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CATTELL'S PERSONALITY FACTORS
AS PREDICTORS OF HIGH SCHOOL PERFORMANCE

by Martin Cooper

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the University of Ottawa
in partial fulfilment of
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INTRODUCTION

In many human qualities which can be measured, most people are not far removed from the average. It is the minority of individuals, who deviate considerably from the population mean, which is often the object of scrutiny. In a society which is set up to suit the majority, special allowances may be made for deviant individuals if they can be identified.

In high schools, for example, some students are extremely good scholastically. Others are generally very poor. Ability to foretell which students are likely to belong to each of these extreme categories allows unusually gifted students to be guided in directions which will allow them to make the best use of their potentials. A student who has extremely poor academic potential, on the other hand, may be directed into training best suited to his temperament, thus possibly saving him from the frustration of attempting academic studies for which he is ill-fitted. A few high school students are able to do well at certain types of subjects, at the expense of performance in others. Early detection of these students, also, allows them to be guided into suitable programmes of study.

Abnormalities of the types indicated have traditionally been predicted by means of intellectual measures such as those provided by intelligence, ability and aptitude tests.

The development of reliable personality tests has, however, caused an increased interest in the use of personality measures as predictors of scholastic success and academic orientation. Many instruments are available which measure specific aspects of personality, although there are relatively few which claim to measure sets of traits which cover the whole spectrum of personality.

Among personality tests designed to measure characteristics believed to embrace personality as a whole are those whose development was based on factor-analytic methods. Provided that the original data, from which the factors measured by such tests were derived, were drawn from the whole spectrum of personality, the factors themselves should be representative of personality as a whole. Whether the factors are correlated or relatively independent depends on the type of rotation to simple structure employed by the test developer. The personality questionnaires developed by Cattell are based on factor analyses, and it is claimed that the original data were carefully drawn from a very wide base. The factors measured by these instruments are intercorrelated, the rotation to simple structure having been oblique. Cattell's personality instruments thus measure factors which are representative of the whole of personality, and which, moreover, are intercorrelated, as would be expected with comprehensive personality characteristics.

Eysenck pioneered the use of factor analysis for the identification of dimensions of personality. His early work led to the establishment of two dimensions, Extraversion and Neuroticism. A number of studies has demonstrated that one of these dimensions, Extraversion, may be used as a predictor of academic achievement. On the other hand, Cattell's extensive research into the structure of personality, conducted more recently, has led him to identify as many as twenty primary personality traits. A survey of Cattell's writings indicates that some of his personality traits are related to scholastic achievement, and may thus be expected to discriminate between students who perform at a high level in general and those whose general performance is generally poor. A number of studies supports this contention.

In addition, the literature indicates that individuals who are involved in the humanities tend to make significantly different scores on some personality traits from individuals who are involved in science and technology. In high school, where most students study a wide range of subjects, the extent of a student's involvement in a particular subject tends to be indicated by his performance in that subject. At this level, therefore, it seems probable that students doing well in humanities subjects, but not in science subjects, would make different scores on some personality scales from those whose performance in the sciences was good, but who did poorly in the humanities.

This study seeks to determine whether non-intellective personality factors will predict various aspects of an individual's scholastic performance. In particular, the problem is to determine whether a specific set of Cattell's personality traits will discriminate between generally high performing and generally low performing students, and whether another specific set of Cattell's traits will discriminate between students who are inclined towards the humanities and those who are inclined towards the sciences. The establishment of relationships between non-intellective personality traits and scholastic performance of the types indicated would not only add to present knowledge in the field of personality, but would enhance the accuracy with which a student's general performance in school, or his leanings towards the humanities or the sciences could be foretold. Direction into suitable courses of study could be then made with greater confidence.

The study was carried out with university-bound grade ten students from English-language high schools in Ottawa. The data collected from these students were processed by means of the statistical procedure known as discriminant analysis. The findings of the study should extend existing knowledge about Cattell's personality traits by showing that, while some factors are related to general scholastic achievement, others will discriminate among individuals involved in different academic areas.

The research report is organised into four chapters. The first presents the rationale which leads to the statement of the problem and the experimental hypotheses. In the second chapter, the personality instrument used in the research is discussed and the design of the study is presented. The collection of the data and the establishment of a number of criterion groups are described also. The analysis of the data by means of discriminant analysis techniques is described in Chapter III; the results are given also. Chapter IV, in which the results are discussed, is followed by a summary and the statement of conclusions. At the end of the report are presented an annotated bibliography and appendices containing the data and an abstract of the dissertation. The word subject, when used in the report refers to a "subject area" such as History or Mathematics, and not to an "experimental subject".

CHAPTER I

SURVEY OF THE LITERATURE

Although ability measures are presently the best single type of predictor of academic performance, they account for less than half of the variation in this quality¹. Researchers have thus been led to consider non-intellective variables, such as measures of various aspects of personality, as predictors of scholastic performance.

Although there are many instruments designed to measure specific personality characteristics, only a few claim to measure the "whole personality" of an individual. Provided that they have been developed on the basis of widely-spread data, tests based on factor analysis provide measures on scales which can justifiably be claimed to encompass personality as a whole.

This chapter starts with a short discussion of personality tests based on factor analysis. There follows a brief description of the pioneer work of H. J. Eysenck in the establishment of dimensions of personality by factor-analytic methods. Some studies, designed to show relationships between Eysenck's Extraversion dimension and scholastic achievement, are also described.

¹ D. E. Lavin, The Prediction of Academic Performance, New York, The Russell Sage Foundation, 1965, p. 64.

Since the pioneering days of Eysenck, R. B. Cattell and his associates have carried out a programme of careful, systematic research into personality structure. They have established a number of primary factors, or "source traits", and have derived, in addition, factors in a number of higher strata. The identification of primary personality factors by Cattell, and descriptions of these factors, appears next in the chapter. In addition, studies seeking to establish relationships between Cattell's source traits and general scholastic performance are discussed.

A number of studies designed to show that university students, and others, who are involved in the humanities tend to make significantly different scores on tests of various aspects of personality from those who are involved in the sciences are discussed. Studies designed to show that these two classes of individuals tend to score differently on some of Cattell's factors are discussed also.

Each of the fourteen primary factors of Cattell's High School Personality Questionnaire is then examined in turn, with the purpose of their classification into one of two groups. One of these groups contains factors which are indicated by the literature as likely discriminators between individuals who are good general scholastic performers and those who are poor general performers. The other group

consists of factors which are indicated as being likely to discriminate between individuals who are inclined towards the humanities and those who are inclined towards the sciences.

This examination of factors leads to a statement of the problem and the formulation of two ancilliary experimental hypotheses.

1. Personality Tests Based on Factor Analysis

Many instruments have been designed to measure various aspects of personality. The development of such tests has been based on a number of different techniques.

Some personality tests, for instance, were designed on the principle that questionnaire items which correlate with socially significant criteria may be used to discriminate between groups of individuals who are at the opposite extremes of these criteria. An example of this type of test is the California Psychological Inventory (CPI). This instrument was developed from a large stock of items which appeared to relate to personality characteristics. Criterion groups which differed sharply in some attribute judged to be socially significant and psychologically meaningful were identified. A scoring key which included those items that were found to differentiate between the criterion

groups was then constructed². Although tests developed in this manner are efficient predictors of membership of the extreme groups on the criteria, there is no limit to the number of criterion dimensions for which one may establish keys. Furthermore, the dimensions which are measured by such tests are decided by the test developer, and thus sometimes tend to be arbitrary and to have considerable overlap with each other.

Another group of personality tests has been derived by factor analytic methods. In effect, factor analysis gives a simple interpretation of a given body of data and thus affords a fundamental description of the particular set of variables analysed³. The factors derived by factor analysis are hypothetical constructs underlying the variables whose measures are analysed, and those emerging from the technique reflect only the variables on which data are provided. Thus the complete description of a field, such as mental ability or personality, is not theoretically possible because of the absence of measures which are not yet defined. Factors which afford satisfactory coverage of such a field may, however, be obtained if the original data is very widely based.

2 R. L. Thorndike, Review of the California Psychological Inventory, in O. K. Buros (Editor), The Fifth Mental Measurements Year Book, Highland Park, Gryphon Press, 1959, article 5:38, p. 99.

3 H. H. Harman, Modern Factor Analysis, Chicago, University of Chicago Press, 1967, p. 5.

Most modern factor analysts do not consider a factor analysis to be complete until simple structure in the factor matrix is achieved⁴. Such a structure generally facilitates meaningful interpretation of the factors in psychological terms⁵. The attainment of simple structure involves a factor rotation, and a decision on the part of the analyst as whether to use an orthogonal rotation or an oblique one. An orthogonal rotation to simple structure produces uncorrelated factors, whereas an oblique rotation results in correlated ones.

Factor-analysis-based personality tests are thus not unaffected by the influence of the test constructor. He controls the generality of the factors by the inclusion or omission of specific original variables, and he decides whether the resulting factors will be correlated or independent. On the other hand, by including a wide range of original variables, the factor test developer may produce a test which measures factors that give a satisfactory coverage of the whole of the personality field. Furthermore, he can produce correlated or independent factors, as indicated by theoretical or practical considerations.

In his pioneer work in the field of personality factors, Eysenck used original variables which had particular associations

4 M. M. Tatsuoka, Multivariate Analysis, New York, John Wiley and Sons, 1971, p. 145.

5 Idem, ibid., p. 145.

with abnormal phenomena⁶. Responses to questionnaire items were subjected to centriod analysis, the resulting factors thus being independent. No particular effort was made to measure variables which were widely-based, and thus the factors could hardly be claimed to cover the whole of personality. Cattell⁷ and Guilford⁸, on the other hand, worked with the deliberate intention of obtaining original variables which sampled as much of the whole personality spectrum as possible. Guilford's factors are based on orthogonal rotation to simple structure, whereas Cattell uses oblique rotation in accordance with the theory that real, natural structures are oblique⁹. Guilford's factors and Cattell's factors have been shown to occupy essentially the same factor space, but each set divides the space differently because of the different types of rotation used¹⁰.

6 H. J. Eysenck, "Types of Personality: A Factorial Study of Seven Hundred Neurotics", Journal of Mental Science, 1944, 90, 851-861.

7 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1965, p. 60.

8 J. P. Guilford and W. S. Zimmerman, "Fourteen Dimensions of Temperament", Psychological Monographs, 1956, 70, 10.

9 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, p. 44.

10 Idem, ibid., p. 44.

The personality questionnaires of Guilford and of Cattell thus measure factors which give satisfactory coverage of the whole of personality. Cattell's factors, however, are correlated, as would be expected with naturally-occurring personality characteristics.

In the present study, Cattell's traits were used to describe an individual's personality. This system was employed because of the extreme care which was taken to ensure that the original variables were sampled from as much of the "personality sphere"¹¹ as possible, and because the resulting factors are intercorrelated. Cattell's primary personality traits, and the instrument used in the study, the High School Personality Questionnaire, are discussed in detail later in this report.

2. Eysenck's Dimensions of Personality

Much research concerning the relationship between personality factors and academic success has been based on Eysenck's personality dimensions, Neuroticism and Extraversion. In his original research, Eysenck, working with seven hundred mental hospital patients, obtained responses to questionnaire items, and subjected these responses to centroid

¹¹ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 6.

analysis¹². Although he extracted four factors, Eysenck concentrated his subsequent work on the first two factors, which accounted respectively for 14% and 12% of the variance. These factors were respectively named Neuroticism and Hysteria-Dysthymia; the latter factor is usually referred to as the Extraversion dimension. Both Neuroticism and Extraversion may be measured by Eysenck's Maudsley Personality Inventory (MPI) and his Eysenck Personality Inventory (EPI) — the latter being a revised form of the former¹³ — and by the Junior Eysenck Personality Inventory (JEPI), which was developed by S. B. G. Eysenck, Eysenck's wife and co-worker.

There have been many studies which have sought to show relationships between Eysenck's Neuroticism and Extraversion dimensions of personality and scholastic success. Lynn¹⁴, for instance, administered the MPI, in England, to 115 university freshman males and to 100 male apprentices having the same mean age. The undergraduates made higher

12 H. J. Eysenck, "Types of Personality: A Factorial Study of Seven Hundred Neurotics", Journal of Mental Science, 1944, 90, 851-861.

13 O. K. Buros (Editor), The Sixth Mental Measurements Year Book, Highland Park, Gryphon Press, 1959, article 6:93, p. 215.

14 R. Lynn, "Two Personality Characteristics Related to Academic Achievement", British Journal of Educational Psychology, 1959, 29, 213-216.

mean scores than the apprentices on the Neuroticism scale and lower mean scores on the Extraversion scale, the differences being significant at the 5% level. At the same time, Lynn administered the MPI to ninety-six female freshmen and to sixty-seven occupational therapists having the same mean age. Once again, the undergraduates made significantly higher scores on the Neuroticism scale and significantly lower scores on the Extraversion scale. Since admission to university in England, at the time of the study, was obtained on the basis of educational attainment in secondary school, Lynn considered that, for the age-group in question, those with a higher level of scholastic achievement tended to be more neurotic and less extravert (as measured by the MPI) than those with a lower level of achievement.

Although all the groups used in Lynn's study had the same social background, it is possible that there may have been differences in intelligence between the undergraduate groups and their respective control groups. Intelligence was not measured, however, and possible influences due to differences in intelligence could not thus be allowed for. No allowance was made, either, for differences in academic motivation, which could also have been an important factor on which the undergraduates differed from their non-university counterparts.

Savage¹⁵ carried out a study with Australian undergraduates in Arts, in which he administered the MPI to 168 freshmen. The students were divided into five categories according to the number of passes obtained (out of four subjects). The mean Neuroticism score and the mean Extraversion score were calculated for each group. For each of the personality dimensions measured, the data were analysed by analysis of variance and correlation methods.

With the five performance groups taken as representative of different populations, two one-way analyses of variance were performed, one based on the Neuroticism scores and the other using the Extraversion scores. In each case, an F value which was significant at the 1% level was obtained. No post hoc procedures were carried out, and the interpretation for each analysis should not thus have exceeded the recognition that the greatest mean score and the smallest mean score were significantly different. The results of the analyses of variance demonstrated that the group with no passes had significantly different Neuroticism scores from the group with four passes and significantly different Extraversion scores from the group with three passes.

15 R. D. Savage, "Personality Factors and Academic Performance", British Journal of Educational Psychology, 1962, 32, 251-253.

A correlation of $\bar{0}.90$ was reported between Neuroticism and scholastic success, and also between Extraversion and scholastic success. Scholastic success, however, was not defined, nor was the method of measuring it described. The type of the correlation whose value was reported as $\bar{0}.90$ was not indicated, nor was the method of its calculation. An inspection of the mean scores of the performance groups, however, revealed that each of the reported correlations was calculated as a Pearson r between the five group means (on the personality dimension involved) and number of passes. The calculation of a Pearson correlation under these conditions is hardly defensible, even if only because there were merely five paired "scores". However, the assumption of linearity between each of the personality variables and number of passes, which should be made before a Pearson correlation is appropriate, is questionable. Plots of the mean personality scores against number of passes yielded curves which might, or might not, have been linear. Unfortunately, insufficient data were given in the report to allow the performance of a test of linearity.

The finding stated in Savage's report, that Neuroticism and Extraversion are both negatively related to scholastic success, thus appears to be founded on inappropriate and inadequate statistical analysis. Graphs, drawn from Savage's data, do, however, indicate a general trend for scores on

each personality dimension to decrease as number of passes increases. It is thus possible that more appropriate treatment of the data would have justified the findings given.

The notion that introverts perform better, at university level than do extraverts, is supported by Entwistle and Wilson¹⁶, Bendig¹⁷ and Kline¹⁸. All of these researchers, using Eysenck's instruments, found significant negative relationships between Extraversion and scholastic performance among university students. None, however, found a significant relationship between Neuroticism and scholastic performance. There is thus a body of support for the contention that Extraversion may be used as a predictor of academic performance at the undergraduate level.

Among children in their early teens, this relationship between Extraversion and scholastic performance does not appear to hold. Eysenck and Cookson¹⁹, working with

16 N. J. Entwistle and J. D. Wilson, "Personality, Study Methods and Academic Performance", Universities Quarterly, 24, 1970, 147-156.

17 A. W. Bendig, "Extraversion, Neuroticism, and Student Achievement in Introductory Psychology", Journal of Educational Research, 1960, 53, 263-267.

18 P. Klein, "Neuroticism and Academic Performance Among Ghanaian University Students", British Journal of Educational Psychology, 1966, 36, 93-94.

19 H. J. Eysenck and D. Cookson, "Personality in Primary Children", British Journal of Educational Psychology, 1969, 39, 109-122.

about three thousand English eleven-year-olds, found that Extraversion (measured by the JEPI) was positively related to scholastic performance, as measured by the Moray House tests and the Schonell Graded Word Reading Test. In this study, the extravert was found to perform better than the introvert. No significant relationship was found between Neuroticism and scholastic performance.

Entwistle and Cunningham²⁰ conducted a study with over two and a half thousand Scottish thirteen-year-olds. Neuroticism and Extraversion were measured by the JEPI, and scholastic attainment was measured by teachers' average rank order in class, differences between classes being controlled for by the adjustment of within-class scores so that they had the same means and standard deviations as those which the respective classes obtained in the Moray House Verbal Reasoning Test. The correlation between Extraversion and attainment was found to be not significant.

The two studies just mentioned were both conducted with large samples. The tests used in each case were reliable and commonly used. In neither case, however, was Extraversion found to be negatively related to scholastic performance, as was found for university students.

20 N. J. Entwistle and S. Cunningham, "Neuroticism and School Attainment - A Linear Relationship?", British Journal of Educational Psychology, 1968, 38, 123-132.

Many of the earlier investigations of the relationships between personality factors and academic achievement were based on Eysenck's dimensions. Presently, a number of other instruments which measure personality factors are widely used, these having been developed by Cattell, by Guilford, and by various other authors. As stated previously, personality was measured in the present study by one of Cattell's instruments. Cattell's primary personality factors are discussed next.

3. Cattell's Primary Traits of Personality

In his work on the structure of personality, Cattell has distinguished between "surface traits", defined as clusters of manifest variables that appear to go together, and "source traits", which represent underlying variables which are the basis of surface behaviour, and which may be identified by means of factor analysis only²¹. In his search for source traits of personality, Cattell has, as previously indicated, taken much care to analyse data taken from the whole spectrum of human personality and to obtain real, natural primary factors.

²¹ R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, pp. 374 and 375.

Cattell's analyses were carried out with distinct types of data, known as "L-data" and "Q-data"²². L-data involved behaviour in the every-day life situation, individuals being observed and rated by trained observers as they went about their normal routines. These data were thus collected as ratings, based on the frequency and intensity with which specific kinds of behaviour occurred in the people being observed. Q-data were collected by means of questionnaires, and consisted of information which individuals provided about themselves or about how they saw themselves.

Cattell's original search for source traits of personality involved the analysis of L-data, and resulted in the extraction of twelve factors accounting for forty per cent of the variance²³. Of these traits, ten matched personality characteristics which had been identified by previous, clinical researches. Analysis of Q-data, which was carried out subsequently, resulted in the identification of factors which matched each of the traits found earlier (with L-data). In addition, a number of new factors was found²⁴.

22 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 61.

23 R. B. Cattell, The Description and Measurement of Personality, Yonkers, World Book Co., 1946, pp. 311-337.

24 Idem, ibid., pp. 355-368.

Cattell and his associates have constructed a number of instruments designed to measure Cattell's source traits of personality. The different instruments are intended to be used with different, specified, age-groups. The Sixteen Personality Factor Questionnaire (16PF), which was first published in 1949²⁵, was designed to measure the sixteen personality source traits which recurred most consistently among, and made the largest contribution to the variation of the behaviour of, adults²⁶. The High School Personality Questionnaire (HSPQ) measures the fourteen variables most appropriate for use with high school students²⁷. The source traits measured by these two instruments are listed, by the code and title provided by Cattell, in Table I.

Other instruments which measure sets of Cattell's source traits which are appropriate to the age-groups for which they were designed include the Children's Personality Questionnaire (CPQ) and the Early School Personality Questionnaire (ESPQ)²⁸.

25 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, p. xix.

26 R. B. Cattell and H. J. Butcher, The Prediction of Achievement and Creativity, Indianapolis, Bobbs Merrill, 1968, p. 57.

27 Idem, ibid., p. 61.

28 R. B. Cattell and H. J. Butcher, op. cit., p. 62.

Table I

The Primary Source Traits Measured by
the Sixteen Personality Factor Questionnaire
and the High School Personality Questionnaire

Code	Title of Trait
A	Affectothymia versus Sizothymia
B	General Intelligence versus Mental Defect
C	Ego Strength versus Ego Weakness
*D	Excitability versus Phlegmatic Temperament
E	Dominance versus Submissiveness
F	Surgency versus Desurgency
G	Superego Strength versus Superego Weakness
H	Parmia versus Thretica
I	Premia versus Harria
*J	Asthenia versus Zeppia
†L	Protension versus Alaxia
†M	Autia versus Practical Concernedness
†N	Sophistication versus Naivete
O	Guilt-proneness versus Confident Adequacy
†Q1	Radicalism versus Conservatism
Q2	Self-sufficiency versus Group Dependency
Q3	Strong Self-sentiment versus Weak Self-sentiment
Q4	High Ergic Tension versus Low Ergic Tension

* included in HSPQ but not in 16PF

† included in 16PF but not in HSPQ

Reference to Table I indicates that, with a few exceptions, the 16PF and the HSPQ measure the same traits. According to Cattell²⁹, the primary source traits are present in people of all ages. Factors L, M, N and Q1, however, which are fairly important in adults, seem to be of relatively little importance in differentiating among children³⁰. Consequently, these four factors are measured by the 16PF but not by the HSPQ. Factors D and J, on the other hand, which contribute substantially to the variance of behaviour in children, are of relatively little importance in adults. These factors appear in the HSPQ but not in the 16PF.

For any particular personality factor, an individual's score represents a point on the continuum which exists between the negative pole and the positive pole of the factor. As Cattell points out³¹, no value judgement is implied by designating one pole as positive and the other as negative, the direction of scoring being purely arbitrary. Cattell is inclined to describe an individual who scores nearer the positive pole than the negative pole of a factor, say Factor A, as "an A+ individual"; a person who makes a low score on Factor A is often described as "an A- person".

29 R. B. Cattell, The Description and Measurement of Personality, Yonkers, World Book Co., 1946, p. 61.

30 R. B. Cattell and M. J. Butcher, op. cit., p. 61.

31 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1965, p. 66.

Each of the factors measured by the HSPQ will now be considered, one at a time, in more detail.

Factor A

The title of Factor A is "Affectothymia versus Sizothymia"; the factor is described also by the more popular phrase "warmhearted versus reserved"³². In connection with the term "sizothymia", Cattell states that

in spite of Kretschmer's using schizothyme to distinguish the normal temperament from the schizophrenic, the general public continues to regard "schizo" as indicating abnormality [. . .] it has seemed best to avoid misunderstanding by using the new title [. . .] now adopted³³.

The term "affectothyme" is used to describe the cyclothyme, when normal, because the primary characteristic is affect or emotion rather than the clinical "ups and downs of elation and depression"³⁴ which occur in the abnormal, clinically insane person.

Among the characteristics which load on Factor A are those that may be described as "easygoing versus obstructive", "adaptable versus inflexible", "trustful versus suspicious", "impulsive versus cautious" and "subject to emotional appeal versus impersonal".

32 R. B. Cattell and M. D. L. Cattell, op. cit., p. 7.

33 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 66.

34 Idem, ibid., p. 67.

Cattell and Eber³⁵ report that in questionnaire responses, the A+ individual expresses marked preference for occupations dealing with people, and enjoys social recognition. The A- person, on the other hand, likes things or words, working alone, intellectual companionship and avoidance of compromise. The highest ranking occupations on the positive pole are teaching and salesmanship, while those which rank most highly at the negative pole are those of the house electrician and the physicist.

Factor B

Factor B is entitled "General Intelligence versus Mental Defect". It is stated in the HSPQ handbook that the principle object in including Factor B in the questionnaire is

not to add personality information in the narrower sense, but to complete the measurement of factors which are important in most school and clinical predictions by adding a good, brief, general ability measure³⁶.

The factor is unlikely to contain much non-intellective material, since it has relatively low correlations with

35 R. B. Cattell and H. W. Eber, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1957, p. 11.

36 R. B. Cattell and M. D. L. Cattell, Handbook for High School Personality Questionnaire, Champaign, IPAT, 1969, p. 28.

the other primary factors measured by the HSPQ³⁷. At the second stratum, Factor B accounts almost fully for the factor labelled "Intelligence" (the other factors all have virtually zero loadings), and has low loadings on all the remaining second stratum factors³⁸.

Factor C

The essence of Factor C, "Ego Strength versus Ego Weakness", appears to be an ability or inability to control emotions and impulses. Behaviour ratings which have high loadings on this factor include items which may be described as "mature versus unable to tolerate frustration", "steady and persistent versus changeable", "emotionally calm versus impulsively emotional" and "reliable about problems versus evades necessary decisions"³⁹. The meaning of this source trait

[. . .] seems to support the psychoanalytic concept of Ego Strength. Further, its demonstrated persistent negative correlation with neuroticism and anxiety, in various experimental groups in America and Britain, supports this interpretation⁴⁰.

38 R. B. Cattell, H. W. Lber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, p. 128.

39 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 73.

