PROBLEMS AND PROSPECTS OF THE BIOMETRIC METHOD

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One of the most important gaps in the biometric approach is the lack of suitable techniques for integrating the data emanating from the various scientific models. The reason why the integration problem is so difficult stems from the fact that the population we are dealing with, schizophrenic patients, represents a universe which is defined by psychiatrists in a rather subjective, intuitive way. We are not even sure whether it is one population or a conglomerate of many. In order to place this problem in proper perspective, I must digress for a moment to discuss the taxonomic problem in general.

One of the earmarks of progress in a discipline is a gradual shift from impressionistic description to the more objective practice of qualitative categorization and eventually to the fully quantitative procedure of measurement. In the field of medicine, for example, gross observation gave rise to the classification of all diseases in which a wasting of tissues took place, as consumption. Castiglioni, in his History of Medicine (1947) points out that Antoine-Laurent Jesse Bayle, who lived in the latter part of the 18th century, recognized six kinds of consumption, of which the commonest would be correctly designated as tuberculosis today. In 1651, Willis complained that people were not distinguishing true consumption from other diseases and were calling everything consumption. As one advance after another was made – first by the discovery by Thomas Willis in 1670 that the urine of some of the consumptives was sweetish, then by the discovery of the leprosy bacillus by Hansen in 1880, and then by the discovery by Koch in 1882 of the tubercle bacillus, etc. – each group of patients with one or more unique characteristics in common, not found in the other subgroups, was finally identified as a separate entity. Thus, the disease entity, consumption, was eventually analyzed into diabetes, tuberculosis, cancer, etc. Now each of these diseases in turn is being scrutinized for further subdivision.

The classification which brought modern nosology into being began in the 18th century soon after the ancient notion that all disease was caused by disturbances of the four bodily humors was given up. In psychiatry, the term insanity still lingers on as a vestige of the earlier unitary conception of mental disease. It was not until late in the 19th century that the modern nosology of separate mental disorders was evolved by Emil Kraepelin.

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Kraepelin's approach was clinical, based on a concatenation of factors observed in the behavior of the patient. Although psychologists have tried to develop tests to provide objective qualitative or quantitative criteria for the different diagnostic categories, not much success has been attained thus far.

One of the disease entities which Kraepelin enunciated was dementia praecox, which Bleuler later broadened into schizophrenia. In the earlier literature, while Kraepelin's diagnostic procedures were adhered to, much more regularity was observed in such characteristics of schizophrenia as incidence rates, release rates, etc. With the broadening of the base by Bleuler, the earlier consistencies seemed to disappear. Perhaps Bleuler's attempt was a step in the wrong direction — apparently science proceeds by narrowing rather than widening concepts.

Kraepelin had hoped that by studying large populations he could discover the incipient mentally ill through the use of psychological tests. He wrote as follows:

As soon as our methodology has sufficiently proved itself through experience with healthy individuals, it would be possible to approach the actual ultimate goal of these efforts, the investigation of sick personality, especially of the inborn pathological disposition. In an investigation of many individuals we will always find some who deviate profoundly from the behavior of the vast majority in one or another aspect. If this deviation appears to be damaging to the mental life, and if it reaches a certain degree — which admittedly can only be arbitrarily determined — then we tend to regard it as an illness. Experience teaches us that persons with pathological traits of this kind are, on the whole, in greater danger of a general mental disturbance than those personalities (natures) whose characteristics are in the middle range. We therefore have first of all to investigate individual deviations which cannot be recognized by ordinary observations. If that succeeds, we would be in the position, through the quantitative determinations at our disposal, to establish the borderline between health and disease much more precisely and more validly than has been possible so far. (1896, p. 77.)

If we follow Kraepelin's suggestion, we would use such well-identified groups as registrants for military draft, random samples
of birth registers, or entire populations for psychological investigation, and pick off the deviant individuals for scrutiny. At the present time, such plans are beyond us. Meantime, we are reduced to using the available diagnoses as starting points, applying a variety of psychological and other tests and using statistical technique for determining the subgroups that exist.

