370	476	382	546	435	296
13	452		772	663	612	517	262	459	346	212	354
14	350	772		639	626	470	356	376	531	212	449
15	561	663	639		562	474	291	445	459	284	243
16	279	612	626	562		678	605	541	364	439	187
17	370	517	470	474	678		744	507	286	550	172
18	476	262	356	291	605	744		487	294	705	227
19	382	459	376	445	541	507	487		375	460	282
20	546	346	531	459	364	286	294	375		429	484
21	435	212	212	284	439	550	705	406	429		470
22	296	354	449	243	187	172	227	282	484	470	
23	220	184	331	240	130	035	061	079	422	343	598
24	206	294	309	121	056	178	107	266	277	308	331
25	262	048	229	056	072	025	206	267	707	277	426
26	-430	-054	-100	-075	-228	-232	-328	-052	316	031	479
27	-175	-343	-388	046	-452	-413	-352	-398	-331	-372	-477
28	275	-487	-367	095	-409	-214	-216	-185	067	-099	-110
29	023	-151	-188	106	-224	-334	-312	-352	044	-187	-084
30	158	036	-143	212	-059	-145	-201	-135	-144	-163	-274
31	133	016	154	326	161	194	016	-063	040	-030	-236
32	019	-045	-032	183	-074	-100	-308	-382	067	-234	-263

TABLE 1—Continued

	23	24	25	26	27	28	29	30	31	32
1	063	174	-026	174	-438	-171	-156	-124	209	-160
2	060	034	208	105	-263	-010	142	031	049	-212
3	013	-054	172	077	-081	-054	004	047	137	-060
4	199	311	062	061	-486	-342	-202	-375	-257	-070
5	062	043	-109	-118	-068	-091	-005	006	-022	073
6	054	258	161	-033	-382	-102	-136	-122	016	014
7	227	111	227	127	-365	-089	-034	-084	-008	041
8	113	213	036	-116	-407	-168	-137	-141	-111	128
9	113	343	148	122	-208	-123	-092	-057	-075	025
10	152	196	180	115	-532	-385	-305	-259	128	-269
11	084	060	047	-499	-319	-366	-339	120	336	-059
12	220	206	262	-430	-175	275	023	158	133	019
13	184	294	048	-054	-343	-487	-151	036	016	-045
14	331	309	229	-100	-388	-367	-188	-143	154	-032
15	240	121	056	-075	046	095	106	212	326	183
16	130	056	072	-228	-452	-409	-224	-059	161	-074
17	035	178	025	-232	-413	-214	-334	-145	194	-100
18	061	107	206	-328	-352	-216	-312	-201	016	-308
19	079	266	267	-052	-398	-185	-352	-135	-063	-382
20	422	277	707	316	-331	067	044	-144	040	067
21	343	308	277	031	-372	-099	-187	-163	-030	-234
22	598	331	426	479	-477	-110	-084	-274	-236	-263
23		189	414	382	-274	-141	117	-217	-036	024
24	189		-002	058	-312	-003	-077	-355	-069	306
25	414	-002		759	-289	105	179	-211	137	010
26	382	058	759		-502	-194	132	-389	-517	-048
27	-274	-312	-289	-502		700	466	711	364	317
28	-141	-003	105	-194	700		550	373	096	198
29	117	-077	179	132	466	550		190	042	326
30	-217	-355	-211	-389	711	373	190		310	127
31	-036	-069	137	-517	364	096	042	310		053
32	024	306	010	-048	317	198	326	127	053	

TABLE 2
ARBITRARY ORTHOGONAL FACTOR MATRIX*

	I	II	III	IV	V	VI	VII	VIII	IX	λ^2
1	297	-166	056	340	277	747	025	047	087	880
2	304	001	156	309	125	811	-025	-047	-095	897
3	500	122	103	-002	026	044	-160	291	162	415
4	796	-296	-060	155	-129	125	106	-163	-122	834
5	503	094	-131	071	-011	-236	-127	118	-184	404
6	847	007	055	135	058	026	-067	-144	083	775
7	803	045	129	-129	092	-022	-051	037	064	697
8	847	-028	-134	-174	071	-037	112	-242	128	860
9	836	056	039	-057	-106	099	186	092	-166	798
10	380	-368	029	126	-196	260	088	226	135	480
11	315	-101	-111	739	206	061	-136	126	141	768
12	277	192	147	467	466	031	180	-291	276	765
13	260	-213	062	766	-140	-075	114	-114	-083	762
14	407	-174	178	734	-302	028	195	071	228	953
15	142	311	215	822	143	-036	062	-167	-226	943
16	410	-200	-014	692	093	021	-233	065	-089	763
17	362	-199	-059	552	422	-026	-151	041	-122	697
18	467	-276	-051	318	620	-002	-173	163	046	841
19	387	-336	123	427	243	-006	-118	-122	-174	578
20	219	-019	690	393	202	-171	081	-079	153	785
21	464	-194	197	216	533	002	262	271	-052	767
22	302	-337	466	175	031	005	499	134	-133	738
23	152	-113	459	144	-044	-103	437	201	023	512
24	239	-086	085	110	122	-057	383	-287	126	347
25	129	014	922	-019	196	-106	-192	154	154	1000
26	020	-382	677	-335	-366	253	109	059	-266	1000
27	-365	848	-226	-110	043	-126	-030	116	-230	1000
28	-189	710	147	-273	436	013	137	-212	-153	913
29	-117	567	266	-131	-136	150	126	-136	-137	517
30	-141	577	-182	176	-010	010	-249	116	-151	515
31	-062	340	-070	330	008	096	-131	332	383	517
32	029	413	081	015	-344	-135	149	-244	234	451

* All entries were multiplied by 1,000 to eliminate decimal points.

