

RELATIONS BETWEEN AND WITHIN
THE 16PF, MAT, GPF, AND GPI.

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CURRICULUM STUDIORUM

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INTRODUCTION

During the past few decades one of the most salient developments in North American personality assessment has been the proliferation of a bewildering array of measures, particularly in the form of multiscale inventories. It has, in fact, been estimated that as of 1970 there were about 500 non-projective and 100 projective tests which have been copyrighted. When one considers that tests without copyright are probably at least as plentiful, and that the average number of measures derivable from each test is about six, a seance to bring back William of Occam and Lloyd Morgan has certain attractive qualities.

Psychological historians will quite likely be able to trace a variety of causes contributing to this present phenomenon. It may be seen as a testimony to the abundant energy and creativity of psychologists, or as evidence of widespread autistic tendencies among test developers. Explanations might also be given in terms of the economic system being organized in such a way as to encourage the profit motive in individual scale construction. Perhaps the pioneering, do-it-yourself, ethic of the culture could be invoked as a possible influencing factor. Whatever the determinants of the present situation, it is clear that from both an applied and a theoretical perspective, the psychologist is faced with a formidable task.

Confronted with such an enormous variety of products together with a typically rather limited time span for assessment, the practitioner must somehow arrive at a decision about what measures, if any, would be most appropriate for a particular client. Similarly, the psychologist concerned with the administration of tests to groups, with the aim of trying to predict relations with various criteria, is faced with a difficult task of test selection. Hence, it would seem that some type of atlas describing the inter-relations between this diversity of measures might be useful.

If a very general assessment is required, the selection of measures will be aimed at covering as many different facets of personality as possible. On the other hand, if it can be immediately ascertained that assessment should focus upon a specific area, then as many similar measures as possible will be desired. In both instances, knowledge of the inter-relations between available personality measures would be of assistance as a guide in selecting measures.

If the relations between tests are well mapped out, then our apparent embarras de richesses might be transformed from a confusing jungle to a powerful pool of resource material. If it is found that there are many large overlaps between measures, test selection can be more firmly guided

by such practical criteria as: the ease of administration, the extent of available local norms, etc., thus allowing much more flexible usage than would otherwise be possible. If on the other hand, it should be discovered that a large number of relatively independent measures seem to be necessary for an adequate, comprehensive description of human personality, then the challenge to the psychologist is more likely to take the form of finding the right measures for each criterion of interest.

It is well known that there is a strong tradition within psychology to always assume the "null hypothesis" until evidence to the contrary is uncovered. While some have voiced objections to this type of inference, it is still a very widely accepted approach. Hence, in the absence of knowledge about relations between the large number of personality measures in existence, the tendency is to look upon them as being unrelated. Thus, the person is conceptualized as a collection of a great number of unrelated elements. It is, therefore, hardly surprising that in recent years, a considerable number of personality theorists have rejected tests altogether. Consequently, information about relations between personality measures is important from a theoretical as well as applied perspective. It is the aim of the present study to contribute to knowledge about this issue.

The thesis is divided into three chapters. The first chapter consists of a review of literature bearing upon the issues of concern. The second chapter contains a description of the method and results of the two investigations undertaken. The third chapter is devoted to an interpretation of the findings of the two studies with attention being given to a comparison of the results of each study. Because of the large number of tables, it was decided to place them all in Appendix 3 where they may be consulted as required. Decimal pcints have been omitted for all correlation coefficients and factor loadings in the tables.

CHAPTER I

REVIEW OF THE LITERATURE

In an exhaustive survey of the literature, Allport¹ extracted almost fifty different definitions of the word "personality." Hence, it is understandable that over the years a tremendous variety of measures have been developed which fall in the general category of personality tests.^{2,3,4} One particular measurement technique, the self-report inventory, has received an amount of attention equalled only by the class of tests known as projective instruments. Two of the main differences between these types of approaches have been the nature of the stimuli presented and the type of response requested. The self-report inventory has generally consisted of a number of linguistic stimuli of a visual nature to which a finite

1 Allport, G. W. Personality: A psychological interpretation. New York: Holt, 1937.

2 Buros, O. K. Personality tests and reviews. Highland Park, N. J.: Gryphon, 1970.

3 Damarin, F. A. A special review of Buros' Personality tests and reviews. Educational and Psychological Measurement, 1971, 31, 215-241.

4 Hundleby, J. D., Pawlik, K., & Cattell, R. B. Personality factors in objective test devices. San Diego: Knapp, 1965.

number of linguistic response alternatives are made possible. With some exceptions, the more popular projective tests have tended to consist of non-linguistic, visual stimuli to which a linguistic response of infinite variety is possible. The present investigation is mainly addressed to the self-report inventory method of approach.

1. History of the self-report inventory

The self-report inventory is generally regarded as having originated in the work of Sir Francis Galton on mental imagery during the last decade of the 19th Century. However, it was not until 1918 with the publication of R.S. Woodworth's Personal Data Sheet that the questionnaire in the form that it is currently used today began to attract a significant amount of attention. Woodworth developed his scale in order to measure the "emotional stability" of army recruits during World War I. The next influential test of this kind was conceived and used in 1921 by G.W. Allport with the intention of measuring the dimension of ascendance-submission. Shortly thereafter, Freyd⁵ published a test of 54 types of behaviours purportedly related to Jung's construct of introversion - extraversion which was later

5 Freyd, M. Introverts and extroverts. Psychological Review, 1924, 31, 74-87.

used by Heidbreder to form a questionnaire. These three tests, coming from the work of Woodworth, Allport, and Heidbreder have served as prototypes for the development of most future tests of this kind.

The next major milestone in the history of self-report measures was the development of multi-scale inventories.⁶ A significant feature of these tests, aimed at measuring more than one dimension of personality, was that they borrowed heavily from the items of the previously published single scale tests. Such a pattern has continued until the present day.

All of the scales mentioned so far were developed using what has become known as the intuitive method of scale construction, that is, items were mainly selected on the basis of how they seemed to fit with previously defined theoretical constructs. However, during the 1930's two other major strategies of item selection were developed, both of which placed a greater emphasis upon purely empirical findings. Influenced by the growing popularity of behaviouristic approaches to psychology and the consequent demise of scientific respectability surrounding introspection, a number of tests were developed by choosing

6 Bernreuter, R. G. The theory and construction of the personality inventory. Journal of Social Psychology, 1933, 4, 387-405.

items only on the basis of their relations with external criteria. The Strong Vocational Interest Blank and the Minnesota Multiphasic Personality Inventory are the best known tests arising from the external method of development. The other main method of scale construction developed at this time has been described as the internal approach. With the finding by Flanagan⁷ that two of the four scales of the Bernreuter test correlated as much as $+ .94$, more attention was given to the internal relations between items. For this reason factor analysis and other similar methods began to be applied, with the temperament tests of Guilford being one of the first products of this form of development.

These three methods of construction, the intuitive, external, and internal, have generally all been used in constructing most present day multi-scale inventories with only a difference in the amount of emphasis placed upon each. The main changes have taken the form of a greater number of scales per inventory and more sophisticated techniques applied to the analysis of intra- and inter-inventory relations. The present investigation is concerned with the study of inter- and intra- inventory relations.

7 Flanagan, J. C. Factor analysis in the study of personality. Stanford, Calif.: Stanford University Press, 1935.

2. Rationale for the present type of approach

Some years ago, R. B. Cattell^{8,9} warned of the possibility of the occurrence of the type of psychometric inflation, alluded to in the introduction, stating that there is virtually no limit to either the number of traits that personality theorists could invent or to the number of criteria psychologists might be asked to predict. As a solution to this dilemma, Cattell proposed a systematic search for the most important individual differences within mankind, as a necessary first step toward the ultimate goal of understanding the structure of relations within a single person. As Baughman¹⁰ points out, Cattell has repeatedly stressed "... that the whole of personality enters into any specific act."¹¹ Thus, he has always been opposed to approaches which contain little thought about eventually facing up to the problem of synthesis.

8 Cattell, R. B. Personality: A systematic theoretical and factual study. New York: McGraw-Hill, 1950.

9 Cattell, R. B. Personality and motivation structure and measurement, Yonkers-on-Hudson, N.Y.: World Book Co., 1957.

10 Baughman, E. F. Personality the psychological study of the individual. Englewood Cliffs, N. J.: Prentice-Hall, 1972.

11 Cattell, R. B. The scientific analysis of personality. Chicago: Aldine, 1965.

One of the main tools which Cattell advocates for "putting Humpty Dumpty back together again" is mathematics. However, he is careful to indicate that this is by no means an endorsement of the pure statistical means of assessment which Meehl¹² originally depicted as being "versus" the clinical method, and which has since been subjected to a more sophisticated analysis.¹³ Instead, Cattell adopts the position that a combined use of clinical and statistical procedures guided by knowledge of general psychological laws should prevail, for example:

One can bring to bear upon prediction all the knowledge which accumulates around these structures. This relating of measurement to "natural history" is what we mean in our heading by "implementation through the textbook." Indeed, unless this development is made, by psychology and psychiatry as pure and applied sciences, the uses of quantitative measures will be purely actuarial. It will remain nothing more than much psychometric scale construction has always been: a species of "psychological accountancy!"¹⁴

12 Meehl, P. E. Clinical versus statistical prediction: A theoretical analysis and review of the evidence. Minneapolis: University of Minnesota Press, 1954.

13 Sawyer, J. Measurement and prediction, clinical and statistical. Psychological Bulletin, 1966, 66, 178-200.

14 Cattell, F. B. The integration of functional and psychometric requirements in a quantitative and computerized diagnostic system. In A. R. Maher (Ed.), New approaches to personality classification. New York: Columbia University Press, 1970, p.46.

Another means of focusing upon relations between the many different facets of the entire organism is a method developed by Cattell¹⁵ that he called P (for person) technique which makes possible a factor analysis of a large number of measures of one person's behaviour over an extended period of time. Luborsky and Mintz¹⁶ have compiled a survey of studies of this type.

Having such an early awareness of the central problem to which this present work is addressed, that is, relations among diverse measures of personality, made Cattell's framework attractive when it came to a decision about more specific organization. It was also believed that Hall and Lindzey have offered sage advice at the conclusion on their influential book:

Our general proposal to the student is that he first acquaint himself broadly with the field of personality, and this is precisely what this volume is intended to do. Then let him immerse himself in one theory of personality. Wallow in it, revel in it, absorb it, learn it thoroughly, and think that it is the best possible way to conceive of behaviour. Only reserve in one small corner of his mind the reservation that the

15 Cattell, R. B. The description of personality: I. Foundations of trait measurement. Psychological Review, 1943, 50, 559-592.

16 Luborsky, I., & Mintz, J. The contribution of P-technique to personality, psychotherapy, and psychosomatic research. In R. M. Dreger (Ed.), Multivariate personality research: Contributions to the understanding of personality in honor of Raymond B. Cattell. Baton Rouge: Claitor's Publishing, 1972.

final crucible for any theory is the world of reality studied under controlled conditions. After the romance is over and the student is seduced by the theory, he may set about the cold hard business of investigation in order to find out whether his theoretical marriage will withstand the ravages of reality.¹⁷

3. Outline of Cattell's approach to personality

Working with a general definition of personality as "that which permits a prediction of what a person will do in a given situation," R. E. Cattell¹⁸ has, over the years, adhered to a number of subdivisions which he considers to be useful in guiding personality research. The general framework of his approach is depicted in Figure 1. One basic distinction which has been made is the conceptualization of three broad "modalities" of personality: ability, dynamic, and temperament traits. (Other divisions will be discussed later.) Particularly in his more recent writing, Cattell often uses the term "general personality" instead of "temperament." Such a change was probably due to the tendency of the word "temperament" to more heavily connote heredity than environment. However, the use of "general personality" traits introduces some confusion in that it implies

17 Hall, C. S., & Lindzey, G. Theories of personality. New York: Wiley, 1970.

18 Cattell, 1950. op. cit., p. 2.

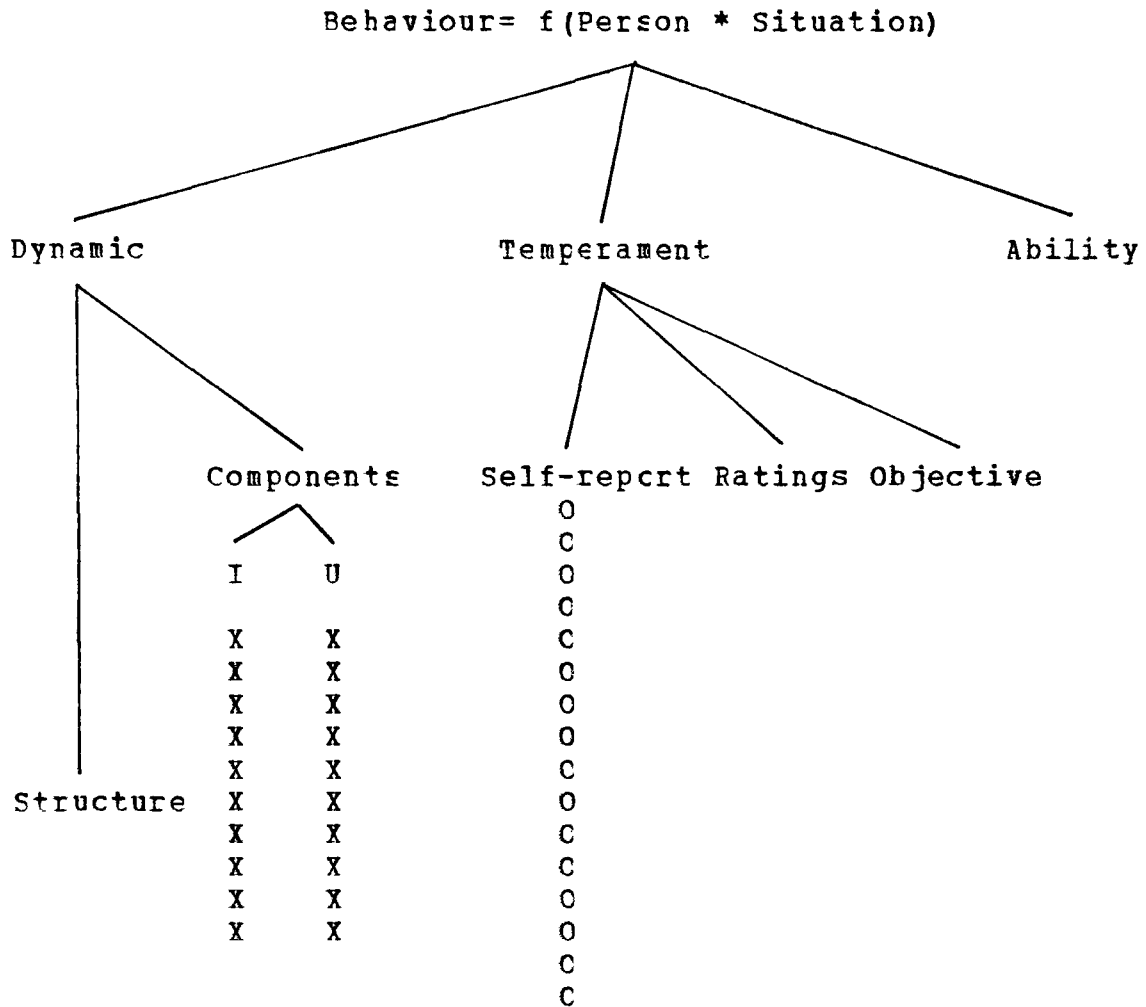


Figure 1.- Outline of Cattell's approach to personality. (The X's and O's refer to the measures that were used in the present investigation. The I stands for integrated and the U for unintegrated. The structure measures may be further divided into ergs and sentiments.)

something beyond one modality. Perhaps the situation could be remedied by the use of another term, such as "temperament-stylistic," which would maintain the historical continuity of a modality distinction and at the same time add some environmental balance. General personality could then be reserved for any factors which may be found that span two or more of the modalities.

It may be noticed that Cattell's approach is very similar to the traditional separation into areas of cognition, conation, and affection, or thinking, willing, and feeling, which O'Neil¹⁹ has chronicled in some detail. Aristotle was one of the first to make a similar distinction, except that he combined conation and affection into "orectic" functions, with the term "neotic" for cognition. Later writers were more inclined to divide orexis into active (conative) and passive (affection) components to give the threefold division which was perpetrated by the general rationalist tradition in continental Europe in the seventeenth, eighteenth, and nineteenth centuries, and in Britain in the late nineteenth, and early twentieth centuries. Kant, Brentano, Stern, Stout, and McDougall were but a few of the more prominent

19 O'Neil, W. M. The beginnings of modern psychology. London: Penguin, 1968.

proponents of this viewpoint.

a) Modalities defined. - Cattell²⁰ refers to the ability, dynamic, and temperament areas as representing different "modalities" of personality trait organization. He attempts an operational definition of each area by suggesting that:

abilities are those traits which change most in response to changes in situational complexity,

dynamic traits are measured best by those variables which change most in response to change of incentives in the situation,

temperament traits are those reliable differences between individuals which remain unaccounted for by changes in complexity and incentives.

Such a system of definitions, of course, requires independent definitions of incentive and complexity. Cattell addressed himself to this problem and proposed that identification of incentives can be achieved by longitudinal analysis of behaviour, defining an incentive by consummatory responses at which a train of behaviour is found to cease. Conditions in the environment which are complexities are defined as any alteration of the field which is not an alteration of incentives.²¹

20 Cattell, R. B. Description and measurement of personality. Yonkers-on-Hudson, N.Y.: World Book Co., 1946, p.160.

21 Ibid., p. 175.

As Radcliffe²² has noted, this leaves the previous definition of temperament unclear. Possibly it is meant that temperament traits are considered to be entirely endogenous; that is, temperament traits are individual differences not tied to the two basic types of external stimulus conditions, of incentive and complexity. Horn and Sweney²³ have also commented upon the ambiguity in operationally distinguishing between modalities, but they, like Radcliffe, recognize the value of this tripartite division on a conceptual level as a general guiding framework.

Cattell's main justification for proposing a modality distinction was that it should offer a more generally effective means of prediction in most real-life situations where changes in levels of incentive and complexity often occur independently.

Turning now to separate considerations of the modalities it should be pointed out that the present study

22 Radcliffe, J. A. Motivation: Its measurement by Cattell and others. In R. M. Dreger (Ed.), Multivariate personality research: Contributions to the understanding of personality in honor of Raymond B. Cattell. Baton Rouge: Claitor's Publishing, 1972.

23 Horn, J. L., & Sweney, A. B. The dynamic calculus model for motivation and its use in understanding the individual case. In A. R. Mahrer (Ed.), New approaches to personality classification. New York: Columbia University Press, 1970.

will focus upon only the dynamic and temperament modalities. Hence, very little will be said throughout the paper about the general area of abilities, but the interested reader may find a thorough treatment of this topic in Cattell.²⁴

b) Dynamic modality. - Within the dynamic modality two main streams of research are discernible. One of these has become known as the dynamic structure work and is basically concerned with identifying the major motives or interests of man. The second portion of the research has dealt with attempting to determine the main ways in which the major motives are expressed and has been referred to as the search for motivational components. Each of these aspects of the dynamic modality will be separately described.

The basic measurement units adopted in the dynamic structure search for the major motives of man have been "attitudes" defined in the form of the following paradigm:

<u>In these circumstances</u> (stimulus situation)	<u>I</u> (organism)	<u>want so much</u> (interest-need of certain intensity)
<u>to do this</u> (specific goal, course of action)	<u>with that.</u> (object concerned in action)	

 24 Cattell, R. B. Abilities: Their structure, growth and action. New York: Houghton Mifflin, 1971a.

Using this definition, attempts have been made to delineate a great many attitudes or specific wants.²⁵ In fact, over 200 different attitudes culled from a great variety of sources, W. James, Freud, McDougall, and Murray in particular, have been tried out in order to determine which attitudes tend to go together, and hence might be conceived of as being an expression of a more limited number of underlying motives. To date, some 30 basic motives have been reported as having been reasonably well established, a sample of which may be found in Table I. On the basis more of a theoretical analysis rather than empirical findings, these motives have been divided into two main groups, those of "ergs" and "sentiments," which in essence correspond to concepts of primary and secondary, or unlearned and acquired drives.

As previously mentioned, in addition to dynamic structure investigations, a related but distinct aspect of Cattell's motivational research has focused upon the study of "components" of motivation measurement.²⁶ The essential concept is that the intensity of any particular erg or sentiment will be manifested in a variety of ways.

25 Cattell, 1957, op. cit.

26 Cattell, R. B., Radcliffe, J. A., & Sweeney, A. B. The nature and measurement of components of motivation. Genetic Psychology Monographs, 1963, 68, 49-211.

The principle of multiple manifestation of motivation strength is analogous to the idea that intelligence cannot be adequately measured by only one or two individual subtests such as vocabulary or digit span. Hence, a large number of devices have been employed in trying to assess the ways in which people express their motivational inclinations (Table II gives a sample).

Upon factor analyzing the devices designed to measure motivational strength according to this variety of principles, from five to seven primary factors have been reported in available researches. There has been some theorizing about the meaning of the primary motivational components, for example, Horn²⁷ mentions that they have been considered as being very similar to the defence mechanisms described by Anna Freud. However, there is still some controversy about their essential nature.²⁸

Factor analysis of the primary factors has resulted in two second-stratum patterns which have been designated as "integrated" and "unintegrated" components of motivation. The unintegrated motivational component, which has a

27 Horn, J. L. Motivation and dynamic calculus concepts from multivariate experiment. In R. B. Cattell (Ed.). Handbook of Multivariate Experimental Psychology. Chicago: Rand McNally, 1966.

28 Radcliffe, op. cit.

wishful, undisciplined, half-unconscious quality, is most validly measured by the devices called distortion of perception, projection, GSR magnitude, and the speed of blood pressure changes, whereas, the integrated component is best assessed by word association and volume of information on the given topic. It has been suggested that they are analogous to the psychoanalytic concepts of the conscious and unconscious.

It has been found that these two motivational components are only very slightly correlated, and some studies have produced evidence that they tend to function independently. For example, Dielman *et. al.*²⁹ found that the integrated, but not the unintegrated, scores significantly contributed to the prediction of Junior High School achievement. Cattell *et. al.*³⁰ obtained results which supported their hypothesis that the unintegrated component is a more responsive "state" measure than the integrated component in relation to self-report of

29 Dielman, T. E., Barton, K., & Cattell, R. B. The prediction of junior high school achievement from objective motivation tests. Personality, 1971, 2, 280-287.

30 Cattell, R. B., Kawash, G. F., & DeYoung, G. E. Validation of objective measures of ergic tension: Response of the sex erg to visual stimulation. Journal of Experimental Research in Personality, 1972, 6, 76-83.

response to stimulation of the sex erg. Sweney and Cattell³¹ also report evidence suggesting different structures on the integrated and unintegrated levels.

c) Temperament modality research. - Cattell's research on the temperament modality has taken three rather distinct directions which Cattell has referred to as different "media" of measurement: behaviour rating, self-report, and objective test.

His early work, best summarized in Cattell,³² took the approach of measuring personality by behavioural ratings of observers using careful condensations of the list of 3000 adjectives compiled by Allport and Odbert.³³

The basic rationale for beginning in this manner has been called the "personality sphere" concept.³⁴ It was reasoned that during the thousands of years of language development, terms describing a very large portion of possible personality characteristics have evolved. Hence,

31 Sweney, A. B., & Cattell, R. B. Relationships between integrated and unintegrated motivation structure examined by objective test. Journal of Social Psychology, 1962, 57, 217-226.

32 Cattell, 1957, op. cit.

33 Allport, G. W. & Odbert, H. S. Trait names: a psycho-lexical study. Psychological Monographs, 1936, 47.

34 Cattell, 1946, op. cit.

by starting with an adequate sampling of all such terms, one should be reasonably assured of a comprehensive commencement to a long-term study of general personality factors.

The behavioural rating studies resulted in the reporting of 20 factors which were indexed by the letters A through P and given tentative psychological titles to guide further research. Being derived from factor analytic techniques based on Thurstone's concept of "simple structure," these traits were described by Cattell³⁵ as being "source traits" as contrasted to the "surface traits," or simple correlation clusters, from which the factor analysis began.

It may be noticed that there is a close parallel here with Chomsky's version of earlier European ideas of surface and deep structures within language. The idea of a finite set of underlying structures being able to generate an infinite variety of behaviour, be it language or otherwise, is common to both theories. A thorough coverage of the distinction between source and surface traits may be found in Hundleby.³⁶

35 Cattell, 1950, op. cit., p. 27.

36 Hundleby, J. D. Structure of personality: Surface and source traits. In R. M. Dreger (Ed.), Multivariate personality research: Contributions to the understanding of personality in honor of Raymond B. Cattell. Baton Rouge: Claitor's Publishing, 1972.

