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## **Dementia praecox and manic-depressive insanity in 1908: a Grade of Membership analysis of the Kraepelinian dichotomy**

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**Abstract** Grade of Membership (GoM) analysis, a multivariate classification technique based on fuzzy-set mathematics, was applied to the demographic, history, and mental-state data on 53 dementia praecox cases and 134 manic-depressive insanity cases admitted to Kraepelin's University Psychiatric Clinic in Munich in 1908. The original data recorded by Kraepelin and his collaborators on special *Zählkarten* (counting cards) were rated and coded in terms of the Present State Examination (PSE) Syndrome Check List. The statistical analysis resulted in a high degree of replication of Kraepelin's clinical entities. However, the dichotomy of dementia praecox and manic-depressive insanity was not fully supported. The catatonic syndrome tended to occupy an intermediate position between the two major psychoses. The possibility is discussed that catatonia in Kraepelin's time shared certain clinical features with the later diagnostic groupings of schizoaffective disorder, cycloid psychoses, and other "atypical" forms of psychotic illnesses.

### **Introduction**

In a previous report (Jablensky et al. 1993) we described the methods and results of a reanalysis of Kraepelin's original data on all patients with diagnoses of dementia praecox (DP; 53 cases) and manic-depressive insanity (MDI; 134 cases) who were admitted to the University Psychiatric Clinic in Munich in the year 1908. That previous analysis focused primarily on the internal consistency and discriminant capacity of the diagnostic concepts of DP and MDI, and on the correspondence between these

two categories and our present-day diagnostic concepts. In this paper we report results of further statistical analyses carried out on the original material. Our aim this time was to apply to the 1908 Munich data an independent, statistical method of grouping clinical disorders and patients, and to compare the resulting empirical taxonomy of the original material with Kraepelin's own classification of the major psychoses, which was to become so influential in the subsequent development of psychiatry worldwide. For the purpose we used a new statistical technique capable of generating discrete "pure types" or symptom profiles from the data matrix on symptoms and patients, and of quantifying each patient's degree of membership in any one of the resulting clinical profiles. In other words, the questions we set out to answer were: (a) Given the original 1908 data, is it possible to construct an empirical classification of the cases using a purely statistical approach? and (b) If such a classification can be developed, will it reproduce Kraepelin's disease concepts and classification of DP and MDI, or not?

It is clear that any such analysis will have a bearing on the long-standing and unresolved debate about the validity and clinical utility of the Kraepelinian dichotomy of the major psychoses, a categorical distinction that has survived many of its critics and continues to underlie influential present-day classifications such as ICD-10 and DSM-IV.

Arguments have been raised against Kraepelin's dichotomy of the psychoses almost from the moment it was first formulated (Hoche 1912; Birnbaum 1923; Jaspers 1948), and a number of attempts have been made to carve the diagnostic map of the psychotic disorders in ways different from the original classification. The observations leading to a recurrent dissatisfaction with the dichotomous model of the major psychoses fall into several groups. Firstly, regardless of how the diagnostic criteria of schizophrenia and of the major affective disorders are defined, there is always a substantial group of cases that cannot be assigned unequivocally to either diagnostic category. A proportion of the patients in this group display, simultaneously or sequentially, the characteristics of both disorders. Since the 1930s (Kasanin 1933) the term schizoaffective

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psychosis has been applied to this mixed or intermediate group, but its nosological status remains contentious (Pope et al. 1980). Secondly, both follow-up and treatment-response studies indicate a significant overlap between schizophrenia and the affective disorders in terms of pattern of course (remitting or unremitting), extent of impairment and disability, and response to antidepressants, antipsychotic agents, and lithium (Jablensky 1981; Taylor et al. 1993). Severe depression and an increased suicide risk are now well-established features of the clinical picture of schizophrenic disorders (Caldwell and Gottesman 1990), whereas mood-incongruent delusions and hallucinations are accepted as compatible with a diagnosis of major depression (Maier et al. 1992). Thirdly, the evidence from family studies (Scharfetter and Nusperli 1980; Maier and Propping 1991; Tsuang 1991), twin research (McGuffin et al. 1982), and biological investigations (Taylor 1992) is inconsistent or inconclusive. No biological variable has yet been shown to discriminate reliably between clinical populations of schizophrenia and major affective disorder.

