# AN ECOLOGICAL STUDY OF HOSPITALIZED MENTAL DISORDERS IN BRITISH COLUMBIA

by

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B.A., University of British Columbia, 1965

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in the Department

of

Psychology



SIMON FRASER UNIVERSITY

May, 1971

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## ABSTRACT

The purpose of this thesis was to describe relationships between environmental attributes and rates of mental hospital admissions in different geographic regions of British Columbia. Seventy-five environmental variables were reduced to eighteen orthogonal factors which were used, in a canonical regression analysis, to predict rates of admission for twelve diagnosed disorders.

An interpretation of the results with reference to the epidemiological literature indicated two main points of agreement. Higher rates in urban than rural areas appeared to be replicated as did the occurrence of higher rates of non-depressive neurosis and sociopathy in areas of sociocultural disintegration. In addition, several combinations of environmental attributes indicative of sociocultural disintegration were found with higher rates of different combinations of mental disorder on each one.

The identification of a variety of environment-mental disorder relationships within one multivariate analysis was considered to clearly demonstrate the value of canonical regression analysis as an exploratory method in epidemiological research.

## ACKNOWLEDGMENTS

I would like to thank my committee members, Drs. Kendall, Coles and Clark, for their advice and assistance at all stages of this project. For permitting access to hospital records, I would like to thank Dr. B. F. Bryson, Superintendent of Riverview Hospital and Dr. W. J. G. McFarlane, Clinical Director of Riverview Hospital. Finally, my special thanks to Dr. Raymond F. Koopman, Department of Psychology, Simon Fraser University, for his inspiration and assistance in conducting the statistical analyses.

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# SECTION I: INTRODUCTION

# CHAPTER 1: Problem

## Statement of Purpose

The essential purpose of this thesis was to describe relationships between environmental characteristics and rates of various mental disorders in different geographic regions of British Columbia. A secondary purpose was to derive an environmental taxonomy, a step preliminary to the epidemiological analysis. The empirical results were to be interpreted with a view to contributing to knowledge of the etiology of mental hospital admission.

On a conceptual, rather than empirical level, attention was directed to questions of statistical methodology. The application of canonical regression analysis, used when relating the diagnostic rates and environmental characteristics, was to be assessed with regard to its general suitability for epidemiological data analysis.

## The Epidemiological Study of Mental Disorders: A Review of the Literature

Epidemiology is basically a method of naturalistic observation. In order to better understand diseases in all their aspects, it is involved with the scrutiny of disease incidents in terms of the times, places, and persons in which they occur (Reid, 1960). Through a consideration of these factors, the circumstances under which diseases occur can be identified and etiological hypotheses can be inductively generated.

Historically, epidemiology's original concern was with the investigation of acute infectious diseases. However, as more and more of these diseases were brought under control, it was found feasible to apply the methods of epidemiology to chronic and endemic diseases. The traditional

conception of mental disorder as a medical problem ensured its inclusion in studies of chronic and endemic disease (MacMahon, Pugh and Ipsen, 1960; Plunkett and Gordon, 1960; Reid, 1960).

The basic assumption in epidemiology is that of interaction between organism and environment. In diseased persons, some aspect of the person's organism is assumed to interact with an external agent in such a way that a disease process ensues. In well persons who are also exposed to the disease, the same interactive process does not occur. The two problems defined for epidemiology, then, are the determination of the crucial qualities of diseased individuals that predispose them to illness, and of the nature of the agent which interacts with that personal characteristic.

There is no one prescribed course to follow in epidemiological studies of either mental or medical disorders. Research orientations are dictated by the question at hand, particularly by the state of knowledge which has been previously reached in studying the specific problem. Some differences in orientation to be considered here include the level of analysis focussed upon, and, procedurally, differences between descriptive and comparative studies and primary and secondary data sources. Cutting across these differences are those relating to the primary aim of the study, whether it is theoretical or practical.

Besides sharing the common objective of predicting the occurrence of disorders, epidemiological studies share a naturalistic orientation. The advantages of naturalistic methods have been discussed by Barker (1965, 1968), and are, essentially that the data obtained by such methods are unique to the natural situation and that they can be collected free of iatrogenic influence. (A discussion of particular findings of epide-

miological research follows in Chapter 3.)

Levels of Analysis

Bloom (1968) has distinguished between two main types of epidemiological investigations. The first is the demographic study in which characteristics of disordered persons are related to various rates of mental disorder. In ecological studies, on the other hand, neighborhood or other environmental characteristics are related to mental disorder rates. While demographic studies identify high- and low-risk groups of people, ecological studies identify high- and low-risk areas of residence. In many major programs of epidemiological research (e.g. Hollingshead and Redlich, 1958; Gurin, Veroff and Feld, 1960; Jaco, 1960; Srole, Langner, Michael, Opler and Rennie, 1962; Leighton, Harding, Macklin, Macmillan and Leighton, 1963; Myers and Bean, 1968) both types of variables have been considered, while in studies on a smaller scale, it is usual to concentrate on one or the other of these types of data.

Because of the limited inferences that can be drawn from ecological relationships, this approach is most appropriately the beginning step in the inductive process of identifying the etiology of a disorder. In a program of study it can be fruitful to begin investigations of the rates of disorder at the ecological level simply to ascertain whether similar relationships exist to those previously found elsewhere.

Faris and Dunham (1960) performed the first and best known ecological study, investigating the distribution of the psychoses in different sections of Chicago between 1922 and 1934. Clausen and Kohn (1959) later discovered that, in a smaller city, psychoses were randomly distributed rather than concentrated in the core of the city as Faris and

Dunham had found. A review by Buss (1966) draws the conclusion that the relationship between rates of mental disorder and area of residence within a city decreases as city size decreases, as does Dunham (1961), who discussed some of the fertile hypotheses generated by these findings.

Ecological studies of mental disorders, usually using census tracts as the unit of analysis, have been gaining in frequency in the past decade. Bloom (1966) studied the distribution of selected socially deviant behaviors in the different census tracts of Pueblo, Colorado, later following this study with an extensive ecological analysis of psychiatric hospitalizations in the same area (Bloom, 1968). Klee, Spiro, Bahn and Gorwitz (1967) performed an ecological analysis of diagnosed mental disorder in the census tracts of Baltimore, Maryland, while Struening and Lehmann (1969) have embarked on a program in the Bronx, the aim of which is to evaluate the effectiveness of and anticipate the need for psychiatric facilities in the different health districts in their catchment area. Another study of interest to epidemiologists, although having a sociological orientation, is that of Cartwright and Howard (1966) on the ecological correlates of gang delinquency in Chicago.

A somewhat different emphasis is found in a review by Sechrest and Wallace (1967), giving particular attention to studies on the effects of weather and climate on behavior. In recent years there has been a revival of interest in this area, an area which saw a great deal of activity early in the present century. Tromp (1968) has written a book considering the effects of the meteorological environment on mental as well as physical disorders. For examples of recent studies see Cerbus (1970), Edelstein, Gnassi and Mishelof (1966), Friedman, Becker and Bachman (1965), and Pantleo (1970).

As a research strategy, the ecological approach has been subject to criticisms that have not been levelled at demographic studies. The most influential criticism was that of Robinson (1950), who demonstrated that ecological correlations derived on a number of groups may be quite different from the correlations that would have resulted had each group member entered the correlation separately. In other words, Robinson was demonstrating that it was not possible to make inferences to individuals from correlations derived on groups. Menzel (1950) replied that such a criticism did not invalidate the approach used in human ecology, stating that correlations between geographic areas were of interest in their own right. However, Dogan and Rokkan (1969) credit Robinson with having stifled research in human ecology for about a decade, as well as, more positively, with inspiring greater rigor in methodology since the discipline has been enjoying a resurgence of interest.

A further criticism of the ecological approach was levelled by Kennedy (1964), but his argument has not had an impact at all comparable to Robinson's. Kennedy's basic assumption was that if the presence of certain environmental phenomena implies higher rates of mental disorder, then the absence of those same conditions must imply the presence of mental health. There is no established empirical validity for this statement. In all, criticism has not indicated invalidity of the ecological approach, Kennedy's criticism being based on a faulty assumption and Robinson's being true only in cases where unjustified inferences are made from results.

Demographic studies of mental disorder have tended to outnumber the ecological studies, probably because of the organic, intrapsychic, and interpersonal nature of most early theories of etiology (Myers and Bean,

1968). The move beyond the level of the individual is seen in the advocacy of Myers and Bean of the consideration of persons within the context of social forces to which they are subjected. Recently, interest has been growing in the study of non-social environmental forces as well (Wohlwill, 1970).

Demographic variables are those which are measures of the individual, such as age, sex, and even socially defined variables such as socioeconomic status. Examples of studies of the demographic type are the classic study of social class and mental illness conducted by Hollingshead and Redlich (1958), the census and follow-up of a small community in Sweden (Hagnell, 1969), Malzberg and Lee's (1956) study of the relationship between migration and mental disorder, and, of interest in the present study, a perusal of age, sex, marital status and other variables for persons resident in Vancouver and Victoria who were hospitalized with mental disorder in the period 1958-60 (Richman, 1968).

In the past few years, teams of researchers in different parts of the world have begun compiling psychiatric case registers in order to better assess the temporal aspects of mental disorder. Two demographically oriented studies derived from such data banks are that of Adelstein, Downham, Stein and Susser (1968) on the epidemiology of mental disorder in an English city, and that of Warthen, Klee, Bahn and Gorwitz (1967) on the epidemiology of diagnosed schizophrenia in Maryland.

Epidemiological Procedures

As mentioned at the outset, epidemiology is basically a method of naturalistic observation. Specific procedures under the more general naturalistic rubric differ in whether the emphasis is descriptive or comparative and in the type of data, whether primary or secondary that is used.

Descriptive studies are the simplest form of studies in epidemiology. Demographically, incidents of disease may be categorized according to age, sex, etc. of the afflicted population, while ecologically, the areas of residence of each member of the population may be described according to population density, crime rate, etc. In this manner, the circumstances under which diseases occur at that point in time can be identified.

It is self-evident that description must precede comparisons, whether the comparisons are between different populations or between the same population at different points in time. Comparisons over time, can, in some cases, be likened to experiments.

Of the experimentation that occurs within the context of epidemiological research, laboratory experimentation as such is invariably the consequence of etiological hypotheses generated from field studies (MacMahon, et. al., 1960; Plunkett and Gordon, 1960; Reid, 1960). The infrequently used technique of observing the spread of an artifically introduced disease in an animal population, as reported by MacMahon et. al. (1960) is of no value in the study of mental disorder. However, the introduction of change into a natural environment, for example, the institution of a community mental health clinic, facilitates experimental study wherein the clinic is seen as the independent variable and rates of mental disorders are seen as the dependent variables. Struening and Lehmann's (1969) continuing program of mental health evaluation in the health districts of the Bronx can be regarded as an experimental study of this type.

The comparison of rates of mental disorder following spontaneous social change can also be observed from an experimental point of view, providing, of course, that there is adequate knowledge of base rates. Results based

on mental hospital admission rates, as reviewed by Reid (1961) and Murphy (1961), indicated increases in neurotic and psychosomatic disorders and decreases in functional psychoses for civilian populations during wartime, with a return to prewar rates after the war. Similarly, further results reviewed by Murphy (1961) indicated an increase in rates of mental disorder in non-Western societies undergoing Westernization, and differing rates of mental disorder, possibly due to varying social demands and prejudices, found in migrants from the same country of origin to different countries. Lesse (1968), in agreement with Murphy, presents evidence indicating increases in certain types of mental disorders in Japan and India with increasing socioeconomic and sociotechnologic change, while Leighton and Hughes (1961) comment that if they were to devise a system for classifying cultures that would have maximal relevance for mental health and illness, they would devise one based on sociocultural change.

With increasing utilization of psychiatric case registers, as mentioned previously (Adelstein et. al., 1968; Warthen et. al., 1967), studies on the effects of social, cultural, and environmental change will be increasingly practicable. As changes naturally occur, it will be possible to observe the details of changes in mental disorder rates. Conclusions derived in this way can be as precise as those from contrived experiments, assuming the nature of the change is understood, with the added advantage that the change is natural and therefore free of iatrogenic influence (Barker, 1968).

The data of both descriptive and comparative studies may be collected from either primary or secondary sources, or both. Primary data are collected directly from persons in the population under study, while sec-

ondary data are originally collected for another purpose but are appropriate for the study at hand. In general, the major epidemiological studies have conducted comprehensive sample surveys (e.g., Gurin, et. al., 1960; Srole, et. al., 1962; Leighton et. al., 1963), obtaining primary data. Such data have the advantage of being uniquely suited to the questions at hand.

Secondary data sources such as hospital records may be of limited value in that they may contain errors and/or less information than desired. Secondary data sources have been used to obtain environmental information in many ecological studies (e.g. Klee et. al., 1967; Bloom, 1966, 1968; Struening and Lehmann, 1969), and in these cases limitations similar to those with demographic data, such as problems of accuracy and suitability, are encountered. Perhaps the most comprehensive epidemiological study using only secondary data was that of Faris and Dunham (1960).

Purposes of Epidemiological Research

The purposes of epidemiological research have been dichotomized by Reid (1960) into descriptive and analytical, or synonymously, practical and theoretical. Ideally, of course, a program of study encompasses both these aspects, such as in the Stirling County study (Leighton et. al., 1963) and the Midtown Manhattan study (Srole et. al., 1962).

Many studies of an epidemiological nature are designed to evaluate community programs in psychiatry. Collins (1968) reviewed a number of evaluative programs in progress at that time, including Struening and Lehmann's (1969) in the Bronx, making particular mention of the increased value of case records with recent advances in computer technology. Richman's descriptive study of mental disorder in the metropolitan areas of British Columbia was conducted with the aim of assessing the use of

psychiatric in-patient care and the results of community mental health programs (Richman, 1968). On the other hand, Klee et. al. (1967) in their ecological study of mental disorder in Baltimore state an expectation that their study would have relevance to both theory and community mental health planning.

With increasing familiarity with the epidemiological literature, it becomes more and more apparent that both practical and theoretical concerns are served by the majority of studies, however limited their scope. Comparisons of data collected in a similar manner but on different people at different times and in different places often reveal interesting differences. A well-known example is the failure to replicate the Chicago relationships between area of residence and rates of schizophrenia (Faris and Dunham, 1960) when dealing with a smaller city (Clausen and Kohn, 1959). Similarly, Jaco (1960) failed to find relationships between socioeconomic status and mental disorder similar to those discovered in New Haven, Connecticut (Hollingshead and Redlich, 1958) when dealing with a Texas population. Comparisons of conditions under which results do and do not replicate provide substantial hypotheses for further investigation.

A more simple operation, comparison of incidence rates, while not so directly conducive to precise hypothesis formation, does raise questions to stimulate further research. For example, Hagnell (1969) reported a lower incidence of mental disorder in the lowest socioeconomic stratum in Sweden as compared to Canada, and Richman (1968) reported a first admission rate for the Vancouver-Victoria area of 90 per 100,000 as compared to his previous findings of 67 per 100,000 in the Regina-Saskatoon area and 69 per 100,000 in London, Ontario.

It is difficult to conceive of a study, whether primarily either

practical or theoretical in purpose, having little utility for other purposes. The general applicability of epidemiological findings can perhaps be best explained by reference to its naturalistic orientation and its goal to describe and understand events that occur spontaneously in nature.

## Summary

The stated purpose of this thesis is to describe relationships between environmental characteristics and rates of mental disorder in various geographic regions of British Columbia. As a means to this end, the derivation of an environmental taxonomy is to be undertaken.

A review of literature relating to the epidemiological study of mental disorders began with a definition of epidemiology as a method of naturalistic observation in terms of the times, places, and persons in which disorders occur. Variations in epidemiological methods were discussed in terms of the level of analysis focussed upon, the most commonly observed procedural variations, and the purposes to which epidemiological research addresses itself.

The present study can be readily described in terms of the discussed variations in epidemiological methodology. An ecological level of analysis is focussed upon, in that the unit of analysis was the geographic region rather than the individual. Demographic or individual analysis is not considered in this study. In terms of procedural variations, the present study has a descriptive emphasis, comparisons occurring only in a general sense, and the data sources are secondary rather than primary. Finally, the purpose of the study, as compared to epidemiological studies in general, is theoretical rather than practical.

Basically, then, the present study can be described as an ecological descriptive study using secondary data and having a theoretical purpose.

# CHAPTER 2: Method

## The Definition of Mental Disorder

It was stated by Scott (1958) that most epidemiological studies use the criterion of exposure to psychiatric treatment as the definition of mental disorder. When such a definition is used, diagnosis after admission usually serves to describe the nature of the disorder.

In previous ecologically designed studies of the epidemiology of mental disorder, wide variations in the applications of this criterion as the definition of mental disorder have been found. Faris and Dunham's (1960) definition, in their study of Chicago in the period 1922-1934, was first admission to both public and private mental hospitals with a psychotic diagnosis. Bloom (1968), in his study of Pueblo from 1959-1961, also used both public and private mental hospitals as data sources, and defined mental disorder as first admission for any psychiatric disorder. In contrast, Klee et. al. (1967) defined as mentally disordered all persons in Baltimore during the period July 1, 1961 to July 1, 1964 who entered both inpatient and outpatient clinics in the Baltimore area, excluding only persons under private psychiatric care and those attending mental health agencies not under psychiatric direction. Jaco (1960) defined a population of interest similar to that of Klee et.al. (1967), in that he obtained his data from private psychiatrists and all public and private hospitals used by his population. However, he included only cases of psychosis, as in Faris and Dunham's (1960) study. More specifically, his population of mentally disordered persons included all bona fide residents of Texas entering psychiatric treatment for the first time during 1951 or 1952. On the whole, considering the variability in def-

initions that have been employed, it is surprising that there has been some agreement in results across studies.

It can be seen that, under the general criterion of exposure to psychiatric treatment, persons attending private mental hospitals, outpatient clinics and private psychiatrists have been included in addition to those admitted to public mental hospitals. Under the definition employed in the present study, only mentally disordered persons who were admitted to Riverview hospital, diagnosed, treated and discharged during the period Jan. 1965 to April 1968 were included. In contrast to some previous studies (e.g., Adelstein et. al., 1968) which have used first admission rates as approximations to the true population incidence of mental disorder, the concern here was with hospitalization per se rather than with mental disorder in general. Mental hospital admission was felt to be a phenomenon worthy of specific attention in that it indicated not only mental disorder but also the inability of the person's community of residence to incorporate the disturbed person and resolve his distress.

Relevant in this regard is Scott's (1958) criticism of exposure to psychiatric treatment as a criterion of mental disorder, that differing rates in different geographic regions may reflect the degree to which communities accept or reject deviants. It was assumed in the present study that rejection of deviants was one of the determinants of mental hospitalization. It was expected that the interrelationships between the diagnostic data and the environmental variates, to be discussed later, would indicate where rejection was more prevalent.

In effect, then, mental hospitalization was studied as an event index-

ing mental disorder and the necessity for hospitalization. Specific diagnoses given subsequent to admission were considered as indexing some observable aspects of the persons' behaviors relevant to severity, social acceptability, etc. The value of analyzing the correlates of mental hospital admission was felt to lie in the possibility of gaining a better understanding of the phenomenon and eventually contributing to its prevention.

The Reliability, Validity and Discriminability of Psychiatric Diagnosis.

Because the reliability and validity of psychiatric diagnosis have generally been found to increase when broad categories are used (Zigler & Phillips, 1961), the available data were collapsed, for purposes of data analysis, into 12 categories. Within the 12 categories, four more basic categories could be distinguished (see Table 2.1).

As in the case of the selected criterion of mental disorder, previous epidemiological studies of an ecologic design have differed in the diagnostic categories upon which they have focussed attention. These differences are summarized for the studies most relevant to the present one, in Table 2.2.

Arguments can be made both for and against the differing degrees of grouping of diagnostic categories seen in Tables 2.1 and 2.2. As mentioned above, reliability and validity in diagnosis have been shown to increase as categories are broadened -- an argument in favor of Bloom's (1968) use of only four categories. On the other hand, such broad groupings may be so heterogeneous within themselves as to curtail the formulation of specified etiological hypotheses.

Further to this question, Zigler and Phillips (1961) have discussed the Kraeplinian view of diagnosis and its original aim to incorporate

Table 2.1

Groupings of Diagnostic Data

| Most General Level | Categories Entering Statistical Analyses | Specific Diagnoses forming the more General Categories |
|---|---|---|
| 1. Brian disorder | 1. Brain disorder | Senile and pre-senile dementia<br>Acute and chronic alcoholic psychoses<br>Acute and chronic brain disorders, psychotic and non-psychotic, of other origin |
| 2. Functional psychoses | 2. Non-schizophrenic psychoses | Manic-depressive psychoses<br>Involutional psychoses<br>Psychotic depression<br>Paranoid states |
| | 3. Chronic undifferentiated schizophrenia | Chronic undifferentiated schizophrenia |
| | 4. Acute schizophrenia | Acute undifferentiated schizophrenia |
| | 5. Paranoid schizophrenia | Paranoid schizophrenia |
| | 6. Miscellaneous schizophrenia | Simple schizophrenia<br>Hebephrenic schizophrenia<br>Catatonic schizophrenia<br>Residual schizophrenia<br>Schizo-affective disorders |
| 3. Neurosis | 7. Depressive neurosis | Depressive neurosis |
| | 8. Other neurosis | Anxiety neurosis<br>Hysterical neurosis<br>Phobic neurosis<br>Obsessive-compulsive neurosis<br>Hypochrondriacal neurosis<br>Psychophysiological disorders<br>Other and unspecified neurosis |
| 4. Personality disorder | 9. Personality disorder | Trait and pattern disturbances<br>Sexual deviation |
| | 10. Sociopathy | Antisocial personality |
| | 11. Addiction | Alcoholism<br>Drug dependence |
| | 12. Transient situational disturbance | Transient situational disturbances |

Table 2.2

Specific diagnostic categories studied in previous epidemiological research of an ecologic design

| Study | Time period of sample | Diagnoses studied |
|---|---|---|
| Faris & Dunham (1960) | 1922-1934 | Schizophrenia, total cases<br>Paranoid schizophrenia<br>Hebephrenic schizophrenia<br>Catatonic schizophrenia<br>Simple and unclassified schizophrenia<br>Manic-depressive, total cases<br>Manic-depressive, manic<br>Manic-depressive, depressed<br>Alcoholic psychoses<br>Drug addiction (without psychosis)<br>General paralysis<br>Senile psychosis<br>Arteriosclerotic psychosis |
| Jaco (1960) | 1951-1952 | Schizophrenia<br>Affective psychosis<br>Involutional psychosis<br>Cerebral arteriosclerosis<br>Senile dementia<br>Toxic psychosis<br>Syphilitic psychosis<br>Other organic psychosis<br>Unspecified psychosis |
| Klee et. al.(1967) | 1961-1964 | Schizophrenic and paranoid disorders<br>Involutional and affective psychotic reactions<br>Personality and psychoneurotic disorders<br>Brain syndromes<br>Mental retardation<br>Alcoholic disorders |
| Bloom (1968) | 1959-1961 | Functional psychoses<br>Psychoneurotic and psychosomatic disorders<br>Acute or chronic brain syndrome<br>Personality disorders |

information relating to etiology, treatment and prognosis into diagnoses, stating that etiological information is usually the last to be discovered about a disorder. But, in order to identify etiological variables, it is an essential condition, as discussed by Eysenck (1961), to first state the precise nature of the disorder under investigation. As epidemiology's main concern is the determination of disease etiology, it follows that it would be most appropriate to study specified discrete disorders rather than heterogeneous groupings of disorders. Unfortunately, the misclassifications encountered when fine discriminations are utilized renders this ideal impractical.

One possible solution is to obtain an unusually large sample, retaining fine discriminations within it. Faris and Dunham's study, covering 12 years and using 28,763 cases, is an example of a case in which such a procedure was possible (Faris & Dunham, 1960). However, criticism can be levelled at the unusually long time period studied and at the possibility that social change may have biased the data in some unknown manner. It is a more usual practise to study admissions over periods from two to three years long, as in the present study.

The 12 diagnostic categories seen in Table 2.1 were chosen as a compromise between the requirements of validity and reliability and those of discriminability of disorders. In order to assess more general trends, the four broader categories, also seen in Table 2.1, could be considered in interpretations.

## The Description of Environments

The province of British Columbia is well suited to epidemiological studies of an ecological design because of the great environmental variety within its boundaries. Topographically, it ranges from the fertile delta of the Fraser Valley, the fiords of the western coastline,

the inhospitable mountains covering much of the province's area, the rolling hills of the interior plateau, to the prairie flatlands of the Peace River country which blend in the north to tundra. A great variation in climate is represented within the province, from the mild and rainy marine climate on the coast to the dry temperature extremes of continental climate in the interior.

The most dense population distribution occurs in the Southwest corner of the province, with Vancouver, the third largest city in Canada, at its center. In sharp contrast, there are regions covering about half the area of the province which are so sparsely populated as almost to be considered virtually uninhabited. Between these extremes lie many cities and towns, ranging between 100,000 and less than 1000 in population, and numerous unincorporated hamlets. The province's economy is based on primary industry, mainly logging, mining and fishing, the relative roles of these different industries varying across regions. There are also great differences in the ages of communities, some being over 100 years old, while some are new planned communities, erected within months to service new industries.

Ethnically, like other areas in western North America, British Columbia has many Japanese and Chinese immigrants. In addition, because of the comparatively small white population, the native Indian population is more in evidence and perhaps more culturally influential, particularly in rural areas, than in most areas of the U. S. and in many areas of Canada. The French Canadian influence is not as strong as in eastern Canada, with persons of British ancestry forming the ethnic majority.

Selection of Geographic Areas.

The school districts of British Columbia were chosen as the environ-

mental areas of study to enter the ecological analysis. The chief advantage of these regional divisions was that they were roughly analogous to counties, containing in most cases, at least one major town and a rural area served by that town. The use of areas similar to counties was considered convenient for purposes of comparison to the previous studies after which the environmental taxonomy was to be modelled, such as those of Johnson (1958), Jonassen and Peres (1960), and Kendall (1963). It was also believed, on the basis of general knowledge of the province, that the school district boundaries approximated social areas with which persons tend to identify and which would therefore be expected to determine their environmental standards of comparison or frames of reference.

The diagnostic data, previously described, to which the school district environmental analysis was eventually to be related, had been located during routine record keeping for the Provincial Department of Health, by both school district and town. The fact that there were few cases in many areas of the province indicated that use of the larger school district regions was more practical for statistical purposes than the use of towns as environmental units. At the same time, clustering of the school districts to ensure an even larger sample of admissions within each area entering the analysis was considered unviable because of the high degree of heterogeneity of environmental characteristics within regions, and lack of heterogeneity between regions, that would have resulted.

In 1966, the median year for which the Riverview data were available, there were a total of 83 school districts in British Columbia, representing a wide range of attributes. Although it was considered necessary to

ensure maximum heterogeneity between regions and homogeneity within regions, it was required that the characteristics to be measured be present, and thus measurable, in all regions. To promote comparability among districts, three very large and sparsely populated areas in the north of the province were excluded from the analysis while two particularly small ones were combined with adjacent school districts. As a result, 78 geographic regions entered the analyses. A map of the school districts can be seen in Appendix A-1 and a listing of them in Appendix A-2.

Selection of a Method to Describe the Geographic Areas

Former ecological studies on the epidemiology of mental disorder have used a variety of methods to describe environmental differences. Jaco's chapter on the spatial distribution of psychosis in Texas (Jaco, 1960) exemplifies the simplest and crudest approach to ecological investigation. He mapped a number of subsets of his data on mental disorder rates, distinguishing between rates on the basis of the quartiles into which they fell. Environmental correlates of the observed rate differences were then noted.

On the next level of sophistication are the studies of Faris and Dunham (1960) and Klee et. al. (1967). Like Jaco (1960), they both mapped the rate differences distinguishing between quartiles, but they followed this by using the same mapping procedure on a number of single variables hypothesized to be relevant to the spatial distribution of mendal disorder. Similarities and differences between the maps were ascertained by visual inspection and by perusal of tabulated percentages and population adjusted rates. Klee et. al. (1967) supplemented their visual inspection by testing for variations from chance by using the Chi-square test of signifi-

cance, while Faris and Dunham (1960) calculated correlation coefficients in cases of interest.

The mapping method described above is conceptually correlational, differing from statistical correlation methods in having a constant score range of four points because of the use of quartiles, and in visually estimating rather than numerically calculating the degree of correlation between variables. Dogan and Rokkan (1969) discussed the trend in human ecology away from the mapping approach to the statistical correlational approach, stating that the latter constitutes an improvement because it forces the use of clearer logic and allows a wider range of variation in the measures used.

Bloom (1968) operated at a level of statistical sophistication similar to that advocated by Dogan and Rokkan (1969). Beginning with 42 environmental variables, he performed a cluster analysis and computed scores on the four derived clusters assignable to each of the census tracts. The cluster scores were mapped by quartiles as in the three previously discussed studies, but the principal analysis involved the calculation of product-moment correlation coefficients between cluster scores, other selected environmental characteristics and mental disorder rates. Interpretation of results was based on these correlation coefficients.

None of the described procedures dealt with the problem of redundant or shared variance within data sets -- a problem of particular concern in multivariate analysis. Struening and Lehmann (1969) point to this problem in a preliminary presentation of their continuing study of environmental determinants of behavior pathology in the Bronx. Using nine environmental predictor variables and ten behavioral criterion measures,

they computed multiple correlation coefficients of all the predictors with each criterion. However, even though most of the behavioral measures were highly predictable, the mean correlation between the predictors was .53, indicating that the number of predictor dimensions might have been reduced without losing predictive power. A reduction of dimensions can serve to produce further information about relationships between variables as well as to enable a more parsimonious approach to data analysis and interpretation of results.

In Bloom's cluster analysis (Bloom, 1968), the third and fourth clusters had strong negative correlations with the first cluster, suggesting that the three clusters together were strongly related to another more general dimension. The studies of Faris and Dunham (1960) and Klee et. al. (1967) were probably as unparsimonious as Bloom's (Bloom, 1968), but as neither team intercorrelated their variables, it is impossible to estimate the degree of inter-variable redundancy that existed.

The problems of reducing the influence of shared or redundant variance between variables or subsets of variables was resolved in this study by the use of factor analysis. The original 78 predictor variables were to be factored to produce fewer more general predictors orthogonal to each other. Varimax rotations were to be performed on the factors aimed at obtaining simple structure, and thus better interpretability, while maintaining orthogonality.

The most obvious advantage of uncorrelated predictors is better interpretability of relative contributions of predictors. In addition they are more stable upon cross-validation. In the present case, the factored set of predictors will have the advantages of orthogonality while including all the information in the original set of 75 variables. (See Burket, 1964 for a complete discussion of these considerations.)

The most crucial consideration in the factor analysis of the school districts concerned the variables that would enter the analysis. It was, of course, important to select variables hypothesized to be of relevance to the etiology of mental disorder because the nature of the variables would determine the nature of the factors that were to be used as predictors of mental disorder. There are infinite possible combinations of variables selectable from any environment, and it would be fruitless to attempt to predict mental disorder from irrelevant combinations. A more detailed consideration of multivariate techniques of data analysis follows directly, while a detailed discussion of the variables entering the factor analysis can be found in Chapter 3.

## The Summarizing and Analyzing of Data

Previously, studies similar to the present one, although of the same basic design (e.g., Faris & Dunham, 1960; Jaco, 1960; Klee et. al., 1967) have tended to have a less strictly quantitative orientation than today's technology allows. Cattell's statement (Cattell, 1965) regarding differences between clinical and statistical methods of studying personality, can be equally as well applied to the differences between qualitative and quantitative epidemiological analyses.

> "For the clinican appraises the total pattern 'by eye', and tries to make generalizations from a good memory, whereas the multivariate experimenter actually measures all the variables and may then set an electronic computer to abstract the regularities which exist, instead of relying on human memory and generalization." (Cattell,1965, p. 22)

Further discussion of the implications for multivariate measurement techniques of advances in computer technology can be found in a monograph by Gullahorn (1967).

The factor analysis of environments previously discussed was to be the first of the multivariate procedures used in this study, its function being to summarize the large number of environmental variables into a manageable number of dimensions. As mentioned in the quotation from Cattell (1965), the computer can abstract regularities but, however, the human researcher must draw inferences and consider the implications of the findings. Summarization is important because the fewer the variates to be considered simultaneously, the more precisely and efficiently they can be considered. Parsimony is also important in communicating findings.

The diagnostic rates for the various school districts, as discussed earlier in this chapter, were to be related to the environmental variates by canonical regression analysis. As indicated by Lee (1969), canonical analysis can be directly compared to both multiple regression analysis and to principal component analysis, a technique similar to factor analysis.

Multiple regression analysis is actually a special case of canonical regression analysis in which there is only one dependent variable or criterion. Within the regression model, canonical analysis permits the estimation of two or more dependent variables. "Natural variation is multivariate and consequently there are advantages to a model which analyzes the variation of several dependent variates simultaneously." (Lee, 1969, p. 4)

A comparison of canonical regression to principal component analysis, as drawn by Stewart and Love (1968), succinctly delineates the relationship between the two techniques while simply describing the conceptual basis of canonical regression analysis.

> "If we were to component analyze two sets of variables independently and then develop weights

> which would rotate the two component structures to maximum correlation, we would have a canonical solution....In the canonical case the components are usually referred to as canonical variates. The correlation between the first variate of the left set and the first variate of the right set is the first canonical correlation...." (Stewart & Love, 1968, p. 160.)

Thus it can be seen that canonical analysis can fulfill a summarizing function because of its relationship to principal component analysis, as well as an analytic function in that it produces coefficients of correlation to indicate degrees of relationship between the weighted linear composites constituting the canonical variates.

In order to improve interpretability of canonical regression analysis, it has been suggested (Meredith, 1964; Stewart & Love, 1968) that correlations of the original variables with the canonical variates be computed. Formerly, interpretation was based on patterns of canonical regression weights (e.g., Kendall, 1963), but this procedure has been revised because regression weights are unstable across samples and because the correlations of the variables on the canonical variates yield results interpretable as factor or principal component loadings. These patterns of loadings have come to be known as canonical components (Stewart & Love, 1968; Thorndike & Weiss, 1970).

A recent development designed to further improve the interpretability of canonical analyses is the non-symmetric index of redundancy, proposed by Stewart & Love (1968), which represents the amount of predicted variance in a set of variables. Given the two data sets entering a canonical regression analysis, the redundant variance refers to the variance occurring within the intersection of the two sets of variables. If two sets were unrelated there would be no redundancy; if they had been drawn from the same population of items, the smaller set would be subsumed within

the larger set and would be completely redundant. As a rule, only a certain proportion of the variance between the two sets is redundant or shared, and as one set is usually smaller than the other, the proportion of the variance in each set that is redundant differs. The need for a specifically non-symmetric measure of redundancy was dictated by these differing proportions of the total redundant variance contained in each set.

In this manner, the relevance of strong canonical correlations can be determined. If there was little in common between two data sets (low redundancy) then a high correlation would indicate a high degree of predictability of trivial amounts of variance. Small canonical correlations are, of course, generally of little interest in any event. Further clarification of the relative importance of each canonical component can be determined by calculating the contribution of each component to that set's total redundancy. The percentage of redundant variance accounted for by canonical components is comparable to the percentage of total or common variance accounted for by principal components or factors.

Discussion of canonical regression analysis will be resumed in Chapter 6, wherein the canonical analysis of the present study is described and interpreted. Attention will be directed at that time to difficulties in interpreting canonical results.

Only one previous study has been designed similarly to the present one; that of Kendall (1963) in the area of job satisfaction. A difference lay in the fact that Kendall used four sets of variates, two of an ecological nature based on taxonomies of companies and of communities, one set of personal background variates, while the criterion measures, measures of satisfaction and of behavior related to the job, comprised

the fourth set. Eighteen combinations of criterion and predictor variates were subjected to canonical regression analysis. In contrast, the present study utilized only one set each of predictor and criterion variables.

## Summary

The research strategy was to involve the computation of canonical regressions between characteristics of environments and rates of twelve different mental disorders for 78 geographic regions of British Columbia.

An episode of mental disorder was considered to be an episode involving admission, treatment and discharge from Riverview Hospital during the period 1965-1968. This definition was compared to those used in four related studies, and it was found that, although it was dissimilar to the definitions used in those studies, those studies differed among themselves as well. Total admissions, as used in the present study, were felt to merit attention in that they indicated both mental disorder and intolerance of mental disorder in the admitted persons' original social milieus.

The set of diagnostic data was reordered into twelve categories in an effort to compromise between the requirements of reliability and validity of diagnosis which can be improved using broader categories, and the necessity to have categories finely enough discriminated to prevent excessive heterogeneity within categories. The school districts of B. C., the geographic divisions that were chosen for analysis, were considered in terms of the reasons for their selection. The comparability of these regions to counties, and thus to former work on the development of environmental taxonomies, and the apparent maximization of heterogeneity between regions were indicated as advantages of using these areas.

Selection of the method to describe the geographical areas proceeded with a consideration of previous relevant studies. These studies were

generally found to be less statistically sophisticated than today's technology will allow, and it was decided that factor analysis would be the method used in the present study. Factor scores were to be subsequently computed in readiness for further calculations. A consideration of the variables entering the analysis was deferred to Chapter 3.

Consideration of the multivariate statistical techniques to be used followed, and it was demonstrated that while factor analysis serves mainly to summarize data, canonical regression analysis performs both summarization and analytical functions. Two recent developments in canonical regression analysis to be used in the present study were discussed. They included the computation of correlations of the original variables with the canonical variates and a non-symmetric measure of redundancy that can be used to determine the overlap between the two sets of variables in the canonical analysis.

The essential design of the present study was to involve the determination of multivariate relationships between two sets of epidemiological variables. The twelve diagnostic categories were to serve as the dependent or criterion variables, while the environmental factors were to serve as the independent or predictor variables. As the complete population was used, there were no sampling errors in the data to take into account. However, although the problem of generalizing from a sample to the population was absent in this study, generalization from the present set of data to future rates of mental hospitalization was implicit in the study's purpose. Thus, the present data set constituted a sample in time.

# SECTION II: DEVELOPMENT OF AN ENVIRONMENTAL TAXONOMY

# CHAPTER 3: A Review of the Literature on Environmental Description

## Introduction

The problem of deriving appropriate environmental descriptions has been a recurrent one in the social sciences, but has only attracted attention in psychology in the past few years with the development of interest in situational and ecological determinants of behavior. Rotter, in 1955, pointed to the role of the situation in determining the direction of human behavior, while Barker (1965, 1968) and Sommer (1968, 1969) have traced the development of their ecological perspectives to the work of Kurt Lewin in the 1930's and 40's.

> "The approach of Lewin...is similar to the ecological view in its emphasis on the myriad influences within an individual's life space but placed less emphasis upon the time dimension. Lewin's field theory tended to be cross-sectional and ahistorical; the phenomenal field was represented as an instant rather than an interconnection of processes enduring over decades or centuries. The historical method is very much a part of modern ecology." (Sommer, 1968, p. 592)

Barker's programs of research, underway since the late 1940's have provided a proliferation of evidence in favor of the importance of the environmental determinants of behavior:

> "When, early in our work at the Field Station, we made long records of children's behavior in real-life settings ..., we found that some attributes of behavior varied less across children within settings than across settings within the days of children. We found, in short, that we could predict some aspects of children's behavior more adequately from knowledge of the behavior characteristics of the drugstores, arithmetic classes, and basketball games they inhabited than from knowledge of the behavior tendencies of particular children..." (Barker, 1968, p. 4)

Wohlwill (1970) discussed the work of these and other authors under the rubric of "environmental psychology", and demonstrated that the

ecological study of the environmental correlates and determinants of human behavior is indeed an "emerging discipline". Taking a refined approach to the accumulation of knowledge to date, Wohlwill described three main areas of study within environmental psychology: first, the structuring of behavior by the proximal situation; second, the influence of environmental variables on broader systems of response; and third, the attitudes and attendant actions of individuals towards their environments. The first mentioned area has received the most attention, and includes the work of Barker (1965, 1968) and Sommer (1968, 1969), while the second, which is the least studied, is cited by Wohlwill (1970) as the most directly relevant to epidemiology. The third orientation is more general and relevant to a broader range of discourse within psychology as a whole, dealing as it does with perception, adaptation, curiosity, and other phenomena.

## A Review of Environmental Taxonomies

Sells (1966) noted that an important step towards encoding the environment had been achieved in factor analyses of census and similar data, particularly with the work of Hadden and Borgatta (1965). However, although such work is only beginning to attract attention in psychology, attempts to quantify environments have presented, as mentioned above, a recurrent problem in the social sciences in general. The environmental units of analysis have varied widely to include cities, census tracts, cultures, countries, and various administrative regions. Cities have received by far the most attention.

Hadden and Borgatta (1965) provide a brief review of intuitive classification schemes that have been applied in urban sociology, concentrating

on historical-evolutionary and economic specialization bases of classification. Passing mention is made of size, geographical location, occupational structure, economic base, relationship of cities to their tributary areas, and regional location as criteria that have been used in the history of writing about cities. Following from this, work in Social Areas analysis such as that of Shevky and Williams (1949) and Shevky and Bell (1955) led to Tryon's (1955) successful cluster analysis of political regions in the San Francisco Bay area.

Although cluster analysis continues to attract interest as a typological technique (see Cureton, Cureton, and Durfee, 1970), it is subject to the disadvantages previously noted in regard to Bloom's (1968) cluster analysis of the census tracts of Pueblo, Colorado i.e. clusters are usually correlated (see Chapter 2). Factor analysis can avoid this problem through the use of orthogonal rotation schemes, and has, in fact, seen a longer tradition of community and environmental classification.

One of the earliest studies of regional classification by factor analysis was that of Hagood, Davilensky and Beum (1941), while Price (1942) was the first to apply factor analysis to the city. Further studies in urban typology have been conducted by Hofstaetter (1952, Kaplan (1958), Moser and Scott (1961), and most notably, Hadden and Borgatta (1965). On a more macroscopic level, cultural variables have been factored by such researchers as Cattell (1949, 1950) and Hofstaetter (1951) as well as by anthropologists such as Schluessler and Driver (1956). Even cultural change has proved amenable to analysis as seen in the work of Cattell and Adelson (1951), Cattell (1953) and Gibb (1956). And, most recently, Shafer (1969), an environmental psychologist, has reported the derivation of nine factors that describe Adirondack campground environ-

ments. A comprehensive bibliography of factor analytic studies performed on non-psychological data including geographic and cultural data is provided in Rummel (1970).

As mentioned earlier (Chapter 2), the school districts to be used as geographical regions in the present study are comparable to counties. Accordingly, the works of Johnson (1958), Jonassen and Peres (1960) and Kendall (1963), all of which included factor analyses of counties, have the most direct relevance and merit more detailed consideration than other previously derived taxonomies. It is of interest to note that only two previous data sets have been analyzed for geographical units of this nature, as Kendall's data was an adaptation of Johnson's.

It will be most expedient to discuss the variables used in these earlier studies in the following section of this chapter, and the composition of the factors in Chapter 4. However, certain basic qualities of the analyses deserve mention at this point because of their relationships to the design of the present study.