The next phase of the research program consisted of the factor analysis of self-ratings made to questionnaire items constructed on the basis of the behaviour rating research, together with previous work by other investigators. In working with questionnaire data Cattell has often stressed that it is not assumed that the person is literally as he describes himself, i.e. that the mental interior and behavioural exterior patterns are considered identical. Instead, the verbal self-description may be taken only as behaviour, not correct self-description, and the inference from this verbal behaviour is systematically different from what the person might assume. Research of this kind has so far indicated some 23 primary factors within the "normal" domain of expression, together with 12 others derived from more pathologically oriented content (see sample in Table III). Upon factor analysing the primary dimensions, it appears that there are at least 16 second-stratum factors. That these primary and second-stratum factors give a rather comprehensive coverage of the questionnaire realm is attested to by the fact that recent studies have shown considerable overlap with other widely used questionnaire measures such as the Comrey, Eysenck,

Guilford, and MMPI inventories.^{37,38,39,40,41}

Research in the temperament modality has also been carried out within what Cattell has termed the "objective test media" of personality measurement.^{42,43} The main distinguishing feature of the objective test approach to personality measurement is an attempt to find measures whose purpose is difficult to detect by the person completing the test. But since the term "objective" has been used quite

37 Cattell, R. B., Bolton, L. S. What pathological dimensions lie beyond the normal dimensions of the 16 P.F.? A comparison of MMPI and 16 P.F. factor domains. Journal of Consulting and Clinical Psychology, 1969, 33, 18-29.

38 Cattell, R. B., & Gibbons, B. D. Personality factor structure of the combined Guilford and Cattell personality questionnaires. Journal of Personality and Social Psychology, 1968, 9, 107-120.

39 Comrey, A. L. & Duffy, K. E. Cattell and Eysenck factor scores related to Comrey personality factors. Multivariate Behavioral Research, 1968, 3, 387-392.

40 Hundleby, J. D. & Connor, W. H. Interrelationships between personality inventories: The 16PF, the MMPI, and the MPI. Journal of Consulting and Clinical Psychology, 1968, 32, 152-157.

41 Sells, S. B., Demaree, R. G., & Will, D. P., Jr. Dimensions of personality: I. Conjoint factor structure of Guilford and Cattell trait markers. Multivariate Behavioral Research, 1970, 5, 391-422.

42 Cattell, R. B., & Warburton, F. W. Objective personality and motivation test: A theoretical introduction and practical compendium. Urbana: University of Illinois Press, 1967.

43 Hundleby, et. al., op. cit.

frequently to refer to other test properties such as high inter-scorer agreement (for which Cattell has proposed the term "conspective" rather than objective), the present writer would like to suggest that either the term "opaque" or "translucent" may offer some semantic clarity.

A great number and variety of measures have been employed in this work so that it is difficult to give typical examples. However, scrutiny of an article devoted to this type of approach,⁴⁴ reveals that certain general categories of tests may be discerned, e.g. expressive movement, simulated real-life situations, physiological variables, motor-perceptual and performance measures. To date, 21 factors have been reported in the objective test area.

d) Inter-media relations. - In addition to working independently within each of the behaviour rating, questionnaire, and objective test media of the temperament modality, attention has also been given to the possibility of alignments between the factors in the different

⁴⁴ Hundleby, J. D. The measurement of personality by objective tests. In P. Kline (ed.), New approaches in personality measurement. New York: Wiley, 1973a.

media.^{45,46,47,48,49,50} There are indications that the behavior rating and questionnaire measures are prone to match mainly on the primary level. However, the primary factors in the objective test domain seem to correspond more to second-stratum factors in the other two measurement medium areas.

4. Cross modality relations.

Since 1946, Cattell has developed his approach to personality by concentrating on each of his proposed three

45 Becker, W. C. The matching of behavior rating and questionnaire personality factors. Psychological Bulletin, 1960, 57, 201-212.

46 Cattell, R. B. Theory of situational, instrument, second order, and refraction factors in personality structure research. Psychological Bulletin, 1961, 58, 160-174.

47 Cattell, R. B. Trait-view theory of perturbations in ratings and self-ratings (L(BR)-and Q-Data): Its application to obtaining pure trait score estimates in questionnaires. Psychological Review, 1968, 75, 96-113.

48 Cattell, R. B. Personality and mood by questionnaire. San Francisco: Jossey Bass, 1973b.

49 Cattell, R. B., & Digman, J. A theory of the structure of perturbations in observer ratings and questionnaire data in personality research. Behavioral Science, 1964, 9, 341-358.

50 Krug, S. E. & Cattell, R. B. A test of the trait-view theory of distortion in measurement of personality by questionnaire. Educational and Psychological Measurement, 1971, 31, 721-734.

modalities with relatively little attention being given to the inter-connection between the modalities. Yet, he was careful to point out at the outset that "wholistic" factors spanning the "conditional" modalities would be expected since "... it is theoretically inadmissible to consider any piece of behaviour as a pure manifestation of one modality.⁵¹ In 1957, Cattell⁵² looked briefly again at the possibility of systematic relationships across modalities and concluded that there was some evidence for their existence. Some years later, when discussing modality distinctions, Cattell and Warburton⁵³ mentioned that there are certain utilities in combining dynamic and temperamental traits into "oretic" traits as advocated by Aristotle, thus hinting at cross-modality connections.

Horn⁵⁴ has also pointed out that the distinction between temperament and dynamic traits is often difficult to make. In this article, it is noted, as well, that other writers such as Piaget⁵⁵ have cogently argued that the

51 Cattell, 1946, op. cit., p. 164.

52 Cattell, 1957, op. cit., p. 526.

53 Cattell and Warburton, op. cit., p. 11.

54 Horn, op. cit., p. 614.

55 Piaget, J. Psychology of intelligence. Paterson, N.J.: Littlefield-Adams, 1960.

traits of one modality may be an outgrowth, developmentally speaking, of the traits of another modality. Horn also draws attention to the fact that Rapaport⁵⁶ has stressed that the interaction between trait functions of different modalities is scientifically more noteworthy than the separateness of the modalities.

More recently, Cattell⁵⁷ has again considered in some detail the question of intermodality relations, and suggests an exploration of the possibility of relations between motivation measures and temperamental, or, general personality traits. The plausibility of overlaps between these areas was again mentioned in Cattell and Delhees.⁵⁸

The present research was therefore undertaken with the aim of clarifying the nature of relations between measures in the dynamic and temperament modalities which have been separately developed by Cattell.

56 Rapaport, D. The structure of psychoanalytic theory: A systemizing attempt. In S. Koch (Ed.), Psychology: A study of a science. Vol. III. New York: McGraw-Hill, 1959.

57 Cattell, R. B. Key issues in motivation theory in relation to learning and the dynamic calculus. Paper presented at the Third Banff Conference of the Center for Advanced Study in Theoretical Psychology, 1971.

58 Cattell, R. B., & Delhees, K. H. Seven missing normal personality factors in the questionnaire primaries. Multivariate Behavioral Research, 1973, 8, 173-194.

5. Development of specific hypotheses.

a) Self-sentiment. - Throughout his writing, Cattell has often placed a great deal of emphasis upon the importance of the self in understanding personality. For example, in 1950, he states what he considers to be the "essential principle":

Some integration (absence of mutual undoing) of behaviour occurs through the normal formation of the dynamic lattice under laws already stated. Further integration occurs through the ability to contemplate the physical and social self, whereby the satisfaction of any desire becomes subsidiated in part to a sentiment for the welfare of the whole self. This sentiment becomes by such contributions the most powerful sentiment in the lattice, controlling all others in some degree.⁵⁹

A few years later when discussing the structure of what, following McDougall, he refers to as the "self-sentiment," Cattell writes:

... this structure is subsidiated to most of the other ergic and sentiment-satisfactions of the individual and is therefore of more central function and importance than any erg.⁶⁰

In 1958, Cattell remarks:

If clinical psychology and personality theory are right in assigning so large a role in the resolution of conflict to the self-sentiment, we should expect to find it loading certain attitudes in factor analysis accordingly. For example, it should be pervasive, with

59 Cattell, 1950, op. cit., p. 654.

60 Cattell, 1957, op. cit., p. 525.

"a finger in every pie," and this wide prevalence of loadings seems to be found.⁶¹

And in 1965, when discussing the self-sentiment, the following statements are made:

This self-concept comes, by virtue of dynamic resources vested in it in the self-sentiment habit structure, to control the impulses of ergs and to integrate the lesser sentiments, within a consistent working system.⁶²

Dynamically, the sentiment towards maintaining the self correct by certain standards of conduct, satisfactory to community and superego, is therefore a necessary instrumentality to the satisfaction of most other life interests.

The conclusion to which this leads is that the self-sentiment must appear in the dynamic lattice at the position indicated in Diagram 37, far to the left and therefore among the latest of sentiments to reach a ripe development. It contributes to all sentiment and ergic satisfactions, and this accounts also for its dynamic strength in controlling, as the 'master sentiment', all other structures.⁶³

Marshall has raised the question of whether the self sentiment may have its own specific energy investment and thus represent "... the innate integrative principle which Jung hypothesized."⁶⁴ On the other hand, Horn and Sweeney

61 Cattell, F. B. The dynamic calculus: A system of concepts derived from objective motivation measurement. In G. Lindzey (Ed.) The Assessment of human motives. New York: Rinehart, 1958, p.234.

62 Cattell, 1965, op. cit., p. 194.

63 Ibid., p. 272.

64 Marshall, I. N. Extraversion and libido in Jung and Cattell. Journal of Analytical Psychology, 1967, 12, 115-136.

place somewhat more emphasis upon the possible learning factors involved. They spoke more in terms of Cattell's concept of confluence learning where it is recognized that:

... an individual in real life (perhaps in contrast, to a laboratory situation) does not simply satisfy this or that need; he attains some satisfaction and frustration of several needs. Probably there is a sense in which the individual works to maximize his total satisfaction of all needs.⁶⁵

In a more recent but rather brief consideration of the relative roles of nature and nurture, Cattell⁶⁶ does not place the self-sentiment in either the heavily, hereditarily determined, or the strongly, environmentally influenced categories, so presumably, he regards it as a mixture of both.

Getting back more to the focus of the present investigation, it is interesting to notice that factors have been independently replicated in the dynamic and temperament modalities which have both been called the self-sentiment. In one article, the possibility of measuring different factors was considered, with the dynamic structure factor being considered as representing the strength of the individual's desire to achieve behaviour fitting the self

65 Horn and Sweeney, op. cit., p.76.

66 Cattell, R. B. Personality pinned down. Psychology Today, 1973a, July, 41-46.

concept, and the temperament factor being the extent to which he feels it has been achieved.⁶⁷ In another instance, interest is drawn to the possibility that the factors may be identical.⁶⁸ The meager empirical findings bearing on this question hint that this may, in fact, be a case of the same factor expressing itself in different modalities. One aim of this study is to consider more carefully the possibility of identity by improving upon the two early unpublished studies. The first improvement over the past is the sheer technical advancement and validity of the measures involved, and the other is separate consideration of the integrated and unintegrated aspects of the dynamic factors. As pointed out earlier, recent evidence suggests that quite different findings may be expected, when the score on any particular motive is broken into these two different components.

b) Superego. - Another name which has been given to factors in both the dynamic and temperament modalities has been that of the "superego." As with the self-sentiment, Cattell has frequently emphasized the role which this factor plays in personality regulation. In the studies of academic

67 Cattell, 1958, op. cit.

68 cattell, 1957, op. cit., p. 528.

achievement discussed earlier, these two measures have proven to be the most important single predictors within their respective modalities, with the qualification that this applies to only the integrated component of the dynamic factor. In addition to being an important factor, there is evidence from previous work which supports the notion of a possible connection between modalities with the superego factor. For example, in a study by Gillis and Woods,⁶⁹ the superego factor of the temperament modality was found to be the most highly related of all factors to the amount of cooperative behaviour in what is commonly referred to as a mixed-motive situation. More direct evidence bearing upon possible inter-modality relations with the superego factor comes from Cattell⁷⁰ and Cattell et. al.⁷¹ where significant correlations were found.

c) Other possible cross-modality connections. - It does not seem too implausible to postulate that

69 Gillis, J. S., & Woods, G. T. The 16PF as an indicator of performance in the Prisoner's Dilemma game. Journal of Conflict Resolution, 1971, 15, 394-402.

70 Cattell, 1957, op. cit.

71 Cattell, R. B., Horn, J. L., Radcliffe, J. A., & Sweeney, A. B. The motivation analysis test, MAT. Champaign, Ill.: Institute for Personality and Ability Testing, 1964.

the dominance factor in the temperament modality corresponds to the assertiveness erg in the dynamic modality although the results from past work are not as suggestive in this case. Cattell has indicated that it is a possibility worth considering.⁷²

Similarly, a possible relation between the fear erg and the temperamental anxiety factor does not seem unreasonable. In fact, a negative relation was reported by Cattell which he termed "... a remarkable one, of great theoretical importance if checked."⁷³ On the other hand, Sweney⁷⁴ has argued for a positive relation with the unintegrated fear erg.

d) Motivation components and temperament. - In the paper which has much to do with the initiation of the present inquiry,⁷⁵ attention was centered more upon possible relations between temperament and motivational components rather than the dynamic structure factors just considered.

72 Cattell, 1957, op. cit., p. 526.

73 Ibid., p. 528.

74 Sweney, A. B. A preliminary descriptive manual for individual assessment with the Motivation Analysis Test. Champaign, Ill.: Institute for Personality and Ability Testing, 1969.

75 Cattell, 1971, op. cit.

In particular, discussion was directed to the total score obtainable by subtracting the integrated portion of each motive from its unintegrated portion and then summing across all motives. This score has been referred to as a probable indicator of the total amount of "conflict" being experienced by a person. Hence, a relationship with the anxiety factor within the temperament area has been suggested.^{76,77,78} This hypothesis has not received the attention which it would seem to deserve.

Another potential relation might be between the total personal interest measure that can be obtained by adding up the scores on all motives, and a temperament factor often referred to as the level of ergic tension.

e) Null hypotheses.- On the basis of the preceding considerations, the following null hypotheses were formulated:

1. There is no relation between the "self-sentiment" measure in the temperament modality and the "self-sentiment" measure in the integrated portion of the dynamic trait modality.

76 Cattell, 1965, op. cit.

77 Cattell, R. B. Anxiety and motivation: theory and crucial experiments. In C. D. Spielberger, (Ed.), Anxiety and Behavior. New York: Academic Press, 1966a.

78 Cattell, 1971b, op. cit.

2. There is no relation between the "self-sentiment" measure in the temperament modality and the "self-sentiment" measure in the unintegrated portion of the dynamic trait modality.

3. There is no relation between the "superego" measure in the temperament modality and the "superego" measure in the integrated portion of the dynamic trait modality.

4. There is no relation between the "superego" measure in the temperament modality and the "superego" measure in the unintegrated portion of the dynamic trait modality.

5. There is no relation between the "dominance" measure in the temperament modality and the "assertiveness" measure in the integrated portion of the dynamic trait modality.

6. There is no relation between the "dominance" measure in the temperament modality and the "assertiveness" measure in the unintegrated portion of the dynamic trait modality.

7. There is no relation between the "anxiety" measure in the temperament modality and the "fear" measure in the integrated portion of the dynamic trait modality.

8. There is no relation between the "anxiety" measure in the temperament modality and the "fear" measure in the unintegrated portion of the dynamic trait modality.

9. There is no relation between the "anxiety" measure in the temperament modality and the "total conflict" measure in the dynamic trait modality.

10. There is no relation between the "ergic tension level" measure in the temperament modality and the "ergic tension level" measure in the dynamic trait modality.

f) Additional questions.- In addition to the preceding hypotheses, a number of worthwhile questions might be asked in a more exploratory manner. As yet, there has not been a published report of a joint factor analysis of measures from the dynamic and temperament modalities. It would be especially interesting to undertake such an analysis if

temperament and dynamic measures are found not to closely correspond at the primary level. It might be revealed that there are connections at the second-stratum level. Such a finding has been reported by Nesselroade and Baltes⁷⁹ who found that there was evidence of factor convergence between Cattell's personality factors and those of Jackson (the PRF) at the second-stratum level. The results of Nesselroade and Baltes have led Cattell to write:

This finding suggests either that the PRF has missed its theoretical objective of covering interests (Murray's needs) and is operating, contrary to our and the designer's assumption substantially in the area of general personality factors, or, alternatively, that the second-order personality factors project their variance into motivation-interest primaries as well as into personality primaries.⁸⁰

Furthermore, since there has been only one brief report of an unpublished second-stratum analysis of the dynamic structure factors,⁸¹ an exploratory analysis is needed. If it should be found that there are only modest relations across modalities, then this type of analysis might benefit from the inclusion of the temperament measures

79 Nesselroade, J. E., & Baltes, P. B. Higher order convergence and divergence of two distinct personality systems: Cattell's HSPQ and Jackson's PRF. (Unpublished manuscript, 1973).

80 Cattell, 1973b, op. cit.

81 Cattell, 1957, op. cit., p. 566.

which could act as "hyperplane stuff"⁸² to give a better delineation of the dynamic second-stratum factors. In addition, the second-stratum level in the temperament area is sufficiently well explored to act as a guide for checking the adequacy of rotations with the dynamic factors.⁸³ Since the categories of ergs were created by theoretical fiat, it would be of interest to see if ergs tend to go with ergs, or, sentiments with sentiments, or ergs with sentiments at the second-stratum level.

82 Cattell, R. B. Factor Analysis. New York: Harpers, 1952.

83 Cattell, R. B., & Nichols, K. E. An improved definition from 10 researches of second order personality factors in Q data. Journal of Social Psychology, 1972, 86, 187-203.

CHAPTER II

PRESENTATION OF RESULTS

With the aim of investigating the possible relations between the temperament and dynamic modalities, it was decided to examine associations between two standardized tests which have been developed on the basis of research in each of the two areas.

1. Method of the first study

a) Participants. - Involved in the study were 243 college students who were seeking consultation at the Student Counselling Services of the University of New Brunswick. There were 177 males and 66 females whose respective ages were 20.7 years (S. D. = 3.1) and 20.0 years (S.D. = 2.4).

b) Test material. - The tests used were Form A of the 1962 Edition of the Sixteen Personality Factor Questionnaire (16PF) and the 1964 Edition of the Motivation Analysis Test (MAT). The MAT was not given as part of the regular test battery until it was added for the purpose of the present research. The 16PF had been used in the past as part of the regular battery.

Guided by the research on dynamic structure and motivational components, Cattell et. al.¹ designed the MAT with the aim of measuring five ergs and five sentiments in both their integrated and unintegrated forms of manifestation (Table I). Four subtests called Uses, Estimates, Paired Words and Information were selected from among devices such as those listed in Table II.

The Uses and Estimates tests were chosen because they are representative of two of the primary factors involved in the Unintegrated (U) component. Similarly, the Paired Words and Information tests have been found to measure primary factors contributing to the Integrated (I) component.

The Uses test requires the person to select between two contrasting choices, in order to determine activity, time, and money spent in the areas of the ergs and sentiments included in the MAT. A typical choice is:

A man with time to ponder could well spend it thinking:
How one can learn to control unruly emotions
On ways of helping others

The Estimates test requires the person to make estimates such as the following:

1 Cattell, R. B., Horn, J., & Butcher, H. J. The dynamic structure of attitudes in adults: A description of some established factors and of their measurement by the Motivational Analysis Test. British Journal of Psychology, 1962, 53, 57-69.

Smoking is responsible for what per cent of the deaths
from lung cancer? 10% 30% 50% 90%

The assumption is that the person more interested in a certain course of action will tend to overestimate the interest of others, underestimate the dangers that may be involved, and so forth. This test is thought to reflect a type of adult "autism."

The paired Words test requires that the person quickly associate one of a pair of words to a root word, e.g.,

 parents
wise
 know self

The assumption is that the more powerful dynamic structure factor will prevail.

The Information device requires that the person give the correct answer for a question like:

The cigarette that advertises: "It's what's up front that counts" is:

a) Winston b) Kent c) Marlboro d) Viceroy

The assumption is that the person interested more in smoking is more likely to know the correct answer than a person not so interested.

In addition to the 10 raw scores for each of the four subtests of the MAT and the 10 sten scores (scores with a mean of 5.5 and standard deviation of 2.0) for the unintegrated and integrated components, the following may

also be obtained:

values for a Total Motivation score (U+I) for each of the 10 ergs and sentiments

10 values for an experimental "conflict" measure (U-I) for each of dynamic structure factors

a General Autism-Optimism score
(sum of 10 Estimates scores)

a General Information-Intelligence score
(sum of 10 Information scores)

a Total Integration score
(sum of 10 U - sum of 10 I)

a Total Personal Interest score
(sum of 10 Total Motivation scores)

a Total Conflict score (sum of 10 conflict measures)

The 16PF was developed over the last 25 years by Cattell and various colleagues² with the aim of measuring predominantly temperament factors, although one ability factor was included for practical purposes. Brief descriptions of each of the 16 primary and four second-stratum factors measured by this test may be found in Table III. The 16PF was first published in 1949 and has been extensively refined with new editions appearing in 1956, 1962, and 1968. There are presently six parallel forms of

² Cattell, R. B., Eber, H. W., & Tatsuoka, M. The Sixteen Personality Factor Questionnaire Test (rev. ed). Champaign, Ill.: Institute for Personality and Ability Testing, 1970.

the test and other instruments aimed at measuring the same factors have been produced at the high school (age 12-16), child (8-12), early school (6-8) and preschool level.

The tests were handscored, using stencils supplied with the tests, then the raw scores were transformed into sten scores by means of the computer program listed in Appendix 1. The sten scores of the 16PF were then used to compute four second-stratum factors by means of a computer program (listed in Appendix 1) based on the information in the test manual.

c) Test procedure. - The tests were given to the students under the supervision of the staff of the Counselling Service. Tests were completed in individual cubicles with the 16PF given first. Both tests were completed before any feedback was given about the test results. The tests were typically administered on two separate testing occasions.

2. Results of the first study

The data of the first study were analysed quite extensively and the results are presented in considerable detail with attention being given to explanation and justification of the procedures used. A brief summary is available in subsection g) of this section.

a) General.- The 16PF and MAT means and standard deviations from the present sample, together with the corresponding values from the test norms, are listed in Tables IV and V. It should be kept in mind that the 16PF norms used were those for college students of the appropriate sex, while only norms for the general population, with males and females combined, were available for the MAT.

It may be seen in Table IV that the factor on which the sample differed most appreciably from the norms is factor B, the general ability factor. On this factor, the sample had a higher mean than the test norms and, unlike the other factors which tended to have a higher standard deviation, factor B showed less variation. A striking feature of Table V was the consistently lower than-test-norm standard deviations of the participants in this investigation. Other noteworthy features of Table V are the higher level of the Narcism erg of the sample and the extremely low score of the females on the unintegrated portion of the Career sentiment.

The inter-correlations between the factors of the 16PF are presented in Table VI. The coefficients closely matched those reported in the 16PF handbook, even though the handbook values were based on the 1968 Edition with only

males, while the present sample included both males and females who had completed the 1962 Edition.

Since, as has been noted previously, quite different results have been found with the unintegrated and integrated motivational components of the MAT, inter-correlations were computed for both of these sets of scores (Tables VII and VIII), in addition to the total motivation score inter-correlations which are the only ones reported in the MAT manual (Table IX). It may be seen that all of the correlations were low, consistent with previous reports.

b) Motivational components.- Examination of the inter-correlations among the five previously listed scores which are obtainable from the MAT, in addition to the erg and sentiment scores, revealed a considerable overlap in these scores. In Table X, it may be seen that the Total Integration and Total Conflict scores were virtually identical; hence, the Total Integration score was not considered for further analysis.

With the significance level for adding and deleting variables set at .05, four separate stepwise multiple linear regression analyses (see Appendix 1 for a description of the computer program) were then carried out with the four remaining scores of Table X as dependent variables. The independent variables in each analysis were the 16 primary

factor raw scores of the 16PF. The results of these analyses are presented in Table XI.

In Table XI it may be seen that the 16PF factors M, G, N and C all made significant contributions to the prediction of the general autism-optimism factor of the MAT.

As expected, in Table XI factor B of the 16PF made a highly significant, although not extremely large, contribution to the prediction of the general information-intelligence score of the MAT with factor Q2 involved to a much less substantial degree. As indicated in Table XI, factor B also seemed to be related to some extent to the total personal interest score of the MAT.