Several strategies have been proposed to remedy these apparent shortcomings of the Kraepelinian dichotomous classification. One approach, originating with Schneider (1939), aims to refine and sharpen the diagnostic criteria in the hope that a stricter assignment of the individual cases will reduce the residue of mixed or intermediate cases. Although DSM-IV and ICD-10 today represent the ultimate development in that direction, neither classification has abandoned the contested category of schizoaffective disorder, and, in fact, other entities, such as acute transient psychotic disorders and schizophreniform disorder, have been added. A more radical approach underlies the proposal (Crow 1986) to replace the dichotomy with a continuum of psychotic and mood-disorder syndromes, thus resurrecting the notion of a "unitary psychosis". Although this approach has certain appeal, no operationalized version of the continuum has thus far gained acceptance. A number of methodological difficulties can be anticipated should a continuum replace the current categorical model underlying biological research into the major psychiatric disorders. Finally, an altogether different approach is that of Leonhard (1957), who developed a complex nosology comprising 35 different disease entities of "endogenous psychoses".

The continuing controversy over a classification created almost a century ago is a poignant commentary on the state of psychiatry, and suggests that a fundamental issue is at stake. We would be better informed if some light could be thrown on the origins of the dichotomy. How well was it supported by the actual clinical data? Did the original body of clinical observations lend itself to alternative taxonomies, different from the one Kraepelin finally espoused and propagated through his influential *Lehrbuch*? To answer such question, a systematic study would have to be launched into the empirical basis of psychiatric nosology at the end of the 19th century and the first decade of the 20th century. Short of being such a project, our limited inquiry into a sample from the database that Kraepelin actually used in the development of the classification of the psychoses provided us with an oppor-

tunity to probe into the original material with modern statistical tools.

## Background and material

The documentation on all admissions to the Munich University *Nervenlinik* headed by Kraepelin in 1908 was made available to us by Professor H. Hippus, then Director of the Psychiatric Clinic and Polyclinic of the University of Munich, and with the assistance of Mrs. A. Kreuter, curator of the archive.

Kraepelin was appointed to the Chair of Psychiatry in Munich in 1903. The new building of the University Clinic whose construction Kraepelin personally supervised opened its wards in 1904. The clinic soon became an active center of multidisciplinary research, which included neuropathology, serology, genetics, physiology, and psychology. Kraepelin's closest collaborators in Munich during that period were A. Alzheimer (1864–1915), H. Gudden (1866–1940), E. Rüdin (1874–1952), F. Plaut (1877–1940), and M. Isserlin (1879–1941). The research documentation, used extensively by Kraepelin in the preparation of the consecutive editions of the textbook and the many revisions of the classification, consisted of a cumulative collection of the so-called *Zählkarten* (counting cards). The *Zählkarte* was a semistructured case summary written<sup>1</sup> on every admitted patient. The card was prepared in duplicate, one copy being filed into the annual book of admissions, and a second copy sorted and bound according to diagnostic group for research purposes. The many volumes of *Zählkarten* constituted Kraepelin's working database. In many instances a *Zählkarte* would contain follow-up notes made by Kraepelin or his assistants during regular trips undertaken to mental hospitals in Bavaria, where former University Clinic patients were transferred or readmitted following the initial hospitalization in Munich.

We selected for analysis the *Zählkarten* of the year 1908 because of the particular significance of that year in the evolution of Kraepelin's thinking. By 1908 the diagnostic system that was to become the cornerstone of psychiatric nosology for subsequent decades was fully elaborated (the 7th edition of the textbook was published in 1904 and Kraepelin was working on the manuscript of the 8th edition). Besides, the system had already attained international recognition. In the same year, Bleuler (1908) published his revision of the concept of dementia praecox and proposed to rename the disorder "the group of the schizophrenias".