Johnson (1958) dealt with a simple but important methodological issue in analyzing his data both in raw form and after conversion to rates. Using the raw data, he found six factors accounted for 100% of the variance in the data set, 60% of that variance accounted for by the first factor. Because he felt that the large first factor could be distorting the structures of the other factors, he reanalyzed the data in rate form, extracting nine factors and retaining five after rotation, thereby accounting for 60% of the total variance. The fact that the five factors of his second analysis replicated the final five factors of his first analysis indicated that no loss of information resulted from using rate figures rather than raw data. On the basis of this finding, all data in the pres-

ent study were converted to rates prior to analysis. The advantage of such a conversion is that the raw data become more meaningful in their own right and can then be useful in the interpretation of the final results of data analysis.

The project undertaken by Jonassen and Peres (1960), an analysis of 82 variables for 88 Ohio counties, was surpassed in magnitude by Johnson's study (1958) in which 72 variables were analyzed for a random sample of 370 American counties. Both studies extracted the factors by Thurstone's complete centroid method, then subjecting the factors to manual orthogonal rotation. Kendall's (1963) procedure in reanalyzing 55 of Johnson's variables involved, as in the present study, the more objective principal component method of factor extraction, followed by Varimax rotations. Although the method of analysis was most comparable to Kendall's (1963), the composition of the present data set, with 75 variables and 78 observations, was more similar to that of Jonassen and Peres (1960).

Kendall's solution yielded 12 latent roots or eigenvalues greater than 1.00, and 10 factors after rotation, of which eight were used in the construction of community variates. Johnson (1958) and Jonassen and Peres (1960), possibly because of the more cumbersome and time-consuming computational techniques they used, extracted and retained fewer factors (Johnson extracted nine and retained five while Jonassen and Peres extracted and retained seven). As will be seen in Chapter 4, the present study retained many more factors than in these previous studies. The reasons for this difference are discussed in Chapter 4.

## Selection of Variables and a Review of the Relevant Literature

There are an infinite number of variables that can be used to describe any environment, and, the more variables sampled, the more comprehensive the final description will be. Because the composition of the derived factors would depend on the nature of the original variables, the variables in this study were selected on the basis of relevance to the research question. The hypothesized relevance of each variable to the etiology of mental disorder was, in some cases, based directly on the literature concerning the precursors of mental disorder, while in other cases, the variables were selected as possibly indexing some aspect of life in the community environment assumed to be favorable or unfavorable.

In general, the variables indexing the social environment were aggregates (e.g. total population, % of males in the population) while the variables describing the physical environments were single measures referring to the school district as a whole. These two types of variables have been referred to as aggregate and global variables by Dogan and Rokkan (1969), and it has been argued that the two types of variables are incomparable and should not be analyzed together. It could further be argued that as the persons admitted to Riverview contribute to the aggregates themselves, any correlations between them and their social aggregates would be of doubtful validity.

Data collection proceeded in the belief that these arguments were nullified by the ecological design of the study (see Chapter 1 for a full discussion of this point). In ecological epidemiological studies the procedure involves the comparison of the differences in disorder rates over a number of geographic areas and no immediate inferences are made to

the individual case. Instead, inferences are made to the environmental differences between the geographic areas. If this study had incorporated demographic data on individuals admitted to Riverview, the problem of drawing inferences to the individual case would have required consideration.

The derivation of each of the 75 variables is described in some detail in Appendix A-3 and a listing of the eleven secondary sources from which data were collected can be seen in Appendix A-4. In order to facilitate discussion of the nature of the variables, they were grouped in terms of certain common qualities (Table 3.1).

TABLE 3.1

The Ten Groupings of the 75 Variables

| Group Number | Group Name | Number of Variables |
|---|---|---|
| I | Community Organization | 15 |
| II | Economics | 12 |
| III | Education | 5 |
| IV | Health | 5 |
| V | Isolation | 4 |
| VI | Physical Geography | 7 |
| VII | Political Behavior | 5 |
| VIII | Population Figures, General | 8 |
| IX | Recreation | 4 |
| X | Social Health | 10 |
| | Total | 75 |

Description of the Variables

I Community Organization. The fifteen variables falling in the first grouping were selected as relating to the distribution and dynamics of the populations within school districts. For example, the age of the main community in the school district (variable 1) was included in this group-

ing to indicate the length of time that social activity had existed in an organized manner in the area, thus including a temporal dimension in the description.

TABLE 3.2

Variables indexing Community Organization

| | | | |
|---|---|---|---|
| 1. | Community age, 1966 | *8. | Pop. in hamlets, 1961 |
| 2. | Number of hamlets, 1961 | *9. | Rural pop., 1961 |
| 3. | Towns 2500- pop., 1966 | 10. | Town pop. density, 1961 |
| 4. | Towns 2500-4999, 1966 | 11. | Non-town pop. density, 1961 |
| 5. | Towns 5000-9999, 1966 | *12. | Pop. growth, 1956-61 |
| 6. | Towns 10,000+, 1966 | *13. | Pop. growth, 1961-66 |
| *7. | Pop. in organized area, 1961 | *14. | Town growth, 1961-66 |
| | | *15. | Natural pop. growth, 1966 |

*Figures not available for Indians on reserves.

Bearing in mind the findings of Faris and Dunham (1960) and the results of subsequent research relating to city size and rates of mental disorder (e.g. Clausen & Kohn, 1959), variables 2 to 6, indexing the number and size of communities into which a district's population had gathered, were included in the data set. As reviewed by Rose and Stub (1955), Buss (1966) and Suinn (1970), and discussed by Dunham (1961), it has been found that differentiation between geographic and socioeconomic status groups in terms of rates of mental disorder decreases as city size decreases.

In a similar attempt to isolate influences similar to those operating in Faris and Dunham's original study (Faris & Dunham, 1960), figures on population density in the organized areas (variable 10) were included in the belief that the degree of urban concentration of towns within school districts could be indexed by such a variable. The computation of separate measures of population density for organized and unorganized (vari-

able 11) areas represents a refinement over the use of overall mean population densities of counties found in the analyses performed by Johnson (1958), Jonassen and Peres (1960) and Kendall (1963).

The percentage of persons living in hamlets (variable 8) was considered to be roughly equivalent to the rural non-farm variable that appears in much of the sociological literature, variable 9 to the sociological variable rural farm population, and variable 7, the percentage of persons living in organized areas, to the urban population variable often used (in U. S. census data, urban areas are those of 2500 population and over). These variables were included as descriptive of the clustering of the school districts' populations and as indexing environmental aspects such as inhabitability of the rural land.

Of the last four variables, number 14, independent growth of organized areas, has not appeared in any previous analyses. It was felt that when analyzing regions with widely varying population dispersions it was important to distinguish between the growth of towns and growth of the area in general when they were independent. Town growth could be expected to correlate with increasing economic and social sophistication and subsequent social change, whereas overall district growth, while possibly indicative of economic well-being, could have an inconsequential effect on the social environment, particularly if the region was large. Differentiation of natural population growth (variable 15) from regional growth in general (variables 12 and 13), thereby distinguishing between population increase due to immigration and to natural growth was felt to be of importance because of the equivocal findings regarding the relationship of migration to mental disorder (Malzberg & Lee, 1956; Jaco, 1960; Klee et. al., 1967).

None of variables 1 to 6 or 14 have appeared in previous analyses. However, variables similar to 7, 8, 9, 12 and 13 were included by Johnson (1958) and Kendall (1963), while both Johnson (1958) and Jonassen and Peres (1960) included a variable similar to numbers 10 and 11 combined and Jonassen and Peres (1960) used variables 7 and 15 and another combining 12 and 13.

II Economics. The frequent implication of socioeconomic variables in the etiology of mental disorders ascribes an important role to the variables in this second grouping. Some readings relevant to this subject include Faris and Dunham (1960), Rose and Stub (1955), Hollingshead and Redlich (1958), Gurin et. al. (1960), Jaco (1960), Dunham (1961), Reid (1961), Theodorson (1961), Srole et. al. (1962), Langner and Michael (1963), Leighton et. al. (1963), Buss (1966), Klee et. al. (1967), Sechrest and Wallace (1967), Bloom (1966, 1968), Myers and Bean (1968) and Suinn (1970).

TABLE 3.3

Variables indexing Economics

| | |
|---|---|
| 16. Increase in liquor sales, 1959-63 | 22. Non-town property value, 1961 |
| 17. Liquor sales, 1963 | 23. Town property value, 1961 |
| 18. Retail sales, 1961 | 24. Mean male wage, 1961 |
| 19. General Mill rate, 1963 | 25. Female wage level, 1961 |
| 20. School Mill rate, 1963 | 26. % of workers earning wages, 1961 |
| 21. Municipal debt, 1963 | 27. % of wage earners who were female, 1961 |

Turning first to the variables that have entered previous analyses, variables 18 and 27, retail sales and female wage earners, were used in a nearly identical form by all of Johnson (1958), Jonassen and Peres (1960) and Kenall (1963). It was expected that the former variable would serve to

identify the more socially complex distribution centers of the province while the latter might index relevant social differences in terms of family structure.

Variables of different form but similar purpose to number 20, school mill rate, were used by Jonassen and Peres (1960). This variable was entered as an indication of local school support beyond the contributions of the senior levels of government. Variable 22, non-town property value, is reminiscent of the farm value variable used by Johnson (1958) and Kendall (1963), but, while their variable was strictly concerned with prosperity, the present variable was included to index the utility of rural land in addition to prosperity.

The remaining variables were unique to this analysis and related chiefly to urbanism and prosperity. Variables 16 and 17 were cited in the Regional Index, their source, as sensitive economic indicators, and were thus included as relevant to prosperity. The general mill rate (variable 19), municipal debt (variable 21), town property value (variable 23) and the incidence of wage earning (variable 26) were all considered to reflect aspects of prosperity and of social complexity such as that found in urban environments. Variables 24 and 25, relating to male and female wage levels, were considered directly relevant to prosperity, while the female wage level, as it was expressed as a percentage of the male wage level, was expected to reflect social differences in a similar fashion to variable 27, the percentage of female wage earners.

III Education. Educational level is a variable included in most epidemiological studies, whether demographic or ecological in design (see Chapter 1). It was unfortunate that educational data for the adult populations were not available, but it was felt that the included educational

variables should provide an indication of educational practices and standards within the school districts.

TABLE 3.4

Variables indexing Education

| | |
|---|---|
| 28. Mean class size, 1966 | 31. Visual education circulation, 1966 |
| 29. Excess of teachers over the number of classes, 1966 | 32. High school attendance, 1966 |
| 30. Per pupil expenditure, 1966 | |

Citing precedent once again, variable 32, high school attendance, has seen frequent use in previous studies, having entered the community descriptions of Johnson (1958), Kendall (1963) and Jonassen and Peres (1960) as well as the epidemiological studies of Bloom (1968) and Klee et. al. (1967). As low educational level generally tends to perpetuate poverty and its attendant ills, this variable could be expected to show covariation with some variables in groups II and X which relate to economics and social health, respectively.

The other four variables were felt to relate more specifically to the quality of education. The roles of variable 30, per pupil expenditure on education (in this case, by the provincial government) and the mean class size (variable 28) appeared initially to be obvious in this respect. However, it became apparent during data collection that the relationships were more complex. Per pupil expenditure, for example, was higher in rural areas where there were less pupils to a school building.

Similarly, visual education circulation (variable 31), although included to index teacher effort, was compounded by the fact that certain more populous school districts had their own stock of visual aids and thus used

fewer from the Department of Education, as indexed here. This variable became something of a rural-urban index, as did number 29, the excess of teachers over the number of school divisions. In the latter case, the raw data suggested the excess to occur mainly in more heavily populated areas. Thus it appeared that variables 29 and 31 were serving two functions in identifying a rural-urban as well as an educational quality dimension.

IV Health. As it is generally more feasible to measure community health in a negative rather than positive sense, this group of variables was concerned mainly with mortality rates.

TABLE 3.5

Variables indexing Health

| | |
|---|---|
| *33. Death rate, 1966 | 36. Motor vehicle deaths, 1965-68 |
| *34. Infant death rate, 1966 | 37. Per capita hospital beds, 1961 |
| *35. Hospital death rate, 1966 | |

*Figures not available for Indians on reserves.

The extent to which variables similar to those indexing health in this study have been used in environmental descriptions in the past suggests that the level of public health is generally assumed to describe an important social dimension. Infant deaths (variable 34) appeared in the taxonomic studies of Johnson (1958), Jonassen and Peres (1960) and Kendall (1963) and in the epidemiological studies of Klee et. al. (1967) and Struening and Lehmann (1969). The overall death rate (variable 33) and possibly the hospital death rate (variable 35), although expected to be related to the prevalence of old age in a district, were included in the

additional expectation that they might relate to measures of social disruption. Death rates were used by all of Johnson (1958), Jonassen and Peres (1960) and Kendall (1963).

The purpose of including the hospital death rate (variable 35) in the data set was to obtain an inverse measure of sudden deaths. The motor vehicle death rate (variable 36) was similarly expected to index the prevalence of sudden and violent demise. Johnson (1958) and Kendall (1963) used motor vehicle death rates in their analyses, while Jonassen and Peres (1960) used a more general measure of accidental death.

The per capita hospital beds variable (number 37) was considered to fulfill two functions. In the first place it could index the degree of health concern in a community, a concern that might extend to mental health, the subject of this study. At the same time, it controlled for the fact that non-hospital death rates (variable 35) could in some cases be inflated because extensive hospital facilities are unfeasible in some of the province's small communities. Thus if both the hospital death rate and the available hospital beds were to have similar loadings on the same factor it would be possible to rule out the assessment of accidental deaths by that factor.

V Isolation. Because some areas of B. C. are cut off from the outside world by great distances and poor roads, it was felt to be particularly relevant to include variables indexing isolation in this study. Life in such communities is less complex because of the greater familiarity with the environment that ensues when there are less people and less buildings with which to become familiar. The social differences between small isolated communities and larger more complex and less restricting communities could be expected to have relevance to mental disorder rates.

TABLE 3.6

Variables indexing Isolation

| | |
|---|---|
| 38. Distance from Riverview Hospital | 39. Accessibility by air<br>40. Impediments to land travel<br>41. Per capita phones, 1961 |

Variable 38, the distance from Riverview Hospital to the major town of each school district, is similar to a variable used by Johnson (1958), the distance between the county seat and the nearest town of 25,000 or more. In the present study, the distance from Riverview was chosen as a criterion of isolation partly because Riverview is near Vancouver, but chiefly because the definition of mental disorder used in the epidemiological analysis involved admission to that hospital. It has been hypothesized (see Jaco, 1960; Suinn, 1970) that one of the reasons for the consistently lower rates of psychiatric treatment in rural areas may be due to decreased availability of mental health facilities. The testing of this hypothesis and its corollary, that the rural admissions would consist of more severe disorders, was felt to be facilitated by the use of this distance measure.

While variable 38 referred to automobile travel, variable 40, impediments to land travel, was added to index the complications that would surround such travel. Variable 39, indexing the feasibility of air travel, was included as an additional measure of isolation and to control for the fact that, while some regions are almost inaccessible by road, they are only a few hours removed by air. Thus, spuriously high highway isolation scores could be controlled for.

Per capita phones (variable 41) was used to refer to isolation within districts. Although it is commonly believed, after Faris and Dunham (1960),

that social isolation is a problem of the inner city, it does not appear unreasonable to suspect that the type of social isolation which occurs when interaction opportunities do not exist, as in the case of a person in a rural environment with no telephone, could have similar etiological implications to the social isolation hypothesis. Kohn and Clausen (1955) found that any social isolation which their sample of psychiatric patients had experienced appeared to be due more to poor social skills than physical isolation. However, such a finding does not preclude the possibility that physical, and therefore social isolation, may foster the development of mental disorders.

VI Physical Geography. Despite his inclusion of five climate variables, Johnson (1958) obtained no particular climate dimension in his taxonomy. Because of the limited information supplied by the variables, only two of them were used by Kendall (1963) in his adaptation of Johnson's data. The present selection of climatic variables, designed with a view to assessing the extremity of climate, were expected to prove more informative because of the wide range of climates to be found in B. C.

TABLE 3.7

Variables indexing Physical Geography

| | |
|---|---|
| 42. Elevation | 46. Mean winter precipitation |
| 43. Ruggedness of terrain | 47. Mean summer-winter precipitation difference |
| 44. Mean winter temperature | 48. Annual frost-free days |
| 45. Summer-winter temperature difference | |

Reviews of the literature on the effects of climatic conditions on behavior indicate that this topic has attracted interest for many years (Tromp, 1968; Sechrest & Wallace, 1967). Unlike in the present study,

where the aim was to assess the overall influence of varying types of climates, most studies relating behavior, both abnormal and normal to meteorological variation, have been concerned with variation over time rather than across regions (for example, see Cerbus, 1970; Edelstein et. al., 1966; Friedman et. al., 1965; Pantleo, 1970; Tromp, 1968). However, the findings suggested by some of these longitudinal studies appear to be suitably applicable to cross-regional studies. For example, Tromp's (1968) observations of hospitalized schizophrenics indicated that this disorder may involve a disruption of the thermoregulation mechanism, with the result that greater than normal stress and therefore restlessness is experienced in periods of temperature change. Tromp (1968) also suggested that the greater restlessness exhibited by his patients in the winter months could be related to a lack of sunlight. Of interest in the study of aggressive acts, particularly suicide and crime, is the finding that these, like schizophrenic restlessness, appear to be associated with changes in the weather. It could be hypothesized then, that in climatic regions with generally changeable weather or decreased sunlight, the aggravation of the above disorders could result in higher rates of mental hospital admission.

While variables 44 to 48 were included in an attempt to assess climatic influences, the choice of variable 42 was based on the possibility that there might be differences in elevation levels between school districts sufficient to create differences in the functioning of the hypothalamic-pituitary system similar to the effects of weather (Tromp, 1968). Variable 43, on the other hand, was included to index the visual environment as in the studies of environmental psychologists such as Shafer (1969) and Sonnenfeld (1969).

VII Political Behavior. Measures of voting behavior were included mainly to indicate community attitudes. The only study using similar measures was Bloom's (1968), in which memberships in five organizations were used as indicators of "Community Participation".

TABLE 3.8

Variables indexing Political Behavior

| | |
|---|---|
| 49. % of registered voters voting in Provincial election, 1966 | 51. % Social Credit Vote, 1966 |
| 50. % spoiled ballots, 1966 | 52. % Liberal vote, 1966 |
| | 53. % N.D.P. vote, 1966 |

Variable 49, the number of registered voters who voted in the Provincial election of 1966, was considered to indicate the degree of involvement in social responsibilities felt within a community. Thus, it might be expected that a low turn-out of voters could indicate feelings of alienation in regard to society at large. Alienation and anomie have frequently been implicated in the etiology of mental disorder (Michael, 1967).

The percentage of spoiled ballots cast (variable 50) was not included for any specified reason. It was felt that it might relate to levels of education or intelligence, but there was not a formulated expectation, on the basis of inspection of the raw data or on theoretical grounds as to how it would function in the factor analysis.

Variables 51 to 53 represented the range of political opinion within each school district, with Social Credit voting considered the most conservative, N.D.P. the most socialistic, and the Liberals in between. In addition, as the Social Credit party was re-elected in 1966, it was felt that a predominance of Social Credit voting could index community satisfaction with the status quo, which in turn, could be related to mental

disorder rates.

VIII Population figures, general. Reidn (1960), as mentioned in Chapter 1, spoke of dividing populations in terms of time, place, and person when seeking epidemiological information. While this study was aimed primarily at divisions on the basis of place, the variables within this grouping were selected as relating to person characteristics within the place divisions or school districts. Thus, some account was taken of the distribution within regions of groups identified as high and low risk groups in previous studies.

TABLE 3.9

Variables indexing Population Figures, General

| | |
|---|---|
| 54. Total population, 1966 | 57. % of pop. 65 years+, 1966 |
| 55. % of pop. 15 years+, 1966 | 58. % of Indians in pop., 1966 |
| 56. % of males in pop., 1966 | 59. Median age, 1966 |
| | 60. Fertility rate, 1966 |
| | 61. Marriage rate, 1966 |

High risk groups were identified by variables 55 to 57. Those over 15 years of age (variable 55) comprised the total population which was at risk of admission to Riverview Hospital, since that hospital, as an adult facility, rarely admits persons under 15 years of age. The percentage of males in the population (variable 56) identified the sex distribution of the district and, perhaps more importantly, the extent of excess of single males, a group with a high probability of suffering mental disorder (Rose & Stub, 1955; Buss, 1966; Suinn, 1970). Similarly, while variable 57, which defines the group of retirement age, might identify some aspects of a community's social atmosphere, it also identifies a group found susceptible to mental disorder.

Variable 59, median age, was included to refine the definition of the age composition of the districts. Thus, in a district with many old people and a high median age overall, the environment might be less conducive to mental breakdown for elderly persons than in an area with the welfare of old people of lower priority. Variables similar to number 55 were used by Jonassen and Peres (1960), 56 and 59 by Johnson (1958), Kendall (1963) and Bloom (1968), and 57 by Johnson (1958), Kendall (1963) and Jonassen and Peres (1960).

While the size of the total population (variable 54) did not identify a high risk group directly, it was considered relevant to identifying rural-urban differences because urban areas should show higher rates of disorder (Rose & Stub, 1955; Jaco, 1960; Suinn, 1970). The percentage of Indians in the population (variable 58), on the other hand, was considered primarily relevant to the social environment of the regions. This ethnic minority was not hypothesized to show any particular relation to admission rates because of the varying reports in the literature regarding non-white minority groups (Rose & Stub, 1955; Jaco, 1960; Murphy, 1961, Suinn, 1970). The importance of the influence on the social environments of communities by minority groups which are subject to prejudice is implied in the inclusion of similar variables by Johnson (1958), Kendall (1963) and Jaco (1960). The total population variable (number 54) previously appeared in the community taxonomies of Johnson (1958), Kendall (1963) and Jonassen and Peres (1960).

Fertility rates (variable 60), as opposed to marriage rates (variable 61) which have not appeared in previous studies, were used in the epidemiological studies of both Klee et. al. (1967) and Bloom (1968). Although the fertility rate may appear similar to variable 15, natural population growth, the former involved the adjustment of the number of births for

the number of women of child-bearing age while the latter adjusted the excess of births over deaths for the total population. Thus, while a correlation between these two variables might be expected, it could be of only moderate or even low proportions. Both fertility and the marriage rate could be expected to index the preponderance in a region of young married adults, a group at low risk of developing mental disorder (Rose & Stub, 1955; Buss, 1966; Suinn, 1970).

IX Recreation. The inclusion of recreational variables, not to be found in previous studies, was based on two suppositions. In the first place, it could be hypothesized that in an area with more recreational facilities there would be more community cohesiveness in that organized effort had been expended to make these facilities available. Once such facilities were available they could be expected to contribute to community mental health by providing adaptive social and emotional outlets. The second reason for using these variables lay in the fact that tourism is a major factor in B. C.'s economy, and it was expected that these variables could identify communities where tourist trade was important. Such communities might be expected to contain differences in social structure as compared to more conventional communities.

TABLE 3.10

Variables indexing Recreation

| | |
|---|---|
| 62. Extent of natural recreational facilities | 64. Grants to recreation commissions, 1966 |
| 63. Acreage in public parks and playgrounds, 1966 | 65. Hotel and motel units per capita, 1961 |

Specifically, variables 63 and 64 referred to recreational facilities for the permanent residents of the districts, while variable 62, and

especially variable 65 referred to aspects of tourism.

X Social Health. Because many of them are commonly believed to be related to the incidence and prevalence of mental disorder, variables similar to those found in this grouping have seen more use in epidemiological than taxonomic studies. The work of Faris and Dunham (1960) was the first to show that mental disorder rates in urban areas were distributed in a similar manner to the rates of delinquency, unemployment and communicable disease observed by human ecologists (Theodorson, 1961). Similar measures to some of those in this grouping were used in the Stirling County study (Leighton et. al., 1963; Leighton, 1961) to identify communities showing socio-cultural disintegration, while the implications of Faris and Dunham's (1960) study have led to demographically designed research centering on the question of social status and mental disorder (e.g., Hollingshead & Redlich, 1958; Myers & Bean, 1968).

TABLE 3.11

Variables indexing Social Health

| | |
|---|---|
| 66. Availability of community mental health facilities, 1964-67 | 70. Delinquency rate, 1965-67 |
| 67. Referrals to community mental health clinics | 71. Welfare recipiency, 1965-67 |
| 68. Admissions to public geriatric facilities, 1965-68 | 72. Welfare expenditure per recipient, 1966-67 |
| 69. Admissions to Woodlands school, 1965-68 | *73. Illegitimacy rate, 1966 |
| | 74. Alcoholics Anonymous membership, 1966 |
| | 75. Number of Alcoholics Anonymous groups, 1966 |

* Figures not available for Indians on reserves.

The first four variables in Table 3.11 have been more commonly used, in epidemiological studies, to serve as criterion rather than predictor measures as in the present case. This study was not concerned with other

cases of mental disorder than those admitted to Riverview Hospital, but it was felt that whatever other measures were available could be used to clarify the Riverview information. Thus, if it was found that the availability of mental health facilities within the community (variable 66) had an inverse relationship with rates of admission to Riverview, the possibility of successful prevention of more serious disorders by the community mental health programs might be indicated. A similar inference could be suggested by high rates of referral to community mental health clinics (variable 67) if accompanied by low rates of admission to Riverview. Both these variables were considered necessary in order to help explain any unusually high or low incidence rates within communities.

Variables 68 and 69, new admissions to public institutions for senility and mental retardation, were considered less directly related to Riverview admission rates than variables 66 and 67. And, while variable 67, the referrals to community mental health clinics, was expected to relate to willingness within the community to seek psychotherapeutic assistance before hospitalization was necessitated, it was expected that variables 68 and 69 might relate to the community's tendency to reject deviants, a tendency which could, in turn, relate to Riverview admission rates.

As mentioned above in regard to the pioneering study of Faris and Dunham (1960), correlations between delinquency rates and other measures of social disorganization including mental disorder have long been established. It is, then, not surprising to find delinquency rates such as included here in variable 70, in the epidemiological studies of Leighton et. al. (1963), Klee et. al. (1967), Bloom (1966, 1968) and Struening and Lehmann (1969), and in the county taxonomy of Jonassen and Peres (1960). Like juvenile delinquency, illegitimate births (variable 73) and welfare recipiency (variable 71) may be surface manifestations of mental

disorder, while the amount of welfare assistance available in a community (variable 72) may reflect the extent to which that community is perpetuating poverty and thereby facilitating the development of mental disorder. Welfare figures were used by Jonassen and Peres (1960), Klee et. al. (1967) and Struening and Lehmann (1969), while Bloom (1968) satisfied approximately the same purpose by using unemployment rates. Both Klee et. al. (1967) and Struening and Lehmann (1969) used illegitimacy rates as one of their criteria of social disorder.

The only variables similar to numbers 74 and 75 to enter previous analyses were Bloom's (1968) relating to club membership. However, the measures used here, relating to Alcoholics Anonymous activity, were felt to be of more direct relevance to the research problem than Bloom's because they directly assessed a type of community participation in dealing with a mental health problem. These figures were felt to be most directly relevant to rates of alcoholism and, as many of the brain damage cases were due to alcoholism, to brain damage rates. As in the case of variable 67, referrals to community mental health services, it could be expected that high scores on these variables, if in combination with low rates of admission to Riverview, would reflect a tendency to seek assistance within the community before hospitalization was required.

## Summary

The chapter was introduced with a discussion of the growing interest within psychology in environmental ecological correlates and determinants of behavior. This concern was shown, through a review of the history of social environmental classification, to have been a recurrent one in the social sciences in general. Factor analytic classification methods were suggested to be superior to those of cluster analysis and both of these to older intuitive schemes.

Various sizes and types of geographical regions have been subjected to factor analysis, but cities have received the most attention over all. However, particular attention was focussed in this chapter on the county taxonomies of Johnson (1958), Jonassen and Peres (1960) and Kendall (1963) because the school districts to be analyzed in the present study were closely comparable to counties. The advantages of using rate data rather than raw data and the differences between the more objective factoring techniques used in the present study and in Kendall's (1963) as compared to the two earlier ones were discussed.

The seventy-five variables measuring aspects of the environments within the seventy-eight school districts entering the analysis were then presented, discussed and justified. They were selected, for the most part, on the basis of their relevance to the etiology of mental disorder, and this was established by reference to the psychological literature.

For convenience of discussion, the seventy-five variables were grouped into ten categories: (1) Community Organization -- the types of towns and population distribution within the districts (2) Economics -- sales volumes, taxes, wages and property values (3) Education -- the use and quality of educational facilities (4) Health -- health services and mortality rates (5) Isolation -- availability of Vancouver and of social interaction in general (6) Physical Geography -- climate and type of terrain (7) Political Behavior -- extent and type of voting (8) Population Figures, General -- age, sex, ethnic distributions; birth and marriage rates (9) Recreation -- extent of recreational facilities for both residents and tourists (10) Social Health -- use and availability of community mental health services, welfare recipiency, delinquency and illegitimacy rates, the prevalence of Alcoholics Anonymous.

It was felt that this selection of variables represented a broad and appropriate sample of the infinite set of variables with possible relevance to mental disorder rates.

# CHAPTER 4: The Environmental Taxonomy

## Considerations in the Collection of the Environmental Data

### Data Collection

The environmental data were derived from eleven secondary sources as listed in Appendix A-4. When figures were listed by school district, as in references 4, 5, 7 and 8, the data were simply transcribed and converted to per capita rates using the appropriate subgroup of the population. Wherever possible, per capita rates were used in order to maximize the meaningfulness of the data (see Chapter 3) and to avoid obtaining a general population factor when the factor analysis of the school districts was performed (Johnson, 1958).

In the other secondary sources, the data were grouped in a variety of ways, none of which corresponded to school districts. The geographical divisions in these other sources were, in most cases, smaller than school districts i.e., polling stations (reference 2), weather stations (reference 3), towns within census districts (reference 6), organized areas such as municipalities, cities and villages (reference 9), towns within eight provincial regions (reference 10) and cities, municipalities, villages and R. C. M. P. detachments (reference 11). Each town, village, weather station, etc. was located by school district and all the values within each school district transcribed, summed and standardized as deemed appropriate. Details of these operations can be seen in Appendix A-3.

It was generally necessary to use statistical regions of smaller size than school districts to avoid cumbersome and inaccurate prorated estimates. Because of this, some potentially interesting provincial government figures could not be used. Conversely, although it would have been possible, with the census figures for 1961, to regroup the many very small enumeration

areas of the province to correspond to school districts, it would have been a long and tedious task yielding only five year old approximations upon completion.

Estimation of Missing Data

Two particular problems of data estimation were encountered in the data collection. First, there were cases where geographic divisions in the data sources were larger than or overlapping between school districts, and second, there was incomplete reporting of some figures. The necessity of finding suitable solutions for these problems was considered particularly important for a factor analytic study such as the present one, because factor analytic operations require Gramian or "true" correlation matrices and often find missing data correlation matrices unsolvable.

In the first case mentioned above, approximations were made on the basis of the available evidence. For example, in the Vital Statistics data (reference 6), figures were given only for towns within census districts and for "others". When census district boundaries did not coincide with school district boundaries, it was necessary to estimate the distribution of the "others" by comparing census district and school district boundaries while considering population density and distribution in the area in question. Similarly, in the Regional Index (reference 8), although the regional boundaries were generally identical with school district boundaries, there were two cases where regions included parts of adjacent school districts in addition to a single school district, and two cases in which more than one school district comprised one region. Again, population density and distribution guided the estimations made.

An additional missing data problem arose in cases in which figures for Indians on reserves were totalled separately from the totals for the rest of the population. This was most evident in the Vital Statistics data

where the Indians were only located by census district, thereby presenting an almost impossible task for assignment to school district. As a result, Indian rates had to be excluded from eleven of the aggregate variables.

The other missing data were dealt with by more empirical means, deriving least squares estimates of the missing cases. This was possible because the majority of the data were already available for each of the school districts with missing cases. The variables in question, with the number of cases missing for each, are listed in Table 4.1.

TABLE 4.1

Variables for which Least Squares Estimates were made of Missing Data Points

| Variable Number | Variable Name | Number of Missing Cases |
|---|---|---|
| 16 | Increase in liquor sales, 1959-63 | 3 |
| 17 | Liquor sales, 1963 | 3 |
| 18 | Retail sales, 1961 | 21 |
| 19 | General Mill rate, 1963 | 7 |
| 20 | School Mill rate, 1963 | 7 |
| 21 | Municipal debt, 1963 | 7 |
| 22 | Non-town property value, 1961 | 1 |
| 24 | Mean male wage, 1961 | 28 |
| 25 | Female wage level, 1961 | 28 |
| 26 | % of workers earning wages, 1961 | 28 |
| 27 | % of wage earners who were female, 1961 | 28 |
| 63 | Acreage in public parks and playgrounds, 1966 | 3 |

The first step in making the least squares estimations involved the computation of a missing data correlation matrix for unequal numbers of cases. For each pair of variables entering a correlation, if one member of the pair was missing, the other was omitted. Then, step-wise multiple

regressions for each of the variables with missing data, using as predictors all variables with no missing data, were performed. The regression weights and constants derived for the estimation of each variable are given in Appendix A-5.

Having obtained the regression weights and constants for each variable, it was then possible to estimate the missing data points for individual school districts. This was accomplished by solving the regression equation with the raw predictor scores entered.

Limitations of the Data

The present data set, like most, was not completely perfect for the purpose at hand, that purpose being the description of the environments in 78 school districts of B. C. between 1965 and 1968, the period during which the patient population entered and left Riverview Hospital. The two most important limitations were felt to be the necessity to estimate missing data and the unavailability of 1965 through 1968 figures for most variables. On the other hand, two particular strengths in the data set were considered to be that there were no problems of representative sampling simply because the whole population had been used and that the selected variables, as described in Chapter 3, were appropriate to the purpose at hand.

The possible sources of bias in estimating missing data were twofold because two estimation methods had been used. The first method discussed above, that of estimating the distributions of cases within regions on the basis of knowledge of population distribution and density, could have introduced bias because the assumption of relevance to population distribution and density may have been unjustified. The least squares estimation, the second method, was subject to a similar source of bias in that

it was assumed that the multiple regression solutions for variables with missing data were the same as they would have been if no data had been missing. However, as the majority of the data were not affected by these possible sources of bias, data anlysis proceeded on the assumption that the complete data set was a close and valid approximation of that which would have been obtained were more information available.

The dates on which the data had been originally collected, although not always coincident with the dates to which the diagnostic data referred, represented the best available data. Basically, it was assumed that the values of the variables when they were measured in 1961 or 1963 were similar to the values between 1965 and 1968 and that any changes that had occurred had also occurred in the province as a whole. In many cases, data for 1966 alone were used. As 1966 was the median year of the data collection period, it was felt that the 1966 figures were probably suitably representative of the 1965 through 1967 period.

## The Factor Analysis

Once the set of raw data was complete with missing data estimations included, a final correlation matrix was computed and subjected to Principal Component analysis. (The environmental components are, however, referred to as factors to avoid confusion with the canonical components discussed in Chapter 6). All calculations were performed in double precision in order to minimize rounding error. The first twenty factors in the unrotated factor matrix had eigenvalues greater than 1.00, and, in order to facilitate the final choice of the number of factors to be retained, seventeen to twenty-two factors were subjected to Varimax rotation. An eighteen factor solution was selected as the most meaningful. The correlation matrix, the matrix of 22 unrotated Principal Component factors and the matrix of 18

Varimax rotated factors can be seen in Appendices B-1, B-2 and B-3, respectively.

As mentioned previously (Chapter 3), the number of factors retained in this taxonomy greatly exceeded that in other relevant taxonomies. To reiterate, Johnson (1958) retained five factors, Jonassen and Peres (1960) retained seven, and Kendall (1963) retained eight. The obvious and clear simple structure of so many factors in the present study indicated that, in order to provide this broad range of independent measures, a broader selection of variables had entered the analysis than in the earlier studies.

Although the small percentages of variance in the data set accounted for by some of the later factors (see Table 4.2) could be cited as an argument against retaining those factors, such an argument was rejected. The reason behind this position was previously stated on page 34: there are an infinite number of variables that can be used to describe any environment, and, the more variables sampled, the more comprehensive the final description will be. If more variables related to those that appeared in the smaller factors had been included in the data set, the same dimensions would have accounted for more variance and thus appeared more important than they did in the present analysis. In other words, just because a factor, as a result of variable sampling, accounts for a lesser amount of variance in a data set does not mean that it has lesser importance in the real world. Because all the retained factors appeared to be potentially relevant to mental disorder rates, hypotheses as to the nature or strength of their relationships to mental disorder rates were based on their composition rather than on the percentages of variance they accounted for.

TABLE 4.2

Eigenvalues and Total Variance accounted for by Principal Component Factors before and after Rotation

| Factor Number | Eigenvalue | % of Total Variance Accounted for | | Accumulated % of Total Variance Accounted for | |
|---|---|---|---|---|---|
| | | Before Rotation | After Rotation | Before Rotation | After Rotation |
| 1 | 14.50 | 19.33 | 10.01 | 19.33 | 10.01 |
| 2 | 7.09 | 9.45 | 9.43 | 28.78 | 19.44 |
| 3 | 5.19 | 6.92 | 9.00 | 35.70 | 28.44 |
| 4 | 4.47 | 5.96 | 5.95 | 41.66 | 34.39 |
| 5 | 3.43 | 4.57 | 5.77 | 46.23 | 40.16 |
| 6 | 2.93 | 3.90 | 4.24 | 50.13 | 44.40 |
| 7 | 2.75 | 3.66 | 3.84 | 53.79 | 48.24 |
| 8 | 2.65 | 3.54 | 3.82 | 57.33 | 52.06 |
| 9 | 2.34 | 3.12 | 3.61 | 60.45 | 55.67 |
| 10 | 2.25 | 3.00 | 3.46 | 63.45 | 59.13 |
| 11 | 2.02 | 2.69 | 3.09 | 66.14 | 62.22 |
| 12 | 1.88 | 2.51 | 2.72 | 68.65 | 64.94 |
| 13 | 1.66 | 2.22 | 2.69 | 70.87 | 67.63 |
| 14 | 1.55 | 2.06 | 2.67 | 72.93 | 70.30 |
| 15 | 1.49 | 1.99 | 2.62 | 74.92 | 72.92 |
| 16 | 1.32 | 1.76 | 2.40 | 76.68 | 75.32 |
| 17 | 1.23 | 1.64 | 2.27 | 78.32 | 77.59 |
| 18 | 1.13 | 1.50 | 2.22 | 79.92 | 79.81 |
| 19 | 1.09 | 1.45 | | 81.27 | |
| 20 | 1.02 | 1.36 | | 82.63 | |
| 21 | .92 | 1.22 | | 83.85 | |
| 22 | .89 | 1.19 | | 85.04 | |

It could be argued that the retention of such a large number of factors is conceptually clumsy and contradictory to the summarization purpose of factor analysis. It was felt that the elimination of redundant variance from the data set was more important than the obtaining of a small and mnemonically convenient number of factors. The problem of the awkwardness of the number of factors has been previously suggested to be trivial in view of today's computer technology (see quote, page 23, Cattell, 1965). Further-

more, as mentioned above, the nature of the factor structure indicated that the selected solution was a parsimonious one for this data set and that the greater number of dimensions accrued from a broader sampling of variables than in the earlier taxonomies of Johnson (1958), Kendall (1963) and Jonassen and Peres (1960).

Upon completion of the component analysis, component scores (hereafter referred to as factor scores) for each school district were computed in T score form (mean = 50, standard deviation = 10). It was felt that, in view of the clarity of the factors, the factor scores could enter directly into the further calculations of the epidemiological analysis (Chapter 6). Recording of the scores in T score form was regarded as desirable in order to maximize interpretability of the scores. This was considered necessary in order to use the scores of the school districts on the factors as aids in the interpretation of the factors.

## Presentation and Discussion of Results

The factor results presented in this chapter were edited from the original factor structure matrix in Appendix B-3. To maximize the clarity of the factors, only the two largest loadings for each variable, if greater than .30, were considered in the factor interpretation. In addition, as its loadings followed no meaningful pattern, variable 69, admissions to Woodlands School, was omitted from the interpretations. It was assumed that the uninterpreted factor loadings would, in each case, either cancel out or add a constant to the values of the factor scores.

The scores of the school districts on the factors were used, in addition to the factor loadings, in the factor interpretations. Specifically, T scores of 60 or greater and of less than 40, representing cases falling more than one standard deviation from the mean, were considered.

In comparing the results to previous findings, attention was directed mainly to the studies of Jonassen and Peres (1960) and Kendall (1963). Johnson's (1958) findings were not considered because Kendall's (1963) results were based on the same data set and were more readily comparable to the present study which had used the same data analysis procedures. Where appropriate, community descriptions used in epidemiological studies were also compared to the present results.

Factor I: Suburban Conditions

The main difference between the first factor here and the first factors in the studies of Jonassen and Peres (1960) and Kendall (1963), is its greater specificity. Jonassen and Peres (1960) named their factor Urbanism, while Kendall's (1963), which was similar, was named Prosperity and Cost of Living. Suburban Conditions, on the other hand, is independent of economic factors, and while consisting of largely organized area, does not show such urban characteristics as high population density.

The loadings on variables 7 and 8 indicate that school districts with high scores on this factor consist almost wholly of organized area and are unlikely to contain small hamlets. A loading of .54 on variable 6 indicated that the populations within the districts are likely to exceed 10,000, or, with less likelihood, as suggested by the loading of .37 on variable 5, be between 5000 and 9999.

The degree of internal autonomy expected in larger organized communities may be reflected in a low per pupil expenditure by the Provincial government (30:-.80), low Provincial grants to recreation commissions (64:-.51) and a small usage of Visual Education materials from Victoria (31:-.50). Such

TABLE 4.3(a)

Varimax Loadings for a

Suburban Conditions Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 8 | -.82 | Pop. in hamlets, 1961 |
| 7 | .82 | Pop. in organized area, 1961 |
| 30 | -.80 | Per pupil expenditure, 1966 |
| 28 | .80 | Mean class size, 1966 |
| 1 | .69 | Community age, 1966 |
| 61 | .56 | Marriage rate, 1966 |
| 6 | .54 | Towns 10,000+, 1966 |
| 56 | -.53 | % of males in pop., 1966 |
| 40 | -.52 | Impediments to land travel |
| 64 | -.51 | Grants to recreation commissions, 1966 |
| 31 | -.50 | Visual Education Circulation, 1966 |
| 9 | -.44 | Rural pop., 1961 |
| 29 | .43 | Excess of teachers over the number of classes, 1966 |
| 41 | .43 | Per capita phones, 1961 |
| 32 | .40 | High school attendance, 1966 |
| 5 | .37 | Towns 5000-9999, 1966 |

% of Total Variance accounted for - 10.01%
% of Common Variance accounted for - 12.54%

communities should be more capable of self-support because of having larger populations and therefore more tax revenue. Unimpeded travel (40:-.52) and a high rate of telephone subscription (41:43) are consistent with suburban conditions and may be due in part to greater community age (1:69) and the attendant probability of such facilities being long established and readily available.