The most interesting finding of the present investigation may be seen in Table XI where there was a strong suggestion of a relation between the MAT total conflict score and factors M and H of the 16PF. A check was made on this finding to see if it applied equally to both sexes. It was found that factor M showed a high degree of significance with both sexes but that factor H seemed to be significantly related to the conflict measure with males only.

c) Dynamic structure. - The inter-correlations between the 16PF and Total Motivation scores of the MAT are

presented in Table XII. Similar calculations were also made with the MAT unintegrated and the MAT integrated scores (Tables XIII and XIV). In all instances the size of the correlations was rather low with the highest being in the .30's. This is consistent with Cattell's postulation of the relative independence of the dynamic and temperament modalities. However, the fact that 31 of 160 sample correlations in Table XII were significant at the .01 level suggested that complete independence was not a tenable interpretation.

Application of Bartlett's test for non-randomness of correlation matrices³ to the matrix of correlations between the 16PF scores plus the 10 MAT U scores plus the 10 MAT I scores (i.e. Tables VI+VII+VIII+XIII+XIV) gave a chi square value of 229 (d.f.= 630, $p < .001$), thus indicating the plausibility of meaningful application of factor analytic techniques.

Two factor analyses were carried out, one on the 16PF and MAT integrated plus unintegrated scores and the other on the 16PF and MAT Total score matrix. The following procedures were carried out for the factor analyses. With unities inserted in the diagonals, a principal components

3 Weiss, D. J. Further considerations in applications of factor analysis. Journal of Counselling Psychology, 1971, 18, 85-92.

analysis was done in order to obtain the eigenvalues for determining the number of factors by the scree test.⁴ The eigervalue plots are presented in Figure 2. It may be seen that there was a discontinuity in the graph at the end of the 2nd scree line, thus suggesting 9 factors in both cases.

The scree test was used since Cliff,⁵ Linn,⁶ and Tucker⁷ have all reported results which are encouraging in their evaluation of the scree test and the most recent, detailed examination of the "number of factors issue," has indicated that a general agreement about a rule for deciding upon the number of factors has not been reached.⁸ It may be noted that the much used Kaiser-Guttman rule of eigenvalue

4 Cattell, R. B. The scree test for the number of factors. Multivariate Behavioral Research, 1966b, 245-276.

5 Cliff, N. The relation between sample and population characteristic vectors. Psychometrika, 1970, 35, 163-170.

6 Linn, R. I. A Monte Carlo approach to the number of factors problem. Psychometrika, 1968, 33, 37-43.

7 Tucker, I. R., Koopman, R. F., & Linn, R. I. Evaluation of factor analytic research procedures by means of simulated correlation matrices. Psychometrika, 1969, 34, 421-427.

8 Hakstian, R. A., & Muller, V. J. Some notes on the number of factors problem. Multivariate Behavioral Research, 1973, 8, 461-475.

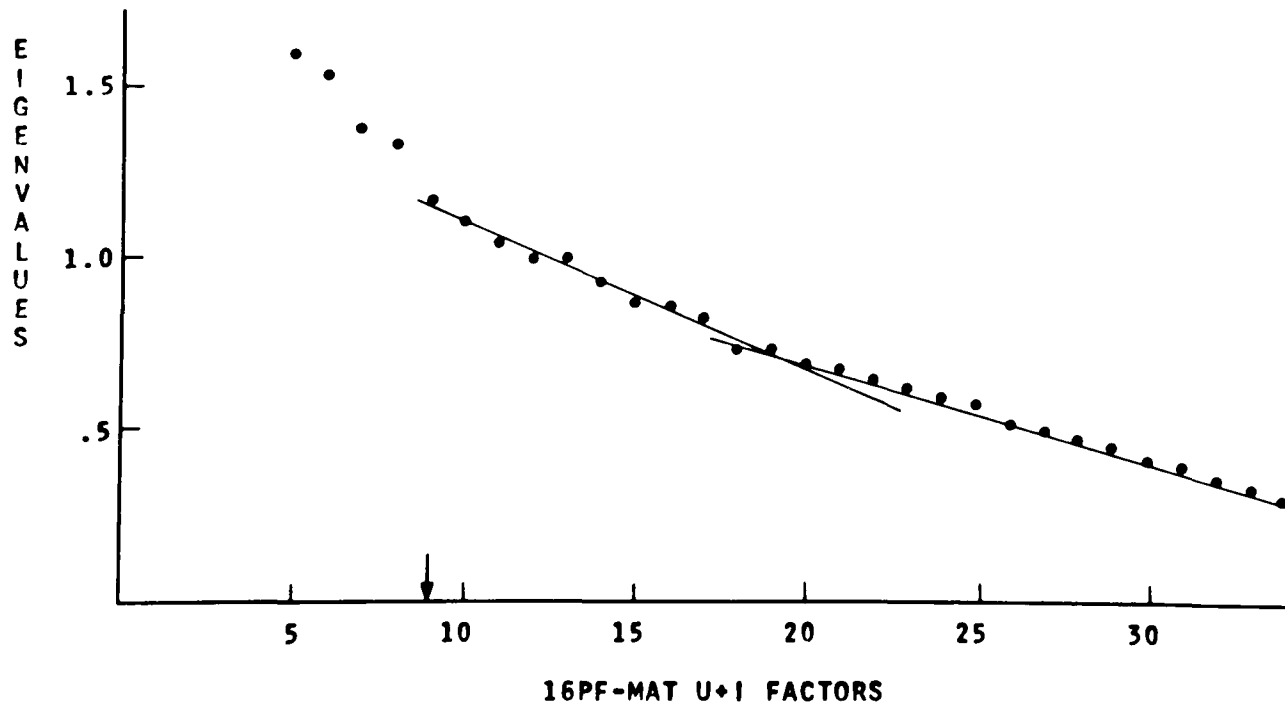
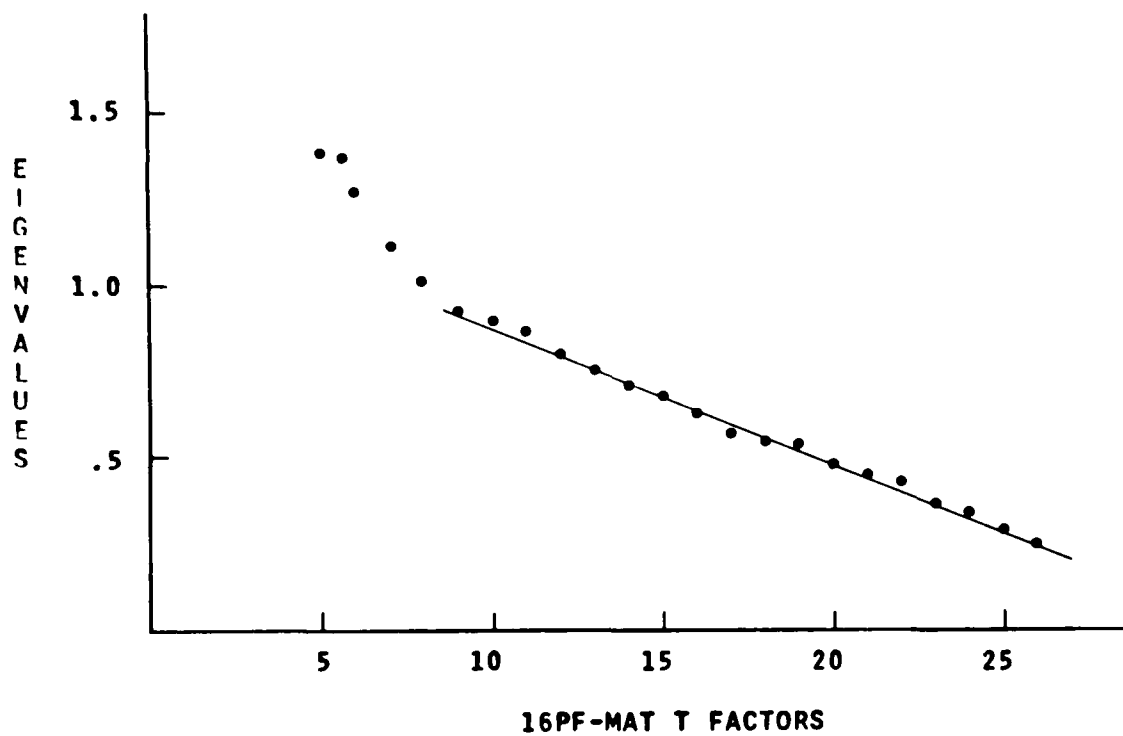


Figure 2.- First study eigenvalue plots.

greater than one indicates a similar, 11, factors.

After deciding upon nine factors, squared multiple correlations were placed in the diagonals and principle factor iterations were performed until a plateau of no change greater than .001 in communalities was reached. The normalized Varimax method of rotation developed by Kaiser^{9,10} was used for an initial orthogonal rotation. In this method, normalizing the loadings is accomplished by dividing the raw loadings of each variable by the square root of the variable's communality. Varimax then serves to maximize the variance of the squares of the normalized factor loadings.

The Varimax rotation was then followed by a Promax rotation to oblique simple structure.¹¹ The Promax program used was a modification by the present writer of a program originally written by D. Preck of the Division of

9 Kaiser, H. F. The varimax criterion for analytic rotation in factor analysis. Psychometrika, 23, 187-200.

10 Kaiser, H. F. A second generation Little Jiffy. Psychometrika, 1970, 35, 401-409.

11 Hendrickson, A. E., & White, P. O. Promax: A quick method for rotation to oblique simple structure. British Journal of Statistical Psychology, 1964, 17, 65-70.

Educational Research Services, University of Alberta. The modified version of the main program is listed in Appendix 1. The original program had to be modified since it was written to give a Prcmax rotation following a method of factor extraction based on unities instead of squared multiple correlations in the diagonal of the original correlation matrix.

Prcmax involves the generation of a target matrix by taking the elements of the orthogonal matrix to a power of K and then dividing this value by the original orthogonal value. The target matrix is then used, in a Procrustes solution¹² to arrive at a best, least-squares fit of the original orthogonal matrix to the target matrix. Promax has been compared to other oblique rotation methods in a number of recent studies and has been found to perform well. Hakstian¹³ ranked it next to the Harris - Kaiser¹⁴ and

12 Hurley, J. R., & Cattell, R. B. The procrustes program: Producing direct rotation to test a hypothesized factor structure. Behavioural Science, 1962, 7, 258-262.

13 Hakstian, A. R. A. A comparative evaluation of several prominent methods of oblique factor transformation. Psychometrika, 1971, 36, 175-193.

14 Harris, C. W., & Kaiser, H. F. Oblique factor analytic solutions by orthogonal transformations. Psychometrika, 1964, 29, 347-362.

better than oblimax¹⁵ and maxplane.¹⁶ Dielman et. al.¹⁷ found that with questionnaire data, as in the present study, Promax "exhibited a clear superiority at all three hyperplane widths." And Gorsuch¹⁸ was led to conclude that "it seems that the best present recommendation for an oblique program is prcmax."

Yet while there is some agreement that Prcmax is a good, analytical procedure, Cattell has suggested that "Prcmax, as commonly used, does not escape from the chief drawback of Varimax, from which it derives, namely, in that it fails to spread sufficiently the variance of the first large principal axis factor, and to some extent of the

15 Saunders, D. R. The rationale for an "oblimax" method of transformation in factor analysis. Psychometrika, 1961, 26, 317-324.

16 Cattell, R. B., & Muerle, J. L. The "maxplane" program for factor rotation to oblique simple structure. Educational and Psychological Measurement, 1960, 20, 569-590.

17 Dielman, T. E., Cattell, R. B., & Wagner, A. Evidence on the simple structure and factor invariance achieved by five rotational methods on four types of data. Multivariate Behavioral Research, 1972, 7, 223-242.

18 Gorsuch, R. L. A comparison of biquartimin, maxplane, promax, and varimax. Educational and Psychological Measurement, 1970, 4, 861-872.

second."¹⁹ For his own research, Cattell still prefers blind rotation by Rotoplot²⁰ as a way of putting a final polish upon his data after using an automatic, machine rotation. Hence, a couple of Rotcplot shifts were tried by the present author, but an improvement in the hyperplane count could not be obtained. With the 16PF and MAT U + I matrix, the percentage of variables in the hyperplane was 40.74% upon initial extraction of the principle axis factors. After Varimax, the hyperplane count was 50.62%, following Promax it was 57.72%. The first Rotoplot shift resulted in a drop to 56.79% while the second merely restored the Promax result of 57.72%. Learning the art of graphic rotation, which has been estimated to take some months, was therefore postponed.

d) MAT Total Scores. - The factor pattern matrix from the analysis with the 16PF and the MAT total scores is presented in Table XV. It may be seen that three of the nine factors are clear matches for the 16PF second-stratum

19 Cattell, R. B., Wagner, A., & Cattell, M. D. Adolescent personality structure, in Q-data, checked in the high school personality questionnaire. British Journal of Psychology, 1970, 61, 39-54.

20 Cattell, R. B., & Foster, M. J. The rotoplot program for multiple single-plane, visually-guide rotation. Behavioral Science, 1963, 8, 156-165.

factors which have been reported by Cattell and Nichols,²¹ whose findings are summarized in Table XVI. The matching factors are respectively 1, 3 and 8 in the present study and 2, 3 and 8 of the Cattell - Nichols study. The second factor in the present study appears to be a mixture of factors 1 and 4 of the Cattell - Nichols study, perhaps resulting from the tendency suggested by Cattell,²² of the first two factors in a Promax solution absorbing too much variance. Some support for this possibility might be reflected in the loading of Q1 on the first factor which does not fit with past research.

The most interesting factors from the point of view of the aims of the present study were the three factors which show some overlap between the temperament and motivation modalities. Factor 3 is recognizable as the second-stratum 16PF factor, pathemia-cortertia, which had been identified in a number of previous studies (e.g. Factor 3 of Cattell - Nichols) together with the self-sentiment factor of the MAT. It may be noted that the self-sentiment factor, Q3, of the 16PF did not load on this factor. Factor 6 appeared to center on the mating erg factor of the MAT with lesser involvement of the surgency, F, factor of the

21 Cattell and Nichols, op. cit.

22 Cattell, Wagner and Cattell, op. cit.

16PF together with the pugnacity erg which was opposite in sign. The other inter-modality factor had positive loadings on the dominance, E, and shrewdness, N, factors of the 16PF together with the assertiveness erg and sweetheart-spouse sentiment of the MAT. The inter-correlations between the Promax factors are given in Table XVII.

e) MAT broken down into integrated and unintegrated. - The factor pattern matrix for the analysis with the 16PF and MAT unintegrated and integrated scores is presented in Table XVIII. Again there were some factors which resembled previously found second-stratum 16PF factors. However, except for the first factor, the matches were not as clear as with the previous analysis. Disregarding factor 3, since B is not a temperament factor, there were only two factors which showed inter-modality loadings. Factor 4 was marked by positive loadings on the superego factor, G, of the 16PF and unintegrated superego factor of the MAT, together with negative loadings on the unintegrated narcissism erg and the unintegrated sweetheart-spouse sentiment. The other cross-modality factor, factor 5, seemed to be a combination of the 16PF second-stratum extraversion factor with the integrated superego MAT factor, together with a negative involvement of the unintegrated career sentiment. The inter-correlations between the Promax factors may be found in Table XIX.

f) Multimethod analysis. - Because of the interest attached to the possibility of cross-modality connections, use was made of technique developed recently by Jackson,²³ designed specifically for looking at relations between different types of measures. The basic idea is that variation due to monomethod or intra-modality relations is eliminated by the substitution of identity matrices prior to factoring. Another difference from the earlier analysis is that 1's instead of squared multiple correlations are placed in the diagonal. Hence, it is what is commonly referred to as a principle "components" (rather than "factor") analysis.^{24,25} A computer program for transforming an ordinary correlation matrix into a multimethod matrix may be found in Appendix 1.

The results of the multimethod analysis with the 16PF and MAT total scores are depicted in Table XX. It may be seen that each of the 10 factors was most highly loaded by a MAT factor. Compared to previous analyses, there were more traces of inter-modality relations.

23 Jackson, D. N. Multimethod factor analysis in the evaluation of convergent and discriminant validity. Psychological Bulletin, 1969, 72, 30-49.

24 Gorsuch, R. I. Factor analysis. Toronto: Saunders, 1974.

25 Mulaik, S. A. The foundations of factor analysis. New York: McGraw-Hill, 1972.

The results of the analysis with MAT integrated and unintegrated scores may be seen in Table XXI. In this analysis there were 16 factors with eigenvalues greater than 1, each of which corresponded to one of the 16PF factors. As with the multimethod analysis with only the MAT total scores, it would appear that, as Jackson suggested, the heteromethod or cross-modality relations seemed to have been blown up so that their form was more readily ascertained.

g) Summary of the first study results.- Since the first study was analysed in quite a variety of ways with rather lengthy descriptions of procedures, it might be well to summarize briefly before going further.

With respect to the null hypotheses formulated in the literature review, the overall results of the study suggest the following:

<u>Null hypothesis #</u>	<u>Variables involved</u>		<u>Rejected</u>
	<u>16PF</u>	<u>MAT</u>	
1	Q3	SSI	no
2	Q3	SSU	no
3	G	SEI	yes
4	G	SEU	yes
5	E	ASI	no
6	E	ASU	no
7	Anxiety	FRI	no
8	Anxiety	FRU	no
9	Anxiety	Conflict	no
10	Q4	Interest	no

The results bearing on hypotheses 1 through 8 are most clearly illustrated in Tables XVIII and XXI. Here it may be seen that the only evidence for cross-modality

relations is with factor 4 of Table XVIII where 16PF-G loads .48 and MAT-SEU loads .69, and with factor 1 of Table XXI where 16PF-G loads .85, SEU .38, and SEI .43.

The results relevant to hypotheses 9 and 10 are depicted in Table XI where it may be seen that the only 16PF factor related to anxiety, factor H, has a value which is opposite in sign to that which was predicted.

Findings which were not predicted, but which were of particular interest, were the highly significant relations found in Table XI between factors M and H of the 16PF and the MAT total conflict measure. More detailed analysis indicated that the result with factor M could be found with both sexes but the factor H result seemed to hold for only males.

Discussion of these results may be found in section 1 of the next chapter which some readers may wish to look at before continuing in the present chapter.

3. Introduction to the second study.

Because of the interesting implications of the results of the preceding study, in particular the finding of a highly significant relation between the 16PF and the motivation component scores of the MAT, a second study was undertaken with the aim of replication, and clarification of the original findings. Some consideration was also given to

the possibility of extending the research into the area of "objective" or "translucent" tests to check upon the possibility of a relation between the total conflict score of the MAT and the test factor U.I. 34. However, it was decided that an attempt should be made to lay a more secure foundation of empirical evidence before advancing to another stage of hypotheses testing.

Thus, the theoretical aims of the second study were the same as that of the first study, with changes being made only with the aim of improving the chances of demonstrating similar relationships. The first improvement was to use a more recent, extensively altered version of the 16PF which had become available during the execution of the initial study. Many items had been added to the new version for the factors showing low factorial validities, one of which, M, was of particular interest in the present context. Another improvement was to use both A and B forms of the 16PF, thus doubling the number of items for each factor. The use of two forms is strongly recommended in the test manual because of the increase in reliability and validity thus obtained. An attempt was also made to obtain a sample which might more closely approximate the general population. Finally, two tests designed by Gordon to measure some of the same factors as the 16PF, but with a self-ipsative scoring system similar to two of the MAT subtests, were included as a check upon

any possible effects upon the results due to the ipsative measurements.^{26,27,28} The rationale for the inclusion of such tests was to see if relations could be observed between an ipsative and non-ipsative test both within the same modality. If relations could be demonstrated, then any lack of relations with an ipsative test in the other modality, would be less reasonably attributed to the method of scoring.

On the basis of the initial study, the following additional null hypotheses were proposed for testing:

11. There is no relation between factor M of the 16PF and the total personal conflict measure of the MAT with males.

12. There is no relation between factor M of the 16PF and the total personal conflict measure of the MAT with females.

13. There is no relation between factor H of the 16PF and the total personal conflict measure of the MAT with males.

14. There is no relation between factor 1 of the initial study and any factor in the follow-up study.

15. There is no relation between factor 2 of the initial study and any factor in the follow-up study.

26 Broverman, D. M. Normative and ipsative measurement in psychology. Psychological Review, 1962, 69, 295-305.

27 Radcliffe, J. A. Some properties of ipsative score matrices. Australian Journal of Psychology, 1963, 6, 1-10.

28 Wright, C. E. A factorial dimension comparison of normative and ipsative measurements. Educational and Psychological Measurement, 1961, 21, 433-444.

16. There is no relation between factor 3 of the initial study and any factor in the follow-up study.

17. There is no relation between factor 4 of the initial study and any factor in the follow-up study.

18. There is no relation between factor 5 of the initial study and any factor in the follow-up study.

19. There is no relation between factor 6 of the initial study and any factor in the follow-up study.

20. There is no relation between factor 7 of the initial study and any factor in the follow-up study.

21. There is no relation between factor 8 of the initial study and any factor in the follow-up study.

22. There is no relation between factor 9 of the initial study and any factor in the follow-up study.

4. Method of the second study.

a) Test material. - The tests used were the MAT, the 16PF, 1967-1968 edition, Forms A and B, the Gordon Personal Profile (GP) and the Gordon Personal Inventory (GI).

Consideration was given to the possibility of using the HSPQ and SMAT which are high school versions of the 16PF and MAT. However, one of the factors of special interest, factor M of the 16PF, is not measured by the HSPQ and the SMAT measures slightly different factors than the MAT. Consequently, it was decided to keep the same measuring instruments as the previous study. The 16PF and MAT have previously been standardized with senior high school as well as college students.

b) Participants. - Involved in the study were 151 senior high school students from a rural area of South-eastern Ontario. Students were asked to volunteer to complete the tests with the understanding that they would obtain feedback about the results. A copy of the feedback to the students may be found in Appendix 2. The students received this information one month after the last testing session. A copy of the computer program written to produce the feedback is listed in Appendix 1. Students were told little about the feedback, only that it "would help them to learn about themselves." The percentage of students who

volunteered was 98%. There were 61 males with a mean age of 17.43 years (S.D. = .72) and 90 females with a mean age of 17.26 years (S.D. = 1.26). It may be seen that the the students were slightly younger, with less variation, than the participants in the initial study.

c) Testing Procedure. - Testing took place on three occasions with one week between sessions. All of the students were tested at the same time in the school cafeteria. However, for practical reasons, due to the expense of test booklets, the students were subdivided into three groups which took the tests in the following orders:

<u>1st day</u>	<u>2nd day</u>	<u>3rd day</u>
MAT	16PFA+GI	16PFB+GP
16PFA+GI	16PFB+GP	MAT
16PFB+GP	MAT	16PFA+GI

Each group was under the supervision of either the investigator of the study or one of the members of the Student Services department of the school. Since each test is self-administrable, there were no difficulties in giving three tests at the same time.

For various reasons, mainly absences and other school activities, 23 of the students could not complete the tests during the regular test sessions. Consequently, these students came back individually at a later date to the Student Services department to complete the tests. However,

the data from these students was not analysed since it had been decided beforehand that only tests from the regular sessions would be considered. The extra sessions were given so that the students would receive feedback based on as many tests as possible.

5. Results of the second study.

As with the first study, because of the extensive nature of the results of the second study, a summary may be found at the end of this section for the reader who might wish to first grasp the essence of the results and then return later for details.

a) General.- The means and standard deviations for both sexes on the 16PF (A+E) are listed in Table XXII. It may be seen that, as with the previous sample, the usual pattern of sex differences is evident (e.g. I,E,A). Factor B was again quite elevated, but since it was an ability factor it is not of primary concern in this study. The means and standard deviation for the MAT are presented in Table XXIII. Here it seemed that there was somewhat of a difference between the present and previous sample on a variable of special interest, the total conflict measure. More careful attention will be given in a later section of this paper to comparisons of the results of both studies.