TABLE 3
ABSOLUTE VALUES OF THE NINTH-
FACTOR RESIDUALS

ρ	f	ρ	f
.00.....	29	.12.....	10
.01.....	57	.13.....	6
.02.....	62	.14.....	5
.03.....	56	.15.....	6
.04.....	52	.16.....	4
.05.....	57	.17.....	2
.06.....	29	.18.....	1
.07.....	38	.19.....	1
.08.....	26	.20.....	1
.09.....	26		
.10.....	15	N	496
.11.....	13		

TABLE 4
ROTATED OBLIQUE SIMPLE-STRUCTURE MATRIX*

	A	B	C	D	E	F	G	H	I
1	-06	02	-06	-08	08	71	04	04	03
2	03	24	04	06	-11	82	-05	-05	-03
3	45	02	24	-01	07	00	05	-09	27
4	55	00	-05	27	00	07	04	08	-09
5	47	20	04	27	21	-28	04	-06	00
6	65	03	20	18	-01	01	-09	21	04
7	68	04	26	-02	05	-04	02	14	01
8	73	-07	00	-08	-03	-08	-02	33	00
9	73	26	01	08	-02	06	25	-02	06
10	19	-23	-04	01	-01	20	18	-22	27
11	-01	-01	-06	39	32	01	02	05	23
12	00	05	01	03	07	07	02	64	02
13	-02	05	-09	64	03	-07	08	04	10
14	15	-10	-01	46	-15	02	21	02	47
15	-08	50	04	64	04	03	04	27	-08
16	07	06	07	58	28	00	-07	-12	06
17	-03	08	-02	36	51	-06	00	05	-13
18	03	-08	03	05	65	-06	04	00	-04
19	02	01	11	40	30	00	-08	00	-23
20	-04	00	46	22	-02	-06	05	28	00
21	04	09	-05	-08	53	-03	45	-01	02
22	-01	03	00	05	08	03	51	-05	-01
23	-01	03	05	00	-01	-06	47	-03	18
24	07	-08	-13	-06	-07	-04	15	41	-04
25	00	-04	82	-01	-04	01	-07	03	-05
26	00	-02	41	-03	-34	34	07	-43	-19
27	01	63	-14	-02	-02	-11	07	07	02
28	-03	53	06	-30	-04	09	01	43	-29
29	10	45	15	-03	-42	24	00	15	-04
30	05	46	00	22	00	01	-09	-02	07
31	-01	00	01	-01	00	06	06	02	53
32	26	06	07	06	-51	-08	-06	33	25

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 5
TRANSFORMATION MATRIX*

	A	B	C	D	E	F	G	H	I
I	83	09	14	13	05	-05	06	12	06
II	32	63	08	-01	-28	05	01	32	18
III	-09	06	73	06	-27	16	-02	00	-12
IV	-27	15	-13	66	12	01	06	06	22
V	-32	07	-06	-36	68	-01	08	29	-34
VI	-10	11	-09	-26	-26	98	-07	-12	01
VII	-09	12	-63	-33	-07	-01	79	25	18
VIII	-01	09	-08	-16	46	-10	59	-73	56
IX	04	-73	11	-46	-28	-03	-11	43	66

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 6
COSINES OF THE ANGLES BETWEEN THE REFERENCE VECTORS*

	A	B	C	D	E	F	G	H	I
A	100								
B	16	100							
C	20	-09	100						
D	08	34	19	100					
E	-26	09	-27	-03	100				
F	-14	16	04	-21	-36	100			
G	-06	25	-57	-27	33	-14	100		
H	11	-12	-02	-18	-32	-05	-24	100	
I	17	-29	-16	-19	-16	-08	39	-10	100

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 7
CORRELATIONS BETWEEN THE PRIMARY VECTORS*

	A	B	C	D	E	F	G	H	I
A	100	-37	-12	17	24	32	16	00	-26
B	-37	100	-10	-55	-10	-44	-57	-13	48
C	-12	-10	100	10	16	14	48	27	-02
D	17	-55	10	100	21	50	48	36	-13
E	24	-10	16	21	100	47	-08	39	27
F	32	-44	14	50	47	100	33	34	-06
G	16	-57	48	48	-08	33	100	29	-51
H	00	-13	27	36	39	34	29	100	10
I	-26	48	-02	-13	27	-06	-51	10	100

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 8
SECOND-ORDER CENTROID
MATRIX*

	I	II	III	IV	h^2
A	39	-24	41	22	43
B	-73	34	-17	16	70
C	33	16	-49	14	39
D	66	10	12	-44	65
E	39	57	28	34	67
F	68	23	26	04	58
G	75	-25	-47	-11	86
H	45	44	-17	-06	43
I	-36	70	11	02	63

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 9
SECOND-ORDER ROTATED
OBLIQUE MATRIX*

	W	X	Y	Z
A	-09	40	-52	-01
B	-06	-13	51	-42
C	56	13	-03	00
D	-08	-03	-01	71
E	-01	68	01	03
F	01	45	-20	35
G	61	-01	-37	33
H	22	19	17	32
I	-26	10	63	-03

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 10
SECOND-ORDER TRANSFORM-
ATION MATRIX*

	W	X	Y	Z
I	33	40	-44	45
II	-09	27	71	20
III	-83	33	-16	12
IV	44	81	-53	-86

* All entries were multiplied by 100 to eliminate decimal points.

TABLE 11
COSINES BETWEEN THE SECOND-
ORDER REFERENCE VECTORS*

	W	X	Y	Z
W	100			
X	19	100		
Y	-31	-47	100	
Z	-35	-42	38	100

* All entries were multiplied by 100 to eliminate decimal points.