If schizophrenia consists of several subgroups, the problem arises how to determine the natural lines of cleavage in this disorder so as to find the underlying subgroups.

While there are techniques available for contrasting samples from two different populations on a variety of tests, viz., Fisher's discriminant function and Hotelling's $T^2$, there are no comparable techniques, to my knowledge, for dealing with the problem of separating a population into subgroups on more than one variable. The univariate problem was solved by Pearson in 1894, by the method of moments. Since there are five parameters to be determined, i.e., the two means, two variances and the proportion of mixture, five moments are sufficient to determine these parameters. The solution depends on a suitably chosen root of a ninth-degree equation. A solution based on the method of maximum likelihood also exists in the univariate case, and we anticipate the appearance of a maximum likelihood solution to the multivariate problem in the not too distant future. Maximum likelihood deals only with estimation. However, since we are concerned more with the question of classification than estimation, the method proposed below, in spite of its being less efficient than that of maximum likelihood, yet has the advantage of not requiring that the number of subgroups be specified a priori.

In summary, one of the acute problems now facing the research biometrician in the field of psychopathology arises from the fact that most diagnoses are based on subjective judgments whose reliability is often not very high. Consequently any particular group of patients who carry a specific diagnostic label is often found to contain individuals who differ from each other not only in level of performance on a given series of tests but also in the interrelationships among these performances, some individuals showing positive trends, while others show negative trends on the same set of variables. As a result, comparisons of one diagnostic group with another or with a normal control group often yield insignificant differences because of the high interindividual variability within these diagnostic groups. While this difficulty is not uncommon in medical, psychological, and social diagnoses, the frequent absence of any objective indicators for making diagnoses in psychopathology makes the heterogeneity in this field a particularly serious problem.
The statistical techniques for dealing with this problem are in a rather primitive state of development. While several methods are available for finding the best set of weights to apply to a series of variables in order to discriminate between two or more populations, these methods are not applicable to our problem since we do not have segregated populations to begin with. Instead we must find the natural lines of cleavage within the diagnosed group so as to separate it into its natural subgroups.

As a first step in this direction we provided the method of like-mindedness analysis (Zubin, 1938a, 1938b), which is suitable for finding the individuals who are like-minded or like-structured on such qualitative variables as response to dichotomous items. This method has already proved its usefulness in a variety of situations and more recently has been exploited by McQuitty (1954, 1960) in several analyses.

In dealing with quantitative data, the like-mindedness method cannot be applied directly unless the quantitative variable can be dichotomized or trichotomized without loss of too much information. If loss of information is to be avoided, a new method suitable to quantitative data must be found.

In order to develop a method applicable to continuous variables, we standardized each score and determined the profile of each patient on these standard scores. Each patient's profile was then matched with the profile of every other patient and patients who resembled each other in level of profile as well as in shape were grouped together. Certain statistical criteria for adequacy of matching were developed and utilized in this grouping. While this method is still in its early stages, it seems to yield subgroups that relate to such criteria as outcome and test performance.

The future of biometric research will depend on the degree of acceptance that objective quantitative methods will receive and on the type of training that can be provided for this field. Because the assessment of mental patients is now largely in the hands of clinically trained men, progress in providing objective measures will be slow. Nevertheless, the advance already achieved through measurement, as demonstrated in the previous papers, lead one to hope that in the long run, objective measures will gain acceptance. Perhaps the greatest stumbling block in the way of progress is the lack of proper training facilities for the biometricians of the future. To really make progress in this field, it is necessary to find individuals who, though steeped in their own discipline, are nevertheless conversant enough with progress in adjacent fields to permit the new discoveries to influence their work. This does not perform
require an interdisciplinary research by individuals cooperating on the same problem. It requires simply having people from different disciplines, each concentrating on his own area, working side by side with those in other areas, so that benefits accruing from informal contacts will be available. Just how to provide such facilities is a problem of the first magnitude — but, acquaintance of the workers in this field with the entire spectrum of psychopathology seems essential to progress in biometric research.