The inter-correlations among the 16PF factors may be found in Table XXIV. Again, the results were quite concordant with those in the test handbook. The MAT intercorrelations between the total stens, unintegrated, and integrated stens may be found respectively in Tables XXV, XXVI, and XXVII. As had been found previously, these inter-correlations tended to be lower than those for the 16PF, probably because of the self-ipsative nature of two of the MAT subtests.

b) Motivational Components. - Because of the finding of differential sex effects in the previous study, four separate stepwise, multiple linear regression analyses were carried out for both males and females. As before, the independent variables were the 16PF raw scores and the dependent variables were the autism-optimism, general information, total personal interest, and total conflict measures. Just as in the first study, the total integration score and total conflict scores showed an extremely high correlation ($-.90$). Inspection of the method by which each of these scores was calculated, strongly suggested that the correlation was built in by the scoring system. It may be seen that the total integration score was obtained by subtracting the sum of the integrated scores from the sum of the unintegrated scores, i.e. $\text{sum}U - \text{sum}I$. The total conflict score is obtained by summing the differences of the

individual integrated and unintegrated scores, i.e. sum U-I. Hence, if the transformation to stens had been linear, a correlation of -1.00 would be expected, and thus, only the conflict measure was included in subsequent analyses. The results of the regression analyses for the females are given in Table XXVIII. With the females, there was some indication of a relation between the MAT autism-optimism score and factor H of the 16PF. As expected, there was also a clear suggestion of a relation between the MAT total information score and the B factor of the 16PF with some possible involvement of factors C and Q4 as well. With the total personal interest measure of the MAT, factor F showed a strong tendency towards a relationship, together with a possible additional connection with factor C. As for the MAT total conflict score, there was a hint of a relation with factor Q2.

The results of the regression analyses with the males are listed in Table XXIX. In this table the following relations were suggested:

<u>MAT</u>	<u>16PF</u>
Autism-optimism	G,O,C,F
Information	M,B
Interest	B

c) Dynamic structure.- The correlation matrices of the 16PF and the MAT, U, I and T scores are, respectively, in Tables XXX, XXXI, and XXXII. The same factor analytic procedures used in the initial study were employed in the analyses of the high school data. Factor analyses were done separately for the 16PF - MAT Total scores and the 16PF - MAT U+I scores. The eigenvalues were plotted in Figure 3, where it may be discerned that the scree test indicated nine factors for the U+I analyses and ten factors for the total score analyses. Since nine factors had been indicated in both of the corresponding previous analyses, in order to facilitate later attempts at factor matching, nine factors were extracted in both the U+I and Total analyses. The primary factor pattern matrices from these analyses are set forth in Tables XXXIII and XXXVI, while the inter-correlations between the Prcmax factors are listed in Tables XXXIV and XXXV.

As in the initial study, in both analyses, there was an apparent replication of some of the 16PF second-stratum patterns with the anxiety factor again being prominent as the first factor. With respect to the cross-modality connections upon which attention has been focussed, there were no factors in the MAT total score analyses which showed substantial loadings on both the 16PF and MAT. In the

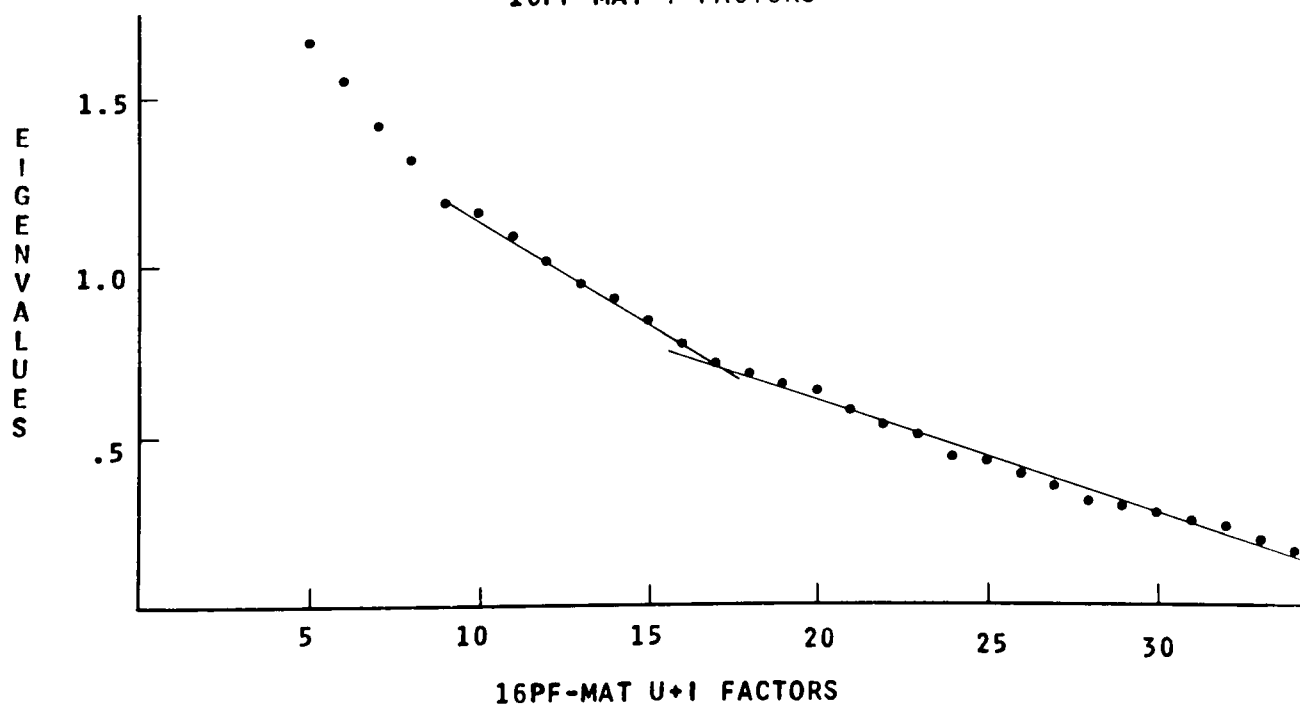
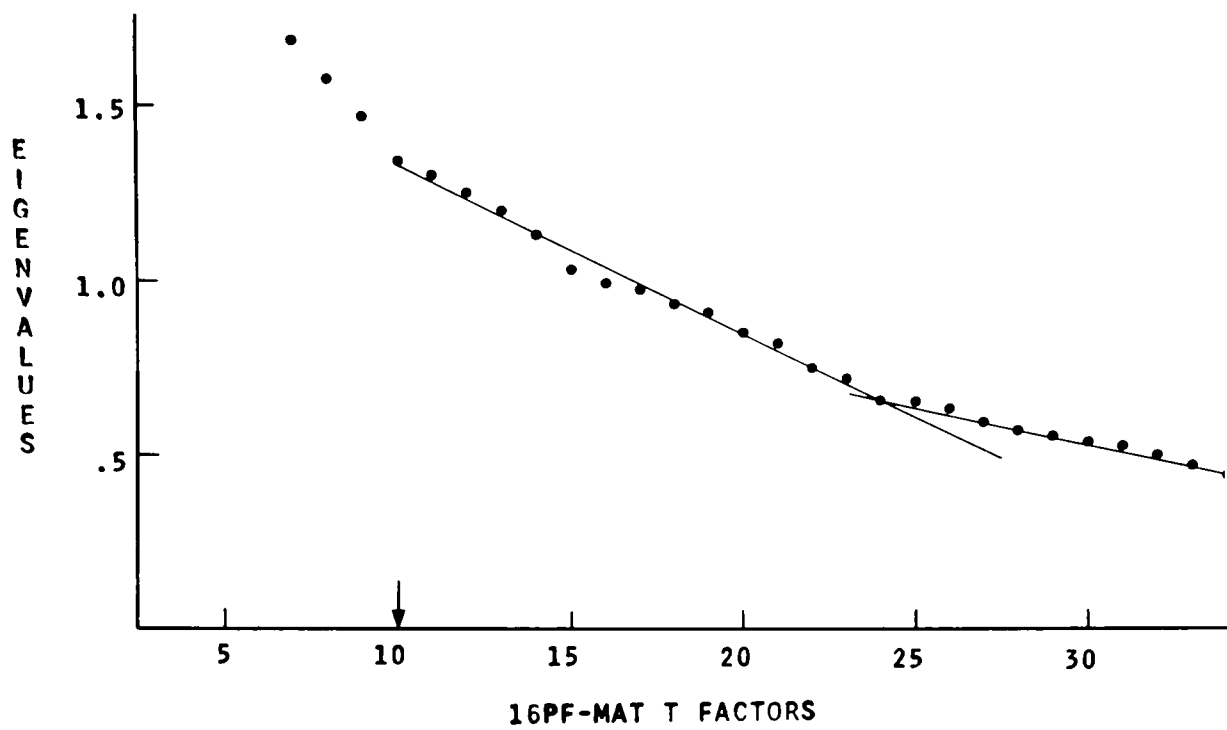


Figure 3. Second study eigenvalue plots.

analyses with the I and U portions of the MAT considered separately, only one factor ,3, had substantial loadings on both tests. The 16PF factors E, I, L, and Q1 resembled the second-stratum independence factor, while the MAT portion was composed of the FGU, HOI, PGI, and SWI factors.

In an effort to separate out, in a more refined manner, any cross-modality relations, multi-method analyses were again carried out with the same variables as in the preceding analyses. These results are depicted in Tables XXXVII and XXXVIII. As before, 10 and 16 components were indicated by the eigenvalue less-than-one rule, with each component being dominated by either one of the MAT or 16PF factors. In contrast to the Promax results, cross-modality loadings abounded.

d) Gordon - 16PF results.- Because of a lack of testing time, only 127 students completed the GP and both forms of the 16PF. Similarly, 133 students completed both the GI and both 16PF forms. The means, standard deviations, and inter-correlations for the two Gordon tests may be found in Table XXXIX. The correlations between the Gordon tests and the 16PF may be found in Table XI, where it can be observed that there were a number of substantial correlations. As a means of ascertaining the overall extent of the relationship between the two tests, 24 multiple regression analyses were performed first using the 16 primary factors of the 16PF as

independent variables to predict the eight Gordon scales and then the procedure was reversed. The squared multiple r 's and F values are given in Table XII. In Table XII, it may be noted that the 16PF was able to predict all of the Gordon scales, at better than the .001 level of significance. The ascendancy and sociability scores were the most readily predicted of the Gordon subscales. It may also be observed in Table XII that with the exception of the ability measure (B), all factors of the 16PF were somewhat predictable from the Gordon scales, particularly factor H. These analyses also resulted in the calculation of beta weights which, upon cross-validation with a large sample, might be used to estimate scores from one test given the results of the other test. This information is given in Tables XLII and XLIII.

e) Summary of the second study results.- With respect to the null hypotheses formulated in the literature review, and tested in the first study, the overall results suggest:

<u>Null hypothesis #</u>	<u>Variables involved</u>		<u>Rejected</u>
	<u>16PF</u>	<u>MAT</u>	
1	Q3	SSI	no
2	Q3	SSU	no
3	G	SEI	yes
4	G	SEU	yes
5	E	ASI	no
6	E	ASU	no
7	Anxiety	FRI	no
8	Anxiety	FRU	no
9	Anxiety	Conflict	no
10	Q4	Interest	no

The results bearing on hypotheses 1 through 8 are most clearly illustrated in Tables XXXVI and XXXVIII. As in the first study, the only suggestion of predicted cross-modality relations was with the superego factors of the 16PF and MAT. In Table XXXVI, factor 8 loads 16PF-G .41 and MAT-SEI .44 suggesting mutual involvement. In Table XXXVIII, factor 2 loaded 16PF-G .86 and MAT-SEU .30 thus giving an indication of a possible connection.

The results relevant to hypotheses 9 and 10 are given in Tables XXVIII and XXIX where it may be seen that, none of the 16PF primaries involved in the second stratum anxiety factor, C,H,C,Q3, or Q4, were related to the MAT total conflict score.

The results pertaining to the first three hypotheses added for the second study were as follows:

<u>Hypothesis #</u>	<u>Variables involved</u>	<u>Rejected</u>
11	16PF-M MAT-Conflict (males)	no
12	16PF-M MAT-Conflict (females)	no
13	16PF-H MAT-Conflict (males)	no

This information was taken from Tables XXXVIII and XXIX.

Hypotheses 14 to 22 refer to comparisons of both studies and are dealt with in the next section of the present chapter.

The results dealing with the 16 PF and Gordon tests are set forth in Table XL where a correlation of .23 is significant at the .01 level. In this table it may also be seen that there were a number of other significant relations between the Gordon and 16PF. The best summary of the overall degree of relationship may be found in Table XLI.

Discussion of the results of the second study may be found in section 2 of the next chapter.

6. Comparison of the two studies.

With the aim of assisting in the interpretation of the results of the entire investigation a number of additional analyses were carried out in which the results of the two separate studies were compared. The first type of analysis was a comparison of the factor loadings of each factor of all eight factor analyses involving the 16PF and MAT dynamic structure factors. Three somewhat different approaches to this sort of comparison have been proposed in

the past:²⁹

- 1) the salient variable method
- 2) the configurative matching method
- 3) the congruence coefficient.

All three methods were attempted but problems were encountered with the writing of programs for the first two methods (A program for the congruence coefficient may be found in Appendix 1). The congruence coefficients for the:

16PF - MAT TOTAL score factor analysis
 16PF - MAT U + I score factor analysis
 16PF - MAT TOTAL score multimethod analysis
 16PF - MAT U + I score multimethod analysis

may be respectively found in Tables XLIV, XLV, XLVI, and XLVII.

a) MAT total score factor analysis.- With the two MAT total score analyses, it may be seen that there were suggestions of matches between the following factors:

First study factor	Second study factor	congruence coefficient	Cattell- Nichols	Name
1	1	-.91	2	Anxiety
2	3	.82	1	Exvia
3	5	.56	3	Pathemia
4	6	.51		
8	4	.83	8	Superego

Comparison with the Cattell-Nichols study reported earlier in Table XXII, indicates that four of the five matching

²⁹ Cattell, R. B., Balcar, K. R., Horn, J. L., & Nesselroade, J. R. Factor matching procedures: An improvement of the s index; with tables. Educational and Psychological Measurement, 1969, 29, 781-792.

factors are recognizable as 16PF second-stratum factors with little MAT involvement. The 16PF anxiety pattern was very much in evidence but in neither study were there any MAT loadings. A similar situation prevailed with the invia-exvia and second-stratum superego factors. However, with what appears to be the second-stratum pathemia-cortertia factor, there was a low but consistent loading of the MAT self-sentiment measure. The remaining match looks like a factor centered upon the home-parental sentiment of the MAT with some suggestion of MAT superego and 16PF self-sufficiency included as well.

b) MAT U+I factor analysis.- The matches between factors based on the MAT U+I scores were not as good as those with the MAT total scores. Again, the 16PF anxiety factor stood out, but the rest of the factors gave rather ambiguous results.

c) MAT total score multimethod.- The best match from the multimethod analyses with the MAT total scores was between factor 5 of the first study and factor 1 of the second study. In this case the mating erg of the MAT and factor F of the 16PF had loadings in both studies.

d) MAT U+I multimethod.- As with the MAT total score multimethod matching, the U+I analyses also resulted in the best evidence of a match between the 16PF factor F and the mating erg in both its integrated and unintegrated

forms, with somewhat more emphasis upon the unintegrated. The next best match was between two factors (1&2) whose core was the 16PF superego factor (G), with apparent satellite connections of a negative nature with the MAT narcissism erg and some positive MAT superego participation. Upon close scrutiny the rest of the congruence coefficients do not appear to reflect any inter-modality consistencies.

Multiple t test comparisons were made between the means of the two samples for the 16PF and MAT scores. These results are illustrated in Table XLVIII.

e) Summary of the study comparisons.- The main finding of the two studies was that there was much more consistent evidence of matching for factors based solely on the 16PF, than either factors restricted to the MAT or for factors including both tests. These 16PF factors were recognizable as the same second stratum factors which have been found in a number of other studies.

The between modality factors showing evidence of matching were as follows:

First study	Second study	Variables	
<u>factor #</u>	<u>factor #</u>	<u>16PF</u>	<u>MAT</u>
3	5	I	SST
(Table XV)	(Table XXXIII)	A	
		M	
4	6	Q2	HOT
(Table XV)	(Table XXXIII)		SET
5	1	F	MAU
(Table XXI)	(Table XXXVIII)		MAI

CHAPTER III

INTERPRETATION OF FINDINGS

1. Discussion of first study results.

a) Motivational components. - The highly significant relation between factor M of the 16PF and the MAT total conflict score was surprising for a number of reasons. First, M is a factor of small variance which has been particularly difficult to measure compared to most of the other 16PF factors. It has not in fact been possible to isolate a questionnaire pattern resembling factor M at the highschool or child level, although a factor has been interpreted as being M at the child level in work with behaviour ratings by teachers and parents.^{1,2,3,4}

1 Cattell, R. B., & Coan, R. W. Personality factors in middle childhood as revealed in parents' ratings. Child Development, 1957a, 28, 439-458.

2 Cattell, R. B., & Coan, R. W. Child personality structure as revealed in teachers' behavior ratings. Journal of Clinical Psychology, 1957b, 13, 315-327.

3 Digman, J. M. The structure of child personality as seen in behavior ratings. In R. M. Dreger, (Ed.), Multivariate Personality Research. Baton Rouge: Claitor's Publishing, 1972.

4 Peterson, D. R., & Cattell, R. B. Personality factor s in nursery school childred as derived from parent ratings. Journal of Clinical Psychology, 1958, 14, 346-355.

Factor M has exhibited adequate reliability in the form of stability and dependability coefficients,⁵ but in a recent study, using the same edition of the 16PF as in the present experiment, the factorial validities of the first four equivalent forms of the test were only .32, .27, .02 and .18.⁶ In contrast, the corresponding loadings for factor H were .69, .91, .63 and .81. In the most recent edition of the 16PF the factorial validities have been improved, but it still may be seen that factor M is considerably lower than most of the other scales.⁷ Yet even with the improved version of the factor M scale, the equivalence coefficient between the A and B forms was only .40 as compared to .71 for factor H. If the correlation of the factor M scale of form A with another scale specifically designed to measure the same factor is only .40 then relations with other variables would not be expected to be readily demonstrable. This is especially the case with a

5 Cattell, R. B. Beyond validity and reliability: some further concepts and coefficients for evaluating tests. Journal of Experimental Education, 33, 133-143, 1964.

6 Cattell, R. B., Eber, H. W. & Delhees, K. H. A large sample cross validation of the personality trait structure of the 16PF with some clinical implications. Multivariate Behavioral Research, 1968, Special Issue, 107-131.

7 Cattell, Eber and Tatsucka, op. cit., p. 35.

variable such as the conflict measure of the MAT. The total conflict score is obtained by first changing all 40 raw scores of the MAT subtests into stens, then transforming each integrated sten score and its corresponding unintegrated sten score into another "conflict" sten for each of the 10 MAT factors, and then adding up all of the conflict stens to obtain a total score. Hence, the total conflict score would seem to cover a fairly broad area and would thus not be expected to relate to a small factor such as factor M. It has in fact been tentatively suggested by Cattell^{8,9} that the total conflict measure would show an association with the broad second-stratum anxiety factor.

However, while factor M is smaller and not as well measured as other questionnaire factors it has shown enough relations to non-questionnaire criteria to make interpretative hypotheses possible. Persons scoring high on factor M appear to have an "intense subjectivity and inner mental life" which is presently hypothesized to be due to "a temperamental, partly constitutional capacity to dissociate ideational systems and memories."¹⁰ Factor M has been found to be the best factor in differentiating between more and

8 Cattell, 1966, op. cit.

9 Cattell, 1971b, op. cit.

10 Cattell, Eber and Tatsuoka, op. cit., p. 98.

less creative artists, writers, and scientific researchers.^{11,12,13} Cross et. al. in fact conclude that M is "perhaps the 'creativity' factor par excellence." High M scorers have been found to be more interested in artistic pursuits.¹⁴ There is some evidence of high M being characteristic of narcotic addicts.¹⁵ Automobile accidents have been reported as being more frequent with high M scorers.¹⁶ In addition, although M apparently does not differentiate psychotics as a general group from normals, high M does tend to be higher among the diagnostic sub

11 Drevdahl, J. E., & Cattell, R. B. Personality and creativity in artists and writers. Journal of Clinical Psychology, 1958, 14, 107-111.

12 Cross, F. G., Cattell, R. B., & Butcher, H. J. The personality pattern of creative artists. British Journal of Educational Psychology, 1967, 37, 292-299.

13 Csikszentmihalyi, M., & Getzels, J. W. The personality of young artists: An empirical and theoretical exploration. British Journal of Psychology, 1973, 64, 91-104.

14 Williams, J. D., & Williams, C. M. Canonical analysis of the vocational preference inventory and the sixteen personality factor questionnaire. Psychological Reports, 1973, 32, 211-214.

15 Cattell, R. B., & Cattell, M. D. Handbook for the Jr. Sr. High School Personality Questionnaire Champaign, Ill.: Institute for Personality and Ability Testing, 1969.

16 Suhr, V. Personality and driving efficiency. Perceptual and Motor Skills, 1961, 12, 34.

category of schizo-affectives than among other groups.¹⁷

The other 16PF factor showing a relation to the total conflict measure of the MAT was factor H. It has been found to be a strongly defined factor which is thought to represent "some largely constitutional factor of low susceptibility to threat."¹⁸ It has consistently loaded on the second-stratum anxiety factor which as mentioned previously has been suspected of being possibly related to the total conflict score of the MAT. However the direction of the relation found in the present study was opposite to that which was expected. A much more detailed description of both factors M and H may be found in Cattell.^{19,20}

Upon looking into the literature on factor M it was noticed that there have been two previous reports of a relation with factor U.I. 34 in the objective-test medium.²¹ Such a discovery raises the interesting question of a possible relation between U.I. 34 and the MAT total conflict score which would constitute another connection between the temperament and motivation modalities.

17 Cattell, et. al., 1968, op. cit.

18 Cattell, Eber and Tatsuka, op. cit.

19 Cattell, 1957, op. cit.

20 Cattell, Eber and Tatsuka, op. cit.

21 Hundleby, et. al., op. cit.

b) Dynamic structure.- One of the most noteworthy features of the dynamic structure analysis was that the variations within modalities was such that it tended to over-shadow between modality variance. It was in fact necessary to employ a technique for reducing intra-modality influences before very much evidence of cross-connections could be observed. With respect to the specific hypotheses developed from past research, there was some suggestion of a relation between the superego factors of each modality; however, it did not appear that the connection was strong enough to warrant any conclusions of identity. There was some inkling of joint variation of the 16PF dominance factor and the MAT integrated assertiveness factor, but it was difficult to detect with any degree of accuracy. With respect to the possibility of a close correspondence between the self factors of the two modalities, the evidence is clearly of a negative nature. The same may be said for any possible concurrency of the MAT fear erg and the 16PF second-stratum anxiety factor. Nowhere in the results was there any trace of the clearly defined anxiety factor having relations with any of the MAT factors.

Analysis of the within modality relations resulted in the replication of most of the major 16PF second-stratum factors which suggested that the procedures used did not go seriously awry. The factors which were restricted to only

the MAT domain, have received little attention in the past so similar comparisons are not possible. But it can be ascertained that there were no strong tendencies for factors to form on the basis of either the integrated-unintegrated or erg-sentiment categorizations.

2. Discussion of the second study results.

a) Motivational components.- One of the most noteworthy findings of the 16PF-MAT components, regression analyses was with the MAT autism scale for males. With the males a large percentage of the autism variation (43%) could be accounted for by the 16PF factors G, O, C, and F. Since the autism factor (M) of the 16PF was not involved, the question of the suitability of the name "autism" in both the 16PF and MAT arose. In addition, because four 16PF factors were implicated, and the same results were not found with females, it would appear that this measure is more complicated than had been previously supposed.

The female results contain some evidence of a relation between the MAT total interest scale and factors F and C of the 16PF. Such a finding makes good clinical sense in that persons described as more enthusiastic and emotionally stable would be expected to have a greater amount of total interest strength. It is perhaps worth noting that factors F and C have been found to be

consistently low in a wide variety of psychological disorders which fits with a tendency toward less total strength of interest.

b) Dynamic structure.- The one factor showing cross-modality connections in the Procmax analysis with the 16PF and dynamic structure factors was comprised of elements which presented a readily interpretable pattern of loadings. On the MAT side this factor was heavily weighted by the pugnacity erg, with contributions from both the unintegrated and integrated modes of manifestation. The 16PF involvement consisted of a negative relation with a trait whose essential nature is embodied in the acronym "premsia" for "projected emotional sensitivity" which is sometimes described as a Proust versus Pizarro type of factor, similar to William James' concept of tender versus tough-minded. As the factor name suggests, tender-minded and pugnacious would hardly seem to be a particularly plausible combination. Similarly, a positive loading by the dominance factor ,E, of the 16PF, which sometimes takes the form of aggressiveness, fits well with clinical expectations regarding pugnacity. The negative loadings on the integrated home-parental and unintegrated sweetheart-spouse sentiment of the MAT might perhaps be taken as giving some suggestion as to the possible origins of this pattern, although tracing the path

of causality requires other than the available cross-sectional information.