A low percentage of males in the population (56:-.53) indicated, because males outnumber females in most areas of B. C., an even sex ratio in areas with high scores on this factor. The high marriage rate (61:56) and large number of children as indicated by a high mean class size (28:80), along with the even sex ratio, point to a large number of young families with children. The higher overall level of education indicated by there being more teachers than school divisions (29:.43) and therefore more well-educated residents in the area, in addition to there being a higher rate of high school attendance (32:40), suggests that the school districts identified by this factor are largely of middle class composition.

Verification of the factor interpretation is evident when the highest and lowest scores on this factor are inspected in Table 4.3(b). An understanding of the low scoring school districts can be better obtained by reversing the signs of the factor loadings in Table 4.3(a). It can be seen that such reflection serves to further verity and clarify the factor interpretation.

Table 4.3(b)

Extreme Factor Scores on a

Suburban Conditions Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 43 | Coquitlam | 66.4 | 29 | Lillooet | 27.7 |
| 36 | Surrey | 66.4 | 25 | Barriere | 27.7 |
| 61 | Victoria | 64.0 | 64 | Gulf Islands | 28.2 |
| 37 | Delta | 63.4 | 84 | Vancouver Isl. West | 28.3 |
| 44 | North Vancouver | 62.9 | | | |
| 38 | Richmond | 62.8 | 26 | Birch Island | 29.6 |
| 53 | Terrace | 62.4 | 49 | Ocean Falls | 32.0 |
| 40 | New Westminster | 62.0 | 46 | Sechelt | 32.3 |
| 34 | Abbotsford | 62.0 | 50 | Queen Charlotte | 33.9 |
| 22 | Vernon | 61.9 | 10 | Arrow Lakes | 36.4 |
| 54 | Smithers | 60.3 | 13 | Kettle Valley | 36.8 |
| 33 | Chilliwack | 60.0 | 85 | Vancouver Isl. North | 37.1 |
| | | | 14 | Windermere | 38.1 |
| | | | 66 | Lake Cowichan | 39.1 |
| | | | 58 | McBride | 39.2 |

Factor II: Climate

The reason a climate factor has not appeared in previous taxonomic studies is undoubtedly due to the fact that a more complete set of climate variables occurred in the present data set. High loadings on all variables but one of those originally grouped under the Physical Geography heading in Chapter 3 demonstrate that this factor accounts for most of the variance in those variables. As a result, no appreciable loadings relevant to climate occurred on any other factors.

School districts with high scores on this factor are clearly identified as having a small annual temperature range (45:-.92), a large discrepancy between summer and winter precipitation (47:.89), high winter temperature

(44:.88), heavy winter rainfall (46:.87), low elevation (42:-.86) and many frost-free days in a year (48:.85).

TABLE 4.4(a)

Varimax Loadings for a

Climate Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 45 | -.92 | Summer-winter temperature difference |
| 47 | .89 | Summer-winter precipitation difference |
| 44 | .88 | Mean winter temperature |
| 46 | .87 | Mean winter precipitation |
| 42 | -.86 | Elevation |
| 48 | .85 | Annual frost-free days |
| 43 | -.50 | Ruggedness of terrain |
| 67 | -.41 | Referrals to community mental health clinics, 1965-68 |
| 71 | -.41 | Welfare recipiency, 1965-67 |
| 72 | .40 | Welfare expenditure per recipient, 1966-67 |

% of Total Variance accounted for - 9.4%
% of Common Variance accounted for - 11.81%

This description suggests that districts with a West Coast marine climate would obtain the highest scores on this factor, an indication borne out upon inspection of the factor scores in Table 4.4(b).

The low rate of referrals to community mental health clinics (67:-.41) in the high scoring districts in Table 4.4(b) may be due in some cases to inaccessibility and in others (e.g., Victoria and Vancouver) to availability of other facilities drawing patients away from publicly supported clinics. Less rugged terrain (43:-.50) is consistent with coastal conditions, while low welfare recipiency (71:-.41) and high welfare expenditures per recipient (72:.40) indicate a better standard of living in the coastal districts.

TABLE 4.4(b)

Extreme Factor Scores on a

Climate Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 84 | Vancouver Isl. West | 72.7 | 3 | Kimberely | 32.8 |
| | | | 60 | Peace River North | 32.9 |
| 85 | Vancouver Isl. North | 66.8 | 54 | Smithers | 34.0 |
| 49 | Ocean Falls | 65.6 | 59 | Peace River South | 35.4 |
| 79 | Ucluelet-Tofino | 64.2 | 4 | Windermere | 36.2 |
| 50 | Queen Charlotte | 64.1 | 2 | Cranbrook | 36.2 |
| 70 | Alberni | 64.1 | 12 | Grand Forks | 36.9 |
| 46 | Sechelt | 63.3 | 18 | Golden | 37.2 |
| 62 | Sooke | 62.7 | 1 | Fernie | 37.4 |
| 61 | Victoria | 62.6 | 13 | Kettle Valley | 37.4 |
| 44 | North Vancouver | 62.6 | 82 | Chilcotin | 38.4 |
| 66 | Lake Cowichan | 61.6 | 22 | Vernon | 39.3 |
| 52 | Prince Rupert | 61.0 | 58 | McBride | 39.8 |
| 41 | Burnaby | 60.7 | | | |
| 43 | Coquitlam | 60.7 | | | |
| 47 | Powell River | 60.6 | | | |

Factor III: Decrepitude

The name for this factor is borrowed from Kendall (1963) who obtained a factor which similarly indexed old age in his community toxonomy. Areas with high scores on this factor have larger numbers of persons over 65 (57:.89), a populace of higher median age (59:.85), and, not unexpectedly, a high percentage of persons over 15 years of age (55:.77) and therefore at risk of admission to Riverview Hospital. It is also not unexpected to find a high per capita death rate (33:.42), but the fact that the death rate has only a moderate loading suggests that old age does not account for the majority of deaths in the province.

The low natural population growth (15:-.71) is probably influenced by

the higher death rate, as it is based on the excess of births over deaths. In a similar manner, deaths may serve to lower the overall population growth (13:-.42), and, as these deaths are presumably due mainly to old age,

TABLE 4.5(a)

Varimax Loadings for a

Decrepitude Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 57 | .89 | % of pop. 65 years+, 1966 |
| 59 | .85 | Median age, 1966 |
| 55 | .77 | % of pop. 15 years+, 1966 |
| 15 | -.71 | Natural pop. growth, 1966 |
| 34 | -.60 | Infant death rate, 1966 |
| 66 | .56 | Availability of community mental health services, 1964-67 |
| 56 | -.55 | % of males in pop., 1966 |
| 49 | .54 | % of registered voters voting in Provincial election, 1966 |
| 13 | -.42 | Pop. growth, 1961-66 |
| 33 | .42 | Death rate, 1966 |

% of Total Variance accounted for - 9.00%
% of Common Variance accounted for - 11.28%

they may outnumber infant deaths greatly (34:-.60). Considering the greater maturity of the population, it is likely that the negative correlations of this factor with natural population growth and infant death rates are due in some measure to infertility as well as deaths from old age.

If the factor is reflected and considered in terms of the low scoring communities in Table 4.5(b), it can be seen that its obverse appears to indicate rugged pioneer-like conditions. The relationship between variables 15, 34 and 13 then suggests extremely high fertility with the majority of the high population growth accounted for by natural increase despite a high

infant death rate.

Decrepitude, with pioneer like conditions as its opposite, would be expected to exist in more established communities. The fact that community mental health services are more available (66:.56) suggests some proximity to larger towns, while a higher rate of voting (49:.54)

TABLE 4.5(b)

Extreme Factor Scores on a

Decrepitude Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 64 | Gulf Islands | 82.4 | 80 | Kitimat | 26.2 |
| 69 | Qualicum | 70.3 | 57 | Prince George | 35.9 |
| 22 | Vernon | 67.7 | 60 | Peace River | 36.2 |
| 14 | South Okanagan | 67.5 | | North | |
| 61 | Victoria | 67.1 | 56 | Vanderhoof | 37.2 |
| 78 | Enderby | 66.8 | 53 | Terrace | 38.3 |
| 39 | Vancouver | 64.8 | 82 | Chilcotin | 38.4 |
| 15 | Penticton | 63.7 | 70 | Alberni | 38.7 |
| 8 | Slocan | 63.4 | 28 | Quesnel | 39.1 |
| 23 | Kelowna | 63.2 | 19 | Revelstoke | 39.7 |
| 40 | New Westminster | 62.3 | 59 | Peace River | 39.8 |
| 16 | Keremeos | 60.8 | | South | |
| 12 | Grand Forks | 60.7 | 43 | Coquitlam | 39.9 |
| 13 | Kettle Valley | 60.4 | | | |

may indicate more accessible polls. Both these variables may index more participation in community affairs. However, it is possible that in the low scoring school districts community participation is different in kind rather than quantity.

Factor IV: Concentration

In his 1926 article outlining the concerns of human ecology, R. D. McKenzie defined the term concentration, as used in human ecology, as the

tendency of persons to settle in a given area. He further suggested that the best measure of this process at a given point in time was population density. Factor IV in the present study represents a refinement over such a measure in giving weight to other variables related to concentration.

The first three loadings appear to describe concentration most clearly and are obviously interdependent, with a high total population (54:.71) resulting in high population density in the main town(s) of the school district (10:89) which in turn results, by the law of supply and demand, in high property value within the same organized towns (23:.93). The

TABLE 4.6(a)

Varimax Loadings for a

Concentration Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 23 | .93 | Town property value, 1961 |
| 10 | .89 | Town pop. density, 1961 |
| 54 | .71 | Total population, 1966 |
| 26 | .61 | % of workers earning wages, 1961 |
| 21 | .61 | Municipal debt, 1963 |
| 41 | .44 | Per capita phones, 1961 |
| 49 | .43 | % of registered voters voting in Provincial election, 1966 |

% of Total Variance accounted for - 5.95%
% of Common Variance accounted for - 7.46%

slightly lower loading on total population is probably due to the fact that it measures the total population of each school district as a whole and not just the organized area within each school district.

The remaining loadings are similarly clear in their interpretations. A high percentage of wage earners (26:61) undoubtedly indexes greater

employment opportunities which presumably sustain the large numbers of residents. A high telephone subscription rate in conjunction with an abundance of regular jobs indicates greater business activity and points to a probability of these areas containing distribution centers for the province. A high municipal debt (21:.61) may be a result of greater needs for community services and of the better municipal collateral in terms of many steadily employed taxpayers. A higher rate of voting (49:.43) is probably due mainly to the polls being more available because of shorter distances.

Reference to Table 4.6(b) serves to confirm these inferences regarding the school districts with high scores on this factor.

TABLE 4.6(b)

Extreme Factor Scores on a

Concentration Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 39 | Vancouver | 111.2 | 75 | Mission | 35.2 |
| 68 | Nanaimo | 74.4 | 78 | Enderby | 37.3 |
| 40 | New Westminster | 66.0 | 63 | Saanich | 37.6 |
| 24 | Kamloops | 65.8 | 35 | Langley | 39.3 |
| 11 | Trail | 62.5 | | | |
| 70 | Alberni | 62.0 | | | |
| 19 | Revelstoke | 62.0 | | | |
| 3 | Kimberley | 60.6 | | | |
| 61 | Victoria | 60.5 | | | |

The relationship of the low scoring school districts to this factor can be understood when it is borne in mind first, that the districts all consist largely of organized area in the form of farming municipalities, and second, that this factor refers only to organized area within school districts.

Referring back to Table 4.6(a) and reversing the signs of the factor loadings, it can be seen that these school districts are most strongly characterized by low property value and low population density within the towns or organized area of the district, consistent with the fact that the land is devoted more to farming than sophisticated commercial activity. The remaining factor loadings pose no contradictions to the environmental description expected to be applicable to agricultural municipalities.

Like Factor I, Suburban Conditions, Factor IV is related to the first factors of both Jonassen and Peres (1960) and Kendall (1963), and represents further evidence of more clear differentiation of dimensions in the present study. A resemblance to Jonassen and Peres' (1960) fifth factor which they named Magni-Complexity, was also noted. It appears worth noting, in favor of the present analysis that, while their urban dimensions, Urbanism and Magni-Complexity, were mathematically independent, the comparable pair of factors in the present analysis, Suburban Conditions and Concentration, are conceptually distinct from each other as well.

Factor V: Slum Conditions

Similar factors to this one have been found in previous analyses of community data. Bloom's (1968) cluster analysis of census tracts yielded a cluster which he called Social Disequilibrium, while Jonassen and Peres (1960) obtained a factor named Poverty and Kendall (1963) obtained one which was named Slum Conditions, as in the present study. Although some differences existed between these three previously derived dimensions and the present one, due to differences in the original sets of variables, the underlying dimension appears to represent a consistently stable aspect of human social life.

It must be realized at the outset that none of the vitality figures loading on this factor were available for Indians on reserves, and thus do not refer to these persons. If Indian people affect these figures at all it can only be through there being more Indians without treaty status living near established reserves or through the Indian society itself affecting the adjacent white society. When it is considered that the native people generally live in the most impoverished conditions of all citizens in B. C., it can be assumed that this factor would have been even more strongly identified if their vital statistics had entered the analysis.

TABLE 4.7(a)

Varimax Loadings for a Slum

Conditions Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 58 | .78 | % of Indians in pop., 1966 |
| 33 | .75 | Death rate, 1966 |
| 60 | .74 | Fertility rate, 1966 |
| 13 | .60 | Pop. growth, 1961-66 |
| 32 | -.53 | High school attendance, 1966 |
| 73 | .51 | Illegitimacy rate, 1966 |
| 35 | -.46 | Hospital death rate, 1966 |
| 70 | .42 | Delinquency rate, 1965-67 |
| 51 | -.40 | % Social Credit vote, 1966 |
| 34 | .33 | Infant death rate, 1966 |

% of Total Variance accounted for - 5.77%
% of Common Variance accounted for - 7.22%

Similar high birth rates (60:.74) were found by Jonassen and Peres (1960) while Kendall (1963) found high death rates associated with homicide, maternity and influenza. The high general death rate on the present factor

(33:.75) and the high sudden death rate as indexed by a low rate of hospital deaths (35:-.46) is consistent with Kendall's findings. Infant deaths, on the other hand, although contributing slightly to deaths on this factor, was unrelated and marked another discrete factor in Kendall's taxonomy.

The negative loading of high school attendance (32:-.53) on this factor is similar to the negative relationship Kendall (1963)found with a median adult education variable. Such concurrence indicates that present high school attendance may serve, as suggested in Chapter 3, as a suitable statistical substitute for the educational level of the adult population.

An inspection of the loadings on the vitality figures indicates that the school districts with high scores on this factor have high rates of in-migration. Overall population growth is vigorous as seen in a loading of .60 on variable 13. This growth occurs despite high death rates (33:.75), and, the possibility that the contribution of a high fertility rate (60:.74) to population growth is diminished by a high infant death rate (34:.33) is supported by the fact that natural population growth, or the excess of births over deaths (variable 15) does not correlate with this factor.

Comparing Slum Conditions with the reflection of Decrepitude, Factor III, similar relationships between birth and death rates can be seen. However, it is evident that Slum Conditions describes much more unhealthy conditions as seen in the higher death rate, in addition to social ill health, aspects of which are absent from Factor III. Specifically, low high school attendance (32:-.53), high illegitimacy (73:.51) and high juvenile delinquency (70:.42) all indicate social disruption and an inability to adapt to the values of the dominant culture. The fact that a low rate

of Social Credit voting occurs under these unpleasant social conditions supports the suggestion (Chapter 3) that a low vote for the political party in power could indicate dissatisfaction with the status quo.

TABLE 4.7(b)

Extreme Factor Scores on a

Slum Conditions Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T. Score | SD No. | SD Name | T score |
| 82 | Chilcotin | 113.9 | 25 | Barriere | 38.1 |
| 51 | Portland Canal | 82.5 | 47 | Powell River | 38.1 |
| 30 | South Cariboo | 66.0 | 9 | Castlegar | 38.4 |
| 69 | Qualicum | 61.1 | 10 | Arrow Lakes | 38.5 |
| 78 | Enderby | 61.0 | | | |

An inspection of the high scoring school districts for this factor reveals results only partially consistent with expectation on the basis of general knowledge of the province. Chilcotin, Portland Canal and South Cariboo all constitute rural poverty areas, but Qualicum and Enderby are not as obviously impoverished. There is probably a greater variation in socio-economic status in these last two districts, while the population of the first three consists largely of persons of low socio-economic status. It is interesting to note, in this respect, that none of the economic variables have appeared on this factor despite its clear indexing of socially disrupted and unhealthy impoverished conditions.

Factor VI: Small Town Autonomy

The school districts identified by this factor, although relating strongly to all three of the variables originally entered as indexing geographic isolation (variables 38, 39 and 40), also tend to contain at least one small organized town (3:.42) and to be relatively self-sufficient

in terms of health facilities (37:.78).

TABLE 4.8(a)

Varimax Loadings for a Small

Town Autonomy Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 37 | .78 | Hospital beds per capita, 1961 |
| 38 | .60 | Distance from Riverview Hospital |
| 39 | .50 | Accessibility by air |
| 40 | .47 | Impediments to land travel |
| 3 | .42 | Towns 2500-, 1966 |

% of Total Variance accounted for - 4.24%
% of Common Variance accounted for - 5.31%

The relationship between variables 38, 39 and 40 indicates that high scoring communities on this factor would have reasonably good air travel facilities (39:.50) as a reaction to excessive distance from Vancouver (38:.60) and difficult travel by road (40:.47).

With one exception, the high scoring districts substantiate the interpretation, being far removed from Vancouver and Riverview Hospital and containing at least one organized community. The exceptional case, New Westminster, has obtained a high score on this factor because of an unusually high number of hospital beds per capita. Similar statistical artifacts appear to be operating in the low scoring school districts. There, the isolated rural school districts of Chilcotin, Birch Island and Barriere appear alongside a group of communities which, due to their geographic position, are not self-sufficient and which are close to

TABLE 4.8(b)

Extreme Factor Scores on a

Small Town Autonomy Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 51 | Portland Canal | 79.2 | 82 | Chilcotin | 26.6 |
| 85 | Vancouver Isl. North | 73.6 | 26 | Birch Island | 29.8 |
| | | | 43 | Coquitlam | 32.2 |
| 50 | Queen Charlotte | 72.8 | 25 | Barriere | 33.1 |
| 80 | Kitimat | 68.1 | 48 | Howe Sound | 33.5 |
| 52 | Prince Rupert | 65.4 | 36 | Surrey | 34.0 |
| 49 | Ocean Falls | 64.3 | 45 | West Vancouver | 34.7 |
| 40 | New Westminster | 61.8 | 37 | Delta | 38.3 |
| 54 | Smithers | 61.6 | 44 | North Vancouver | 39.3 |
| 84 | Vancouver Isl. West | 61.6 | | Sooke | 39.3 |
| 53 | Terrace | 60.4 | | | |
| 60 | Peace River North | 60.1 | | | |

Riverview. The spuriously low scores on the above three districts are due to high isolation scores being cancelled out by there being no organized towns within their boundaries, little or no hospital facilities and limited air service. Because of the heterogeneity of the districts with low scores on Small Town Autonomy, any further interpretations based on its reflection would be unprofitable.

Factor VII: A. A. Prevalence

The failure of the variables indexing Alcoholics Anonymous activity to link with others in the factor analysis demonstrates that such activity is independent of the other phenomena represented in the data set. Although such a result adds no new information from the point of view of environmental description, the simplicity of this factor maximizes its interpretability as a predictor to be used in the canonical analysis (Chapter 6).

TABLE 4.9(a)

Varimax Loadings for an

A. A. Prevalence Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 74 | .88 | Alcoholics Anonymous membership, 1966 |
| 75 | .87 | Number of Alcoholics Anonymous groups, 1966 |

% of Total Variance accounted for - 3.8%
% of Common Variance accounted for - 4.81%

It can be seen in Table 4.9(b) that the spatial distribution of scores on this factor are as random as the factor loadings in Table 4.9(a) are independent of the other environmental variables. The nature of these relationships indicates that the development of community resources to deal with alcoholism is not environmentally determined but is probably determined by chance.

TABLE 4.9(b)

Extreme Factor Scores on an

A. A. Prevalence Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 79 | Ucluelet-Tofino | 117.3 | 50 | Queen Charlotte | 32.8 |
| 54 | Smithers | 69.2 | 51 | Portland Canal | 33.5 |
| 17 | Princeton | 65.8 | 10 | Arrow Lakes | 39.2 |
| 67 | Ladysmith | 62.8 | | | |
| 26 | Birch Island | 62.2 | | | |

Factor VIII: Wage Level

Although this factor indexes wage levels in general, it can be seen that it relates most predominantly to working women.

TABLE 4.10(a)

Varimax Loadings for a

Wage Level Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 25 | .81 | Female wage level, 1961 |
| 27 | .81 | % of wage earners who were female, 1961 |
| 24 | .72 | Mean male wage, 1961 |
| 12 | -.42 | Pop. growth, 1956-61 |

% of Total Variance accounted for - 3.82%
% of Common Variance accounted for - 4.79%

The fact that women's wages were higher (25:.81) in the high scoring school districts in 1961 meant that more women were working (27:.81)and, as evidenced in the low population growth at that time (12:-.42), less women

were having babies. It would appear that some aspects of the circumstances accompanying large numbers of working women in a community have been clearly identified by this factor and show some accordance with the expectations expressed in Chapter 3.

TABLE 4.10(b)

Extreme Factor Scores on a

Wage Level Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 75 | Mission | 63.6 | 38 | Richmond | -7.3 |
| 33 | Chilliwack | 62.3 | 37 | Delta | 1.1 |
| 13 | Kettle Valley | 60.9 | 16 | Keremeos | 39.9 |

It can be seen in Table 4.10(b) that the distributions of both high and low scores on this factor add nothing to its interpretability.

Factor IX: Rural Property Value

This factor forms an interesting complement to both Factor IV, Concentration, and its reflection. Where Concentration indexed high population density and high land values within organized areas of an urban nature, and its reflection indexed lower population density and property value in organized farming municipalities, Factor IX relates to districts in which population density and land values are high in the unincorporated or rural area. It would appear that areas with high scores on this factor are in fact quite similar to those scoring low on Concentration, the main difference between them being that in the present case the land area is unincorporated. The presence of moderately sized cities or towns within communities would be needed to service the large rural populations.

Consultation of the factor scores in Table 4.11(b) indicates that the

interpretation fits well for the high scoring communities. The inference that districts with high scores on Rural Property Value would be similar to districts with low scores on Concentration is verified by the fact that Saanich received a T score of 98.4 in the present case and a score of

TABLE 4.11(a)

Varimax Loadings for a Rural

Property Value Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 22 | .85 | Non-town property value, 1961 |
| 11 | .83 | Non-town pop. density, 1961 |
| 4 | .65 | Towns 2500-4999, 1966 |

% of Total Variance accounted for - 3.61%
% of Common Variance accounted for - 4.52%

37.6 on Concentration. Evidently that school district consists of both organized and unincorporated areas which are indistinguishable from each other. It is interesting to note that, with only two exceptions, the high scoring school districts are on the east coast of Vancouver Island. Thus, Factor IX is somewhat of a regional factor in that it differentiates a large contiguous portion of the province from the rest of the province with some accuracy.

An inspection of the school districts with low scores on this factor indicates a degree of heterogeneity similar to that seen in the reflection of Factor VI, Small Town Autonomy. This lack of bi-polarity is unfortunate in that it means there was a failure to differentiate the highly centralized school districts, those with small organized areas surrounded by large expanses of uninhabitable land.

TABLE 4.11(b)

Extreme Factor Scores on a Rural

Property Value Variate

High Factor Scores

| SD No. | SD Name | T score | SD No. | SD Name | T score |
|---|---|---|---|---|---|
| 63 | Saanich | 98.4 | 42 | Maple Ridge | 35.2 |
| 68 | Nanaimo | 86.1 | 4 | Windermere | 39.3 |
| 65 | Cowichan | 75.9 | 40 | New Westminster | 39.8 |
| 71 | Courtenay | 69.4 | | | |
| 67 | Ladysmith | 68.2 | 51 | Portland Canal | 39.9 |
| 9 | Castlegar | 66.5 | | | |
| 64 | Gulf Islands | 65.4 | | | |
| 62 | Sooke | 62.3 | | | |
| 11 | Trail | 60.9 | | | |

Factor X: Opposition Voting.

The majority of the variance in Factor X describes the distribution of opposition (non-Social Credit) voting in the 1966 Provincial election.

TABLE 4.12(a)

Varimax Loadings for an

Opposition Voting Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 53 | -.82 | % N.D.P. vote, 1966 |
| 52 | .54 | % Liberal vote, 1966 |
| 29 | .45 | Excess of teachers over the number of classes, 1966 |

% of Total Variance accounted for - 3.46%
% of Common Variance accounted for - 4.34%

The implication of this factor's structure is that, independent of Social Credit voting, N.D.P. and Liberal voting tend to be opposed to

each other. In other words, it can be predicted that a school district will probably show a high rate of N.D.P. voting if its Liberal vote is low (and vice versa) but no prediction can be made from either of these to Social Credit voting. The reason for the negative relationship between the rates of endorsement of the two parties appearing on this factor could be attributed to the fact that the Liberal party is traditionally associated with the upper middle class while the N.D.P. tends to be associated with the working classes. The fact that there tends to be an excess of teachers coexisting with a high Liberal vote is consistent with an interpretation based on socio-economic status, as it can be assumed to index, as in the case of Factor I, a higher educational level in the adult population.

TABLE 4.12(b)

Extreme Factor Scores for an

Opposition Voting Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 45 | West Vancouver | 77.8 | 51 | Portland Canal | 18.7 |
| 64 | Gulf Islands | 68.6 | 13 | Kettle Valley | 26.8 |
| 82 | Chilcotin | 67.1 | 32 | Fraser Canyon | 30.6 |
| 44 | North Vancouver | 66.4 | 8 | Slocan | 31.3 |
| 61 | Victoria | 65.5 | 17 | Princeton | 33.1 |
| 60 | Peace River North | 65.0 | 67 | Ladysmith | 34.4 |
| 22 | Vernon | 63.2 | 29 | Lillooet | 35.2 |
| 59 | Peace River South | 62.7 | 65 | Cowichan | 36.8 |
| 57 | Prince George | 60.5 | 36 | Surrey | 37.6 |
| 18 | Golden | 60.0 | | | |

The distribution of high and low factor scores is basically consistent with the above interpretation. The most notable exception is the T score of 67.1 for the Chilcotin school district, one which has already been demonstrated, by its high score on Slum Conditions, to be an area of poverty

rather than upper middle-class affluence. Other less notable exceptions in the high scoring districts are the two Peace River districts and Prince George and Golden, while no notable discrepancies occur in the low scoring areas. The discrepancies are most likely due to the fact that personal qualities of the candidates outweigh political affiliation in obtaining votes in some constituencies.

Factor XI: Rural Distribution Centers

In contrast to Factor IV, Concentration, which appeared to relate to general commercial activity, the present factor appears to relate more strictly to the distribution of goods.

TABLE 4.13(a)

Varimax Loadings for a Rural Distribution Centers Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 2 | .73 | Number of hamlets, 1961 |
| 18 | .73 | Retail sales, 1963 |

% of Total Variance accounted for - 3.09%
% of Common Variance accounted for - 3.88%

The higher number of hamlets and greater per capita retail sales in the communities with high scores on this factor undoubtedly reflect a reciprocal relationship. The fact that the designated towns are surrounded by hamlets raises their retail sales, while the better distribution facilities permit the existence of the hamlets. The relationship between the hamlets and the distribution centers could be compared to that between a city and its suburbs.

Consultation of the list of high scoring school districts in Table

4.13(b) essentially supports the above interpretation. Comparing the scores to those on Concentration, the fact that the high scoring communities on this factor service rural areas becomes clear. While some high concentration areas were strictly urban (e.g., Vancouver, New Westminster), none of the districts in Table 4.13(b) could be so described.

It is found, once again, that statistical artifacts have led to heterogeneity in the list of low scoring school districts. It appears that an inordinate emphasis on one or the other of the defining attributes of this factor has led to affluent suburbs such as North and West Vancouver scoring similarly to such isolated rural districts as McBride and Portland Canal.

TABLE 4.13(b)

Extreme Factor Scores on a Rural

Distribution Centers Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 27 | Williams Lake | 78.5 | 63 | Saanich | 26.1 |
| 57 | Prince George | 74.9 | 1 | Fernie | 30.9 |
| 20 | Salmon Arm | 70.2 | 45 | West Vancouver | 34.3 |
| 35 | Langley | 68.5 | 44 | North Vancouver | 34.8 |
| 68 | Nanaimo | 66.9 | 3 | Kimberley | 36.7 |
| 65 | Cowichan | 66.1 | 58 | McBride | 36.8 |
| 46 | Sechelt | 64.5 | 61 | Victoria | 37.9 |
| 28 | Quesnel | 64.0 | 51 | Portland Canal | 38.6 |
| 23 | Kelowna | 63.8 | 50 | Queen Charlotte | 39.3 |
| 24 | Kamloops | 62.7 | 48 | Howe Sound | 39.8 |
| 60 | Peace River North | 62.5 | 76 | Agassiz | 39.9 |
| 33 | Chilliwack | 61.3 | | | |
| 72 | Campbell River | 60.5 | | | |

Factor XII: Spoiled Ballots

As was mentioned in Chapter 3, there was no specific *a priori* reason

for including variable 50, the percentage of cast ballots which were spoiled, in the data set. As a result this factor was more difficult to interpret and a heavier reliance was placed on the factor scores than in other factor interpretations.

TABLE 4.14(a)

Varimax Loadings for a

Spoiled Ballots Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 50 | .85 | % spoiled ballots, 1966 |
| 36 | .64 | Motor vehicle deaths, 1965-68 |
| 17 | .40 | Liquor sales, 1963 |

% Total Variance accounted for - 2.72%
% Common Variance accounted for - 3.41%

It would be tempting, but facile, to interpret the high numbers of spoiled ballots and motor vehicle deaths to excessive alcohol consumption The relationships between the factor scores suggested that the actual underlying common dimension could be the type of highway transportation available.

TABLE 4.14(b)

Extreme Factor Scores on a

Spoiled Ballots Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 30 | South Cariboo | 104.3 | 51 | Portland Canal | 24.6 |
| 32 | Fraser Canyon | 82.2 | 82 | Chilcotin | 34.0 |
| 31 | Merritt | 71.1 | 25 | Barriere | 36.5 |
| 56 | Vanderhoof | 66.2 | 53 | Terrace | 37.1 |
| 40 | New Westminster | 64.3 | | | |
| 29 | Lillooet | 61.3 | | | |

The high scoring districts (except New Westminster) all consist of lightly populated areas of largely rural composition served by paved highways. The highways in these areas, however, are treacherous because of the terrain, the best example being the trans-Canada highway which, on passing through the Fraser Canyon, traverses both of school districts 30 and 32, the districts with the highest scores on this factor. The low scoring school districts, on the other hand, are similarly lightly populated and of rural composition, but have poor roads. It is evident then, that differences in motor vehicle deaths at least, are a result of the fact that high speeds are not possible on the roads in the low scoring school districts while the combination of good roads and dangerous terrain, not to mention heavier traffic, raises the rates in the high scoring districts.

The positive correlation of liquor sales with this factor may be attributable to transportation differences determining the demand and supply of liquor. The relationship of spoiled ballots, although more complex, appears also to be related to transportation. Investigation of scores on previous factors and general knowledge of the province indicate that, on this factor, both high and low scoring school districts tend to be rural, less affluent, and to have a lower level of education in the population. It might be assumed then, that the voters in these areas were less capable, on the average, of correctly filling in a ballot. The inference could then be drawn that in the high scoring districts, with more efficient transportation, more of the large number of less capable voters turned out to vote, while in the low scoring areas only those with a strong interest in voting went to the considerable inconvenience of travelling to the polls.

Therefore, it can be seen that this factor performs the function of distinguishing between rural transportation facilities. The presence of New Westminster in the high scoring districts, once again, represents a statistical artifact due to an unusually high score on one of the strongly loading variables.

Factor XIII: Rural School Support

The interpretation of this factor presents a straightforward task. An implication from its structure is that school taxes are higher when a heavier rural population must be served in a town's schools. The relationship of natural recreation facilities to the factor is not obvious, but it may be that the larger rural population is in part attracted by the recreational facilities and has also led to their development. In any case, this factor clearly relates to rural life i.e. rural in the sense of removed from the greater Vancouver area.

TABLE 4.15(a)

Varimax Loadings for a Rural

School Support Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 20 | .78 | School Mill rate, 1963 |
| 9 | .47 | Rural pop., 1961 |
| 62 | .41 | Extent of natural recreation facilities |

% of Total Variance accounted for - 2.6%
% of Common Variance accounted for - 3.37%

TABLE 4.15(b)

Extreme Factor Scores on a Rural

School Support Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 55 | Burns Lake | 77.6 | 29 | Lillooet | 17.5 |
| 56 | Vanderhoof | 71.4 | 80 | Kitimat | 26.2 |
| 62 | Sooke | 70.5 | 25 | Barriere | 32.9 |
| 53 | Terrace | 68.4 | 40 | New Westminster | 33.2 |
| 18 | Golden | 64.3 | 67 | Ladysmith | 33.8 |
| 58 | McBride | 63.4 | 31 | Merritt | 35.9 |
| 85 | Vancouver Isl. North | 62.8 | 66 | Lake Cowichan | 36.0 |
| | | | 15 | Penticton | 37.2 |
| 30 | South Cariboo | 62.7 | 3 | Kimberley | 37.7 |
| 17 | Princeton | 61.0 | 60 | Peace River North | 38.3 |
| 86 | Creston-Kaslo | 60.1 | 78 | Enderby | 39.9 |

Consultation of the lists of high and low factor scores indicates that essentially rural school districts are to be found at both scoring extremes. This means that the distinction is being made between rural districts in which the local school support and other correlates of the factor vary.

There appears to be some heterogeneity in the factor scores that would not be expected on an a priori basis. However, it is probably safe to assume, because it has an appreciably higher factor loading, that the relationship of the School Mill rate is generally consistent with the distribution of factor scores.

Factor XIV: Community Growth

The structure of this factor suggests well-organized community growth.

TABLE 4.16(a)

Varimax Loadings for a Community

Growth Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 14 | .80 | Town growth, 1961-66 |
| 63 | .44 | Acreage in public parks and playgrounds, 1966 |
| 51 | -.44 | % Social Credit vote, 1966 |
| 70 | -.41 | Delinquency rate, 1965-67 |

% of Total Variance accounted for - 2.67%
% of Common Variance accounted for - 3.34%

Attention to the needs of children is indicated in there being more extensive playground facilities, while the low rate of juvenile delinquency indicates that attempts to fulfill the children's needs have been successful. The low Social Credit vote, which was suggested at the outset (Chapter 3) to index dissatisfaction with the status quo, could likewise indicate attempts to improve the social environment of the community.

A comparison with Factors III, V and VIII demonstrates that population growth in entire school districts correlates with different events than does growth of the organized area within the district. On the reflection of Factor III, high population growth coexists with a predominance of youth and fertility, while on Factor V it contributes to the description of Slum Conditions and on Factor VIII it has a negative relationship with working women and wage levels.

TABLE 4.16(b)

Extreme Factor Scores on a

Community Growth Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 84 | Vancouver Isl. West | 96.7 | 49 | Ocean Falls | 31.1 |
| | | | 50 | Queen Charlotte | 31.5 |
| 8 | Slocan | 90.7 | 56 | Vanderhoof | 34.5 |
| 60 | Peace River North | 65.5 | 46 | Sechelt | 37.4 |
| | | | 26 | Birch Island | 38.8 |
| 48 | Howe Sound | 65.4 | 25 | Barriere | 39.5 |
| 27 | Williams Lake | 65.3 | 47 | Powell River | 39.5 |
| 1 | Fernie | 60.7 | 68 | Nanaimo | 39.7 |
| 72 | Campbell River | 60.3 | 16 | Keremeos | 39.7 |

The listing of factor scores indicates that, on the whole, newly developing rural areas obtain high scores while long-established rural communities which have either reached a state of equilibrium between jobs and population or are actually losing population receive low scores.

Factor XV: Tourist Trade

The pairing of hotel accommodations and natural recreation facilities on a single factor is in accordance with the relationship between them posited in Chapter 3.

TABLE 4.17(a)

Varimax Loadings for a

Tourist Trade Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 65 | .70 | Hotel and motel units per capita, 1961 |
| 62 | .43 | Extent of natural recreation facilities |

% of Total Variance accounted for - 2.62%
% of Common Variance accounted for - 3.29%

The factor appears to have identified a dimension of dependence on tourism as the major source of revenue in a district. It could be expected that social differences would exist along this dimension, with high scoring communities presenting more social complexity because of the high rate of transiency and having many persons employed in jobs relating to tourism. Low scoring communities, on the other hand, could be expected to be relatively unattractive and quiet to live in.

TABLE 4.17(b)

Extreme Factor Scores on a

Tourist Trade Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 76 | Agassiz | 79.6 | 13 | Kettle Valley | 19.5 |
| 19 | Revelstoke | 73.0 | 56 | Vanderhoof | 27.6 |
| 17 | Princeton | 72.5 | 85 | Vancouver Isl. North | 34.4 |
| 18 | Golden | 68.8 | | | |
| 49 | Ocean Falls | 66.9 | 34 | Abbotsford | 36.0 |
| 15 | Penticton | 65.3 | 33 | Chilliwack | 37.1 |
| 69 | Qualicum | 63.0 | 36 | Surrey | 37.4 |
| 52 | Prince Rupert | 60.6 | 11 | Trail | 37.8 |
| 4 | Windermere | 60.1 | 7 | Nelson | 37.9 |
| | | | 84 | Vancouver Isl. West | 38.4 |
| | | | 68 | Nanaimo | 38.5 |
| | | | 62 | Sooke | 39.6 |

It can be seen that the distribution of factor scores is essentially in agreement with this interpretation.

Factor XVI: Liquor Sales Growth

As it has been established in other factors that the rate of hospital deaths is an inverse index of the incidence of sudden deaths, it is interesting to see it and increasing liquor consumption loading on the same factor. The implication, of course, is that the greater consumption of alcohol leads to more accidental deaths. Making a comparison to Factor XII, Spoiled Ballots, it can be seen that, in that case, the actual rate of liquor consumption relates to deaths in motor vehicle accidents.

Inspection of the factor scores does not serve to contradict the above interpretation. However, it appears that the previously cited statement

TABLE 4.18(a)

Varimax Loadings for a Liquor

Sales Growth Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 16 | .71 | Increase in liquor sales, 1959-63 |
| 35 | -.44 | Hospital death rate, 1966 |

% of Total Variance accounted for - 2.40%
% of Common Variance accounted for - 3.00%

(Chapter 3) from the Regional Index, that liquor sales are sensitive economic indicators, is open to question. In the present analysis the increase and level of rates of alcohol purchasing have shown no apparent relationship with the economic state of school districts.

TABLE 4.18(b)

Extreme Factor Scores on a Liquor

Sales Growth Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 79 | Ucluelet-Tofino | 73.7 | 8 | Slocan | 21.3 |
| 51 | Portland Canal | 72.9 | 80 | Kitimat | 24.7 |
| 9 | Arrow Lakes | 72.4 | 56 | Vanderhoof | 25.4 |
| 32 | Fraser Canyon | 67.9 | 58 | McBride | 35.3 |
| 84 | Vancouver Isl. West | 66.2 | 70 | Alberni | 35.7 |
| | | | 17 | Princeton | 37.3 |
| 18 | Golden | 64.8 | 66 | Lake Cowichan | 37.6 |
| 60 | Peace River North | 64.7 | 69 | Qualicum | 38.7 |
| 13 | Kettle Valley | 64.5 | | | |
| 12 | Grand Forks | 63.5 | | | |
| 31 | Merritt | 63.3 | | | |
| 41 | Burnaby | 63.2 | | | |
| 26 | Birch Island | 62.1 | | | |

Factor XVII: Social Malaise

When such indicators of social disorder as high welfare recipiency and illegitimacy coexist with a low usage of community mental health clinics, it appears safe to assume that social malaise not only exists but is being perpetuated.

TABLE 4.19(a)

Varimax Loadings for a

Social Malaise Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 71 | .53 | Welfare recipiency, 1965-67 |
| 73 | .47 | Illegitimacy rate, 1966 |
| 67 | -.46 | Referrals to community mental health services, 1965-68. |

% of Total Variance accounted for - 2.27%
% of Common Variance accounted for - 2.85%

The relationships observed in this factor may be best attributed to the fact that persons of lower socio-economic status are less inclined to seek psychiatric care on an outpatient basis (Myers and Bean, 1968). Welfare recipiency, of course, defines low social status and both it and illegitimacy tend to covary with mental disorder. This factor, then, describes a dimension which should be predictive of mental disorder but is negatively correlated with outpatient treatment of mental disorder. The implication is that mental disorder is going untreated in regions with high scores on this factor.

TABLE 4.19(b)

Extreme Factor Scores on a

Social Malaise Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 54 | Smithers | 81.0 | 3 | Kimberley | 27.2 |
| 60 | Peace River North | 73.5 | 19 | Revelstoke | 28.7 |
| | | | 80 | Kitimat | 33.0 |
| 59 | Peace River South | 67.1 | 11 | Trail | 34.6 |
| | | | 51 | Portland Canal | 34.6 |
| 50 | Queen Charlotte | 66.4 | 18 | Golden | 35.8 |
| 39 | Vancouver | 65.7 | 85 | Vancouver Isl. North | 36.0 |
| 29 | Lillooet | 64.3 | | | |
| 31 | Merritt | 63.7 | 46 | Sechelt | 36.0 |
| 52 | Prince Rupert | 61.7 | 48 | Howe Sound | 37.7 |
| 36 | Surrey | 61.5 | 22 | Vernon | 37.8 |
| 25 | Barriere | 61.2 | 78 | Enderby | 39.1 |
| 55 | Burns Lake | 60.8 | 12 | Grand Forks | 39.3 |
| 64 | Gulf Islands | 60.5 | 72 | Campbell River | 39.5 |
| 61 | Victoria | 60.3 | 32 | Fraser Canyon | 39.9 |

Factor XVIII: High Taxes

High taxes and high rates of admission to public institutions for the Aged are indicated, by this factor, to be likely to occur together and to occur elsewhere than in towns with populations between 5000 and 9999.

TABLE 4.20(a)

Varimax Loadings for a

High Taxes Variate

| Variable Number | Loading | Variable Name |
|---|---|---|
| 19 | .64 | General Mill rate, 1963 |
| 68 | .47 | Admissions to public geriatrics facilities, 1965-68 |
| 5 | -.41 | Towns 5000-9999, 1966 |

% Total Variance accounted for - 2.22%
% Common Variance accounted for - 2.78%

The fact that the rate of geriatric admissions is unrelated to the prevalence of old age in a community suggests that the tendency to hospitalize old people may be related to the tendency of a community to reject deviants (see Chapter 3). The relationship between geriatric admissions and the Mill rate is unclear, but it may be that the fact that lower taxes occur in towns of 5000-9999 population is due to their larger populations being better able to sustain necessary community services than smaller communities.