40 Idem, ibid., p. 72.

It is reported in the 16PF handbook⁴¹ that individuals whose occupations cause them to have to adjust to difficulties thrown upon them from outside run well above the average on Factor C, typical occupations in this class being those of teachers, salesmen, engineers and firemen. At the negative end of the scale, occupations such as postman, janitor, writer and clerk tend to be found — occupations which do not usually demand sudden adjustments.

Factor D

The fourth factor measured by the HSPQ, Factor D, is entitled "Excitability versus Phlegmatic Temperament". This factor has sometimes failed to appear in adults, but shows a substantial dimension in children⁴².

What is discovered in the D source trait is a pattern of distractibility, along with irresponsible and assertive overaction⁴³. Characteristic expressions of individuals who have high scores on Factor D include proneness to distraction, overaction and jealousy, and the demonstration of many nervous

41 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, p. 84.

42 R. B. Cattell and M. D. L. Cattell, Handbook for the High School Personality Questionnaire, Champaign, IPAT, 1969, p. 29.

43 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit. p. 85.

symptoms. The high-D scoring individual, although likeable and affectionate in quieter moods, is apt to be regarded as considerable nuisance in restrictive situations, since he is so demanding and impulsive⁴⁴.

Factor E

"Dominance versus Submissiveness" is the title of Factor E. Characteristics which load on this factor include "assertive versus submissive", "independent-minded versus dependent", "solemn versus expressive", "hard and stern versus kindly and soft-hearted", "unconventional versus conventional" and "attention-getting versus self-sufficient".

Cattell and Eber write:

Here we have the well-known factor of dominance which has been investigated by Maslow, Allport and others [. . .] From the ascendance-submission studies with Allport's test it is known that dominance tends to be positively correlated to some extent with social status and is somewhat higher in established leaders than in followers⁴⁵.

Among occupations, Factor E is most associated with those that require boldness and courage, the highest obtained values being for firemen and airmen, and the lowest for secretaries⁴⁶.

44 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 85.

45 R. B. Cattell and H. W. Eber, op. cit., p. 12.

46 Idem, ibid., p. 13.

It is reported in the 16PF handbook that dominance (as measured by Factor E) is negatively related to school achievement at all ages up to university graduate work, and it is suggested that this is possibly due to the tendency of docility to enhance performance in examinations⁴⁷.

Factor F

Factor F is the largest factor among children, and is known by the title "Surgency versus Desurgency". The essence of high F "is a placid, unemotional realistic cheerfulness, with talkativeness, geniality, enthusiasm, sociability and a witty originality"⁴⁸. Of this factor, Cattell writes:

As the title indicates, the extreme low endowment in this source trait apparently corresponds to the clinical syndrome of anxious hysteria and, ultimately, agitated melancholia⁴⁹.

Cattell writes, further:

In some ways this factor may look like a state of elation-depression rather than a trait [. . .]

47 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, p. 86.

48 R. B. Cattell, Description and Measurement of Personality, Yonkers-on-Hudson, World Book Company, 1946, p. 484.

49 R. B. Cattell, Personality: A Systematic, Theoretical and Factual Study, New York, McGraw-Hill, 1950, p. 61.

but it can be said here and now that it is more than a state, and that the evidence points to its representing a steadily enduring individual difference⁵⁰.

Among occupational groups, business executives and directors are high in surgency, while artists, university administrators and physicists are low⁵¹.

Factor G

The seventh factor measured by the HSPQ is entitled "Superego Strength versus Superego Weakness". Characteristics which load most highly on this factor are "persevering versus quitting", "responsible versus frivolous", "emotionally mature versus impatient", "consistently ordered versus indolent" and "conscientious versus undependable".

Subjectively, the G+ person views himself as correct in, and a guardian of, manners and morals, persevering, planful, able to concentrate, cautious in thinking before he speaks, and preferring efficient people to other companions⁵².

Whatever coheres in the psychoanalytic concept of superego strength seems to be embodied in this demonstrated source trait. Certainly, it best depicts deeply rooted concern for moral

50 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 92.

51 Idem, ibid., p. 88.

52 R. B. Cattell and M. D. L. Cattell, op. cit., p. 30.

standards, for persistence of effort, and, in general, that tendency to drive the ego and restrain the id⁵³.

High scores on Factor G, in typical high school groups, "consistently correlate positively and significantly with academic achievement, interest in school and peers, popularity, and election to leadership"⁵⁴. Conversely, institutionalised delinquents score below average on G, and gradually obtain higher scores as their adjustment improves⁵⁵.

Factor H

Factor H is another whose title is made up of new terms — "Parmia versus Thretica". The definitions of these terms are given by Cattell in the following statement:

The nature-nurture studies show H to have the highest degree of inheritance found among personality source traits, and this is supported by physiological findings, notably that electric heart records [. . .] show a "stout-heartedness" and smaller and slower reaction to startle in H+ individuals. For this reason, on the hypothesis that the parasympathetic nervous system predominates in these individuals over the sympathetic, it has been called for short Parmia or the parmic temperament. The opposite pole has been called Thretica, because its essence is a high susceptibility to threat⁵⁶.

53 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 89.

54 R. B. Cattell and M. D. L. Cattell, op. cit., p. 31.

55 Idem, ibid., p. 31.

56 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 97.

It is reported that the H+ individual tends to recall emotional rather than unemotional material, and that in childhood he tends to be labelled "lazy", probably because of his tendency to show little inhibition by environmental threat. The H- person, in contrast, tends to be shy and withdrawn⁵⁷.

Factor I

Among characteristics which load on Factor I, "Premia versus Harria", are those that have been described by such phrases as "demanding versus emotionally mature", "dependent versus independent-minded", "gentle, sentimental versus hard, realistic", "enjoys imaginative fancies versus not fanciful" and "likes to be with people versus self-sufficient"⁵⁸.

It is possible that this factor consists, in fact, of two factors. Cattell writes:

The essential characteristic of factor I is more elusive than with most source traits. There is every indication [. . .] that the I factor is really two highly "coöperative" factors requiring to be "split" by more exact research techniques. The positive loadings show primarily a tender-hearted, sensitive, sympathetic emotionality and imaginativeness, with some emotional dependence, gregariousness, neuroticism and timidity. The obverse is represented by a hardboiled,

57 R. B. Cattell and H. W. Eber, op. cit., p. 14.

58 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 96.

mature, independent, unemotional, poised individual with some smugness, overprecision, and blinkered logic⁵⁹.

The "nature-nurture evidence"⁶⁰, already referred to in connection with Factor H, shows that I+ is associated with "overprotected, and, in some cases, more fastidiously cultured homes, as well as with over-ripe cultures"⁶¹, a pattern which is well described by the phrase "protected emotional sensitivity", which may be shortened to "premsia". The term "harria", which is applied to the negative pole of the factor, is derived from the phrase "hard realism".

It is reported⁶² that the I+ individual has, in various questionnaire studies, shown a dislike for crude people and rough occupations, a like for travel, a love of dramatics and a certain impracticality in general affairs.

Factor J

Factor J carries the title "Asthenia versus Zeppia". According to Cattell and Cattell, this factor has so far

59 R. B. Cattell, Description and Measurement of Personality, Yonkers-on-Hudson, World Book Company, 1946, p. 486.

60 R. B. Cattell, D. B. Blewett and J. R. Beloff, "The Inheritance of Personality", American Journal of Human Genetics, 7, 1955, 122-146.

61 R. B. Cattell and H. W. Eber, op. cit., p. 15.

62 R. B. Cattell and H. W. Eber, op. cit., p. 15.

proved to be a difficult one to interpret. They write:

In questionnaire responses, the J+ individual prefers to do things on his own, is physically and intellectually fastidious, thinks over his mistakes and how to avoid them [. . .] has private views differing from the group, but prefers to keep in the background to avoid argument [. . .] this factor appears to be the common influence underlying psychasthenic behavior; hence the term "coasthenia" [. . .]⁶³.

In some literature, Cattell uses the term "coasthenia", whereas in other writings he uses the shorter term, "asthenia". He acknowledges that this factor needs more intensive research on its associations and origins⁶⁴.

Factor 0

Factor 0 is described as "Guilt-proneness versus Confident Adequacy". Characteristics which load most highly on this factor include those described as "worrying versus self-confident", "depressed versus cheerful", "strong sense of duty versus expedient", "scrupulous and fussy versus does not care" and "hypochondriacal versus rudely vigorous"⁶⁵.

It is reported in the HSPQ manual⁶⁶ that the 0+ person feels overfatigued by exciting situations, has a

63 R. B. Cattell and M. D. L. Cattell, op. cit., p. 32.

64 Idem, ibid., p. 33.

65 R. B. Cattell and H. W. Eber, op. cit., p. 17.

66 R. B. Cattell and M. D. L. Cattell, op. cit., p. 33.

sense of inferiority and inadequacy when dealing with the rough demands of daily life, becomes emotionally upset by pressure from authority, and prefers books and quiet interests to people and noise.

Factor Q2

The last three factors measured by the HSPQ belong to a group which shows up much more readily in questionnaire responses than in gross behaviour⁶⁷. The factors discussed so far, on the other hand, have been demonstrated to exist simultaneously as patterns in behaviour ratings made by observers and patterns in questionnaire responses. These last three factors have therefore been allocated "Q" designations.

Factor Q2 is described as "Self-sufficiency versus Group Dependency". Responses to questionnaire items show a Q2+ person as one who is resolute and accustomed to making his own decisions. A Q2- person, on the other hand, tends to go with the group, places greater value on social approval and is conventional and fashionable⁶⁸.

67 R. B. Cattell, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1967, p. 71.

68 R. B. Cattell and M. D. L. Cattell, op. cit., p. 33.

Occupationally, the factor is reported to be very high in farmers, writers and scientists⁶⁹. The factor is "a constant and very significant contributor to scholastic success"⁷⁰.

Factor Q3

The title given to Factor Q3 is "Strong Self-sentiment versus Weak Self-sentiment". According to questionnaire items which load on this factor, the Q3+ person "shows socially approved character responses, self-control, persistence, foresight, considerateness of others and conscientiousness"⁷¹. It is reported that the factor is "related strongly to success in school"⁷².

High Q3 scores are associated with success in mechanical, mathematical and productive organisational activities. Occupationally, the factor is strong in executives, policemen, electricians and psychiatric technicians, in all of whom objectivity, balance and decisiveness are required⁷³.

69 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 105.

70 Idem, ibid., p. 105.

71 R. B. Cattell and H. W. Eber, op. cit., p. 18.

72 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 107.

73 R. B. Cattell and M. D. L. Cattell, op. cit., p. 34.

The individual who makes a low score on Q3 tends to be uncontrolled, lax and careless of social rules, and likes to follow his own urges⁷⁴.

Factor Q4

The last factor measured by the HSPQ, Factor Q4, is described as "High Ergic Tension versus Low Ergic Tension". Cattell and Cattell state that the best theoretical interpretation of this factor available at present is that it describes excitement and tension, and reflects level of undischarged drive⁷⁵. People scoring high on Q4 describe themselves as irrationally worried, tense, irritable and in turmoil, whereas low scoring individuals see themselves as relaxed, tranquil and unfrustrated⁷⁶. High-Q4 children feel frustrated and are sensitively aware of being criticised by parents for untidiness, phantasy and neglect of good goals⁷⁷.

74 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 106.

75 R. B. Cattell and M. D. L. Cattell, op. cit., p. 35.

76 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 107.

77 R. B. Cattell and M. D. L. Cattell, op. cit., p. 34.

4. Relationships Between Cattell's Source Traits and General Academic Achievement

It has already been shown that, at the university level, Eysenck's Extraversion dimension of personality is related to general academic achievement. Cattell has indicated that some of his primary personality factors, also play a part in scholastic achievement. The findings of a number of studies support this contention.

Warburton, Butcher and Forrest⁷⁸, for example, carried out a study in which the 16PF was administered to one hundred English graduates who were undergoing their year of professional teacher-training. It was found that factors C, G and M were significantly correlated, at the 5% level, with the final theory marks. Moreover, the fifteen non-intellective factors measured by the 16PF accounted for twenty-seven per cent of the variance of performance.

In another study, Rushton⁷⁹ worked with 485 ten-year-old English children. This sample was drawn from fourteen schools which approximately represented the different

78 F. W. Warburton, H. J. Butcher and G. M. Forrest, "Predicting Student Performance in a University Department of Education", British Journal of Educational Psychology, 1963, 33, 68-80.

79 J. Rushton, "The Relationship Between Personality Characteristics and Scholastic Success in Eleven-year-old Children", British Journal of Educational Psychology, 1966, 36, 178-184.

socio-economic strata and school-size of a large English county borough. Academic ability was measured by a battery of the Moray House tests, and personality was measured by Cattell's Children's Personality Questionnaire (CPQ).

Product-moment correlations were calculated between the primary personality factors and each of the academic abilities. The factors A, F and G were each significantly and positively correlated with each of the verbal, arithmetic and English abilities, at the 5% level.

The 16PF was used in a recent study conducted by Trent, using university freshmen⁸⁰. Trent had a large sample consisting of 583 men and 780 women. On the basis of verbal scores obtained on the Scholastic Aptitude Test of the CEEB, each sex was divided into three "ability" categories: low, average and high. On the basis of "Freshman Cumulative Grade Point Averages", each of the six subsamples was divided into three achievement categories: below average, average and above average. For each subsample, a series of one-way analyses of variance was carried out; the object of these analyses was, for each personality factor separately, to test the null hypothesis that there

80 S. J. Trent, A Study of the Relationship of Personality Factors to Academic Achievement, a doctoral dissertation presented to the Graduate Council of the University of Tennessee, 1968.

was no difference between the mean trait-scores of the three achievement levels. The association between each personality variable and level of achievement was thus examined for each of the six sex-ability combinations. No consistent pattern of personality factors emerged as being related to achievement, although Factor F was associated with a significant F-ratio on three occasions and Factor O appeared twice. In any case, it is doubtful whether the findings of the Trent study are very reliable in view of the extreme imbalance between some of the treatment group sizes (within a subsample).

A sample consisting of 144 seventh and eighth grade students was used in part of a study conducted by Cattell, Sealy and Sweney⁸¹. The students were given the IPAT Culture Fair Intelligence Test (CF), the HSPQ, and a standard scholastic achievement test. School marks were available also. There were thus two sets of measures of scholastic achievement. Multiple correlations were calculated between each set of achievement measures and various combinations of predictors, with the following results. The CF accounted for twenty-five per cent of the variance of the standard achievement variable, the thirteen non-intellective HSPQ

81 R. B. Cattell, A. P. Sealy and A. B. Sweney, "What Can Personality and Motivation Source Trait Measurements Add to the Prediction of School Achievement?", British Journal of Educational Psychology, 1966, 36, 280-295.

traits accounted for twenty-seven per cent, and the CF and the thirteen non-intellective HSPQ factors accounted for sixty-two per cent when used together as predictors. When school marks were used as measures of achievement, twenty-three per cent of the variance was accounted for by the CF, thirty-six per cent by the thirteen non-intellective HSPQ traits, and fifty-six per cent by both sets of predictors together. This suggests that fluid intelligence (which is measured by the CF) and non-intellective personality are essentially different things, and that each accounts for about one quarter of the variance of scholastic performance.

A study reported by Cattell and Butcher⁸² involved an urban sample containing 153 junior high school students, and a rural sample of 124 junior high school students. The students were given the Primary Mental Abilities Test (PMA), the HSPQ, the IPAT Culture Fair Intelligence Test (CF) and the Stanford Achievement Test (SAT). Factor B of the HSPQ (General Intelligence versus Mental Defect) accounted for 37.5 per cent of the variance of achievement in the urban sample and for 26.0 per cent in the rural sample. The addition of the rest of the HSPQ variables increased the proportions to 47.5 per cent and 37.2 per cent, respectively.

82 R. B. Cattell and H. J. Butcher, The Prediction of Achievement and Creativity, Indianapolis, Bobbs Merrill, 1968, Chapter 10, pp. 181-200.

The addition of the non-intellective factors of the HSPQ thus produced an increase of about ten per cent in the proportion of the variance of achievement accounted for. The results do not indicate the relative contributions of the respective traits, and it is possible that a few traits account for substantial parts of the increase and that others account for virtually none.

When measures of primary mental abilities were brought into the calculations, the CF and the PMA together accounted for 44.9 per cent of the variance of achievement in the rural sample. The addition of the HSPQ variables increased this proportion to 54.8 per cent. In the urban sample, the respective proportions were 51.8 per cent and 62.4 per cent. The HSPQ, of course, contains Factor B, which is reported to measure, essentially, crystallised general ability⁸³. The addition of Factor B is thus unlikely to have added much to the proportion of the variance of achievement, since Factor B and the PMA variables measure essentially the same thing. The increase in proportion must therefore have been due chiefly to the non-intellective factors of the HSPQ.

83 R. B. Cattell and M. D. L. Cattell, Handbook for the High School Personality Questionnaire, Champaign, IPAT, 1969, p. 28.

For the urban sample, additional information was reported. The factors A, D, E, G, Q2 and Q3 together accounted for 13.0 per cent of the variance of achievement, the addition of the rest of the non-intellective HSPQ variables increased this proportion to 22.1 per cent, and the further addition of Factor B produced a further increase of the proportion to 47.5 per cent.

An inspection of the information produced by this study shows that, in general, the addition of the non-intellective HSQP variables to intellective predictors, such as the CF or Factor B, produces an increase of the proportion of the variance of achievement accounted for, of about ten per cent. This is considerably less than the twenty-five per cent suggested by Cattell, Sealy and Sweney, but is, nevertheless, not insubstantial. With the urban sample, on the other hand, a relatively large proportion of the variance of achievement was accounted for by only six of the non-intellective factors together. It is possible, however, that the urban sample was a "lucky sample", since the data for the rural sample indicates that the HSPQ variables would be unlikely to account for such a high proportion of the variance of achievement.

Taken as a whole, the studies reviewed in this section indicate that Cattell's source traits of personality may indeed be used as predictors of general scholastic performance.

5. Personality Differences Among Individuals

Working in Different Academic Areas

In the handbook for the 16PF, personality profiles for many different occupations are given⁸⁴. These profiles are different from occupation to occupation, and comparisons reveal interesting trait differences between persons in one occupation and those in another occupation.

For instance, the profiles for chemists and chemical engineers, and for writers, are reproduced below⁸⁵.

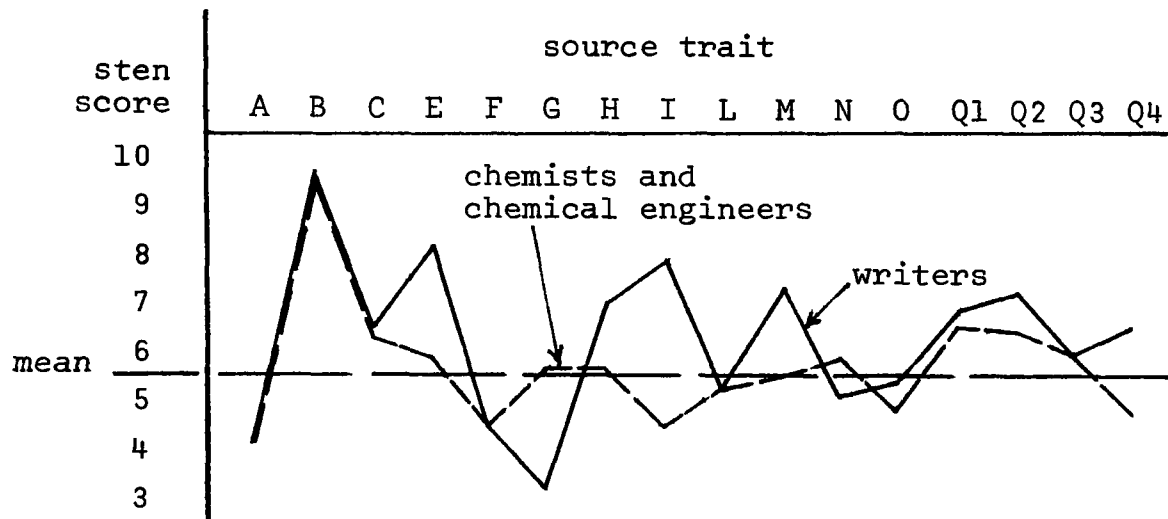


Figure 1. Personality Profiles for Chemists and Chemical Engineers and for Writers

⁸⁴ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, Chapter 12.

⁸⁵ Idem, ibid., pp. 216 and 227.

Striking differences between these groups can be observed from the profiles, for the traits E, G, I, M and Q4. In general terms, writers tend to be more dominant, tender-minded, tense and imaginative than chemists and chemical engineers. Writers of fiction tend to be interested in people and in literary styles; chemists, on the other hand tend to be interested in the more impersonal realm of the sciences. In short: the academic inclinations of these two groups tend to be in different areas.

In a study involving the 16PF, Roe and Siegelman⁸⁶ obtained samples of men who were committed to engineering (N = 22) or social work (N = 24) as a lifetime occupation, and whose jobs in these fields were not primarily administrative. Measures on all the 16PF factors were obtained. An inspection of the data reveals that the samples were significantly different, at the 5% level, on factors A, F, H, Q2 and Q3. The engineers made lower scores than the social workers on factors A, F and H, and higher scores on factors Q2 and Q3.

A number of studies have been conducted in order to demonstrate that university students who are in departments as widely separated as the humanities and the sciences differ

86 A. Roe and M. Siegelman, "The Origin of Interests", APGA Inquiry Studies, Washington, American Personnel and Guidance Association, 1964.

in various aspects of personality. Such a study, designed to compare personality characteristics of engineering majors and liberal arts majors was carried out by Trent and Athey⁸⁷. Samples consisted of male students who had persisted in college for four years. There were 107 engineering majors and 376 liberal arts majors. The study was conducted at the Center for the Study of Higher Education at the Berkeley campus of the University of California. Several attitudinal scales from the Center's Omnibus Personality Inventory were administered to the samples. The scores of three scales were combined to yield measures of intellectual disposition; other scales gave measures of manifest anxiety and "flexibility and open-mindedness in thinking". Analysis of the responses revealed that the engineering students were much less flexible and open-minded in their thinking, and manifested less anxiety, than the liberal arts students. The manual for the instrument used, however, is not published⁸⁸, and in the absence of any data about the psychometric properties of its scales, the reliability of the results of the study is unknown.

87 J. W. Trent and I. J. Athey, Dispositional Differences Between Technology and Liberal Arts Majors, paper presented at the Annual Conference of the California Educational Research Association, 1965.

88 M. L. Goldschmid, The Prediction of College Major in the Sciences and the Humanities by Means of Personality Tests, a doctoral dissertation presented to the Graduate Division of the University of California, 1965.

Gallese⁸⁹, using the Minnesota Multiphasic Personality Inventory (MMPI), conducted a study involving 298 male engineering students. Their mean scores on the MMPI variables were compared with those of over five thousand "general" male students. The engineers made a reliably higher mean score on the K scale, and significantly lower mean scores on all the other scales except the Pa scale, than did male students in general. The most marked differences were found on the Mf and Ma scales. These findings indicate that engineers tend to be more masculine in their interests and less interested in people than are students in general.

Personality differences between recent graduates in the physical and social sciences were investigated by Field⁹⁰. In this study, twenty-nine matched pairs were used, matching being on age and intelligence (measured by the Otis Intelligence Scale). Experimental subjects were recruited by telephone or by personal contact. A "self concept test", based on the five personality traits consistently isolated by Fiske, was administered. The traits measured by the test

89 A. J. Gallese, Personality Characteristics and Academic Achievement in School of Engineering Students, a doctoral dissertation presented to the Faculty of the Graduate School, University of Minnesota, 1958.

90 L. W. Field, Personality Correlates of College Achievement and Major Areas of Study, a doctoral dissertation presented to the Faculty of the Graduate School, University of Houston, 1954.

are referred to as "Social Adaptability", "Inquiring Intellect", "Emotional Control", "Conformity" and "Confident Self-expression". For each of these factors, a Student t test was carried out to test the null hypothesis that there was no difference between the mean score of the physical scientists and that of the social scientists. Emotional Control and Conformity produced differences which were significant at the 5% level.

The Emotional Control factor of the test is reported by Field⁹¹ to be characterised by descriptions such as "unshakeable", "self-sufficient", "placid" and "limited overt social expression at one pole, and by "easily upset", "dependent", and "marked overt emotional expression" at the other pole. The other significant factor, Conformity, is reported as being related to obeying the social mores. The study thus indicates that recently graduated physical scientists exercise more social control and are more conformist as far as social standards are concerned. These findings, however, must be viewed with caution in view of the smallness of the samples, the method of recruitment, and since no psychometric properties of the "self concept test" were reported.

A comparison of the personalities of students in Arts courses and Sciences courses was part of a study carried

91 L. W. Field, op. cit., p. 51.

out by Drevdahl⁹². The experimental subjects were fifty-two graduate or advanced undergraduate students from several of the science and arts departments of the University of Nebraska. The students were divided into two groups according to whether they were from science or arts departments, and were given the 16PF. The proportion of the students in each of the groups is not indicated in the report. For each of the traits measured by the 16PF, an F test was carried out to test the null hypothesis that there was no difference between the mean score of the arts group and that of the science group. Differences, significant at the 1% level, were found for Factor I and Factor M, indicating that the arts students were more premsic (tender-minded) and more autic (imaginative and Bohemian) than the science students. A multivariate analysis of variance might have produced some interesting results, although the investigation of personality differences was not the main purpose of the study.