## Patients and methods

A total of 721 *Zählkarten* on all consecutive admissions in 1908 were sorted by the original diagnoses, which were then grouped into 12 categories (Table 1). There were 53 cases diagnosed as DP

<sup>1</sup> Many of the *Zählkarten* were in Kraepelin's handwriting; others had been filled in by his assistants and collaborators. More than one-third of the 1908 cards had been prepared on a typewriter.

**Table 1** Consecutive admissions diagnoses in Kraepelin's Clinic, Munich, 1908

Diagnosis	Males	Females	Total
Alcoholism	125	36	161
Manic-depressive insanity	26	108	134
Epilepsy (including psychoses)	56	22	78
Neurosyphilis	40	35	75
Hysteria	23	45	68
Psychopathy	28	30	58
Dementia praecox	27	26	53
Senile/presenile dementia	13	14	27
Mental retardation	11	7	18
Organic psychoses	11	8	19
Neuroses	8	1	9
Other and uncertain	6	15	21
Total	374	347	721

and 119 cases diagnosed as MDI. To the latter we added 15 cases diagnosed as depression, circular depression, circular psychoses, mania, chronic mania, or cyclothymia. Thus, the material selected for the present analysis consisted of 53 DP and 134 MDI cases.

Two raters<sup>2</sup> read the 187 *Zählkarten* and coded the information contained in the case summaries using the Syndrome Check List (SCL) and the definitions of the glossary accompanying the Present State Examination, 9th edition (PSE; Wing et al. 1973) supplemented with items from the WHO International Pilot Study of Schizophrenia (WHO 1979) and the MRC Social Psychiatry Unit Aetiology Schedule (Wing and Sturt 1978). The interrater reliability of the coding procedure was high (unweighted kappa = 0.89). Because the majority of the 1908 cases were first admissions, the information on symptoms occurring at any time prior to the admission was coded on a single SCL. In instances where more than one episode prior to the admission was described in the card, symptoms belonging to different episodes (e.g., a hypomanic and a depressive episode) were conflated. In this sense the information rated was *lifetime*, including the episode of admission.

The demographic, history, and clinical characteristics of the 53 DP patients (27 males and 26 females), and of the 134 MDI cases (26 males and 108 females), have been described in detail in Jablensky et al. (1993). In summary, the majority were first admissions (73.1% of the DP cases and 65.6% of the MDI cases), with a mean age of 29.3 years for the DP group and 35.9 years for the MDI group. Using the PSE syndrome ratings, an ICD-9 classification of the cases was generated by the CATEGO computer program. There was a high level of concordance between Kraepelin's original diagnoses and the assignment of the cases by the computer to ICD-9 categories. Among Kraepelin's DP cases, 88.6% were classified by CATEGO as either schizophrenic or paranoid psychoses. Of the MDI cases, 76.9% were assigned to the ICD-9 categories of manic-depressive disorder or neurotic depression. The overall agreement between Kraepelin's diagnoses and ICD-9 was 80.2% (Table 2).

The aim of the Grade of Membership (GoM) analysis was to generate a classification of the 1908 Munich cases using as input all the information available (a total of 88 variables on each case, including 38 syndrome scores, demographic and history data, and original diagnosis). The GoM model (Woodbury et al. 1978) generates a classification by assigning grades of membership in analytically derived disease categories to cases. The disease categories are intended to be similar to prototypical or "textbook" cases of a given disorder and are referred to as "pure types". The GoM dif-

**Table 2** Agreement between Kraepelin's dementia praecox (DP)/manic-depressive insanity (MDI) diagnoses and the ICD-9 CATEGO classification of the original data

CATEGO-assigned ICD-9 diagnoses	Kraepelin's diagnoses			
	DP	MDI	OA <sup>a</sup>	Total
295.2	11	3	0	14
295.3	25	13	0	38
297.9	11	11	0	22
296.1, 2, 9	2	81	11	94
300.4	0	8	3	8
Other	4	3	1	8
Total	53	119	15	187

<sup>a</sup> Other affective (including cyclothymia, depression, circular depression, circular psychosis, mania, and chronic mania)

Agreement DP / ICD295 & 297: 47/ 53 (88.6%)