TABLE 4.20(b)

Extreme Factor Scores on a

High Taxes Variate

| High Factor Scores | | | Low Factor Scores | | |
|---|---|---|---|---|---|
| SD No. | SD Name | T score | SD No. | SD Name | T score |
| 52 | Prince Rupert | 76.3 | 80 | Kitimat | 17.8 |
| 1 | Fernie | 73.0 | 65 | Cowichan | 31.1 |
| 22 | Vernon | 70.2 | 60 | Peace River North | 34.4 |
| 84 | Vancouver Isl. West | 65.3 | 28 | Quesnel | 34.9 |
| 11 | Trail | 65.0 | 39 | Vancouver | 35.7 |
| 68 | Nanaimo | 64.2 | 63 | Saanich | 36.1 |
| 19 | Revelstoke | 63.5 | 51 | Portland Canal | 36.9 |
| 56 | Vanderhoof | 63.2 | 10 | Arrow Lakes | 38.7 |
| 78 | Enderby | 62.6 | 72 | Campbell River | 38.8 |
| 13 | Kettle Valley | 62.0 | 14 | Sth. Okanagan | 39.5 |
| 31 | Merritt | 61.4 | | | |
| 35 | Langley | 60.9 | | | |
| 66 | Lake Cowichan | 60.3 | | | |

## Discussion of Hypothesized Relationships between the Environmental Factors and Mental Disorder

As was stated prior to the presentation of the results of the factor analysis, all the retained factors were hypothesized to bear some relationship to mental disorder rates. The fact that successive pairs of complex linear composites would be extracted in the canonical analysis made it unfeasible to formulate precise expectations, but general expectations could be stated on the basis of previous research findings.

### Factor I: Suburban Conditions

The districts with high scores on this factor were largely of middle-class composition, and, as suburban areas, fell within the urban designation used in previous ecological studies of mental disorder. There were two reasons, then, for expecting higher admission rates in general in these districts.

(a) Admission rates have consistently been found to be higher in urban than rural areas (Rose & Stub, 1955; Jaco, 1960; Buss, 1966; Suinn, 1970)

(b) Persons of middle and higher socio-economic status have been found more willing to enter psychiatric treatment (Myers & Bean, 1968)

It was further expected that the high admission rates associated with Suburban Conditions would be concentrated in the less severe disorders. This expectation was based on the assumption that more readiness to seek psychiatric treatment would prevent the development of more severe disorders.

### Factor II: Climate

High scores on this factor indexed a mild rainy coastal climate. It was expected, in accordance with the suggestions of Tromp (1968) that the decreased sunlight and more changeable weather on the coast would result in higher admission rates from there than from the interior. There were

no expectations regarding the types of disorders that would be most affected although previous findings relating to schizophrenia and aggressive acts were considered (see Chapter 3).

Factor III: Decrepitude

As this factor indexed the tendency for there to be greater numbers of older persons in the school districts, and as the susceptibility to mental disorder has been found to increase with age (Rose & Stub, 1955; Buss, 1966; Suinn, 1970) it was hypothesized that Decrepitude would be a good predictor of mental disorder. Specifically, it was expected that the rates of brain disorder and non-schizophrenic psychoses (see Table 2.1), the disorders with the latest onsets, would be related to this factor.

Factor IV: Concentration

The role of Concentration in identifying the urban and urban-like cities of the province led to the expectation that Concentration would be predictive of the schizophrenic disorders, sociopathy and addiction in accordance with the findings in human ecology that these tend to be problems of the inner city (Faris & Dunham, 1960; Theodorson, 1961). However, as many of the cities scoring high on this factor were of insufficient size to sustain the ecological relationships found in larger cities (see Clausen & Kohn, 1959), it was expected that the correlations would not be strong.

Factor V: Slum Conditions

The strong indications that this factor related to poor physical health, social disorganization and low socio-economic status gave rise to the hypothesis that it would be predictive of high rates of the more severe mental disorders. Poor nutrition was expected to raise the incidence of brain disorders while the predominance of low socio-economic status was

expected to raise the rate of schizophrenia (Faris & Dunham, 1960; Hollingshead & Redlich, 1958). However, with more reluctance to seek psychiatric treatment in the lower socio-economic strata (Myers & Bean, 1968) it was expected that the schizophrenic admissions would be restricted to its more severe forms, acute and paranoid.

In addition, a less debilitating disorder, sociopathy, was expected to show high rates. This prediction was based on the assumption that the high rates of delinquency and illegitimacy loading on Slum Conditions indexed prevalent tendencies to engage in antisocial behavior within the high scoring communities.

Further evidence in favor of this factor being predictive of mental disorder is found in the epidemiological literature. The most notable comparison might be made with the communities displaying "sociocultural disintegration" studied by Leighton et. al. (1963) in the testing and substantiation of their hypothesis that more mental disorder would exist in such communities.

Factor VI: Small Town Autonomy

The fact that this factor described school districts that contained particularly small towns and were isolated except for relatively good air travel facilities, raised two etiological possibilities. It would be expected, on the whole, that admission rates would be lower in areas with high scores on this factor because the areas were rural according to U.S. Census criteria, and rural areas have been consistently found to have lower rates of mental disorders (Rose & Stub, 1955; Jaco, 1960; Suinn, 1970). On the other hand, the limited social environment and inaccessibility of other communities could be expected to promote a sense of tedium which could influence the development of some kinds of mental disorders. Apart

from the exclusion of organic disorders, it was not possible to make specific predictions regarding the disorders that would be affected by these environmental conditions.

Factor VII: A. A. Prevalence

Although the direction of the relationship could not be predicted, it was expected that the prevalence of Alcoholics Anonymous in a district would be related to the rates of addiction and possibly brain disorder, half of the latter cases being associated with alcoholism. On the one hand, it was considered that high A. A. rates and high alcoholic hospital admissions might be positively correlated with both reflecting higher rates of alcoholism in the general population. On the other hand, it was expected that there might be fewer cases of alcoholism treated at Riverview when A. A. was strong because of the availability of informal treatment right within the community. It was further expected that higher rates of A. A. in a community might index more generalized tendencies to deal with mental health problems informally and within the community thereby reducing the number of cases admitted to Riverview.

Factor VIII: Wage Level

Two specific expectations could be formulated on the basis of this factor indexing higher wages and greater numbers of working women in conjunction with a low population growth. First, the higher wages and therefore higher socio-economic status suggested lower rates of mental disorder in general would occur, particularly schizophrenia (Faris & Dunham, 1960; Rose & Stub, 1955; Hollingshead & Redlich, 1958; Gurin et. al., 1960; Jaco, 1960; Theodorson, 1961; Srole, et. al., 1962; Langner & Michael, 1963; Leighton, et. al., 1963; Buss, 1966; Klee et. al., 1967; Sechrest & Wallace, 1967; Bloom, 1968; Myers & Bean, 1968; Suinn, 1970). Second, the greater

number of working women indicated a social difference which was expected to be influential, although no specific direction of influence could be predicted. On the one hand, the increased stress to the women and possible familial disorganization might be expected to raise disorder rates, while on the other hand the more interesting and varied life styles of the women could be expected to promote mental well-being.

Factor IX: Rural Property Value

The types of school districts scoring high on this factor imply moderation in some aspects of social life. They are not so densely populated as to even slightly suggest crowding, but not so sparsely populated as to produce social isolation. The towns of 2500-4999 population within these districts can adequately fill the demand for consumer goods without the pressures of an urban-like environment. If it can be assumed that such moderation results in an environment favorable to the maintenance and development of good mental health, it would be expected that mental disorder rates in general would correlate negatively with this variate. This expectation was strengthened by the rural composition of the factor, as mental disorder rates have been found, as previously mentioned, to be lower in rural areas.

Factor X: Opposition Voting

The interpretation of this factor was based on social class differences, with high scores indexing higher social class and the reverse for low scores. Thus, higher scores on this factor were expected to be predictive of lower mental disorder rates and lower scores predictive of higher rates. In addition, given the decreased willingness of the lower social classes to seek psychiatric care, it was expected that lower scores would be predictive of the disorders sufficiently severe to make hospitalization a necessity.

Factor XI: Rural Distribution Centers

The towns referred to in this factor, being retail centers and surrounded by more than the usual number of small hamlets, would probably be the more bustling rural centers of the province. The constant influx of consumers from outside the towns would produce more social complexity in the form of more people than in a community where distribution services were more dispersed. Such a difference in the social environment was expected to be reflected in mental disorder rates, but it was not possible to predict which disorders would be affected or in which direction.

Factor XII: Spoiled Ballots

The main underlying dimension on this factor appeared to be transportation, high scores indexing well-built highways through treacherous terrain and low scores indexing a prevalence of poor unpaved roads. It would be expected that the poor roads in the low scoring areas would produce social isolation and that the factor would then correlate negatively with mental disorder rates, particularly schizophrenia (Faris & Dunham, 1960).

Factor XIII: Rural School Support

The evidence suggests lower mental disorder rates in school districts scoring high on this factor for two reasons. First, as rural districts their rates should be lower. Second, if a higher rate of local school support can be assumed to reflect a higher level of concern for good social functioning within the community, even lower rates of mental disorder of all kinds than if only rurality was taken into account would be expected.

Factor XIV: Community Growth

The structure of this factor was reminiscent of positive striving or active adjustment (Scott, 1958; Jahoda, 1950) on a community scale. As such, it was expected to be negatively predictive of all mental disorder rates. In particular, its negative loading on juvenile delinquency

suggested that sociopathy would be most likely to correlate negatively with it.

Factor XV: Tourist Trade

Once again, no direction or specific type of rate differential could be predicted for communities scoring high on this factor. However, the high rate of transience and seasonal employment in tourist-related industries were believed to create a difference in social environment that could be reflected in mental disorder rates.

Factor XVI: Liquor Sales Growth

Higher rates of sudden death and increasing liquor sales suggest that this factor indexes a more violent way of life in its high scoring school districts. Such antisocial social organization might be expected to produce higher rates of addiction and sociopathy and of brain disorders due to alcoholism.

Factor XVII: Social Malaise

Considering the indications that this factor indexes higher rates of non-hospitalized mental disorder in conjunction with unusually sparse attempts to deal with it at the community level, its etiological implications are self-evident. It was expected that this factor would be a good predictor of all categories of mental disorder, particularly the more severe ones such as brain disorders and the schizophrenic psychoses.

Factor XVIII: High Taxes

The loading of most interest on this factor related to the rate of geriatric admissions and it was suggested that those admission rates might reflect the tendency of a community to reject deviants. On the assumption that this inference was justified it was expected that this variate would tend to be predictive of mental disorder rates in general.

## Summary

The chapter opened with a description of the procedures involved in collecting the data for the factor analysis. The data sources were all secondary, most of them published by the provincial government. The nature of the geographic units used in the various records were discussed in terms of their recombination into school districts.

Problems of missing data were encountered in two types of situations: first, when incomplete information regarding the geographic distribution of events complicated the recombination of geographic areas into school districts, and second, when some of the data points of specific variables were simply missing. Estimates in the former cases were judged on the basis of population distribution, while in the latter case, least squares estimates were made of the missing data points.

The data were acknowledged to have two principle limitations -- (a) that information was missing for some variables and had to be estimated, and (b) that data were not available in all cases for the years 1965 to 1968, the period to which the diagnostic data pertained. These limitations were felt to be offset in the first case by there being relatively few cases of missing data and in the second case by the available figures falling close to the time period of interest.

Data collection was followed by the execution of the factor analysis, selection of the number of factors and the computation of the factor scores. A Principal Component analysis was conducted on a product-moment correlation matrix, twenty-two factors extracted and eighteen retained after rotation. Reference to the literature on environmental taxonomy indicated that eighteen factors exceeded the number retained in previous studies. The necessity to retain this number was dictated by the distinct simple

structure of that many factors, and was suggested to be due to the broader selection of variables entering the present analysis. Scores of the seventy-eight school districts on the eighteen factors were computed and recorded in T-score form to maximize their comprehensibility when used in the factor interpretations.

The basic guidelines observed in the factor interpretation were that only the two largest loadings for each variable were considered and then only if they exceeded a value of .30. In addition, one variable was omitted from the interpretation entirely because the patterning of its loadings was apparently meaningless. Factor scores which fell one standard deviation or more away from the mean were considered, in addition to the factor loadings, in the factor interpretations.

The eighteen factors were interpreted in some detail, following which, hypotheses regarding the role of each factor in predicting mental disorder rates were presented. A brief summary of the factor interpretations can be seen in Table 4.21 and of the hypotheses attending the factors in Table 4.22.

TABLE 4.21

Summary of Factor Interpretations

| Factor Number | Factor Name | Brief description of qualities represented in high scoring school districts. |
|---|---|---|
| I | Suburban Conditions | More highly populous communities with larger numbers of middle-class young families |
| II | Climate | Mild rainy coastal climate |
| III | Decrepitude | Preponderance of elderliness |
| IV | Concentration | High concentration of population in the major commercial centers |

TABLE 4.21 (cont.)

| Factor Number | Factor Name | Brief description of qualities represented in high scoring school districts |
|---|---|---|
| V | Slum Conditions | Poverty indicated in high death rates and social disorder |
| VI | Small Town Autonomy | Self-contained, isolated small towns |
| VII | A. A. Prevalance | High number of Alcoholics Anonymous groups and members |
| VIII | Wage Level | More working females and overall higher wages |
| IX | Rural Property Value | More highly populated rural area |
| X | Opposition Voting | Voting other than N.D.P. with a preference for Liberal voting |
| XI | Rural Distribution Centers | Centers distributing retail goods in the rural areas |
| XII | Spoiled Ballots | Higher rates of spoiled ballots, motor vehicle deaths and liquor sales. |
| XIII | Rural School Support | Rural areas with higher local school taxes |
| XIV | Community Growth | Growth within organized area and development of facilities for children |
| XV | Tourist Trade | High reliance on tourism indicated in extensive hotel and natural recreation facilities |
| XVI | Liquor Sales Growth | Increasing liquor sales and high accidental death rate |
| XVII | Social Malaise | Higher rates of welfare recipiency and illegitimacy in conjunction with low rates of referral to community mental health centers |
| XVIII | High Taxes | Higher taxes and more admissions to public geriatric facilities in other than towns of 5000-9999 |

TABLE 4.22

Summary of the Hypothesized Relationships between the Factors and Mental Disorder Rates

| Factor Number | Factor Name | Hypothesized Relationship with Disorder Rates | Reasons behind Hypotheses |
|---|---|---|---|
| I | Suburban Conditions | Positively predictive of higher rates | Higher rates in urban-like areas |
| | | | Middle classes more willing to seek psychiatric care |
| | | Most highly predictive of milder disorders | Readiness to seek psychiatric care would prevent more serious disorders developing |
| II | Climate | Higher rates in general | Decreased sunlight and more changeable weather on the coast |
| III | Decrepitude | Higher rates of brain disorders and non-schizophrenic psychoses | Susceptibility to mental disorders, particularly those mentioned, increases with age |
| IV | Concentration | Higher rates of schizophrenia, sociopathy and addiction | These disorders occur more frequently in densely populated inner city regions |
| V | Slum Conditions | High brain damage | Poor physical health |
| | | High schizophrenia | Low social class |
| | | High sociopathy | Factor indicates prevalence of antisocial behavior |
| VI | Small Town Autonomy | Lower rates overall | Rates lower in rural areas |
| | | Elevation of some unspecific rates possible | Tedium arising from restriction of the social environment |
| VII | A. A. Prevalence | Relationship with addiction and brain disorder expected but in unknown direction | Positive correlation between alcoholism and the factor could reflect higher rates in the com- |

TABLE 4.22 (contd.)

| Factor Number | Factor Name | Hypothesized Relationship with Disorder Rates | Reasons behind Hypotheses |
|---|---|---|---|
| | | | munity while negative correlations could reflect a tendency to resolve the problem within the community |
| | | Lower rates overall | Might index a general tendency to deal with mental health problems within the community |
| VIII | Wage Level | Lower rates overall | Higher wages and therefore higher socio-economic status |
| | | Relationship of unspecified direction | Greater numbers of working women may be indicative of a social difference which could lower rates by optimizing social stimulation or could raise them by providing stimulation to the point of stress |
| IX | Rural Property Value | Lower rates overall | Rates lower in rural areas<br>Moderate level of environmental stress |
| X | Opposition Voting | Lower rates overall | High scores indicate higher socio-economic status |
| XI | Rural Distribution Centers | Relationship of unspecified direction | More social complexity than in areas with dispersed distribution services |
| XII | Spoiled Ballots | Lower rates overall, particularly schizophrenia | Social isolation in low scoring areas would result in negative relationships between the factor and mental disorder rates |
| XIII | Rural School Support | Lower rates overall | Rates lower in rural areas<br>Greater community concern for good social functioning |
| XIV | Community Growth | Lower rates overall | Factor indicates positive striving for community betterment |

TABLE 4.22 (cont.)

| Factor Number | Factor Name | Hypothesized Relationship with Disorder Rates | Reasons behind Hypotheses |
|---|---|---|---|
| | | Lower rates of sociopathy | Negative factor loading on juvenile delinquency |
| XV | Tourist Trade | Relationship of unspecified direction | Social differences between these and other communities possibly influential |
| XVI | Liquor Sales Growth | Higher rates of brain disorder, addiction and sociopathy | Antisocial social environment |
| XVII | Social Malaise | Higher rates overall, particularly more severe disorders such as brain disorders and schizophrenia | Higher rates of non-hospitalized mental disorder and less tendency to seek early treatment |
| XVIII | High Taxes | Higher rates overall | More tendency to reject deviants from the community |

# SECTION III: CANONICAL REGRESSION ANALYSIS TO FIND THE ENVIRONMENTAL CORRELATES OF MENTAL HOSPITALIZATION IN BRITISH COLUMBIA

## CHAPTER 5: Preparations for the Canonical Analysis

### Collection and Presentation of the Diagnostic Data

From the set of data from Riverview Hospital which was available for the present study, the diagnostic data were tabulated for each school district and arranged into twelve categories. There were fifteen diagnostic differentiations available in the original data set, but the regrouping was necessitated by the problem of low frequencies of admission in many of the school districts and by the need to have a small enough number of categories to allow for manageable data manipulation. The loss of information resulting from regrouping was felt to be compensated for by the fact that fine discriminations between diagnostic categories are, in practice, so imprecise as to be of limited meaningfulness (Zigler and Phillips, 1961).

The total numbers of cases of each diagnosis in each school district were expressed as rates per 10,000 persons fifteen years of age or older in each school district. The fifteen and over age group was chosen to represent the population at risk of admission because, Riverview being an adult facility, admission of persons under fifteen years of age is rare. A strict per capita rate would have spuriously lowered incidence rates in school districts with larger proportions of the population under fifteen years of age.

Population figures for 1966 were those used to estimate the population at risk because these figures were the ones available closest to the period of the data collection. As 1966 was the median year for which the diagnostic data were available, the figures used were probably the best estimates of the populations of the school districts over the three year period that could have been obtained in any event.

In addition to the rates per 10,000 of the twelve diagnoses for each school district, the rate per 10,000 of normality (the total non-hospitalized population) was calculated. The purpose of this was to determine which combinations of environmental qualities would be predictive of mental health rather than mental disorder.

The twelve selected diagnostic categories can be seen in Table 5.1. As mentioned above, there were fifteen diagnostic distinctions made in the available data set, with trait and pattern personality disorders, schizo-affective disorders, and involutional psychoses formerly listed separately. The reasons for regrouping these categories have been discussed in Chapter 2.

## Modifications in Correlation Procedures

Certain considerations relating to the nature of the data had to be dealt with before the calculation of correlation matrices to enter the canonical regression analysis. Specifically, a problem relating to the influence of the base rate on the magnitude of the inter-diagnostic correlations was dealt with by the use of a cross products correlation technique. As an added benefit, singularity of the interdiagnostic correlation matrix was prevented. If the matrix had been singular, a canonical solution would have been impossible (Lee, 1969).

The interpretive advantage of the cross products technique is that the base rates of the disorders are included in its calculation, such that, in interpretation of the canonical component loadings, statements can be made about higher or lower rates as well as of more or less predictability. The initial correlation coefficients, as seen in Appendix C-1, were larger for diagnostic categories with greater numbers of cases, with the coefficients' sizes determined by both the implicit base rate and the degree of similarity in patterning of rates across school districts. A product

TABLE 5.1

Total Number of Cases in each of

the Diagnostic Categories

| | Diagnosis | Total Cases | % |
|---|---|---|---|
| 1. | Brain disorder: chronic and acute | 674 | 7.1 |
| 2. | Non-schizophrenic psychoses: manic-depressive, paranoid and involutional | 1088 | 11.5 |
| 3. | Schizophrenia: chronic undifferentiated | 902 | 9.5 |
| 4. | Schizophrenia: acute undifferentiated | 352 | 3.7 |
| 5. | Schizophrenia: paranoid | 1174 | 12.4 |
| 6. | Schizophrenia: other; simple, hebephrenic, residual, catatonic, affective | 682 | 7.2 |
| 7. | Neurosis: depressive | 1719 | 18.1 |
| 8. | Neurosis: other | 608 | 6.4 |
| 9. | Personality disorders: pattern and trait | 823 | 8.7 |
| 10. | Sociopathy | 373 | 3.9 |
| 11. | Addiction: drugs or alcohol | 762 | 8.0 |
| 12. | Transient situational disorder | 336 | 3.5 |
| | Total | 9493 | |

moment correlation would, of course, only assess the degree of similarity in patterning, with differences in base rates being irrelevant to the sizes of the coefficients.

Not all the data entering the correlational calculations were rate measures, however, and the computational formulae were revised accordingly.

The environmental variates, which were deviated measures, were correlated using the usual product moment formula, while a combined cross product-product moment technique was used to find the correlations between the diagnostic and environmental measures. The three formulae can be seen in Table 5.2.

TABLE 5.2

The Three Formulae used in Deriving the Initial Correlation Matrix

---

Let: X and Y be diagnostic measures and
A and B be environmental measures

1. Cross products formula for deriving inter-diagnostic correlations

$$r_{xy} = \frac{\Sigma XY}{\sqrt{(\Sigma X^2)\ (\Sigma Y^2)}}$$

2. Product moment formula for deriving inter-environmental correlations

$$r_{ab} = \frac{N\Sigma AB - (\Sigma A)\ (\Sigma B)}{\sqrt{\left[N\Sigma A^2-(\Sigma A)^2\right]\ \left[N\Sigma B^2-(\Sigma B)^2\right]}}$$

3. Combined cross product-product moment formula for deriving correlations between diagnostic and environmental variables

$$r_{ax} = \frac{\Sigma AX-\Sigma A\ \frac{(\Sigma X)}{N}}{\sqrt{\left[\Sigma A^2-\frac{(\Sigma A)^2}{N}\right]\ \left[(\Sigma X^2)\right]}}$$

---

The cross product correlation matrix is reported in Appendix C-1 while the cross product-product moment correlations between the diagnostic rates and the environmental variates are reported in Appendix C-2. The

correlations between the environmental variates are not reported because, as they are correlations between scores on orthogonal factors, they are uncorrelated and can be represented by an identity matrix (ones on the diagonal and zeroes on the off-diagonal). The complete correlation matrix entering the canonical analysis, then, was a super matrix containing four submatrices. In the upper left was the 13 by 13 inter-diagnostic cross products matrix, in the lower right the 18 by 18 identity matrix representing the uncorrelated environmental variates, and in the lower left and upper right the 18 by 13 and 13 by 18 cross products-product moment matrices of correlations between the diagnostic rates and environmental variates.

## Summary

Diagnostic data were tabulated and converted to rates per 10,000 for each school district. Although fifteen categories were available they were collapsed, for reasons discussed in Chapter 2, into the twelve categories reported in Table 5.1. Rates of normality were also entered into analysis.

To undergo canonical regression analysis, data must first be intercorrelated. To improve interpretability of results while preventing singularity of the interdiagnostic correlation matrix, a cross-products correlation technique was used. It then became possible to intepret the canonical component loadings in terms of higher and lower rates as well as of more and less predictability. Product moment correlations were appropriate between the environmental variates but, as they were computed on uncorrelated factor scores, the inter-environmental matrix was an identity matrix. To obtain the correlations between the diagnostic and environmental variates a combined cross products-product moment technique was used.

# CHAPTER 6: The Canonical Analysis

## Derivation of the Population Parameters from Canonical Regression Analysis

Having obtained the correlation matrices discussed in the previous chapter, the canonical analysis was undertaken. It will be recalled that the total correlation matrix was actually a super matrix consisting, in the upper left of a matrix of cross product correlations between rates of hospitalization for the twelve disorders and normality all expressed as per 10,000 rates; in the lower right if an identity matrix representing the product moment correlations between the factor scores; and in the lower left and upper right of cross product-product moment correlations between the diagnostic rates and the factor scores. As there were 13 diagnostic measures and 18 factor scores, the whole super-matrix was 31 by 31 in dimensions.

Canonical correlations and regression weights were found using a program from the University of Alberta program library. This program was especially suited to the present problem because it employed a Jacobi solution to solve for eigenvalues. The simultaneous method of the Jacobi solution was preferable to a sequential solution which lead, when tried, to improper ranking of the canonical roots. This happened when the sequential solution was used because the larger correlation coefficients obtained using the cross products technique caused the eigenvalues of the inter-diagnostic matrix to be highly correlated before extraction.

Correlations of the variables with the canonical variates were then computed in the manner advocated by Meredith (1964) and Stewart and Love (1968), these to be interpreted as component or factor loadings, known in the case of canonical analysis as canonical component loadings. As a final step, the amounts of redundant or predicted variance of each of the

diagnostic and environmental sets, given the other, were calculated as suggested by Stewart and Love (1968). The amount of redundant variance attributable to each component was also found and expressed as a percentage of the total redundant variance in its set. In this way it was possible to assess the relative importance of each canonical component, useful in deciding how many should be retained for interpretation.

A more complete discussion of the background and rationale for computing canonical component loadings and redundancies can be found in Chapter 2.

## Presentation and Discussion of Canonical Relationships between Environmental Variates and Diagnostic Rates

### General Interpretive Considerations

As indicated in Chapter 2, interpretation of canonical regression requires consideration of (a) the strength of the canonical correlation coefficients, (b) the redundancy or predictability of each set given the other, (c) the percentage of each set's redundancy contributed by each of its canonical components, and (d) the structure of the canonical components. Ordinarily, levels of statistical significance would also require consideration, but the use of the entire population in the present study rendered such considerations irrelevant.

It may be profitable to approach the problem of canonical interpretation by first considering what results there would be if there were extreme degrees of relationship between the two sets of measures. No relationship between the sets would be most obvious in the case in which the canonical correlations were all near zero. Less obvious would be the case in which the redundancies were extremely low or zero. The canonical correlations then would be uninteresting because they would be indexing consistency of

negligible amounts of variance. At the other extreme, while strong canonical correlations are always desirable, very high redundancies may or may not be, depending on the problem. High redundancies would be desired, for example, if measures of job performance were being related to scores on relevant selection tests. In the present study, having very high redundancies was not considered important because, as the body of epidemiological evidence shows, characteristics of individuals are also important in the determination of mental hospital admission. Thus, just as with personal or demographic qualities of persons, aspects of the persons' environments would only be expected to account for a limited portion of the variance in predicting mental disorder.

The complete set of results can be seen in Appendix C-3, while the results to be interpreted are presented in Table 6.1. It can be seen that there is a moderate degree of predictability of the two sets of data i.e. 15.17% of the variance in the diagnostic set is predictable from the environmental variates, and 20.05% of the variance in the environmental set is predictable from the diagnostic set. These percentages may appear unremarkable at first glance, but when the unique combinations of personal experiences that culminate in each mental hospital admission are considered, it is surprising to find even this amount of predictability from qualities of the extra-personal and extra-familial environment. These degrees of predictability between the sets as wholes are of even more interest in light of the relatively strong canonical correlations. It will be noted that only canonical correlations exceeding .50 were reported.

Moving next to the pairs of canonical components, interpretation centers around component loadings, the size of the canonical correlation and the percentage of redundancy accounted for. The canonical correlation describes

TABLE 6.1

Correlations of Variables on Diagnostic and Environmental Canonical Variates

(Canonical correlations of .50 or greater and canonical component loadings of .25 or greater reported)

| Diagnosis | Component Pair 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total Redundant Variance |
|---|---|---|---|---|---|---|---|---|
| 1. Brain Disorder | | | | .30 | | .41 | | |
| 2. Non-schizophrenic psychosis | .25 | | .31 | | | | | |
| 3. Schizophrenia: chronic undifferentiated | | | | | -.36 | .31 | | |
| 4. Schizophrenia: acute | .34 | | | | .29 | .31 | | |
| 5. Schizophrenia: paranoid | | | | | | .36 | | |
| 6. Schizophrenia: other | .35 | | | .48 | | | | |
| 7. Neurosis: depressive | .38 | | | | | | | |
| 8. Neurosis: other | .49 | .46 | | | | .25 | | |
| 9. Personality disorder | .30 | | | | | | .28 | |
| 10. Sociopathy | | .27 | .35 | | | | | |
| 11. Addiction | .34 | | | | | | .25 | |
| 12. Transient situational disorder | | | .39 | | | -.25 | | |
| 13. Normal | | | | | | | | |
| Contribution to the redundant variance | .0506 | .0184 | .0199 | .0162 | .0117 | .0162 | .0073 | .1517 |
| % contribution to the redundant variance | 33.35 | 12.13 | 13.12 | 10.68 | 7.71 | 10.68 | 4.81 | |

TABLE 6.1 (Cont.)

| Environment | Component Pair 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total Redundant Variance |
|---|---|---|---|---|---|---|---|---|
| 1. Suburban Conditions | .44 | | | | | | | |
| 2. Climate | .45 | | .28 | | | | | |
| 3. Decrepitude | | | | | | -.42 | | |
| 4. Concentration | | | | .34 | | | | |
| 5. Slum Conditions | | .37 | -.26 | .32 | .28 | .31 | | |
| 6. Small Town Autonomy | | | | | .54 | .30 | | |
| 7. A. A. Prevalence | -.47 | | .27 | | | | -.48 | |
| 8. Wage Level | | | | | | | | |
| 9. Rural Property Value | -.32 | | -.34 | | | -.25 | .38 | |
| 10. Opposition Voting | | | | | | -.40 | .30 | |
| 11. Rural Distribution Centers | | | | | | | | |
| 12. Spoiled Ballots | | .54 | | .57 | | -.35 | | |
| 13. Rural School Support | | | .46 | | .53 | | | |
| 14. Community Growth | | -.34 | -.43 | .26 | | | -.51 | |
| 15. Tourist Trade | | | | | | | .39 | |
| 16. Liquor Sales Growth | | .32 | | -.29 | | | | |
| 17. Social Malaise | | | .29 | .26 | -.35 | | | |
| 18. High Taxes | -.26 | | .28 | .32 | | | | |
| Contribution to the redundant variance | .0374 | .0295 | .0287 | .0256 | .0210 | .0162 | .0148 | .2005 |
| % contribution to the redundant variance | 18.65 | 14.71 | 14.31 | 12.77 | 10.47 | 8.08 | 7.38 | |
| Canonical correlations | .82 | .75 | .72 | .68 | .62 | .54 | .52 | |

the consistency of the relationship between each pair of canonical variates while the contribution to the redundancy describes the relationship of each canonical variate to the set from which it was derived. The patterns of component loadings (to be discussed later in this chapter) are straightforwardly descriptive of the interrelationships of the variables. In line with the suggestion of Stewart and Love (1968), the respective contributions to the redundancies were used chiefly in deciding whether a canonical component deserved interpretation and further attention.

Correspondence between the Hypothesized and Actual Predictive Properties of the Environmental Variates

In order to clarify the interpretation of the pairs of canonical components the environmental variates were first considered in terms of their actual behavior in the canonical analysis and that hypothesized in Chapter 4. At this stage of the interpretation, attention was directed to the rows of Table 6.1. Only very general statements could be made on this basis, as the component loading of each environmental variate on each canonical component is part of a linear composite which could be greatly changed if that variate were removed and considered out of context. Similarly, the correlation of each environmental variate with each of the diagnostic variables, or the multiple regression of all the diagnostic variables on each of the environmental variates would yield different results to those of a canonical regression analysis.

The best predictor of all, in terms of the number of components on which it loaded, was Slum Conditions. And, on three of the five components, it did, as expected, constitute part of a composite which accompanied higher diagnostic rates. With four loadings each, Community Growth and Rural Property Value also contributed well to the prediction and description of

relationships. In general they were negatively loaded on components predictive of higher rates, as expected. Another variate of almost equal efficacy to these was Spoiled Ballots. Although it only loaded on three components, two of its loadings were among the highest in the analysis. However, these high loadings, contrary to hypothesis, contributed to the prediction of elevated rates. Other relatively good predictors were A. A. Prevalence, Social Malaise, and High Taxes, with three component loadings each.

The poorest predictors were Wage Level and Rural Distribution Centers, neither of which loaded on any components at all. Although this was contrary to hypothesis, the almost equally poor predictive power of Concentration was not. The similarly weak contributions of Tourist Trade to a composite predictive of only slightly elevated rates and of Decrepitude, negatively, to one predictive of higher rates, were both contrary to hypothesis in addition to indicating limited utility of these variates as predictors.

On the other hand, even the environmental variates which loaded only once each were nevertheless useful from a simply descriptive point of view. This was particularly evident for Suburban Conditions. Its single loading identified the first environmental component as referencing suburban areas. At the same time, the fact that the linear composite to which it contributed was related to one third of the redundant variance in the diagnostic set suggested that it had only one loading because all the relevant diagnostic covariance had been accounted for, and not because it was superfluous. In this manner, Suburban Conditions and the other variates with only one or two loadings could be seen to be functioning, like marker variables in factor analysis, as aids to interpretation.

On the whole, the behavior of the environmental variates in the canonical analysis was in general agreement with the hypotheses suggested in Chapter 4. Two notable exceptions were Wage Level and Rural Distribution Centers which, with no loadings at all, were irrelevant in the present analysis.

The Predictability of the Diagnostic Categories

The interpretation of raised or lowered rates was based on the direction and size of the component loadings in Table 6.1 and on the number of cases originally falling in each diagnostic category. For example, it can be seen in Table 5.1 that neurotic depression, with 1719 cases, was the most frequently occurring diagnosis. This means that rates in all districts tended to be higher on this diagnosis than, say, acute schizophrenia with only 352 cases overall. Thus, on the first component pair, while the loadings on acute schizophrenia and neurotic depression, being of similar magnitude, indicate similar proportional excesses of cases, the actual number of cases accounted for by each is a function of the original number of cases in each category.

If all incidents of mental hospitalization were due to chance i.e. if there were constant base rates in all situations, no correlations would be found between different environments and rates of certain mental disorders. Faris and Dunham (1960), for example, would have found all mental disorders to be distributed in equal proportions throughout Chicago. The present set of results, in line with previous epidemiological findings, indicates that deviations from base rates occur in such consistent manners as to be predictable from certain environmental qualities.

The total redundancy for the diagnostic set indicated that diagnoses were not as predictable from environmental qualities as vice versa. In addition, the loadings were generally lower and no diagnostic variable

loaded on more than three components (four and five component loadings for some variates were seen in the environmental set).

Random distribution of a diagnostic rate would have been indicated by a failure to load on any of the environmental components. As shown in Table 5.2, this occurred only for the rate of normality, indicating that its rate was, in effect, unrelated to any particular environments. Such a failure to discriminate differences among school districts was probably a result of there being very large values in the denominators of the two cross product correlation formulae (see Table 5.2). Among the diagnostic rates proper, depressive neurosis and paranoid schizophrenia each had only one component loading, indicating that their rates were unpredictable under most conditions.

Only two diagnostic categories, miscellaneous neurosis and acute schizophrenia loaded on as many as three canonical components. This greater variability in loadings indicates a systematic variability in rates of hospitalization across environments for disorders which were given these diagnoses. The implication, then, is that the environment of origin had more of an influence on the diagnosed rates of these disorders either through influencing the rate of disorder and type of symptom formation or through somehow shaping behavior in such a way as to influence the judgement of the attending physician at the time of admission.

It can be seen in Table 6.1 that neurosis:other was the most discriminable category, with two of its loadings at .49 and .46. Schizophrenia: other had a loading of .48 on one of its two components and brain disorder had one of its two loadings at .41. The rest of the categories were less clearly marked, with reported loadings ranging between .25 and .39.

## Interpretation of the Pairs of Canonical Components

First Canonical Component Pair. The fact that over one third of the predicted variance in the diagnostic set was predicted in the first pair of canonical components, indicates that, given the indexed environmental description, a large percentage of all the predictable variability in diagnostic rates was explained. On the whole, the diagnostic categories predicted appear to be those that would be expected from the predominantly middle class areas indexed by the environmental component. The loadings on Suburban Conditions and Climate mark the relevant areas as being the populous suburban school districts close to both Vancouver and Riverview Hospital.

Except for the two schizophrenic categories, the indexed diagnostic categories are generally those in which less severe personality disorganization and less tendency to act out conflicts are found. It can probably be assumed that the absence of manifest behavior along these lines led to the observed distribution of diagnostic differentials in the suburban areas. However, it is possible that, as hypothesized in Chapter 4, the residents of these areas, being more willing to seek psychiatric care, were better able to keep the development of more dramatic symptoms under control. Their proximity to the hospital would be expected to increase this willingness for early treatment.

The two schizophrenic categories loading on this factor are only slightly contradictory to the general trend for less debilitating disorders to occur under the described circumstances. As can be seen in Table 5.1, acute schizophrenia accounted for only 3.7% of the total cases and schizophrenia:other for 7.2%. These percentages, except for neurosis:other, are lower than for any of the other categories loading on this component and

TABLE 6.2

Canonical Relationships between the

First Pair of Canonical Components

| Diagnostic set | | | Environmental set | | |
|---|---|---|---|---|---|
| 8. | Neurosis:other | .49 | 7. | A. A. Prevalence | -.47 |
| 7. | Neurosis:depressive | .38 | 2. | Climate | .45 |
| 6. | Schizophrenia:other | .35 | 1. | Suburban Conditions | .44 |
| 4. | Schizophrenia:acute | .34 | 9. | Rural Property Value | -.32 |
| 11. | Addiction | .34 | 18. | High Taxes | -.26 |
| 9 | Personality disorder | .30 | | | |
| 2. | Non-schizophrenic psychosis | .25 | | | |
| % contribution to redundancy | | 33.35% | | | 18.65% |
| Canonical correlation | | .82 | | | |

indicate that a comparatively small number of actual cases of hospitalization were explained by their loadings. The cases diagnosed as acute schizophrenia may even merit consideration among the less severe disorders as it is usually characterized by good pre-morbid adjustment, short duration, and good prognosis.

The environment component, as mentioned above, was identified as relating to the suburbs of Vancouver on the basis of its loadings on Suburban Conditions and Climate. The negative loading on Rural Property Value may relate to the fact that there was generally no rural property in the relevant school districts, while the weaker negative loading on High Taxes could be related to any or all of the variables originally describing that factor (see Table 4.20(a).

The fact that the strongest loading on this component was a negative one on A. A. Prevalence is somewhat difficult to explain. It is probably not legitimate to say that there is less A. A. in the described school districts because, even though the per capita rates are lower, the resi-

dents of the areas have a greater number of A. A. groups in nearby school districts to visit, and thus effectively have more A.A. available to them than in other regions of the province. It does not appear justified therefore to claim, as hypothesized, that either the lower per capita A. A. membership is directly related to the higher rate of hospitalization for addiction or that lower A. A. rates reflect a more general lack of concern with informal care for mental disturbance in the community.

However, if the component pair is reflected a different and interesting pattern of interrelationships can be seen. Reference to Table 4.3(b) reveals that the school districts scoring strongly on the reflection of Suburban Conditions are more recently established rural areas with a high percentage of their populations in hamlets and little or none of it in larger towns. The component loading on Climate identifies these areas as in the interior, the loading on Rural Property Value indicates a fairly well dispersed population throughout the districts, and High Taxes may reflect greater need for revenue to develop these relatively new areas. Within such an environmental context, high rates of A. A. membership are found, and the complete environment described, of course, is strongly predictive of lower rates of seven of the twelve diagnoses.

High A. A. membership in these rural areas is, in contrast to the low membership in the suburban areas, straightforwardly interpretable. It would appear that when it is in combination with the other environmental variates represented here, A. A. membership can be predictive of low rates of mental hospitalization for disorders diagnosed as among the less debilitating.

The fact that both the suburban areas and the rural areas described by this component pair and its reflection are independent of the five non-

loading diagnostic variables means that they both contribute unpredictably high and low (probably average overall) numbers of cases of these five disorders. Thus it appears that the suburban areas may keep their hospitalizations for more severe disorders down by obtaining early treatment, while the described rural areas may keep their severe disorder rates down by coping with the disorder in its early stages within the community.

Second Canonical Component Pair. The second diagnostic component accounts for approximately one third the amount of variance that the first did, and has its loadings on two of the smallest diagnostic categories (see Table 5.1). The canonical correlation of .75 indicates that the excess of neurosis:other and less consistently pronounced excess of sociopathy represent a consistent relationship even though relatively small numbers of persons are involved. On the whole, some excess of emotional distress, symptom formation, and acting-out behavior in otherwise rational oriented persons is suggested.

The interpretation of the environmental component was complicated only by the loading on Spoiled Ballots, a factor which had presented problems for interpretation in Chapter 4. However, the overall picture of poor health and social disorder (Slum Conditions), low school attendance and possibly greater ignorance (Slum Conditions and Spoiled Ballots), greater and growing liquor consumption and high rates of violent and sudden death (Spoiled Ballots and Liquor Sales Growth), and less community growth or development of recreational facilities within the community (Community Growth) indicates that Spoiled Ballots interacts with the other three variates as an index of social disorder.

On the whole, the environmental component appears to describe social conditions very like those Leighton et. al. (1963) referred to in the

TABLE 6.3

Canonical Relationships between the

Second Pair of Canonical Components

| Diagnostic set | | Environmental set | |
|---|---|---|---|
| 8. Neurosis:other | .46 | 12. Spoiled Ballots | .54 |
| 10. Sociopathy | .27 | 5. Slum Conditions | .37 |
| | | 14. Community Growth | -.34 |
| | | 16. Liquor Sales Growth | .32 |
| % contribution to redundancy | 12.13% | | 14.71% |
| Canonical correlation | .75 | | |

Stirling County study under the heading of "sociocultural disintegration". The diagnostic loadings are directly in agreement with the mental disorder rates Leighton et. al. found in conducting a sample survey in communities selected as showing sociocultural disintegration. This close replication of the Stirling County results is particularly remarkable on two counts. First, strong agreement between actual disorder rates in the general population and in those of the population that were hospitalized are shown to exist. Second, it has been possible, in the present study, to obtain similar results to those of Leighton et. al. simply through data analysis rather than through the complicated procedure of selecting communities and sampling and interviewing persons.

A consideration of the reflection of this component pair indicates low rates of mixed neurosis and sociopathy to occur in rural areas with poor transportation (Spoiled Ballots) where physical and social health are sound (Slum Conditions, Community Growth, Liquor Sales Growth) and the organized towns are growing (Community Growth).

Third Canonical Component Pair. The third environmental component is

marked by its highest loading as descriptive of rural areas, while a moderate loading on Climate indicates a tendency for these areas to be near the coast.