The studies reviewed so far have indicated that personality differences exist between arts students and students in science and technology. Unfortunately, different personality instruments have been used, and it is difficult to assess the similarity of similar-sounding characteristics. In addition, each of the studies has dealt with arts students

⁹² J. E. Drevdahl, "Facts of Importance for Creativity", Journal of Clinical Psychology, 1956, 12, 21-26.

and science students as if they were members of mutually independent categories. An interesting departure from this procedure was taken in a study, carried out with university students, by Goldschmid⁹³.

Rather than assuming a single dimension with the humanities at one end and the sciences at the other, Goldschmid set up two continua, one for "sciences" and one for "humanities". Fifty-five major fields of study were selected so as to include the major departments which existed in most colleges and universities, to consist of fields in which both men and women tend to major, and to represent as wide a spectrum of the "science-to-humanities continuum" as possible. Two rating forms, Form A and Form B, were completed by eleven groups of judges consisting of counsellors, professors and upper division students majoring in a wide variety of subjects at the University of California. Form A dealt with the science continuum, and consisted of fifty-four pairs of subjects, Physics being paired with each other subject in turn. Raters were asked to divide one hundred points between the members of each pair of subjects, according to the degree of "science" that was perceived as being in each.

93 M. L. Goldschmid, The Prediction of College Major in the Sciences and the Humanities by Means of Personality Tests, a doctoral dissertation presented to the Graduate Division of the University of California, 1965.

Form B dealt with the humanities continuum, each subject being paired with Philosophy. The agreement among the data provided by the various groups for each of the forms was very good, no correlation between any two sets of ratings being below 0.90. The various subjects were allocated positions along the science continuum and along the humanities continuum by a method referred to as the constant-sum method. The scale value of each subject on each continuum is included in Goldschmid's report⁹⁴. In particular, it is noted that Mathematics, Physics and Chemistry occupied high positions on the sciences continuum, while English, History and Foreign Languages occupied high positions on the humanities continuum.

The purpose of Goldschmid's study was to relate measured personality traits to his continua of science and the humanities. For this purpose, he obtained a number of samples, each of which had been measured by a different personality instrument, the data of which were available at a number of different universities. In this way, data from the following instruments were collected (the numerals in parentheses indicate the numbers in the samples): the California Psychological Inventory (507), the Minnesota Multiphasic Personality Inventory (345), the Myers-Briggs-Type Indicator (122), and the Omnibus Personality Inventory (470).

94 M. L. Goldschmid, op. cit., p. 28.

Each sample was divided into two sub-samples; one of these, containing two-thirds of the original sample, was used to set up regression equations, and the other was used for cross-validation. The "score" of each student's major subject on each continuum was found.

For each sample, two regression equations were established. One of these equations had science continuum scores as the criterion variable, the other had humanities continuum scores. In each case, the variables measured by the relevant personality instrument were used as independent variables.

In the equations relating to the CPI variables, the equation predicting a student's standing on the humanities continuum contained three variables, Do, Sp and Fe, which were included in the science equation also, but with reversed signs. These variables are named Dominance, Social Presence and Femininity, respectively. The interpretation of these findings was that students who were high on the science continuum (and low on the humanities continuum) tended to lack dominance and social initiative, and were robust, decisive and masculine. Students having high scores on the humanities continuum tended to have the opposite characteristics.

In connection with the MMPI, it was found that students who scored high on the science continuum tended to

score high on the MMPI K and Si scales and low on the Mf scale, whereas those with high humanities scores had the opposite tendencies. It was thus interpreted that students with high science scores tended to be prudent, reserved and clear-thinking, action-oriented and to have a limited range of interests, and be shy in social contexts.

Analyses involving the Myers-Briggs-Type Indicator showed that a student scoring low on Extraversion would tend to major in the sciences, and that a student who scored high on Intuition and on Perception would be likely to major in the humanities.

The equations developed with the variables measured by the Omnibus Personality Inventory had three variables in common, but with opposite signs. These were T0 (technical orientation) and SI (lack of social interest), which were positive in the science equation, and TI (theoretical interest), which was positive in the humanities equation.

It was reported that high scores on the T0 scale indicated an interest in science and the tendency to use a logical, rational and realistic approach to problems, whereas low scores were associated with a preference for intuitive, imaginative thought. The TI scale was reported to be associated with a liking for reflective thought, especially of an abstract nature, and a tendency to express interest in a wide variety of areas. The person scoring low on the TI

scale tended to have interest in immediate and practical concerns. An individual scoring low on the SI scale was reported as seeking social contacts and gaining satisfaction from them, whereas a high scorer on this scale displayed little interest in people and social contacts. Typical candidates for graduation in the sciences were thus characterised as being interested in scientific activities, displaying little interest in social activities, and tending to evaluate ideas on the basis of their practical, immediate application.

The precise nature of the qualities measured by the scales of the various instruments is, of course, unknown. There are certainly indications, however, that those who are interested in the sciences tend to be socially withdrawn, have narrower fields of interest and to be practically-minded in comparison with students of the humanities.

6. The HSPQ Factors and Scholastic Performance

So far in this chapter, a number of personality characteristics has been shown to relate to general scholastic performance. In addition, certain characteristics have been identified as discriminators between those who are involved in the humanities and those who are involved in the sciences.

In this section, each of the personality factors measured by the HSPQ will be examined in turn with a view to categorisation, as follows. The review of the literature has indicated that some factors should be discriminators between those whose general scholastic performance is high and those whose general scholastic performance is poor. Such factors will be assigned to a general performance category. The evidence indicates that other factors should be discriminators between those who are inclined towards the humanities and those who are inclined towards the sciences. These factors will be assigned to a humanities-sciences category. It may prove impossible, of course, after examination, to place some factors in either category. Such uncategorised factors will be referred to as "omitted factors".

Factor A

Factor A is characterised by a rigid, cold, precise objective and critical person at the negative pole, and by a soft-hearted, easygoing, warm, trustful, adaptable individual at the positive pole.

Roe and Siegelman found engineers and social workers to differ significantly on Factor A. Goldschmid showed a tendency for university students who were majoring in subjects which were high on his science continuum to be cold, precise and critical.

Cattell, moreover, reports that electricians and research scientists are among the lowest-scoring occupations for Factor A.

It thus appears that individuals who are involved in the sciences tend to make higher scores than those who are involved in the humanities. Factor A is thus assigned to the humanities-sciences category.

Factor B

The Intelligence versus Mental Defect source trait is probably related to academic performance in general. This factor is not, however, a non-intellective personality trait, and will thus be omitted from further discussion.

Factor C

High scores on Factor C are associated with stability, calmness and ability to adjust to facts. There is no reason to believe that these characteristics are related to one subject, or group of subjects, more than to any other. Each characteristic is, however, surely associated with scholastic performance; the individual who is stable and calm is much less likely to be upset by examinations than the person who is unstable and turbulent, and is thus likely (all else being equal) to perform at a higher level.

The characteristics associated with low scores on Factor C, tendency to give up, perturbability and emotional instability, would appear to be related to poor scholastic performance, but are not likely to be more detrimental in one area than in another.

The study of Warburton, Butcher and Forrest indicated that teacher-trainees who scored high marks in their final theory examinations tended to have high scores on Factor C.

It seems probable, therefore, that Factor C will discriminate between high and low general performers, individuals with high scholastic performance having high scores on Factor C also. This factor is thus assigned to the general performance category.

Factor D

None of the studies which has been reviewed has indicated that Factor D (Excitability versus Phlegmatic Temperament) is a predictor of general scholastic performance. Neither has the factor been demonstrated to be one which distinguishes between those with humanities and sciences interests. This may, of course, be because most of the studies in question have employed the 16PF rather than the HSPQ, Factor D being excluded from the more senior instrument. In the case of studies in which other instruments

have been used, relevant characteristics similar to those which make up Factor D have not been identified.

Characteristics which load on Factor D include "attention-getting versus complacent", "excitable versus deliberate", "prone to jealousy versus not easily jealous" and "self-assertive versus self-effacing"⁹⁵. None of these dichotomies appears to be strongly related to either general scholastic performance or orientation towards the humanities or the sciences in particular.

Factor E

Characteristics associated with the positive pole of Factor E include "assertive", "independent-minded" and "unconventional". The negative pole of the factor is associated with characteristics such as "submissive", "dependent" and "conventional".

The individual who is assertive and independent-minded is likely to master the material which he is studying. Dominance, the positive pole of Factor E, may therefore be associated with general scholastic performance. On the other hand, the expressive, self-sufficient person seems likely to perform well scholastically. These two descriptors are associated with the negative pole of Factor E, Submissiveness.

⁹⁵ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 84.

Theoretical considerations thus indicate that both poles of Factor E are associated with general academic performance.

As far as involvement in the humanities or the sciences is concerned, Trent and Athey demonstrated engineering students to be inflexible in their thinking. An inflexibly-thinking individual tends to be independent-minded and assertive, rather than dependent and submissive. It was thought that the finding of Trent and Athey indicated that engineers should make high scores on Factor E. On the other hand, Field showed science majors to be conformist, and Goldschmid showed them to be conventional. Conventionality is a characteristic of the negative pole of Factor E, and submissiveness and dependency characteristics of the conformist. On the other hand, the profiles for writers and chemical engineers show that writers tend to score higher on Factor E than do chemical engineers. There thus appears to be conflicting information as to whether Factor E will discriminate between humanities-oriented people and those who are oriented towards the sciences. Factor E will therefore remain uncategorised, and thus becomes an omitted factor.

Factor F

Goldschmid's study demonstrated that the humanities, are seen as dealing primarily with people and abstraction,

and that the sciences are viewed as dealing mainly with theory and method, and least of all with people. The positive pole, Surgency, of Factor F is loaded by such characteristics as "talkative", "cheerful", "expressive" and "reflects the group"⁹⁶. These are indeed manifestations of the individual who is interested in people. Opposite characteristics, which are associated with the Desurgency pole of Factor F, include "silent", "introspective", "socially cautious" and "incommunicative"⁹⁷. These indicate a lack of interest in other people, and are commonly associated with individuals who are more concerned with theoretical or practical matters rather than with people.

Analysis of data from Roe and Siegelman's study indicated that engineers, who tend to be scientifically oriented, scored significantly lower on Factor F than did social workers, who, in general tend to have inclinations in the opposite direction.

There appears to be little evidence to indicate that Factor F might discriminate between individuals with high general scholastic performance and those with poor general performance.

⁹⁶ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 87.

⁹⁷ Idem, ibid., p. 87.

Factor F is thus assigned to the humanities-sciences category, with the expectation that those inclined towards the humanities will make higher scores on the F scale than will individuals who are inclined towards the sciences.

Factor G

The positive pole of Factor G, High Superego Strength, is composed of such characteristics as "persevering", "responsible", "consistently ordered" and "conscientious". All tend to be associated with good scholastic performance in general. The opposite characteristics, "quitting", "indolent" and "undependable", tend to be associated with poor general academic performance. There is no reason to believe that any of these traits is associated with interest in one academic area rather than another.

Support for the contention that Factor G is a predictor of general scholastic performance comes from the study of Warburton, Butcher and Forrest, who found that teacher-trainees who made high marks in their final theory examinations obtained high scores on Factor G also. In addition, a "school achievement" profile which is reproduced in the HSPQ handbook⁹⁸ shows that this factor is highly related to general performance in school. As mentioned

98 R. B. Cattell and M. D. L. Cattell, op. cit., p. 47.

earlier, high scores on Factor G, in typical high school groups, consistently correlate positively with academic achievement and interest in school.

Factor G is thus assigned to the general performance category.

Factor H

It was reported earlier that the individual who makes high scores on Factor H tends to be labelled "lazy" during childhood, probably because of his tendency to show little inhibition by environmental threat. This tendency could be expected to cause such an individual to perform at a lower level in school, because of his apparent indifference to the possible consequences. The degree of depression of performance level due to this characteristic may, of course, be very small, and it would perhaps be incautious to make hypotheses without some additional pointers.

Characteristics which load on Factor H include "adventurous, likes meeting people versus shy, withdrawn", "friendly versus apt to be embittered", "responsive, genial versus emotionally cautious" and "emotional and artistic interests versus restricted interests"⁹⁹. Cattell reports

⁹⁹ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 91.

that the

H- individual reports himself to be intensely shy, [. . .] slow and impeded in expressing himself, [. . .] disliking occupations with personal contacts, . . . 100

Gallese demonstrated that engineering undergraduates were less interested in people than students in general, and Goldschmid showed that students who were majoring in science-type subjects lacked social initiative, had little interest in social activities, and had limited ranges of interests. These characteristic, although not exactly equal to those which are known to be associated with the negative pole of Factor H, do suggest the personality of the H- individual. The data of Roe and Siegelman, moreover, demonstrate a significant difference between the mean scores, on Factor H, of engineers and social workers.

Factor H is thus assigned to the humanities-sciences category. The evidence indicates that individuals who are inclined towards the humanities should make higher scores on the H scale than those inclined towards the sciences.

Factor I

Characteristics such as "acts on practical, logical evidence", "hard (to the point of cynicism)", "unaffected

100 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 91.

by fancies" and "has few artistic responses (but not lacking in taste)" may all be associated with individuals who are concerned with calculations and theories rather than with people and cultures. All are associated with the negative pole of Factor I, Harria¹⁰¹. The positive pole of this factor is associated with such characteristics as "gentle, sentimental", "enjoys imaginative fancies" and "likes to be with people". Such traits may be associated with those who are interested in people, rather than in theories and objects.

Drevdahl demonstrated that Arts students made significantly higher scores on Factor I than did their peers in departments of science. In their study, which compared engineering majors with liberal arts majors, Trent and Athey found that the engineers tended to have much more interest in practical matters than did the arts students, thus indicating that the engineers were less "fanciful". In addition, the study of Goldschmid indicated that science students tended to evaluate ideas on the basis of their practicability.

There is thus no reason to believe that Factor I is associated with general scholastic performance.

¹⁰¹ R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 93.

Factor I is thus assigned to the humanities-sciences category. Individuals who are inclined towards the humanities would be expected to make higher scores on this factor than would those who are inclined towards the sciences.

Factor J

It was mentioned earlier that in questionnaire responses, the J+ individual preferred to do things on his own, was physically and intellectually fastidious, and tended to think over his mistakes and how to avoid them. It might thus be thought that a high score on Factor J would be associated with a higher level of scholastic performance. The profile for school achievement, given in the HSPQ handbook, however, indicates that there is no relationship¹⁰². None of the studies surveyed has touched on Factor J, since this factor is measured by the HSPQ but not by the 16PF. Insufficient evidence has been encountered to suggest that Factor J might discriminate among individuals having different academic orientations. This factor is thus unassigned to either category, and becomes an omitted factor.

102 R. B. Cattell and M. D. L. Cattell, op. cit., p. 47.

Factor 0

A survey of the characteristics associated with the respective pole of the Guilt-proneness versus Confident Adequacy factor indicates that this trait is related to general scholastic performance. The secure, self-confident individual, who would make a low score on Factor 0, would seem much more likely to succeed at academic work than the person who is apprehensive and worrying. The school achievement profile in the HSPQ handbook, moreover, indicates that Factor 0 is negatively related to achievement, although the relationship may not be significant.

It seems unlikely that persons with different academic orientation would be distinguished by Factor 0.

Factor 0 is thus assigned to the general performance category. High general performers would be expected to make lower scores on the 0 scale than individuals who have high general scholastic performance.

Factor Q2

Factor Q2, "Self-sufficiency versus Group Dependency", was reported to be very high among writers and scientists. The person who scores highly on this factor tends to be resolute and accustomed to making his own decisions; low scorers on Q2 tend to be conventional and fashionable. Self-sufficiency, Q2+, is a characteristic which would assist a student

in attaining a high level of scholastic performance, because, in examinations and tests, he relies very much on his own resources. Indeed, Cattell reported Factor Q2 to be a constant and very significant contributor to scholastic success.

Factor Q2 is thus placed in the general performance category. Those with high general scholastic performance are expected to make higher Q2 scores than those with a low level of general performance.

Factor Q3

The person who scores high on the Q3 scale tends to be persistent, conscientious and able to exercise self-control. At the opposite pole is the individual who is uncontrolled, lax, and careless of social rules, and who tends to follow his own urges. It would seem that the characteristics associated with Q3 are attributes which would help a student to perform well scholastically. It was reported, in fact, that the factor was related strongly to success in school.

In the study of Roe and Siegelman, however, engineers were found to have higher scores on Factor Q3 than social workers.

Factor Q3 is assigned to the general performance category, there being more evidence in favour of this classification than of the alternative one. It is expected

that high-performing individuals would make higher scores on the Q3 scale than would people with low general scholastic performance.

Factor Q4

None of the studies reviewed has indicated evidence which might support the belief that Factor Q4 is related to academic success, or to interest in different scholastic areas. The factor is labelled "High Ergic Tension versus Low Ergic Tension"; ergic tension is evident in an individual who describes himself as being irrationally worried, tense, irritable, anxious and in turmoil. It is possible that such characteristics would tend to act against an individual as far as examination performance is concerned. On the other hand, characteristics such as "relaxed" and "torpid", which are associated with the negative pole of the factor, may tend to prevent a student from learning efficiently in the first place.

No evidence has been reviewed that suggests that Factor Q4 might be related to interest in any particular academic area, and it is difficult to see why ergic tension should be so related.

Factor Q4 is therefore assigned to neither the general performance category nor the humanities-sciences category, and is thus an omitted factor.

In summary: the non-intellective personality factors measured by the HSPQ have been divided into three groups. The general performance category, containing those factors which are hypothesised to be predictors of general scholastic performance, is made up of factors C, G, O, Q2 and Q3. Factors which are hypothesised to be discriminators between individuals who are inclined towards the humanities and those who are oriented towards the sciences have been placed in the humanities-sciences category; this group contains factors A, F, H and I. The remaining factors, having been assigned to neither of the above categories, form the third group, and are known as omitted factors.

7. The Problem

Undergraduates are usually separated into specialised areas of study, such as Arts and Sciences, which are related to their particular academic orientations. At the high school level, on the other hand, students in the academic courses are not divided into such groupings. Except possibly in the very senior years, they tend, rather, to study all the basic subjects. This is not to say that all high school students are equally inclined towards, or do equally well in all subjects. The level of performance of a high school student in a particular subject does, however, tend to reflect his interest in that subject. Moreover, a

student who, at high school, does very well in English and History but only moderately well in Mathematics and Science tends to enter an Arts faculty rather than a Science or Engineering faculty at the university level. University students who major in the sciences, on the other hand, undoubtedly have an orientation towards the sciences, which, in general, is manifest at the senior high school level.

It has been postulated that certain of Cattell's source traits of personality will predict general academic performance, and that others will discriminate between students, at the university level, who are oriented towards the sciences and those who are inclined towards the arts.

At senior high school level, orientation towards a subject is very often reflected by performance in that subject. It is hypothesised, therefore, that the personality traits which have already been named in association with field of academic interest among university students will discriminate between senior high school students who perform well in "humanities" subjects and those who do well in "the sciences".

The problem is to answer the following questions, as they relate to senior high school students who are in university-preparatory courses. Will Cattell's personality factors C, G, O, Q2 and Q3 discriminate between students who perform well in general and those who do poorly in

their school subjects? Will the factors A, F, H and I discriminate between students who perform well in "arts" subjects (but not in "science" subjects) and those who perform well in "science subjects (but not in "arts" subjects)?

In concordance with the implications of these questions, the following experimental hypotheses are formulated.

1. Factors C, G, O, Q2 and Q3 will discriminate between senior high school students who have high scholastic performance in general and those who perform poorly in school; students who perform well will tend to make higher scores on factors C, G, Q2 and Q3, and lower scores on Factor O, than will students who perform poorly.
2. Factors A, F, H and I will discriminate between students who are oriented towards the humanities and those who are oriented towards the sciences; students who are inclined towards the humanities will tend to make higher scores on all four factors than will those who are inclined towards the sciences.

In this chapter, each of Cattell's primary factors of personality was described. Evidence was presented to show that measures on various personality characteristics have been successfully used to predict general academic

performance, and that others have been used to discriminate between people who are oriented towards the humanities and those who are inclined towards the sciences. Five of the traits measured by Cattell's HSPQ were hypothesised to be predictors of general scholastic performance at the high school level.

Four more were hypothesised as being discriminators between students who are inclined towards the humanities subjects and those who are inclined towards the science subjects.

CHAPTER II

DESIGN OF THE STUDY

In the present chapter are described the research population, the High School Personality Questionnaire, the collection of the data and the establishment of criterion groups. The chapter concludes with the postulation of two sub-hypotheses, each being a re-statement, in more precise terms of one of the experimental hypotheses given in Chapter I.

The testing of the experimental hypotheses stated at the end of Chapter I necessitated the establishment of a number of criterion groups. Because students were drawn from a number of schools, and since four different school subjects were involved, it was decided to establish, within schools, an upper and a lower performance group for each subject. The object in doing this was to avoid the necessity for combining marks across schools or across subjects. The establishment of these extreme performance groups, and their definition, are described in this chapter. High general performers were then simply defined as those students who were in the upper performance groups for all four subjects under investigation; low general performers were similarly defined as those who were in all four lower performance group. The criterion groups needed for the examination of the first experimental hypothesis were thus obtained.

For the examination of the second experimental hypothesis, another pair of criterion groups was necessary. These groups were called the humanities-oriented group and the sciences-oriented group, respectively. They are defined later in the chapter.

Following the definition of the various criterion groups, more exact sub-hypotheses, corresponding to the experimental hypotheses, were formulated. After the statement of these hypotheses, the chapter concludes with a brief description of the planned analytic procedures.

1. The Research Population

The Ottawa Board of Education administers the high schools situated in the City of Ottawa. In the year 1970-1971, seventeen of these schools were English-speaking; the rest were French-speaking. Courses offered by the Board are entitled "Arts and Science", "Business and Commerce" and "Science and Technology". All three categories are offered in the "Four-Year Program" and in the "Five-Year Program". Five-year programmes are intended to "prepare the student for admission to university or other post-secondary education, or for employment which requires advanced standing"¹. The Arts and Science Five-Year Program offers general

¹ J. Keith, Courses 1970-71 Offered in Secondary Schools, Ottawa Board of Education, 1970, p. 12.

academic courses in grades nine to thirteen. Students enrolled in the latter course were selected for the study.

Five-Year Arts and Science students in grade nine are required to take English, history, geography, physical education, mathematics, science and French². In grade ten, only English, history and physical education are compulsory, although most students take mathematics, science and French as well. In the higher grades, only English and physical education are compulsory. In grades nine and ten, therefore, most students take English, history, mathematics, science and French. A number of students in the Ottawa area, however, come from families which speak both English and French, with the result that some students study French as a second language, whereas some do not. French was therefore excluded from the study, which was thus restricted to students enrolled in English, history, mathematics and science classes.

In order to exercise some measure of control over age, it was decided to base the study on students who were at the same grade level. Students in grade nine, the first year of senior high school, are often experiencing a period of adjustment. It was therefore decided to use students from grade ten. The restriction of the study to a grade ten population made it necessary to draw students from a number of schools.

² J. Keith, Courses 1970-71 Offered in Secondary Schools, Ottawa Board of Education, 1970, p. 13.

Procedures for reporting marks differ from school to school. Some schools award marks; others classify students into categories designated by letters; some use a combination of the two systems. Most schools report marks three times during the school year: near Christmas, near Easter and in June. In many schools, however, a student who has been awarded satisfactory marks at Christmas and at Easter may be exempt from examinations leading to June marks. Thus, only Christmas marks and Easter marks are necessarily obtained directly by the student. In order to facilitate the statement of meaningful definitions of the extreme performance groups, only schools for which numerical assessments were available at Christmas and at Easter were included in the study.

The students of seven schools satisfied the conditions described above. Of these, five subsequently agreed to allow research to be carried out with their students. These schools were: Brookfield High School, Hillcrest High School, Lisgar Collegiate, Rideau High School and Ridgemont High School. It was decided, further, to drop students for whom the Board's records of Christmas and Easter marks were not complete (except where a whole school was involved), and to exclude students who were repeating grade ten.

The research population for the study thus consisted of grade ten Five-Year Arts and Science students who were

enrolled in English, history, mathematics and science classes in the five schools named above, and for whom the Board had complete records of the relevant marks.

2. The High School Personality Questionnaire

The High School Personality Questionnaire is based on factor analysis, and thus, given the original data and the type of rotation employed, consists of naturally occurring scales rather than ones based on selected criteria. The original data from which the test was developed were sampled from a wide spectrum of human behaviour. Resulting, as they do, from oblique rotation to simple structure, the source traits measured by the HSPQ are intercorrelated, as would be expected with naturally occurring personality structures. The fourteen primary source traits measured by the HSPQ are listed in Table II.

The test is designed for use with individuals whose ages range from twelve to eighteen years.

The HSPQ is available in four equivalent forms, A, B, C and D, the last two being recently developed and thus being without published psychometric data. Each form contains 142 items, two of which (the first and the last) are not scored. Each source trait is measured by ten items, which are distributed relatively uniformly throughout the questionnaire, in accordance with the stated aim of not

Table II
The Primary Traits Measured by the
 High School Personality Questionnaire

Code	Title of Variable*
A	Affectothymia versus Sizothymia
B	General Intelligence versus Mental Defect
C	Ego Strength versus Ego Weakness
D	Excitability versus Phlegmatic Temperament
E	Dominance versus Submissiveness
F	Surgency versus Desurgency
G	Superego Strength versus Superego Weakness
H	Parmia versus Thretica
I	Premsia versus Harria
J	Asthenia versus Zeppia
O	Guilt-proneness versus Confident Adequacy
Q2	Self-sufficiency versus Group Dependency
Q3	Strong Self-sentiment versus Weak Self-sentiment
Q4	High Ergic Tension versus Weak Ergic Tension

* The positive pole of each variable is named first

letting all items for one factor become contiguous³. Each item offers a choice of three responses; testees are instructed to check one response to each item. One response relates to one pole of the relevant factor, one relates to the other pole, and the middle response is one which commits the testee to neither pole. The aim of eliminating effects from acquiescence and positional response sets "is achieved by having in each factor scale as many items in which "yes" contributes positively to the total score as items for which "no" contributes"⁴. Each form is designed so that it can be administered to all but the slowest reader in about forty-five minutes. Each factor thus receives about three minutes of testing time per form.