An example of the kind of problem on which interdisciplinary cooperation has been utilized in biometric research is the problem of prognosis. It is not the only problem toward which the various disciplines and techniques can be directed, but it will serve to illustrate one dimension along which different methods can be aligned in the biometric approach to psychopathology. I have selected prognosis because prediction is a primary problem of science. Furthermore, we have gone as far as we can go with diagnosis, and it is time prognosis came to the rescue. One need only to look into a series of case histories to realize to what a low state prognosis has dropped. The most frequent entry is "guarded." The drop in interest in diagnosis and nomenclature is at least in part due to the fact that we have shifted our release policies so that now almost two-thirds of the patients leave the hospital regardless of what therapy or what treatment they have received. If this tremendous outflow of patients occurs anyhow, of what purpose is diagnosis? Furthermore, it looks as if no matter what the diagnosis is, or what the therapy is, in a five-year followup the outcome seems to be independent of the nature of the therapy and to a great extent depends on the nature of the patient. There are at least the following levels of information which may be utilized in making prognoses of outcome of mental illness: paranatal, premorbid, morbid, course of illness, and finally, the criterion — outcome on follow-up. We have attempted to sample each of these levels in order to obtain information which may be useful in making predictions. The first step was to complete a literature survey of the characteristics in these various levels which have been claimed to have prognostic import. A literature consisting of some one thousand articles was surveyed and about a hundred or so traits were discovered that had been claimed to be related to outcome in schizophrenia. This has been reported elsewhere in summary form (Zubin, et al., 1961).

Our initial approach to prognosis (Zubin, et al., 1961) tapped the premorbid area through interviews, the morbid area through psychological tests of the psychomotor, perceptual, and conceptual variety, and the course of illness through ward behavior inventories.
The crudeness of our initial tools and the revolution in release policies which occurred in the middle of our investigation prevented our initial results from emerging to their best advantage. Nevertheless, correlations of the order of 0.40 between test performance and outcome was the rule rather than the exception and certain new subgroupings of schizophrenia were developed based on our test results. It became quite clear that the social-cultural milieu and premorbid characteristics of our patients loomed larger than our psychological tests in making predictions of outcome. Since they are reflections of deviant behavior, rather than the behavior itself, they are not as good indicators of deviation as observations based more directly on the behavior itself.

It might be of interest to inquire why the social-cultural, premorbid characteristics of our patients are so important in prognosis. Anyone acquainted with the current scene must admit perforce that we detect mental disorder not on the basis of anything else, but deviation in behavior from expected social-cultural norms. While it is true that the inner suffering of the patient is also important, this in itself may not always bring the patient to attention unless it affects his overt behavior, nor can we regard this inner suffering as the primary cause of the illness. Social-cultural factors not only determine the detection and emergence of the person as mentally ill but they also determine the kind of treatment he gets and the chances of his return to the community. For this reason, most of the psychological tests used in the clinic measure conceptual responses, which are highly dependent on social-cultural norms.

It is of course important not to lose sight of the biological underpinnings of mental disorder, or some of the very early environmental influences (those which can not now be distinguished from the hereditary) which may propel an individual in the direction of mental illness. How can one separate the biological factors from the social-cultural factors in the emergence of mental illness when, as a matter of fact, it is the social-cultural factors that permit the illness to emerge and be detected. One way of answering this question is to conduct cross cultural studies in mental disorder. Presumably, those factors leading toward the emergence of mental illness which are culturally determined should vary considerably from culture to culture, but those which make the person vulnerable in the psychophysiological sense should be relatively independent of culture, unless they themselves result from social-cultural pressures. The search for these culture-fair indices of mental disorder, namely, some neurophysiological responses which may characterize the vulnerable individual regardless of whether the social-cultural
pressures are enough to elicit mental illness, is indeed a worthwhile search. Perhaps some of the indices which have been discussed in this monograph, namely, pupillographic responses, cross-modal reaction time, and delayed auditory feedback may provide us with measures which are culture-fair.

Thus, biometrics can fruitfully integrate the techniques of various disciplines and focus them on a single problem area in psychopathology. This volume presented and discussed some of the methods being developed and sharpened in connection with various problems. However, as these techniques are perfected, it is hoped that they will be brought together again and again to complement one another in united research efforts.

References