TABLE 6.4

Canonical Relationships between the

Third Pair of Canonical Components

| Diagnostic set | | | Environmental set | | |
|---|---|---|---|---|---|
| 12. | Transient situational disorder | .39 | 13. | Rural School Support | .46 |
| | | | 14. | Community Growth | -.43 |
| 10. | Sociopathy | .35 | 9. | Rural Property Value | -.34 |
| 2. | Non-schizophrenic psychoses | .31 | 17. | Social Malaise | .29 |
| | | | 2. | Climate | .28 |
| | | | 18. | High Taxes | -.28 |
| | | | 7. | A. A. Prevalence | .27 |
| | | | 5. | Slum Conditions | -.26 |
| % contribution to redundancy | | 13.12% | | | 14.31% |
| Canonical correlation | | .72 | | | |

This component pair is similar to the previous one in two respects. First, on the diagnostic component, the loading categories indicate excessive admissions of persons who are basically rational and oriented without apparent personality disintegration. A second similarity is found in the fact that the relationships of each component to its set of origin and the correlations between both pairs of components are almost identical, indicating that they are of equal importance in explaining the variance within and between the two sets. This would indicate, then, that the relationships found by Leighton et. al. (1963) and replicated in the second component pair only represent one important set of environment-mental disorder interrelationships.

Transient situational disorder, sociopathy, and manic depressive psycho-

sis, which comprised the majority of the non-schizophrenic psychoses, could perhaps all be viewed as responses to unusual levels of frustration, responses in lieu of the overt expression of anger. In the cases of transient situational disorder and sociopathy it could be interpreted that an outwardly manifested mode of expressing hostility was selected, while with the mainly manic-depressive disorders hostility was directed inwardly and made manifest in affective disorder. Such internalization of hostility has been implicated in other disorders, particularly schizophrenia, but with manic-depressive psychosis as with the other disorders loading on this component, personality and reality orientation tend to remain relatively intact.

The environmental component, as mentioned above, related to rural areas which tend to have milder climates. Within these areas there are some apparently contradictory trends to be seen. The most evident involves the positive loading on Rural School Support and to a lesser extent on A. A. Prevalence, together suggesting a concern within the community for stable social functioning, in contrast to the strong negative loading on Community Growth and a less strong positive loading on Social Malaise which suggest the opposite. Similarly, if it can be inferred that High Taxes, with its factor loading on geriatric admissions, is related to a lack of community concern for the deviant and disabled, and that A. A. Prevalence indexes informal community concern at least with alcoholism and maybe with other disturbances, the fact that both have loaded positively constitutes an apparent contradiction. However, the loadings are small and may not index an important relationship.

High taxes might, alternatively, be better explained with reference to its factor loading on the higher taxation rate, and when this is considered

in view of the negative loading on Slum Conditions, it can be seen that the described areas are likely more prosperous. The low rural property values, when considered with the mild climate, would appear to designate coastal school districts in which habitation of the entire district has been unfeasible because of the mountainous terrain and thick forests. However, the fact that Small Town Autonomy has not loaded on this component pair indicates that these districts are not isolated from each other or the lower mainland area.

On the whole, the description here appears to be of a working class small town environment. Small town may be a better term than rural because the low rural property value indicates a lack of developed area outside the towns. A low concern for developing recreational facilities for children (Community Growth) and high rates of illegitimacy, welfare recipiency and low rates of admission to community mental health services (Social Malaise) suggest lower overall social status, while the negative relationship with Slum Conditions and high rates of School and General taxation suggest a fairly high income level.

The reflection of this component pair similarly contains some contradictions. Thus lower than average rates of situational disorder, sociopathy and non-schizophrenic psychoses are predicted, in general accordance with the hypotheses in Chapter 4, by high Community Growth, high Rural Property Value, low Social Malaise, more severe climate, and low taxes (and thus lower geriatric admissions). However, low Rural School Support, high Slum Conditions, and to a lesser extent, low A. A. Prevalence appear inconsistent with lowered hospitalization rates.

Fourth Canonical Component Pair. On this component pair, it appears that the coincidence of poverty and economic well-being within the same

school districts is being described. The loadings of Spoiled Ballots and Slum Conditions on the present component pair are very similar to their loadings on the environmental component in the second pair. In this case a complementary loading on Social Malaise is also found and all together they index a general state of poverty, poor health, and social disorder. On the other hand, relationships between high Community Growth and low Liquor Sales Growth in interaction with high Concentration and high taxes indicates the presence of socially healthy commercial centers in the school districts as well.

TABLE 6.5

Canonical Relationships between the

Fourth Pair of Canonical Components

| Diagnostic set | | Environmental set | |
|---|---|---|---|
| 6. Schizophrenia:other | .48 | 12. Spoiled Ballots | .57 |
| 1. Brain disorder | .30 | 4. Concentration | .34 |
| | | 18. High Taxes | .32 |
| | | 5. Slum Conditions | .32 |
| | | 16. Liquor Sales Growth | -.29 |
| | | 17. Social Malaise | .26 |
| | | 14. Community Growth | .26 |
| % contribution to redundancy | 10.68% | | 12.77% |
| Canonical correlation | .68 | | |

How the excesses of hospitalizations for the miscellaneous schizophrenias and the brain disorders would relate to the relative extremes of economic status in these school districts is not clear. It might be that the impoverished segments of the population contribute both types of disorders or it may be that both tend to stay in the cities near medical and welfare facilities. However, an excess of chronic undifferentiated schizo-

phrenia would add credence to the latter possibility.

A consideration of the interrelationships when this component pair is reflected sheds no further light on its relatively straightforward interpretation.

Fifth Canonical Component Pair. Unlike the other diagnostic components, the fifth indexes a case in which lower than usual overall rates are found. Reference to Table 5.1 shows that chronic undifferentiated schizophrenia constituted 9.5% of the total hospitalizations while acute schizophrenia accounted for only 3.7%. The larger loading on chronic undifferentiated schizophrenia indicates that it accounts for proportionately as well as numerically more cases and, having a negative loading, takes the overall admission rate down farther than the slight excess of acute schizophrenia raises it.

TABLE 6.6

Canonical Relationships between the

Fifth Pair of Canonical Components

| Diagnostic set | | Environmental set | |
|---|---|---|---|
| 3. Schizophrenia:chronic undifferentiated | -.36 | 6. Small Town Autonomy | .54 |
| | | 13. Rural School Support | .53 |
| 4. Schizophrenia:acute | .29 | 17. Social Malaise | -.35 |
| | | 5. Slum Conditions | .28 |
| % contribution to redundancy | 7.71% | | 10.47% |
| Canonical correlation | .62 | | |

The environmental component describes an interesting coincidence of conditions in areas, as indexed by the loading on Small Town Autonomy, in which the main town is geographically isolated. If Rural School Support can be assumed to index a concern for sound social functioning, the ob-

served relationship with lower rates in general makes sense as does the relationship of both of them to a negative loading on Social Malaise. However, the loading on Slum Conditions, while not strong, appears to contradict these relationships. It may be that this slight loading is due to there being more Indians in the relevant areas.

It is not possible, of course, to say whether the observed interrelationships between the two schizophrenic disorders and the environmental variates really indicate higher and lower levels of these disorders in the population as a whole. It is possible that chronic schizophrenia is tolerated in these communities while the more dramatic manifestations of acute schizophrenia are not. However, if greater tolerance of chronic schizophrenia existed, it might be expected that negative correlations with other disorders would also be found. An alternative explanation might be that these communities are more intolerant than usual of mental disorder with the result that the chronic undifferentiated schizophrenics are not likely to return to their community of origin between readmissions.

Sixth Canonical Component Pair. The relationships observed here, generally indicative of higher rates of the more severe disorders in isolated rural areas, forms an interesting complement to the first component pair which, it will be recalled, indexed essentially the opposite relationship. However, the appreciably lower canonical correlation in this case indicates a much less consistent relationship to be present.

The interpretation of the diagnostic component as indexing relative excesses of more severe disorders is reinforced by the two strongest loadings being on brain disorder and paranoid schizophrenia. As noted earlier (page 124), despite the high overall rates of paranoid schizophrenic hospitalizations, this is the only case in which the rates were predictably higher. The higher hospitalization rates for acute and chronic

TABLE 6.7

Canonical Relationships between the

Sixth Pair of Canonical Components

| Diagnostic set | | | Environmental set | | |
|---|---|---|---|---|---|
| 1. | Brain Disorder | .41 | 3. | Decrepitude | -.43 |
| 5. | Schizophrenia:paranoid | .36 | 10. | Opposition Voting | -.40 |
| 4. | Schizophrenia:acute | .31 | 12. | Spoiled Ballots | -.35 |
| 3. | Schizophrenia:chronic undifferentiated | .31 | 5. | Slum Conditions | .31 |
| | | | 6. | Small Town Autonomy | .31 |
| 8. | Neurosis:other | .25 | 9. | Rural Property Value | -.25 |
| 12. | Transient situational disorder | -.25 | | | |
| % contribution to redundancy | | 10.68% | | | 8.08% |
| Canonical correlation | | .54 | | | |

undifferentiated as well as paranoid schizophrenia suggest two main possibilities. First, it might be that the environments described here are stressful and produce and maintain more cases of schizophrenia or, as a second possibility, it may be that there is selective migration of persons predisposed to schizophrenia in the relevant areas. As the interpretation of the environmental component will show, the latter probably constitutes the more feasible interpretation.

The overall diagnostic distribution appears similar to those found both in urban slum regions (eg. Klee et. al., 1967; Bloom, 1968) and in socially disintegrated rural communities (Leighton et. al., 1963). Specifically, the studies of Klee et. al. and Bloom showed higher rates of brain disorder and schizophrenia in areas high in poverty and social disorganization. On the other hand, as mentioned earlier, Leighton et. al. found neurosis and sociopathy to occur more frequently in rural communities showing similar impoverishment and social disorganization.

Although it might be expected that regions in which excesses of the more severe mental disorders occur would show clear signs of social disorder and poverty, such is not the case on this component pair. Basically, the relevant areas appear to be isolated with an unusual predominance of youth and in-migration.

Reference to Table 4.5 (a) and a consideration of the reflection of Decrepitude indicates a pioneer-like type of setting marked by a youthful population and high population growth through both births and migration. Similar high rates of fertility and population growth in general loaded on Slum Conditions in Table 4.7(a). The predominance of younger people may partly account for the greater tendency to vote N.D.P.

The main geographic aspects of the environment are poor highway transportation (Spoiled Ballots), isolation from other school districts and the lower mainland (Spoiled Ballots and Small Town Autonomy) and centralization of the population (Small Town Autonomy and Rural Property Value). Although the high rate of brain disorder would be expected to be associated with poor health and related social disorder, the relationship between Slum Conditions and Spoiled Ballots, which load in opposite directions on this component, may serve to cancel out, as it were, signs of social disorder.

There are only two apparent inferences based on the environmental description that could be used to explain the high rates of severe disorders found. It could be suggested, first, that the geographic isolation of the districts makes it impractical for persons to seek psychiatric care until very dramatic symptoms have developed. However, the relative isolation seen in the fifth component pair actually predicted lower overall rates than average. A second possibility

is that the geographic and social isolation in these areas contributed to the development of psychopathologies. This, however, does not explain why rates are not higher for all disorders rather than just the more severe ones.

As mentioned earlier, it appears most reasonable to attribute the higher rates of these disorders to selective in-migration. Such an interpretation is supported largely by the high rates of population growth indexed by both the reflection of Decrepitude and by Slum Conditions. Furthermore, earlier research by Malzberg and Lee (1956) indicated similar trends in rates of schizophrenia and brain disorders, finding these to be most prevalent in persons who had migrated to New York within five years of the period for which hospital admission data were collected. Given the isolated nature of the areas under discussion, it does not appear unreasonable to infer that persons who are unable to adjust comfortably to life in more conventional communities might be both predisposed to the indexed disorders and likely to migrate to isolated rural areas.

If the component pair is reflected, an environment can be seen which is mainly characterized by many elderly people (Decrepitude), higher Liberal voting (Opposition Voting), low Slum Conditions and higher Rural Property Values as predictive of unusually low rates of the more severe disorders discussed above.

Seventh Canonical Component Pair. Only slight predictability, in view of the small loadings of the two diagnostic categories, personality disorder and addiction, was seen on this component pair. In addition, the canonical correlation of .52 indicates that the relationship between the diagnostic and environmental components is of only moderate consistency.

TABLE 6.8

Canonical Relationships between the

Seventh Pair of Canonical Components

| Diagnostic set | | | Environmental set | | |
|---|---|---|---|---|---|
| 9. | Personality Disorder | .28 | 14. | Community Growth | -.51 |
| 11. | Addiction | .25 | 7. | A. A. Prevalence | -.48 |
| | | | 15. | Tourist Trade | .39 |
| | | | 9. | Rural Property Value | .38 |
| | | | 10. | Opposition Voting | .30 |
| % contribution to redundancy | | 4.81% | | | 7.38% |
| Canonical correlation | | .52 | | | |

The described environments are most strongly characterized by low Community Growth and low A. A. Prevalence. Thus, as on the second and third component pairs, Community Growth is negatively related to higher rates of hospitalization and A. A. Prevalence is, as on the first component pair, negatively predictive of hospitalizations for addiction and personality disorder.

The loadings on Tourist Trade and Rural Property Value indicate that the relevant areas are probably comparatively attractive rural areas in that they have many visitors and a relatively dense rural population. The positive loading on the Opposition Voting variate indicates that the regions may be mainly of middle class composition.

The low rate of Community Growth may be a result of growth in the rural areas surrounding the small towns rather than in the towns themselves. In addition, there may be less parks and playgrounds (Community Growth) because there are natural recreational facilities available (Tourist Trade) which eliminate the need to specially construct recreation areas.

If this component pair is reflected, a set of interrelationships is found somewhat reminiscent of those seen on the reflection of the first component pair. On this seventh pair, rural conditions are again being indexed (see high factor scores for Community Growth and A. A. Prevalence) while the negative loading on Rural Property Value in this case suggests that whereas the areas mainly contain small towns, they are larger than 4999 population rather than that size, smaller, or hamlets as on the first component pair.

The vigorous growth in the indexed areas is presumably independent of the areas' physical attractiveness, with Tourist Trade negatively related, and if it can be assumed that the growth involves some in-migration, it is interesting to see, as on the sixth component pair, N.D.P. voting again associated with migration.

The diagnostic rates in the reflected communities are, of course, unpredictable except for personality disorder and addiction which are lower. The fact that A. A. Prevalence can predict lowered rates of these disorders, as it did for these and other less severe disorders on the first component pair, provides further evidence that this type of informal facility may be useful in controlling hospitalization rates at least for alcoholism.

## Summary

The super matrix of intercorrelations was solved to find canonical correlations and regression weights. The weights were then used to compute canonical component loadings, and from the loadings, measures of redundancy for each set and each component were found.

Interpretation proceeded with four basic considerations in mind: (a) the strenght of canonical correlations (b) the sizes of the redundant variances (c) the percentage contribution of each component to

its set's redundancy (d) the structure of the canonical components. Moderate degrees of redundancy were found and results with canonical correlations of .50 or greater were retained for interpretation.

The performances of the environmental variates were briefly compared to the performances that had been hypothesized for them in Chapter 4. Slum Conditions, Rural Property Value, Community Growth and Spoiled Ballots were found to be the best predictors while Wage Level and Rural Distribution Centers, which did not load on any of the components, were the worst predictors.

A brief consideration of the diagnostic set indicated that the set as a whole was less predictable than the environmental set. Depressive neurosis and paranoid schizophrenia, with only one loading each, had the most similar distributions, and thus the least differential predictability across environments, while neurosis:other and acute schizophrenia showed wider variation in rates by loading on three components each.

Turning then to a detailed consideration of the relationships for each pair of canonical components, it was found in the first pair that one third of the variance in the diagnostic set was explained in the diagnostic component of the pair. This variance was found mainly in diagnostic categories indicating less severe personal disorganization and was predictable from a set of qualities descriptive of the suburban school districts surrounding Vancouver. On the second pair, conditions of poverty and social disorder were predictive only of neurosis:other and, to a lesser extent, sociopathy. Higher rates of transient situational disorder, sociopathy and non-schizophrenic psychoses were predicted, on the third pair, from a working-class small town environment with mild climatic conditions. Discrepancies between

poverty and economic well-being within the same school district predicted schizophrenia:other and brain disorder in the fourth component pair, while in the fifth pair isolated small towns were indicated to be predictive of higher rates of acute schizophrenia but of even lower rates of chronic undifferentiated schizophrenia. Generally more severe disorders were associated, on the sixth component pair, with isolated rural areas where youth and in-migration were noteably prevalent. On the seventh and final pair, slight predictability of personality disorder and addiction was associated with rural tourist areas.

Interpretation included a consideration of the reflections of the components. This was of interest because, except for one case, the canonical components were reported in the direction indicative of higher rates. Thus, after reflection, the interrelationships predictive of lowered rates could be scrutinized.

## SECTION IV: AN OVERVIEW

## CHAPTER 7: Concluding Discussion

The discussion of the results of the present study centers around a consideration of their differences and similarities with those of previous ecological studies of mental disorder. The task of comparison is complicated by the fact that this was the first ecological study to use canonical regression analysis or factor scores as predictors.

Bloom (1968) represented an earlier attempt to use composite predictors, with the use of cluster scores. Similarly, Kendall (1963) derived composites based on factor structures to use as predictors in a study of job satisfaction, but both his and Bloom's predictors were correlated. The predictors in the present study were not only uncorrelated, but they were also greater in number than in these previous studies. Thus, the predictors, being composites rather than single variables, and being composites dissimilar to those previously used, did not provide ready comparability.

Another difference resided in the fact that the type of geographical unit used in this study was dissimilar to those used in most ecological studies of mental disorder. The economic sub-regions of Texas used by Jaco (1960) were similar in composition to the school districts of the present study, but Jaco concentrated on a restricted number of single variables, in contrast to the consideration of eighteen environmental composites in the present study.

The use of canonical regression analysis was consistent with a growing trend towards the use of correlational methods in human ecology and epidemiology. However, the fact that it represented the first actual use of canonical regression in epidemiology com-

plicated its comparison to previous studies. Some earlier related studies used such quantitative techniques as chi-square (Hollingshead and Redlich, 1958; Klee et. al, 1967), percentages (Leighton et. al., 1963), quartiles and product moment correlations (Jaco, 1960; Bloom, 1968) and multiple regression (Struening and Lehmann, 1969).

The ensuing discussion proceeds with a general consideration of the findings of this study in relation to the relevant literature. Following this are some comments on methodology and some suggestions for future research on the environmental correlates and determinants of mental disorder in British Columbia.

## The Correlates of Mental Hospital Admission

### Rural-Urban Differences

One of the more clearly replicated findings in this study was the higher rates in urban than rural areas (see the reviews by Rose and Stub, 1955; Buss, 1966 and Suinn, 1970; and the studies by Jaco, 1960 and Richman, 1968). Discussion of the interpretation of measures of redundancy will be taken up later in this chapter, but at this point it should be mentioned that the high percentage of redundant variance accounted for by the first diagnostic component (see Table 6.2) appeared to be interpretable as indicating higher rates through accounting for greater extremes of variability. It appears that the majority of the variability in the diagnostic set had contributed to the description of an urban or urban-like dimension in the first pair of components, leaving the remaining component pairs to describe differences within the overall rural environment. Such an interpretation is supported by Richman's (1968) figures for Greater Vancouver and Victoria versus the rest of the province from 1958-60; Greater Vancouver and Victoria had 267 admissions per 100,000 persons 15-64 years of age while there

were only 188 per 100,000 in the rest of the province.

There exists an important difference between the types of disorders accounted for in higher urban rates in this and Jaco's (1960) study. Jaco, dealing only with psychoses, found urban rates to be two and a half times greater than rural rates. However, as was indicated in the previous chapter, the excess of cases on the first component pair was attributable, in most part, to non-psychotic disorders. This difference may be partly due to the fact that Jaco defined "urban" according to the U.S. Census definition of 2500 or more population, this meaning that the suburban areas referred to in the first component pair would have constituted only a limited segment of the range of communities included under Jaco's definition. The differences in diagnostic distribution are probably also partly attributable to the suburban areas being predominantly of middle-class composition, a point to be discussed presently.

Although Jaco (1960) rejected the so-called "law of distance" and Dunham (1961) has referred to it as controversial, the diagnostic distribution of less debilitating disorders in the less distant (suburban) areas in this study indicate that distance does influence mental hospital admission in British Columbia. This would be expected in view of the extreme distances between many British Columbia communities and Riverview Hospital, an expectation supported by the finding of Gurin et. al (1960) that one of the main differences between persons who do and do not seek psychotherapeutic help when they feel the need of it lies in facilitating factors.

The rural-urban difference in disorder rates described by the first component pair and its reflection appears possibly relevant to the findings of Barker (1968) regarding the sizes of populations

of "behavior settings". It will be recalled that the reflection of the first component indicated unusually low rates of the less severe mental disorders to occur in rural areas with greater proportions of the population in hamlets and other unincorporated areas.

Barker has found that in certain types of human communities, usually smaller ones, "behavior settings" are underpopulated with the result that persons within the settings are more important to their functioning. As a consequence, persons living in smaller communities would tend to have more social interaction, to judge others on the basis of role performance rather than personality characteristics, to see themselves as having greater functional importance, and to experience more general satisfaction in their social life, despite the greater insecurity associated with their greater responsibilities. It can be seen that extreme differences between the perceived degree of importance of one's self to community functioning would exist between the anonymity of the suburbs and the close-knit relationships within rural hamlets. Such a high degree of community involvement may account for the positive relationship of Alcoholics Anonymous activity to the low-incidence communities described on the reflection of the first component pair.

It would be expected, however, that underpopulated behavior settings would exist in all rural areas, even those showing excessive hospitalizations for some disorders. Further discussion of this point is deferred to a consideration, later in this chapter, of implications for future research.

Socioeconomic Status

Beginning with the ecological study of neighborhood variations in mental disorder rates of Faris and Dunham (1960), socioeconomic

status has received considerable attention as a correlate of mental hospitalization (Hollingshead and Redlich, 1958; Jaco, 1960; Klee et. al., 1967; Bloom, 1966, 1968; Myers and Bean, 1968) and of mental disorder in the general population (Gurin et. al., 1960; Srole et. al., 1962; Leighton, et. al., 1963).

In contrast to these previous studies, the present study did not use direct measures of socioeconomic status; rather the general socioeconomic environment of communities was inferred from factor structures and factor interrelationships on the canonical components. The most clear relationships to socioeconomic standing were found in the middle class environment distinguished on the first component pair and the lower class environment found on the second component pair. The other relationships were less clear, with the third pair indicating lower middle or working class tendencies, the fifth pair tending to imply low socioeconomic status, the sixth indicating a higher status similar to that on the first, and the fourth indicating discrepancies in social class within the same school district. Except for the first component pair, the role of socioeconomic status was generally unclear and appeared to be more fruitfully considered as an interacting component of such concepts as sociocultural disintegration, to be discussed presently.

When the loadings on the first diagnostic component are compared to the findings of Hollingshead and Redlich (1958), some agreement with their findings regarding social status can be found. To begin with, they found neuroses to be more prevalent in classes I, II and III, the class composition suggested on the first environmental component. However, within the neurotic category, they found depression to be relatively infrequent and to be quite evenly distributed across classes. While no explanation can be offered for the

much higher rate of depression found in British Columbia, its apparent relationship to socioeconomic status may be explained as reflecting the proximity of the suburban school districts to Riverview rather than actual greater depression in middle socioeconomic strata. It would also be expected, considering the indications that persons of higher socioeconomic status are more willing to seek psychiatric help (Gurin et. al., 1960; Myers and Bean, 1968) that this willingness, in interaction with proximity, could account for the greater number of hospitalizations for milder disorders, including depression, in the suburban areas.

Another point of agreement with Hollingshead and Redlich (1958) was found in high rates of personality disorder. The relationships with addiction and non-schizophrenic psychoses in the present analysis, however, were not found by Hollingshead and Redlich, while the present results regarding schizophrenia are not comparable because Hollingshead and Redlich grouped all their schizophrenics into one category.

The fact that mixed neurosis related both to the first and second component pairs, despite their apparently different environmental structures in terms of socioeconomic status, may be best explained by the statement of Hollingshead and Redlich (1958) that "the class V neurotic behaves badly, the class IV neurotic aches physically, the class III patient defends fearfully, and the class I-II patient is dissatisfied with himself". The loading of neurosis:other along with schizophrenia and brain disorders on component pair 6 is probably explainable in similar fashion.

Sociocultural Disintegration

As noted in the previous chapter, the relationships found by Leighton et. al., (1963) in the Stirling County Study appear to have

been replicated on the second component pair. The replication applies to both the components in the pair, with there being a predominance, on the diagnostic component, of mixed neurosis and, to a lesser extent, sociopathy, as in the comprehensive sample survey conducted by Leighton's team. However, other variations of environmental characteristics indicative of less than optimal sociocultural integration were found to be predictive of higher rates of some other disorders besides neurosis and sociopathy. These findings indicate that the relationships found by Leighton et. al., (1963) only referred to one of many relevant combinations of environmental and mental disorder characteristics.

As was mentioned in the previous chapter, the third component pair was just as important as the second in explaining variance within and between the environmental and diagnostic sets. However, the environmental description suggests a slightly higher socioeconomic standing to be present on the third. Consistent with this, there was a loading on the diagnostic component on non-schizophrenic psychoses, the majority of which were manic-depressive, a disorder which tends to be less prevalent in the lowest social classes (Rose and Stub, 1955; Hollingshead and Redlich, 1958). Although similar geographic conditions may not have existed in Nova Scotia, where Stirling County was located, it is evident that an environmental dimension indicating a somewhat different but nevertheless important selection of qualities predictive of mental disorder was missed by Leighton and co-workers.

A coexistence of contradictory environmental conditions within school districts on the third component pair was even more strongly in evidence on the fourth pair, where poverty and economic well-being appeared to be existing side by side. Relevant in this regard may be Leighton's (1967) comment regarding the role of relative deprivation as a contributor to mental disorder.

"The process of disintegration, therefore, is not only a matter of poverty, starvation, poor health, and short life expectancy, important as these are; it is also a matter of a sentiment system which says that the situation is unjust and needless — an outrage. When such a state of mind persists without change of conditions it brings about deterioration in zestful attitudes and a blunting of ability to cope. Withdrawal and hostility emerge instead,...and from this follows progressive disintegration of the social system. Psychiatric symptoms then occur such as irrational fears, depressions, delusions, mental dullness, psychophysiological disturbances, and much else." (Leighton, 1967, p.343)

While the Stirling County findings pointed to higher rates of mixed neurosis and sociopathy in rural areas of sociocultural disintegration, the urban studies (eg. Faris and Dunham, 1960; Klee, et. al., 1967; Bloom, 1968) have indicated brain damage and schizophrenia to occur more frequently in the socially disordered sections of cities. An apparent combination of these trends was indicated on the sixth component pair to occur in isolated, rapidly growing rural areas. Such a diagnostic distribution was suggested in the previous chapter as probably reflective of selective in-migration.

Taking the argument one step further, it may also be useful to consider the relationship from the viewpoint of sociocultural integration. If the population were growing rapidly, and particularly if the movement was of white population into a formerly Indian area, there would be no pre-existing sociocultural milieu to aid the adaptation of in-migrants to their new environment. Some of the criteria of sociocultural disintegration used by Leighton et. al., (1963) such as cultural confusion, few and weak formal and informal associations, few and weak leaders, few patterns of recreation and leisure time activity, and weak and fragmented networks of communication would be expected to exist in these regions. However, such conditions would

exist not because of disintegration but because the population was small and not sufficiently settled to have developed a social system. In such cases, it might be more appropriate to speak of sociocultural unintegration rather than disintegration.

Migration

While the unsettled social order in the communities represented on component pair 6 may account in part for the high rates of hospitalization, it appears nevertheless necessary to at least partially attribute the high rates of schizophrenia to selective in-migration. There is a body of evidence to suggest that predispositions to schizophrenia can be genetically determined (see reviews in Suinn, 1970 and Goldenson, 1970) and, given a rather high concentration of schizophrenia in one type of geographic area, it seems reasonable to infer that more predisposed individuals were present in order for this to occur.

If this interpretation is correct, it provides a rare substantiation of the "drift hypothesis". This hypothesis was first proposed as an alternative explanation for Faris and Dunham's (1960) results, stating that high rates of schizophrenia and brain damage in the inner city could be due to downward social and geographic mobility of afflicted persons. On the whole, little evidence has been found to support this hypothesis. Both Hollingshead and Redlich (1958) and Leighton et. al., (1963), to name two particularly relevant studies, found that there had been neither downward drift in the social hierarchy nor drift into disintegrated areas with the development of mental disorder.

The diagnostic relationships on the sixth component pair are consistent with previous findings regarding migration and mental

disorder. Malzberg and Lee (1956) found migrants to have higher rates of brain damage and schizophrenia, as in this case, with the rates highest for the most recent immigrants, while Klee et. al. (1967) found migration and mobility to be predictive of mental disorder in general. Jaco (1960), on the other hand, found no relationship to exist, but as Murphy (1961) has observed, his geographic regions were biased in respect to social class.

Further evidence from Scandinavian studies by Hagnell (1969) indicate that internal migrants from rural to urban areas are at greater risk of developing a mental disorder. It is possible that, in part, the higher rates in the urban areas of British Columbia may be due to similar selective migration away from rural areas.

Age and Sex

As with socioeconomic status these variables were not, on the whole, clearly represented on the environmental variates of the factor analysis or the environmental components of the canonical analysis. Decrepitude was perhaps the most clear indicator and, comparing its performance in the canonical analysis to its hypothesized performance in chapter 4, it can be seen that it did not predict as expected. The basic reason for this failure was probably a lack of elderly patients in the hospitalization data. The finding of Richman (1968) that the disorder rates in British Columbia for persons 65 and older were 408 and 483 per 100,000 for urban and rural areas respectively demonstrates that relationships between Decrepitude and old age disorders would have been found if more elderly persons had been included in the data set. A difficulty in obtaining old age figures in British Columbia is that persons over 65 are admitted to Riverview as well as to geriatric hospitals,

this necessitating the use of data sets from several institutions if old age disorders are to be represented. Future research using the data set of the present study should include complete geriatric data if comparability with previous research including old age disorders is desired.

The one component pair on which Decrepitude did load, the sixth pair, indicated excessively high rates of brain disorders, paranoid, acute and chronic undifferentiated schizophrenia, non-depressive neurosis, and excessively low rates of transient situational disorders to be associated with an unusually youthful population. The high rates of acute and paranoid schizophrenia in such regions are consistent with the tendency for schizophrenia to have an earlier onset than other disorders, occurring more frequently in persons in their 20's and 30's (Rose and Stub, 1955).

Referring back to the original factor loadings on Decrepitude, seen in Table 4.5(a), the loading on percentage of single males indicates that there would be a greater than usual number of single males in the environment described on the sixth component pair. This too is consistent with higher rates of schizophrenia, as young single males have been found to be the group most at risk of developing this disorder (Rose and Stub, 1955). However, a possible contradiction of this trend is seen on the first component pair. Reference to Table 4.2(a) shows a loading of single males on Suburban Conditions equally strong to that on Decrepitude and of such a nature that a high percentage of single males would contribute, in the first component pair, to the prediction of unusually low rates of the less severe disorders. However, as it was only one of many variables entering the prediction, these results can only be considered suggestive.

Climate

As was noted in the previous chapter, the strong loading of climate on the first component pair was confounded by its association with the suburbs of Vancouver. Thus the relationship may have been due simply to its coincidence with the social conditions of the suburbs rather than to any influence of climate on disorder rates. The apparently unconfounded relationship seen on the third component pair, if reflective of a climatic influence, indicates the relationship is not a strong one.

Support for the possibility that the results in the present study indicate an actual relationship between climate and disorder rates may reside in similar relationships previously found. Tromp (1968) mentions that sleep disturbance, suicide and crime all appear to be related to weather disturbances. The findings, on the third component pair, of higher rates on sociopathy and non-schizophrenic psychoses, most of which were manic-depressive, are consistent with these earlier findings.

Although Tromp (1968) found weather to affect restlessness in schizophrenic patients, no relationship between climate and schizophrenia was found in this study. This is not necessarily inconsistent, as Tromp was dealing with persons who were already hospitalized.

Urbanization

As was hypothesized in chapter 4, it was expected that if the Concentration variate predicted the types of disorders more characteristic of the inner city, it would be only slightly predictive. This expectation was based on the fact that, except for Vancouver, even the larger commercial centers of B. C. are too small to contain the types of social conditions necessary to produce the relationships

found by Faris and Dunham (1960) and replicated in such studies as those of Klee et. al (1967) and Bloom (1968). Although the usual relationships, with more brain damage and schizophrenia in the inner city slum areas, probably apply in Vancouver, that city is so unique in the province and so heterogeneous within itself that any operation of these relationships was obliterated in the analysis.

Clausen and Kohn's (1959) study of a small city, in which they found the Faris and Dunham relationships to be completely absent, is of direct relevance to the small cities indexed on the Concentration factor in the present study. The city they studied had a population of 36,000, larger than any of the nine high scoring districts in Table 4.6(b) except for Vancouver, New Westminster, and Victoria. It would thus be expected that, in most of the relevant school districts, the same lack of associations found by Clausen and Kohn (1959) would prevail.

The association found with brain disorders and one of the schizophrenic categories is probably not attributable to the same social processes found in large urban areas. If it was, the other schizophrenic disorders should also have shown higher rates. As was indicated earlier in this chapter, Concentration's function in this study appeared to lie in a contribution to a description of school districts in which social discrepancies occurred.

## Comments on Methodology

The multivariate methods employed in the present study represent a departure from earlier methods of data analysis used in epidemiology. Rather than considering the effects of various combinations of two or three variables at a time, all variables in combination were considered simultaneously. Thus, in the canonical analysis, between the

75 environmental variables that had already been reduced by factor analysis and the 13 diagnostic rates, there were 88 variables under consideration at once.

The importance of simultaneous analysis of all variables is indicated in the observation made by Lee (1969) in regard to canonical analysis, that canonical component loadings are not stable as variables are removed from or added to an analysis. The same observation can be made of factor analysis. In both these multivariate methods, interactions between variables are being assessed. It is clear that if a variable which strongly interacted with other variables was added to or removed from a data set, that a very different set of interrelationships might then be found. This kind of information about interactions cannot be obtained when only two or three variables are considered at a time.

Factor Analysis as a Method of Environmental Description

The use of factor analysis in environmental description has an impressive history, as indicated in chapter 4. The advantages of factor analysis as a tool for developing environmental predictors have been discussed in chapter 2. Its two main advantages are that it can reduce massive amounts of data to a manageable number of dimensions and that it can be rotated to provide orthogonal predictors which, in contrast to correlated predictors, provide more stable and interpretable results.

Any weaknesses with the factors derived in this study in terms of their interpretations being unclear was attributable to a lack of previous knowledge of some of the initial variables. A good example of such a problem occurred with the Spoiled Ballots factor. Despite the ambiguity of this factor, however, it provides a lead for further research that, in view of its good predictive power,

would probably be fruitful.

It must be remembered, however, that the value of factor analyzing predictors depends on the research question. Factor analysis creates new more general variables which may be of interest, but sometimes old familiar variables are of more crucial interest. In demographically designed studies in epidemiology, where characteristics of persons are focussed upon, it is evident that single variables such as age, sex, marital status, etc. must usually be studied as such rather than as part of a composite.

Canonical Analysis as a Method of Relating Diagnostic Rates and Environmental Attributes

As the discussion of canonical regression analysis in chapter 2 indicated, refinements in this technique in the past few years have greatly increased its utility as a research tool. Despite these advances, however, interpretation may still provide a complex task. The technique is also limited by its inability to delineate definite etiological relationships. This limitation is, of course, common to all correlational techniques and, as Lee (1969) has suggested, canonical analysis is best regarded as an exploratory tool which will provide some idea of the complicated multivariate relationships in a data set.

From a more positive point of view, the problem of interpretive difficulty is not insurmountable and should not be overrated. With advanced computer technology and increasing availability of good programs, anyone with a basic knowledge of correlation and factor analysis should be able to conduct and interpret a canonical regression analysis. It is not necessary to understand the complex mathematical "innards" of the technique in order to understand its results.

The value of canonical regression analysis as an exploratory tool has been aptly demonstrated in the present study. In contrast to studies such as the Stirling County study where relevant environmental qualities were selected on the basis of theory, canonical analysis can provide empirically derived combinations of variables predictive of mental disorder. The identification of different dimensions bearing some relationship to the concept of sociocultural disintegration used by Leighton et. al., (1963) and established as predictive of mental hospitalization provided more promising research leads in a shorter period of time than could be possible in constructing community dimensions based only on theory.

A further advantage of canonical regression analysis is that it is possible to derive canonical scores. This was not done in the present study because of the temporal limitations of the study, a problem of particular relevance in view of the fact that no suitable program was readily available. If, however, the selection of school districts most strongly related to some of the canonical variates was desired in order to undertake cross-regional studies, the computation of canonical scores would readily identify these communities. Such a method of community selection has obvious advantages over the "key informant" method used in the Stirling County study in terms of greater objectivity and less time expended.

The Interpretability of Measures of Redundancy

Stewart and Love (1968), in proposing the use of a redundancy measure, suggest that it may not be used in interpretation of canonical results beyond deciding upon how many canonical components to retain for interpretation. In their example, using data from psychological tests, the first pair of canonical components accounted for almost all of the total redundant variance, despite the fact that

both the first two pairs of canonical variates were highly correlated. The single high redundancy indicated, according to Stewart and Love, that only the first pair of components should be retained for interpretation.

In the present study the criterion (diagnostic) set contained intercorrelations between rates and, because the cross products correlation technique had been used, the magnitudes of the rates were represented within the intercorrelations. It was known beforehand that the areas indexed in the first canonical component pair had higher rates than the rest of the province and it appeared that, in accounting for a third of the total redundant variance, the first diagnostic component was reflecting these higher rates. By extension of this interpretation, then, it would appear that the remaining diagnostic redundancy measures accounted for magnitudes of variability consistent with their respective numerical magnitudes. Thus, for example, similar overall excesses of hospital admissions would be involved in both the second and third component pairs.

Such interpretations would appear to be possible only because the cross products correlation technique was used. If product moment correlations had been used, the base rates of the various disorders would have had no influence on any of the calculations. Thus it can be seen that these interpretative properties would not apply to other than rate data, the only data with which cross product correlations would be appropriate.

## Directions for Future Research

The results of the present study are only suggestive of the many complex interrelationships between persons and their environ-

ments which can culminate in mental hospital admission. For future studies, however, the development of reliable and comprehensive environmental predictors in the present study has laid the foundations for refining and clarifying the present set of relationships.

The weak point of this study lay in the relatively unreliable criterion measures used in the canonical prediction task. Psychiatric diagnosis, being of limited reliability at the best of times, is open to the effects of attenuation (see Nunnally, 1967) which lowers the observed correlations from their true values. If figures on the reliability of the psychiatric diagnoses used in this study were available, the correlations could be corrected for attenuation with the result that greater predictability and therefore higher redundancies between the criterion and predictor sets might be found. It is unlikely, however, that reliability figures will become available to allow correction for attenuation, and attention would be more profitably directed to obtaining more reliable measures.

Remaining with the diagnostic data, it could be informative to collapse the existing categories into the four most broad ones in Table 2.1, thereby increasing the reliability of the categories as discussed by Zigler and Phillips (1961). Alternatively, the categories could be reorganized within themselves such that, for example, all alcoholic diagnoses, those associated with acute and chronic brain damage as well as cases of simple alcoholism, could be grouped together. In this way, excessive heterogenity within categories, a problem in using greatly collapsed categories, could be lessened.

Another means of avoiding excessive heterogeneity within categories would be to use only the diagnostic categories containing large numbers of cases. Reference to Table 5.1 indicates that chronic undifferentiated schizophrenia, paranoid schizophrenia, and neurotic depression would be the three best categories to use in pursuing this course. With large numbers of cases, these categories would be likely to have several cases in each school district and thus be less influenced by chance variation in the case of there being only one or two cases within a school district.

Despite the fact that these alternative arrangements of the diagnostic data could improve reliability of the criterion measures, the basic low reliability of diagnosis would prevent overall reliability from becoming high. Thus, it might be profitable to consider other measures available in the same set of data on Riverview patients from which the diagnostic data was taken. Possibilities within the data include those pertaining to the mental status examination, type of treatment, level of improvement, and numerous demographic items such as age, sex, religion, occupation, and others.

Methodologically, two particular improvements on the present methods of analysis are suggested. The first of these is multistage sequential prediction, based on decision theory, and described by Cronbach and Gleser (1965). By this technique, two categories, for example psychotic versus non-psychotic, could first be discriminated, and then further differentiation could proceed within each of those categories. As Cronbach and Gleser demonstrate, this method of prediction may be more efficient than single stage prediction.

The second alternative is multiple canonical regression

analysis (Horst, 1961; Carroll, 1968). This method, like multi-stage prediction, might improve prediction, but, more importantly, it would provide a broader description than a canonical regression which involved only two sets of measures. By this method, then, the variables mentioned above as alternative criterion measures, along with the diagnostic measures, could be entered in various combinations of two or more sets along with the environmental factors to provide a description of greater refinement that that found in the present analysis.

Following from these statistical studies, it might be desired to use the discovered relationships as a basis for selecting communities to study using survey methods. While the approach of Leighton et. al., (1963) provided a wealth of information, it would probably be worthwhile to expand on their method of community description by employing Barker's (1968) theory of behavior settings. It might be found that there are less social activities perceived to be important or worthwhile in the areas with higher mental disorder rates. Thus, in the suburbs it might be difficult to feel one was making a significant contribution to community life because of the great numbers of persons. In areas like those indexed on the second component pair it is likely that there are few major behavior settings beside the local beer parlour, which in areas such as were indicated on the sixth pair, few community activities might exist because of insufficient social organization.

An investigation of cross-regional rural differences with an emphasis on perceived social discrepancies could be of interest. Areas of consistent poverty could be compared to areas of poverty coexisting with areas of relative affluence such as were indexed

on the fourth component pair. Of relevance in this respect is Leighton's (1967) statement that poverty and sociocultural disintegration do not necessarily appear together.

Beyond these main indications there are numerous smaller leads which could be enlarged upon in further research. It might, for example, be worthwhile removing some of the variables from the factor analysis and adding others to see if the factor interpretations could be improved. Or, working with the same data, it might be profitable to attempt different groupings of the diagnostic categories in a similar attempt to improve interpretability of results. The wide variety of relationships extracted from the present set appear suitable to provide numerous leads for research of both practical and theoretical orientation.

## Summary

As this study was the first ecological study to use canonical regression analysis or factor scores as predictors, the task of comparing its results to previous studies was somewhat complex. One long established relationship, that of higher rates in urban than rural areas appeared to be replicated as did the occurrence of higher rates of certain disorders in areas of sociocultural disintegration. However, several combinations of environmental attributes indicative of sociocultural disintegration were found with differing mental disorders having higher rates on each one.

Although no direct measures on the subjects were available, some similarities between environmental-diagnostic relationships and previously found demographic-diagnostic relationships were found for socioeconomic status and migration. Previous findings

regarding age were not replicated, but this was attributed to there being incomplete data on geriatric cases. A comparison with earlier findings regarding age was slightly suggestive of contradictory findings in the present case.

There was some indication that the mild coastal climate was predictive, as previous research suggests, of aggressive acts against the self and others. Similarly, the degree of urbanization of British Columbia's small cities was, as in previous studies, insufficient to produce the type of mental hospital admissions found in large urban areas.