Agreement MDI / ICD296 & 300.4: 103/134 (76.9%)

Overall agreement: 150/187 (80.2%)

fers from other classification procedures in that cases need not be assigned to a single diagnostic class. Instead, the characteristics of a case are described as a weighted linear combination of symptoms or syndromes, each associated with a specific "pure type", and the individual patient can simultaneously and partially express symptoms in two or more diagnostic classes. The model assigns scores, or Grades of Membership ( $g_{ik}$ ) describing the degree to which an individual belongs to a pure type. Pure types are described by symptom profiles whose coefficients are estimated for each symptom to indicate the probability ( $\lambda_{ij}$ ) of a symptom being manifest by a case belonging exclusively ( $g_{ik}$ ) to one pure type.

The GoM model has certain similarities to factor analysis in that the function of the pure-type coefficients ( $\lambda_{ij}$ ) can be compared to that of factor loadings, and GoM scores are similar in function to factor scores. There are, however, important differences. Whereas factor analysis identifies clusters of variables from pairwise correlations or covariances and, in doing so, does not retain information on individuals, GoM is essentially a classification of individuals in which the symptoms of a case can be decomposed, using  $g_{ik}$ , into membership in each analytically derived pure type. Furthermore, GoM uses categorical variables without specific distribution assumptions, which makes it more robust to sample variation than factor analysis. The details of the method are described in Woodbury and Manton (1982) and its applications to the analysis of psychiatric databases (in Davidson et al. 1988, 1989; Woodbury and Manton 1989; Manton et al. 1994).

The GoM algorithm was applied to all available data on the 187 cases of MDI and DP. A three-pure-type solution was stipulated, based on the expectation that if in addition to DP and MDI, the original data contained a significant number of individuals with mixed or intermediate symptomatology, a syndrome profile describing such cases would appear as a third pure type.

## Results

Four alternative runs of the GoM program, each differing from the others by the total number of iterations involved (16, 66, 81, and 122), generated slightly different three-pure-type solutions. The output of the 122-iterations analysis was finally chosen for a detailed examination and interpretation on the basis of the likelihood-ratio values obtained.

The essential features of the three pure types are listed in Table 3. The top part of the table includes the variables

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**Table 3** Grade of membership (GoM) pure types derived from Kraepelin's original data

Type I Bipolar affective disorder	Type II Unipolar depression	Type III Dementia praecox
<i>Unique features (<math>\lambda_{kj} &gt; 0.5</math>)</i>		
Female (0.93)	Simple depression <sup>a</sup> (0.97)	Diagnosis DP (1.00)
Hypomania (0.91)	Diagnosis MDI (0.84)	Delusions of persecution (0.95)
Diagnosis MDI (0.90)	Female (0.83)	Male (0.80)
Overactivity (0.87)	First admission (0.80)	Marital status: single (0.80)
Marital status: single (0.65)	General anxiety (0.70)	First admission (0.76)
Sudden onset (0.51)	Worrying (0.59)	Nonspecific psychosis <sup>b</sup> (0.70)
First admission (0.50)	Agitation (0.52)	Continuous illness or incomplete remission (0.67)
	Depressive delusions and hallucinations (0.50)	Sexual and fantastic delusions (0.67)
	Age 31–45 years (0.50)	Age 14–30 years (0.64)
		Catatonic syndrome (0.62)
		Auditory hallucinations (0.61)
		Delusions of reference (0.55)
		Insidious onset (0.50)
<i>Other characteristic features (<math>\lambda_{kj} &lt; 0.5</math>)</i>		
Age 14–30 years (0.45)	Slowness (0.38)	Flattening (0.46)
Irritability (0.44)	Attempted suicide (0.37)	Incoherent speech (0.43)
Simple depression <sup>a</sup> (0.32)	Special features of depression <sup>c</sup> (0.34)	Nuclear syndrome <sup>e</sup> (0.27)
Nonspecific psychosis <sup>b</sup> (0.20)	Other symptoms of depression <sup>d</sup> (0.29)	Organic factors (0.27)
	Lack of energy (0.17)	Loss of interest (0.20)
	Hypochondriasis (0.17)	Social unease (0.20)