In the handbook for the HSPQ, Cattell and Cattell present data on the dependability, stability and homogeneity of the scales.

The dependability coefficient is defined as the correlation between the scores obtained at two administrations of the same test when the lapse of time is insufficient for the testees themselves to change with respect to what is

3 R. B. Cattell and M. D. L. Cattell, Handbook for the High School Personality Questionnaire, Champaign, IPAT, 1969, p. 9.

4 R. B. Cattell and M. D. L. Cattell, op. cit., p. 8.

being measured⁵. It is known that certain traits, especially Ergic Tension (Q4), Ego Strength (C) and Surgency (F), fluctuate appreciably with time and stimulus circumstances⁶. The dependability of a scale is therefore intended to be independent of changes in the trait itself. The dependability coefficients given in the HSPQ handbook are for immediate retest, and for retest after one day. These are reproduced in Table III. For Form A, the immediate retest dependabilities range from 0.79 to 0.88, with a median of 0.88; those for a retest after one day range from 0.74 to 0.88, the median being 0.88 also. Superficially, these values appear to be quite high for scales to which only about three minutes of testing time (per form) is devoted. However, it appears that the test and retest on which they were based were carried out with the same form, and it is thus likely that the values are somewhat inflated by the effect of memory.

Stability coefficients are test-retest reliabilities obtained when the test administrations are separated by specified periods of time⁷. The values given in Table III are for

5 R. B. Cattell, H. W. Eber and M. M. Tatsuoka, op. cit., p. 30.

6 R. B. Cattell and M. D. L. Cattell, op. cit., p. 9.

7 Idem, ibid., p. 9.

Table III

Reliabilities and Validities for the High School Personality Questionnaire, Form A

(decimal points omitted)

	factor													
	A	B	C	D	E	F	G	H	I	J	O	Q2	Q3	Q4
dependability ^a														
immediate retest	86	85	79	81	76	82	74	81	90	82	84	85	80	91
one day delay	85	78	77	80	74	76	72	81	88	81	83	82	78	84
stability ^b														
six-month delay	62	60	58	65	57	53	62	69	65	58	56	55	60	58
homogeneity ^c	22	40	25	26	34	30	41	36	43	20	40	26	36	40
direct validity ^d	67	69	71	63	65	68	68	72	70	58	77	61	57	74

a arithmetic means for three groups: of 90, 102 and 110 high school juniors

b N = 120 (ninth graders)

c N = 250 (eighth graders); each coefficient is the average (via Fisher's Z) of four random split halves

d N = 250 (high school students)

a six-month interval between testings. For Form A, the stabilities range from 0.53 to 0.69, the median value being 0.59. These coefficients "fall below conventional standards for individual diagnosis"⁸. With both Form A and Form B, the values range from 0.68 to 0.82, with a median of 0.71⁹. It thus seems that when all four forms have been thoroughly tested, the use of them all might produce reliabilities which are suitable for individual diagnosis.

In a review of the HSPQ, Adcock writes

The general impression with which one is left is that the HSPQ has rather lower reliability and validity than the 16PF. This is no reflection on the construction of the test. . . The truth seems to be that questionnaire tests are not so satisfactory with children and need to be used with caution¹⁰.

Since individual diagnosis is not the purpose of the present study, and because the samples represent students near the upper end of the HSPQ age-range, the published reliabilities were thought to be satisfactory.

8 P. E. Vernon, Review of the High School Personality Questionnaire, in O. K. Buros (editor), The Sixth Mental Measurements Year Book, Highland Park, Gryphon Press, 1965, article 6:131, p. 274.

9 R. B. Cattell and M. D. L. Cattell, op. cit., p. 10.

10 C. J. Adcock, Review of the High School Personality Questionnaire, in O. K. Buros (Editor), The Sixth Mental Measurements Year Book. Highland Park, Gryphon Press, 1965, article 6:131, p. 272.

The third aspect of consistency is expressed by the homogeneity coefficient, defined as the average extent to which items correlate with each other, within each factor, as shown by the Kuder-Richardson and Cronbach Alpha coefficients¹¹. The homogeneities reported for the HSPQ appear to be low (see Table III), but Cattell states that this is a desirable situation:

In measuring personality factors of broad importance, it is in fact desirable to have items correlating as little as possible with each other, while consistently correlating to a maximum degree with the underlying factor¹².

Item-factor correlations are not given in the HSPQ handbook, however, and one can only assume that these correlations are "to a maximum degree", as desired.

The traits measured by the HSPQ are personality structures which are uniquely defined by factor analysis. The primary validities of the various scales of the test are thus properly measured directly with regard to the pure factors which they are supposed to measure¹³. Such a "direct concept validity", or construct validity, for a scale is best calculated "by finding the multiple R of the

11 R. B. Cattell and M. D. L. Cattell, op. cit., p. 10.

12 Idem, ibid., p. 10.

13 Idem, ibid., p. 11.

14 Idem, ibid., p. 12.

totality of items in the factor scale with the pure factor"¹⁴. The direct construct validities for the HSPQ scales, calculated in the manner described above, for a sample of two hundred high school students extending over the whole high school age-range, are presented in Table III.

The direct validities for Form A are not particularly high, ranging, as they do, from 0.57 to 0.77, the median value being 0.68. They indicate that the test is not highly successful in measuring factors D, J, Q2 or Q3, while the best validities may be expected with factors O, Q4, H, C and I. When both Form A and Form B are used, the direct validities range from 0.72 to 0.86, with a median of 0.81¹⁵. When the purpose of testing is individual diagnosis, therefore, it appears that at least two forms should be administered. Even though the direct validities are low, the values were thought to be sufficiently high for the test to be used for research in which the measures were to be used for predicting membership of one or other of the criterion groups involved.

14 R. B. Cattell and M. D. L. Cattell, op. cit., p. 12.

15 Idem, ibid., p. 12.

3. Collection of Data

In each of the participating schools, Form A of the High School Personality Questionnaire was administered to all grade ten students who were enrolled in English, history, mathematics and science classes in the Five-Year Program. At each school, this testing was carried out at one sitting. Typically, the students were assembled in a large room (usually the school cafeteria), the questionnaires, answer sheets and pencils having been placed in position before the students entered. An adequate number of teachers and guidance staff was available to act as proctors, there being typically one proctor to about twenty-five students. Before starting to answer the questionnaire, students were asked to follow the instructions which were printed on the cover of the form while these instructions were being read aloud by the researcher. The administration of the questionnaire was, in fact, carried out in accordance with the "instructions for test administration" which are given in the HSPQ handbook¹⁶.

Raw scores for the HSPQ scales are given, by school, in Appendix 1.

¹⁶ R. B. Cattell and M. D. L. Cattell, op. cit., p. 16.

The Christmas marks and the Easter marks were obtained from the Board's records shortly after each had been awarded by the participating schools. These data are tabulated, by school and by subject, in Appendix 2. The school records for a few of the students were incomplete; the students involved were dropped from the study.

The number of students included in the study, from each of the participating schools, was as follows:

Brookfield High School. . .	174
Hillcrest High School . . .	134
Lisgar Collegiate	97
Rideau High School.	61
Ridgemont High School . . .	116

There were thus 582 students in the study.

4. Establishment of Extreme Performance Groups

In high schools, marks are usually used as measures of scholastic performance. Marks are, in fact, real measures of performance in school. Standardised achievement tests, on the other hand, although they may have high internal reliability, do not always measure performance in school.

In most schools, the mean and variance of marks awarded for any particular subject vary a little from term to term. This variation is due partly to differing difficulty levels of examinations. It is thus desirable to base

measures of scholastic performance on more than one set of term marks. The use of the average, for example, of two separate sets of marks as a measure of school performance in a subject, has the further advantage that the correlation between the two sets of marks may be calculated, thus giving an indication of the stability of school marks.

Thus the performance score of a student for a particular subject was defined as the average of his Christmas mark and his Easter mark in that subject.

In the present study, students who did very well, or very poorly, in the various subjects were of particular interest. An upper performance group and a lower performance group were therefore established for each subject. These extreme performance groups consisted, respectively, of those students who were among the top, or bottom, thirty per cent in their schools for the subjects concerned. The decision to include thirty per cent of the students in each extreme performance group was arbitrary. It had previously been decided, however, that when the data had been collected, an examination would be made to ensure that the possible overlap of the extreme groups for any particular subject, due to errors of measurement, was acceptably small.

An examination of the overlap between the extreme performance groups for a subject was based on the estimated reliability of the school marks. Although the reliability

of school marks is not generally known, the correlation between the Christmas marks for a subject and the corresponding Easter marks is an indication of the stability of the marks for that subject in the school concerned. For each school, therefore, the value of the product-moment coefficient of correlation between the Christmas marks and the Easter marks was calculated, for each subject. These values are shown, by school and by subject, in Table IV. The mean value, via Fisher's z , was 0.75.

If the mean correlation between Christmas marks and Easter marks is taken as an estimate of the reliability of marks, it may be used in determining whether the extreme performance groups for a subject are sufficiently separated to prevent mutual contamination. Lack of mutual contamination will be taken to mean that there is 95% assurance that the top student in the lower performance group is not a member of the upper performance group, and that the bottom student in the upper performance group is not a member of the lower performance group. This concept may be checked by calculating the 95% confidence interval of the performance score of (say) the top student in the lower performance group, and determining whether the performance score of the bottom student in the upper performance group lies within this interval.

Table IV
Correlations between Christmas Marks and Easter Marks

	Brookfield	Hillcrest	Lisgar	Rideau	Ridgemont
English	0.63	0.65	0.77	0.70	0.70
History	a	0.77	0.71	b	0.76
Mathematics	0.75	0.83	0.85	0.78	0.79
Science	0.70	0.74	0.85	0.84	0.67

^aEaster marks not awarded

^bChristmas marks not awarded

If the reliability of a set of performance scores is r , and if their standard deviation is s , the standard error of measurement, S , of a performance score is

$$S = s \sqrt{(1-r)}$$

When performance scores are standardised, this expression becomes

$$S = \sqrt{(1-r)}$$

Under the assumption that a set of performance scores is normally distributed, and if the extreme performance groups are of the same size, the top student in the lower performance group and the bottom student in the upper performance group will have the same absolute standardised performance score. If this absolute standardised performance score is denoted by z_0 , the ordinates which limit the extreme performance groups will be $2z_0$ standard deviations apart.

In order to be 95% certain that the student with the least absolute standardised performance score in one extreme performance group does not really belong to the other extreme performance group, the value of z_0 may be determined such that the 95% confidence interval of his standardised performance score has a width of $4z_0$. Since the 95% confidence interval extends $1.96S$ units either side of the relevant score, we have:

$$1.96S = 2z_0$$

and therefore

$$\begin{aligned} z_0 &= 0.98S \\ &= 0.98 \sqrt{(1-r)} \end{aligned}$$

The relative positions of the bounding ordinates of the lower and upper extreme performance groups are shown in Figure 2, in which z denotes standardised performance scores and C represents the 95% confidence interval for $z = z_0$.

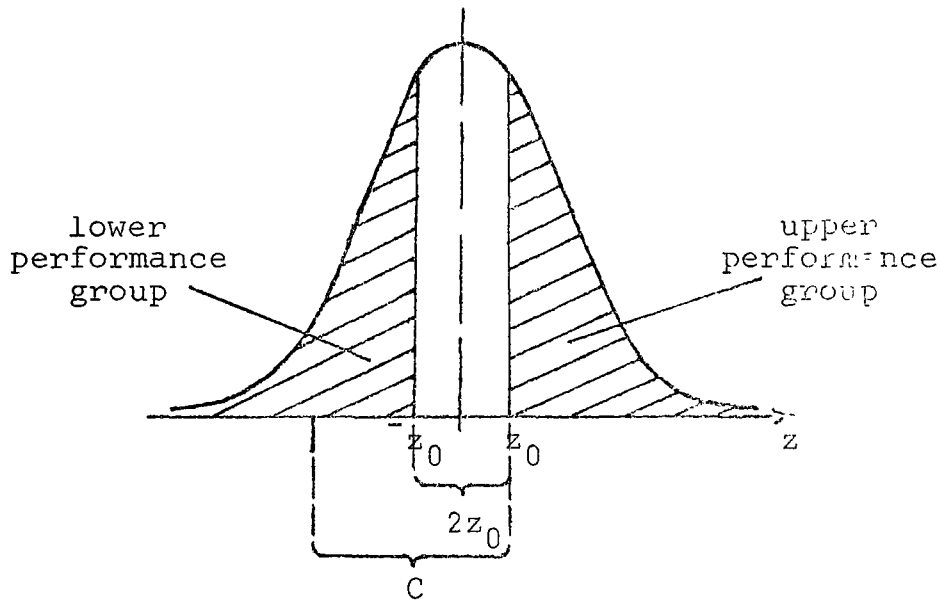


Figure 2: Relative Positions of the Bounding Ordinates of the Extreme Performance Groups for a Subject

In the present study, an estimate of r is 0.75, the mean correlation between Christmas marks and Easter marks.

The value of z_0 is thus

$$\begin{aligned} z_0 &= 0.98 \sqrt{(1-r)} \\ &= 0.98 \sqrt{0.25} \\ &= 0.49 \end{aligned}$$

If it is assumed that performance scores are normally distributed, z_0 may be taken as a deviation from the mean of the unit normal distribution. Normal distribution tables indicate that, in order to avoid mutual contamination, the extreme performance groups should contain no more than 31.2 per cent of cases. The extreme performance groups actually used in the study, each containing thirty per cent of cases, may thus be regarded as sufficiently separated.

5. Establishment of Criterion Groups

The problem which the study is designed to investigate involves students who perform well in general, those who perform poorly in general, those who are oriented towards the humanities and those who are oriented towards the sciences.

The first experimental hypothesis seeks to discriminate between students who perform well in general and those who perform poorly in general. Two appropriate criterion groups were therefore defined as follows. Students who belonged to the upper performance groups for English, History, Mathematics and Science were designated high general performers; students who were in the lower performance groups for all these subjects were named low general performers. Together, these groups formed the general performance criterion-pair.

The second experimental hypothesis refers to students who are oriented towards the humanities and to those who are oriented towards the sciences. The definition of appropriate criterion groups was based on certain results taken from Goldschmid's study. These results were that English and History occupied high positions on the humanities continuum and that Mathematics, Physics and Chemistry occupied high positions on the sciences continuum. For the purposes of the present study, therefore, English and History are regarded as humanities and Mathematics and Science as sciences. Students who perform well in the humanities, but not in the sciences, together with those who perform poorly in the sciences, but better in the humanities, are better performers in the humanities than in the sciences. On the other hand, students who perform well in the sciences, but not in the humanities, together with those who perform poorly in the humanities, but not in the sciences, are better performers in the sciences than in the humanities. Two criterion groups, forming the humanities-sciences criterion-pair, were therefore defined as follows. Those students who were in the upper performance groups for English and History, but for neither Mathematics nor Science, together with those students who were in the lower performance groups for Mathematics and Science, but for neither English nor History, were called the humanities-oriented group. Those students who were in

the upper performance groups for Mathematics and Science, but for neither English nor History, together with those who were in the lower performance groups for English and History, but for neither Mathematics nor Science, were called the sciences-oriented group.

The number of students in each criterion group is shown in Table V.

With appropriate criterion groups defined, the postulation of two sub-hypotheses, being re-statements in more precise terms of the experimental hypotheses, was possible. These sub-hypotheses were as follows.

Hypothesis 1:

Factors C, G, O, Q2 and Q3 will discriminate between the high general performers and the low general performers. High general performers will tend to make higher scores on factors C, G, Q2 and Q3, and lower scores on Factor O, than will low general performers.

Hypothesis 2:

Factors A, F, H and I will discriminate between the humanities-oriented group and the sciences-oriented group. The humanities-oriented students will tend to make higher scores on each of the factors than will the sciences-oriented students.

Table V

Number of Students in Each Criterion GroupGeneral Performance Groups

high general performers . . .	66
low general performers . . .	55

Humanities-Sciences Groups

humanities-oriented group . . .	51
sciences-oriented group . . .	51

It was proposed to examine both Hypothesis 1 and Hypothesis 2 by means of a series of discriminant analyses, the F ratio for the difference between the predicted criterion group means being tested in each case at the 5% level of significance. For each sub-hypothesis, the planned analyses consisted of a multivariate analysis in which all the appropriate factors were used as discriminant variables, and a series of univariate analyses in which each factor was used alone as the discriminant variable. Details of these analyses and the results are reported in Chapter III.

In summary, the purpose of the present chapter was to present the design of the study. The chapter opened with the identification of the research population. Following a description of the properties of the HSPQ, the collection of the data was described. The establishment of an upper and a lower performance group for each subject was described, and it was shown that a student assigned to one of these groups for a particular subject was unlikely to belong, in reality, to the other. The definition of general performance and humanities-sciences criterion groups was described, and sub-hypotheses, being more exact statements of the experimental hypotheses, were formulated. The chapter concluded with a brief description of the proposed analysis procedures, which are described fully, together with the results, in the next chapter.

CHAPTER III

ANALYSIS OF THE DATA

The analysis of the data is discussed in this chapter, the procedure used being discriminant analysis. The basis of the technique is, briefly, as follows. When there are two dissimilar groups of individuals which have been measured on a number of variables, discriminant analysis will provide weights which may be applied to the respective variables will produce maximum separation between the groups¹. This linear combination is known as a linear discriminant function, z , the weights being known as discriminant weights. It is usual with a discriminant analysis with two groups to carry out a test of significance in order to determine whether the divergence between the two groups predicted by the discriminant function is sufficiently large to assume two distinct populations. An appropriate test statistic for this test is an F ratio².

The sub-hypotheses for the study, restated in the null form, were each tested by means of discriminant analysis. The analyses were all done by means of the University of

1 O. R. Porebski, Introduction to Discriminatory Analysis, University of Ottawa, an unpublished paper.

2 O. R. Porebski, op. cit., p. 11.

California computer programme "BMD04M: Discriminant Analysis for Two Groups"³. Details of these analyses, together with the resulting discriminant equations and values of F, are given in this chapter.

Following the testing of the sub-hypotheses, which had been postulated as a result of a survey of the literature, the personality factors which were not included in these hypotheses were examined. The object of this investigation was to discover whether any of these omitted traits should have perhaps been included in either of the sub-hypotheses. The chapter concludes with the results of these post hoc examinations.

1. Testing Hypothesis 1

It was postulated in Hypothesis 1 that Cattell's source traits C, G, O, Q2 and Q3 would discriminate between the high general performers and the low general performers. In order to test this hypothesis, the high general performance group and the low general performance group were made the dichotomous criterion variable for a series of discriminant analyses.

The first of these analyses was a multivariate analysis in which the variables C, G, O, Q2 and Q3 were

³ W. J. Dixon (Editor) BMD Biomedical Programs, Berkeley, University of California Press, 1971, p. 214a-217.

all used as the discriminant variables. The discriminant equation resulting from this analysis was

$$10^5 z = 23C + 243G - 510 + 116Q2 + 35Q3$$

The hypothetical criterion groups predicted by the discriminant function were found to be significantly separated, the F ratio being 9.62, with 5 and 114 degrees of freedom.

The remainder of the analyses were univariate analyses. In these procedures, the factors C, G, O, Q2 and Q3 were each used separately as the discriminant variables. The F ratio associated with each of the factors except Factor O was significant at the 5% level. The results of the univariate analyses associated with Hypothesis 1 are given in Table VI.

2. Testing Hypothesis 2

Hypothesis 2 stated that the personality factors A, F, H and I would discriminate between the humanities-oriented group and the sciences-oriented group, and that the humanities-oriented students would tend to make higher scores on each of these factors than would the sciences-oriented students. A multivariate discriminant analysis and four univariate discriminant analyses were used to test this hypothesis.

In the multivariate analysis, the factors A, F, H and I were used together as the discriminant variables, the humanities-sciences criterion-pair being used as the

Table VI
Results of Univariate Discriminant Analyses
Associated with Hypothesis 1

trait	discriminant weight	F ratio	degrees of freedom
C	0.00100	5.60*	1,118
G	0.00282	32.35*	1,118
O	-0.00073	2.51	1,118
Q2	0.00165	16.10*	1,118
Q3	0.00167	13.22*	1,118

* significant at the 5% level

dichotomous criterion variable. The discriminant equation resulting from this analysis was

$$10^5 z = 117A + 17F + 70H + 143I$$

The value of the associated F ratio was 6.10, there being 4 and 97 degrees of freedom. The value is significant at the 5% level.

Each of the factors A, F, H and I was used separately as the discriminant variable in one of four univariate discriminant analyses. The humanities-sciences criterion-pair formed the criterion variable in each case. The F ratios associated with factors A, H and I, respectively, had values which were significant at the 5% level. The results of these analyses are given in Table VII.

3. Post Hoc Investigations

So far, the hypotheses which were postulated as a result of the review of relevant literature have been tested. Factors C, G, O, Q2 and Q3 have been examined, severally and separately, to see whether they discriminate between high general performers and low general performers. Similarly, factors A, F, H and I have been examined to see whether they discriminate between humanities-oriented students and sciences-oriented students. No investigation has yet been made, however, to determine whether factors C, G, O, Q2 and Q3 discriminate between humanities-oriented and sciences-oriented students, or whether factors A, F, H and I

Table VII
Results of Univariate Discriminant Analyses
Associated with Hypothesis 2

trait	discriminant weight	F ratio	degrees of freedom
A	0.00196	12.07*	1,100
F	0.00073	1.76	1,100
H	0.00106	3.98*	1,100
I	0.00158	16.54*	1,100

* significant at the 5% level

discriminate between high and low general performers. Since it is possible that both these sets of factors discriminate between the groups in each criterion pair, some post hoc analyses were undertaken.

In order to determine whether factors A, F, H and I would discriminate between high and low general performers, one multivariate analysis and four univariate analyses were carried out. The factors were first made the discriminant variables for an analysis in which the high general performers and the low general performers were the criterion groups. The value of F associated with this analyses was 2.69, there being 4 and 115 degrees of freedom. The value is significant at the 5% level the critical value being 2.45.

With the same criterion groups, four univariate analyses, one with each of the factors A, F, H and I, separately, were performed. The values of the F ratios associated with these analyses are given in Table VIII.

In order to determine whether factors C, G, O, Q2 and Q3 would discriminate between the humanities-oriented group and the sciences-oriented group, a multivariate analysis and five univariate analyses were carried out. With the humanities-sciences criterion-pair as the dependent variable, factors C, G, O, Q2 and Q3 were used together as the discriminant variables for a multivariate analysis.

Table VIII

Results of Univariate Discriminant Analysis
for Each of Factors A, F, H and I with the
General Performance Criterion-Pair

trait	discriminant weight	F ratio	degrees of freedom
A	-0.00067	2.39	1,118
F	-0.00123	7.16*	1,118
H	-0.00075	2.80	1,118
I	0.00061	5.10*	1,118

* significant at the 5% level

The value of the F ratio associated with this analysis was 1.05, with 5 and 96 degrees of freedom. The value is not significant at the 5% level.

Each of the factors C, G, O, Q2 and Q3 was then used separately as the discriminant variable in an analysis with the humanities-sciences criterion-pair. The values of the F ratios associated with these analyses are given in Table IX.

Four of the factors measured by the HSPQ were not classified as discriminators between the high and low general performers, or between the humanities-oriented and sciences-oriented groups. These factors will be referred to as the "omitted factors".

In order to assess the wisdom of omitting these factors from the classifications referred to above, a series of univariate discriminant analyses was carried out for each of the factors in question. For each of the factors D, E, J and Q4, therefore, two discriminant analyses were performed. For one of these, the criterion variable consisted of the high and low general performance groups, and for the other, the humanities-sciences criterion-pair was used. The F ratios associated with these analyses are given in Table X.

4. Summary of the Results

For the purpose of easier comparison of the various results of the analyses, this chapter concludes with the assembling of the respective F values.

Table IX

Results of Univariate Discriminant Analysis
for Each of Factors C, G, O, Q2 and Q3 with
the Humanities-Sciences Criterion-Pair

trait	discriminant weight	F ratio	degrees of freedom
C	0.00026	0.19	1,100
G	0.00030	0.25	1,100
O	-0.00032	0.42	1,100
Q2	-0.00119	4.66*	1,100
Q3	0.00009	0.02	1,100

* significant at the 5% level

Table X

F-ratios Associated with Univariate Discriminant
Analyses with Omitted Factors

factor	criterion-pair			
	general performance		humanities-sciences	
	F	degrees of freedom	F	degrees of freedom
D	0.31	1,118	0.82	1,100
E	0.22	1,118	10.36*	1,100 ^a
J	3.68	1,118	1.99	1,100
Q4	0.07	1,118	0.19	1,100

* significant at the 5% level

^a the discriminant weight associated with this
analysis was $\bar{0.00192}$

The F values associated with the various multivariate analyses and the results of the univariate analyses carried out with each of the thirteen factors are given in Table XI.