A discussion of the methodology of the study focussed on the use of factor analysis, canonical regression analysis and measures of redundancy. The value of factor analysis was stated to be limited by the variables used in it and also by the type of research question. Canonical regression analysis was indicated to be useful as an exploratory tool, a use well demonstrated in the present study. It was suggested, in contradiction to Stewart and Love (1968), that some analytic value might accrue from measures of redundancy in the present study. This was felt to be possible because cross product correlations rather than product moment correlations were used on the diagnostic data.

Two major directions for future research based on the present set of findings were suggested. The first related to modifications in methodology, suggesting the use of either multistage sequential prediction or multiple canonical regression analysis. In the latter case, it would be possible to incorporate demographic data and presenting characteristics of mental disorder at the time of admission along with the environmental and diag-

nostic data used in the present study. The purpose of such research would be to refine and expand on the present results. A second direction suggested was community study as in the Stirling County study but incorporating Barker's (1968) theory of behavior settings. Social discrepancies within regions were indicated to be of interest to the question of sociocultural disintegration.

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# APPENDICES

Appendix A - The School District Data

1. A map of the school districts
2. A listing of the school districts
3. The variables descriptive of the school districts
4. Sources from which the variables were obtained
5. Regression weights and constants derived for the least squares estimations of missing data

Appendix B - The Factor Analysis of School Districts

1. Intercorrelations of the variables descriptive of the school districts
2. Twenty-two unrotated Principle Axis factors
3. Eighteen Varimax rotated factors
4. Factor Scores of the seventy-eight school districts on the eighteen factors

Appendix C - The Canonical Regression Analysis of the School District Factors and the Mental Disorder Rates

1. Cross product correlations between diagnostic frequencies
2. Cross product-product moment correlations between diagnostic frequencies and environmental factor scores
3. Canonical component loadings and measures of redundancy

# APPENDIX A

## The School District Data

# APPENDIX A-2

## A LISTING OF THE SCHOOL DISTRICTS

| Number | Name |
|---|---|
| 1 | Fernie |
| 2 | Cranbrook |
| 3 | Kimberely |
| 4 | Windermere |
| 7 | Nelson |
| 8 | Slocan |
| 9 | Castlegar |
| 10 | Arrow Lakes |
| 11 | Trail |
| 12 | Grand Forks |
| 13 | Kettle Valley |
| 14 | South Okanagan |
| 15 | Penticton (includes S.D. 77, Summerland) |
| 16 | Keremeos |
| 17 | Princeton |
| 18 | Golden |
| 19 | Revelstoke |
| 20 | Salmon Arm |
| 22 | Vernon |
| 23 | Kelowna |
| 24 | Kamloops |
| 25 | Barriere |
| 26 | Birch Island |
| 27 | Williams Lake |
| 28 | Quesnel |
| 29 | Lillooet |
| 30 | South Cariboo |
| 31 | Merritt |
| 32 | Fraser Canyon |
| 33 | Chilliwack |
| 34 | Abbotsford |
| 35 | Langley |
| 36 | Surrey |
| 37 | Delta |
| 38 | Richmond |
| 39 | Vancouver |
| 40 | New Westminster |
| 41 | Burnaby |
| 42 | Maple Ridge |
| 43 | Coquitlam |
| 44 | North Vancouver |
| 45 | West Vancouver |
| 46 | Sechelt |
| 47 | Powell River |
| 48 | Howe Sound |
| 49 | Ocean Falls |
| 50 | Queen Charlotte |

| Number | Name |
|---|---|
| 51 | Portland Canal |
| 52 | Prince Rupert |
| 53 | Terrace |
| 54 | Smithers |
| 55 | Burns Lake |
| 56 | Vanderhoof |
| 57 | Prince George |
| 58 | McBride |
| 59 | Peace River South |
| 60 | Peace River North |
| 61 | Victoria |
| 62 | Sooke |
| 63 | Saanich |
| 64 | Gulf Islands |
| 65 | Cowichan |
| 66 | Lake Cowichan |
| 67 | Ladysmith |
| 68 | Nanaimo |
| 69 | Qualicum |
| 70 | Alberni |
| 71 | Courtenay |
| 72 | Campbell River |
| 75 | Mission |
| 76 | Agassiz |
| 78 | Enderby (includes S.D. 21, Armstrong-Spallumchean) |
| 79 | Ucluelet-Tofino |
| 80 | Kitimat |
| 82 | Chilcotin |
| 84 | Vancouver Island West |
| 85 | Vancouver Island North |
| 86 | Creston-Kaslo |

School Districts Excluded from the Analysis

| | |
|---|---|
| 81 | Fort Nelson |
| 83 | Portage Mountain |
| 87 | Stikine |

## APPENDIX A-3

## THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

| | Variables | Derivation | Sources** |
|---|---|---|---|
| I. | Community Organization | | |
| 1. | Age of main community | Number of years to 1966 that main town or municipality has been organized. | 8 |
| 2, | Number of hamlets | Number of unorganized communities with populations over 100 in 1961 census | 8 |
| 3. | Towns with populations 2500 or less. | Number of communities of organized status in 1966 with 2500 or less residents | 7 |
| 4. | Towns with populations 2500-4999. | Number of communities of organized status in 1966 with between 2500 and 4999 residents | 7 |
| 5. | Towns with populations 5000-9999. | Number of communities of organized status in 1966 with between 5000 and 9999 residents | 7 |
| 6. | Towns with populations over 10,000. | Number of communities of organized status in 1966 with 10,000 or more residents. | 7 |
| *7. | % of population in organized area in 1961. | (Organized population)/ (Total population) x 100 | 8 |
| *8. | % of population in hamlets in 1961. | (Hamlet population)/(Total population) x 100. Includes hamlets within municipalities where relevant. | 8 |
| 9. | % of population rural, 1961. | Rural population defined as persons living neither in hamlets or organized areas. % derived as for variables 7 and 8. | 8 |
| 10. | Town population density, 1966. | (Population of organized area)/(Area in acres of organized area) | 7,9 |
| 11. | Non-town population density, 1966. | (Population of unincorporated area of the district)/ (Area in square miles of the unincorporated area.) | 7,8,9 |
| *12. | Population growth, 1956-61 | Available in Regional Index. | 8 |

| | Variables | Derivation | Sources |
|---|---|---|---|
| *13. | Population growth, 1961-66 | (Difference between 1966 and 1961 populations)/(1961 population) x 100 | 7,8 |
| *14. | Town growth, 1961-1966 | (Difference between 1966 and 1961 populations in organized areas)/(1961 population in organized area) x 100 | 7,8 |
| *15. | Natural population | (Excess of births over deaths, 1966)/(Total deaths, 1966) x 100 | 6 |
| II. | Economics | | |
| 16. | Increase in liquor sales, 1959-63. | Available in Regional Index. | 8 |
| 17. | Per capita liquor sales, 1963 | (Total liquor sales, 1963)/(Number of persons 15 years old or older, 1966) | 7,8 |
| 18. | Per capita retail trade, 1961 | (Total retail sales for communities reporting in Regional Index)/(Populations of those communities, 1961) | 8 |
| 19. | General Mill Rate for municipal purposes, 1963 | Available in Regional Index | 8 |
| 20. | Mill Rate for School purposes, 1963. | Available in Regional Index | 8 |
| 21. | Municipal debt, 1963 | Available in Regional Index | 8 |
| 22. | Non-town property, 1961 | (Total assessed value of property outside organized area, 1961)/(Area of unincorporated area in square miles) | 8,9 |
| 23. | Town property value, 1961 | (Assessed value of property in organized area, 1961)/(Area of organized area in acres) | 8,9 |
| 24. | Mean male wage, 1961. | Available in Regional Index | 8 |

| | Variables | Derivation | Sources |
|---|---|---|---|
| 25. | Female wage level, 1961 | (Mean female wage, 1961)/ (Mean male wage,)1961 x 100. | 8 |
| 26. | % of wage earners in working force, 1961 | (Total wage earners)/ (Number of persons between 15 and 65 years) x 100 | 7,8 |
| 27. | % of wage earners who were female, 1961 | (Number of female wage earners)/(Total number of wage earners) x 100 | 8 |
| III. | Education | | |
| 28. | Mean class size, 1966. | (Total pupils in school district)/(Number of class divisions) | 4 |
| 29. | Excess of teachers over classes, 1966. | ((Total pupils)/(Total teachers)) - Mean class size. | 4 |
| 30. | Per pupil expenditure, 1966. | (Total school expenditure)/(Total pupils) | 4 |
| 31. | Visual Education Circulation, 1966. | (Total number of movies and film strips circulated by the Division of Visual Education, Victoria)/(Total pupils) | 4 |
| 32. | High school attendance, 1966 | (Total pupils in grades 10-12)/(Total population aged 15-19) x 100 | 4,7 |
| IV. | Health | | |
| *33. | Death rate, 1966 | (Total deaths)/(Total population) x 1000 | 6,7 |
| *34. | Infant death rate, 1966. | (Total infant deaths)/ (Total deaths) x 100 | 6 |
| *35. | Hospital death rate, 1966. | (Total hospital deaths)/ (Total deaths) x 100 | 6 |
| 36. | Per capita motor vehicle deaths, 1965-68 | (Total motor vehicle deaths, 1965-68)/ (Total 1966 population) x 10,000. | 11,7 |
| 37. | Hospital beds per capita, 1961 | (Total hospital beds, 1961)/(Total population, 1961) x 10,000. | 8 |

| Variables | Derivation | Sources |
|---|---|---|
| V. Isolation | | |
| 38. Distance from Riverview Hospital. | The distance from an arbitrarily chosen central point in each school district, usually the largest town, to Riverview. One sea mile is weighted as equal to two land miles. | 8 |
| 39. Accessibility by air. | A composite score in which each commercial airline serving the area contributes 5 points, each charter service available 2 points, and each non-commercial airstrip 1 point. | 8 |
| 40. Impediments to land travel. | A composite score in which the state of the roads in the district is rated 1-5, 5 being the worst condition, 3 points being added to this rating if ferry travel is necessary to reach the lower mainland, and another 3 points if any stretch of gravel road must be traversed when going to the lower mainland by car. | |
| 41. Per capita phones, 1961. | (Number of telephones, 1961)/ (Total population) | 8 |
| VI. Physical Geography | | |
| 42. Elevation. | Mean elevation of weather stations situated in that school district. | 3 |
| 43. Ruggedness of terrain. | Rating on 1-5 scale, 5 being the most rugged. | |
| 44. Mean winter temperature. | Mean temperature over all weather stations in a school district for the months Dec., Jan., and Feb. | 3 |
| 45. Mean annual temperature range. | (Mean temperature over all weather stations in a school district for June, July, and August) - Mean winter temperature. | 3 |

| | Variables | Derivation | Sources |
|---|---|---|---|
| 46. | Mean winter precipitation. | Mean level of precipitation over all weather stations in a school district for the months Dec., Jan., and Feb. | 3 |
| 47. | Mean summer-winter difference in precipitation. | (Mean level of precipitation over all weather stations in a school district for June, July, and Aug.) - Mean winter precipitation. | 3 |
| 48. | Mean annual number of frost-free days. | Available in Regional Index. | 8 |
| VII. | Political Behavior | | |
| 49. | % of registered voters voting in Provincial election, 1966. | (Number voting)/(Number of registered voters) x 100 | 2 |
| 50. | % spoiled ballots | (Number of spoiled ballots)/(Total votes cast) x 100 | 2 |
| 51. | % Social Credit vote | (Total S. C. votes)/(Number of registered voters) x 100 | 2 |
| 52. | % Liberal vote | (Total Liberal votes)/(Number of registered voters) x 100 | 2 |
| 53. | % N.D.P. vote | (Total N.D.P. votes)/(Number of registered voters) x 100 | 2 |
| VIII. | Population figures, general | | |
| 54. | Total population, 1966. | White population plus Indian population, 1966 | 7 |
| 55. | % of population 15 years old and older. | (Whites plus Indians, 15+ years old)/(Total population, 1966) x 100 | 7 |
| 56. | % of males, 1966 | (White plus Indian males)/(Total population) x 100 | 7 |
| 57. | % of population 65 years and older, 1966. | (White plus Indian 65+ year olds)/(Total population)x 100. | 7 |
| 58. | % of Indians, 1966 | (Number of Indians on reservations)/(Total population) x 100. | 7 |
| 59. | Median age, 1966 | Median age of white plus Indian population, estimated from class interval breakdown. | 7 |

| | Variables | Derivation | Sources |
|---|---|---|---|
| *60. | Fertility rate, 1966. | (Total number of live births)/(Number of females 15-30 years) x 100. | 6,7 |
| *61. | Marriage rate, 1966. | (Number of marriages)/ (Number of females 15-30 years) x 100 | 6,7 |
| IX. | Recreation | | |
| 62. | Extent of natural recreation facilities | Rating on a 0-10 scale on availability of ski facilities, amount of district in wilderness park, availability of camping facilities. | 8 |
| 63. | Per capita acres in public parks and playgrounds, 1966. | (Total acres in park and playground)/(Total population) x 1000. | 7,9 |
| 64. | Per capita government grants to recreation commissions, 1966. | (Total grant in dollars)/ (Total population) x 1000 | 4,7 |
| 65. | Hotel and motel units per capita, 1961. | (Number of hotel and motel units, 1961)/(Total population, 1961) x 1000 | 8 |
| XI. | Social Health | | |
| 66. | Availability of mental health services in the community. | Rating on a 1-10 scale taking the number of months between Jan. 1964 and Dec. 1967 that the facility in question was in operation, the number of days a month the facility is available, and the hours of travelling time necessary to reach the nearest facility, into account. | 5 |
| 67. | Per capita referrals to community mental health facilities. | (Total referrals Apr. 1965-March 1966 and Apr. 1967-March 1968)/(Total population, 1966) x 10,000. | 5,7 |
| 68. | Per capita admissions to public geriatric facilities. | (Total geriatric admissions for same period as variable 67)/(Number of persons 65+ years old, 1966) x 10,000. | 5,7 |

| | Variables | Derivation | Sources |
|---|---|---|---|
| 69. | Per capita admissions to Woodlands school. | (Admissions to Woodlands school for retarded children during same period as in variable 67)/(Number of persons 0-15 years of age, 1966) x 10,000. | 5,7 |
| 70. | Delinquency rate, 1965-67. | (Number of admissions to training schools 1965-67)/(Number of persons 10-19 years of age, 1966) x 10,000. | 7,10 |
| 71. | Rate of welfare recipiency. | (Mean number of welfare recipients in March taken over 1965, 66, and 67)/(Total population, 1966) x 1000. | 7,10 |
| 72. | Welfare expenditure per recipient. | (Expenditure for March 1966 and March 1967)/(Number of recipients in March 1966 and 1967) | 10 |
| *73. | Illegitimacy rate, 1966. | (Number of illegitimate births)/(Total live births) x 100. | 6 |
| 74. | Per capita membership in Alcoholics Anonymous, 1966. | (Estimated number of members of A.A., 1966)/(Persons 15 years and older, 1966) x 10,000. | 1,7 |
| 75. | Per capita Alcoholics Anonymous groups, 1966. | (Number of A. A. groups)/(Population 15 years and older, 1966) x 10,000. | 1,7 |

* Figures not available for Indians on reserves.
** See Appendix A-4 for bibliography of secondary data sources.

## APPENDIX A-4

### SOURCES FROM WHICH THE VARIABLES WERE OBTAINED


1. Alcoholics Anonymous World Services, Inc. World Directory, Spring 1966.

2. British Columbia. Chief Electoral Office. Summary of Votes, Statement of Results of the General Election. Victoria, 1966.

3. British Columbia. Department of Agriculture. Climate of British Columbia. Victoria. 1964.

4. British Columbia. Department of Education. Annual Report of the Public Schools of the Province of British Columbia. Victoria. 96th Annual Report, 1966/67.

5. British Columbia. Department of Health and Welfare. Mental Health Services Branch. Report. Victoria. 1965/66, 1967/68.

6. British Columbia. Department of Health Services and Hospital Insurance. Vital Statistics of the Province of British Columbia. Victoria. 1966.

7. British Columbia. Department of Industrial Development, Trade and Commerce. Economics and Statistics Branch. Age Group Distribution of British Columbia's population by School Districts. Victoria. 1961, 1966.

8. British Columbia. Department of Industrial Development, Trade and Commerce. Economics and Statistics Branch. Regional Index of British Columbia, 1966.

9. British Columbia. Department of Municipal Affairs. Municipal Statistics. Victoria. 1964.

10. British Columbia. Department of Social Welfare. Branch of Social Welfare. Annual Report. Victoria. 1966, 1967.

11. British Columbia. Department of the Attorney-General. Motor Vehicle Branch. Report. Victoria. 1965, 1967.

APPENDIX A-5

REGRESSION WEIGHTS AND CONSTANTS DERIVED FOR THE LEAST SQUARES ESTIMATIONS OF MISSING DATA

| Variable Number | Variable Name | Multiple R | $R^2$ | Constant | Regression Weights | Predictor Number |
|---|---|---|---|---|---|---|
| 16 | Increase in liquor sales, 1959-63 | .67 | .44 | 9.46 | -.07 | 1 |
| | | | | | .38 | 13 |
| | | | | | -.06 | 23 |
| | | | | | .26 | 37 |
| | | | | | .01 | 48 |
| | | | | | -1.56 | 61 |
| | | | | | .43 | 74 |
| | | | | | -3.22 | 75 |
| 17 | Liquor sales, 1963 | .69 | .48 | 58.72 | -.16 | 5 |
| | | | | | -.08 | 7 |
| | | | | | 5.79 | 10 |
| | | | | | .41 | 36 |
| | | | | | 14.08 | 50 |
| | | | | | 1.57 | 60 |
| | | | | | -.03 | 66 |
| 18 | Retail sales, 1961 | .76 | .57 | -4682.86 | 83.31 | 2 |
| | | | | | 140.67 | 9 |
| | | | | | 31.42 | 13 |
| | | | | | 1015.60 | 61 |
| | | | | | 55.18 | 71 |
| 19 | General Mill rate, 1963 | .58 | .34 | -41.21 | .01 | 1 |
| | | | | | .31 | 6 |
| | | | | | .46 | 10 |
| | | | | | .08 | 12 |
| | | | | | -.06 | 41 |
| | | | | | .16 | 42 |
| | | | | | 1.02 | 56 |
| | | | | | .07 | 67 |

| Variable Number | Variable Name | Multiple R | $R^2$ | Constant | Regression Weights | Predictor Number |
|---|---|---|---|---|---|---|
| 20 | School Mill rate, 1963 | .64 | .41 | 17.53 | .67 | 9 |
| | | | | | -.19 | 33 |
| | | | | | .58 | 36 |
| | | | | | .28 | 38 |
| | | | | | .74 | 42 |
| | | | | | .15 | 44 |
| | | | | | -.12 | 48 |
| 21 | Municipal debt, 1963 | .71 | .51 | 3.61 | .01 | 1 |
| | | | | | -.12 | 4 |
| | | | | | -.87 | 10 |
| | | | | | .01 | 15 |
| | | | | | .10 | 23 |
| | | | | | -.09 | 35 |
| | | | | | .07 | 67 |
| 22 | Non-town property value, 1961 | .92 | .85 | -5.65 | 29.44 | 11 |
| 24 | Mean male wage, 1961 | .94 | .89 | 35.52 | .09 | 40 |
| | | | | | .25 | 41 |
| | | | | | -.72 | 57 |
| | | | | | -.16 | 58 |
| | | | | | -.62 | 75 |
| 25 | Female wage level, 1961 | .85 | .73 | 79.87 | .01 | 1 |
| | | | | | .12 | 15 |
| | | | | | .47 | 31 |
| | | | | | -.33 | 32 |
| | | | | | -.80 | 40 |
| | | | | | -.49 | 56 |
| | | | | | .79 | 57 |
| | | | | | .14 | 61 |
| | | | | | .10 | 68 |
| | | | | | .07 | 73 |

| Variable Number | Variable Name | Multiple R | $R^2$ | Constant | Regression Weights | Predictor Number |
|---|---|---|---|---|---|---|
| 26 | % of workers earning wages, 1961 | .94 | .88 | 34.50 | -.10 | 2 |
| | | | | | .14 | 23 |
| | | | | | -.39 | 32 |
| | | | | | .97 | 37 |
| | | | | | -.74 | 58 |
| 27 | % of wage earners who were female, 1961 | .90 | .80 | 116.35 | .01 | 15 |
| | | | | | -.41 | 32 |
| | | | | | -1.45 | 56 |
| | | | | | .85 | 57 |
| | | | | | -.59 | 60 |
| | | | | | .29 | 61 |
| 63 | Acreage in public parks and playgrounds, 1966 | .64 | .41 | -28.87 | .11 | 7 |
| | | | | | -2.64 | 10 |
| | | | | | .67 | 11 |
| | | | | | .22 | 14 |
| | | | | | 1.85 | 38 |
| | | | | | .80 | 53 |
| | | | | | 1.81 | 61 |
| | | | | | -.08 | 70 |

# APPENDIX B

## The Factor Analysis of School Districts

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 019 | | | | | | | | |
| 3 | -225 | 035 | | | | | | | |
| 4 | 062 | 042 | -210 | | | | | | |
| 5 | 137 | 028 | -090 | -010 | | | | | |
| 6 | 604 | -098 | -273 | -204 | -046 | | | | |
| 7 | 656 | -354 | -181 | 115 | 276 | 568 | | | |
| 8 | -473 | 443 | -036 | -064 | -221 | -395 | -763 | | |
| 9 | -517 | 153 | 327 | -121 | -202 | -491 | -779 | 215 | |
| 10 | 309 | 178 | -042 | -045 | -106 | 228 | 183 | -251 | -093 |
| 11 | 088 | 254 | -166 | 353 | 168 | -050 | -045 | 035 | 041 |
| 12 | 172 | -012 | -128 | -048 | 123 | 210 | 074 | -108 | -003 |
| 13 | -175 | -091 | -156 | -053 | -003 | 006 | -132 | -056 | 261 |
| 14 | -190 | 113 | 247 | 031 | -006 | -206 | -314 | 271 | 213 |
| 15 | -420 | -027 | 131 | -127 | 030 | -190 | -238 | 114 | 229 |
| 16 | -157 | -185 | -128 | 104 | -058 | -045 | 004 | -018 | 004 |
| 17 | -299 | -046 | 024 | -040 | -158 | -214 | -243 | 095 | 253 |
| 18 | 172 | 453 | -001 | 169 | 097 | -143 | -138 | -004 | 278 |
| 19 | 370 | 081 | 108 | -046 | 007 | 297 | 204 | -210 | -130 |
| 20 | -208 | 097 | 179 | -026 | -163 | -174 | -376 | 104 | 494 |
| 21 | 413 | 049 | -044 | -138 | 090 | 312 | 320 | -286 | -241 |
| 22 | 014 | 170 | -161 | 338 | 146 | -059 | -038 | 041 | 003 |
| 23 | 357 | -055 | -139 | -104 | -109 | 339 | 273 | -295 | -184 |
| 24 | -042 | 154 | 010 | 158 | 198 | 038 | 015 | -005 | -027 |
| 25 | -182 | 189 | 130 | -064 | -017 | -150 | -299 | 229 | 282 |
| 26 | 043 | -213 | 113 | -202 | -091 | 125 | 171 | -169 | -141 |
| 27 | 131 | 160 | -028 | 020 | 133 | 141 | 043 | -027 | -005 |
| 28 | 606 | -083 | -346 | 142 | 252 | 611 | 676 | -582 | -472 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 29 | 338 | -168 | -161 | 093 | 003 | 385 | 396 | -427 | -226 |
| 30 | -585 | 047 | 250 | -134 | -268 | -475 | -619 | 561 | 374 |
| 31 | -348 | 129 | 163 | -054 | -109 | -382 | -445 | 387 | 352 |
| 32 | 360 | 100 | -262 | 322 | 167 | 275 | 382 | -217 | -391 |
| 33 | -002 | -204 | 104 | 057 | -140 | -137 | -015 | -065 | 109 |
| 34 | -315 | -023 | 205 | -206 | 075 | -244 | -325 | 044 | 463 |
| 35 | 386 | -033 | -023 | -045 | 055 | 362 | 336 | -257 | -273 |
| 36 | -195 | -078 | 194 | 072 | -165 | -268 | -158 | -012 | 257 |
| 37 | -028 | -100 | 188 | -039 | -026 | -079 | 025 | -167 | 091 |
| 38 | -394 | -105 | 290 | -127 | 030 | -340 | -279 | 030 | 367 |
| 39 | -153 | 164 | 119 | -083 | 030 | -021 | -045 | -118 | 170 |
| 40 | -522 | -019 | 184 | -134 | -122 | -326 | -444 | 314 | 345 |
| 41 | 505 | -052 | -322 | -010 | 056 | 494 | 534 | -334 | -518 |
| 42 | -174 | 118 | 203 | 020 | -059 | -289 | -326 | 057 | 431 |
| 43 | -269 | 074 | 228 | 031 | -046 | -388 | -326 | 212 | 312 |
| 44 | 255 | -048 | -266 | 057 | 006 | 297 | 316 | -017 | -457 |
| 45 | -209 | 054 | 255 | 018 | -004 | -283 | -306 | 051 | 401 |
| 46 | 064 | -131 | -087 | -103 | 022 | 134 | 235 | -003 | -341 |
| 47 | 108 | -138 | -123 | -045 | 020 | 154 | 261 | -029 | -359 |
| 48 | 171 | -078 | -247 | 022 | -031 | 411 | 324 | -047 | -464 |
| 49 | 457 | -097 | -249 | 106 | 025 | 377 | 411 | -235 | -413 |
| 50 | -033 | 089 | 144 | -001 | -044 | -042 | -018 | -028 | 052 |
| 51 | 098 | 168 | 077 | 021 | -068 | 146 | -029 | 028 | 063 |
| 52 | 226 | -185 | -298 | 164 | -025 | 436 | 315 | -271 | -255 |
| 53 | 193 | -016 | -102 | 067 | 034 | -103 | 121 | 025 | -237 |
| 54 | 390 | -167 | -219 | -123 | 000 | 484 | 382 | -296 | -330 |
| 55 | 247 | -003 | -088 | 061 | -147 | 231 | 176 | -025 | -243 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 56 | -497 | -017 | 299 | -127 | -100 | -422 | -440 | 348 | 341 |
| 57 | 296 | 071 | -101 | 104 | -023 | 216 | 155 | -040 | -171 |
| 58 | -347 | -197 | 104 | -123 | -119 | -250 | -237 | 109 | 263 |
| 59 | 161 | -032 | -080 | 084 | -094 | 181 | 153 | -073 | -173 |
| 60 | -438 | -181 | 237 | -095 | -117 | -337 | -356 | 115 | 445 |
| 61 | 466 | -047 | -122 | 095 | 109 | 325 | 422 | -423 | -242 |
| 62 | -259 | 156 | -022 | -036 | -025 | -224 | -305 | 155 | 352 |
| 63 | 071 | 081 | 029 | 183 | 221 | -110 | 090 | -006 | -153 |
| 64 | -394 | 067 | 270 | 018 | -166 | -430 | -464 | 327 | 399 |
| 65 | -252 | -154 | 063 | 034 | -137 | -174 | -083 | -027 | 156 |
| 66 | 550 | 015 | -303 | 073 | 000 | 544 | 420 | -206 | -442 |
| 67 | 213 | 249 | 043 | 145 | 096 | 059 | 091 | -142 | -017 |
| 68 | 248 | -028 | 018 | -053 | -083 | 043 | 134 | -138 | -059 |
| 69 | 260 | -082 | 001 | 057 | 125 | -000 | 186 | -215 | -046 |
| 70 | -056 | -115 | 122 | -084 | -115 | -075 | -202 | 044 | 270 |
| 71 | 150 | 076 | 143 | -082 | 051 | -056 | -044 | -026 | 173 |
| 72 | 202 | -133 | -207 | 078 | 116 | 433 | 372 | -217 | -362 |
| 73 | -280 | -039 | 059 | -095 | -204 | -185 | -315 | 219 | 279 |
| 74 | -048 | -134 | 089 | 029 | -075 | -058 | 098 | -143 | -021 |
| 75 | -217 | -120 | 134 | 004 | -075 | -199 | -072 | -008 | 108 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

## (DECIMALS OMITTED)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 11 | -058 | | | | | | | | |
| 12 | -073 | -054 | | | | | | | |
| 13 | -155 | -117 | 248 | | | | | | |
| 14 | -085 | -112 | 013 | 057 | | | | | |
| 15 | -129 | -288 | 245 | 296 | 079 | | | | |
| 16 | -216 | -033 | 210 | 285 | 061 | 071 | | | |
| 17 | 324 | -191 | 004 | -000 | -005 | 263 | 055 | | |
| 18 | 013 | 157 | 039 | 023 | 039 | -019 | -123 | 176 | |
| 19 | 292 | -111 | 230 | 039 | 077 | 024 | -067 | -036 | 044 |
| 20 | 011 | -049 | 062 | 040 | -084 | 124 | 112 | -018 | 142 |
| 21 | 483 | 167 | -086 | -102 | -173 | -047 | -201 | -053 | 072 |
| 22 | 012 | 920 | -096 | -116 | -101 | -222 | -006 | -140 | 016 |
| 23 | 900 | -001 | -061 | -138 | -120 | -172 | -170 | 220 | 014 |
| 24 | 281 | 033 | -180 | -045 | 055 | 077 | 005 | 242 | 176 |
| 25 | 026 | 029 | -336 | 000 | -023 | -065 | -024 | 217 | 330 |
| 26 | 531 | -179 | -287 | -301 | -000 | 077 | -088 | 351 | -144 |
| 27 | 099 | 220 | -372 | -222 | -184 | -296 | -180 | -007 | 313 |
| 28 | 253 | 135 | 292 | -008 | -362 | -174 | -124 | -222 | 013 |
| 29 | 251 | -026 | 190 | 054 | -182 | -042 | -045 | 051 | 028 |
| 30 | -107 | -140 | -182 | 035 | 266 | 249 | 036 | 328 | -021 |
| 31 | -315 | -162 | -136 | 054 | 144 | 081 | 174 | 191 | 096 |
| 32 | 128 | 275 | 132 | -429 | -152 | -308 | -105 | -290 | 092 |
| 33 | -083 | 091 | -386 | 187 | 030 | -517 | -071 | 026 | -018 |
| 34 | -155 | -193 | 127 | 350 | 072 | 613 | -097 | 199 | 121 |
| 35 | 231 | 030 | -061 | -421 | -065 | -224 | -179 | -264 | -094 |
| 36 | 134 | -155 | -047 | -172 | 003 | 011 | -071 | 391 | 066 |
| 37 | 150 | -067 | -290 | 016 | 028 | 275 | 029 | 279 | 130 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 38 | -054 | -269 | -149 | 275 | -020 | 479 | 039 | 234 | 024 |
| 39 | -062 | -048 | 188 | 233 | -055 | 439 | 071 | 118 | 056 |
| 40 | -248 | 096 | -285 | 270 | 183 | 279 | 203 | 183 | -129 |
| 41 | 364 | 089 | 115 | -037 | -236 | -263 | 019 | -036 | 048 |
| 42 | 208 | -302 | 052 | 082 | 093 | 185 | -190 | 213 | 203 |
| 43 | 089 | -356 | -151 | 091 | 129 | 283 | -102 | 114 | 041 |
| 44 | -075 | 348 | -174 | -193 | -002 | -412 | 201 | -226 | -223 |
| 45 | 132 | -276 | 134 | 041 | 070 | 273 | -245 | 180 | 209 |
| 46 | -126 | 026 | -112 | 046 | 228 | -009 | 261 | -097 | -250 |
| 47 | -102 | 123 | -123 | -015 | 225 | -106 | 219 | -138 | -248 |
| 48 | -032 | 207 | -057 | -119 | 038 | -295 | 250 | -059 | -218 |
| 49 | 444 | 219 | -031 | -424 | -264 | -437 | -080 | -133 | -034 |
| 50 | 048 | -062 | 157 | -263 | 064 | 193 | -076 | 234 | 167 |
| 51 | -137 | 201 | 070 | -298 | -287 | -000 | -036 | -130 | 172 |
| 52 | 169 | 010 | 046 | 014 | -103 | -205 | 053 | -216 | -180 |
| 53 | 123 | 129 | -236 | -261 | 033 | -328 | -035 | 019 | -094 |
| 54 | 584 | -068 | 069 | -063 | -107 | -191 | -024 | -033 | -084 |
| 55 | 241 | 278 | -290 | -414 | 043 | -544 | -069 | -107 | -037 |
| 56 | -194 | -249 | -098 | 280 | 392 | 489 | 225 | 169 | -114 |
| 57 | 049 | 413 | -184 | -394 | -181 | -688 | -175 | -244 | 089 |
| 58 | -228 | -135 | -200 | 584 | 008 | 093 | 138 | 184 | -085 |
| 59 | 089 | 349 | -203 | -356 | -105 | -554 | 045 | -133 | -060 |
| 60 | -223 | -087 | -002 | 469 | 112 | 355 | 026 | 340 | 044 |
| 61 | 355 | 215 | -029 | -323 | -219 | -164 | -270 | 134 | 373 |
| 62 | 028 | -119 | -088 | 052 | 150 | 119 | 024 | 180 | 167 |
| 63 | -188 | 289 | -190 | -158 | 246 | -067 | -181 | -204 | 136 |
| 64 | -155 | -005 | -230 | -098 | 318 | -060 | 097 | 169 | 087 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

## (DECIMALS OMITTED)

| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 65 | 066 | -047 | -233 | 003 | -082 | -051 | 080 | 276 | 010 |
| 66 | 195 | 223 | 154 | -258 | -162 | -559 | -023 | -379 | -148 |
| 67 | 192 | 025 | -040 | -085 | -032 | -186 | -041 | -173 | 208 |
| 68 | -029 | -212 | 013 | -164 | -134 | -189 | -005 | 019 | 098 |
| 69 | -000 | 126 | -109 | -138 | -113 | -128 | 050 | -043 | -010 |
| 70 | -024 | -118 | 054 | 253 | -160 | 253 | 002 | 166 | 037 |
| 71 | 078 | -153 | 093 | 006 | 042 | 185 | -016 | 226 | 341 |
| 72 | 023 | 291 | 023 | -150 | -067 | -311 | 030 | -277 | -239 |
| 73 | -002 | -103 | -077 | 204 | -094 | 157 | -044 | 483 | 194 |
| 74 | -015 | -032 | -012 | -008 | -055 | 116 | 308 | 251 | 008 |
| 75 | -062 | -088 | -073 | -061 | 082 | 293 | 185 | 289 | 001 |

| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|
| 20 | -037 | | | | | | | | |
| 21 | 266 | -175 | | | | | | | |
| 22 | -028 | -119 | 241 | | | | | | |
| 23 | 193 | -064 | 594 | 048 | | | | | |
| 24 | 220 | -058 | 165 | 077 | 263 | | | | |
| 25 | 001 | 145 | -066 | 002 | 020 | 537 | | | |
| 26 | 178 | -040 | 401 | -119 | 580 | 350 | 178 | | |
| 27 | -017 | 020 | 105 | 169 | 154 | 453 | 732 | 157 | |
| 28 | 170 | -232 | 404 | 093 | 360 | 112 | -295 | 004 | 073 |
| 29 | 054 | -218 | 350 | -029 | 350 | 162 | -181 | 141 | -026 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|
| 30 | -269 | 125 | -234 | -047 | -148 | 029 | 265 | 054 | -081 |
| 31 | -149 | 178 | -342 | -153 | -365 | -032 | 387 | -032 | 074 |
| 32 | 007 | -174 | 234 | 251 | 145 | 096 | -349 | -105 | 021 |
| 33 | -164 | -107 | -212 | 047 | -060 | -144 | 322 | -104 | 244 |
| 34 | 045 | 207 | -040 | -170 | -169 | 042 | 181 | -005 | -093 |
| 35 | 149 | 016 | 108 | 032 | 264 | 092 | -144 | 262 | 071 |
| 36 | -065 | 326 | -222 | -157 | -019 | -036 | 002 | 059 | -049 |
| 37 | -013 | 099 | 185 | -033 | 126 | 086 | 230 | 417 | 133 |
| 38 | 106 | 318 | -083 | -229 | -175 | 071 | 212 | 191 | -027 |
| 39 | 138 | 152 | 064 | 010 | -060 | -150 | -236 | -003 | -259 |
| 40 | -210 | 044 | -222 | 142 | -239 | -028 | 214 | 061 | -127 |
| 41 | 059 | -314 | 478 | 100 | 533 | 185 | -216 | 155 | 075 |
| 42 | 210 | 355 | -063 | -276 | -013 | 124 | 175 | 086 | 029 |
| 43 | 087 | 258 | -065 | -294 | -103 | 144 | 163 | 110 | -106 |
| 44 | -209 | -353 | 079 | 329 | 106 | -133 | -173 | -018 | -014 |
| 45 | 144 | 239 | -007 | -269 | -040 | 131 | 133 | 044 | 023 |
| 46 | 024 | -262 | -009 | 044 | 002 | 073 | -053 | 119 | -120 |
| 47 | -033 | -301 | 013 | 127 | 041 | 044 | -091 | 091 | -125 |
| 48 | -169 | -377 | 082 | 238 | 138 | -018 | -164 | -002 | 002 |
| 49 | 029 | -143 | 255 | 182 | 543 | -013 | -112 | 190 | 219 |
| 50 | -050 | 057 | 070 | -038 | -024 | 060 | 088 | 045 | 072 |
| 51 | -048 | 131 | 012 | 138 | -069 | -051 | 038 | -036 | 211 |
| 52 | 119 | -016 | 109 | 036 | 159 | 075 | -090 | 015 | 165 |
| 53 | -067 | -195 | -003 | 143 | 065 | -081 | -138 | -022 | -171 |
| 54 | 134 | -118 | 400 | -065 | 758 | 082 | -000 | 335 | 229 |
| 55 | -103 | -197 | 278 | 293 | 329 | 030 | 072 | 312 | 251 |
| 56 | 060 | 217 | -263 | -198 | -274 | 018 | 119 | 138 | -312 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

## (DECIMALS OMITTED)

| | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|---|---|
| 57 | -223 | -144 | 066 | 355 | 124 | -094 | 164 | -109 | 446 |
| 58 | -161 | 044 | -240 | -112 | -222 | -176 | 263 | -167 | -021 |
| 59 | -204 | -162 | 123 | 349 | 172 | -058 | 084 | 065 | 295 |
| 60 | -146 | 102 | -245 | -067 | -257 | -106 | 265 | -106 | -080 |
| 61 | 111 | -060 | 396 | 148 | 439 | 188 | 086 | 302 | 370 |
| 62 | 040 | 324 | -177 | -104 | -045 | 173 | 086 | 064 | 047 |
| 63 | -147 | -149 | -011 | 214 | -137 | 069 | 013 | -080 | 143 |
| 64 | -019 | 290 | -216 | 007 | -228 | -034 | 158 | 048 | -021 |
| 65 | -121 | 059 | -148 | -052 | -003 | 047 | 118 | -003 | 103 |
| 66 | 059 | -206 | 326 | 186 | 296 | -067 | -225 | -006 | 177 |
| 67 | 272 | 031 | 317 | 007 | 114 | 190 | 015 | 115 | 163 |
| 68 | 244 | 005 | -065 | -198 | -055 | -090 | 083 | 026 | 173 |
| 69 | 025 | -144 | 084 | 078 | 049 | 059 | -022 | 057 | 146 |
| 70 | 143 | 246 | 013 | -080 | -039 | 011 | 239 | -029 | 044 |
| 71 | 163 | 165 | -024 | -200 | -005 | 062 | 223 | 110 | 209 |
| 72 | -064 | -173 | 091 | 264 | 133 | -023 | -128 | 027 | 230 |
| 73 | -080 | 108 | -158 | -088 | -007 | 016 | 327 | -008 | 112 |
| 74 | -093 | 015 | -024 | -026 | 007 | 029 | -040 | 162 | -110 |
| 75 | -143 | 055 | -122 | -083 | -085 | 020 | -026 | 193 | -146 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