<sup>a</sup> Depressed mood, hopelessness, suicidal plans, inefficient thinking

<sup>b</sup> Delusional mood, perplexity, heightened/changed perception, minor hallucinations, suspicion, incongruous affect

<sup>c</sup> Self-deprecation, guilt, guilty ideas of reference, dulled perception, lost affect

<sup>d</sup> Early waking, morning depression, loss of appetite, loss of libido

<sup>e</sup> Thought intrusion, broadcast, commentary, withdrawal, voices about patient, delusions of control and alien penetration

describing each pure type at a high level of probability ( $\lambda_{kj} > 0.5$ ). These characteristics are in this sense unique to the type. They are displayed by individuals belonging entirely ( $g_{ik} = 1.0$ ) to one particular pure type and appear rarely, if at all, among the features describing another pure type. The bottom part of the table lists additional features contributing to the description and interpretation of a pure type, but not necessarily unique to it.

The three pure types generated by the GoM model correspond clearly to the major clinical syndromes of bipolar affective disorder (pure type I), unipolar depression (pure type II), and dementia praecox or schizophrenia (pure type III). Thus, the prototype case of a Kraepelinian bipolar affective disorder in the 1908 material was a young single female with an acute onset of hypomania, overactivity, and nonspecific psychotic symptoms who was also likely to develop episodes of depressed mood, hopelessness, subjectively inefficient thinking, and suicidality. A case of unipolar depression was also more likely to be a female, in her early middle age, presenting with depressed mood, generalized anxiety and agitation (or psychomotor slowness), and frequently, with depressive delusions and hallucinations in addition to ideas of guilt and self-deprecation. She might also describe early waking and feeling worse in the morning, with a loss of appetite and libido. A history of attempted suicide was likely. On the other hand, the prototype of DP was a young single male with an insidious onset of delusional mood and perplexity, persecu-

tory, fantastic and sexual delusions, auditory hallucinations, and frequently, catatonic symptoms. The course of the illness was either continuous or characterized by incomplete remissions. There was affective flattening and incoherence, and the premorbid history would relatively often include seizures, head trauma, or other organic involvement.

The pure types identified by GoM are neither abstract entities nor averages: They are composite profiles of concrete individuals in the sample under investigation that have been selected by the algorithm as the "best" sets of reference points enabling the calculation of each remaining subject's similarity to them in terms of the dimensions provided by the 38 PSE syndrome scores and 50 background or history variables. Of the 69 individuals assigned by GoM to pure type I, 18 (26.1%) had a  $g_{ik} = 1.00$ , i.e., represented the prototype of bipolar affective disorder in the sample studied. In the instance of pure type II, an even greater number, 24 (35.3%), of the 68 patients assigned to it had a  $g_{ik} = 1.00$ . In contrast, only 8 (17.0%) of the 47 subjects assigned to pure type I had a  $g_{ik} = 1.00$  and represented, therefore, prototype cases. Because all of the pure type III cases had an original diagnosis of DP, the lower percentage of cases in this group, which were identified as prototypical, indicates a greater heterogeneity of the clinical features of DP compared with the two prototypes of MDI. As a measure of such heterogeneity we selected the extent to which the DP cases assigned by GoM

**Table 4** Number of cases with primary assignment to each of the three pure types that had significant secondary membership in other pure types

Significant membership ( $g_{ik} > 0.30$ ) in other types	Assigned primary membership ( $g_{ik} > 0.5$ )		
	Type I ( $n = 69$ ) (Bipolar affective disorder)	Type II ( $n = 68$ ) (Unipolar depression)	Type III ( $n = 47$ ) (Dementia praecox)
Type I	—	12	9
Type II	12	—	7
Type III	12	6	—
Total	24 (34.8%)	18 (26.5%)	15 (31.9%)

to pure type III also held membership in the symptom profiles represented by the two other pure types.