The discussion of the results will be postponed until the next chapter.

Table XI
 Summary of F-ratios Associated with
 Discriminant Analyses with Each Criterion-Pair

factors	criterion-pair	
	general performance	humanities-sciences
C,G,O,Q2,Q3	9.62*	1.05
A,F,H,I	2.69*	6.10*
A	2.39	12.07*
C	5.60*	0.19
D	0.31	0.82
E	0.22	10.36*
F	7.16*	1.76
G	32.35*	0.25
H	2.80	3.98*
I	5.10*	16.54*
J	3.68	1.99
O	2.51	0.42
Q2	16.10*	4.66*
Q3	13.22*	0.02
Q4	0.07	0.19

* significant at the 5% level

CHAPTER IV

DISCUSSION OF THE RESULTS

The problem to be investigated by the study was stated in two hypotheses. The first of these was that factors C, G, O, Q2 and Q3 would discriminate between high school students who had high general scholastic performance and those who had low general scholastic performance. The second hypothesis postulated that factors A, F, H and I would discriminate between high school students who were humanities-oriented and those who were sciences-oriented.

The discussion of the results of the statistical analyses of the data is organised into four sections. The first two sections deal with the results of the analyses planned in connection with the two experimental hypotheses (as reviewed above). In the third section are discussed the results of post hoc analyses involving the omitted factors — factors which had been assigned to neither the general performance category nor the humanities-sciences category, and which were thus excluded from the experimental hypotheses. These factors were examined to check the possibility that some (or all) of them had been excluded erroneously.

The final section of the chapter deals with factors which were found to discriminate between pairs of criterion groups for which they had not been expected to discriminate.

1. Results of Tests Associated with the First Experimental Hypothesis

Four subjects were used in the study; they were English, History, Mathematics and Science. Students who were in the upper performance groups for all of these subjects were called high general performers; those who were in all four lower performance groups were named low general performers. Cattell's personality traits C, G, O, Q2 and Q3, in combination, were found to discriminate significantly between these two groups of students. Students in the high general performance group tended, as shown by the signs of the discriminant weights, to make relatively low scores on Factor O and relatively high scores on each of the other four factors. These tendencies are all in the directions hypothesised.

When each of the factors C, G, Q2 and Q3 was respectively used as the sole discriminant variable in a univariate analysis with the general performance criterion-pair, a significant F value was obtained. In each case, the direction of the relationship between the factor and general performance was, as indicated by the sign of the discriminant weight, in the direction hypothesised. When Factor O was used in a univariate discriminant analysis with the general performance criterion-pair, however, the obtained F value was not significant.

The signs of the discriminant weights of the respective factors were the same in the multivariate analysis and in the univariate analyses. The failure of Factor 0 to discriminate between the general performance groups in the univariate analysis, however, suggests that the reduced set of factors {C, G, Q2, Q3} might be a more efficient discriminator between these groups than the set actually used. This notion should, perhaps, be investigated with new data.

The results obtained in connection with each factor will next be discussed separately.

High scores on Factor C are reported in the literature to be associated with stability, calmness and ability to adjust to facts. Low scores are associated with perturbability and having a tendency to give up. The finding that Factor C will discriminate between high general performers and low general performers, high scores on C being associated with high general performance, thus makes good sense. It is, moreover, in agreement with the finding of Warburton, Butcher and Forrest, who found that trainee teachers who performed well in their final theory marks had high scores on Factor C.

The finding that high general performers made significantly higher scores on Factor G than did low general performers supports Cattell's statement that high scores on Factor G, in typical high school groups,

consistently correlate positively with academic achievement in school. It is in agreement, also, with the finding of Warburton, Butcher and Forrest, whose higher-performing trainee teachers tended to score highly on the G scale. That the positive pole of Factor G, being composed of such characteristics as "persevering", "responsible" and "conscientious", is associated with high general performance, is, of course, to be expected.

As far as Factor 0 is concerned, it was hypothesised that this factor would discriminate between the high and low general performance groups, the former group making lower scores than the latter group. This proposition was based on the consideration that the self-confident person, a characteristic of the negative pole of Factor 0, would be likely to perform better scholastically than would the worrying individual, characteristic of the negative pole of the factor.

In the present study, Factor 0 was not shown to be a discriminator between high and low general performers. In agreement with the school achievement profile in the HSPQ handbook, however, the high general performers did make lower Factor 0 scores than did the low general performers. Although the individual who scores highly on Factor 0 is described in the literature as being apprehensive, depressed and worrying, he is also described as having a strong sense

of duty rather than being expedient, and as being scrupulous and fussy rather than uncaring. It is probable that a high school student with a strong sense of duty, and who is scrupulous, would be likely to perform scholastically better than average. Thus, characteristics associated with the positive pole of Factor 0 are likely to be contributors to good performance, in the same way as some of those associated with the negative pole. This would explain why the discriminating power of Factor 0 between the general performance groups was smaller than that expected.

The finding that Q2 is a discriminator between the high and low general performers supports Cattell's statement that Q2 is a constant and very significant contributor to scholastic success. A similar statement by Cattell, that Factor Q3 is strongly related to success in school, is supported by the finding of the present study, that Q3 is a discriminator between high general performers and low general performers. The signs of the discriminant weights for factors Q2 and Q3 are in agreement with the expectations, stated in Chapter I, that the positive poles of these traits would be associated with high general performance.

In summary, it may be said that the findings indicate that a high general performer tends to be a persevering, conscientious, responsible individual, who is also stable and self-sufficient. The low general performer, on the

other hand, tends to be lax and perturbable, tends to give up, and has a tendency to be group-dependent.

2. Results of Tests Associated with the Second Experimental Hypothesis

The second hypothesis postulated that factors A, F, H and I would discriminate between students who were humanities-oriented and those who were sciences-oriented. It was hypothesised also that the positive pole of each trait would be associated with the humanities-oriented group whereas the negative pole would be associated with the sciences-oriented group. When used together in a multivariate discriminant analysis, the set of four factors was found to discriminate significantly between the criterion groups. The associated discriminant weights were all positive, indicating that the directions of the relationships between the factors and the criterion-pair were as predicted.

When each of the factors A, H and I was respectively used as the sole discriminant variable, the resulting F value was significant. In addition, the sign of the discriminant weight was positive, as expected. The univariate analysis involving Factor F, however, produced an F value which was not significant, indicating that Factor F is not a discriminator between humanities-oriented students and sciences-oriented students.

The failure of Factor F to discriminate as hypothesised suggests that the reduced set of factors {A, H, I} might be a more efficient discriminator between the humanities-oriented and sciences-oriented groups than the set actually used. This notion should, perhaps, be investigated in a further study.

The results obtained in connection with each factor will next be discussed separately.

The finding that Factor A is a significant discriminator between humanities-oriented groups and sciences-oriented groups is similar to findings of other researchers. Roe and Siegelman, for instance, found engineers and social workers to differ significantly on Factor A. The negative pole of Factor A is characterised by a person who is rigid, cold, precise, objective and critical. Goldschmid found that students who were majoring in science-type subjects tended to be cold, precise and critical. Thus the association between A- and orientation towards the sciences, found in the present study, is similar to Goldschmid's result.

As far as Factor H is concerned, the data of Roe and Siegelman indicated that engineers and social workers were significantly different on measures of this trait. The results of the present study support that finding. Characteristics associated with the negative pole of this trait include "shy, withdrawn", "has restricted interests"

and "emotionally cautious". Gallese demonstrated that undergraduates in engineering were less interested in people than were students in general, and Goldschmid showed that students who were majoring in "science" subjects lacked social initiative, had little interest in social activities, and had limited ranges of interests. Although the characteristics which are mentioned above as being related to sciences and engineering students are not identical to those which are associated with the negative pole of H, the personality of the H- person is nevertheless suggested. The findings of this study with respect to Factor H thus match those of Gallese, and of Goldschmid, as described above.

In a study with undergraduates, Drevdahl found that Arts students made significantly higher scores on Factor I than did their peers in departments of science. The present study supports this finding. Factor I is associated at the positive pole with "enjoys imaginative fancies", and at the negative pole with "acts on practical, logical evidence". Trent and Athey found that engineering students tended to have much more interest in practical matters than did liberal arts majors, and Goldschmid's study indicated that science students tended to evaluate ideas on the basis of their practicability. These studies suggest that students in the sciences tend to act on practical, logical evidence, but not, perhaps, to be fanciful. Again, the characteristics measured

in these studies are not the same as those on which Factor I is based. There is, nevertheless, the essence of these traits in Factor I. The finding of the present study, that Factor I is a discriminator between students who are humanities-oriented and those who are oriented towards the sciences, is thus similar to those of Trent and Athey, and of Goldschmid.

In the analysis in which it was used as the sole discriminant variable, Factor F was found not to be a significant discriminator between the humanities-oriented and the sciences-oriented groups. The factor had been hypothesised as a discriminator between these groups because the surgent individual, being characterised by such traits as "talkative", "cheerful", "expressive" and "reflects the group", would appear to be one who is interested in people. Goldschmid's study demonstrated that the humanities are seen as dealing primarily with people and abstraction. The surgent person was thus thought of as being inclined towards the humanities. Data from the study of Roe and Siegelman, moreover, indicated that professional engineers were significantly lower on the F scale than were social workers. On the other hand, the characteristics which make up the surgent (high F) individual would seem also to describe the extravert. It was shown earlier that Extraversion, one of Eysenck's personality dimensions, was negatively related to general scholastic performance. Although it has not been

shown here that there is a relationship between Cattell's Factor F and Eysenck's Extraversion, it is suggested nevertheless that the typical extravert would probably score better than average on both these variables. If this were the case, Factor F could be expected to be a predictor of general scholastic performance, rather than of performance in one field at the expense of another. This would explain the failure of Factor F to discriminate as hypothesised.

3. Results of Analyses Involving "Omitted Factors"

The factors D, E, J and Q4 were not involved in either of the experimental hypotheses, and have been referred to as the "omitted factors". As reported in Chapter III, analyses were carried out to determine whether these factors should have been excluded from the experimental hypotheses, or whether some (or all) of them may in fact be used as discriminators. Each omitted factor was used as the sole discriminant variable in an analysis with each of the criterion-pairs, there being thus eight analyses.

For each of the analyses involving Factor D, Factor J, or Factor Q4, the resulting value of F was not significant. This was true both when the criterion variable consisted of the high and low general performers and when the humanities-sciences criterion-pair was used. The omission of these factors from the experimental hypotheses was thus justified.

The F value resulting from the analysis in which Factor E was used as the discriminant variable with the high and low general performers as the criterion-pair was less than unity. Thus, the factor does not discriminate between the general performance groups. When the humanities-sciences criterion-pair was used with Factor E, however, the resulting F ratio had a significant value. Factor E was thus shown to be a discriminator between the humanities-oriented group and the sciences-oriented group. The discriminant weight associated with the analysis was negative, thus indicating that higher scores on the E scale tended to be made by the sciences-oriented group than by the humanities-oriented group.

Characteristics associated with the positive pole of Factor E include "assertive", "independent-minded" and "unconventional". The negative pole of the factor is associated with characteristics such as "submissive", "dependent" and "conventional".

Factor E was not originally assigned to the humanities-sciences category because it was considered that there was conflicting evidence. Trent and Athey demonstrated that engineering students tended to be inflexible in their thinking. In the belief that an inflexibly-thinking individual would be independent-minded and assertive, rather than dependent and submissive, it was thought that the finding of Trent and Athey indicated that engineers would make high

scores on Factor E. On the other hand, Field showed science majors to be conformist, and Goldschmid showed them to be conventional. Conventionality is a characteristic of the negative pole of Factor E, and submissiveness and dependency were thought of as being characteristics of the conformist. The profiles for writers and chemical engineers, moreover, showed that writers tended to make higher Factor E scores than did chemical engineers. The presence of conflicting evidence resulted in the omission of Factor E from either the general performance category or the humanities-sciences category.

The present finding, that Factor E discriminates between the humanities-oriented and the sciences-oriented groups, indicates that the judgement of the writer was in error when he excluded Factor E from the humanities-sciences category. Either the findings of Trent and Athey are not reliable, or the inflexibly-thinking individual should not be thought of as being independent-minded and assertive. In any case, it is admitted that the evidence from the studies of Field and of Goldschmid, together with that of the occupational profiles, should perhaps have been considered to outweigh that from Trent and Athey's study.

A future study might determine whether the addition of Factor E to factors A, H and I would increase the efficiency with which the latter factors discriminate between humanities-oriented and sciences-oriented students.

4. Factors Which Discriminate Between Groups

Other Than as Hypothesised

As a result of evidence derived from the literature, five factors were originally assigned to a "general performance category" and four to a "humanities-sciences category". Univariate analyses indicated that one factor in the general performance category did not discriminate between the high and low general performance groups, and that one factor in the humanities-sciences category did not discriminate between the humanities-oriented and the sciences-oriented groups.

It was not known whether each of these misclassified traits belonged really to the category other than that to which it had been assigned, or whether it belonged in fact to the group of omitted factors. This uncertainty was resolved by some of the post hoc analyses described in Chapter III. These examinations revealed that Factor F really belonged to the general performance category, rather than to the humanities-sciences category (to which it had been originally assigned), and that factors I and Q2 each discriminated between the general performance groups and between the humanities-oriented and the sciences-oriented groups. The results concerning these factors are discussed in the present section.

The failure of Factor F to discriminate between the humanities-oriented group and the sciences-oriented

group, as hypothesised, was discussed earlier in the chapter. In that discussion, it was suggested that perhaps the factor would be a predictor of general scholastic performance. As a result of post hoc analyses, it was found that Factor F did, in fact discriminate between high and low general performers, the former group tending to make lower scores than the latter group. The earlier suggestion in relation to Factor F was based on a surmise that the typical extravert would probably make good scores on both Eysenck's Extraversion scale and Cattell's Factor F scale. In effect, then, the present finding with regard to Factor F indicates that these two scales may be positively related, each being negatively related to general scholastic performance.

There were two factors which had predictive efficiency for both the high and low general performers and the humanities-sciences criterion-pairs. These were factors I and Q2. Factor I had already been established as a discriminator between humanities-oriented and sciented students. In addition, the F value associated with the discrimination between the general performance groups by Factor I was significant. The discriminative efficiency in this case, however, was not so high as that obtained with most of the humanities-sciences criterion-pairs. It may thus be said that Factor I will discriminate between high and low general

performers and between humanities-oriented and sciences-oriented students, the more powerful discrimination being with the latter criterion-pair.

Factor Q2, also, was found to discriminate in both categories. This factor had already been established as a discriminator between the high and low general performers. In the post hoc analysis involving Factor Q2 and the humanities-sciences criterion-pair, however, a significant F ratio was obtained, indicating that the factor was a discriminator between the humanities-oriented and sciences-oriented groups also. The associated discriminant weight was negative, indicating that the humanities-oriented group tended to make lower Q2 scores than did the sciences-oriented group. The discriminating power of Factor Q2 was higher for the general performance criterion-pair than for the humanities-sciences criterion-pair.

One of the characteristics associated with the negative pole of Factor Q2 is "conventional". Goldschmid demonstrated in his study that science students were more conventional than students of the humanities. This may explain why the factor discriminates between the humanities-oriented group and the sciences-oriented group.

5. Results of Post Hoc Multivariate Analyses

For the multivariate analysis in which the factors C, G, O, Q2 and Q3 were used as discriminant variables with the humanities-sciences criterion-pair, the obtained value of F was not significant. When the factors A, F, H and I were used in conjunction with the general performance criterion-pair, however, the obtained F value was significant. This result indicates that the set of factors A, F, H and I was a discriminator between the humanities-oriented group and the sciences-oriented group and between the high and low general performers. The latter discrimination was, however much less efficient than the former.

Of the factors A, F, H and I, Factor F and Factor I, as previously mentioned, were found to be discriminators between the general performance groups. It is thus not surprising that the set of all four factors was found to discriminate between these groups. Factor F, of course, was found not to discriminate between the humanities-oriented and the sciences-oriented groups, although it had been expected to do so, and it has been suggested that the factor does not really belong in the category in which it was placed. Since the set {A, F, H, I} appears to contain a spurious element, the fact that it was found to discriminate between the general performance groups is not really of much interest.

In conclusion, the results of the planned and post hoc univariate analyses, in which each factor was considered separately, may be summarised as follows. Factors C, F, G, I, Q2 and Q3 were found to be discriminators between the humanities-oriented and the sciences-oriented group. These results were derived from data gathered from students belonging to a limited population, and should therefore be viewed with caution. Further, replicative research could perhaps investigate whether certain subsets of the sets of factors given above would produce more efficient discrimination between the relevant criterion groups. Some such subsets were suggested earlier in the chapter.

Generally the study has demonstrated that the structure of personality is such that some traits tend to be related to general scholastic performance while others tend to be associated with differential inclination towards the humanities or the sciences.

SUMMARY AND CONCLUSIONS

The problem investigated by the study was divided into two sub-problems. The first was whether measures of Cattell's personality traits C, G, O, Q2 and Q3 would discriminate between senior high school students who perform well, in general, in school, and those who generally have poor scholastic performance. The second sub-problem was whether the personality factors A, F, H and I would discriminate between those senior high school students who are inclined towards the humanities rather than the sciences, and those who are inclined towards the sciences rather than the humanities.

The research population consisted of the grade ten students who were enrolled in university-preparatory English, History, Mathematics and Science courses in five English-language high schools in Ottawa. The study involved 582 of these students.

The High School Personality Questionnaire, Form A, which measures the traits concerned, was administered to the students involved, at the respective schools. Christmas marks and Easter marks for English, History, Mathematics and Science were obtained, for each student, from the appropriate school's records. For each student, a performance score for each subject was calculated, this being the average of his Christmas mark and Easter mark for that subject.

A number of criterion groups was formed. For each subject, students who were in the top thirty per cent in their schools were placed in the upper performance group for the subject; those in the bottom thirty per cent formed the lower performance group. Students who were in the upper performance groups for all four subjects were designated the high general performers; those in the lower performance groups for all four subjects were called low general performers. These two general performance groups were used in connection with the first sub-problem. English and History were referred to as the "humanities" subjects, Mathematics and Science being called the "sciences" subjects. Students who were in the upper performance groups for both humanities subjects, but for neither sciences subject, together with those who were in the lower performance groups for both sciences subjects, but for neither humanities subject, were designated the humanities-oriented group. In contrast, a sciences-oriented group was formed; this consisted of all students who were in the upper performance group for each sciences subject, but for neither humanities subject, together with those who were in the lower performance group for each humanities subject, but for neither sciences subject. The humanities-oriented and sciences-oriented groups were used in connection with the second sub-problem.

Discriminant analysis was used to examine the proposition that the personality factors C, G, O, Q2 and Q3 would discriminate between the high general performers and the low general performers. A multivariate analysis, in which all these traits were present as discriminant variables, indicated that they produced significant discrimination between the predicted criterion groups. Five univariate analyses, in which the different factors were respectively used as the discriminant variables, indicated that factors C, G, Q2 and Q3 were significant discriminators between the criterion groups. For each of these factors, the positive pole was associated, as expected, with high general performance.

The second proposition, that the traits A, F, H and I would discriminate between the humanities-oriented group and the sciences-oriented group was examined by means of one multivariate and four univariate analyses. In the multivariate analysis, all four factors were used as discriminant variables. The resulting F value was significant, indicating that this set of factors was a discriminator between the criterion groups. The four univariate analyses, each involving a different one of the four factors, indicated that factors A, H and I were discriminators between the humanities-oriented group and the sciences-oriented group.

The findings, for the planned analyses, may be summarised separately for each sub-problem, as follows:

- (a) Cattell's personality source traits C, G, Q2 and Q3 were each found to be significant discriminators between grade ten students in academic courses who generally perform well in school and those who exhibit poor general performance. In addition, the set of traits {C, G, O, Q2, Q3} was found to discriminate significantly between these groups of students.
- (b) Cattell's personality source traits A, H and I were each found to be significant discriminators between grade ten students in academic courses who are inclined towards the humanities and those who are inclined towards the sciences. In addition, the set of traits {A, F, H, I} was found to discriminate significantly between these groups of students.

Following the performance of analyses in connection with the testing of the hypotheses, a number of post hoc analyses was carried out. These analyses were organised into two sets. The first set of post hoc analyses was carried out in order to determine whether any of the factors which had been omitted from the hypotheses would discriminate between the groups of either of the criterion-pairs. The aim of the second set was to determine whether any of the factors C, G, O, Q2 or Q3 would discriminate between humanities-oriented

and sciences-oriented groups, and whether any of the factors A, F, H or I would discriminate between the high and low general performance groups. In effect, the post hoc analyses completed the series of univariate discriminant analyses in which each factor, respectively, was used as the discriminant variable with each of the established criterion-pairs.

The results of these analyses indicated that, of factors C, G, O, Q2 and Q3, Factor Q2 discriminated between the humanities-oriented and the sciences-oriented groups.

When factors C, G, O, Q2 and Q3 were used together in a multivariate discriminant analysis with the humanities-sciences criterion-pair, however, the obtained F value was not significant.

The set of factors A, F, H and I, on the other hand, which had previously been found to discriminate between the humanities-oriented group and the sciences-oriented group (as hypothesised), was found to discriminate between the general performance groups also. The efficiency of the latter discrimination was, however, far smaller than that of the former. Of the four factors involved, Factor F and Factor I were each found, in univariate analyses, to discriminate between the general performance groups. That the set of all four factors was found to discriminate between the general performance groups was thus not surprising. Factor F, of course, had previously been found not to

discriminate between the humanities-oriented group and the sciences-oriented group, although it had been expected to do so. The set {A, F, H, I} thus contains a spurious element, and the fact that it discriminates between the general performance groups is not of great interest.

Of the omitted factors, only Factor E was found to discriminate between either pair of criterion groups. This factor turned out to be one which discriminated between the humanities-oriented group and the sciences-oriented group.

As far as individual factors are concerned, the results of the planned and the post hoc analyses are, briefly, as follows. Of the non-intellective personality traits measured by the High School Personality Questionnaire, factors C, F, G, I, Q2 and Q3 were found to discriminate between the high and low general performers. These factors, with the exception of Factor F, were positively related to scholastic performance; the relationship between Factor F and the criterion was negative. Factors A, E, H, I and Q2 were found to discriminate between the humanities-oriented group and the sciences-oriented group. For these factors, high scores on A, H and I indicated inclination towards the humanities rather than the sciences, and high scores on E and Q2 indicated an orientation towards the sciences rather than the humanities.

There were three main limitations to the study which should be borne in mind when looking at the findings. One is that the five schools whose grade ten students were involved were not selected at random. Strictly speaking, therefore, the findings may not be generalised beyond the research population described in Chapter II. Secondly, although there were sufficient numbers of cases in the criterion groups for each of the discriminant analyses, these numbers were sometimes not much greater than commonly acceptable minima. The third limitation is that only one form of the HSPQ was used. The reliability of the personality data would have been greater if it had been possible to use all four, or even just two, of the available forms. The researcher collecting experimental data from high schools necessarily takes time from regular class activities, and causes some reorganisation of the usual school routine. School authorities are sometimes reluctant, therefore, to allow testing to take place. As in the case of the present study, the researcher must often carry out the minimum amount of testing that is in concordance with the principles of good research.

It has already been suggested that further studies should be carried out to investigate the discriminating power of sets of HSPQ traits different from the sets hypothesised in this study. Attempts should be made also to validate the discriminant equations which were derived, both for the

grade ten age-group and for other levels of school students. Having established that certain personality traits will discriminate between humanities-oriented and sciences-oriented students, the next step is for one to inquire about the personality of the student who performs well in one subject, but not in others. A study designed to investigate a question such as this would require a vast research population, because the proportion of students who do well (or poorly) in one subject alone must be quite small.

Much of the existing information about personality in relation to area of academic inclination derives from studies with undergraduates. The findings of the present study add to this information and extend it to the senior high school level. Personality data of the type investigated may be used in the identification of students who are likely to have strong biases towards the humanities or the sciences.

As well as identifying sets of Cattell's primary traits which will discriminate between various criterion groups, the study has indicated that the structure of personality is such that some traits are related to general scholastic performance, while others are associated with performance in one area to the exclusion of another area.

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A comprehensive survey and description of Cattell's identification of personality source traits by the factor analysis of ratings, questionnaire responses and objective test data. A comparison of many of these factors with traits already identified by clinical psychologists is also undertaken.

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Describes the factor analysis of objective test data. From some 150 factors in objective personality tests, eighteen potentially invariant patterns were found. Twelve of these were considered to have a satisfactory degree of invariance and universality.

-----, "Second-Order Factors in the Questionnaire Realm", Journal of Consulting Psychology, 1956, 20, 411-418.

Describes the factor analysis of the correlation matrix based on the scores of 408 young men on the non-intellective factors measured by the 16PF. The analysis resulted in the identification of four second-order factors.

-----, The Scientific Analysis of Personality, Harmondsworth, Penguin Books, 1965, 400 p.

Following a discussion of the formation of personality by environment and heredity, the structure of personality and various traits are described. Further chapters on the techniques of objective testing, the motivation of personality, the analysis of mood changes, and the development of personality lead to a final survey of the wider social implications of personality measurement.

Cattell, Raymond B., and Butcher, H. John, The Prediction of Achievement and Creativity, Indianapolis, Bobbs Merrill Company, 1968, 386 p.

Discusses abilities, intelligence and scholastic achievement. Surveys the present state of knowledge of the structure and measurement of personality. Reports the authors' recent research into the abilities and personalities of school students, and discusses the prediction of their achievement from measures of these qualities. Discusses psychological tests and their various psychometric properties. Outlines a programme for testing students at key points during their school careers.