The results of the multimethod analyses were so copious that it seemed best to look closely at only the factors of prime concern, namely the self-sentiment, superego and dominance factors. In so doing it was apparent that there was clearly no support for the hypothesized identity of the three types of factors from the MAT and 16PF. In fact, only with the superego factors was there an indication of similarity.

c) 16PF-Gordon.- Since the Gordon tests consist of ipsative measures, the overlap found between the 16PF and Gordon tests tends to negate the possibility of the low degree of correspondence between the 16PF and MAT being due to the ipsative scoring of two of the MAT subtests. The more general implications of the 16PF-Gordon results are discussed in subsection f) of the next section in this chapter.

3. Discussion of the combined results.

a) Motivation components.- Looking first at the original hypothesis of a connection between the total personal conflict measure of the MAT and the second-stratum anxiety factor of the 16PF, it can only be concluded that the tenability of a relation has been substantially reduced.

Similarly, the original suggestion of a relation between the ergic tension level factor (Q4) of the 16PF and the total personal interest measure of the MAT, did not receive any support in either of the two studies. As for the additional hypotheses generated on the basis of the first study, the outcome was also one of a lack of confirmation.

However, there were some results which, although not explicitly predicted, did show up in both studies at a level of probability not easily attributed to the operation of chance alone. Factors G and C of the 16PF did show a significant relation in both regression analyses with the autism device score. The fact that four other factors also showed a tendency to be related in one or the other of the two studies would suggest that this device may be tapping psychological processes of a similar nature to those measured by general personality questionnaires. In addition, the relation with four different 16PF factors, not resembling any known second-stratum pattern, gives the impression of multidimensionality.

Another consistent result, was the high correlation between two scales of the MAT which are presented in the test manual as measuring separate entities, the total conflict and total integration measures. Instead, it would appear that only one measure need actually be calculated.

b) Dynamic structure.- As with the motivational component results, the evidence concerning the original hypotheses with respect to the dynamic structure factors of the MAT are of a generally non-supportive nature. The self-sentiment factors of both tests did not show any inclination toward regular covariation. Since this is the largest factor of the MAT in terms of the number of items included in the test (almost double the number of the other factors with the exception of the superego), and since the 16PF factor has not shown fidelity of measurement problems, this finding is not easily attributed to test deficiencies. Also, since two quite different, but not particularly abnormal, samples of people were studied, an explanation in terms of the type of persons studied does not contain an abundance of plausibility.

Another hypothesized relation, between the fear erg of the MAT and the anxiety factor of the 16PF, also did not make an appearance. The assertiveness erg showed some degree of correspondence with the dominance factor of the 16PF, but only in one study, at a level of significance explainable in terms of chance due to the relatively large number of relations being studied. Only the superego factors in both modalities showed a noticeable amount of concomitance. Even so, the degree of resemblance is such that one can only concur with the conclusion reached by

Gorsuch²² in an intensive study of the superego domain, that "superego is probably best viewed from a multidimensional approach."

With respect to other relations besides those prognosticated, only two findings emerged with a degree of consistency to warrant honourable mention. The possibility of a connection between the MAT self-sentiment and the second-stratum, pathemia versus cortertia factor is an interesting one worthy of future investigation. One might venture the speculation that a strong self-sentiment mitigates against the moods of frustration and depression considered to be characteristic of persons scoring low on the pathemia factor. The other finding of noticeable reproducibility was a tendency toward mutual variation with the MAT mating erg and the 16PF surgency (F) factor. Because of the excellent fidelity of measurement possible with factor F and the recent demonstration of feasible methods of manipulating the mating, or sex, erg,²³ more precise formulations of the nature of any relationships could be investigated.

22 Gorsuch, R. I. The clarification of some superego factors. Unpublished doctoral dissertation. University of Illinois, 1967.

23 Cattell, et. al., 1972, op. cit.

4. General discussion.

In view of the findings of the two studies just described, it is clear that it is possible to demonstrate relations between and within personality trait modalities which reach a high degree of statistical significance. However, as some recent writers have observed,^{24,25,26} attention should ultimately be drawn to the question of the "importance" of the statistical significance. Two indices of "importance" which appear to merit some consideration are the size of the relations and their replicability. With respect to the relations for which statistical evidence was found, it may readily be seen that the relations within modalities were consistently larger and more replicable than those between modalities. It is therefore tempting to conclude that within modality relations are more important than between modality relations. There are, however, a number of other possibilities which should be entertained.

24 Bakan, I. On method: Toward a reconstruction of psychological investigation. San Francisco: Jossey-Bass, 1967.

25 Cohen, J. Some statistical issues in psychological research. In B. B. Wolman, (ed.), Handbook of Clinical Psychology. New York: McGraw-Hill, 1966.

26 Friedman, H. Magnitude of experimental effect and a table for its rapid calculation. Psychological Bulletin, 1968, 70, 245-251.

a) Test characteristics.- It may be that there are strong and important relations between trait modalities but the tests used suffered from some inadequacies which obviated the discovery of the existing relations. Since the 16PF predates the MAT by a dozen years, and has undergone three extensive revisions, while the MAT is still in its relative infancy, it seems most reasonable to look toward the MAT as perhaps being the weaker link in the psychometric chain. As indicated in the test manuals, the test-retest coefficients of the MAT are substantially lower than those of the 16PF. However, it should be mentioned that the lower test-retest coefficients of the MAT are quite likely not solely due to the features of the test itself. There does seem to be some justification for believing that the nature of the traits measured by the MAT are more prone to "function fluctuation" than are general personality traits.²⁷ Hence, the MAT traits may simply be harder to measure. Perhaps recent developments in the separation of state and trait variance will be of assistance in bringing

27 Cattell, 1957, op. cit.

about better understanding of this issue.²⁸ For example, state measures of the 16PF factors, which are just now becoming possible, may hold more promise of showing relations with dynamic traits.

Meanwhile, one way of checking upon the quality of measurement attained by the measures used in the present study would be to examine the predictive ability of the tests with respect to some criteria. If it were found that the tests serve as good predictors, then the modest evidence for between modality relations which has been found could less reasonably be attributed to shortcomings of the tests. Perhaps the best type of criteria would be scholastic performance since this area has been well explored in the past.²⁹

b) Participant idiosyncrasy.- Another consideration, bearing more on relative replicability than size of relations, is the possibility that, with one of the samples

28 Nesselrcade, J. R., & Bartsch, T. W. Multivariate experimental perspectives on the construct validity of the trait-state distinction. In R. B. Cattell & R. M. Dreger, (Ed.), Handbook of modern personality theory. New York: Appleton Century Crofts, 1974.

29 Cooper, M. Cattell's personality factors as predictors of high school performance. Ph.D. Thesis, University of Ottawa, 1972.

studied, some general relations were actually found but could not be reproduced because of differences due to the unusual nature of the other sample. One might wonder about the representativeness of a sample of students coming to the student counselling services. Although the comparisons made between the samples indicated little to suggest that one sample was any less "normal" than the other, there were definite differences between the samples which quite likely influenced attempts to measure factor invariance. The fact that the 16PF second-stratum factors showed a fair degree of matching must be tempered by the somewhat greater differences between the samples on the MAT factors.

Again there is hope that some recent advances in factor analytic methodology may provide some solutions to problems of this sort. Real-base true-zero factor analysis which moves the level of analysis from the correlation matrix to the covariance matrix may be appropriately applied to problems of this type.³⁰ This type of analysis makes it possible for differences in sample means and standard deviations to be taken into consideration.

c) Media perturbation.- An additional possible influencing factor which was only briefly alluded to in the

³⁰ Cattell, R. B. Real base true zero factor analysis. Multivariate Behavioral Research, 1972, 72-1.

introduction, was the chance that differences in media of measurement as well as differences in modality were operating to obscure relations.³¹ However, although there does not seem to be a sharp demarcation between self-report and objective test data,³² Cattell has always considered the MAT as belonging more to the objective test media of measurement. As noted earlier, investigators have sometimes had difficulty in finding evidence for cross-media matching of factors. Hundleby³³ has even reported a low degree of correspondence for U. I. 24 and the questionnaire anxiety factor which had previously shown the most promise of convergence. On the other hand, Cattell³⁴ has reported results of a more positive nature. Again, the apparent solution is in the form of increased methodological sophistication, which leads to the next topic.

d) Methodological precision.- Although considerable effort was exerted in an effort to achieve a high degree of methodological precision, it must be admitted that, had time allowed, a more satisfactory rotational position could

31 Cattell and Digman, op. cit.

32 Hundleby, 1973a, op. cit.

33 Hundleby, J. D. Personality constructs and adjustment in the middle-childhood years. Guelph: University of Guelph, 1973b.

34 Cattell, 1973b, op. cit.

probably have been reached. With two fruitless attempts at an increase in the hyperplane count using Rotoplot, the Promax solution was accepted. Subsequently it was learned that there is often a groping period even with experienced rotators.³⁵ At least it is now known that very sensitive techniques are necessary in this area and future researchers may take this into consideration when budgeting their time.

e) Separate space.- While each of the preceding explanations has some merit, it would seem that the most reasonable possibility is that Cattell³⁶ was right in his contention of abilities, motivation, and temperament occupying separate domains.

Early studies directed specifically toward this issue were successful in demonstrating independent contributions of the ability and temperament-stylistic tests to the prediction of academic achievement.³⁷ Yet, as Radcliffe³⁸ has indicated, the motivation results were not as good as expected. More recent findings, however, have

35 Ibid.

36 Cattell, 1946, op. cit.

37 Cattell, R. B., & Butcher, H. J. The prediction of achievement and creativity. New York: Bobbs-Merrill, 1968.

38 Radcliffe, 1972, op. cit.

tended to confirm that school achievement is best predicted by a combination of all three modality measures.^{39,40} The indication from this research is that the ability, motivation, and temperament modalities each can separately account for as much as 20-25% of the achievement variation, to give a total of 60-75% accounted-for-variation. In addition, a longitudinal follow-up study with motivation measures, reports results which indicate the appropriateness of the earlier findings.⁴¹ Thus, it would seem that future research might advantageously be aimed at extension into areas other than school achievement, to check upon the generality of predictive gains through the use of tests from three modalities.

Another suggestion for further research stemming from the present finding of little overlap between the 16PF and MAT, concerns other tests designed to measure needs or interests. In the literature review it was mentioned that

39 Cattell, et. al., 1972, op. cit.

40 Dielman, et. al., 1971, op. cit.

41 Bartsch, T. W., Barton, K., & Cattell, R. B. A repeated measures investigation of the relation of the school motivation analysis test to academic achievement. Psychological Reports, 1973, 33, 743-748.

Nesselroade and Baltes⁴² have found evidence of significant overlap between the high school version of the 16PF and Jackson's PRF. Such a finding is consistent with other results in which it has been found that (1) the PRF and one of Edward's tests (the EPPS) show considerable congruence,⁴³ which is not surprising since they were both designed to measure Murray's needs, and, (2) the 16PF and EPPS exhibit significant correspondence.⁴⁴ In view of such findings, Cattell⁴⁵ has suggested that the Jackson test may have missed its theoretical objective of covering interests. In rebuttal, Jackson would probably cite an earlier finding of relations between the PRF and the Strong Vocational Interest Blank (SVIB).⁴⁶ Cattell's reply would quite likely be that the SVIB is also not going far beyond that which is

42 Nesselroade and Baltes, op. cit.

43 Edwards, A. L., Abbott, R. D., & Klockars, A. J. A factor analysis of the EPPS and PRF personalities. Educational and Psychological Measurement, 1972, 32, 23-29.

44 Edwards, A. L., & Abbott, R. D. Relationships between the EPI scales and the 16PF, CPI, and EPPS scales. Educational and Psychological Measurement, 1973, 33, 231-238.

45 Cattell, 1973b, op. cit., p. 121.

46 Siess, T. F., & Jackson, D. N. Vocational interests and personality: An empirical integration. Journal of Counseling Psychology, 1970, 17, 27-35.

measured by most temperament-stylistic questionnaires.⁴⁷

Hence, it would seem that some empirical light might well be focused on this matter. A study of relations between the MAT and PRF would appear to be particularly appropriate. Another interesting analysis would be between the MAT and the SVIB.

f) Within modality relations.- As pointed out in the introduction, one of the general aims of the present research was to contribute to the building of an atlas of relations between different personality tests currently available. The finding of some degree of correspondence between the 16PF and Gordon scales is of interest for a number of reasons. First, it may be possible to someday translate readily from one test to the other via the same regression approach that has been suggested with the 16PF-Guilford and 16PF-MMPI tests.⁴⁸ Hence, if one already has data with the Gordon scales (as at the University of Ottawa with about 7,000 cases having been accumulated over the past few years) and wishes, for example, to select extreme groups on the introversion-extraversion dimension, use can be made of the knowledge of a 16PF connection. Since it has also been

47 Cattell, 1973b, op. cit., p. 443.

48 Cattell, Eber and Tatsuoka, op. cit.

reasonably well established that the Eysenckian and Cattellian measures of introversion - extraversion are tapping the same dimension^{49,50,51,52,53} one could further extrapolate to an Eysenckian frame of reference, with the necessity of course, of checking the extreme groups on Eysenck's test after selecting the groups.

More generally, the finding of 16PF-Gordon communality, is yet another indication that questionnaire measures may well be approaching asymptote with respect to how much can be measured with this type of approach. In addition to the Eysenck-Cattell-Jackson-Edwards-Guilford-MMPI overlaps already mentioned, there is recent evidence of other concurrent relations.^{54,55,56}

49 Adcock, C. J. A comparison of the concepts of Eysenck and Cattell. British Journal of Educational Psychology, 1965, 35, 90-97.

50 Edwards, et. al., 1972, op. cit.

51 Eysenck, H. J., & Eysenck, S. G. B. Personality structure and measurement. London: Routledge and Kegan Paul, 1969.

52 Sells, et. al., 1968, op. cit.

53 Hundleby and Connor, op. cit.

54 Aberman, H. M., & Chansky, N. Factor analysis of two personality tests with differing conceptual frameworks. Psychological Reports, 1973, 27, 475-480.

55 Comrey and Duffy, op. cit.

56 Williams and Williams, op. cit.

Perhaps it would therefore be advisable for much more attention to now be focused upon the objective or translucent test approach. Cattell^{57,58} has long contended that psychologists have leaned too much on the questionnaire method. Similarly, Damarin⁵⁹ has emphasized the "strategic importance" of objective tests.

g) Beyond personality.- As well as giving thought to an extension of personality measures, it also seems appropriate that some effort be made to look at issues transcending the bounds of traditional personality measurement. Bowers⁶⁰ has recently engaged in a penetrating discussion of how personality theorists, being reluctant to consider variables other than those of an organismic nature, have provoked a type of situational "backlash" which has resulted in a relative neglect of the person. Bowers calls for a more balanced approach in which the person, the situation, and, in particular, the interaction between these two basic psychological variables, are given their due recognition.

57 Cattell, R. B. A guide to mental testing. London: London University Press, 1936.

58 Cattell, 1973b, op. cit.

59 Damarin, op. cit.

60 Bowers, K. S. Situationalism in psychology: An analysis and a critique. Psychological Review, 1973, 80, 307-336.

SUMMARY AND CONCLUSIONS

In the review of the literature it was noted that, while many different measures of personality are currently available, knowledge about possible inter-relations has not kept abreast with test development. Such knowledge is not only particularly vital to the practising psychologist who must select suitable tests for everyday use, it is also essential for guiding theory development. The present investigation was primarily concerned with instruments issuing from the work of R. B. Cattell, who has been involved in one of the more comprehensive programs of research with psychological tests since the early 1930's. Examination of Cattell's writing revealed that a major information gap could be found with respect to relations between the modalities of temperament, or general personality traits, and motivational measures. Previous preliminary reports of research results indicated some of the more likely points of intersection between tests in each domain, making it possible to advance some specific hypotheses for testing.

In general, with regard to between modality relations, there was little evidence to support any of the hypotheses derived on the basis of previous research. It must be concluded that the self-sentiment factors which may be obtained from the MAT and 16PF do not show the expected

tendency to converge at either the primary or second-stratum levels. The same may be said for assertiveness-dominance, fear-anxiety, and total conflict-anxiety relations which were originally posited. The results with the superego factors were more suggestive of a connection, but the plausibility of identity must be considered as having been substantially reduced. It would seem that superego phenomena are best considered multidimensional in nature.

Although a number of alternative explanations were entertained, e.g. test characteristics, participant idiosyncrasy, media perturbation, and methodological precision, it seemed most reasonable to conclude that the time-honoured separation of psychological phenomena into distinct areas of temperament, or general personality traits, and motivational, or dynamic factors, is not without empirical support. Hence, future research might well be guided by the dictum "heed ye the wisdom of the ancients."

In particular, further studies aimed at more precisely identifying which types of criteria are best predicted by each modality, appear to be worthwhile. Until now, studies aimed at comparing the predictive utility of the modality distinction have been concerned almost exclusively with academic achievement. Extension into other areas would also shed more light upon the as yet little understood question of why human personality appears to be

organized into relatively separate modalities. Perhaps the most satisfying answers to such questions will come from longitudinal studies with children investigating developmental processes.

In the other major area of this investigation, within modality relations, the results were such that a number of conclusions seem possible. For instance, it was evident that the second order factors from the dynamic modality were not readily matched from one study to another. On the other hand, the equivalent factors in the temperament modality were quite easily identified. In addition, within the temperament modality, it was apparent that some communality exists between the three different tests used in the study. Consequently, knowledge of the existence of these relationships may have useful ramifications for future research, for example, in a situation where a translation from one test to another is desired. Similarly, the applied psychologist might use this information in order to avoid spending valuable testing time collecting redundant information. However, cross-validation with a much larger and more representative sample in a variety of testing situations should be attempted before actual, practical use of these results can be made.

Cattell, R. E. Description and measurement of personality. New York: World Book, 1946.

In this book may be found a detailed discussion of the rationale behind the division of personality into modalities of ability, temperament, and dynamic traits which Cattell has maintained over the years, and which was a central issue of the present paper.

Cattell, R. B. Personality: A systematical theoretical and factual study. New York: McGraw-Hill, 1950.

This book contains Cattell's most detailed treatment of the self-sentiment factor which was involved in one of the main hypotheses tested in the two studies just described.

Cattell, R. E. Personality and motivation structure and measurement. New York: World Book, 1957.

In this volume there is a brief description of the results of the only previous empirical exploration of motivation-temperament relations using Cattell's tests. It contains many of the seeds for the hypotheses generated in the earlier sections of this thesis.

Cattell, R. B. Personality and social psychology. San Diego: Knapp, 1964.

Herein may be found a varied collection of some of Cattell's journal articles. It is a good general introduction to his work because it gives an indication of the range of topics he has explored as of 10 years ago. It is an important source for the present investigation because of the sections containing papers which describe Cattell's early work in the motivation and temperament modalities.

Cattell, R. B. Handbook of multivariate experimental psychology. Chicago: Rand McNally, 1966.

This edited work is generally regarded as an essential reading for multivariate research of any kind. It is of special relevance to the current work because of its excellent chapter by Horn, summarizing work done up until 1963 in the motivation realm. Nesselroade and Delhees have an equally good chapter dealing with multivariate personality research. Cattell has a chapter on factor analysis which gives a clear overview of the essentials of this method. In addition, the first chapter by Cattell is regarded by the present author as a classic, perspective-giving introduction to the philosophy of science underlying research such as that undertaken for the present project.

Cattell, R. E. Key issues in motivation theory in relation to learning and the dynamic calculus. Paper presented at the Third Banff Conference of the Center for Advanced Study in Theoretical Psychology, 1971.

This paper was the focal stimulus for the initiation of the present investigation. It contains a detailed explanation of why inter-modality research may be of particular importance for advancing psychological knowledge.

Cattell, R. E. Personality and mood by questionnaire. San Francisco: Jossey Bass, 1973.

This book, just published about a month before the writing of this bibliography, is an important contribution to the area of multivariate personality research. It has a number of portions in which consideration is given to the central issues of this thesis. A particularly useful feature of the book is that it contains brief descriptions of a large number of articles which, because of journal publication-lag, would otherwise not be available. Consequently, it is possible to get a better indication of recent trends in the field.

Cattell, R. E., Barton, K., & Dielman, T. E. Prediction of school achievement from motivation, personality, and ability measures. Psychological Reports, 1972, 30, 35-43.

The usefulness of the integrated-unintegrated distinction with dynamic traits is illustrated by differential prediction of achievement. Also of interest is the evidence bearing upon the independent contributions of the three modalities to the prediction of achievement.

Cattell, R. E., & Nichols, K. E. An improved definition from 10 researches of second order personality factors in Q data. Journal of Social Psychology, 1972, 86, 187-203.

In this article a reanalysis is made of 10 previous researches, using different language versions of the 16PF (English, German, Spanish, Portuguese) with a variety of subcultural groups. From this article, it may be seen that the second-stratum factors of the 16PF have reached a high degree of replicability.



Cattell, R. B., & Warburton, F. Objective personality and motivation tests. Urbana, Ill.: U. Illinois Press, 1967.

Two of the most noteworthy features of this book with respect to the present research are the discussion of the modality distinction first made in 1946, and the section on motivation tests by Sweeney. It is also of relevance because it serves as a companion compendium to the book by Hundleby et. al. which is separately described in this bibliography.

Cooper, M. Cattell's personality factors as predictors of high school performance. Ph.D. thesis. U. of Ottawa, 1972.

This thesis contains a comprehensive review of Cattell's work related to the prediction of academic achievement. It is an excellent demonstration of the predictive utility of the high school version of the 16 PF.

Dreger, R. M. Multivariate personality research: Contributions to the understanding of personality in honor of Raymond B. Cattell. Baton Rouge: Claitor's Publishing, 1972.

The chapter of most direct relevance to the present work is that of Radcliffe on motivational measurement in which he questions some of the interpretations of previous research by Cattell and his associates. He considers the properties of ipsative scores in some detail. The chapter by Hundleby is also of special interest because it focuses directly upon issues at the very heart of multivariate approaches to personality measurement.

Gorsuch, R. L. Factor Analysis. New York: Saunders, 1974.

There are quite a few books currently available dealing with factor analysis but this book stands out for its clarity and up-to-date, comprehensive coverage of the area. Other books on the same topic may be found in the references of this text.

Hundleby, J. D., Pawlik, K., & Cattell, R. B. Personality factors in objective test devices. San Diego: Knapp, 1965.

A number of times in this thesis, reference was made to objective tests, which this author has long regarded as being a particularly promising development in the field of personality measurement. This book is an extensive, careful survey and synthesis of the main factors which have been studied in this area.

Nesselroade, J. R., & Faltes, P. B. Higher order convergence and divergence of two distinct personality systems: Cattell's HSPQ and Jackson's PRF. Unpublished manuscript.

This is an example of the type of integrative article which was mentioned in the introduction as being particularly needed at the present time. It contains evidence of overlap between two quite widely used tests using an approach similar to that of the present thesis.