Table 4 presents the numbers and percentages of cases assigned by the GoM model to each one of the three pure types that exhibited significant membership in any of the other two pure types ("significant" being arbitrarily defined here as  $g_{ik} > 0.30$  for any other type). There were no significant differences among the three pure types regarding the proportions of cases with  $g_{ik} > 0.30$  for pure types, other than the one to which the case had been primarily assigned by the GoM model. However, whereas the finding of an overlapping membership between bipolar affective disorder and unipolar depression would hardly be surprising, the observation of a comparable extent of overlap between DP and the affective disorders could not be predicted from the discriminant analysis of the same data (Jablensky et al. 1993) which achieved a good separation (misclassification rate 4.3%) between DP and MDI in terms of a discriminant function defined by 12 variables including catatonia, simple depression, hypomania, sexual and fantastic delusions, and flat affect.

In order to identify the characteristics of those pure type III cases that had significant membership in either of the pure types I and II, we tabulated the PSE syndrome scores of the overlapping cases and compared them with the syndrome scores of the nonoverlapping prototypical pure type III cases. It turned out that the majority of the overlapping cases were female (in contrast to the nonoverlapping type III group), and that the three subgroups of pure type III cases differed most from one another on three PSE syndromes: catatonia, the "nuclear" schizophrenic syndrome, and simple depression (Table 5).

Whereas the DP cases overlapping with unipolar depression were mainly women with positive scores on simple depression, the overlap of DP with bipolar affective disorder was largely due to female patients with positive scores on the catatonic syndrome. Of a total of 22 type-III patients (10 men and 12 women) who had positive scores on catatonia, 8 (1 man and 7 women) had high membership coefficients for one of the affective pure types. The other distinguishing characteristic of these 8 cases was the absence (in 6 of the 8 cases) of the "nuclear" schizophrenic syndrome. Similarly, we tabulated the characteristics of all type-I and type-II cases (a total of 18 cases) with significant membership in type III. Five of these cases

**Table 5** Characteristics of the cases with significant membership in pure types other than the assigned primary pure type

Cases	DP	MDI	Males	Fe- males	NS <sup>a</sup>	CA <sup>b</sup>	SD <sup>c</sup>
Type I cases with $g_{ik} > 0.30$ for Type III ( $n = 12$ )	4	8	4	8	1	3	3
Type II cases with $g_{ik} > 0.30$ for Type III ( $n = 6$ )	4	2	2	4	0	2	6
Type III cases with $g_{ik} > 0.30$ for Type I ( $n = 8$ )	8	0	3	5	0	6	0
Type III cases with $g_{ik} > 0.30$ for Type II ( $n = 7$ )	3	4	2	5	1	2	5

<sup>a</sup> Positive score on the "nuclear" schizophrenic syndrome

<sup>b</sup> Positive score on catatonia

<sup>c</sup> Positive score on simple depression

(four women and one man) had positive scores on catatonia. Only one among the 18 cases had a positive score on the "nuclear" syndrome.

Thus, the results of this analysis suggest that the catatonic syndrome in Kraepelin's 1908 data was of a relatively low diagnostic specificity and occupied an intermediate position between the pure types of DP, on one hand, and the two pure types describing manic-depressive disorder, on the other hand. The assignment by GoM of cases with the catatonic syndrome to any one of the alternative diagnostic prototypes was dependent on the context in which catatonia occurred, i.e., the presence or absence of "nuclear" schizophrenic symptoms and of syndromes of affective disorder.

## Discussion

In this study we applied a GoM analysis to Kraepelin's dichotomous classification of the "endogenous" psychoses using a sample from his original case material, which had provided the empirical basis of this classification. By assigning PSE syndrome scores to the signs and symptoms described in Kraepelin's summaries on all patients with diagnoses of DP and MDI admitted to the Munich University Psychiatric Clinic in 1908, we obtained a database that could be analyzed by present-day statistical techniques. This report is an extension of the analyses described in a previous paper (Jablensky et al. 1993) in which we concluded that: (a) Kraepelin's diagnostic system of the psychoses and, in particular, the DP/MDI dichotomy, possessed construct validity, internal consistency, and discrimination power in terms of the clinical material on which it was based; (b) there was a high degree of correspondence between Kraepelin's clinical entities and the ICD-9 diagnostic concepts of schizophrenia

and affective disorders; (c) Kraepelin's DP was a narrower concept than present ICD schizophrenia; MDI, however, was a broader category that included cases that presently might be classified as schizoaffective.