## (DECIMALS OMITTED)

| | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|---|---|
| 29 | 704 | | | | | | | | |
| 30 | -735 | -209 | | | | | | | |
| 31 | -591 | -387 | 357 | | | | | | |
| 32 | 605 | 433 | -426 | -551 | | | | | |
| 33 | -200 | -138 | 056 | 177 | -321 | | | | |
| 34 | -270 | -116 | 350 | 225 | -534 | -108 | | | |
| 35 | 356 | 260 | -245 | -307 | 392 | -238 | -209 | | |
| 36 | -196 | -055 | 119 | 211 | -093 | 081 | 014 | -192 | |
| 37 | -251 | -216 | 092 | 205 | -382 | 072 | 247 | -084 | 013 |
| 38 | -398 | -406 | 191 | 264 | -518 | 015 | 479 | -313 | 006 |
| 39 | -033 | -141 | -060 | 096 | -303 | -256 | 356 | -078 | -122 |
| 40 | -586 | -430 | 443 | 409 | -622 | 208 | 376 | -252 | -177 |
| 41 | 611 | 588 | -254 | -478 | 509 | -115 | -373 | 304 | -225 |
| 42 | -235 | -049 | 218 | 077 | -107 | -044 | 221 | -131 | 282 |
| 43 | -372 | -096 | 370 | 300 | -295 | -102 | 315 | -116 | 321 |
| 44 | 213 | 101 | -157 | -118 | 183 | 119 | -392 | 256 | -280 |
| 45 | -182 | -042 | 134 | 073 | -019 | -129 | 219 | -217 | 319 |
| 46 | 022 | 012 | -049 | -012 | -125 | 021 | -016 | 105 | -213 |
| 47 | 071 | 039 | -081 | -068 | -042 | 064 | -085 | 165 | -201 |
| 48 | 232 | 147 | -130 | -058 | 169 | 021 | -387 | 119 | -185 |
| 49 | 441 | 213 | -307 | -403 | 524 | 009 | -548 | 393 | -066 |
| 50 | -018 | -045 | 052 | 033 | 036 | -166 | 204 | 020 | 399 |
| 51 | 202 | 112 | -186 | -066 | 283 | -273 | -130 | 296 | -009 |
| 52 | 405 | 403 | -176 | -273 | 361 | -059 | -281 | 276 | -198 |
| 53 | -101 | -233 | -074 | -061 | 099 | 267 | -304 | 025 | 152 |
| 54 | 400 | 278 | -187 | -330 | 139 | 025 | -182 | 195 | -180 |
| 55 | 171 | 291 | -009 | -148 | 375 | 159 | -469 | 335 | -124 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
|---|---|---|---|---|---|---|---|---|---|
| 56 | -626 | -428 | 420 | 467 | -678 | -117 | 474 | -234 | 061 |
| 57 | 258 | 163 | -172 | -145 | 496 | 342 | -514 | 294 | -100 |
| 58 | -449 | -357 | 289 | 355 | -748 | 556 | 397 | -513 | 007 |
| 59 | 181 | 289 | -012 | -157 | 465 | 234 | -476 | 277 | -124 |
| 60 | -350 | -079 | 385 | 217 | -523 | 477 | 494 | -375 | 154 |
| 61 | 574 | 430 | -432 | -344 | 381 | -008 | -177 | 272 | 028 |
| 62 | -154 | -020 | 117 | 119 | -024 | -186 | 095 | -057 | 446 |
| 63 | -048 | -082 | 071 | -158 | 158 | 141 | -072 | -002 | -055 |
| 64 | -535 | -265 | 426 | 311 | -190 | 119 | 045 | -100 | 271 |
| 65 | -138 | 006 | -017 | 015 | -048 | 173 | -119 | -103 | 267 |
| 66 | 544 | 345 | -443 | -389 | 603 | 005 | -626 | 312 | -111 |
| 67 | 270 | 228 | -263 | -118 | 338 | -023 | -106 | 042 | 016 |
| 68 | 141 | 063 | -235 | 100 | 068 | 074 | -153 | 133 | 024 |
| 69 | 046 | 028 | -100 | 000 | -023 | 086 | -042 | -110 | -026 |
| 70 | -058 | -078 | 093 | 130 | -364 | 054 | 545 | -125 | -028 |
| 71 | -127 | -137 | -056 | 063 | -089 | -046 | 061 | -030 | 020 |
| 72 | 411 | 175 | -293 | -399 | 308 | 066 | -322 | 274 | -275 |
| 73 | -287 | -165 | 343 | 151 | -426 | 244 | 265 | -231 | 139 |
| 74 | -056 | 208 | 174 | -107 | -019 | 020 | 016 | 001 | 088 |
| 75 | -214 | 095 | 282 | -021 | -115 | -058 | 197 | -018 | 201 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS (DECIMALS OMITTED)

| | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| 38 | 522 | | | | | | | | |
| 39 | 280 | 380 | | | | | | | |
| 40 | 470 | 452 | 344 | | | | | | |
| 41 | -086 | -448 | -113 | -378 | | | | | |
| 42 | -059 | 382 | -030 | -258 | -344 | | | | |
| 43 | 044 | 386 | -025 | 026 | -392 | 613 | | | |
| 44 | -092 | -559 | -114 | 179 | 336 | -876 | -539 | | |
| 45 | 042 | 428 | -030 | -285 | -272 | 812 | 507 | -923 | |
| 46 | 108 | -243 | 002 | 374 | 154 | -669 | -281 | 683 | -770 |
| 47 | 047 | -355 | -068 | 327 | 190 | -712 | -327 | 756 | -806 |
| 48 | 006 | -502 | 000 | 145 | 418 | -830 | -563 | 850 | -775 |
| 49 | -188 | -430 | -328 | -421 | 567 | -222 | -356 | 325 | -210 |
| 50 | 106 | -115 | -093 | -174 | -108 | 055 | 101 | -115 | 143 |
| 51 | -128 | -126 | -016 | -242 | 116 | -004 | -064 | -040 | 112 |
| 52 | -169 | -166 | -148 | -299 | 372 | 025 | -000 | 074 | -083 |
| 53 | 019 | -214 | -220 | 076 | -020 | -226 | -244 | 346 | -266 |
| 54 | -038 | -283 | -107 | -251 | 526 | -224 | -296 | 269 | -254 |
| 55 | -058 | -443 | -316 | -164 | 417 | -232 | -268 | 450 | -304 |
| 56 | 307 | 492 | 331 | 648 | -542 | 085 | 359 | -143 | 036 |
| 57 | -231 | -485 | -425 | -298 | 372 | -248 | -396 | 380 | -244 |
| 58 | 354 | 443 | 180 | 590 | -358 | -039 | 089 | -065 | -060 |
| 59 | -143 | -473 | -314 | -117 | 444 | -299 | -375 | 477 | -366 |
| 60 | 123 | 299 | 114 | 407 | -353 | 183 | 185 | -238 | 104 |
| 61 | 185 | -154 | -073 | -365 | 440 | -170 | -327 | 140 | -085 |
| 62 | -031 | 092 | -060 | -095 | -141 | 436 | 410 | -392 | 363 |
| 63 | -018 | -026 | -120 | 075 | 062 | -118 | -146 | 140 | -100 |
| 64 | -078 | 123 | -069 | 181 | -320 | 261 | 398 | -134 | 142 |
| 65 | 183 | 129 | -017 | 152 | 065 | 052 | -004 | -094 | 135 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS (DECIMALS OMITTED)

| | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
|---|---|---|---|---|---|---|---|---|---|
| 66 | -418 | -650 | -379 | -622 | 477 | -194 | -402 | 349 | -188 |
| 67 | -021 | 068 | -095 | -315 | 091 | 299 | 126 | -250 | 347 |
| 68 | 090 | 146 | 054 | -234 | 036 | 125 | -041 | -163 | 157 |
| 69 | 058 | -124 | -083 | -073 | 064 | -148 | -092 | 160 | -130 |
| 70 | 218 | 354 | 184 | 185 | -194 | 128 | 090 | -209 | 069 |
| 71 | 191 | 249 | 021 | -168 | -101 | 337 | 147 | -384 | 373 |
| 72 | -259 | -403 | -213 | -194 | 259 | -376 | -379 | 454 | -470 |
| 73 | 125 | 218 | 058 | 210 | -176 | 059 | 028 | -130 | 072 |
| 74 | 239 | -055 | 000 | 218 | 128 | -103 | -039 | 138 | -203 |
| 75 | 303 | 042 | -003 | 333 | -067 | -006 | 108 | 016 | -088 |

| | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---|---|---|---|---|---|---|---|---|---|
| 47 | 978 | | | | | | | | |
| 48 | 638 | 687 | | | | | | | |
| 49 | -070 | 018 | 244 | | | | | | |
| 50 | -078 | -045 | 016 | -072 | | | | | |
| 51 | -331 | -305 | -137 | 331 | 017 | | | | |
| 52 | 037 | 054 | 197 | 288 | -145 | -104 | | | |
| 53 | 163 | 232 | 186 | 211 | 060 | -295 | -419 | | |
| 54 | 125 | 154 | 294 | 667 | -063 | -080 | 272 | -021 | |
| 55 | 157 | 217 | 403 | 497 | -121 | 155 | 367 | 031 | 281 |
| 56 | 281 | 184 | -128 | -577 | -018 | -242 | -370 | -081 | -319 |
| 57 | -104 | -007 | 275 | 598 | -111 | 376 | 259 | 090 | 238 |
| 58 | 122 | 069 | -012 | -515 | -108 | -455 | -232 | 026 | -170 |
| 59 | 131 | 196 | 405 | 543 | -182 | 270 | 366 | 034 | 244 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---|---|---|---|---|---|---|---|---|---|
| 60 | -053 | -082 | -278 | -417 | 044 | -168 | -253 | -108 | -219 |
| 61 | -049 | -018 | 087 | 412 | 113 | 196 | 167 | -002 | 311 |
| 62 | -171 | -216 | -365 | -160 | -010 | 143 | -032 | -157 | -230 |
| 63 | 070 | 108 | 017 | 066 | -006 | -127 | -072 | 309 | -041 |
| 64 | -100 | -106 | -231 | -155 | -050 | 101 | -189 | 020 | -310 |
| 65 | -038 | -070 | -046 | 009 | -082 | 095 | -059 | 019 | -130 |
| 66 | -075 | 017 | 314 | 537 | 013 | 189 | 353 | 106 | 375 |
| 67 | -325 | -332 | -303 | 093 | -005 | 094 | 154 | -022 | -012 |
| 68 | -165 | -205 | -138 | 054 | -039 | 121 | 097 | 009 | -105 |
| 69 | 086 | 107 | 087 | 173 | -050 | 070 | -071 | 203 | 043 |
| 70 | -103 | -165 | -216 | -244 | 157 | 016 | -170 | -190 | -027 |
| 71 | -258 | -323 | -375 | -026 | -022 | 242 | -190 | -173 | -064 |
| 72 | 276 | 344 | 465 | 417 | 019 | 073 | 478 | -082 | 375 |
| 73 | -191 | -208 | -109 | -231 | 129 | -076 | -300 | 008 | -023 |
| 74 | 289 | 251 | 077 | 003 | -061 | 090 | -104 | 052 | -052 |
| 75 | 279 | 237 | -054 | -116 | 091 | 057 | -237 | 077 | -140 |

| | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |
|---|---|---|---|---|---|---|---|---|---|
| 56 | -328 | | | | | | | | |
| 57 | 709 | -626 | | | | | | | |
| 58 | -379 | 417 | -326 | | | | | | |
| 59 | 822 | -466 | 853 | -345 | | | | | |
| 60 | -307 | 254 | -191 | 570 | -164 | | | | |
| 61 | 332 | -529 | 357 | -382 | 273 | -115 | | | |
| 62 | -129 | 162 | -184 | -113 | -154 | 010 | -097 | | |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |
|---|---|---|---|---|---|---|---|---|---|
| 63 | 115 | -129 | 144 | -120 | 121 | -012 | 159 | -078 | |
| 64 | -035 | 222 | 001 | 017 | 073 | 228 | -239 | 360 | 061 |
| 65 | 060 | 064 | 071 | 184 | 158 | 078 | 054 | 285 | -047 |
| 66 | 496 | -686 | 553 | -501 | 478 | -487 | 269 | -226 | 042 |
| 67 | 134 | -239 | 104 | -252 | 056 | -218 | 235 | 118 | -006 |
| 68 | 057 | -177 | 128 | -032 | 023 | -182 | 163 | 104 | -095 |
| 69 | 040 | -157 | 012 | -056 | 043 | -134 | 055 | -074 | 038 |
| 70 | -300 | 216 | -222 | 420 | -308 | 398 | 008 | -062 | -213 |
| 71 | -151 | 062 | -035 | -029 | -141 | 114 | 102 | 156 | -163 |
| 72 | 376 | -372 | 391 | -240 | 393 | -263 | 179 | -259 | 146 |
| 73 | -215 | 200 | -085 | 476 | -225 | 504 | 019 | -020 | -105 |
| 74 | 011 | 054 | -112 | 016 | 213 | 181 | 007 | 084 | 047 |
| 75 | -081 | 266 | -222 | 027 | 048 | 224 | -101 | 220 | 093 |

| | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
|---|---|---|---|---|---|---|---|---|---|
| 65 | 112 | | | | | | | | |
| 66 | -288 | -174 | | | | | | | |
| 67 | 010 | 018 | 222 | | | | | | |
| 68 | -096 | 101 | 042 | 258 | | | | | |
| 69 | -090 | -116 | 149 | -041 | 159 | | | | |
| 70 | -157 | -027 | -325 | -128 | 111 | -069 | | | |
| 71 | 130 | 091 | -133 | -006 | 219 | 157 | 035 | | |
| 72 | -197 | -175 | 493 | -126 | -206 | 019 | -231 | -272 | |
| 73 | 108 | 082 | -319 | -198 | -090 | -169 | 384 | 223 | -186 |

## APPENDIX B-1

## INTERCORRELATIONS OF THE VARIABLES DESCRIPTIVE OF THE SCHOOL DISTRICTS

(DECIMALS OMITTED)

| | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 |
|---|---|---|---|---|---|---|---|---|---|
| 74 | 132 | 178 | -140 | -089 | -126 | 175 | -114 | 074 | -055 |
| 75 | 138 | 231 | -293 | -149 | -193 | 139 | -032 | 073 | -145 |

| | 73 | 74 |
|---|---|---|
| 74 | -080 | |
| 75 | 008 | 857 |

## APPENDIX B-2

### 22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 894 | 684 | 224 | 221 | 013 | 171 | 066 | 081 | 295 | 027 | 129 |
| 2 | 822 | 067 | 152 | 332 | 141 | 000 | 514 | 251 | 164 | 074 | 145 |
| 3 | 717 | 369 | 085 | 087 | 165 | 119 | 033 | 078 | 181 | 169 | 131 |
| 4 | 801 | 134 | 031 | 237 | 158 | 004 | 193 | 239 | 113 | 145 | 369 |
| 5 | 771 | 137 | 056 | 123 | 175 | 118 | 417 | 004 | 231 | 011 | 252 |
| 6 | 782 | 638 | 074 | 378 | 022 | 133 | 108 | 091 | 165 | 179 | 126 |
| 7 | 938 | 697 | 032 | 444 | 030 | 056 | 049 | 117 | 379 | 091 | 096 |
| 8 | 876 | 422 | 220 | 458 | 130 | 128 | 057 | 315 | 308 | 104 | 171 |
| 9 | 872 | 667 | 164 | 271 | 057 | 073 | 035 | 142 | 263 | 009 | 018 |
| 10 | 895 | 298 | 397 | 178 | 565 | 165 | 092 | 228 | 108 | 312 | 012 |
| 11 | 918 | 307 | 206 | 424 | 057 | 229 | 525 | 167 | 137 | 160 | 113 |
| 12 | 822 | 053 | 194 | 387 | 485 | 016 | 010 | 202 | 259 | 129 | 188 |
| 13 | 879 | 354 | 124 | 411 | 161 | 382 | 139 | 146 | 257 | 046 | 388 |
| 14 | 831 | 250 | 192 | 105 | 054 | 319 | 069 | 334 | 027 | 087 | 213 |
| 15 | 864 | 546 | 086 | 502 | 065 | 205 | 294 | 146 | 227 | 018 | 049 |
| 16 | 872 | 078 | 327 | 133 | 097 | 135 | 108 | 248 | 100 | 261 | 107 |
| 17 | 852 | 345 | 103 | 074 | 529 | 146 | 070 | 280 | 105 | 299 | 129 |
| 18 | 846 | 091 | 344 | 223 | 129 | 199 | 442 | 203 | 015 | 075 | 060 |
| 19 | 799 | 082 | 336 | 342 | 043 | 006 | 127 | 307 | 105 | 124 | 050 |
| 20 | 816 | 368 | 269 | 121 | 009 | 048 | 024 | 081 | 180 | 201 | 158 |
| 21 | 794 | 412 | 249 | 252 | 339 | 032 | 266 | 182 | 083 | 160 | 065 |
| 22 | 905 | 277 | 224 | 359 | 008 | 169 | 489 | 106 | 173 | 180 | 151 |
| 23 | 942 | 445 | 267 | 228 | 601 | 098 | 068 | 197 | 202 | 272 | 026 |
| 24 | 846 | 036 | 211 | 004 | 405 | 089 | 370 | 153 | 105 | 035 | 380 |
| 25 | 918 | 271 | 077 | 352 | 534 | 343 | 134 | 123 | 099 | 222 | 089 |

## APPENDIX B-2

22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | 823 | 092 | 157 | -202 | 705 | 338 | 015 | -230 | -027 | 105 | -012 |
| 27 | 914 | 191 | 199 | 392 | 446 | -402 | 192 | -062 | 025 | 273 | 077 |
| 28 | 936 | 757 | 283 | -354 | -129 | -139 | 087 | 212 | 074 | -013 | 087 |
| 29 | 874 | 496 | 250 | -246 | 081 | 136 | -102 | 345 | 258 | -027 | 255 |
| 30 | 851 | -568 | -212 | 275 | 214 | 235 | -116 | -088 | 305 | -145 | 033 |
| 31 | 788 | -555 | -186 | 237 | 062 | -084 | -049 | -166 | -070 | 225 | -157 |
| 32 | 889 | 714 | 287 | 212 | -289 | 237 | 137 | 155 | 013 | -073 | 080 |
| 33 | 920 | -056 | -270 | 323 | 295 | -510 | -408 | 075 | -289 | -092 | 227 |
| 34 | 836 | -625 | 038 | -358 | 079 | -139 | 245 | 059 | 186 | -025 | -001 |
| 35 | 757 | 490 | 122 | -020 | 056 | 261 | 071 | -137 | 039 | 287 | -190 |
| 36 | 849 | -268 | 238 | 203 | 124 | 297 | -255 | 245 | -218 | -294 | -131 |
| 37 | 840 | -268 | -076 | -237 | 571 | -062 | 254 | 071 | -250 | 190 | -053 |
| 38 | 887 | -670 | 186 | -236 | 180 | -186 | 093 | -069 | -140 | 243 | 116 |
| 39 | 747 | -285 | -043 | -442 | -081 | -085 | 320 | 054 | 102 | 138 | -187 |
| 40 | 912 | -538 | -641 | -035 | 259 | -054 | 186 | -020 | 075 | 127 | 052 |
| 41 | 797 | 724 | 069 | -183 | 195 | 057 | -024 | 155 | 191 | -059 | 072 |
| 42 | 890 | -461 | 732 | 116 | -025 | 090 | -165 | -081 | -004 | -043 | 223 |
| 43 | 825 | -547 | 364 | 036 | 017 | 279 | -102 | -205 | -007 | 045 | 254 |
| 44 | 951 | 572 | -744 | 057 | 067 | 030 | 065 | -022 | 018 | 002 | -140 |
| 45 | 938 | -445 | 785 | 088 | -079 | 037 | -084 | -021 | -065 | -083 | 124 |
| 46 | 928 | 196 | -757 | -282 | 154 | 225 | 120 | -094 | -039 | 151 | 085 |
| 47 | 931 | 291 | -775 | -208 | 131 | 218 | 113 | -088 | -040 | 066 | 077 |
| 48 | 919 | 529 | -676 | -076 | 089 | 035 | 004 | -035 | 127 | -003 | -127 |
| 49 | 840 | 732 | 147 | 181 | 197 | 067 | -129 | 020 | 028 | -057 | -164 |

## APPENDIX B-2

### 22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 50 | 839 | -078 | 149 | -012 | 063 | 129 | 154 | 062 | -027 | -326 | -326 |
| 51 | 831 | 179 | 312 | 295 | -107 | 068 | 195 | 326 | 188 | 387 | -417 |
| 52 | 867 | 460 | 137 | -071 | -067 | -019 | -260 | -077 | 323 | 305 | 432 |
| 53 | 884 | 157 | -298 | 167 | 076 | 084 | -014 | -087 | -589 | -480 | -143 |
| 54 | 849 | 538 | 057 | -264 | 388 | -076 | -191 | -191 | 250 | -147 | -056 |
| 55 | 846 | 590 | -108 | 421 | 317 | 126 | -104 | -110 | 163 | 159 | 049 |
| 56 | 839 | -720 | -321 | -217 | 072 | 226 | 110 | -233 | 020 | 145 | -006 |
| 57 | 931 | 608 | -010 | 635 | 099 | -232 | -127 | 096 | 088 | 120 | -104 |
| 58 | 931 | -566 | -401 | -170 | 186 | -513 | -247 | 041 | -090 | -054 | 128 |
| 59 | 909 | 585 | -183 | 513 | 217 | 066 | -141 | 186 | 192 | 218 | 049 |
| 60 | 848 | -574 | -154 | -027 | 175 | -288 | -156 | 349 | 135 | -176 | 119 |
| 61 | 817 | 520 | 314 | -032 | 389 | -163 | 251 | 243 | -061 | -055 | -082 |
| 62 | 776 | -309 | 337 | 195 | 009 | 375 | -007 | 125 | 049 | 103 | 183 |
| 63 | 729 | 120 | -167 | 256 | -027 | 000 | 323 | 001 | -293 | -210 | 275 |
| 64 | 757 | -402 | -017 | 479 | 058 | 315 | -081 | -020 | 009 | 078 | 066 |
| 65 | 778 | -129 | 018 | 174 | 268 | 080 | -202 | 378 | -108 | 131 | 099 |
| 66 | 852 | 792 | 134 | 165 | -178 | -032 | -183 | -089 | 048 | -070 | -055 |
| 67 | 776 | 161 | 509 | 113 | -020 | -013 | 123 | -106 | -161 | 085 | 294 |
| 68 | 816 | 069 | 304 | 018 | 006 | -174 | -150 | -001 | -375 | 401 | -186 |
| 69 | 836 | 158 | -063 | -001 | 102 | -023 | 110 | 120 | -381 | 063 | -047 |
| 70 | 796 | -354 | 078 | -268 | 162 | -425 | 028 | 081 | 173 | 017 | -210 |
| 71 | 794 | -207 | 404 | 007 | 161 | -063 | 080 | 135 | -157 | 225 | -220 |
| 72 | 788 | 600 | -248 | 037 | -075 | -080 | -043 | -045 | 240 | 071 | 118 |
| 73 | 773 | -400 | -028 | 031 | 312 | -361 | -124 | 143 | 189 | -293 | -251 |

## APPENDIX B-2

22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 74 | 895 | -024 | -223 | -093 | 280 | 434 | 042 | 594 | -085 | 128 | 098 |
| 75 | 909 | -222 | -215 | -072 | 276 | 532 | 104 | 524 | -101 | 053 | 049 |
| % COMMON VARIANCE | 100.000 | 22.727 | 11.111 | 8.141 | 7.002 | 5.379 | 4.588 | 4.306 | 4.162 | 3.663 | 3.527 |
| % TOTAL VARIANCE | 85.045 | 19.328 | 9.449 | 6.924 | 5.955 | 4.574 | 3.902 | 3.662 | 3.540 | 3.115 | 3.000 |

| VARIABLE | FACTORS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 1 | 112 | 082 | 288 | 118 | 071 | -029 | -070 | 069 | 207 | -042 | -081 | 019 |
| 2 | 159 | 281 | 192 | 003 | -168 | -016 | -169 | -157 | 101 | 126 | -182 | 047 |
| 3 | -174 | -365 | 257 | 251 | -082 | -037 | 157 | -068 | -282 | 158 | -022 | -061 |
| 4 | 022 | 206 | -260 | 165 | 077 | -046 | 197 | 371 | 301 | -066 | -134 | -034 |
| 5 | 106 | -190 | -070 | -230 | 159 | 146 | 011 | -222 | -195 | -164 | 253 | -261 |
| 6 | 118 | -021 | 060 | 055 | 012 | 067 | -042 | -041 | -013 | 153 | -224 | 100 |
| 7 | 041 | -122 | -087 | -004 | 020 | 027 | 057 | 019 | 017 | -009 | 141 | -154 |
| 8 | 145 | 144 | -003 | -251 | -106 | -065 | -116 | 136 | 050 | 090 | -002 | 086 |
| 9 | -132 | 050 | 173 | 257 | 096 | 033 | -008 | -184 | -082 | -107 | 174 | 137 |
| 10 | -167 | 213 | 001 | 067 | 119 | 066 | -020 | 005 | 006 | -017 | 006 | 055 |

## APPENDIX B-2

22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 11 | -279 | 114 | -024 | 146 | 204 | -038 | 037 | 064 | -110 | -060 | -048 | 071 |
| 12 | 176 | 085 | 212 | 067 | 097 | 051 | 301 | 020 | -073 | 058 | 190 | 030 |
| 13 | 061 | 238 | 226 | 001 | 031 | 076 | -089 | -092 | -019 | 036 | -046 | -014 |
| 14 | 187 | -058 | 355 | 199 | -137 | 274 | 327 | 004 | -047 | -052 | 084 | 170 |
| 15 | -006 | -177 | -109 | -190 | -049 | 008 | 098 | 028 | 012 | -000 | -024 | 070 |
| 16 | 153 | 416 | -021 | 021 | 256 | -078 | 320 | 020 | 021 | 276 | 231 | -220 |
| 17 | 193 | 192 | -134 | -081 | -124 | 005 | 208 | 121 | -129 | -167 | -012 | -008 |
| 18 | 318 | 172 | 248 | 074 | -170 | 170 | 029 | -128 | 282 | -070 | -035 | -097 |
| 19 | 063 | 194 | 259 | 284 | 095 | 026 | 014 | 384 | -238 | 074 | -068 | 084 |
| 20 | -140 | 080 | -097 | 366 | 321 | 206 | -118 | -154 | 299 | 137 | 141 | -072 |
| 21 | -273 | 029 | 165 | 014 | -069 | -285 | -016 | -159 | -070 | 066 | -105 | -095 |
| 22 | -344 | 126 | -086 | 139 | 180 | -124 | 074 | 157 | -184 | -068 | -052 | 069 |
| 23 | -152 | 177 | 054 | -004 | 117 | 059 | -047 | -079 | 023 | -049 | 068 | 017 |
| 24 | 404 | 033 | -198 | -100 | 076 | -044 | -062 | 143 | -203 | 115 | 105 | -035 |
| 25 | 401 | -080 | -039 | -041 | 092 | -046 | -041 | 024 | -044 | 150 | 059 | -029 |
| 26 | -134 | -072 | -091 | -051 | 027 | -071 | 098 | 057 | -070 | -054 | 005 | -111 |
| 27 | 315 | -137 | -151 | -080 | 148 | 030 | -022 | -121 | -022 | 067 | -054 | 093 |
| 28 | 068 | -020 | -067 | 097 | -079 | -011 | -139 | -015 | -072 | -045 | 041 | -049 |
| 29 | 120 | -085 | 137 | 080 | -268 | -242 | -107 | 014 | -033 | -147 | 063 | -062 |
| 30 | -003 | -168 | 122 | -195 | -060 | -178 | 079 | 073 | 190 | -037 | 069 | 021 |
| 31 | 217 | 176 | -085 | 057 | -035 | -233 | 135 | -153 | 083 | -174 | 042 | -210 |
| 32 | -020 | -013 | -085 | -045 | -142 | 018 | 020 | 089 | 011 | 090 | 101 | -001 |
| 33 | -034 | -054 | 212 | 147 | 001 | 015 | -027 | -007 | -021 | 014 | -067 | -024 |
| 34 | 013 | -308 | 083 | 115 | 020 | -119 | -127 | -050 | 064 | -113 | 154 | 044 |
| 35 | -090 | -246 | -028 | 167 | -031 | 192 | -233 | 267 | 083 | -066 | 090 | -080 |

## APPENDIX B-2

## 22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 36 | 145 | 032 | -260 | 382 | 068 | 004 | -017 | -204 | -076 | -073 | -069 | -023 |
| 37 | -203 | 064 | -128 | 021 | -112 | 000 | 204 | -111 | 223 | 086 | -104 | 097 |
| 38 | -305 | 004 | -170 | -117 | -022 | 102 | 120 | 036 | 062 | 077 | 062 | -028 |
| 39 | -348 | 221 | -014 | 092 | -175 | 109 | 112 | -113 | 010 | -162 | -091 | -059 |
| 40 | -255 | 067 | -010 | -032 | -058 | 026 | -022 | 000 | 017 | 059 | 037 | 042 |
| 41 | 047 | 148 | 111 | -188 | -198 | 012 | -042 | -057 | 036 | -009 | 072 | -032 |
| 42 | -043 | -034 | 092 | 003 | 084 | 002 | 017 | 070 | 059 | 018 | -029 | 073 |
| 43 | 038 | -090 | -047 | 062 | 085 | -190 | -153 | 022 | 150 | -154 | -192 | -173 |
| 44 | 038 | 075 | 007 | 077 | -015 | -025 | -076 | 016 | 025 | -059 | 008 | -113 |
| 45 | -065 | -051 | -022 | -124 | -054 | -029 | 152 | -036 | -089 | 068 | -010 | 103 |
| 46 | 238 | 010 | 057 | 154 | -016 | 056 | -115 | 009 | -048 | -035 | 023 | 055 |
| 47 | 208 | -021 | 050 | 190 | 006 | 050 | -116 | 011 | -042 | -062 | 018 | 046 |
| 48 | 164 | 145 | -142 | 068 | -123 | -035 | 161 | -107 | -048 | -034 | -070 | -005 |
| 49 | -144 | 037 | -016 | -158 | 245 | 141 | 033 | 048 | 086 | 009 | 140 | -022 |
| 50 | 330 | -311 | -259 | 346 | -020 | -187 | 237 | -116 | 023 | 206 | -051 | 076 |
| 51 | -096 | -067 | 020 | -112 | 089 | -049 | -113 | 071 | -141 | 034 | -111 | -081 |
| 52 | 013 | -051 | -184 | 128 | -020 | -003 | 164 | 030 | 222 | -111 | -074 | 149 |
| 53 | -074 | 159 | 013 | -018 | 056 | 036 | -160 | 112 | 014 | 140 | 173 | -027 |
| 54 | 004 | 004 | 093 | -095 | 243 | 174 | 058 | -141 | 128 | 041 | 146 | -024 |
| 55 | -127 | -021 | 087 | 064 | -200 | -100 | 153 | -001 | 035 | -097 | 027 | 049 |
| 56 | -028 | 087 | -021 | 077 | 028 | 062 | 016 | 071 | -035 | 004 | -001 | -031 |
| 57 | -058 | -101 | 086 | -005 | -085 | 042 | 032 | -001 | -014 | -022 | 056 | -033 |
| 58 | -023 | 094 | -013 | 031 | -012 | -027 | -068 | -055 | 019 | 065 | -094 | 034 |
| 59 | -142 | -047 | 138 | -002 | -110 | -053 | 113 | -022 | -012 | -008 | 088 | -010 |
| 60 | 015 | -253 | 239 | 101 | -040 | 023 | -001 | 131 | -082 | -047 | -009 | -009 |

## APPENDIX B-2

22 UNROTATED PRINCIPAL AXES FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 61 | 042 | -091 | -054 | 154 | -203 | 158 | 050 | 013 | 052 | -133 | 058 | -068 |
| 62 | 173 | 234 | -108 | 122 | 078 | 185 | -310 | -143 | -081 | -179 | -001 | 140 |
| 63 | -046 | -335 | 088 | -098 | -114 | 276 | 057 | -019 | 224 | 076 | 126 | 120 |
| 64 | -046 | 032 | 198 | 147 | 109 | 130 | 025 | 079 | -075 | -135 | -073 | -343 |
| 65 | -093 | 254 | -244 | -037 | -231 | 266 | -125 | -086 | -302 | 130 | -013 | 201 |
| 66 | 046 | 025 | 083 | 025 | 117 | -142 | 078 | -086 | -059 | 164 | -069 | 059 |
| 67 | -084 | 192 | 095 | 156 | -220 | -219 | -016 | -081 | -020 | 324 | 108 | -187 |
| 68 | 092 | 227 | -019 | 069 | -270 | -112 | 049 | 158 | 026 | -144 | 284 | 223 |
| 69 | 064 | 055 | 177 | -153 | 438 | -416 | 043 | -118 | -022 | -321 | 055 | 262 |
| 70 | -003 | -105 | -072 | 222 | 047 | -183 | -176 | 288 | 076 | 075 | 259 | 099 |
| 71 | 182 | 096 | 302 | -253 | 186 | 239 | 204 | 130 | -051 | -118 | -209 | 025 |
| 72 | 023 | -298 | -144 | 101 | 258 | 171 | 138 | -040 | -046 | 050 | -159 | 080 |
| 73 | 158 | -015 | -029 | -065 | -058 | 144 | -019 | 265 | -021 | 020 | -109 | -160 |
| 74 | 000 | 004 | 280 | -085 | 115 | -104 | -071 | 018 | 120 | 212 | -080 | -001 |
| 75 | 015 | -121 | 167 | -070 | 097 | -061 | -131 | 013 | 121 | 181 | -053 | 140 |
| % COMMON VARIANCE | 3.163 | 2.949 | 2.606 | 2.425 | 2.339 | 2.067 | 1.929 | 1.768 | 1.707 | 1.605 | 1.436 | 1.401 |
| % TOTAL VARIANCE | 2.690 | 2.508 | 2.216 | 2.062 | 1.989 | 1.758 | 1.640 | 1.503 | 1.452 | 1.365 | 1.221 | 1.191 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 842 | 687 | 108 | 215 | 210 | -117 | -115 | -062 | 008 | -065 | -197 |
| 2 | 761 | -246 | -035 | -023 | -023 | -248 | -095 | -187 | 105 | 127 | -036 |
| 3 | 608 | -186 | -209 | 050 | -120 | 081 | 415 | 175 | -047 | -178 | 009 |
| 4 | 687 | 123 | -096 | 040 | -176 | -068 | -144 | 020 | 095 | 648 | -062 |
| 5 | 574 | 370 | -029 | -232 | -146 | -168 | 017 | -025 | 247 | 133 | -088 |
| 6 | 698 | 536 | 295 | 148 | 274 | -119 | -130 | -162 | -011 | -214 | 253 |
| 7 | 894 | 819 | 221 | 087 | 110 | -141 | 031 | 051 | 009 | -072 | -083 |
| 8 | 858 | -820 | 042 | -031 | -152 | -105 | -208 | -171 | 069 | -007 | -053 |
| 9 | 805 | -444 | -368 | -088 | -085 | 325 | 130 | 095 | -037 | 080 | 161 |
| 10 | 891 | 128 | -149 | 052 | 893 | -069 | 002 | -030 | 046 | 011 | -089 |
| 11 | 895 | 024 | 186 | 255 | -027 | -017 | 005 | -031 | 038 | 827 | -057 |
| 12 | 777 | 256 | -096 | -242 | -057 | -069 | -276 | -038 | -420 | -021 | 323 |
| 13 | 875 | 048 | -019 | -423 | -045 | 601 | -143 | -031 | -114 | -026 | 278 |
| 14 | 790 | -308 | 081 | -064 | -051 | -010 | 003 | -005 | -049 | -076 | 040 |
| 15 | 858 | -170 | -154 | -713 | -039 | -086 | 202 | 216 | -097 | -061 | 336 |
| 16 | 694 | -068 | 243 | -065 | -133 | .010 | 018 | 193 | -060 | 069 | 142 |
| 17 | 808 | -259 | -133 | -161 | 333 | 204 | 137 | 252 | 096 | -041 | 004 |
| 18 | 751 | 124 | -226 | 024 | -037 | 079 | 045 | 059 | 252 | 109 | 015 |
| 19 | 725 | 266 | -126 | -230 | 232 | -092 | 004 | -087 | 056 | 008 | 007 |
| 20 | 682 | -142 | -256 | -104 | -016 | -005 | 078 | -013 | -010 | 017 | 105 |
| 21 | 765 | 273 | -020 | 057 | 605 | -080 | 181 | 012 | -013 | 126 | 068 |
| 22 | 859 | -052 | 187 | 205 | 050 | -033 | 041 | -035 | 014 | 853 | -025 |
| 23 | 935 | 189 | 029 | 121 | 934 | -042 | -004 | -009 | 054 | -021 | -015 |
| 24 | 780 | 003 | -037 | -207 | 265 | -164 | -070 | 086 | 721 | 159 | 118 |
| 25 | 889 | -257 | -080 | 112 | 010 | 275 | 131 | -037 | 809 | -044 | 056 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | 803 | -050 | -003 | 010 | 613 | -210 | 385 | 205 | 258 | -155 | 005 |
| 27 | 898 | 124 | -056 | 351 | 049 | 054 | 107 | -131 | 806 | 044 | 045 |
| 28 | 925 | 797 | 104 | 085 | 184 | -160 | -255 | -042 | -051 | 102 | 243 |
| 29 | 844 | 431 | -004 | 173 | 240 | 002 | -289 | 334 | -060 | -026 | 445 |
| 30 | 808 | -804 | -093 | -029 | 031 | 182 | 005 | 216 | 050 | -069 | 107 |
| 31 | 705 | -499 | 007 | -046 | -303 | 140 | 262 | -130 | 204 | -210 | -089 |
| 32 | 870 | 404 | -064 | 384 | 013 | -528 | -326 | 019 | -115 | 278 | 083 |
| 33 | 915 | -001 | 028 | 420 | -092 | 753 | 053 | -036 | 146 | -001 | -302 |
| 34 | 794 | -173 | -127 | -595 | -073 | 331 | 188 | 151 | 069 | -062 | 258 |
| 35 | 731 | 251 | 193 | 209 | 121 | -456 | -050 | 041 | 038 | -048 | 111 |
| 36 | 832 | -081 | -256 | -000 | 019 | 053 | -087 | 149 | -049 | -095 | -264 |
| 37 | 763 | 013 | 050 | -181 | 165 | 124 | 777 | 160 | 170 | -011 | -073 |
| 38 | 873 | -161 | -403 | -441 | -069 | 175 | 599 | -067 | 110 | -043 | 040 |
| 39 | 709 | -31 | 059 | -426 | 002 | -004 | 502 | -084 | -356 | 065 | 205 |
| 40 | 905 | -522 | 372 | -263 | -102 | 310 | 474 | 134 | 009 | 120 | -011 |
| 41 | 790 | 429 | 227 | 302 | 437 | -141 | -176 | 124 | -044 | -021 | 195 |
| 42 | 880 | -148 | -859 | -140 | 069 | 025 | -093 | 014 | 089 | -093 | 056 |
| 43 | 712 | -345 | -495 | -310 | -009 | -040 | -066 | 107 | 183 | -159 | 027 |
| 44 | 934 | 061 | 875 | 314 | 030 | -056 | -066 | 021 | -067 | 139 | -131 |
| 45 | 915 | -082 | -916 | -146 | 007 | -051 | 041 | -061 | 030 | -104 | 058 |
| 46 | 921 | 013 | 870 | -143 | -007 | -002 | 028 | 209 | 090 | -087 | -013 |
| 47 | 923 | 034 | 893 | -059 | 011 | -006 | -034 | 185 | 056 | -012 | -054 |
| 48 | 911 | 075 | 846 | 243 | 091 | -069 | 005 | -102 | -062 | 039 | 057 |
| 49 | 812 | 302 | 067 | 539 | 429 | -294 | -161 | -009 | 010 | 104 | -139 |
| 50 | 787 | 020 | -015 | -127 | -007 | -080 | 000 | -033 | 063 | -005 | 015 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 51 | 791 | 049 | -180 | 319 | -180 | -403 | 017 | 208 | 016 | 067 | 184 |
| 52 | 778 | 294 | 019 | 275 | 110 | -110 | -162 | -185 | 122 | 050 | 535 |
| 53 | 833 | 006 | 221 | 072 | 074 | 027 | -075 | 017 | -141 | 124 | -825 |
| 54 | 809 | 286 | 207 | 187 | 707 | 030 | -117 | -121 | 069 | -144 | 084 |
| 55 | 832 | -036 | 234 | 765 | 257 | -171 | 061 | 015 | 086 | 093 | 148 |
| 56 | 837 | -531 | 134 | -554 | -103 | 062 | 311 | 067 | -007 | -126 | -000 |
| 57 | 926 | 117 | 093 | 887 | -025 | -026 | -108 | -104 | 118 | 152 | 022 |
| 58 | 917 | -215 | 111 | -275 | -144 | 780 | 232 | -108 | 050 | -103 | -123 |
| 59 | 901 | 005 | 232 | 853 | 079 | -082 | -012 | 182 | 037 | 156 | 177 |
| 60 | 829 | -243 | -134 | -166 | -152 | 739 | 037 | 261 | -020 | 024 | 149 |
| 61 | 789 | 559 | 011 | 264 | 290 | -042 | 163 | 050 | 186 | 159 | 087 |
| 62 | 718 | -156 | -302 | -158 | -015 | -183 | -201 | 220 | 182 | -081 | 006 |
| 63 | 643 | 096 | 052 | 098 | -171 | -020 | 045 | 069 | 113 | 265 | -211 |
| 64 | 611 | -506 | -195 | 156 | -120 | -002 | -012 | 221 | 029 | 040 | -092 |
| 65 | 629 | -022 | -077 | 148 | -026 | 100 | 186 | 193 | 038 | -052 | -058 |
| 66 | 814 | 381 | 089 | 555 | 182 | -239 | -372 | -189 | -091 | 043 | -011 |
| 67 | 624 | 241 | -408 | 156 | 074 | -134 | 058 | -068 | 077 | -097 | 025 |
| 68 | 664 | 260 | -207 | 210 | -223 | -071 | 243 | -132 | 072 | -257 | -110 |
| 69 | 660 | 180 | 023 | 092 | -008 | -029 | 064 | 312 | 170 | 029 | -390 |
| 70 | 708 | -037 | -060 | -329 | -015 | 423 | 118 | -073 | 096 | 041 | 155 |
| 71 | 733 | 079 | -407 | -012 | -001 | -045 | 164 | 179 | 199 | -198 | -080 |
| 72 | 752 | 290 | 398 | 311 | 067 | -110 | -202 | -162 | 097 | 191 | 248 |
| 73 | 734 | -277 | -069 | -131 | 088 | 511 | -013 | -074 | 111 | -017 | -017 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | COMMUNALITY | FACTORS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 74 | 829 | 012 | 152 | 021 | 021 | 026 | 064 | 880 | -040 | 001 | -008 |
| 75 | 839 | -137 | 110 | -139 | -025 | -026 | 083 | 865 | -009 | -029 | -053 |
| % COMMON VARIANCE | 100.000 | 12.544 | 11.810 | 11.279 | 7.455 | 7.224 | 5.307 | 4.812 | 4.788 | 4.521 | 4.341 |
| % TOTAL VARIANCE | 79.816 | 10.012 | 9.426 | 9.003 | 5.950 | 5.766 | 4.236 | 3.841 | 3.822 | 3.608 | 3.465 |

| VARIABLE | FACTORS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 1 | 172 | -076 | -065 | -013 | -273 | -020 | 010 | 283 |
| 2 | 730 | -052 | 056 | 022 | -076 | -074 | -114 | 021 |
| 3 | -014 | 187 | 196 | 244 | -243 | -252 | -043 | 111 |
| 4 | -112 | 104 | -130 | 125 | 220 | 199 | -040 | 163 |
| 5 | 077 | -137 | -078 | 160 | -153 | -039 | -004 | -406 |
| 6 | -021 | -095 | -007 | -122 | -138 | 001 | 070 | 107 |
| 7 | -260 | -018 | -219 | 011 | -045 | 015 | -023 | 024 |
| 8 | 214 | -068 | -088 | -045 | 031 | -033 | 078 | 011 |
| 9 | 252 | 088 | 467 | 015 | 015 | 021 | -017 | -040 |
| 10 | -025 | 072 | 037 | 019 | 096 | -032 | -035 | 132 |
| 11 | 211 | -072 | 106 | -068 | -123 | -043 | -007 | -146 |
| 12 | 173 | 136 | -004 | 048 | -220 | 298 | 295 | 043 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 13 | 094 | -351 | 031 | 035 | 052 | 268 | -067 | -063 |
| 14 | 111 | 047 | 005 | 803 | -069 | 013 | -004 | 088 |
| 15 | 001 | 097 | -106 | -047 | -030 | -039 | 181 | -131 |
| 16 | -119 | -077 | 078 | 030 | 066 | 705 | 076 | 085 |
| 17 | 085 | 399 | -200 | -057 | 359 | 178 | 274 | 072 |
| 18 | 729 | 133 | 039 | 116 | 087 | -012 | 151 | 016 |
| 19 | 062 | -133 | 069 | 202 | -196 | 024 | 007 | 638 |
| 20 | 030 | 082 | 732 | -096 | 099 | 036 | 052 | 045 |
| 21 | 181 | -032 | -182 | -097 | -277 | -132 | -299 | -000 |
| 22 | 096 | -062 | 024 | -085 | -118 | -033 | -055 | -073 |
| 23 | 016 | 006 | 004 | -050 | 028 | -039 | -006 | 030 |
| 24 | 078 | 030 | -157 | 109 | 097 | 019 | -084 | 082 |
| 25 | 164 | 052 | 073 | -048 | -021 | -013 | 092 | 061 |
| 26 | -233 | 090 | -068 | 041 | 008 | -086 | -040 | 152 |
| 27 | 143 | 024 | 097 | -117 | -034 | -044 | 087 | -118 |
| 28 | 065 | -003 | -124 | -192 | 014 | -082 | -089 | 027 |
| 29 | 047 | 087 | -267 | -098 | 074 | -065 | -252 | 099 |
| 30 | -073 | 084 | -128 | 090 | -056 | -062 | 028 | -090 |
| 31 | 120 | 157 | 099 | -054 | -024 | 306 | -105 | 081 |
| 32 | 069 | 040 | -196 | 019 | 108 | -107 | -060 | -031 |
| 33 | -130 | -078 | 020 | 119 | 044 | -028 | -070 | 007 |
| 34 | 087 | 118 | 117 | -083 | -230 | -221 | -018 | -037 |
| 35 | -143 | -062 | 168 | -017 | -008 | -441 | 087 | 299 |
| 36 | -044 | 636 | 324 | 033 | 336 | 079 | -118 | -025 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 37 | 019 | 075 | -025 | -019 | 111 | 044 | 010 | 013 |
| 38 | -148 | -185 | 066 | -017 | 110 | 002 | 052 | 018 |
| 39 | 223 | -116 | 101 | -100 | 038 | 049 | 048 | 026 |
| 40 | -038 | -213 | 050 | 014 | 070 | -020 | -011 | -077 |
| 41 | 147 | -132 | -313 | -096 | 126 | 025 | -011 | -051 |
| 42 | -026 | 013 | 146 | 140 | 036 | -019 | -073 | 133 |
| 43 | -151 | 055 | 149 | 094 | 001 | -040 | -315 | 132 |
| 44 | -025 | -053 | -091 | -038 | -052 | 003 | -013 | -019 |
| 45 | 046 | 111 | -015 | 068 | 063 | 007 | -032 | -013 |
| 46 | -088 | -079 | -025 | 223 | -012 | 033 | -106 | 081 |
| 47 | -102 | -035 | -022 | 227 | -033 | -006 | -114 | 050 |
| 48 | -023 | 109 | -190 | 000 | 042 | 205 | -009 | -082 |
| 49 | -127 | -073 | 024 | -123 | -012 | -014 | 238 | -073 |
| 50 | 066 | 853 | 013 | 012 | -135 | -072 | 040 | -040 |
| 51 | 204 | -032 | 222 | -442 | -076 | -110 | 264 | 053 |
| 52 | -353 | -131 | -011 | 096 | 089 | 143 | -208 | 062 |
| 53 | -015 | 082 | -143 | 091 | 072 | -100 | -010 | 021 |
| 54 | -102 | -075 | 026 | 000 | -131 | 045 | 184 | -133 |
| 55 | -032 | -013 | -116 | 086 | 014 | -073 | -145 | 075 |
| 56 | -078 | -065 | 162 | 185 | 026 | 072 | -011 | 146 |
| 57 | 081 | -039 | 003 | -100 | 005 | -154 | 101 | -058 |
| 58 | -109 | -113 | 010 | -092 | 092 | 126 | -032 | -045 |
| 59 | -029 | -085 | -039 | -011 | 051 | -025 | -030 | -048 |
| 60 | -032 | 092 | 014 | 046 | 004 | -140 | 179 | -015 |