APPENDIX 1

Program for converting MAT raw scores to stens.

```

INTEGER*2 ID(8),IGORD(8)
INTEGER*2 CAU(13,9),HCU(13,9),FRU(13,7),NAU(13,7),SEU(25,17)
1 SSU(49,25),MAU(13,9),PGU(13,7),ASU(13,9),SWU(13,7),CAI(5,9)
2 HOI(5,9),FRI(5,7),NAI(5,7),SEI(9,17),SSI(17,25),MAI(5,7),
3 PGI(5,9),ASI(5,7),SWI(5,9)
INTEGER*2 TOTC(20,10,10),SPEC(5,10),RAW(40),RAWT(5),STEN1(20)
1 STEN2(20),STEN3(5)
READ(1,100)((CAU(I,J),J=1,9),I=1,13)
READ(1,100)((HCU(I,J),J=1,9),I=1,13)
READ(1,101)((FFU(I,J),J=1,7),I=1,13)
READ(1,101)((NAU(I,J),J=1,7),I=1,13)
READ(1,102)((SFU(I,J),J=1,17),I=1,25)
READ(1,103)((SSU(I,J),J=1,25),I=1,49)
READ(1,100)((MAU(I,J),J=1,9),I=1,13)
READ(1,101)((PGU(I,J),J=1,7),I=1,13)
READ(1,100)((ASU(I,J),J=1,9),I=1,13)
READ(1,101)((SWU(I,J),J=1,7),I=1,13)
READ(1,100)((CAI(I,J),J=1,9),I=1,5)
READ(1,100)((HCI(I,J),J=1,9),I=1,5)
READ(1,101)((FFI(I,J),J=1,7),I=1,5)
READ(1,101)((NAI(I,J),J=1,7),I=1,5)
READ(1,102)((SEI(I,J),J=1,17),I=1,9)
READ(1,103)((SSI(I,J),J=1,25),I=1,17)
READ(1,101)((MAI(I,J),J=1,7),I=1,5)
READ(1,100)((PGI(I,J),J=1,9),I=1,5)
READ(1,101)((ASI(I,J),J=1,7),I=1,5)
READ(1,100)((SWI(I,J),J=1,9),I=1,5)
100 FORMAT(3X,9I3)
101 FORMAT(3X,7I3)
102 FORMAT(3X,17I3)
103 FORMAT(3X,25I3)
104 FORMAT(3X,10I3)
READ(1,104)((TOTC(I,J,K),K=1,10),J=1,10),I=1,20)
READ(1,107)((SPEC(I,J),J=1,10),I=1,5)
107 FORMAT(7X,10I3)
KOUNT=0
306 READ(1,105,END=600) ID,RAW,IGORD
105 FORMAT(8I1,23I2,1X,12I2/3X,I1,4I2,8I2)
DO 98 I=1,40
KDUM=RAW(I)
98 RAW(I)=KDUM+1

```

```
KOUNT=KOUNT+1
DO 30 K=2,40,2
  I=K-1
  J=RAW(L)
  I=RAW(K)
  M=K/2
  GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20),M
1 STEN1(M)=CAU(I,J)
  GO TO 30
2 STEN1(M)=HOU(I,J)
  GO TO 30
3 STEN1(M)=FRU(I,J)
  GO TO 30
4 STEN1(M)=NAU(I,J)
  GO TO 30
5 STEN1(M)=SEU(I,J)
  GO TO 30
6 STEN1(M)=SSU(I,J)
  GO TO 30
7 STEN1(M)=MAU(I,J)
  GO TO 30
8 STEN1(M)=PGU(I,J)
  GO TO 30
9 STEN1(M)=ASU(I,J)
  GO TO 30
10 STEN1(M)=SWU(I,J)
  GO TO 30
11 STEN1(M)=CAI(I,J)
  GO TO 30
12 STEN1(M)=HOI(I,J)
  GO TO 30
13 STEN1(M)=FRI(I,J)
  GO TO 30
14 STEN1(M)=NAI(I,J)
  GO TO 30
15 STEN1(M)=SEI(I,J)
  GO TO 30
16 STEN1(M)=SSI(I,J)
  GO TO 30
17 STEN1(M)=MAI(I,J)
  GO TO 30
18 STEN1(M)=PGI(I,J)
  GO TO 30
19 STEN1(M)=ASI(I,J)
  GO TO 30
20 STEN1(M)=SWI(I,J)
30 CONTINUE
  DO 50 I=1,10
    J=STEN1(I)
```

```

      L=I+10
      K=STEN1(L)
50  STEN2(I)=TOTC(I,J,K)
      DC 60 I=11,20
      L=I-10
      J=STEN1(L)
      K=STEN1(I)
60  STEN2(I)=TOTC(I,J,K)
      DO 65 I=1,5
65  RAWT(I)=0
      DO 70 I=2,20,2
70  RAWT(1)=RAWT(1)+RAW(I)
      RAWT(1)=RAWT(1)-10
      DO 71 I=22,40,2
71  RAWT(2)=RAWT(2)+RAW(I)
      RAWT(2)=RAWT(2)-10
      SUMU=0
      SUMI=0
      DO 72 I=1,10
      SUMU=SUMU+STEN1(I)
72  RAWT(4)=RAWT(4)+STEN2(I)
      DO 73 I=11,20
      RAWT(5)=RAWT(5)+STEN2(I)
73  SUMI=SUMI+STEN1(I)
      RAWT(3)=SUMI-SUMU
      DO 80 I=1,5
      DO 78 J=1,10
      IF(RAWT(I).LT.SPEC(I,J)) GO TO 76
      GO TO 78
76  STEN3(I)=J
      GO TO 80
78  CONTINUE
80  CONTINUE
      WRITE(3,200) IL,STEN1,STEN2,RAWT,STEN3
200  FORMAT(' ',10X,8I1,10I5/31X,10I5/31X,10I5/31X,10I5/31X,10I5)
      WRITE(5,201) IL,STEN1,STEN2,STEN3,RAWT,IGORD,ID
201  FORMAT(8I1,35I2/5I2,5I5,13I2,8I1)
      GO TO 306
600  STOP
      END

```

Computer program for calculating all possible product moment correlation coefficients between a set of variables and then outputting the results in whatever triangular and square matrices are desired.

```

      INTEGER IT(20),IS(84)
      INTEGER TITLE(20)
      DIMENSION FMT(20)
      REAL X(60),SUMX(60),SUMXX(60),R(60,60)
9    FORMAT(' ','N=',I4)
10   FORMAT('1',20A4)
11   FORMAT(20A4)
12   FORMAT(16I5)
      READ(1,11) TITLE
      WRITE(3,10) TITLE
      READ(1,12) NV,NT,NS
      READ(1,12) (IT(I),I=1,NT)
      READ(1,12) (IS(I),I=1,NS)
      READ(1,11) FMT
      DO 51 J=1,NV
        SUMX(J)=0.
51    SUMXX(J)=0.
      DO 52 J=1,NV
        DO 52 K=1,NV
52    R(J,K)=0.
      N=0
200  READ(1,FMT) (X(J),J=1,NV)
      IF(X(1).EQ.99.) GO TO 60
      N=N+1
      NDF=N-2
      DO 50 J=1,NV
        SUMX(J)=SUMX(J)+X(J)
50    SUMXX(J)=SUMXX(J)+(X(J)**2)
      DO 55 J=1,NV
        DO 55 K=1,NV
55    R(J,K)=R(J,K)+X(J)*X(K)
      GO TO 200
60   CONTINUE
      DO 70 J=1,NV
        DO 70 K=1,NV
          TOP=(N*R(J,K))-(SUMX(J)*SUMX(K))
          BOTJ=SQRT(N*SUMXX(J)-SUMX(J)**2)
          BOTK=SQRT(N*SUMXX(K)-SUMX(K)**2)
70    R(J,K)=TOP/(BOTJ*BOTK)
      DO 80 K=1,NV
        AVG=SUMX(K)
        SUMX(K)=AVG/N
        STD=SUMXX(K)

```

```
      80 SUMXX(K)=SQRT(STD/N-SUMX(K)**2)
        WRITE(3,9) N
C   TRIANGULAR
      DO 98 I=1,NT,2
        WRITE(3,104)
104   FORMAT('1',10X,'CORREIATIONS')
        NTC=IT(I)
        NTR=NTC+1
        I1=I+1
        NF=IT(I1)
        DO 96 J=NTR,NF
          NC=J-1
          WRITE(3,102) (F(J,K),K=NTC,NC)
102   FORMAT('-',10X,16F6.2)
          WRITE(2,251) (F(J,K),K=NTC,NC)
251   FORMAT(16X,16F6.2)
        96 CONTINUE
      98 CONTINUE
C   SQUARE
      DO 97 I=1,NS,4
        WRITE(3,104)
        NS1=IS(I)
        I2=I+1
        NS2=IS(I2)
        I3=I+2
        NS3=IS(I3)
        I4=I+3
        NS4=IS(I4)
        DO 99 J=NS3,NS4
          WRITE(2,251) (F(J,K),K=NS1,NS2)
99   WRITE(3,102) (F(J,K),K=NS1,NS2)
97   CONTINUE
      STOP
      END
```

Program to produce a multimethod matrix.

```
DIMENSION A(16),B(16),C(16),D(16)
DO 10 I=1,16
  READ (1,200) A,B
200 FORMAT (8F10.7)
  DO 9 J=1,16
    9 A(J)=0.
    A(I)=1.
    WRITE (3,301) A,B
301 FORMAT (10X,15F5.2)
  10 WRITE (2,100) A, B
    DO 11 I=1,16
      READ (1,200) C,D
      DO 12 J=1,16
        12 D(J)=0.
        D(I)=1.
        WRITE (3,300) C,D
300 FORMAT (10X,20F5.2)
      11 WRITE (2,100) C,D
    100 FORMAT (8F10.7)
  STOP
END
```

Program to give feedback to students.

```

DIMENSION LIKE(3),IDIF(3),ISEX(200),IDLIKE(3,8),IDDIFF(3,8)
DIMENSION IX(200,15),IDS(200),ID(200,8)
N=193
NF=15
READ(1,102)((ID(I,J),J=1,8),I=1,N)
102 FORMAT(8A4)
DO 350 I=1,N
350 READ(1,100) ISEX(I),(IX(I,J),J=1,NF)
100 FORMAT(4X,I1,3X,I3,3X,14I3)
DO 13 I=1,N
WRITE(3,103)(ID(I,J),J=1,8)
103 FORMAT('1',3X,8A4)
WRITE(3,412)
412 FORMAT('0',34X,'15%',6X,'70%',8X,'15%')
DO 600 J=1,16
GO TO (21,600,22,23,24,25,26,27,28,29,30,600,31,32,600,600),J
21 WRITE(3,400)
400 FORMAT('0',10X,'LIKES THINGS',43X,'LIKES PEOPLE')
GO TO 700
22 WRITE(3,401)
401 FORMAT('0',10X,'EASILY UPSET',43X,'CALM')
GO TO 700
23 WRITE(3,402)
402 FORMAT('0',10X,'MILD',51X,'ASSERTIVE')
GO TO 700
24 WRITE(3,403)
403 FORMAT('0',10X,'SOLEMN',49X,'CHEERFUL')
GO TO 700
25 WRITE(3,404)
404 FORMAT('0',10X,'EXPEDIENT',46X,'CONSCIENTIOUS')
GO TO 700
26 WRITE(3,405)
405 FORMAT('0',10X,'SHY',52X,'VENTURESCME')
GO TO 700
27 WRITE(3,406)
406 FORMAT('0',10X,'TOUGH-MINDED',43X,'SENSITIVE')
GO TO 700
28 WRITE(3,407)
407 FORMAT('0',10X,'TRUSTING',47X,'SUSPICIOUS')
GO TO 700
29 WRITE(3,408)
408 FORMAT('0',10X,'PRACTICAL',46X,'IMAGINATIVE')
GO TO 700
30 WRITE(3,409)
409 FORMAT('0',10X,'NATURAL',48X,'SOPHISTICATED')
GO TO 700

```

```

31 WRITE (3,410)
410 FORMAT('0',10X,'CONSERVATIVE',43X,'EXPERIMENTING')
GO TO 700
32 WRITE (3,411)
411 FORMAT('0',10X,'GROUP ORIENTED',41X,'SELF DIRECTED')
700 CONTINUE
N3=IX(I,J)
GO TO (1,1,1,2,2,2,2,3,3,3),N3
1 WRITE (3,370)
370 FORMAT('+',36X,'*')
GO TO 600
2 WRITE (3,371)
371 FORMAT('+',46X,'*')
GO TO 600
3 WRITE (3,372)
372 FORMAT('+',56X,'*')
600 CCNTINUE
KK=0
10 KK=KK+1
DO 8 M=1,3
LIKE(M)=120
8 IDIF(M)=120
DC 11 K=1,N
IF(K.EQ.I) GO TC 11
IF(KK.EQ.2) GO TO 9
IF (ISEX(I).NE.ISEX(K)) GO TO 11
GO TO 14
9 CONTINUE
IF (ISEX(I).EQ.ISEX(K)) GO TC 11
14 CONTINUE
IDS(K)=0
DO 12 J=1,NF
12 IDS(K)=IDS(K)+(IX(I,J)-IX(K,J))**2
IF (IDS(K).LE.LIKE(1)) GO TO 20
IF (IDS(K).GE.IDIF(1)) GO TO 50
IF (IDS(K).LE.LIKE(2)) GO TO 34
IF (IDS(K).GE.IDIF(2)) GO TC 60
IF (IDS(K).LE.LIKE(3)) GO TO 40
IF (IDS(K).GE.IDIF(3)) GO TO 70
GO TO 11
20 LIKE(2)=LIKE(1)
DO 91 L=1,8
91 IDLIKE(2,L)=IDLIKE(1,L)
LIKE(1)=IDS(K)
DO 80 L=1,8
80 IDLIKE(1,L)=ID(K,L)
GO TO 11
34 LIKE(3)=LIKE(2)
DO 92 L=1,8

```

```

92 IDLIKE(3,L)=IDLIKE(2,I)
   LIKE(2)=IDS(K)
   DO 81 L=1,8
81 IDLIKE(2,L)=ID(K,L)
   GO TO 11
40 Ilike(3)=IDS(K)
   DO 82 L=1,8
82 IDLIKE(3,L)=ID(K,L)
   GO TO 11
50 IDIF(2)=IDIF(1)
   DO 93 L=1,8
93 IDDIFF(2,L)=IDDIFF(1,L)
   IDIF(1)=IDS(K)
   DO 83 L=1,8
83 IDDIFF(1,L)=ID(K,L)
   GO TO 11
60 IDIF(3)=IDIF(2)
   DO 94 L=1,8
94 IDDIFF(3,L)=IDDIFF(2,L)
   IDIF(2)=IDS(K)
   DO 84 L=1,8
84 IDDIFF(2,L)=ID(K,L)
   GO TO 11
70 IDIF(3)=IDS(K)
   DO 85 L=1,8
85 IDDIFF(3,L)=ID(K,L)
11 CONTINUE
   IF(KK.EQ.1) WRITE(3,450)
   IF(KK.EQ.2) WRITE(3,451)
450 FORMAT('-',5X,' SAME SEX')
451 FORMAT('-',5X,' OPPOSITE SEX')
   WRITE(3,200) ((IDLIKE(I,J),J=1,8),M=1,3)
200 FORMAT('0',5X,'THREE MCST SIMILAR',5X,24A4)
   WRITE(3,202) ((IDDIFF(I,J),J=1,8),M=1,3)
202 FORMAT('0',5X,'THREE MCST DIFFERENT',3X,24A4)
   IF(KK.EQ.1) GO TO 10
13 CCNTINUE
   STOP
   END

```

Modification of Promax program.

```

    DIMENSION RX(750), LAMBDA(50), XBAR(50), STD(50), B(50), D(50), T(50)
1  TV(51), FMT(80), TITLE(20), FACS(50,16)
    DIMENSION C(16,16), E(16,16), A(50,16), NF(8)
    REAL LAMBDA
    COMMON FMT
    I1=1
    I30=16
    I100=50
7  READ(5,4,END=20) TITLE
4  FORMAT(20A4)
    IF(TITLE(1).EQ.TITLE(2)) STOP
    WRITE(6,5) TITLE
5  FORMAT(1H1,25X,20A4)
    READ(5,1) NPER,NVAR,NFMT,IDCOR,ITER,ICR,NPROM,IPW,NF
1  FORMAT(16I5)
    IF(IPW.EQ.0) IPW=4
    IF(NFMT.EQ.0) NFMT=1
    NFMT=NFMT*20
    READ(5,4) (FMT(I),I=1,NFMT)
    WRITE(6,18) NPER,NVAR,IPW
18 FORMAT(/10X,'NUMBER OF SUBJECTS =' ,I5
1/10X,'NUMBER OF VARIABLES =' ,I5
3/10X'EXPONENT FOR POWERING OBLIQUE TARGET MATRIX =' ,I5,/)
    WRITE(6,1) NFMT,I1,I30,I100
    WRITE(6,17) (FMT(I),I=1,NFMT)
17 FORMAT(/10X,20A4)
    NFAC=NF(1)
    READ(5,FMT) ((FACS(I,J),J=1,NFAC),I=1,NVAR)
    K=0
    DO 52 J=1,NFAC
    DO 52 I=1,NVAR
    K=K+1
52 RX(K)=FACS(I,J)
    CALL VARMX(NVAR,NFAC,RX,NITER,TV,B,D,T)
    WRITE(6,9)
9  FORMAT(1H1,10X,'VARIMAX ROTATED FACTORS' //)
    CALL ARRAY(I1,NVAR,NFAC,I100,I30,RX,FACS)
    CALL CRDER(FACS,STD,NVAR,NFAC,I100,I30)
    CALL REFLEC(NVAR,NFAC,FACS,I100,I30)
    CALL PRINT3(FACS,XBAR,STD,B,T,NVAR,NFAC,I100,I30)
    CALL PROMX(NVAR,NFAC,FACS,C,E,FMT,I100,I30,IPW)
    CALL RFOUT(NVAR,NFAC,FACS,A,C,E,STD,I100,I30)
    CALL FACVAR(NVAR,NFAC,FACS,C,E,I100,I30)
    GO TO 7
20 STOP
    END

```

Program for calculating congruence coefficients.

```
DIMENSION SC(16,16),C(36,16),D(36,16)
NF=16
NV=36
DO 20 L=1,NV
20 READ(1,200) (C(L,M),M=1,NF)
DC 10 L=1,NV
10 READ(1,200) (D(I,M),M=1,NF)
200 FORMAT(16X,10F6.2/16X,6F6.2)
DO 70 K=1,NF
DO 50 I=1,NF
SUMAB=0.
SUMAS=0.
SUMBS=0.
DC 60 J=1,NV
SUMAB=SUMAB+C(J,K)*D(J,I)
SUMAS=SUMAS+C(J,K)**2
SUMBS=SUMBS+D(J,I)**2
60 CCNTINUE
SC(I,K)=SUMAB/SQRT(SUMAS*SUMBS)
50 CONTINUE
70 CONTINUE
WRITE(3,101) ((SC(I,J),I=1,NF),J=1,NF)
WRITE(2,726) ((SC(I,J),I=1,NF),J=1,NF)
726 FORMAT(16X,10F6.2)
101 FORMAT(' ',16F6.2)
STOP
END
```

Description of regression program.

The computer program for the stepwise multiple regression analysis was written in Fortran IV (H) for the I.B.M. 360/67 by J. Carlson of the Division of Educational Research Services, University of Alberta. The program was based upon procedures described by Draper, N. R. and Smith, H. Applied Regression Analysis, New York: Wiley, 1966.

In this program it is possible to specify the level of significance for adding and deleting predictor variables. The program first calculates all correlations between the dependent variable and the independent variables. The program then selects the independent variable which accounts for the largest proportion of the variance of the dependent variable. If the correlation between the dependent and independent variables reaches the previously set level of significance the independent variable is introduced into the regression function. The independent variable which accounts for the largest portion of the remaining variance after the effect of the first independent variable has been removed is then selected and if it results in a significant increase in accounted for variation, it is also introduced into the regression function. This procedure is repeated for all of the remaining independent variables.

APPENDIX 2

FEEDBACK GIVEN TO HIGH SCHOOL STUDENTS

Attached is a computer printout of your scores on the personality tests which you recently completed. Your scores, in comparison with other North American high school students, are indicated by *'s. As you can see there are 3 scores, each of which fall in one of the 3 columns labeled by percentages. The percentage tells how many other students tend to answer in that way. In the first row, if you scored in the 15% column nearest "LIKES THINGS", means that you would be described by others as showing more liking for things than people. If you scored in the 15% column nearer to "LIKES PEOPLE", you would be described as seeming to have a greater preference for people than things. A score in the 70% column means you appear to be about average on that characteristic. e.g. an equal liking for persons and things.

Your scores should be regarded as "good estimates" of a portion of your total personality. These scores will most certainly change with time as you undergo different life experiences. The total pattern of scores might well be compared to one snapshot taken with a rather inexpensive camera when you knew your picture was being taken.

Also included are the names of students who scored most similarly and most differently from you on the tests. We thought that this information might be of some use in helping you to gain a better understanding of your own personality. Each person is of course very much an individual and the tests do not by any means measure all of your personality characteristics, hence being "most similar" does certainly not mean "identical" and "most different" does not mean "completely opposite!"

You should keep in mind that being similar or different should not be looked upon as either a good or bad thing. In order to develop your own personality most fully, it is best to be friendly with a variety of other people both different and similar. Thus, in no way is this meant to advise you as to who you may like or not like. The idea is to perhaps assist you in becoming more aware of what you are like by looking at the test results and at your personality as mirrored and reflected by other people.

FEEDBACK GIVEN TO HIGH SCHOOL STUDENTS

STUDENTS OWN NAME

	15%	70%	15%	
LIKES THINGS	*			LIKES PEOPLE
EASILY UPSET		*		CALM
MILD		*		ASSERTIVE
SCLENN	*			CHEERFUL
EXPEDIENT			*	CONSCIENTIOUS
SHY	*			VENTURESOME
TOUGH-MINDED		*		SENSITIVE
TRUSTING		*		SUSPICIOUS
PRACTICAL	*			IMAGINATIVE
NATURAL		*		SOPHISTICATED
CCNSERVATIVE		*		EXPERIMENTING
GRUP ORIENTED		*		SELF DIRECTED

SAME SEX

THREE MOST SIMILAR	NAME #1	NAME #2	NAME #3
THREE MOST DIFFERENT	NAME #4	NAME #5	NAME #6

OPPOSITE SEX

THREE MOST SIMILAR	NAME #7	NAME #8	NAME #9
THREE MOST DIFFERENT	NAME #10	NAME #11	NAME #12

Table I.-

The ten most thoroughly studied Dynamic Structure factors

Title		Brief description
Mating erg	(MA)	Strength of the normal, heterosexual or mating drive.
Assertiveness erg	(AS)	Strength of the drive to self-assertion, mastery, and achievement
Fear erg	(FR)	Level of alertness to external dangers.
Narciss-comfort erg	(NA)	Level of drive to sensuous, self-indulgent satisfactions.
Pugnacity-sadism erg	(PG)	Strength of destructive, hostile impulses.
Self-concept sentiment	(SS)	Level of concern about the self-concept, social repute, and more remote rewards.
Super-ego sentiment	(SE)	Strength of development of conscience.
Career sentiment	(CA)	Amount of development of interests in a career.
Sweetheart-spouse sentiment	(SW)	Strength of attachment to wife (husband) or sweetheart.
Home-parental sentiment	(HC)	Strength of attitudes attaching to the parental home.

Table II.-

Some devices used in motivation component research.

1. Preferences: Readiness to admit preference for course of action.
2. Autism: misbelief. Distorted belief that facts favor course of action.
3. Reasoning distortion: means-ends. Readiness to argue that doubtfully effective means to a goal are really effective.
4. Machiavellianism. Willingness to use reprehensible means to achieve ends favoring interest.
5. Fantasy choice. Readiness to choose interest-related topic to read about, write about, or explain.
6. Defensive reticence. Low fluency in listing bad consequences of course of action.
7. Naive projection. Misperception of others as having one's own interests.
8. Guilt sensitivity. Expression of guilt feelings for non-participation in interest-related activity.
9. Conflict involvement. Time spent making decision under approach-approach conflict.
10. Threat reactivity: psychogalvanic resistance drop when interest threatened.
11. Selective perception. Ease of finding interest-related material embedded in a complex field.
12. Sensory acuity. Tendency to sense lights as brighter, sounds as louder, etc., when interest is aroused.
13. Spontaneous attention. Involuntary movements with respect to interest-related stimuli.
14. Proactive inhibition by interest-related task.

Table III.-

Best known questionnaire traits from Cattell's research.

Factor	Low score description	High score description
A	Reserved, detached, critical, aloof, stiff. (Sizothymia)	Outgoing, warmhearted, easy going, participating. (Affectothymia)
B	Low general ability.	High general ability.
C	Affected by feelings, less stable, easily upset. (Lower ego strength)	Emotionally stable, mature. (Higher ego strength)
E	Humble, mild, easily led, docile, accommodating. (Submissiveness)	Assertive, aggressive, competitive, stubborn. (Dominance)
F	Sober, taciturn, serious. (Desurgency)	Happy-go-lucky, enthusiastic. (Surgency)
G	Expedient, disregards rules. (Weaker superego strength)	Conscientious, persistent, moralistic, staid. (Stronger superego strength)
H	Shy, timid, threat-sensitive. (Threctia)	Venturesome, uninhibited, socially bold. (Parmia)
I	Tough-minded, self-reliant, realistic. (Harria)	Tender-minded, sensitive, clinging, over-protected. (Premsia)
L	Trusting, accepting conditions. (Alaxia)	Suspicious, hard-to-fool. (Protension)
M	Practical, down-to-earth concerns. (Praxernia)	Imaginative, bohemian, absent-minded. (Autia)

Table III.- (continued)

N	Forthright,unpretentious, genuine but socially clumsy. (Artlessness)	Astute,polished,socially aware. (Shrewdness)
O	Self-assured,placid,secure, complacent,serene. (Untroubled adequacy)	Apprehensive,self- reproaching,insecure, worrying,troubled. (Guilt proneness)
Q1	Conservative,respecting traditional ideas (Conservatism)	Experimenting,liberal, free-thinking. (Radicalism)
Q2	Group dependent,a "joiner" and sound follower. (Group adherence)	Self-sufficient.resource- ful,prefers own decisions. (Self-sufficiency)
Q3	Undisciplined self-conflict, lax, follows own urges, careless of social rules. (Low self-sentiment integration)	Controlled,exacting will power,socially precise, compulsive, following self- image. (High strength of self- sentiment)
Q4	Relaxed,tranquil,torpid, unfrustrated,ccomposed. (Low ergic tension)	Tense,frustrated,driven, overwrought. (High ergic tension)

II. Secondaries

Technical title	Popular label
Exvia-Invia	Extraversion-Introversion
Adjustment-Anxiety	Low anxiety-High anxiety
Pathemia-Corteria	Sensitivity,emotionalism- Tough poise
Subduedness-Independence (Promethean Will)	Dependence-Independence

Table IV.-

First study 16PF means and standard deviations.