The aim of the GoM analysis described in the present communication was to derive a classification of the 187 DP and MDI cases assessed at the Munich Clinic in 1908 using a statistical taxonomic technique that has been shown to be particularly suitable for analyzing psychiatric data. The GoM model obviates some of the distributional assumptions of factor analysis, operates with categorical data, and is robust to missing values. The main advantage of GoM over other methods is that it produces simultaneously a classification of symptoms (pure types) and a classification of individuals by quantifying their membership into one or more of the pure types. Before discussing the possible significance of the results reported herein, the limitations of the database need to be clearly stated.

Although the two raters were able to apply the PSE glossary definitions and to score Kraepelin's *Zählblätter* in terms of the PSE system with a high level of interrater reliability, it was not possible to establish with certainty the extent to which the original case summaries were selective in describing the patient's behavior and symptoms. Summarizing the clinical features of a case is, of course, selective by definition, and the process is inevitably influenced by the diagnostic concepts and theoretical notions held by the clinician. Some bias, therefore, can be assumed to be always present. In the absence of independent corroborative material, a meta-analysis of a classificatory system in terms of patient data collected by clinicians using that very same system can be in danger of circularity. In this particular instance, we can only assume that the recording of clinical data in Munich in 1908 was not grossly selective and, therefore, biased. Support for this assumption can be derived from Kraepelin's detailed description of the clinical research procedures maintained in his clinic, and of his method of abstracting and classifying clinical data (Kraepelin 1983). He was fully aware of the methodological problems of observer bias and reliability, and insisted on the objective empirical approach to clinical phenomena. All that considered, however, a certain amount of reservation should be retained in interpreting the results of this analysis.

The main finding emerging from the GoM analysis of the 1908 data is the fairly close and veridical reconstruction by a statistical algorithm of the *taxa*, which Kraepelin had obtained using the method of clinical analysis. Thus, the application of a powerful present-day statistical technique indicated that the "best" classification of the original clinical material was that developed by Kraepelin himself. No support for a "third psychosis" emerged from the GoM meta-analysis, and the "atypical" cases not fitting the defining features of the major diagnostic groups apparently did not present sufficiently consistent features that would identify them as a separate "pure type".

This finding, disappointing as it might appear to a nosological "revisionist", disposes with the argument of some critics that Kraepelin's delineation of DP and MDI

was arbitrary, based on personal beliefs and lacking correspondence with any systematic empirical basis (Boyle 1990). It also helps explain the practically universal acceptance of Kraepelin's nosological schema and the lack of success thus far of any rival classifications in the field of the major psychotic and affective disorders.

However, in addition to supporting the construct validity of Kraepelin's diagnostic groupings, the findings reported here raise two questions warranting further research and discussion. The first question concerns the nature and nosological status of the catatonic syndrome. How correct was Kraepelin in assimilating Kahlbaum's catatonia with DP? The second is the general question whether a categorical classification or a continuum is the more appropriate model for a database on the major psychiatric disorders.

Our analysis suggests that Kraepelin's decision to group catatonia with hebephrenia and paranoid dementia, and to construct in this way the new clinical entity of DP, was not unambiguously supported by his own data. As pointed out herein in our reanalysis catatonia appeared to be a two-way bridge between DP and MDI in Kraepelin's 1908 data.