## APPENDIX B-3

18 VARIMAX ROTATED FACTORS

(DECIMALS OMITTED)

| VARIABLE | FACTORS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 61 | 230 | 235 | -088 | -045 | 151 | -247 | 139 | 053 |
| 62 | 157 | 009 | 405 | 069 | 428 | 074 | -178 | 023 |
| 63 | 049 | -050 | -179 | 444 | -005 | -354 | 032 | -312 |
| 64 | 010 | -010 | 320 | 304 | 091 | 001 | 017 | 118 |
| 65 | -006 | -047 | 096 | -083 | 696 | 052 | -005 | -065 |
| 66 | -021 | 027 | -065 | -058 | -224 | 109 | -084 | -025 |
| 67 | 236 | -056 | -070 | 080 | 026 | 018 | -462 | 207 |
| 68 | 092 | -013 | -092 | -159 | 133 | 125 | -031 | 468 |
| 69 | -013 | -012 | -032 | -172 | -435 | 323 | -083 | -061 |
| 70 | -024 | 136 | 100 | -406 | -127 | -171 | 134 | 321 |
| 71 | 235 | -115 | 072 | 063 | -078 | 176 | 526 | 149 |
| 72 | -322 | -007 | 116 | 107 | -161 | -041 | 110 | -230 |
| 73 | 090 | 186 | -079 | -185 | 164 | -119 | 466 | 084 |
| 74 | -021 | -039 | 003 | -001 | 072 | 129 | 027 | -017 |
| 75 | -050 | 079 | 048 | 030 | 106 | -015 | 030 | -070 |
| % COMMON VARIANCE | 3.877 | 3.411 | 3.373 | 3.340 | 3.288 | 3.005 | 2.847 | 2.778 |
| % TOTAL VARIANCE | 3.094 | 2.722 | 2.693 | 2.666 | 2.625 | 2.399 | 2.272 | 2.217 |

## APPENDIX B-4

### FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 45.8574 | 37.3762 | 55.8717 | 55.1188 | 46.6183 | 51.1082 | 45.1550 |
| 2 | 57.5041 | 36.2110 | 46.3689 | 59.7025 | 47.3684 | 49.4831 | 51.7650 |
| 3 | 48.2470 | 32.8050 | 47.1574 | 60.6083 | 42.6565 | 54.4246 | 52.5894 |
| 4 | 38.1193 | 36.1960 | 52.1470 | 45.7632 | 40.7173 | 50.6703 | 45.4489 |
| 7 | 50.8524 | 41.8520 | 58.3059 | 57.0702 | 46.5640 | 57.5490 | 51.3482 |
| 8 | 41.0430 | 40.8380 | 63.3989 | 46.4219 | 52.2382 | 54.1467 | 49.4674 |
| 9 | 43.7246 | 43.4335 | 45.9704 | 50.5053 | 38.3466 | 47.0118 | 43.7703 |
| 10 | 36.3557 | 45.0831 | 51.8877 | 47.1060 | 38.4866 | 51.4228 | 39.1702 |
| 11 | 52.5012 | 40.2323 | 51.9360 | 62.4604 | 42.8767 | 54.8246 | 59.0434 |
| 12 | 52.3017 | 36.8783 | 60.6613 | 46.1055 | 51.0066 | 54.3023 | 55.3119 |
| 13 | 36.7566 | 37.4191 | 60.3613 | 45.8937 | 42.6243 | 50.3162 | 47.6916 |
| 14 | 51.8280 | 40.8502 | 67.4825 | 48.4686 | 47.9172 | 56.3964 | 57.2028 |
| 15 | 57.9061 | 45.2320 | 63.6525 | 44.6789 | 46.1573 | 54.4769 | 52.0615 |
| 16 | 40.6336 | 43.7370 | 60.7943 | 45.0084 | 48.8836 | 42.2738 | 39.0041 |
| 17 | 48.5696 | 43.8531 | 57.3095 | 53.8238 | 46.3182 | 47.0094 | 65.7887 |
| 18 | 49.9545 | 37.1969 | 42.5566 | 48.1188 | 47.2993 | 44.5954 | 59.2767 |
| 19 | 50.5682 | 44.0801 | 39.6989 | 61.9618 | 45.4642 | 40.1234 | 48.4363 |
| 20 | 57.2338 | 42.8622 | 57.2645 | 40.4172 | 53.9948 | 51.7340 | 47.2522 |
| 22 | 61.9800 | 39.2701 | 67.7044 | 41.5386 | 52.6035 | 58.4715 | 46.1073 |
| 23 | 52.6978 | 44.0808 | 63.1847 | 51.1023 | 46.9513 | 54.1285 | 45.0082 |
| 24 | 54.6016 | 46.9403 | 45.4221 | 65.8280 | 46.8908 | 43.8605 | 44.4933 |
| 25 | 27.7332 | 41.4725 | 46.2614 | 47.8724 | 38.0615 | 33.1115 | 43.5382 |
| 26 | 29.5685 | 41.5882 | 41.0006 | 51.6850 | 43.1236 | 29.8031 | 62.1567 |
| 27 | 44.9005 | 41.0549 | 41.1832 | 50.5386 | 48.9810 | 48.6795 | 43.2328 |
| 28 | 52.5645 | 40.8717 | 39.0960 | 50.9318 | 44.6438 | 49.4659 | 47.4567 |
| 29 | 27.7217 | 48.3056 | 43.6835 | 56.7428 | 54.9625 | 42.6699 | 47.7378 |
| 30 | 49.2622 | 46.9903 | 51.6951 | 53.5415 | 66.0350 | 55.0058 | 40.6132 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 31 | 52.2695 | 42.5460 | 41.6169 | 50.1904 | 56.8297 | 43.0279 | 47.4253 |
| 32 | 45.6853 | 55.5911 | 47.3010 | 52.3049 | 50.6032 | 41.3092 | 50.2842 |
| 33 | 60.0205 | 54.0685 | 52.2764 | 40.8633 | 44.1187 | 47.1038 | 51.1333 |
| 34 | 62.0285 | 55.9183 | 52.2528 | 41.3125 | 44.0415 | 47.7582 | 47.1524 |
| 35 | 58.6115 | 58.5355 | 55.9949 | 39.2706 | 49.1060 | 43.4795 | 46.9268 |
| 36 | 66.3938 | 56.8723 | 45.1303 | 42.3222 | 49.0436 | 34.0026 | 45.3961 |
| 37 | 63.4166 | 53.6056 | 50.4975 | 42.1809 | 47.4307 | 38.3382 | 49.4367 |
| 38 | 62.7735 | 56.1497 | 49.1732 | 48.8545 | 45.2328 | 54.7492 | 43.2451 |
| 39 | 52.9833 | 56.1530 | 64.7660 | 111.1679 | 58.2009 | 46.7306 | 46.3889 |
| 40 | 62.0302 | 58.5375 | 62.2849 | 66.0032 | 54.4194 | 61.8223 | 54.2161 |
| 41 | 57.7632 | 60.7178 | 52.4786 | 59.2896 | 47.9450 | 43.3794 | 47.1331 |
| 42 | 56.2630 | 59.2912 | 54.6639 | 41.6597 | 43.2245 | 41.3157 | 51.5455 |
| 43 | 66.4253 | 60.7082 | 39.9449 | 46.8421 | 47.1484 | 32.2399 | 47.1761 |
| 44 | 62.9132 | 62.5857 | 47.5397 | 49.0122 | 46.5570 | 39.3210 | 42.1370 |
| 45 | 59.3458 | 58.2862 | 58.1047 | 49.0832 | 51.4245 | 34.6837 | 47.0002 |
| 46 | 32.3129 | 63.3479 | 58.4590 | 43.9883 | 41.0000 | 48.5389 | 43.4641 |
| 47 | 46.3595 | 60.5546 | 49.0146 | 49.7225 | 38.1470 | 58.1175 | 45.8138 |
| 48 | 44.7203 | 59.4312 | 41.8965 | 44.2179 | 55.3082 | 33.4636 | 50.6781 |
| 49 | 31.9712 | 65.5606 | 38.5370 | 46.6734 | 48.7666 | 64.2567 | 50.4203 |
| 50 | 33.9051 | 64.0613 | 39.4884 | 46.9367 | 54.4777 | 72.7564 | 32.8229 |
| 51 | 57.0316 | 50.4341 | 46.2347 | 42.4979 | 82.5316 | 79.1688 | 33.4622 |
| 52 | 59.8683 | 61.0204 | 38.4460 | 52.4145 | 53.5549 | 65.3792 | 47.6232 |
| 53 | 62.4050 | 46.3905 | 38.2749 | 45.0259 | 49.4998 | 60.4421 | 50.6721 |
| 54 | 60.3274 | 34.0497 | 40.2275 | 43.9818 | 47.7278 | 61.5940 | 69.1590 |
| 55 | 48.9262 | 40.6751 | 42.8532 | 49.0906 | 53.0510 | 51.0838 | 44.9507 |
| 56 | 53.5258 | 40.7324 | 37.2416 | 41.0074 | 59.8089 | 49.2318 | 58.6146 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 57 | 57.6874 | 41.1119 | 35.8663 | 59.7935 | 49.2944 | 51.8799 | 46.6232 |
| 58 | 39.2500 | 39.7697 | 43.2495 | 48.3907 | 40.8229 | 57.1285 | 58.9210 |
| 59 | 58.9068 | 35.3668 | 39.8358 | 51.1527 | 42.9772 | 61.8559 | 48.1528 |
| 60 | 55.7073 | 32.8882 | 36.1499 | 50.7450 | 49.7353 | 60.0922 | 46.5487 |
| 61 | 64.0418 | 62.5869 | 67.1376 | 60.5118 | 51.1901 | 49.0297 | 42.5013 |
| 62 | 42.9244 | 62.7316 | 54.8831 | 44.4014 | 52.6931 | 39.3492 | 41.7373 |
| 63 | 58.2550 | 54.4616 | 56.3136 | 37.5860 | 47.7554 | 52.8316 | 40.0537 |
| 64 | 28.2126 | 56.4405 | 82.4285 | 45.2778 | 52.8094 | 58.8053 | 46.9240 |
| 65 | 57.8784 | 56.6640 | 46.1872 | 45.0942 | 50.4549 | 48.0400 | 53.3593 |
| 66 | 39.0576 | 61.5893 | 42.6535 | 51.0610 | 44.4110 | 41.2489 | 52.6428 |
| 67 | 48.2480 | 55.3759 | 52.6366 | 47.4505 | 57.5877 | 42.3564 | 62.7585 |
| 68 | 51.5172 | 57.7030 | 49.1109 | 74.3629 | 52.9750 | 54.3040 | 50.0018 |
| 69 | 48.8610 | 53.7148 | 70.2606 | 44.2458 | 61.1529 | 49.2705 | 58.7717 |
| 70 | 51.5056 | 64.0520 | 38.7020 | 61.9643 | 40.6156 | 46.4917 | 55.5720 |
| 71 | 50.5927 | 56.8000 | 44.9334 | 52.8663 | 48.5646 | 43.5795 | 52.8923 |
| 72 | 49.1714 | 59.2795 | 43.3522 | 44.8849 | 48.8612 | 51.5106 | 49.5167 |
| 75 | 59.6037 | 57.3522 | 51.6677 | 35.2054 | 42.9815 | 42.2827 | 52.9452 |
| 76 | 52.2231 | 57.7315 | 52.3918 | 41.4708 | 52.9192 | 42.5217 | 45.6117 |
| 78 | 51.4380 | 41.7562 | 66.8361 | 37.3027 | 61.0044 | 58.1540 | 48.4827 |
| 79 | 46.2310 | 64.1848 | 55.5716 | 47.7274 | 57.5002 | 56.7810 | 117.3360 |
| 80 | 56.5986 | 54.7728 | 26.2252 | 46.8322 | 43.4191 | 68.1223 | 55.1107 |
| 82 | 40.8424 | 38.3689 | 38.4115 | 48.2161 | 113.9387 | 26.6065 | 50.0596 |
| 84 | 28.3249 | 72.6954 | 41.7359 | 49.0608 | 53.7987 | 61.5770 | 50.2743 |
| 85 | 37.1096 | 66.7806 | 41.1062 | 51.1884 | 51.3039 | 73.6425 | 50.2093 |
| 86 | 44.5479 | 43.2866 | 55.5980 | 48.2793 | 44.2433 | 42.1792 | 48.5880 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | 53.3682 | 55.1015 | 42.6022 | 30.9457 | 43.6382 | 53.9247 | 60.7235 |
| 2 | 49.8676 | 49.4482 | 50.0945 | 48.8137 | 45.2171 | 51.2264 | 58.8768 |
| 3 | 51.5868 | 54.0678 | 45.7726 | 36.7328 | 45.9083 | 37.6740 | 57.4127 |
| 4 | 55.3393 | 39.3339 | 56.0403 | 53.0724 | 56.4297 | 56.6917 | 51.6779 |
| 7 | 55.2631 | 46.2397 | 51.6157 | 59.5480 | 55.4341 | 50.2977 | 54.1306 |
| 8 | 43.9846 | 47.4711 | 31.3168 | 46.2602 | 45.1652 | 52.2730 | 90.6816 |
| 9 | 44.5427 | 66.4956 | 58.2319 | 40.0154 | 49.0652 | 40.7386 | 50.2962 |
| 10 | 48.2419 | 47.7804 | 43.2451 | 43.5536 | 46.2080 | 51.7785 | 58.1050 |
| 11 | 49.0880 | 60.9422 | 52.4874 | 41.1619 | 44.8726 | 45.4940 | 46.3971 |
| 12 | 48.2868 | 52.9114 | 44.2701 | 48.9957 | 55.4135 | 43.3702 | 44.9006 |
| 13 | 60.8597 | 40.1434 | 26.7826 | 41.9415 | 44.2528 | 54.7886 | 46.4409 |
| 14 | 45.5596 | 48.2062 | 48.9496 | 55.3737 | 47.1812 | 53.3616 | 41.8451 |
| 15 | 50.7133 | 48.8938 | 58.2104 | 47.9539 | 43.4135 | 37.1996 | 47.2680 |
| 16 | 39.8625 | 45.8542 | 42.5864 | 42.9825 | 49.0677 | 51.9571 | 39.7482 |
| 17 | 49.2874 | 40.6899 | 33.0563 | 41.2986 | 58.1494 | 60.9735 | 51.0543 |
| 18 | 51.4135 | 50.9101 | 60.0222 | 41.6759 | 55.1699 | 64.2874 | 50.6112 |
| 19 | 50.2943 | 51.5199 | 45.0296 | 45.5312 | 44.8881 | 54.3248 | 51.0752 |
| 20 | 55.3124 | 52.3597 | 47.0263 | 70.1547 | 59.8375 | 47.5170 | 51.2008 |
| 22 | 51.6880 | 48.0017 | 63.1583 | 53.3858 | 50.1105 | 37.4866 | 52.5887 |
| 23 | 46.6077 | 50.6646 | 58.2079 | 63.7658 | 41.9873 | 54.5968 | 43.9392 |
| 24 | 48.6740 | 46.5032 | 54.8839 | 62.7312 | 42.9076 | 55.6950 | 43.9103 |
| 25 | 47.8566 | 45.9434 | 57.9284 | 46.1461 | 36.4940 | 32.8575 | 39.5045 |
| 26 | 53.2668 | 46.8926 | 52.8233 | 49.1699 | 46.7886 | 52.9594 | 38.8154 |
| 27 | 53.7513 | 51.1016 | 54.9061 | 78.4779 | 55.8001 | 49.7930 | 65.2942 |
| 28 | 57.0191 | 45.8751 | 46.4907 | 63.9609 | 43.1939 | 59.1334 | 44.4246 |
| 29 | 50.8485 | 46.7650 | 35.1958 | 50.5670 | 61.2891 | 17.4850 | 47.0614 |
| 30 | 46.1334 | 43.9483 | 45.2207 | 49.1842 | 104.3342 | 62.6723 | 54.3046 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 31 | 43.4333 | 57.6387 | 44.7213 | 46.0820 | 72.1043 | 35.8986 | 44.5521 |
| 32 | 52.0542 | 48.5979 | 30.6480 | 51.0449 | 82.2270 | 50.1165 | 45.2891 |
| 33 | 62.3085 | 41.4012 | 46.0763 | 61.2873 | 46.0462 | 44.1981 | 43.0992 |
| 34 | 58.5238 | 48.9026 | 42.9439 | 49.8457 | 47.4486 | 54.2663 | 48.2373 |
| 35 | 58.3394 | 45.8851 | 47.6819 | 68.5226 | 52.4376 | 48.6202 | 48.7062 |
| 36 | 57.2014 | 41.9166 | 37.6227 | 46.5303 | 44.9160 | 51.7470 | 49.4884 |
| 37 | 1.0759 | 42.3038 | 45.4118 | 44.8711 | 47.4582 | 49.0956 | 47.8474 |
| 38 | -7.2938 | 44.4282 | 48.6044 | 48.0514 | 47.5882 | 50.2234 | 45.8794 |
| 39 | 56.3071 | 41.4299 | 49.6280 | 42.0387 | 45.2061 | 51.2021 | 51.7940 |
| 40 | 58.4200 | 39.7638 | 47.5351 | 56.5510 | 64.2720 | 33.1828 | 46.5476 |
| 41 | 50.3066 | 45.6563 | 48.4721 | 40.8853 | 50.2024 | 45.2812 | 52.8475 |
| 42 | 56.8042 | 35.1550 | 42.9253 | 54.4397 | 46.7610 | 54.5891 | 46.1617 |
| 43 | 50.5579 | 42.8518 | 48.1258 | 45.9425 | 49.3768 | 50.3325 | 53.9001 |
| 44 | 59.9447 | 42.1835 | 66.3882 | 34.8073 | 54.6787 | 52.6627 | 55.5198 |
| 45 | 58.4288 | 44.2705 | 77.7561 | 34.3222 | 52.5299 | 44.9935 | 59.1868 |
| 46 | 48.3900 | 41.8773 | 53.1840 | 64.5275 | 50.0191 | 44.3723 | 37.3734 |
| 47 | 46.0746 | 44.4697 | 54.0017 | 55.8878 | 53.3216 | 40.9838 | 39.5822 |
| 48 | 57.9161 | 52.8643 | 56.9769 | 39.7546 | 52.4498 | 54.3268 | 65.3545 |
| 49 | 54.6009 | 45.1773 | 53.5676 | 48.8460 | 48.9116 | 42.6210 | 31.0529 |
| 50 | 53.2159 | 51.9256 | 52.5797 | 39.2965 | 51.8862 | 59.9278 | 31.5243 |
| 51 | 56.6300 | 39.8653 | 18.6514 | 38.5929 | 24.5987 | 48.2840 | 45.5026 |
| 52 | 52.2327 | 51.8635 | 55.3319 | 45.6360 | 48.9134 | 40.5612 | 47.8603 |
| 53 | 53.3860 | 48.0144 | 42.7286 | 45.2931 | 37.0755 | 68.4398 | 46.8141 |
| 54 | 54.2333 | 55.5544 | 53.4741 | 41.7265 | 55.5542 | 45.5585 | 41.9769 |
| 55 | 53.9928 | 48.5610 | 45.0620 | 57.1998 | 48.3075 | 77.5827 | 50.4021 |
| 56 | 50.0445 | 49.7050 | 55.1680 | 44.4292 | 66.2255 | 71.3628 | 34.5448 |
| 57 | 44.5555 | 50.4671 | 60.5017 | 74.8537 | 42.1196 | 52.2595 | 52.6284 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 58 | 51.9792 | 43.8392 | 59.7516 | 36.8100 | 44.0639 | 63.4350 | 45.1310 |
| 59 | 49.2248 | 46.1418 | 62.7088 | 47.7538 | 53.5609 | 48.2221 | 51.4002 |
| 60 | 43.3151 | 49.9007 | 65.0449 | 62.4937 | 50.7832 | 38.2925 | 65.4571 |
| 61 | 57.7889 | 41.3441 | 65.4868 | 37.9011 | 48.8890 | 57.5450 | 43.4190 |
| 62 | 48.3653 | 62.2647 | 54.4584 | 51.3414 | 56.9127 | 70.5356 | 47.7685 |
| 63 | 55.0373 | 98.4393 | 55.9628 | 26.1342 | 52.0834 | 53.7519 | 53.5007 |
| 64 | 49.3049 | 65.4545 | 68.5956 | 56.5329 | 46.4813 | 54.6408 | 42.1857 |
| 65 | 57.4285 | 75.9310 | 36.8345 | 66.1398 | 46.0574 | 46.5194 | 55.8627 |
| 66 | 47.3002 | 53.1398 | 40.3852 | 46.9155 | 46.9105 | 35.9933 | 43.7930 |
| 67 | 45.5820 | 68.1805 | 34.4301 | 49.5356 | 48.5908 | 33.7576 | 57.2029 |
| 68 | 44.4886 | 86.1050 | 40.4094 | 66.8564 | 46.4599 | 57.6753 | 39.7080 |
| 69 | 46.8967 | 53.5384 | 51.9177 | 57.6883 | 48.5910 | 51.7556 | 51.3810 |
| 70 | 49.2988 | 48.4763 | 44.7819 | 55.8147 | 40.1325 | 56.7104 | 43.0797 |
| 71 | 49.2664 | 69.4331 | 45.2898 | 56.9900 | 50.2419 | 55.7563 | 50.3624 |
| 72 | 52.0862 | 46.6850 | 53.3782 | 60.4564 | 42.8388 | 50.0978 | 60.3182 |
| 75 | 63.5674 | 50.8563 | 42.4528 | 58.2390 | 43.3456 | 43.8947 | 57.5609 |
| 76 | 51.4112 | 47.4781 | 44.9537 | 39.8733 | 45.1479 | 47.1292 | 49.5458 |
| 78 | 48.9060 | 43.1774 | 57.8261 | 47.2533 | 51.3893 | 39.8853 | 45.9339 |
| 79 | 45.6386 | 45.2561 | 52.8833 | 48.1422 | 46.6070 | 54.8478 | 50.6239 |
| 80 | 58.7766 | 50.2314 | 57.6848 | 42.1301 | 58.1608 | 26.2420 | 49.9485 |
| 82 | 47.8458 | 48.6657 | 67.0592 | 53.0889 | 33.9756 | 44.4322 | 43.1667 |
| 84 | 43.8420 | 42.0913 | 59.2671 | 52.1383 | 48.6262 | 52.7285 | 96.6914 |
| 85 | 42.8996 | 45.1192 | 55.4796 | 50.2169 | 49.9866 | 62.7952 | 55.0604 |
| 86 | 49.3484 | 51.4569 | 51.0343 | 54.8883 | 45.3108 | 60.1094 | 54.9368 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | |
|---|---|---|---|---|
| | 15 | 16 | 17 | 18 |
| 1 | 52.1995 | 46.3079 | 56.4148 | 72.9709 |
| 2 | 59.4105 | 46.8252 | 46.3108 | 49.1614 |
| 3 | 41.3002 | 48.8490 | 27.2087 | 47.0187 |
| 4 | 60.0845 | 57.2674 | 41.5144 | 57.5449 |
| 7 | 37.8673 | 43.3355 | 41.9723 | 40.5203 |
| 8 | 46.4780 | 21.3017 | 55.9961 | 45.8266 |
| 9 | 50.6292 | 72.3789 | 42.9097 | 49.1544 |
| 10 | 51.5814 | 51.9313 | 54.8355 | 38.6688 |
| 11 | 37.7812 | 47.2163 | 34.5787 | 64.9672 |
| 12 | 42.0162 | 63.5550 | 39.2847 | 54.4547 |
| 13 | 19.5158 | 64.5157 | 51.4192 | 61.9874 |
| 14 | 51.5937 | 53.9475 | 48.5623 | 39.4584 |
| 15 | 65.2578 | 47.9548 | 58.6377 | 54.0306 |
| 16 | 59.1602 | 44.5229 | 55.8543 | 40.8679 |
| 17 | 72.4714 | 37.2709 | 48.2661 | 45.8118 |
| 18 | 68.7673 | 64.7967 | 35.7806 | 41.6450 |
| 19 | 72.9627 | 48.3522 | 28.6516 | 63.4575 |
| 20 | 51.2860 | 51.3161 | 44.8721 | 57.3624 |
| 22 | 56.5651 | 55.7817 | 37.7987 | 70.2145 |
| 23 | 46.3159 | 49.3010 | 46.5683 | 41.8993 |
| 24 | 56.3365 | 54.8661 | 47.9425 | 50.2716 |
| 25 | 47.4958 | 50.8998 | 61.2475 | 43.7073 |
| 26 | 42.5075 | 62.0198 | 51.7736 | 43.6992 |
| 27 | 56.9794 | 57.5508 | 53.9148 | 53.9486 |
| 28 | 53.8703 | 51.1775 | 50.5086 | 34.8643 |
| 29 | 46.6794 | 40.4240 | 64.2568 | 48.8462 |
| 30 | 57.2122 | 50.1984 | 49.7493 | 40.2306 |

## APPENDIX B-4

### FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | |
|---|---|---|---|---|
| | 15 | 16 | 17 | 18 |
| 31 | 50.5961 | 63.2905 | 63.7471 | 61.3564 |
| 32 | 52.4914 | 67.8506 | 39.9022 | 47.6293 |
| 33 | 37.0914 | 53.4215 | 51.0759 | 43.6481 |
| 34 | 36.0433 | 50.1031 | 55.6107 | 41.9030 |
| 35 | 43.3017 | 52.9471 | 57.8827 | 60.8762 |
| 36 | 37.4483 | 53.3021 | 61.4636 | 42.8758 |
| 37 | 44.7048 | 48.4945 | 51.1611 | 47.8747 |
| 38 | 46.2547 | 51.4883 | 50.2891 | 47.2577 |
| 39 | 45.2371 | 51.5657 | 65.7306 | 35.6618 |
| 40 | 49.8274 | 44.9635 | 48.0542 | 56.1548 |
| 41 | 46.0494 | 63.1910 | 49.7549 | 54.8662 |
| 42 | 41.9526 | 53.8346 | 49.2121 | 51.4039 |
| 43 | 43.3303 | 48.8925 | 48.6263 | 51.8737 |
| 44 | 46.2816 | 51.4759 | 44.1306 | 57.0035 |
| 45 | 51.3097 | 54.0429 | 41.0470 | 43.2559 |
| 46 | 45.5639 | 48.7733 | 36.7797 | 51.4541 |
| 47 | 54.8944 | 51.1357 | 42.1892 | 46.8015 |
| 48 | 51.2086 | 47.2925 | 37.6784 | 50.9938 |
| 49 | 66.9365 | 44.8623 | 51.8450 | 50.9235 |
| 50 | 55.1031 | 59.5439 | 66.4212 | 54.4946 |
| 51 | 56.2035 | 72.9132 | 34.6232 | 36.8619 |
| 52 | 60.6446 | 41.8603 | 61.7479 | 76.3099 |
| 53 | 56.8769 | 50.5026 | 56.1369 | 56.2984 |
| 54 | 45.1221 | 49.2962 | 81.0078 | 58.5620 |
| 55 | 55.8360 | 41.2167 | 60.7945 | 49.7347 |
| 56 | 27.5502 | 25.3678 | 46.5777 | 63.2105 |
| 57 | 47.7381 | 50.8386 | 40.9525 | 56.4785 |

## APPENDIX B-4

FACTOR SCORES IN T - SCORE FORM FOR 18 VARIMAX ROTATED FACTORS

| SCHOOL DISTRICT | FACTORS | | | |
|---|---|---|---|---|
| | 15 | 16 | 17 | 18 |
| 58 | 40.2943 | 35.2644 | 49.6921 | 45.9200 |
| 59 | 49.9223 | 45.9954 | 67.0545 | 45.6487 |
| 60 | 46.9470 | 64.6569 | 73.4746 | 34.3594 |
| 61 | 47.4242 | 46.4871 | 60.2861 | 46.5683 |
| 62 | 39.6131 | 47.6066 | 52.1611 | 40.4269 |
| 63 | 46.3262 | 58.8340 | 50.5542 | 36.0883 |
| 64 | 53.7620 | 43.5832 | 60.5018 | 46.4977 |
| 65 | 46.4839 | 44.2565 | 54.7337 | 31.0894 |
| 66 | 49.1985 | 37.5786 | 42.9610 | 60.3081 |
| 67 | 55.7205 | 40.7657 | 51.0669 | 48.8360 |
| 68 | 38.4949 | 51.2036 | 44.7931 | 64.1834 |
| 69 | 62.9559 | 38.7426 | 44.8791 | 40.5029 |
| 70 | 57.9168 | 35.6899 | 49.4001 | 56.2199 |
| 71 | 58.5534 | 49.6585 | 47.0997 | 57.2864 |
| 72 | 59.1437 | 57.0948 | 39.5050 | 38.8226 |
| 75 | 56.3396 | 41.9712 | 58.5047 | 58.9571 |
| 76 | 79.6363 | 46.2064 | 59.8807 | 54.1749 |
| 78 | 40.8786 | 40.4637 | 39.0766 | 62.5964 |
| 79 | 52.2146 | 73.6884 | 55.7576 | 44.4253 |
| 80 | 44.3944 | 24.6659 | 32.9616 | 17.8233 |
| 82 | 43.1545 | 43.7942 | 47.8177 | 50.0152 |
| 84 | 38.4272 | 66.1571 | 56.8290 | 65.3271 |
| 85 | 34.4392 | 41.7467 | 36.0114 | 52.8119 |
| 86 | 57.8362 | 47.5579 | 53.7258 | 52.7558 |

# APPENDIX C

## The Canonical Regression Analysis of the School District Factors and the Mental Disorder Rates

## APPENDIX C-1

CROSS PRODUCT CORRELATIONS BETWEEN DIAGNOSTIC FREQUENCIES

(LOWER TRIANGLE, DECIMALS OMITTED)

| DIAGNOSIS | DIAGNOSIS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 2 | 572 | | | | | | | | |
| 3 | 688 | 612 | | | | | | | |
| 4 | 676 | 601 | 633 | | | | | | |
| 5 | 713 | 652 | 793 | 758 | | | | | |
| 6 | 749 | 597 | 661 | 571 | 690 | | | | |
| 7 | 830 | 742 | 766 | 692 | 790 | 763 | | | |
| 8 | 681 | 625 | 652 | 637 | 734 | 656 | 844 | | |
| 9 | 510 | 684 | 679 | 590 | 769 | 619 | 674 | 605 | |
| 10 | 688 | 613 | 649 | 481 | 683 | 693 | 715 | 570 | 648 |
| 11 | 663 | 621 | 765 | 572 | 752 | 723 | 752 | 645 | 762 |
| 12 | 513 | 643 | 499 | 426 | 554 | 541 | 638 | 525 | 562 |
| 13 | 757 | 733 | 779 | 717 | 849 | 740 | 793 | 647 | 746 |

| | 10 | 11 | 12 |
|---|---|---|---|
| 11 | 873 | | |
| 12 | 535 | 584 | |
| 13 | 710 | 756 | 652 |

## APPENDIX C-2

## CROSS PRODUCT-PRODUCT MOMENT CORRELATIONS BETWEEN DIAGNOSTIC FREQUENCIES AND ENVIRONMENTAL FACTOR SCORES (DECIMALS OMITTED)

| DIAGNOSIS | ENVIRONMENTAL FACTORS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1 | -053 | 038 | -064 | 049 | 229 | 100 | 026 | 055 | -078 |
| 2 | 085 | 231 | 126 | 060 | -097 | -055 | 068 | 012 | -178 |
| 3 | -075 | 135 | -096 | 020 | -046 | -117 | -004 | 034 | -104 |
| 4 | 057 | 224 | -081 | -038 | 019 | 151 | -149 | -051 | -146 |
| 5 | 070 | 103 | -098 | 112 | -018 | 063 | -025 | 019 | -136 |
| 6 | 092 | 097 | -028 | 162 | 029 | -013 | -125 | 044 | -111 |
| 7 | 130 | 136 | -038 | 040 | -001 | -031 | -038 | 061 | -200 |
| 8 | 235 | 128 | -065 | 055 | 079 | -008 | -122 | 051 | -219 |
| 9 | 133 | 187 | 015 | 144 | -038 | -088 | -112 | 001 | -031 |
| 10 | 071 | 113 | -087 | 112 | 025 | 010 | 090 | 003 | -137 |
| 11 | 080 | 195 | -127 | 110 | -064 | -007 | -127 | 068 | -081 |
| 12 | 080 | 124 | 081 | 001 | -029 | -015 | -058 | -047 | -099 |
| 13 | -000 | -001 | 000 | -000 | 000 | 000 | 000 | -000 | 001 |

## APPENDIX C-2

## CROSS PRODUCT-PRODUCT MOMENT CORRELATIONS BETWEEN DIAGNOSTIC FREQUENCIES AND ENVIRONMENTAL FACTOR SCORES (DECIMALS OMITTED)

| DIAGNOSIS | ENVIRONMENTAL FACTORS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 1 | -159 | 031 | 120 | -085 | 051 | -002 | -003 | 037 | 012 |
| 2 | -036 | -039 | 047 | 050 | -036 | -018 | 072 | 045 | -034 |
| 3 | -134 | 005 | 025 | -130 | -123 | 018 | -060 | 017 | -020 |
| 4 | -095 | 026 | -126 | 032 | 107 | -041 | 003 | -073 | -100 |
| 5 | -082 | 006 | -080 | 044 | -071 | 087 | -003 | 037 | 022 |
| 6 | -138 | 081 | 268 | -018 | 163 | -065 | -043 | 064 | 066 |
| 7 | -181 | 012 | 072 | -086 | -010 | -057 | 095 | 044 | -098 |
| 8 | -222 | -057 | 157 | -052 | -059 | 061 | 174 | -126 | -158 |
| 9 | 000 | 007 | 051 | -085 | -100 | 051 | 003 | 090 | -088 |
| 10 | -035 | 019 | 239 | 003 | -151 | 012 | 038 | 141 | 049 |
| 11 | -041 | 072 | 161 | -043 | -099 | 033 | -027 | 145 | -029 |
| 12 | 062 | -015 | 179 | 193 | -157 | 016 | -004 | 086 | 012 |
| 13 | 001 | -000 | -001 | 000 | 000 | -000 | -000 | -000 | 000 |

## APPENDIX C-3

### CANONICAL COMPONENT LOADINGS AND MEASURES OF REDUNDANCY

(DECIMALS OMITTED)

| | Canonical Component Pairs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Diagnosis** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | 040 | 186 | -106 | 300 | 029 | 411 | -178 | -137 |
| 2 | 254 | 099 | 310 | -115 | -112 | -045 | -215 | -104 |
| 3 | 127 | 085 | 069 | -040 | -359 | 311 | 068 | -229 |
| 4 | 342 | -161 | -053 | -107 | 290 | 312 | -049 | -318 |
| 5 | 162 | -022 | 222 | -016 | 070 | 359 | 045 | 148 |
| 6 | 355 | 085 | 004 | 476 | -071 | -005 | -243 | 008 |
| 7 | 379 | 192 | 026 | -042 | -126 | 229 | -187 | 010 |
| 8 | 488 | 456 | -027 | -072 | 139 | 251 | 011 | 069 |
| 9 | 298 | 081 | 130 | 032 | -235 | 029 | 276 | 108 |
| 10 | 135 | 272 | 351 | 228 | -146 | 144 | -020 | 003 |
| 11 | 339 | 042 | 204 | 217 | -221 | 170 | 254 | 011 |
| 12 | 148 | 126 | 394 | 093 | 068 | -247 | 168 | -188 |
| 13 | 000 | 000 | -001 | -000 | 001 | -003 | 000 | 001 |
| Contribution to Redundancy | .0506 | .0184 | .0199 | .0162 | .0117 | .0162 | .0073 | .0038 |
| % Contribution to Redundancy | 33.35 | 12.13 | 13.12 | 10.68 | 7.71 | 10.68 | 4.81 | 2.50 |
| **Environment** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| 1 | 438 | 185 | 073 | -106 | 216 | -196 | 017 | 469 |
| 2 | 446 | -116 | 285 | -002 | -121 | 191 | 084 | -481 |
| 3 | -083 | 058 | 026 | -055 | -048 | -425 | -200 | -037 |
| 4 | 118 | 024 | 193 | 344 | -115 | 147 | -041 | 449 |
| 5 | -223 | 369 | -261 | 317 | 276 | 309 | 039 | -147 |
| 6 | -032 | -174 | 038 | 154 | 544 | 305 | -000 | -007 |
| 7 | -472 | 222 | 273 | -175 | -149 | 120 | -478 | 037 |
| 8 | 067 | -034 | -099 | 082 | -175 | 170 | -002 | 304 |
| 9 | -316 | -142 | -336 | 137 | -073 | -252 | 381 | 128 |
| 10 | -221 | -193 | 151 | -015 | 075 | -400 | 303 | 022 |
| 11 | 093 | -232 | -042 | 203 | -083 | 042 | -004 | 027 |
| 12 | 160 | 541 | 078 | 571 | -083 | -353 | 019 | -214 |
| 13 | -041 | -148 | 463 | 044 | 528 | -244 | -022 | -047 |
| 14 | 168 | -340 | -428 | 258 | 186 | -143 | -510 | 047 |
| 15 | -122 | 135 | 141 | 038 | 131 | 231 | 389 | 231 |
| 16 | 118 | 319 | -040 | -287 | 151 | -050 | -140 | 255 |
| 17 | 006 | -232 | 287 | 256 | -347 | 067 | 006 | 196 |
| 18 | -263 | -127 | 277 | 319 | 024 | -008 | -228 | 074 |
| Contribution to Redundancy | .0374 | .0295 | .0287 | .0256 | .0210 | .0162 | .0148 | .0101 |
| % Contribution to Redundancy | 18.65 | 14.71 | 14.31 | 12.77 | 10.47 | 8.08 | 7.38 | 5.04 |
| Canonical Correlations | .822 | .750 | .720 | .681 | .617 | .543 | .522 | .440 |

## APPENDIX C-3

### CANONICAL COMPONENT LOADINGS AND MEASURES OF REDUNDANCY

### (DECIMALS OMITTED)

| | Canonical Component Pairs | | | | | |
|---|---|---|---|---|---|---|
| **Diagnosis** | **9** | **10** | **11** | **12** | **13** | |
| 1 | -101 | -144 | -115 | -149 | 758 | |
| 2 | -331 | 179 | -237 | 081 | 734 | |
| 3 | 232 | 149 | 038 | -047 | 780 | |
| 4 | -119 | 024 | 156 | 039 | 717 | |
| 5 | 050 | 127 | 136 | -075 | 850 | |
| 6 | 128 | 066 | 072 | -051 | 741 | |
| 7 | -034 | -152 | -089 | -224 | 794 | |
| 8 | 065 | 107 | -118 | -107 | 648 | |
| 9 | -309 | 127 | 272 | 010 | 746 | |
| 10 | 022 | -350 | 069 | 242 | 711 | |
| 11 | 071 | -198 | -086 | 166 | 757 | |
| 12 | -081 | -083 | -167 | -449 | 652 | Total |
| 13 | 001 | -001 | 001 | 002 | 1.000 | Redundant Variance |
| Contribution to Redundancy | .0032 | .0026 | .0009 | .0009 | .0000 | .1517 |
| % Contribution to Redundancy | 2.11 | 1.71 | .59 | .59 | .00 | |
| **Environment** | **9** | **10** | **11** | **12** | **13** | |
| 1 | -092 | -132 | 263 | -022 | 324 | |
| 2 | -393 | 165 | -065 | 323 | -009 | |
| 3 | -544 | 330 | -221 | -341 | -039 | |
| 4 | -186 | 347 | 306 | 147 | -177 | |
| 5 | -379 | -059 | 153 | -313 | 121 | |
| 6 | -167 | -304 | -153 | 214 | 052 | |
| 7 | -142 | -116 | -008 | 365 | 018 | |
| 8 | 046 | 028 | -747 | -018 | 356 | |
| 9 | -149 | 000 | -017 | 238 | -304 | |
| 10 | -241 | -179 | 074 | 331 | 384 | |
| 11 | 061 | -215 | 000 | -022 | -407 | |
| 12 | 190 | -153 | -181 | 206 | -005 | |
| 13 | 134 | 073 | -207 | -244 | -246 | |
| 14 | -084 | 151 | -040 | 230 | 039 | |
| 15 | -015 | 415 | -209 | 125 | -087 | |
| 16 | -140 | -229 | -192 | 202 | -467 | |
| 17 | -280 | -481 | -048 | -321 | -065 | Total |
| 18 | 264 | 174 | 116 | 022 | 143 | Redundant Variance |
| Contribution to Redundancy | .0070 | .0059 | .0026 | .0017 | .0000 | .2005 |
| % Contribution to Redundancy | 3.49 | 2.94 | 1.30 | .89 | .00 | |
| Canonical Correlations | .366 | .329 | .216 | .177 | .000 | |