I. Primaries

Factors	Sample mean		Norm mean		Sample S.D.		Norm S.D.	
	M	F	M	F	M	F	M	F
A	9.14	10.88	9.80	11.88	3.40	3.44	3.43	3.27
B	9.36	9.05	7.72	5.92	1.69	1.67	1.80	2.06
C	14.83	12.95	15.50	16.03	4.17	4.15	3.69	4.17
E	13.50	11.60	13.94	9.90	4.10	4.15	3.92	4.13
F	15.54	15.02	15.73	13.35	4.71	4.81	4.40	4.33
G	12.03	11.02	12.73	13.64	3.94	3.74	3.60	3.27
H	11.54	11.36	13.01	12.31	5.36	5.50	5.24	5.03
I	9.46	11.42	8.79	11.84	3.38	3.03	3.49	2.89
L	9.36	8.79	9.47	7.41	3.40	3.00	3.13	3.07
M	12.00	13.23	11.68	12.74	3.52	3.62	3.41	3.29
N	10.02	9.65	11.07	10.64	2.85	2.70	2.63	2.55
O	10.41	12.57	10.65	10.70	3.98	4.38	3.90	3.84
Q1	10.70	9.32	9.64	8.77	2.82	3.05	2.75	2.76
Q2	11.90	12.09	9.97	10.02	3.50	3.02	3.50	3.42
Q3	9.37	8.77	10.14	11.52	2.96	2.76	3.07	2.95
Q4	12.21	15.35	12.01	12.92	4.83	4.65	4.81	4.96

 II Secondaries
 (Norm mean=5.5 S.D.=2.0)

	M	F
Anxiety	5.56	6.79
Exvia	5.01	5.24
Corteria	5.19	5.56
Independence	6.29	6.77

Table V.-

First study MAT means and standard deviations.
 (Norm mean = 5.5 S.D. = 2.0)

	Mean				S.D.			
	U		I		U		I	
	M	F	M	F	M	F	M	F
CA	4.60	3.56	5.12	5.20	1.77	1.63	1.55	1.52
HO	4.41	4.47	4.88	5.27	1.76	1.84	1.69	1.71
FR	4.80	4.14	5.15	5.06	1.98	1.67	1.91	1.63
NA	6.20	6.27	6.23	6.39	1.89	1.93	1.95	1.94
SE	4.70	4.97	4.86	5.03	1.96	1.81	1.70	1.87
SS	5.41	5.74	6.24	5.89	1.63	1.77	1.55	1.24
MA	5.88	5.97	6.40	6.17	1.79	1.82	1.46	1.67
PG	5.39	4.53	5.84	4.82	2.21	1.93	1.82	1.64
AS	5.81	6.03	4.73	4.44	1.87	1.53	1.90	1.90
SW	6.27	6.61	5.23	5.82	1.88	1.81	1.81	1.86

M&F

	Mean	S.D.
General Autism-Optimism	4.68	1.70
Total Information	7.21	1.36
Total Integration	6.47	1.66
Total Personal Interest	5.80	1.52
Total Conflict	6.63	1.42

Table VI.-

First study 16PF inter-correlations.

	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3
E	-06														
C	15	00													
F	10	04	03												
F	25	-09	19	35											
G	-01	02	33	-12	05										
H	35	-08	51	41	47	20									
I	22	02	-15	-00	-18	-15	-05								
L	-07	-03	-33	17	-02	-16	-15	-05							
M	-02	08	-25	10	-15	-27	-09	38	11						
N	05	04	25	03	-12	15	11	-04	-03	-02					
C	-06	-07	-55	-18	-18	-23	-47	08	36	22	-19				
Q1	-09	15	17	19	01	04	13	-02	-09	11	03	-26			
Q2	-32	05	-17	-14	-43	-12	-39	07	09	22	06	14	16		
Q3	09	08	45	-12	-06	45	19	-13	-34	-18	19	-35	11	-05	
Q4	-07	-06	-59	01	-08	-24	-40	08	37	20	-14	64	-26	13	-43

Table VII.-

First study MAT Unintegrated inter-correlations.

	CAU	FCU	FRU	NAU	SEU	SSU	MAU	PGU	ASU
HOU	14								
FRU	-02	-19							
NAU	-29	-31	03						
SEU	-02	29	-04	-33					
SSU	-18	-04	03	-24	12				
MAU	-03	-15	-11	17	-01	-02			
PGU	-09	-13	30	07	-14	-09	-18		
ASU	07	03	-00	02	-16	-21	-04	04	
SWU	-09	-09	-05	18	-26	-01	13	01	-06

Table VIII.-

First study MAT Integrated inter-correlations.

	CAI	FOI	FRI	NAI	SEI	SSI	MAI	PGI	ASI
HCI	02								
FRI	00	-06							
NAI	-09	01	05						
SEI	04	11	-13	-02					
SSI	-14	-25	01	24	-19				
MAI	-16	-15	-10	01	-08	16			
PGI	-02	-04	-01	-08	-11	-22	-03		
ASI	-06	-15	01	12	-09	09	06	09	
SWI	21	18	06	-02	07	-19	-26	-07	-33

Table IX.-

First study MAT Total score inter-correlations.

	CA	HC	FR	NA	SE	SS	MA	PG	AS
HO	14								
FR	-00	-12							
NA	-20	-21	-01						
SE	-05	28	-09	-25					
SS	-09	-16	-01	03	01				
MA	-15	-27	-12	17	-09	08			
PG	-01	-12	18	-00	-24	-17	-12		
AS	02	-15	-03	11	-24	-14	-00	11	
SW	06	08	-00	12	-02	10	01	-10	-15

Table X.-

Correlations between the MAT component scores.

General Information 09

Total Integration -52 57

Total Interest 48 65 04

Total Conflict 53 -58 -96 -06

Autism Information Integration Interest

Table XI.-

First study regression analyses with 16PF-MAT.

Dependent var.	Ind. var.	d.f.	F	cum. var.	cum. p
MAT Autism	16PF -M	1,241	12.36	4.87%	.000524
	16PF G	2,240	5.62	7.05%	.000154
	16PF -N	3,239	5.47	9.14%	.000042
	16PF C	4,238	5.52	11.20%	.000011
MAT Information	16PF B	1,241	19.19	7.38%	.000018
	16PF Q2	2,240	6.33	9.76%	.000004
MAT Interest	16PF B	1,241	3.94	1.61%	.048187
MAT Conflict	16PF -M	1,241	21.27	8.11%	.000007
	16PF H	2,240	9.99	11.78%	.000000

Table XII.-

First study 16PF-MAT T correlations.

	CA	HC	FR	NA	SE	SS	MA	PG	AS	SW
A	02	11	-16	-10	10	02	-09	-16	03	02
F	-07	-07	05	22	04	06	09	-04	02	-01
C	14	24	10	-13	19	01	-20	-11	-19	06
E	-02	-28	12	19	-16	05	19	06	17	-12
F	06	-06	01	-05	-06	01	14	03	08	05
G	16	30	03	-26	32	02	-22	-11	-27	01
H	06	12	02	-12	24	-02	-07	-16	-03	01
I	-17	-07	-16	06	06	22	15	-21	-12	13
L	-12	-09	08	09	-12	-09	13	15	10	-17
M	-20	-20	-07	19	00	11	21	-13	12	-11
N	11	02	-08	07	07	-06	-12	01	07	-07
O	-17	-07	-10	09	-07	-16	05	12	16	-01
Q1	-01	-14	13	07	01	19	03	-08	-08	-06
Q2	01	-12	03	18	-07	11	00	-02	10	-02
Q3	14	17	05	-10	18	03	-20	-15	-18	04
Q4	-21	-13	-08	06	-12	-09	12	13	21	-03

Table XIII.-

First study 16PF-MAT U correlations.

	CAU	HOU	FRU	NAU	SEU	SSU	MAU	PGU	ASU	SWU
A	-04	10	-13	-12	03	15	-04	-12	09	-04
B	-09	-06	07	16	00	-06	-01	01	02	05
C	16	26	11	-17	23	03	-11	-09	-15	-01
E	05	-24	13	18	-16	-09	18	01	06	07
F	07	-01	08	-06	-08	-03	17	05	08	12
G	19	26	01	-27	31	11	-15	-08	-15	-13
H	12	14	11	-15	21	05	03	-14	-01	03
I	-20	-13	-17	07	01	20	16	-18	-10	08
L	-07	-11	04	14	-15	-10	02	12	07	-12
M	-20	-27	-11	20	-08	05	10	-16	00	-04
N	13	00	-03	-03	04	-16	-13	00	-05	00
O	-19	-13	-12	11	-08	-08	-06	06	11	-02
Q1	-01	-08	12	09	05	04	03	-02	-16	-03
Q2	05	-07	-03	13	-05	06	-03	-07	01	-01
Q3	14	18	06	-16	18	08	-18	-09	-15	-03
Q4	-22	-15	-07	10	-13	-05	03	12	14	-01

Table XIV.-

First study 16PF-MAT I correlations.

	CAI	HOI	FRI	NAI	SEI	SSI	MAI	PGI	ASI	SWI
A	10	05	-09	-07	13	-11	-08	-10	-02	04
B	-08	-05	01	22	16	16	19	-06	03	-03
C	07	08	03	-02	03	-01	-17	-09	-15	13
E	-15	-21	01	13	-07	20	09	11	17	-27
F	04	-08	-05	-04	-01	05	02	01	05	-05
G	03	23	02	-13	19	-10	-19	-07	-26	14
H	01	02	-09	-03	11	-07	-16	-07	-05	-02
I	-08	05	-06	04	10	12	05	-13	-09	09
L	-14	-01	06	-02	-03	-05	18	10	06	-12
M	-17	-04	00	12	11	15	19	-04	18	-13
N	-02	00	-12	15	-02	07	-05	01	12	-10
O	-06	06	-02	00	03	-20	16	12	11	02
Q1	-02	-18	04	06	-03	25	01	-12	04	-06
Q2	-04	-09	09	20	-08	09	04	05	16	-04
Q3	03	08	02	03	08	-02	-13	-14	-15	07
Q4	-14	-04	-02	-03	-01	-10	16	10	16	-06

Table XV.-

First study 16PF-MAT T Promax factor pattern matrix.

	1	2	3	4	5	6	7	8	9
A	-05	41	40	-06	-02	27	01	-01	-19
B	07	-08	-05	06	22	-14	03	09	-01
C	66	20	-07	10	06	23	-02	-02	10
E	-04	54	05	-16	07	-11	43	09	17
F	00	74	-20	-11	-01	-36	-02	08	-08
G	-23	04	-10	23	-05	07	-02	85	00
H	37	74	03	21	00	08	26	-05	04
I	-12	-06	85	-03	-03	15	-16	-07	-05
L	-51	08	-10	10	03	01	25	05	17
M	-13	-10	36	12	01	-10	29	-14	-08
N	11	-08	-01	-04	12	27	31	16	-15
O	-81	-16	05	08	06	09	-03	05	-03
Q1	37	-05	03	03	-04	-18	19	02	17
Q2	02	-59	05	-06	02	01	16	00	00
Q3	32	-09	00	03	05	18	-06	33	-04
Q4	-92	-04	08	-01	-01	00	09	19	-03
CA	20	-07	-15	-20	-17	05	04	07	-16
HO	04	00	-11	32	01	25	-16	01	-11
FR	09	00	-01	-05	-02	29	-02	00	64
NA	-01	-01	-04	-12	95	-05	-17	-05	-02
SE	-01	09	-01	63	-09	-05	08	13	-09
SS	09	-06	36	-10	-08	-20	-13	15	06
MA	-05	15	-11	05	05	-76	01	-06	-29
PG	-14	-04	-16	-23	-01	33	03	-07	40
AS	-10	03	-14	-28	00	05	40	-14	-22
SW	05	00	16	-12	20	-01	-49	02	00

Table XVI.-

Average factor loadings from Cattell and Nichols study.

	16PF second-stratum factors					
	1	2	3	4	5	8
A	58		32		31	
B						
C		66				
E				62		
F	53			34		-30
G						71
H	52	39		40		
I			73			
L		-57		38		
M			51			
N					65	
O		-77				
Q1						
Q2	-68					
Q3		42				50
Q4		-80				

Table XVII.-

First study correlations among 16PF-MAT Total factors.

	1	2	3	4	5	6	7	8
2	13							
3	10	-08						
4	17	-07	16					
5	00	-18	28	-11				
6	13	21	-46	18	-32			
7	-01	-15	26	-16	42	-31		
8	66	06	-06	19	-10	16	-11	
9	-05	-15	05	-19	18	-57	28	-03

Table XVIII.-

First study 16PF-MAT U+I Promax factor pattern matrix.

	1	2	3	4	5	6	7	8	9
A	03	36	-16	-10	60	16	13	11	16
B	14	-15	36	-02	05	-04	-09	06	-01
C	75	19	-06	03	08	-06	-08	-06	-06
E	07	68	18	-01	03	-08	-04	16	14
F	-01	65	05	-05	29	-01	04	-32	02
G	21	-04	05	48	03	-04	01	-18	-10
H	46	82	-11	13	37	-01	-03	15	01
I	-04	-01	-04	-11	23	24	18	49	-09
L	-47	11	09	17	-08	-10	-11	07	-01
M	-18	04	15	03	07	15	09	61	12
N	27	-04	13	01	05	05	-15	08	29
O	-75	-25	-04	04	09	03	-04	09	03
Q1	32	08	20	11	-25	-12	15	15	00
Q2	-02	-44	-04	02	-50	07	06	31	19
Q3	53	-16	10	11	08	-04	01	-11	05
Q4	-83	-09	06	11	07	00	04	04	09
CAU	15	09	-21	14	-32	23	-18	-18	23
HOU	11	-08	-21	24	05	22	-21	-16	-14
FBU	16	14	-01	01	-09	-63	15	-08	-08
NAU	17	-07	23	-55	-04	-12	-35	21	-17
SEU	01	04	04	69	-03	06	04	07	-31
SSU	-08	-02	-24	14	16	-13	82	13	08
MAU	-05	21	19	-01	-15	32	-10	04	-32
PGU	-09	-05	07	-14	-04	-55	03	-28	02
ASU	-18	10	-01	-09	10	08	-26	-04	16
SWU	17	-05	04	-51	12	07	00	-07	06
CAI	10	-09	-40	-18	03	03	24	-13	07
HOI	01	-10	-21	13	16	05	-09	06	-09
FRI	05	-07	-07	-02	-24	-01	-01	-03	-06
NAI	16	-11	17	-21	-03	15	-07	13	19
SEI	-05	03	03	22	36	02	09	18	-03
SSI	07	00	52	04	-21	09	26	-04	11
MAI	-23	-01	44	01	03	06	-14	-03	01
PGI	-06	07	-25	-12	-13	-26	-17	-01	08
ASI	-14	07	05	-28	05	02	11	08	65
SWI	11	-16	-41	01	-03	05	11	01	-34

Table XIX.-

First study correlations among 16PF-MAT U+I factors.

	1	2	3	4	5	6	7	8
2	-09							
3	-03	16						
4	41	-30	-39					
5	16	-31	-20	35				
6	13	08	01	-09	-01			
7	15	10	25	-23	-11	35		
8	-19	-09	22	-12	-10	-12	00	
9	11	-04	-10	20	-10	-19	-38	-03

Table XX.-

First study 16PF-MAT T multimethod analysis.

	1	2	3	4	5	6	7	8	9	10
A	26	-01	01	-20	-07	27	39	12	-27	06
B	07	14	-05	62	12	00	00	02	11	-03
C	33	13	06	05	-20	-05	13	05	35	-09
E	-46	-09	15	10	17	15	04	01	15	15
F	-04	05	20	-11	52	16	-05	04	04	-16
G	23	60	06	-19	-07	-20	-18	21	-03	11
H	-03	48	02	-07	06	16	32	-18	18	-08
I	-03	02	-28	14	21	-36	23	25	-32	-26
L	09	-11	-12	07	14	-02	-12	-07	12	60
M	-19	06	-23	19	14	04	40	06	-14	32
N	-10	20	35	18	-23	12	-10	-10	-43	11
O	-10	01	-28	11	-09	08	-08	-47	-13	-08
Q1	-46	10	-10	-06	-19	-14	03	34	17	05
Q2	-03	-11	03	29	-16	37	-04	38	02	-08
Q3	04	08	15	-04	-32	-19	27	-08	15	-08
Q4	-07	05	-50	-08	01	37	-21	-03	-04	-02
CA	01	06	81	-07	03	03	-05	06	01	-10
HO	82	09	08	-01	-05	-03	02	03	09	07
FR	-12	04	06	07	-02	01	-07	05	79	08
NA	-12	-18	02	80	-09	04	00	00	-09	08
SE	04	82	01	12	-04	-05	07	-02	-03	-06
SS	-08	02	-06	05	04	-01	04	80	-04	-07
MA	-10	-07	-10	13	79	-10	05	-02	-02	14
PG	-01	-04	-05	00	05	08	-81	-07	-03	09
AS	-06	-05	-08	04	15	81	03	-08	-05	03
SW	13	-05	-07	06	11	-04	-04	-04	06	-76

Table XXI.-

First study 16PF-MAT U+I multimethod analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	03	01-02	04-01	06	00-80-01-03-02-04	02-04	00	00								
B	-01-01-01	00	82	01	02	02	01	00	03	00-05	03	01-02				
C	07	01-03	04-02	79	06	07	04-05-02	02	00-03-07-01							
E	-05	02	83	03	05-08	10	06-03	08	06	00-02	02-04	04				
F	-03-02	02-01	02-02	03-01-01	02-02-03	78										
G	85	03-07-07-04	07-08-02	06-07-03	04-03-04	03-02										
H	04	01	03	02-02	05-03-05	80-02	00-05	01-01-03	03							
I	-02	84-06	08	05-03	01-02-02	03	00-03-02	04-05	00							
L	-07	00	10-03	02	00-04	05-03	01-02	01	06	08	78	01				
M	01	04	04	82	08-13-01	01-04	02	00	02-04	08	07-01					
N	04-08	04	03	01	02	00	06-04-06	09-80-04	00-01-02							
C	00-01-03	06	06-08	00	01-05	04-01-04	79	04	01-03							
Q1	02	02-03	05	02-06	80	06	03-03-01	00-10-03	04-03							
Q2	-03-01	01	05	00	00	04	00-03	03	80	06	01	00	02-02			
Q3	06	03	00-02	00	05-01	00	04-79	02	03-01-04-04	00						
Q4	-04-05	00-02-01-06	01-04-03	04-01	01	07	79	00	02							
CAU	27-18	16-20-13-02-09	11	11-15	30-14-15-40	07	26									
HCU	02-11-21-24	05	61-13-21	09-01	01-02-22-01	10	02									
FFU	-07-24	22-12	16	15	21	23	32-15-12	23-02-08	08	11						
NAU	-27	07	06	07	23-19	09	13	01	25	13	09	08-10	17-36			
SEU	38-04-22	03	05	10	14	18	46	05	02-06	00	01-22-19					
SSU	16	33-06-07-12-12	12-33	06-13	30	34-10	07-04	00								
MAU	-09	31	07	07-05-09-02	09	22	45-06	15-17-06	09	36						
EGU	07-21-14-49	09-29	09	19-18	08-10-06-06	27	09	09								
ASU	-15-29	04-07	17-23-37-28	15	22	05	15-08	18-04	03							
SWU	-26	16	12-09	13	03-14	15	02-12-04	04	07	05-49	25					
CAI	-09-23-25-10-03-06	10-23-09	11-08	03	06-51-24	05										
HCI	21	05-25	14-03-05-52	17-01-09-10-04-03-09	05-08											
FRI	07-23-01	14-01	07-04	21-21-08	18	52-08	00	00-07								
NAI	-13	10	07-03	41-01-04	07	02-10	46-24-02-06-05-11									
SFI	43	03	07	17	43-01-01-29	04-04-17	03	14	00-05	10						
SSI	05	07	13	20	23	03	25	13-28	15	02-08-54-06-17	02					
MAI	-10	06-11	15	33-06	04	09-19	04	04	06	25	05	36	27			
EGI	16-08	35-16-11	14-13	08-20	40	13	01	31	06-04-06							
ASI	-16-31-06	36-09-06	14-01	03	14	32-20	11	27-05	23							
SWI	09	17-45-16	04	18-01	10-09	07	09	14	16-04-18	05						

Table XXII.-

Means and standard deviations of second study 16PF.

	males		females	
	mean	S.D.	mean	S.D.
A	15.81	5.64	21.37	5.16
B	16.90	2.69	16.34	2.61
C	28.63	7.56	27.52	7.25
E	26.34	5.32	20.81	6.77
F	32.45	7.34	32.56	8.21
G	23.03	5.68	24.75	5.14
H	24.96	10.27	25.62	10.06
I	15.78	5.51	24.12	4.52
L	20.63	4.72	18.07	4.57
M	21.67	6.12	20.94	6.80
N	17.09	3.81	19.51	4.91
O	24.14	8.38	27.27	10.19
Q1	18.98	4.42	15.76	4.25
Q2	18.14	5.78	16.96	4.83
Q3	22.11	8.66	21.25	4.52
Q4	27.78	8.66	29.35	7.82

Table XXIII.-

Second study MAT means and standard deviations.

Factor	Mean	S.D.
CAU	4.14	1.67
HOU	4.89	2.04
FRU	3.75	1.89
NAU	5.79	2.00
SEU	4.90	1.99
SSU	4.80	1.83
MAU	6.17	1.87
PGU	4.88	2.18
ASU	5.64	1.83
SWU	6.54	2.19
CAI	4.74	1.65
HOI	4.61	1.90
FRI	4.44	1.82
NAI	5.33	1.87
SEI	4.32	1.80
SSI	4.60	1.57
MAI	6.39	1.75
PGI	5.25	1.97
ASI	4.45	2.02
SWI	5.57	1.89
Autism	4.07	1.79
Information	5.74	1.37
Integration	5.58	1.71
Interest	4.54	1.60
Conflict	7.32	1.41

Table XXIV.-

Second study 16PF inter-correlations.

	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3
P	-04														
C	-02	14													
E	-03	12	19												
F	42	14	16	41											
G	12	01	02	-33	-15										
H	38	20	51	50	61	-00									
I	45	09	-10	-34	08	29	06								
L	-13	-02	-50	24	03	-20	-16	-24							
M	-01	06	13	31	04	-07	16	21	-02						
N	00	-19	-05	-48	-39	33	-27	21	-17	-28					
O	07	-18	-51	-16	-13	03	-35	17	34	-02	13				
Q1	01	06	10	57	29	-26	28	-27	13	29	-33	-22			
Q2	-32	00	-28	-04	-37	-09	-50	-10	16	16	04	18	02		
Q3	-15	08	42	-12	-22	38	13	-08	-39	-18	29	-30	-13	00	
Q4	07	01	-66	-01	02	-03	-33	20	47	-05	-10	52	-07	24	-51

Table XXV.-

Second study MAT Total score inter-correlations.

	CA	HC	FR	NA	SE	SS	MA	PG	AS
HO	12								
FR	14	-16							
NA	-05	-21	-03						
SE	05	23	07	-18					
SS	-12	-06	06	03	01				
MA	-19	-06	-19	22	-15	02			
PG	12	-28	06	08	-28	-17	-03		
AS	-09	-02	-06	11	-08	-03	19	05	
SW	-30	-12	-19	06	-07	-05	28	-10	-10

Table XXVI.-

Second study MAT I inter-correlations.