The dramatic decline since the beginning of this century in the frequency with which the catatonic syndrome is diagnosed remains largely unexplained (Mahendra 1981). In contrast to the catatonic subtype, there seem to be no major changes in the relative frequencies of the other subtypes of schizophrenia. The rarity of catatonia today is illustrated by the findings of the WHO ten-country study on the manifestations, incidence, and course of schizophrenia (Jablensky et al. 1992). Of 1151 schizophrenic patients who had a subtype diagnosis, only 60 (5.2%) were identified as catatonic. The majority (52) of these cases were in developing countries, and only 8 were assessed in centers in developed countries. An etiological heterogeneity of the catatonic syndrome has always been suspected (Gelenberg 1976). The affinity of catatonia to the affective disorders was first examined by Kraepelin's contemporaries (Kirby 1913). The latter point is reinforced by the fact that both severe depression and catatonia respond to electroconvulsive therapy (ECT) and remain presently the primary indications for it. A possibility to be considered is that the catatonic syndrome has undergone an imperceptible "dissolution" over time, and that many of the patients with conspicuous motility disorders who would have been diagnosed as catatonic schizophrenia in the past are now included in the rubrics of schizoaffective disorders, cycloid psychoses, acute polymorphous psychotic disorders, and other atypical, mixed, or intermediate forms of psychotic illnesses. Psychomotor disturbances tend to be given less diagnostic weight at present than earlier in the 20th century, relative to disorders of mood, perception, thought, and speech. The collection of systematic data on the frequency and nature of psychomotor and movement disorders in patients with psychotic and mood disorders might shed some light on the vexing question about the disappearance of catatonia.

Regarding the categorical vs continuum classification of psychiatric data, the application of the GoM model to

Kraepelin's material provides an illustration of a way in which the two approaches can be combined. The multivariate nature of psychopathological data, and the absence of sharp boundaries between psychopathological states, have long been recognized. It has been pointed out repeatedly that dimensional models provide a better representation of reality in the area of psychiatric disorders than discrete disease classes (Beck 1967; Crow 1990). Although toward the end of his career Kraepelin moved radically toward a dimensional point of view (Kraepelin 1920), the classification system that he transmitted to the next generation of psychiatrists was a categorical one. It was predicated on the belief that discrete disease classes could be defined in psychiatry following the same rules and procedures as in physical medicine at the time. Kraepelin's assumptions about the nosological entities in psychiatry have been the subject of criticism, and Jaspers (1948) referred to the disease-entity hypothesis as "an idea in Kant's sense", or as a goal that could never be attained. However, a purely dimensional nosology has never been demonstrated to be a viable option in clinical practice, possibly because of lack of agreement on the relevant dimensions and the computational complexity involved. Besides, a dimensional classification is likely to appear counterintuitive to clinicians who seem to rely more on pattern-recognition strategies and on storing information according to prototypes of disease states, rather than on statistical inference (Feinstein 1967; Albert et al. 1988). Apart from the viewpoint of cognitive ease, the problem of categorical vs dimensional organization of psychiatric diagnostic data is of critical importance in psychiatric research. For example, current genetic linkage strategies depend on the assumption that discrete phenotypes can be unambiguously identified. In the numerous instances where this assumption cannot be met because of the fluid nature of psychiatric data, the case is either forced into a diagnostic category or excluded, resulting in a loss of information.

The GoM model combines the advantages of the prototype-based classification of psychiatric phenomena (by identifying discrete pure types or symptom profiles) and of the multidimensional classification of individuals (by allowing each subject to be a member of two or more discrete pure types and by quantifying their degree of membership). Either of the two options provided by GoM, i.e., assignment to one discrete pure type or shared membership in several pure types, can be the basis of classifying or sampling individuals depending on the aims and purposes of the investigation. In this sense it can be seen as a post-Kraepelinian research tool capable of dealing with the increasing complexity of psychiatric data.

## Conclusions

Kraepelin's clinical entities of DP and MDI are empirically replicable in terms of his own clinical data, using a modern statistical technique (GoM analysis). In 1908 DP was more heterogeneous in its syndromal profile than ei-

ther of the two subtypes of MDI, bipolar affective disorder, and unipolar depression. The dichotomy of the major psychoses, DP and MDI, was only partially supported by Kraepelin's clinical data. The catatonic syndrome and, especially female patients with catatonic features, tended to occupy an intermediate position between DP and bipolar affective disorder. By applying GoM analysis to Kraepelin's original data, we have shown that the conflicting requirements of a categorical system and a continuum model for organizing psychiatric data need not be mutually exclusive, and that a classification possessing both properties is feasible.

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