-----, and Cattell, Mary D. L., Handbook for the High School Personality Questionnaire, Champaign, IPAT, 1969, 88 p.

States the purpose and describes the construction of the HSPQ. Discusses the psychometric properties of the fourteen scales. Gives instructions for the administration and scoring of the test. Discusses the psychological meanings of the primary factors measured by the test and describes how to obtain scores on second-stratum factors. Gives criterion relations thought to be useful in educational, clinical and vocational practice.

-----, Eber, Herbert W. and Tatsuoka, Maurice M., Handbook for the Sixteen Personality Factor Questionnaire, Champaign, IPAT, 1970, xxv-388 p.

Describes the design and construction of the 16PF. Discusses the psychometric properties of the scales. Describes the standardisation of scores. Conducts an extensive survey of the psychological meaning of each primary and second-stratum trait measured by the test and discusses the relationships between the factors and various criteria. Gives extensive data and profiles relating to professions and occupations, achievement and creativity, and various other criteria in the fields of education, vocational guidance and sociology.

Cattell, R. B. and Saunders, D. R., "Inter-Relation and Matching of Personality Factors from Behavior Rating, Questionnaire, and Objective Test Data", Journal of Social Psychology, 1950, 31, 243-260.

Report of a study designed to compare factors from three areas of personality measurement — behaviour ratings, questionnaire responses and objective test scores. The factors in the three areas were found to have considerable variance in common but also to occupy some factor space peculiar to each. In the common space, certain tentative matchings of factors were suggested.

Cattell, R. B., Sealy, A. P. and Sweney, A. B., "What Can Personality and Motivation Source Trait Measurements Add to the Prediction of School Achievement?", British Journal of Educational Psychology, 1966, 36, 280-295.

Intelligence, personality and school motivation were measured on five samples of seventh and eighth grade children. Personality was measured by the HSPQ. Two school achievement variables were used, one based on measures made with a standardised test and one based on school marks. Multiple regression procedures indicated that the three modalities concerned occupied essentially separate spaces, and that each accounted for about one quarter of the variance of scholastic achievement.

Drevdahl, John E., "Factors of Importance for Creativity", Journal of Clinical Psychology, 1956, 12, 21-26.

A report of an investigation made into some of the relationships between certain intellectual and personality characteristics and ratings of creativity. The study involved university students. The sample was divided into creative and non-creative and arts and sciences groups. For each of these groups, characteristics which discriminated between the criterion groups were found.

Eysenck, H. J. and Cookson, D., "Personality in Primary School Children", British Journal of Educational Psychology, 1969, 39, 109-122.

A study involving some four thousand eleven-year old children. Neuroticism and Extraversion were measured by the JEPI, and the scores were analysed in relation to performance on scholastic and ability tests at the primary school leaving level. Correlation and analysis of variance methods indicated that extraverted children of this age are scholastically superior to introverted ones. Neurotic children, however, had only marginally lower achievement scores than did those with low Neuroticism.

Field, Lewis William, Personality Correlates of College Achievement and Major Areas of Study, unpublished doctoral dissertation presented to the Faculty of the Graduate School, University of Houston, 1954, xvi-191 p.

A study designed to show that high and low achievers in college and that successful physical and social science majors can be differentiated on a series of personality measures, a distinct constellation of traits being indicated for each group. Each group consisted of twenty-nine matched pairs. Discriminating traits were found in each group.

Gallese, Arthur J., Personality Characteristics and Academic Achievement in School of Engineering Students, unpublished doctoral dissertation presented to the Faculty of the Graduate School, University of Minnesota, 1958, vii-106 p.

Report of a study designed to explore the relationships between academic achievement and personality characteristics measured by the MMPI. Personality data for the sample, which was made up of engineering students, was significantly different from that of students in general for all the MMPI scales except one. No personality differences were found between high and low achievers.

Goldschmid, Marcel Lucien, The Prediction of College Major in the Sciences and the Humanities by Means of Personality Tests, unpublished doctoral dissertation submitted to the Graduate Division of the University of California, 1965, iii-89 p.

Purpose of study was to demonstrate relationships between personality traits and choice of college major. Personality data were collected from different universities each using a different personality instrument. Students' major subjects were assigned numerical positions on a humanities continuum and on a science continuum. For each personality test, two regression equations were established, the respective criteria being the humanities "scores" and the science "scores" of the students' major subjects.

The study indicated that several of the traits considered could be used as discriminators between students in the humanities and those in the sciences.

Lynn, R., "Two Personality Characteristics Related to Academic Achievement", British Journal of Educational Psychology, 1959, 29, 213-216.

A matched-pairs study involving undergraduates and apprentices matched on age and social background. The MPI was used to assess Extraversion and Neuroticism scores for each sample. The undergraduates had significantly higher Neuroticism and lower Extraversion than the controls.

Savage, R. D., "Personality Factors and Academic Performance", British Journal of Educational Psychology, 1962, 32, 251-253.

The MPI was given to a sample of undergraduates in Arts, Neuroticism and Extraversion scores thus being obtained. First-year marks were used as estimates of achievement. Analysis of variance and correlation techniques indicated that scores on both factors were negatively related to academic performance.

Trent, James, W. and Athey, Irene J., Dispositional Differences Between Technology and Liberal Arts Majors, paper presented at the Annual Conference of the California Educational Research Association, 1965.

Report of a study in which personality characteristics of engineering and liberal arts undergraduates were compared. The groups were found to differ on certain traits.

Trent, Shirley J., A Study of the Relationship of Personality Factors to Academic Achievement, unpublished doctoral dissertation presented to the Graduate Council of the University of Tennessee, 1968, xx-117 p.

Report of a study designed to determine whether differences on Cattell's primary traits existed between groups of college freshmen of the same ability levels who were achieving at different levels. Consistent differences were not found.

Warburton, F. W., Butcher, H. J. and Forrest, G. M., "Predicting Student Performance in a University Department of Education", British Journal of Educational Psychology, 1963, 33, 68-80.

Describes a study in which one hundred teacher-trainees were given tests of abilities, personality interests, values and general culture. The predictive power of these various measures was examined in terms of three main criteria — final teaching mark, final theory mark and award of the General Certificate of Education. Scores made on the 16PF were the best single predictor of teaching mark.

APPENDIX 1

Personality Data

APPENDIX J

PERSONALITY SCORES OF EACH STUDENT

BROOKFIELD HIGH SCHOOL

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	Q1	Q2	Q3	Q4
290600	16	8	9	8	7	4	12	8	17	7	7	5	12	11
290266	11	9	14	16	10	15	10	14	5	9	12	6	9	11
290477	14	8	13	8	11	11	13	12	17	14	2	11	15	6
290423	17	8	11	7	13	15	8	13	12	10	4	8	14	7
290715	11	7	18	10	15	8	15	14	8	11	4	10	12	9
290790	11	9	10	4	11	14	12	16	15	7	7	6	14	7
290201	13	10	9	10	8	8	13	12	12	9	7	8	12	9
290814	12	9	7	10	5	13	5	7	10	7	13	7	4	12
290909	7	9	2	12	7	5	16	3	3	13	15	10	10	16
290969	8	10	12	8	10	9	10	5	6	12	13	10	11	7
290749	16	8	13	9	4	7	16	10	17	12	6	10	16	7
290388	14	9	9	7	6	6	14	5	16	5	5	5	11	9
290753	8	7	12	10	12	7	15	11	12	14	4	15	13	12
290607	8	7	13	8	16	4	15	14	17	8	3	10	18	12
290558	7	8	12	5	16	13	9	13	8	12	7	15	8	3
290274	11	8	15	9	12	12	17	14	0	10	9	8	12	7
200552	12	9	7	15	8	8	12	6	3	7	12	6	10	15
290465	8	8	10	13	11	5	8	6	14	7	10	13	11	8
290826	13	7	9	13	8	8	12	7	18	4	10	13	10	14
200528	8	7	6	6	4	8	14	8	12	12	7	12	9	6
290599	8	8	11	9	11	10	14	12	2	16	4	12	13	12
290971	0	7	7	7	12	9	13	7	8	12	10	12	14	10
280108	14	9	6	7	7	13	11	7	9	5	11	8	8	14
290309	12	8	4	12	8	12	10	10	11	11	8	4	7	9
290822	12	5	3	11	9	12	14	8	11	9	9	11	10	16
290665	17	9	13	10	10	12	12	13	14	6	8	5	13	2
290435	17	9	12	11	8	10	15	20	2	7	3	8	10	5
200368	14	6	4	9	7	10	13	6	18	7	13	7	11	12
290425	13	7	8	10	10	13	15	6	8	15	13	10	7	15
290282	10	10	8	10	7	6	13	7	16	9	9	11	11	7
290481	9	8	8	9	7	7	13	8	16	9	6	10	11	15
290407	16	10	9	8	8	9	15	7	10	5	9	6	13	10
290475	14	9	9	11	6	12	12	11	15	12	13	5	9	10
290675	16	7	6	16	8	13	5	9	11	10	17	5	11	13
290842	13	7	4	15	7	11	6	4	17	7	16	7	6	12
290609	10	10	13	6	10	6	14	6	16	12	9	18	20	10

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	K	Q2	Q3	Q4
290307	8	7	14	11	9	13	5	9	13	6	10	8	9	18
290806	8	7	16	8	10	11	8	11	15	11	6	6	11	13
290895	15	9	11	10	8	11	14	7	13	8	9	7	10	7
290367	14	6	0	5	4	8	9	5	18	10	12	11	6	9
290433	11	9	13	12	15	16	12	15	1	12	8	11	9	8
290889	4	7	16	4	12	9	11	15	1	8	6	7	11	4
200414	9	7	10	14	8	10	6	5	9	12	15	18	5	12
290259	14	8	5	11	6	8	13	6	14	4	9	4	8	14
290357	12	10	14	6	9	15	11	12	16	7	1	3	12	4
290879	5	9	14	10	12	2	13	12	11	14	11	17	13	4
290356	11	8	16	7	13	8	16	12	7	11	3	14	11	3
200402	9	8	8	7	10	13	8	9	7	11	8	6	10	6
290467	10	7	11	10	10	11	7	10	8	8	9	8	12	9
200386	14	8	5	14	9	17	4	7	16	9	11	7	4	13
290411	12	8	14	5	11	5	14	13	15	6	6	11	10	5
290643	11	7	5	13	7	8	10	10	9	9	14	14	14	10
290941	9	8	12	9	10	11	13	8	3	8	6	14	11	8
200404	8	9	13	6	8	9	13	11	20	9	11	8	12	11
290493	10	8	3	15	6	10	8	3	14	12	12	12	5	14
200533	10	8	14	9	9	14	10	14	14	6	8	11	13	5
290361	11	7	18	6	13	10	15	10	4	9	3	13	12	5
290804	14	9	6	12	8	10	14	11	17	5	9	7	10	5
290441	11	9	6	9	6	10	13	3	9	9	14	7	12	16
290301	12	8	11	6	9	10	13	11	19	3	8	6	14	8
290752	16	8	11	9	11	13	11	11	9	10	6	7	15	3
290891	6	6	12	11	9	8	13	7	8	9	11	8	11	12
290834	12	9	7	8	9	9	13	10	11	8	9	9	11	10
290384	10	6	13	10	12	14	7	11	8	10	4	10	9	10
290983	10	7	12	16	18	12	14	10	0	8	10	9	10	10
290262	16	8	8	12	10	8	14	13	14	6	5	7	11	11
290419	17	9	13	9	2	16	17	18	18	7	6	11	12	8
290717	17	7	12	10	11	17	10	15	8	0	6	5	12	7
290792	14	8	6	12	10	10	11	16	12	7	10	12	10	12
290431	16	7	15	12	10	10	11	9	6	5	7	10	14	9
290576	6	10	5	10	6	7	10	5	16	8	15	11	10	14
290373	18	8	4	8	13	16	6	16	5	10	14	2	6	14

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	O	Q2	Q3	Q4
290311	10	8	10	18	6	6	9	10	3	15	14	7	10	13
290828	16	8	9	10	6	11	7	14	16	11	5	4	7	11
290977	8	8	13	4	8	11	14	5	12	4	11	14	12	13
290757	13	8	10	15	6	10	10	9	19	8	11	11	7	15
290605	12	6	8	14	8	17	12	10	13	12	8	10	14	15
290981	11	10	3	13	7	10	8	5	10	7	11	5	12	13
290925	17	9	11	12	9	9	10	15	14	7	8	2	9	6
290264	14	9	8	13	11	15	9	6	18	10	10	7	7	12
290566	12	8	11	9	10	8	10	13	13	9	2	7	14	7
290417	12	7	7	12	10	14	7	11	6	8	12	6	11	10
290877	15	8	8	12	9	9	7	13	14	5	7	3	11	13
200409	11	7	12	8	10	4	17	10	5	10	9	14	15	10
290719	18	7	11	4	10	9	12	11	16	4	3	3	13	6
290568	11	7	10	7	11	13	16	17	9	9	7	13	14	11
290723	6	8	9	7	10	11	13	9	7	12	6	12	8	9
290953	5	9	6	14	10	14	8	13	2	10	13	12	9	11
290729	9	10	6	8	11	15	10	10	8	10	11	6	12	8
290583	11	8	7	11	3	15	12	12	15	7	6	9	9	13
200465	11	9	7	10	15	9	9	11	7	8	8	12	13	7
290516	12	8	10	10	13	10	15	10	6	10	10	10	11	9
290832	14	9	12	10	12	10	8	8	6	10	10	10	4	12
290603	17	7	19	5	9	13	9	14	12	4	6	7	8	4
290527	8	9	5	6	5	4	8	5	15	7	16	9	10	14
290412	6	7	10	14	8	12	18	10	14	4	10	16	8	10
290703	6	8	6	11	13	10	12	9	3	12	11	5	12	11
290469	15	8	9	15	2	7	15	6	18	9	10	9	10	11
290786	10	7	10	8	10	10	18	10	5	8	4	9	11	8
200399	15	9	7	16	7	14	7	8	15	10	13	2	12	10
290280	11	9	8	10	8	8	12	8	19	10	9	5	10	14
290371	9	3	9	8	9	10	11	8	9	6	4	11	10	2
200442	8	6	10	5	11	8	9	12	8	10	9	11	16	10
290949	12	7	10	14	11	15	9	17	3	7	6	3	11	9
290299	10	6	4	9	9	11	5	12	13	8	12	12	7	11
290725	17	4	16	8	13	12	16	14	0	4	12	10	16	11
290746	10	9	2	12	9	14	5	10	15	5	15	9	4	12
290667	15	6	14	3	16	15	8	19	0	8	2	7	17	4

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	O	Q2	Q3	Q4
290402	9	8	10	9	12	17	7	19	2	13	4	7	7	13
290685	14	7	6	14	7	12	12	10	10	4	7	12	10	13
200359	11	9	12	4	6	10	17	11	17	9	6	7	14	8
290784	6	7	9	12	9	8	13	6	12	10	12	11	11	7
290871	8	7	12	11	10	12	7	11	6	8	7	12	9	8
290353	10	7	10	10	11	6	10	12	4	9	10	7	5	9
290421	17	9	4	11	4	11	9	5	17	4	13	10	4	13
290570	14	10	12	10	11	14	10	17	10	10	5	3	11	7
200420	6	10	9	8	16	9	10	7	4	14	14	17	16	13
290288	13	9	17	4	15	15	9	13	2	6	10	7	9	5
290947	4	9	1	10	14	8	9	7	11	12	11	10	11	12
290437	9	9	10	9	13	10	16	15	2	12	7	7	16	10
200548	12	5	9	9	4	6	14	12	5	8	10	10	13	8
290903	10	8	5	17	15	16	11	10	6	10	9	8	11	13
290818	13	8	10	8	10	9	8	7	12	9	12	13	10	9
290955	5	8	15	12	14	11	8	10	6	16	8	13	11	8
290961	10	10	8	10	12	14	16	7	12	10	14	6	8	12
290390	11	10	4	9	14	8	10	8	15	10	12	12	7	11
290520	15	9	9	10	9	13	12	8	15	5	3	8	14	11
290453	10	7	8	12	9	11	12	10	4	6	6	5	12	14
290552	9	7	9	8	3	9	9	8	18	10	9	12	14	7
290272	15	9	12	9	5	11	9	11	18	9	6	7	10	7
290705	5	6	10	12	10	0	8	2	3	14	13	12	13	9
290355	15	10	10	13	7	10	5	8	15	8	10	5	9	10
290711	12	8	2	13	5	13	9	6	18	8	10	9	10	13
290883	12	8	6	9	10	11	7	11	12	6	8	9	9	8
290800	13	10	10	10	8	11	8	9	4	6	7	12	9	11
290580	9	8	7	11	16	13	8	10	10	9	11	13	6	4
290585	12	10	9	16	12	15	6	8	5	12	6	8	7	11
290587	12	10	13	13	13	13	10	14	6	7	5	13	7	10
290907	8	7	12	10	7	5	14	6	19	12	15	18	14	11
290945	12	10	12	11	13	14	11	18	6	10	3	12	15	2
290591	16	6	10	5	8	10	10	11	12	6	9	8	10	9
200503	11	9	17	4	14	13	10	6	5	10	7	15	14	6
290677	8	7	8	12	11	11	10	13	7	10	14	13	11	10
200508	16	7	11	8	10	19	13	18	10	6	2	7	13	6

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	O	Q2	Q3	Q4
290276	13	10	9	13	10	11	14	13	16	12	4	5	10	8
290483	15	9	5	11	6	12	7	12	18	5	12	3	12	8
290788	14	8	10	8	11	16	9	20	10	8	9	5	10	9
290798	8	5	13	2	12	15	14	13	4	12	2	8	9	6
290574	11	10	12	10	8	11	14	7	11	6	12	9	7	8
290651	5	8	14	10	16	5	13	10	2	13	6	19	13	8
290655	13	6	15	10	4	16	13	11	16	9	9	1	12	9
290737	12	6	12	9	7	17	4	11	9	9	14	15	8	13
290380	12	8	15	5	12	6	17	12	9	8	6	9	13	2
200493	16	10	11	8	11	11	10	14	14	9	7	7	10	11
290313	12	4	6	12	7	9	7	11	11	10	16	7	12	11
290319	10	7	15	9	17	10	10	12	4	8	5	8	13	6
290320	13	9	8	9	9	14	10	14	11	9	9	7	8	11
290523	8	10	12	10	9	12	12	10	6	11	10	9	10	10

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PERSONALITY SCORES OF EACH STUDENT

HILLCREST HIGH SCHOOL

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	K	Q2	Q3	Q4
1090364	12	9	13	17	15	16	4	14	0	8	8	2	7	13
1090457	11	9	9	11	13	10	11	11	1	8	8	11	10	11
1090383	14	7	9	15	13	18	7	11	5	9	12	6	12	12
1090385	11	5	11	11	12	7	14	9	0	6	4	8	9	7
1090386	7	5	8	14	11	10	8	7	9	10	11	9	10	15
1090387	8	8	13	8	17	10	13	14	6	9	9	12	16	7
1090388	8	8	8	11	17	13	9	16	2	10	3	5	7	10
1090645	11	9	10	10	15	18	6	14	2	8	9	6	9	7
1090366	12	8	10	17	5	10	9	13	6	8	9	4	10	12
1090466	20	8	8	11	10	15	0	16	8	6	4	2	7	10
1090543	7	10	13	12	8	5	9	4	14	15	11	15	13	10
1090392	12	8	10	16	12	11	7	14	5	11	9	9	11	15
1090368	13	9	13	7	7	13	10	11	15	6	6	7	9	6
1090369	5	10	8	8	7	5	13	4	15	18	15	14	14	10
1090393	14	8	5	10	11	14	7	9	0	7	8	8	5	8
1090372	10	6	15	9	8	12	13	20	6	8	1	8	16	10
1090373	13	9	13	9	7	9	15	11	8	5	6	5	11	0
1090399	9	6	15	9	16	7	13	11	4	3	5	5	13	2
1090374	12	8	10	10	10	10	8	8	15	5	11	12	6	7
1090429	12	8	13	9	12	12	10	10	4	11	5	5	8	8
1090400	7	9	9	11	13	5	8	6	3	14	11	18	13	8
1090375	8	9	7	10	5	11	11	1	8	12	6	12	8	7
1090377	14	9	9	9	5	11	8	10	11	10	8	11	11	5
1090129	13	10	10	15	10	16	8	5	12	13	12	9	11	16
1090379	10	6	14	12	9	18	14	10	5	7	6	11	10	7
1090680	16	8	11	6	13	6	5	14	11	5	5	10	13	3
1090404	5	8	11	11	1	10	5	5	9	7	12	9	8	10
1090405	7	7	6	8	9	7	12	9	14	7	6	8	13	14
1090406	7	8	12	12	3	12	8	7	7	6	7	11	8	8
1090408	14	6	13	9	7	11	11	14	16	9	11	7	7	12
1090989	13	8	8	12	6	8	10	6	12	10	11	11	10	17
1090412	9	7	18	5	15	11	12	12	10	3	4	8	13	10
1090413	10	6	16	12	15	14	6	15	0	13	3	9	13	8
1090416	6	7	12	6	9	6	5	10	6	4	8	8	11	6
1090418	15	7	8	12	5	12	11	13	16	10	11	12	4	11
1090419	8	6	3	13	6	15	6	12	5	11	10	10	7	10

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	C	Q2	Q3	Q4
1090424	6	10	15	9	7	7	12	10	14	11	4	10	14	10
1090425	13	8	20	2	17	4	17	16	14	7	2	7	16	4
1090426	10	8	16	5	12	11	12	15	4	5	5	7	12	6
1090427	18	7	14	6	8	5	13	11	13	8	12	5	14	14
1090430	11	6	10	9	15	15	8	9	4	4	6	4	7	15
1090431	5	6	9	11	12	10	12	9	7	7	9	11	9	10
1090435	12	10	15	11	11	5	15	8	15	6	7	9	14	8
1090436	16	6	4	14	5	6	12	8	20	0	11	2	7	16
1090437	9	9	6	14	7	9	12	6	16	10	8	9	10	12
1090477	7	10	15	12	11	16	14	11	0	10	2	8	15	10
1090478	7	9	10	9	14	6	9	11	5	4	7	12	11	8
1090479	16	10	17	8	14	13	16	11	6	8	6	7	8	12
1090439	10	7	10	8	10	10	8	9	8	6	9	7	9	12
1090480	6	9	11	9	12	7	18	9	9	9	5	15	15	10
1090440	13	10	7	13	10	8	14	7	16	9	2	11	12	8
1090982	18	10	11	8	8	12	9	11	14	8	7	5	9	13
1090442	16	10	10	11	10	9	16	13	10	5	4	4	13	8
1090482	13	6	10	10	16	7	12	15	11	10	3	13	9	5
1090443	16	7	9	10	8	17	9	13	15	7	14	7	6	11
1090970	11	7	11	4	16	8	16	14	8	8	6	4	10	12
1090995	6	9	12	7	9	10	15	10	4	12	4	11	14	12
1090444	11	7	17	6	8	7	17	10	14	4	8	7	16	10
1090485	9	6	7	13	15	10	4	6	7	9	12	17	5	10
1090486	5	10	13	6	16	10	15	11	11	10	4	15	14	5
1090487	9	10	13	6	13	5	13	10	8	7	10	12	13	10
1090447	14	10	15	6	7	7	16	10	17	9	6	4	12	8
1090488	14	7	15	7	12	13	10	14	2	7	4	10	17	8
1090489	14	7	8	9	10	11	9	16	3	7	8	6	11	11
1090451	9	7	3	13	12	6	15	9	2	7	14	8	7	9
1090452	11	9	16	7	12	11	7	14	7	9	3	8	13	2
1090453	9	9	9	11	5	9	12	8	15	11	12	12	10	10
1090454	15	9	14	8	11	12	10	11	7	6	3	8	13	4
1090455	13	7	12	12	10	15	7	14	8	9	6	6	13	9
1090456	6	6	8	12	10	13	8	8	2	8	12	14	12	8
1090476	15	10	13	7	15	13	10	17	1	7	7	3	9	6
1090458	7	10	10	5	12	7	11	10	0	14	10	13	10	7

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PERSONALITY SCORES OF EACH STUDENT

HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HS PQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	O	Q2	Q3	Q4
1090463	5	10	11	10	11	13	12	11	3	10	6	11	12	9
1090465	16	9	13	10	14	16	11	12	2	5	7	15	12	7
1090468	10	7	6	12	10	5	10	8	3	9	7	8	7	16
1090469	13	7	10	7	16	16	4	8	3	3	8	7	12	11
1000996	15	10	17	4	13	4	14	17	14	6	2	12	16	4
1090470	12	7	11	10	13	14	7	12	4	9	11	10	11	7
1090471	8	10	10	4	12	6	14	6	2	15	2	14	14	10
1090473	16	10	16	4	16	10	16	16	2	6	0	4	12	8
1090475	12	9	6	4	11	11	10	13	1	5	3	10	10	7
1090505	15	9	8	5	11	12	5	12	15	6	10	8	6	5
1000101	7	10	5	12	9	7	15	2	12	9	16	9	10	7
1090491	7	9	7	17	10	15	11	9	4	10	7	10	6	11
1090492	10	9	13	6	10	3	15	10	18	5	6	12	8	9
1000125	9	8	5	11	7	10	11	9	9	11	9	11	6	10
1090534	17	8	13	9	12	14	8	11	12	5	12	6	9	13
1090493	10	8	15	3	13	9	13	13	4	8	0	10	11	6
1090495	9	8	12	8	9	9	10	11	10	11	10	9	10	9
1090508	11	8	8	12	12	19	6	13	1	7	8	7	5	12
1090510	7	9	7	12	14	14	5	7	1	12	11	14	7	9
1090539	17	9	12	5	12	2	14	10	14	11	5	3	14	8
1090540	12	9	3	15	7	13	9	6	18	8	15	12	8	18
1090097	10	10	15	12	11	9	8	4	11	10	7	19	6	14
1090514	14	7	12	1	12	11	7	12	13	8	6	7	17	7
1090515	14	9	11	10	8	12	10	15	19	7	10	5	6	16
1090541	17	10	8	6	8	11	12	9	14	4	9	5	16	11
1090542	17	9	10	7	11	12	8	9	7	7	10	7	10	10
1090544	9	9	10	10	12	13	6	12	7	7	5	6	10	8
1090490	9	5	11	9	12	13	11	15	6	7	5	5	12	5
1090519	11	6	8	11	15	12	8	13	4	6	4	3	6	16
1090500	15	7	17	5	7	7	12	18	14	5	3	8	15	10
1090545	15	7	6	9	5	11	15	5	15	7	7	8	11	11
1090501	13	10	13	12	10	7	11	11	16	5	4	9	11	10
1090503	14	7	14	6	13	6	13	13	4	10	7	7	13	7
1090523	6	7	12	10	20	13	9	15	3	17	4	12	12	8
1090504	10	7	4	8	7	13	6	5	16	8	16	11	4	15
1090524	13	9	11	8	2	12	11	14	9	9	5	14	16	5

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	HSPQ FACTOR													
	A	B	C	D	E	F	G	H	I	J	Q1	Q2	Q3	Q4
1090511	7	9	11	9	13	10	16	14	5	16	5	15	13	3
1090525	13	9	10	10	13	11	15	13	2	8	9	13	15	7
1090526	9	6	14	6	7	3	14	14	16	6	6	13	16	7
1090527	10	6	13	13	15	9	15	6	1	6	6	16	10	12
1090513	9	7	9	13	14	16	10	8	11	13	5	6	9	10
1090516	14	8	12	1	9	10	9	12	14	6	6	4	13	3
1090528	16	9	8	12	16	19	6	9	7	6	7	4	3	6
1090538	11	7	15	7	8	15	10	10	8	10	9	11	11	7
1090519	4	10	14	8	8	2	18	6	16	10	8	14	18	8
1090520	11	9	15	12	8	6	10	6	0	7	5	10	11	6
1090529	12	9	15	11	8	9	15	12	14	8	6	10	10	5
1090530	8	8	13	15	8	6	12	7	13	15	12	15	14	9
1090521	9	9	13	5	15	12	10	15	3	11	9	14	13	6
1090531	18	9	5	14	5	12	11	12	5	9	11	13	14	12

APPENDIX 1

SPECIALTY SCORES OF EACH STUDENT

1 YEAR COLLEGE

HSPQ FACTOR

STUDENT

STUDENT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1250217	15	6	11	7	0	10	12	11	0	12	4	8	7	10												
1250221	14	7	15	14	10	14	10	12	18	11	7	8	12	12												
1250222	14	7	15	0	4	5	13	12	20	3	7	8	13	16												
1250229	14	8	14	7	13	12	8	16	14	8	2	13	16	4												
1250245	14	10	0	14	7	0	11	12	12	8	7	8	10	10												
1250246	6	8	2	10	14	0	8	6	6	12	12	18	9	14												
1250256	14	6	8	4	7	1	15	6	6	8	7	12	14	0												
1250257	10	0	10	15	0	12	10	6	10	15	0	5	11	0												
1250260	14	5	16	6	12	12	14	14	12	6	7	8	6	15												
1250262	14	10	7	13	6	11	0	10	9	7	8	7	0	11												
1250267	10	0	9	15	4	9	15	11	20	7	11	6	7	18												
1250272	14	0	8	16	7	12	7	7	7	2	12	8	11	14												
1250275	12	8	10	10	10	10	12	8	16	3	10	4	11	11												
1250276	11	8	11	10	15	10	12	0	0	5	7	0	11	0												
1250277	5	10	11	5	7	2	13	8	14	12	2	12	17	10												
1250278	11	0	13	6	7	11	12	5	12	13	4	14	8	12												
1250281	12	7	5	14	7	14	7	12	18	12	0	6	12	6												
1250282	12	4	10	11	9	7	10	8	9	0	12	0	12	8												
1250283	12	14	0	12	13	12	17	10	16	8	10	2	16	8												
1250284	18	8	13	3	4	13	17	10	16	8	10	2	16	8												
1250285	16	0	10	11	12	12	8	0	0	12	12	16	10	15												
1250286	12	7	6	8	5	14	6	14	5	2	11	10	14	6												
1250287	16	0	8	16	7	12	7	7	7	2	12	8	11	14												
1250288	14	0	8	16	4	7	12	7	15	4	15	6	11	11												
1250289	10	0	9	15	4	9	15	11	20	7	11	6	7	18												
1250290	15	8	7	7	7	10	12	12	0	6	7	10	17	5												
1250291	11	7	10	3	13	4	16	13	8	11	0	16	6	15												
1250292	11	8	11	10	10	10	12	8	16	3	10	4	11	11												
1250293	11	0	9	15	4	9	15	11	20	7	11	6	7	18												
1250294	12	2	3	10	11	0	12	10	15	2	11	0	11	11												
1250295	18	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250296	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250297	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250298	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250299	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250300	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250301	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250302	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250303	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250304	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250305	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250306	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250307	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250308	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250309	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250310	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250311	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250312	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250313	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250314	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250315	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250316	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250317	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250318	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250319	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250320	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250321	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250322	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250323	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250324	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250325	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250326	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250327	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250328	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250329	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250330	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250331	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250332	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250333	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250334	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250335	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250336	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250337	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250338	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250339	12	6	15	7	12	10	12	10	15	2	11	0	11	11												
1250340	12	6	15	7	12	10	12	10																		

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

LISAP COLLEGE

(CONTINUED)

HSPQ FACTOR

STUDENT NUMBER	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
1291265	8	6	10	12	11	8	0	6	14	0	8	7	11	15	8	7	11	15	12	10	12	14	10	12	14	10	12
1291557	14	10	11	7	4	15	11	0	20	5	5	6	12	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292269	11	9	10	10	16	10	11	8	6	4	0	6	15	11	11	9	10	10	16	10	11	9	10	10	16	10	11
1292504	6	7	7	12	10	7	13	0	18	9	12	15	12	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292561	12	8	6	16	0	14	6	6	12	12	14	4	6	14	10	12	14	10	12	14	10	12	14	10	12	14	10
1292570	10	8	5	14	11	8	13	6	18	10	8	8	18	18	18	18	18	18	10	8	8	18	18	18	18	18	18
1292853	15	0	8	10	7	14	11	15	18	6	8	1	8	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292224	7	5	8	17	8	11	10	4	13	9	14	6	6	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292609	14	0	11	8	4	7	15	10	18	6	0	7	12	14	10	12	14	10	12	14	10	12	14	10	12	14	10
1292612	0	8	8	13	14	15	4	10	2	6	8	10	7	8	10	12	14	10	12	14	10	12	14	10	12	14	10
1292975	11	7	10	9	14	10	7	17	9	5	2	0	14	5	8	10	12	14	10	12	14	10	12	14	10	12	14
1292222	14	7	6	0	7	0	14	10	4	9	11	1	3	10	12	14	10	12	14	10	12	14	10	12	14	10	12
1292172	6	7	12	10	10	12	11	5	10	6	6	6	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292421	8	8	6	13	0	10	7	8	18	0	12	0	12	14	10	12	14	10	12	14	10	12	14	10	12	14	10
1292188	11	8	12	14	7	13	8	5	15	13	11	0	11	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292877	12	5	7	15	6	8	0	9	14	12	12	12	10	12	14	10	12	14	10	12	14	10	12	14	10	12	14
1292282	14	10	9	6	9	6	13	7	18	0	12	0	12	14	10	12	14	10	12	14	10	12	14	10	12	14	10

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

FIFTH HIGH SCHOOL

(CONTINUED)

HSPQ FACTOR

STUDENT NUMBER	A	B	C	D	E	F	G	H	I	J	Q G2	Q3	Q4
1600420	17	8	13	14	10	16	5	14	7	8	4	9	7
1600454	14	9	9	10	5	14	10	12	6	8	2	10	7
1600640	8	9	6	9	5	10	8	2	18	0	14	6	16
1600646	17	4	4	5	5	7	0	15	6	12	4	8	16
1600580	13	3	10	9	13	7	15	1	3	7	9	11	3
1600616	14	10	12	4	6	9	15	13	17	12	0	6	8
1601622	19	0	13	1	12	13	9	7	6	8	4	6	5
1600624	5	8	5	13	10	11	5	7	9	14	13	18	9
1600668	8	6	6	16	10	14	6	14	2	10	6	0	7
1600552	10	7	4	0	10	7	10	6	10	3	11	10	0
1600556	10	0	2	16	5	10	12	6	12	12	15	12	15
1600628	9	0	11	15	10	14	6	5	9	14	12	8	12
1600625	13	8	12	17	8	8	17	7	18	5	11	4	12
1600632	14	9	11	4	0	10	18	7	18	8	1	6	14
1600724	17	10	7	3	6	7	18	12	15	3	5	7	17
1600505	0	7	16	11	13	14	13	13	10	11	0	10	14
1600505	12	9	14	5	10	10	14	6	15	3	8	8	13
1600550	14	0	11	5	10	11	11	13	2	10	8	5	10
1600684	10	8	11	6	7	7	16	14	2	9	11	18	11
1600688	11	7	14	4	10	11	14	7	17	0	12	10	12
1600416	14	8	14	6	5	12	12	19	14	8	6	12	11

APPENDIX I

PERSONALITY SCORES OF EACH STUDENT

RIDGEMONT HIGH SCHOOL

HSPQ FACTOR

STUDENT NUMBER	A	B	C	D	E	F	G	H	I	J	0	02	03	04
1790296	17	10	10	7	6	14	6	13	16	5	8	5	4	6
1790397	7	10	11	11	10	13	12	10	3	6	3	9	11	9
1790304	12	9	10	8	12	7	13	9	6	4	11	12	11	6
1790016	15	7	7	11	7	13	10	15	15	8	3	5	10	9
1790305	10	10	13	8	5	3	16	10	18	5	6	9	16	10
1790314	9	10	7	17	7	12	16	7	13	6	11	12	12	12
1790320	5	10	15	11	7	6	17	9	16	11	5	16	14	8
1790423	13	9	3	14	10	10	13	5	1	14	14	7	9	20
1790321	12	9	7	10	11	11	5	4	13	13	12	10	10	7
1790512	7	9	8	12	14	8	7	8	2	7	10	6	10	14
1790327	9	7	17	4	14	11	10	13	2	10	3	9	11	2
1790518	10	9	10	15	14	16	12	10	7	5	10	5	8	13
1790148	15	7	7	15	5	7	18	12	19	7	11	10	10	12
1790533	5	9	10	4	10	8	11	2	13	11	5	13	11	8
1790059	15	9	7	12	1	17	10	10	19	6	12	2	5	7
1790271	14	10	8	6	13	13	8	15	15	1	4	3	10	9
1790080	12	10	14	8	7	7	14	8	1	4	4	11	13	12
1790342	12	8	13	5	14	14	11	14	10	8	3	8	12	7
1790077	10	10	10	5	9	8	7	15	13	4	6	10	12	7
1790090	12	8	10	4	10	6	11	10	6	6	8	10	10	7
1790310	8	7	14	7	11	11	11	10	4	14	6	12	15	13
1790099	5	8	13	4	11	8	12	6	10	13	3	18	18	8
1790100	8	8	8	6	5	10	15	5	12	7	4	11	14	6
1790311	10	8	12	9	11	7	15	13	11	18	4	17	18	2
1790410	13	10	11	6	10	16	7	9	14	4	11	4	4	5
1790114	13	10	9	5	11	12	13	13	18	6	9	9	13	4
1790658	15	9	14	9	13	18	13	14	15	8	0	7	13	2
1790591	14	7	10	10	8	10	14	13	12	9	8	6	3	10
1781335	10	9	11	7	10	10	7	16	1	6	2	2	8	10
1790600	9	7	7	8	8	11	12	11	19	10	7	5	12	12
1790606	11	6	14	5	6	11	12	16	15	10	6	3	7	4
1790216	11	10	10	10	12	11	16	19	7	8	6	9	14	9
1700317	11	5	13	7	14	11	13	11	5	7	2	8	12	7
1790456	11	6	14	3	11	12	11	10	5	4	5	9	12	10
1750399	6	8	4	12	3	9	16	0	14	6	16	8	10	17
1790007	14	9	10	8	9	16	7	12	7	11	3	8	10	7

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

TRINGEMONT HIGH SCHOOL (CONTINUED)

HSPQ FACTOR

STUDENT NUMBER A R C O E F G H I J U O QZ OR Q4

170145	5	10	7	11	9	4	12	3	18	16	13	15	12	17
170432	13	0	11	7	6	6	17	11	14	8	3	10	20	5
170524	10	3	0	11	16	10	12	10	4	10	7	13	11	7
170527	12	8	10	6	14	7	15	17	6	7	7	18	1	1
170965	15	8	10	6	8	10	12	8	18	10	12	6	16	10
170969	11	7	0	10	11	10	0	7	17	9	15	10	7	6
170936	11	5	12	9	6	8	14	9	7	9	5	8	12	8
170944	9	7	5	12	2	2	17	2	16	9	12	10	10	12
170947	13	10	6	11	7	8	11	8	13	10	12	7	10	12
170948	8	9	8	2	6	6	15	7	16	8	12	10	15	11
170949	7	5	5	14	11	9	12	9	14	13	14	15	11	12
170975	15	0	6	10	5	15	4	5	7	11	10	8	3	11
170976	12	6	14	16	6	9	14	14	16	8	6	4	16	8
170977	17	7	10	4	5	6	14	11	10	8	10	4	12	6
170978	10	4	13	7	13	6	11	17	13	14	7	15	7	15
170979	16	8	5	9	0	11	11	10	11	8	12	4	8	14
170980	12	7	6	10	8	10	7	3	14	7	9	7	7	14
170981	13	8	13	9	11	12	11	20	8	5	7	7	0	2
170982	13	0	12	2	15	13	15	14	12	10	8	4	10	8
170983	17	0	12	11	7	6	12	2	7	5	6	7	9	11
170984	14	10	2	15	10	15	12	15	5	8	12	14	6	7
170985	17	0	12	2	15	13	15	14	12	10	8	4	10	8
170986	12	7	9	8	0	9	10	6	12	9	15	12	6	14
170987	17	0	12	11	7	6	12	2	7	5	6	7	9	11
170988	13	7	8	14	0	10	17	11	14	16	8	4	16	8
170989	15	10	15	2	15	12	11	15	17	13	10	4	16	8
170990	14	10	2	15	10	15	12	11	15	15	12	14	6	7
170991	13	10	15	2	15	12	11	15	17	13	10	4	16	8
170992	17	0	12	11	7	6	12	2	7	5	6	7	9	11
170993	12	7	9	8	0	9	10	6	12	9	15	12	6	7
170994	15	10	15	2	15	12	11	15	17	13	10	4	16	8
170995	14	10	2	15	10	15	12	11	15	15	12	14	6	7
170996	13	10	15	2	15	12	11	15	17	13	10	4	16	8
170997	17	0	12	11	7	6	12	2	7	5	6	7	9	11
170998	12	7	9	8	0	9	10	6	12	9	15	12	6	7
170999	15	10	15	2	15	12	11	15	17	13	10	4	16	8

APPENDIX 1

PERSONALITY SCORES OF EACH STUDENT

PRINCIPAL HIGH SCHOOL (CONTINUED)

HSPQ FACTOR

STUDENT

STUDENT	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1700032	11	0	12	11	11	12	7	11	2	7	8	4	7	11	0	12	11	11	12	11	12	11	11	11	11	11
1700124	13	0	16	8	6	10	12	11	12	6	6	7	13	6	9	16	6	7	13	6	9	16	6	7	13	6
1700134	16	10	12	7	2	13	7	5	20	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
1700138	13	0	6	7	7	16	10	5	7	4	7	11	8	10	7	16	10	5	7	4	7	11	8	10	7	11
1700200	11	10	5	14	5	14	7	10	7	7	8	4	10	5	14	5	14	7	10	7	7	8	4	10	5	14
1700250	7	0	8	13	10	14	6	3	12	3	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
1700276	14	9	14	14	14	14	7	18	0	0	6	7	12	7	18	0	0	6	7	12	7	18	0	0	6	7
1700324	18	9	14	14	14	14	7	18	0	0	6	7	12	7	18	0	0	6	7	12	7	18	0	0	6	7
1700374	13	10	11	11	11	11	12	2	8	8	7	10	10	7	10	10	7	10	10	7	10	10	7	10	10	7
1700377	0	6	0	5	0	5	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10
1700390	10	7	14	11	17	18	12	14	8	8	8	12	17	18	12	14	8	8	12	17	18	12	14	8	8	12
1700410	11	10	9	8	17	16	10	18	10	7	4	5	0	6	9	18	10	7	4	5	0	6	9	18	10	7
1700425	14	10	14	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
1700468	15	0	12	8	8	17	11	17	5	4	6	7	9	4	6	7	9	4	6	7	9	4	6	7	9	4
1700474	14	8	11	6	3	12	16	12	17	7	7	13	19	7	7	13	19	7	7	13	19	7	7	13	19	7
1700490	2	0	15	0	7	12	6	19	16	13	19	7	8	16	13	19	7	8	16	13	19	7	8	16	13	19
1700572	16	0	15	9	15	11	13	15	2	0	3	13	15	2	0	3	13	15	2	0	3	13	15	2	0	3
1700322	0	6	7	0	5	8	5	11	0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
1700372	16	4	16	12	13	13	13	13	11	10	2	14	15	11	10	2	14	15	11	10	2	14	15	11	10	2
1700470	15	0	12	17	8	14	8	12	0	0	6	7	9	4	6	7	9	4	6	7	9	4	6	7	9	4
1700527	0	6	0	5	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700675	16	8	14	2	6	10	11	15	14	7	8	9	10	7	8	9	10	7	8	9	10	7	8	9	10	7
1700684	17	10	5	10	8	7	11	9	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700607	19	7	5	11	8	14	7	15	15	0	1	1	5	5	0	1	1	5	5	0	1	1	5	5	0	1
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700561	0	0	7	14	8	11	9	4	5	9	11	11	11	9	4	5	9	11	11	9	4	5	9	11	11	9
1700228	14	10	19	5	11	7	12	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11
1700477	14	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0
1700585	14	8	14	5	12	11	15	12	2	2	5	5	11	5	5	11	5	5	11	5	5	11	5	5	11	5
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700500	12	10	11	10	10	10	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9
1700527	0	6	0	5	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700675	16	8	14	2	6	10	11	15	14	7	8	9	10	7	8	9	10	7	8	9	10	7	8	9	10	7
1700684	17	10	5	10	8	7	11	9	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700607	19	7	5	11	8	14	7	15	15	0	1	1	5	5	0	1	1	5	5	0	1	1	5	5	0	1
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700561	0	0	7	14	8	11	9	4	5	9	11	11	11	9	4	5	9	11	11	9	4	5	9	11	11	9
1700228	14	10	19	5	11	7	12	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11
1700477	14	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0
1700585	14	8	14	5	12	11	15	12	2	2	5	5	11	5	5	11	5	5	11	5	5	11	5	5	11	5
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700500	12	10	11	10	10	10	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9
1700527	0	6	0	5	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700675	16	8	14	2	6	10	11	15	14	7	8	9	10	7	8	9	10	7	8	9	10	7	8	9	10	7
1700684	17	10	5	10	8	7	11	9	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700607	19	7	5	11	8	14	7	15	15	0	1	1	5	5	0	1	1	5	5	0	1	1	5	5	0	1
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700561	0	0	7	14	8	11	9	4	5	9	11	11	11	9	4	5	9	11	11	9	4	5	9	11	11	9
1700228	14	10	19	5	11	7	12	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11	14	4	15	11
1700477	14	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0	15	0	7	0
1700585	14	8	14	5	12	11	15	12	2	2	5	5	11	5	5	11	5	5	11	5	5	11	5	5	11	5
1700651	11	7	0	4	7	4	18	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4	15	4
1700500	12	10	11	10	10	10	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9
1700527	0	6	0	5	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0	10	12	0
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700675	16	8	14	2	6	10	11	15	14	7	8	9	10	7	8	9	10	7	8	9	10	7	8	9	10	7
1700684	17	10	5	10	8	7	11	9	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1	13	1
1700555	5	10	8	3	13	2	17	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8	14	8
1700607	19	7	5	11	8	14	7	15	15	0	1</															

APPENDIX 2

Performance Data

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT
 BROOKFIELD HIGH SCHOOL

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	EA	CH	EA	CH	EA
290600	53	73	53	68	41	32		62
290266	52	52	65	67	47	45		62
290477	70	75	57	57	63	57		86
290422	61	65	66	43	53	38		72
290715	75	71	55	57	57	57		73
290700	39	52	55	56	47	38		19
290201	37	61	50	50	25	55		57
290814	50	64	51	53	59	57		54
290009	62	81	74	70	78	60		82
290969	64	59	65	65	82	57		60
290749	71	78	85	82	63	51		71
290388	59	64	83	76	57	43		67
290752	70	68	62	69	71	45		64
290607	76	80	74	83	51	51		75
290558	67	64	53	55	57	57		61
290274	74	72	53	50	55	43		78
290552	59	68	57	55	59	47		73
290465	70	85	65	74	61	72		80
290826	58	59	88	88	63	55		72
290528	50	37	63	70	43	53		57
290500	70	69	65	65	47	51		75
290071	78	82	78	94	84	70		85
280108	58	63	50	56	49	36		66
290300	52	43	44	44	20	26		16
290822	75	71	58	53	43	43		71
290665	59	80	73	65	59	47		62
290435	53	73	69	73	74	47		73
290368	66	67	78	85	78	40		50
290425	76	79	74	85	94	81		91
290282	56	61	43	43	51	38		62
290481	58	66	78	79	45	45		65
290407	66	80	73	85	82	66		79
290475	52	63	61	61	45	47		71
290675	65	60	72	75	33	45		63
290842	57	60	60	60	53	55		60
290609	60	80	84	84	86	83		86

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT
 BRACKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	EA	CH	EA	CH	EA
290601	64	62	51	48	59	47		67
290611	67	57	38	51	37	31		47
290607	64	74	55	80	55	40		66
290278	66	74	63	64	65	53		67
290307	56	60	50	50	33	45		66
290806	52	63	47	47	34	34		64
290895	56	62	59	51	49	49		69
290367	56	58	58	71	43	36		57
290433	55	52	60	62	74	75		62
290889	54	50	35	36	49	21		60
290414	59	58	56	58	74	62		68
290359	76	78	74	81	76	70		71
290357	71	72	65	65	45	47		63
290879	65	74	39	52	65	60		73
290356	48	58	55	50	65	64		47
290402	29	34	66	66	53	47		34
290467	56	60	51	40	35	20		50
290286	51	51	47	50	43	23		54
290411	58	77	68	70	67	66		80
290643	58	68	54	46	35	32		60
290941	69	75	68	78	69	72		70
290404	81	70	66	71	51	51		84
290492	60	66	54	54	31	34		55
290532	53	56	50	29	43	51		48
290261	56	56	30	40	38	38		64
290804	56	61	72	84	76	72		57
290441	64	66	71	66	65	51		70
290201	52	48	31	31	20	21		47
290752	79	74	64	70	65	70		77
290991	59	57	68	68	78	70		63
290834	51	62	57	56	43	43		68
290284	63	62	13	13	35	23		52
290982	75	76	80	89	86	75		77
290262	44	60	47	45	43	34		58
290419	71	73	57	57	45	45		75
290717	76	72	68	69	63	47		80

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
290792	60	52	52	69	27	47		59
290431	65	78	74	90	78	66		70
290576	68	83	96	96	78	66		79
290373	64	64	62	62	65	45		60
290731	58	65	77	65	51	34		74
290445	50	59	60	50	63	55		61
290449	69	77	72	72	71	55		82
290593	70	63	64	73	69	69		66
290311	64	56	67	67	74	55		74
290828	71	67	66	66	69	75		74
290977	71	71	69	67	71	66		83
290757	71	72	61	61	67	77		55
290605	76	75	54	65	57	45		67
290981	64	68	81	81	78	60		74
290925	54	62	55	55	43	23		63
290264	55	67	70	70	59	62		60
290566	66	69	64	64	57	32		71
290417	43	55	56	56	25	26		62
290877	56	66	55	53	61	38		60
200409	59	61	70	90	41	49		62
290719	62	74	76	78	71	51		80
290568	55	81	78	81	80	81		88
290723	69	65	69	70	57	57		61
290953	59	45	53	53	45	51		50
290729	51	68	60	56	39	30		55
290583	46	54	54	61	41	45		63
200465	60	43	42	42	49	43		60
290516	50	56	43	32	39	28		50
290832	69	72	38	52	63	64		75
290603	69	69	74	75	63	40		63
290527	62	41	51	51	67	49		50
290413	69	72	70	66	78	77		81
290703	50	64	59	59	55	40		47
290469	66	70	68	63	29	34		67
290786	58	71	45	48	71	72		77
200399	66	70	68	63	35	19		67

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
290280	63	70	62	65	51	57	68	
290371	57	50	27	27	47	32	50	
200442	53	61	39	32	41	55	75	
290949	54	73	41	41	43	30	61	
290299	62	66	43	48	61	45	69	
290735	56	54	39	39	41	49	63	
290746	54	71	50	50	43	38	61	
290667	47	51	51	53	49	38	56	
290748	64	55	54	52	35	43	55	
200360	66	70	72	71	51	45	60	
290830	50	48	60	54	69	60	60	
290518	72	71	82	89	67	66	83	
290402	66	63	50	50	41	41	50	
290685	54	62	57	56	65	47	61	
200359	76	74	91	89	82	94	85	
290784	76	72	74	89	49	49	69	
290871	35	52	31	30	53	34	62	
290353	58	50	63	65	67	53	54	
290421	70	80	46	36	71	36	70	
290570	73	83	52	56	57	45	71	
200420	50	63	45	67	65	70	66	
290288	74	75	86	86	84	81	80	
290947	64	60	57	57	53	57	64	
290437	59	65	65	63	57	51	65	
200548	67	56	68	66	37	30	61	
290903	62	66	61	61	63	64	86	
290818	69	69	50	56	63	60	76	
290955	53	77	68	76	80	66	69	
290961	74	79	40	40	35	40	79	
290390	68	67	63	67	49	40	61	
290520	70	70	48	52	65	55	65	
290453	66	72	60	60	49	45	67	
290552	68	71	66	66	65	36	74	
290272	59	73	70	70	65	34	62	
290705	64	62	57	51	35	28	66	
290355	66	57	66	68	59	66	60	

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 BROOKFIELD HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
290711	69	78	67	71	82	72	75	
290883	62	55	53	54	51	26	72	
290800	47	54	50	50	76	55	51	
290580	63	74	49	48	84	72	25	
290585	76	63	80	80	90	77	78	
290587	70	81	75	75	96	79	76	
290907	59	67	59	55	37	26	53	
290945	71	71	65	67	78	83	69	
290591	67	48	58	58	57	40	51	
290503	62	58	52	42	71	55	75	
290677	57	64	61	60	67	62	76	
290509	47	55	62	62	49	34	70	
290970	71	65	50	50	43	34	81	
290846	66	69	62	62	45	43	60	
290268	72	80	65	68	52	53	67	
290270	68	74	70	73	82	70	79	
290276	51	74	82	82	61	38	65	
290483	68	80	61	63	55	55	73	
290788	58	74	60	64	63	49	67	
290708	51	61	77	84	65	51	76	
290574	58	74	60	64	61	36	67	
290651	63	68	52	57	55	70	79	
290655	51	53	55	53	35	30	51	
290737	37	56	57	72	71	40	70	
290280	64	84	62	63	65	60	60	
290403	67	64	69	66	45	36	79	
290213	54	55	50	54	49	36	65	
290210	48	45	37	38	35	34	61	
290221	70	32	73	75	78	49	84	
290523	50	54	53	50	51	26	55	

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT
HILLCREST HIGH SCHOOL

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	EA	CH	EA	CH	FA
1090364	50	76	68	76	56	60	50	74
1090457	51	65	63	70	74	72	61	75
1090383	57	70	44	54	58	58	65	68
1090385	66	60	52	54	68	76	63	78
1090386	60	56	41	39	62	53	54	58
1090387	64	68	44	52	66	70	61	74
1090388	65	64	47	29	72	67	72	68
1080645	57	57	43	42	62	56	51	55
1090366	60	68	42	50	56	50	66	62
1090466	50	67	40	35	66	45	43	55
1090543	75	89	71	81	82	87	88	84
1090302	44	67	21	39	28	45	55	62
1090368	56	69	40	51	50	18	58	68
1090369	64	72	61	68	76	62	60	69
1090393	58	51	42	54	60	50	67	68
1090372	71	61	66	67	58	59	55	70
1090373	53	70	67	58	62	64	53	75
1090399	45	58	34	35	54	50	51	52
1090374	75	79	86	87	88	75	89	83
1090429	59	63	27	39	58	52	66	71
1090400	52	52	52	51	61	62	43	50
1090375	58	65	70	67	66	80	63	75
1090377	62	74	88	85	66	80	61	71
1090129	56	66	54	68	72	79	54	70
1090370	60	72	60	66	88	89	59	75
1081680	60	64	32	20	32	30	46	64
1090404	62	62	69	73	76	66	66	70
1090405	56	66	77	79	60	50	42	43
1090406	56	70	72	73	67	75	65	71
1090408	57	63	75	66	30	60	50	59
1090389	61	69	56	60	20	32	64	78
1090412	67	76	54	60	63	68	76	82
1090413	52	62	66	57	79	95	63	73
1090416	56	61	44	41	62	53	53	54
1090418	62	71	68	61	70	62	57	76
1090419	57	60	45	44	30	39	46	51

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT
 HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1090420	47	52	75	77	56	70	30	68
1090421	60	75	75	68	74	73	75	75
1090422	50	59	48	25	42	53	45	51
1090423	69	67	83	71	86	86	84	85
1090424	70	66	72	58	50	50	67	67
1090425	67	74	71	71	86	83	75	82
1090426	61	67	81	82	82	80	78	71
1090427	52	50	68	73	44	40	53	38
1090428	57	55	60	65	58	64	66	59
1090429	33	50	55	62	55	44	30	51
1090430	54	71	48	56	56	70	69	69
1090431	56	45	85	81	58	40	53	58
1090432	77	83	88	83	90	94	80	84
1090433	76	72	73	75	72	88	71	71
1090434	64	69	81	77	90	88	65	80
1090435	62	72	83	83	92	84	73	71
1090436	56	68	68	64	70	71	47	54
1090437	60	70	69	76	84	80	88	91
1090438	73	75	60	57	64	60	73	74
1090439	52	63	68	51	52	53	66	60
1090440	50	76	74	79	72	89	71	67
1090441	67	76	53	61	68	74	74	77
1090442	60	77	86	82	67	62	51	54
1090443	58	54	61	59	30	45	43	56
1090444	76	73	72	80	96	94	91	84
1090445	57	71	75	72	60	55	60	79
1090446	34	41	39	36	28	26	34	46
1090447	75	81	90	86	86	80	85	92
1090448	65	71	81	70	92	91	80	81
1090449	54	65	69	63	62	83	35	48
1090450	66	74	62	73	74	72	61	79
1090451	50	67	74	71	76	81	68	76
1090452	52	71	73	71	78	70	46	65
1090453	61	71	50	40	76	68	64	70
1090454	42	62	66	73	58	62	67	53
1090455	58	82	86	93	98	94	75	81

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT

LISGAR COLLEGIATE

(CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1290111	78	59	75	66	85	87	72	78
1290039	79	85	84	76	86	99	89	93
1290668	70	76	70	75	62	86	80	83
1290267	44	45	67	42	56	58	56	70
1290105	55	40	58	55	45	42	47	42
1290433	80	82	72	69	91	92	82	83
1291552	62	62	68	45	45	45	80	82
1290181	58	60	67	56	78	83	67	61
1280265	48	32	43	34	59	31	53	51
1220557	73	67	62	61	59	72	52	58
1290261	78	68	86	81	88	94	82	89
1291504	67	70	82	80	79	83	76	78
1231561	72	75	58	59	37	57	79	80
1290520	74	79	65	71	65	70	70	78
1290853	66	51	59	45	42	60	77	86
1290326	66	56	76	65	59	29	66	74
1290608	63	57	80	65	62	72	68	86
1290613	63	57	80	65	62	72	68	86
1290075	59	58	54	56	53	42	76	79
1290233	57	44	50	47	63	80	50	70
1290172	35	49	72	54	66	56	33	69
1290421	50	64	51	58	56	65	58	77
1290188	77	71	67	63	18	18	62	76
1290877	52	52	77	64	86	84	70	80
1291283	61	60	82	71	78	81	63	76

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1090455	77	66	51	50	74	83	88	91
1090456	50	56	58	55	60	54	45	64
1090476	25	26	42	33	38	32	45	39
1090458	55	62	47	50	50	42	59	56
1090459	43	58	31	43	62	62	62	62
1090921	66	73	64	69	54	61	66	69
1090772	50	70	75	71	42	34	50	64
1090143	66	85	58	51	60	55	65	80
1090462	51	57	60	63	78	58	60	52
1090465	60	50	54	40	70	63	66	58
1090468	58	74	56	59	63	37	55	52
1090469	46	61	44	55	78	82	60	61
1090956	73	78	62	64	62	54	81	73
1090470	42	61	56	45	58	64	57	57
1090471	79	85	90	92	94	98	87	84
1090473	70	97	65	62	80	76	85	75
1090475	61	59	63	53	45	52	70	73
1090505	30	26	43	30	58	42	43	50
1090101	71	69	82	76	80	88	78	82
1090491	44	69	70	76	66	44	70	75
1090492	78	78	90	90	88	88	92	95
1090125	42	60	31	34	30	30	67	67
1090534	70	69	59	52	80	81	74	71
1090493	76	71	82	80	82	87	78	79
1090495	65	72	66	72	90	90	72	82
1090508	55	65	55	53	66	55	54	66
1090510	55	62	34	41	37	39	41	49
1090539	68	73	75	58	72	67	84	89
1090540	50	73	87	84	45	29	68	70
1090997	34	66	75	74	56	71	61	64
1090514	62	41	75	68	62	54	62	75
1090515	59	60	44	50	50	50	31	56
1090541	56	60	61	56	58	51	37	55
1090542	73	61	85	84	56	45	65	66
1090544	62	56	87	71	76	90	60	81
1090499	61	64	46	58	42	34	46	65

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 HILLCREST HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1090519	44	52	51	45	45	36	55	56
1090520	71	76	73	60	66	68	83	69
1090545	61	61	56	62	70	80	62	72
1090501	63	62	61	69	68	66	69	65
1090503	53	68	41	51	36	50	63	64
1090523	81	82	80	76	84	65	73	85
1090504	74	67	72	79	70	35	86	73
1090524	73	74	65	75	80	84	76	73
1090506	77	76	83	85	75	77	69	67
1090527	73	79	97	84	76	76	76	84
1090509	64	70	75	70	78	79	77	80
1090526	70	57	79	85	62	50	63	52
1090511	70	72	69	67	79	81	75	81
1090525	75	60	76	82	82	82	76	72
1090526	73	73	88	84	76	84	68	69
1090527	72	75	61	67	71	84	75	71
1090513	68	70	73	80	61	63	71	67
1090516	69	76	72	79	75	65	74	66
1090528	76	67	55	52	69	75	76	78
1090938	50	41	37	44	44	50	53	37
1090510	85	81	85	89	95	97	91	92
1090520	60	77	59	64	68	75	73	82
1090529	64	79	53	56	70	70	73	71
1090530	77	74	70	77	70	77	79	86
1090521	77	83	65	83	84	78	82	90
1090531	74	72	72	72	78	88	64	71

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT

LISGAR COLLEGIATE

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1290217	67	63	75	62	47	70	71	69
1290631	60	50	62	56	55	46	79	69
1290273	65	65	58	60	75	72	78	77
1290229	51	41	61	53	69	61	50	75
1290345	77	75	51	39	62	64	69	87
1290264	75	15	90	84	58	60	44	77
1290136	57	55	67	75	82	74	51	55
1290760	51	41	61	53	69	61	50	75
1290218	44	20	39	44	57	37	39	54
1290330	71	68	67	63	87	82	64	66
1290202	53	55	74	66	51	55	42	78
1290687	75	83	82	76	65	76	90	91
1290869	56	45	88	86	53	40	47	59
1290483	50	43	39	39	71	70	58	64
1290548	54	54	58	44	54	52	56	65
1290791	66	65	45	46	68	81	76	77
1290150	74	75	64	68	92	95	85	89
1290532	68	62	64	52	78	79	66	87
1290842	70	71	58	58	61	51	70	85
1290508	64	60	51	46	55	54	46	63
1290732	61	46	51	46	60	66	44	63
1290615	69	57	74	60	65	70	62	70
1290427	45	50	62	60	54	57	50	52
1290327	80	76	76	70	94	95	79	78
1290596	79	87	67	54	52	53	77	82
1290756	77	67	64	58	90	88	79	88
1290218	60	67	84	78	92	95	72	81
1290412	71	67	75	70	74	90	79	89
1290071	69	76	79	69	56	71	61	63
1290417	76	60	69	69	62	76	60	59
1290262	57	66	68	67	85	90	50	65
1290861	71	75	74	61	71	82	68	71
1290816	66	66	86	79	88	81	65	70
1290204	65	60	72	65	97	97	71	75
1290470	74	78	94	91	90	92	79	84
1290690	64	60	58	36	70	60	64	60

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT

LISCAR COLLEGIATE (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1290512	65	68	75	66	62	77	67	80
1290100	53	61	61	51	55	58	50	66
1290441	65	67	78	73	85	89	78	86
1290475	40	37	63	56	84	82	58	64
1290565	67	61	75	73	86	94	69	74
1290741	45	45	67	47	87	91	50	61
1290813	63	30	53	46	60	51	57	63
1200576	65	54	74	74	74	80	78	90
1290873	47	39	75	76	95	97	63	50
1290119	61	51	81	78	34	42	57	72
1290460	55	51	61	57	56	55	53	71
1290683	65	54	66	63	57	53	50	67
1290635	50	47	68	65	43	30	22	45
1290580	38	45	70	74	40	38	65	52
1290644	76	82	71	56	61	62	88	73
1290764	71	65	72	62	35	51	67	65
1290536	72	70	67	75	55	51	77	74
1200613	32	32	52	48	22	35	52	55
1290404	36	34	29	10	18	9	45	63
1290047	64	51	68	77	51	40	58	48
1290488	65	63	65	75	59	74	78	80
1290360	50	46	54	28	78	53	85	80
1290572	78	70	84	81	95	96	93	95
1290453	77	76	82	80	93	91	61	85
1290210	65	55	72	65	51	70	73	84
1290205	64	55	47	45	35	47	51	67
1290846	46	51	70	57	56	64	55	69
1290165	74	69	65	60	81	73	54	77
1290429	93	91	92	90	96	99	92	95
1290333	71	65	64	63	43	60	56	58
1290810	74	74	80	74	88	95	77	87
1290131	66	65	89	72	88	91	79	74
1290465	77	76	87	79	86	86	66	85
1290177	92	90	83	68	89	67	72	90
1290786	47	35	74	58	77	62	58	70
1290749	62	65	89	72	90	86	81	85

APPENDIX 2

CHRISTMAS MARKS AND FASTER MARKS OF EACH STUDENT

RIDEAU HIGH SCHOOL

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	EA	CH	FA	CH	EA
1690544	72	61	43	41	65	58		60
1690670	76	77	73	64	64	53		67
1690568	75	76	66	68	90	91		69
1690625	78	75	77	69	75	71		85
1690747	69	76	55	62	75	57		45
1690750	72	67	64	63	45	53		59
1690752	87	81	80	75	72	67		80
1690612	77	72	69	61	89	68		62
1690567	75	76	55	37	78	80		73
1690432	85	80	79	87	97	98		82
1690583	75	75	89	92	62	68		84
1690452	72	66	71	62	60	52		71
1690595	78	68	72	82	61	60		70
1690470	72	63	69	65	70	58		77
1690610	66	63	88	80	61	59		64
1690620	71	69	65	57	58	52		70
1690718	89	77	82	82	92	96		91
1690575	88	88	90	94	99	97		83
1690590	80	79	70	77	73	73		77
1690654	73	74	65	62	62	73		68
1690720	89	95	76	85	97	86		79
1690757	58	51	45	52	38	50		52
1690600	75	70	45	39	74	37		71
1690551	65	58	66	72	44	59		69
1690730	54	15	72	55	34	34		38
1690600	70	78	78	78	74	72		85
1690692	80	75	60	61	67	47		87
1690568	74	76	58	56	81	70		73
1690648	82	93	72	68	38	48		58
1690755	74	78	77	72	65	80		53
1690686	91	94	80	81	92	95		77
1690712	53	56	71	66	72	66		54
1690565	81	77	75	70	78	64		68
1690636	59	74	51	46	57	50		69
1690664	78	80	31	31	69	68		85
1690604	80	71	86	89	87	81		79

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT

RIDEAU HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	FA	CH	FA	CH	FA
1690674	81	57	73	61	69	70		65
1690722	78	61	55	55	70	59		67
1690656	70	70	57	50	29	44		72
1690672	60	50	71	78	74	58		71
1690420	69	77	69	63	48	56		82
1690654	60	63	42	42	67	66		68
1690640	70	79	72	63	58	50		71
1690646	65	72	66	56	64	66		57
1690580	74	75	50	37	65	42		71
1690616	82	71	77	75	76	78		76
1690622	80	54	70	61	71	66		58
1690624	60	53	51	45	52	57		77
1690668	75	60	63	65	53	71		68
1690552	84	75	66	73	75	67		56
1690556	73	70	60	63	66	44		62
1690628	65	66	63	58	46	41		71
1690625	91	76	79	73	77	86		71
1690632	75	72	70	75	42	36		53
1690724	85	88	76	72	81	77		88
1690596	82	85	82	80	75	80		79
1690505	62	59	70	73	57	63		76
1690550	57	51	56	57	56	45		55
1690684	91	79	72	78	91	85		84
1690688	61	71	46	40	41	50		47
1690416	79	72	86	84	54	37		69

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 RIDGEMONT HIGH SCHOOL

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1790296	70	81	57	63	41	57	50	72
1790397	73	71	51	46	57	58	46	46
1790394	66	76	61	62	66	50	69	64
1790416	78	73	68	62	71	70	65	63
1790305	74	84	78	74	54	55	58	67
1790314	75	71	50	41	53	36	57	67
1790321	92	93	57	57	80	78	71	85
1790423	72	72	60	63	59	85	63	57
1790321	79	73	51	50	55	40	54	47
1790512	71	68	44	43	72	62	47	40
1790327	81	82	55	50	69	73	55	75
1790518	84	81	30	34	65	64	66	66
1790148	80	85	84	73	69	49	83	77
1790532	65	70	44	61	87	84	55	70
1790050	77	77	58	62	62	62	61	66
1790271	74	73	73	73	75	73	61	50
1790080	84	80	60	64	65	50	69	73
1790342	77	72	35	39	45	52	60	67
1790077	77	75	65	62	68	53	62	75
1790090	71	62	61	52	51	50	71	62
1790310	82	86	79	83	79	67	81	84
1790000	65	71	65	64	67	69	62	64
1790100	66	74	80	86	79	54	71	56
1790211	76	75	54	58	80	00	79	69
1790410	53	60	60	60	40	28	30	36
1790114	82	90	74	76	72	71	73	70
1790658	81	80	68	69	45	50	80	78
1790501	64	63	56	54	32	22	53	55
1781335	51	62	57	50	79	63	63	47
1790600	5	63	35	46	36	50	40	39
1790606	67	64	50	30	55	57	58	60
1790316	68	75	50	54	70	80	78	75
1790317	54	50	44	54	45	52	71	60
1790456	70	64	50	58	51	50	60	73
1790309	72	72	81	76	72	66	75	60
1790107	76	75	71	70	62	59	73	60

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 RIDGEMONT HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	EA	CH	EA	CH	EA	CH	EA
1790405	69	79	70	67	62	75	76	69
1790302	84	82	58	59	69	66	86	85
1790590	58	67	51	50	52	36	56	57
1790256	74	75	64	70	77	68	79	73
1790145	78	82	81	87	71	97	81	70
1790422	74	72	60	51	45	34	70	65
1790524	42	64	35	35	24	26	50	50
1790527	62	66	60	63	54	80	62	55
1790365	79	91	77	80	86	84	80	77
1790660	75	91	83	81	81	83	88	77
1790236	39	59	26	30	19	23	51	42
1790444	62	72	68	64	48	44	59	50
1790164	55	75	62	66	56	61	60	55
1790162	52	67	65	60	65	46	51	45
1790447	76	84	70	71	72	73	75	82
1790345	79	77	56	52	47	62	77	70
1790412	49	64	26	17	25	25	56	50
1790291	85	79	84	70	68	54	68	60
1790475	74	74	68	74	73	53	64	64
1790481	82	69	68	69	60	41	56	71
1790411	74	76	65	62	78	68	68	60
1790572	68	68	61	72	54	40	61	65
1790576	66	70	59	54	20	26	37	34
178157	69	78	70	60	51	31	61	73
1781180	92	75	80	80	62	51	68	80
1790579	64	71	57	57	44	24	44	45
1790582	62	73	51	60	66	50	58	57
179052	86	92	60	66	70	74	72	79
1790142	72	71	53	64	51	54	45	30
1790425	82	74	79	82	74	66	70	72
1790507	74	83	65	72	85	75	50	44
1790154	74	81	77	65	64	52	57	61
1790329	74	72	51	58	64	28	67	76
1790452	87	87	64	74	95	77	72	69
179057	75	62	57	70	41	38	56	65
1790378	66	67	62	67	66	84	64	64

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT

PURVIS HIGH SCHOOL (CONTINUED)

SUBJECT

STUDENT NUMBER	ENGLISH	MATHS	SCIENCE	HISTORY
1701384	72 70	57 64	70 65	61 71
1701387	85 82	83 74	75 75	79 82
1701392	70 55	64 79	65 65	75 73
1701395	72 55	52 57	22 32	44 61
1701397	91 25	86 88	80 70	82 82
1701398	80 70	69 70	42 27	62 60
1701399	58 67	51 53	63 32	50 47
1701400	74 82	80 84	70 64	68 76
1701401	50 65	80 70	30 22	41 34
1701402	90 82	79 74	80 58	66 65
1701403	75 66	40 54	51 38	63 68
1701404	71 71	72 74	54 50	57 58
1701405	78 73	53 63	47 38	59 68
1701406	90 90	85 91	95 99	87 86
1701407	76 79	75 77	62 66	72 68
1701408	80 80	76 77	88 90	72 67
1701409	52 74	68 63	65 65	61 66
1701410	71 72	71 70	38 52	57 71
1701411	54 54	54 48	31 18	53 45
1701412	83 78	77 76	87 88	71 64
1701413	63 82	68 69	57 40	46 26
1701414	57 57	42 50	20 19	47 41
1701415	75 65	68 60	75 62	56 41
1701416	72 76	52 59	80 85	63 65
1701417	74 65	62 73	68 66	54 58
1701418	61 59	35 43	52 38	59 70
1701419	60 54	77 78	72 66	59 61
1701420	61 59	56 52	61 41	54 36
1701421	45 44	44 62	73 76	74 66
1701422	60 80	83 81	69 73	72 50
1701423	68 64	86 96	39 52	71 57
1701424	70 71	51 66	65 64	78 73
1701425	63 64	29 50	67 78	64 50

APPENDIX 2

CHRISTMAS MARKS AND EASTER MARKS OF EACH STUDENT
 RIDGEMONT HIGH SCHOOL (CONTINUED)

STUDENT NUMBER	SUBJECT							
	ENGLISH		MATHS		SCIENCE		HISTORY	
	CH	FA	CH	FA	CH	FA	CH	FA
1790028	88	82	82	92	87	71	77	78
1790657	62	65	56	60	68	53	62	61
1790047	72	86	68	80	85	90	68	74
1791585	56	55	41	61	57	70	54	50
1790061	72	80	74	68	59	61	72	80
1790062	70	88	63	72	61	52	71	82
1790509	51	57	52	57	50	42	63	62
1790681	75	80	72	76	83	74	78	80

APPENDIX 3

Abstract of Personality and High School Performance

APPENDIX 3

ABSTRACT OF

Personality and High School Performance

Two questions were examined by the study. The first was whether Cattell's personality traits C, G, O, Q2 and Q3 would discriminate between senior high school students who have generally high scholastic performance and those who generally perform poorly. The second question was whether the personality factors A, F, H and I would discriminate between those senior high school students who are inclined towards the humanities and those who are inclined towards the sciences.

The research population consisted of five hundred and eighty-two grade ten students who were enrolled in university-preparatory courses in five high schools in Ottawa. Personality was measured by the High School Personality Questionnaire and scholastic performance measures were based on school marks.

A student was said to do well in a subject if he was among the top thirty per cent in the subject in his school; students who were in the bottom thirty per cent were said to do poorly. Students who did well in English, History, Mathematics and Science were called high general performers; students who did poorly in all these subjects were called

low general performers. A multivariate discriminant analysis showed that factors C, G, O, Q2 and Q3 did discriminate significantly between these general performance groups. A series of univariate analyses indicated that the factors C, G, Q2 and Q3 were significant discriminators between the general performance groups when used separately as discriminant variables. The positive pole of each personality factor was associated with high general performance.

Those students who did well in English and in History (but not in Mathematics or Science), together with those who did poorly in Mathematics and Science (but not in English or History) were called the humanities-oriented group. Students who did well in Mathematics and Science (but not in English or History), and those who did poorly in English and History (but not in Mathematics or Science) were called the sciences-oriented group. The two groups formed the criterion variable for a series of discriminant analyses in which factors A, F, H and I were the discriminant variables. The results of a multivariate analysis indicated that this set of traits was a significant discriminator between humanities-oriented students and sciences-oriented students. Univariate analyses showed the traits A, H and I to be significant discriminators between these groups when used singly as discriminant variables.

Taken together, the results of the planned analyses and those of a number of post hoc analyses indicated that factors C, F, G, I, Q2 and Q3 were discriminators between students who had high and low levels of general scholastic performance. Factors A, E, H, I and Q2, on the other hand, were found to be discriminators between students who were oriented towards the humanities and those who were oriented towards the sciences.