	CAI	ECI	FRI	NAI	SEI	SSI	MAI	PGI	ASI
HOI	09								
FRI	17	-06							
NAI	-08	-10	02						
SEI	-09	00	02	-04					
SSI	-22	-12	02	26	-12				
MAI	-18	-16	-10	20	-19	26			
PGI	09	-16	10	-22	-05	-34	-07		
ASI	-13	07	02	13	-15	12	19	01	
SWI	04	09	-04	-08	07	-07	-06	-16	-12

Table XXVII.-

Second study MAT U inter-correlations.

	CAU	EOU	FRU	NAU	SEU	SSU	MAU	PGU	ASU
HCU	21								
FRU	05	-12							
NAU	-09	-33	02						
SEU	13	32	07	-32					
SSU	-02	04	18	-17	03				
MAU	-09	06	-19	16	-01	-17			
PGU	-01	-32	03	17	-37	-03	-04		
ASU	-05	09	-10	-02	05	-05	30	-05	
SWU	-29	-19	-14	25	-32	-20	30	11	-01

Table XXVIII.-

Second study 16PF-MAT regression analyses with females.

Dependent var	Ind. var.	d.f.	F	cum. var.	cum. p
MAT Autism	16PF H	1,88	4.53	4.90%	.036
MAT Information	16PF B	1,88	12.46	12.40%	.000663
	16PF C	2,87	4.26	16.49%	.000394
	16PF Q4	3,86	10.34	25.45%	.000013
MAT Interest	16PF F	1,88	12.50	12.44%	.000650
	16PF C	2,87	4.48	16.73%	.000347
MAT Conflict	16PF-Q2	1,88	5.45	5.84%	.022
	16PF -B	2,87	4.45	10.42%	.0083

Table XXIX.-

Second study 16PF-MAT regression analyses with males.

Dependent var.	Ind. var.	d.f.	F	cum. var.	cum. p
MAT Autism	16PF G	1,59	8.51	12.60%	.005000
	16PF O	2,58	5.63	20.33%	.001373
	16PF C	3,57	12.27	34.44%	.000022
	16PF F	4,56	7.99	42.62%	.000002
MAT Information	16PF M	1,59	10.18	14.71%	.002272
	16PF B	2,58	4.08	20.32%	.001376
MAT Interest	16PF B	1,59	4.74	7.44%	.033363

Table XXX.-

Second study 16PF-MAT U correlations.

	CAU	HOU	FRU	NAU	SEU	SSU	MAU	PGU	ASU	SWU
A	-16	08	-09	06	10	-04	19	-23	11	13
B	-04	-10	-05	10	-01	-14	00	10	08	-02
C	19	13	-08	06	13	11	03	-05	07	-11
E	10	-11	05	29	-24	-16	08	29	03	13
F	04	11	-07	13	-11	-14	30	06	15	16
G	02	20	-10	-36	30	22	-07	-14	01	-15
H	12	09	-11	15	05	-10	20	02	12	06
I	-28	04	-13	-07	22	04	04	-26	18	13
L	-05	-02	15	-03	-20	-15	06	17	-04	07
M	-23	-20	07	25	-10	02	03	04	01	15
N	-01	18	-02	-26	12	12	-17	-12	02	-05
O	-10	06	08	-01	06	08	-03	-11	-09	15
Q1	-02	-18	14	30	-36	-08	06	22	05	14
Q2	-09	-33	14	00	-01	01	-21	12	-17	03
Q3	20	04	-06	-11	19	21	-17	-02	-03	-23
Q4	-14	-04	02	-01	-04	-11	02	01	00	14

Table XXXI.-

Second study 16PF-MAT I correlations.

	CAI	HOI	FRI	NAI	SEI	SSI	MAI	PGI	ASI	SWI
A	00	00	01	08	12	06	10	-08	-03	26
B	05	-04	09	01	-02	32	17	07	06	09
C	12	06	02	12	12	12	04	-04	-03	-14
E	-04	-26	-02	20	-14	09	15	16	20	-14
F	00	-14	02	11	-04	17	29	-03	09	16
G	15	14	00	-18	21	04	-13	-17	-20	11
H	-01	-09	-04	13	09	16	14	-02	06	-01
I	-13	20	04	07	08	21	05	-29	-06	24
L	-12	-14	04	02	-11	-07	07	18	14	-03
M	-09	-06	03	24	14	21	14	-19	00	-10
N	-01	20	-03	-17	05	-06	-19	04	-09	-13
O	-07	10	01	-10	-05	-03	-06	-01	-13	14
Q1	03	-30	-07	13	-20	11	29	-02	13	-13
Q2	-03	-15	05	10	-04	04	-09	04	-01	-08
Q3	16	05	-06	03	17	-02	-16	-02	-14	-15
Q4	-13	-03	-01	-01	-12	-01	07	11	07	24

Table XXXII.-

Second study 16PF-MAT T correlations.

	CA	HC	FR	NA	SE	SS	MA	PG	AS	SW
A	-15	04	-06	10	13	-02	19	-17	05	24
B	03	-08	02	05	00	10	12	10	13	02
C	18	15	-07	10	19	16	04	-05	02	-17
E	09	-25	02	29	-24	-03	12	29	15	03
F	00	-02	-06	14	-11	00	38	03	14	22
G	09	22	-01	-34	32	17	-11	-18	-14	-04
H	05	-01	-13	16	09	01	21	02	12	05
I	-30	13	-04	-01	19	15	07	-32	08	23
L	-08	-09	11	-01	-22	-15	10	22	06	05
M	-19	-17	08	25	04	20	14	-06	01	06
N	-04	27	-07	-25	11	03	-24	-06	-05	-12
O	-12	09	06	-06	01	05	-03	-10	-14	21
Q1	03	-33	04	26	-36	06	22	15	11	03
Q2	-04	-30	15	07	-04	05	-18	11	-11	-02
Q3	21	08	-08	-03	25	12	-22	-02	-10	-27
Q4	-17	-08	02	-02	-13	-07	07	06	06	25

Table XXXIII.-

Second study 16PF-MAT T Promax factor pattern matrix.

	1	2	3	4	5	6	7	8	9
A	09	-14	89	02	-07	-18	-04	-21	-04
B	05	-12	-12	09	-04	-11	05	66	24
C	-80	07	00	-02	15	15	02	08	-02
E	07	93	18	05	23	-01	-06	00	00
F	05	25	63	-12	-12	01	12	13	01
G	15	04	13	73	03	06	02	08	-14
H	-25	47	67	17	03	03	01	07	00
I	17	-51	34	13	32	-05	-03	10	24
L	69	46	-10	02	-03	15	-04	01	08
M	-10	34	-14	-09	89	05	-07	-03	-01
N	-02	-17	-03	46	-11	07	-05	-38	15
O	60	08	-01	08	14	14	08	-21	-21
Q1	-07	66	13	00	21	-18	02	-14	05
Q2	18	-02	-48	04	20	-32	-04	08	-12
Q3	-45	08	-11	62	-12	-13	04	07	-09
Q4	88	-01	-01	02	-03	-01	05	20	08
CA	-09	16	06	03	-22	05	-33	04	-08
HO	-01	-07	-10	02	05	82	-02	-11	12
FR	13	-02	11	-14	12	-20	-54	03	-03
NA	-16	13	03	-20	20	-17	05	-03	10
SE	-11	-25	08	09	14	16	-16	13	-19
SS	-08	08	-09	21	35	-03	03	05	01
MA	01	05	05	-11	03	08	44	15	11
PG	14	28	-01	07	-27	-27	-11	08	13
AS	08	-06	01	-10	02	12	-17	19	62
SW	12	-09	10	-01	-08	-17	77	05	-45

Table XXXIV.-

Second study correlations among 16PF-MAT Total factors.

	1	2	3	4	5	6	7	8
2	-19							
3	-13	-05						
4	-20	-54	-06					
5	10	-27	29	03				
6	-14	-24	27	24	-16			
7	15	05	36	-29	26	-15		
8	-27	30	34	-08	10	14	-08	
9	-06	20	12	-18	02	-29	50	-15

Table XXXV.-

Second study correlations among 16PF-MAT U+I factors.

	1	2	3	4	5	6	7	8
2	-10							
3	-17	-18						
4	08	13	32					
5	23	06	01	16				
6	-04	23	09	14	24			
7	11	34	06	05	06	11		
8	-06	-11	-29	-19	-13	-03	-44	
9	-16	11	03	-20	-01	04	05	04

Table XXXVI.-

Second study 16PF-MAT U+I Promax factor pattern matrix.

	1	2	3	4	5	6	7	8	9
A	12	64	-14	-09	19	-03	00	12	-07
B	00	02	-01	18	00	08	-04	-08	67
C	-80	14	-06	12	-07	08	04	03	05
E	02	34	52	38	-07	05	-06	-08	-01
F	10	71	15	21	-06	-03	08	-04	07
G	07	17	-03	-41	-14	10	-06	41	11
H	-28	77	22	12	-06	02	00	07	05
I	15	25	-45	-26	30	32	-10	06	14
L	66	00	35	09	-19	-04	00	-09	-07
M	-12	-03	03	27	31	41	-08	12	-07
N	-03	-06	-01	-76	02	-04	-06	01	-21
O	58	-07	-08	-09	03	02	-01	10	-17
Q1	-04	22	47	21	07	14	-05	-09	-11
Q2	20	-60	11	12	13	17	-05	14	14
Q3	-48	-07	14	-30	-14	03	-02	28	12
Q4	86	-02	-02	07	-02	01	-03	-05	15
CAU	-07	02	13	07	-48	-06	00	02	01
HCU	03	20	-29	-07	-53	01	11	-03	-16
FRU	12	-03	20	10	-07	07	-26	11	-14
NAU	-17	00	13	21	41	-01	06	-17	01
SEU	-03	-07	-46	13	-39	12	05	23	11
SSU	-04	04	05	-13	-04	11	-21	29	-17
MAU	-05	05	-01	08	10	-03	77	22	-03
PGU	08	04	60	-10	18	-15	-11	-09	15
ASU	-03	11	-02	-10	-03	09	27	01	01
SWU	05	04	13	-07	53	-05	40	11	-09
CAI	-09	12	00	10	-10	-27	-27	05	11
HCI	-10	00	-52	-09	-06	-02	-31	-33	-05
FRI	04	05	03	06	10	-09	-19	02	13
NAI	-07	-05	01	13	-03	41	01	-12	01
SEI	-13	08	-01	-02	10	-02	05	44	-10
SSI	03	-02	06	-13	02	61	07	-12	29
MAI	04	08	05	01	03	28	19	-26	05
PGI	08	08	39	-04	12	-62	07	00	11
ASI	08	07	06	-02	-07	13	-29	-54	08
SWI	20	11	-42	28	-03	-08	10	20	17

Table XXXVII.-

Second study 16PF-MAT T multimethod analysis.

	1	2	3	4	5	6	7	8	9	10
A	26	13	30	-06	-26	20	12	-17	-02	10
B	08	-06	08	-08	16	07	-05	27	44	-09
C	07	25	19	31	-02	-24	-22	33	03	-07
E	-05	45	-09	-09	31	20	-21	08	27	00
F	54	02	-11	11	05	21	-08	07	02	10
G	07	-60	25	-01	-07	02	-18	32	-05	-05
H	29	11	21	-07	09	01	02	-01	06	46
I	-06	02	09	12	-51	22	34	17	30	-03
L	18	-08	-03	04	47	-05	29	-19	06	-24
M	19	23	08	-19	00	-14	49	39	-13	-07
N	-35	-20	-07	40	13	00	24	13	-01	30
O	-02	05	00	18	-01	45	-01	20	-46	-17
Q1	21	10	-65	-26	-05	-06	-03	20	04	10
Q2	-28	05	09	-55	11	09	03	11	-11	-12
Q3	-23	01	20	-06	06	-23	-17	23	-14	36
Q4	-02	-08	-07	-09	14	47	16	-05	09	13
CA	05	-01	-01	00	06	-16	-83	05	00	03
HC	-04	-06	18	84	-04	01	-03	02	-10	-04
FR	-03	01	07	-12	10	-04	04	05	00	-75
NA	12	86	01	-09	-05	-06	02	09	-04	03
SE	-02	-12	84	-04	-13	-10	00	15	03	14
SS	-01	-06	-08	-01	-09	01	04	81	04	03
MA	87	01	-05	02	04	-04	09	01	07	00
PG	-02	11	-02	-06	83	09	-04	02	09	07
AS	05	12	-06	09	-05	02	01	-06	78	02
SW	18	04	06	-04	-13	83	-02	-03	-01	-08

Table XXXVIII.-

Second study 16PF-MAT U+I multimethod analysis.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	-02	01	03	05-02	00	C8	08-02	81	05	02-01-02	05	03				
B	-01-05-06	00	01	82-02-02-01	01	05-06-05-01	05-04									
C	-02	03-03	07-02	07	00	00	C2	01-02-02	80-02-07	02						
E	06-12-03	00	83	04	02-02-06-03	01-02	03	00-01	03							
F	07	00	03	05	06	09	82-02	00	01	03	01	02-05	05	02		
G	-07	86	03	07-05	04-C3	03	C5	01-02	01-01-04-01	00						
H	01-03	02	04	04	C8	09	05-C2	02	02-02	04-02-02	79					
I	-08	04	86	02-07	10	00	01-C3	09-01	03	03-05	06	00				
L	-02-04-03	03	C8	00	C8-01-C6-02-03-09-04	79	05-01									
M	10-09	10-09	C6	06	03	84-03-03	03	05	03	01-03-03						
N	-06	06	00	09-07	00-C7-01	03	01-81	03-02-03-03-02								
O	-04	01	01	05-04	01-02-04	00	02	01	79-01	C7	04-02					
Q1	87-07	01-06	10	05	02-02-04-01	03	00	00	07-03-01							
Q2	-02	03-02-83	C6	03-C4-01	C2	00-05	05	02	07-02-02							
Q3	-03	07-02	00	01-02-10	01	81-03-02-04	09-03-02	03								
Q4	03-03	00-03	02-01-01-01-C7	00-01	01-02	01	79	01								
CAU	-03-04-26	04	01-08	19-33	25-33	09-01	27-15-12	28								
HOU	-11	24	01	58	09-09	12-12	00	09-20	16	17	13-04	08				
FRU	21	00-07-07-07-03-18	04	00-03	09	27	04	54-08-06								
NAU	19-45-10	16	30	13-17	20-C6	12	36	23	09-21-11	10						
SFU	-34	30	19-11-07	07-26-14	C5	14	04	10	25-11	03	31					
SSU	10	31	05	06	02-20-11	13	24-06-04	19	27-12	03-26						
MAU	-06-04-01	21-02-08	43	03-20	16	25-01-02	11-17	23								
PGU	03	12-17-01	48	12	10	10	C4-46	13-09-17	12	04-06						
ASU	13-09	35	30	12	16	C9-10	18	19-14-24-07-03-06	00							
SWU	08-05	09-18	25-14	29	12-33	13-25	36-04-13	15	07							
CAI	16	28-31-01	02	11	02-13	C5	25	05-13	16-27-22-22							
HOI	-34-12	14	29-30	04-11	10-08-23-14	10	15-20	08-22								
FEI	-31-03	02-12	00	18	18-02-19	03	11	01	15	13-24-34						
NAI	-02-24	24-22	25-14	19	19	25	12	14-15	37	11	07-01					
SEI	-26	21-16	07-10	00-01	55	18	17-03-15	01-03-04	20							
SSI	09	11	22-09	09	66	11	14	00-05-06	10	14-03-05	16					
MAI	41-06-05	09-20	19	30	14-16-02	10-11	24	04	28	07						
EGI	-17-26-47-01	17	17-C3-19	09	14-25	00	05	21	29-04							
ASI	05-01	01	07	27-05-17-05-44-03	09-37	17	10	16	06							
SWI	-16	17	14	10-C7	10	16-15	02	23	42	16-22-05	49-11					

Table XXXIX.-

Gordon means, standard deviations and inter-correlations.

	mean	S.D.
Ascendency (AS)	19.82	6.74
Responsibility (RE)	21.71	5.27
Emotional stability (ES)	21.97	6.33
Sociability (SO)	22.58	6.52
Cautiousness (CA)	21.06	6.56
Original thinking (OT)	22.02	5.46
Personal relations (PR)	21.58	5.91
Vigor (VI)	22.21	5.88

Inter-correlations

	AS	RE	ES	SO	CA	OT	PR
RE	14						
ES	36	58					
SO	78	16	20				
CA	-27	42	-03	-21			
CT	35	34	14	33	16		
PR	16	28	19	21	47	46	
VI	25	44	14	23	22	50	18

Table XL.-

Gordon with 16PF correlations.

	AS	FE	ES	SO	CA	OT	PR	VI
A	30	-18	-20	41	-06	07	18	06
E	22	09	08	18	03	17	06	26
C	39	44	59	29	06	25	36	19
F	53	-04	27	28	-45	17	-17	10
F	59	-10	11	63	-44	26	05	13
G	-14	36	-13	01	49	36	25	34
H	82	17	31	73	-23	36	24	28
I	00	-13	-35	11	24	25	29	17
L	-08	-42	-32	-21	-29	-15	-43	-16
M	16	-09	03	05	-07	35	13	03
N	-36	16	-13	-29	39	-15	05	02
O	-28	-27	-50	-13	-04	-16	-23	-25
Q1	33	-07	16	21	-26	22	-06	06
Q2	-39	-08	-07	-57	11	-05	-10	-12
Q3	08	63	35	02	48	12	20	39
Q4	-22	-50	-59	-18	-14	-24	-37	-23

Table XLI.-

Gordon and 16PF regression results.

1. 16PF factors as independent variables

Dependent variable	r squared	F (d.f. = 16,105)
GP Ascendancy	.72	16.80
GP Responsibility	.53	7.46
GP Emotional stability	.53	7.44
GP Sociability	.70	15.65
GI Cautiousness	.48	6.01
GI Original thinking	.46	5.60
GI Personal relations	.34	3.34
GI Vigor	.42	4.68

(F>2.53 is significant at .001)

2. Gordon factors as independent variables

Dependent variable	r squared	F (d.f. = 8,113)
16PF A	.29	5.79
16PF B	.12	1.87
16PF C	.45	11.47
16PF E	.46	11.80
16PF F	.56	18.03
16PF G	.44	11.12
16PF H	.74	39.77
16PF I	.28	5.70
16PF L	.35	7.57
16PF M	.21	3.66
16PF N	.27	5.21
16PF O	.34	7.33
16PF Q1	.22	3.91
16PF Q2	.37	8.40
16PF Q3	.49	13.84
16PF Q4	.43	10.68

(F>3.55 is significant at .001)

Table XLII.--

Beta weights to predict the Gordon given the 16PF.

	AS	RE	ES	SO	CA	OT	PR	VI
A	07	-09	-06	04	02	-17	01	-01
B	05	04	01	07	05	05	01	15
C	-07	10	17	-14	01	-05	09	-17
D	08	09	18	-14	-17	08	-16	26
E	12	-03	10	27	-23	14	-03	04
F	-14	26	-08	00	24	45	17	23
G	69	14	03	54	-12	26	20	11
H	03	-14	-14	-03	10	28	22	27
I	00	-20	-14	-18	-02	01	-20	05
L	-05	-08	-08	-06	08	08	-01	-09
M	-02	01	-02	-10	03	-10	-08	03
N	-03	03	-18	16	-01	06	00	-16
O	-04	-09	-13	04	08	14	01	-04
Q1	02	05	12	-21	01	21	15	03
Q2	09	27	04	02	31	-11	-16	30
Q3								
Q4	-04	-15	-29	-07	03	-36	-29	-22

Table XLIII.-

Beta weights to predict the 16PF given the Gordon.

	AS	RE	ES	SO	CA	OT	PR	VI
A	12	-13	-25	37	-03	-09	20	04
B	18	-08	07	01	09	04	-07	23
C	18	23	33	-03	-19	-06	28	05
F	57	-09	15	-27	-27	22	-17	02
F	21	-12	06	38	-29	12	01	02
G	-25	34	-33	20	27	19	-04	11
H	58	11	-05	18	-22	05	12	07
I	-02	-19	-32	15	18	09	21	14
L	29	-24	-16	-31	05	16	-40	-08
M	20	-27	09	-21	02	46	02	-14
N	-19	22	-20	-06	22	-19	05	08
O	-19	09	-48	19	07	10	-16	-28
Q1	26	-25	22	-05	-05	30	-16	-05
Q2	08	-09	08	-67	06	26	-08	-10
Q3	11	43	06	-10	25	-15	-05	28
Q4	09	-17	-43	-03	11	01	-26	-13

Table XLIV.-

Congruence coefficients for the 16PF-MAT Total Promax.

	First study factor #								
	1	2	3	4	5	6	7	8	9
Second study factor #									
1	-91	-15	09	-10	-07	-04	12	12	08
2	06	43	-24	-12	08	-20	53	07	33
3	09	82	26	00	-03	04	03	05	-08
4	03	-04	10	25	-12	29	08	83	-07
5	-03	-09	56	22	15	-17	23	-09	02
6	-09	15	-20	51	-17	03	03	05	-35
7	-06	08	08	-00	26	-46	-46	03	-38
8	-00	06	-09	04	06	-31	-01	11	03
9	-03	04	-02	-28	09	-01	46	-26	-13

Table XLV.-

Congruence coefficients for the 16PF-MAT U+I Promax.

	First study factor #								
	1	2	3	4	5	6	7	8	9
Second study factor #									
1	-84	-18	01	05	-09	-05	07	06	08
2	23	83	-10	00	67	05	05	-08	-01
3	06	33	31	-26	-24	-56	-03	-15	36
4	-06	28	01	-12	-18	-06	-04	16	-21
5	-07	-09	24	-67	15	-09	07	43	03
6	03	-04	59	13	-02	31	24	44	15
7	-01	13	27	-10	-03	41	-37	-10	-35
8	16	-03	-26	43	15	06	30	07	-41
9	10	-09	27	00	-14	-02	-02	-05	-02

Table XLVI.-

Congruence coefficients for 16PF-MAT T multimethod.

	First study factor #									
	1	2	3	4	5	6	7	8	9	10
Second study factor #										
1	-05	05	-11	01	78	01	17	-00	10	06
2	-31	-41	-04	55	05	23	20	-07	09	02
3	49	63	06	08	-09	-03	24	-12	-02	-10
4	63	10	15	-13	01	-12	-02	-26	-13	01
5	-16	-11	10	09	07	23	-67	-23	26	43
6	-03	-10	-38	02	22	23	-18	-11	-18	-55
7	-10	-10	-72	18	14	03	19	02	-30	28
8	-11	35	-02	31	-07	-16	15	58	04	-07
9	-14	01	-05	19	34	42	-01	16	03	01
10	-03	30	14	-15	-10	08	19	-07	-51	-14

Table XLVII.-

Congruence coefficients for 16PF-MAT U+I multimethods.

Second study factor #	First study factor #															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-37-04	13	06	10-23	67-02-05	03-01	02-07-00	15	15							
2	73	03-37-18-12	22	06-22	11-21-12	06-14-09-18	10									
3	-08	60-19	25	13-05-08-03	12-07	04-02-21	19-14-06									
4	08-02-18-13-01	19-29-20	12	13-52-04-04-01	18	10										
5	-25-15	60-13	13-18	22	10-08	21	26-04-07	18-07	05							
6	06-05	02	13	64-01	13	15-20	22-01	04-18-00-01-02								
7	-14	11	04-07	13-00-08	01-10	18	02	09-11-07	03	80						
8	03	21	07	65	38-21	03-10-06-05-10	05-03	15	07-04							
9	31	02	01-26	05	04-07-18	08-59	09-03-08-22-02-16									
10	-08	15-07	13	13	19-01-65	10	18-01	08	16-10-21-06							
11	-10	10-18	02	12-15	22	10	06	15	04	57	06-10	12	03			
12	01	22-03-06-01	12	03	16	04-06-06	14	39-07-16-11								
13	13-00	01	16	09	54	07	06	12-13	32	01-09-20-05	01					
14	-12-17	25-08	06	13	13	18	02	05	02	11	09	24	64	08		
15	-01	13-13-07	08-00-07	02-15	09	07-08	33	68-03	11							
16	10	05	16	05	09	08	07	00	71	09-04-26-08-02-02	16					

Table XLVIII.-

Comparison of the means of the samples.

Factor	t	p
H	2.68	.008
I	4.29	.000
M	2.66	.008
Q1	3.90	.000
Q2	6.67	.000
Q3	4.74	.000
FRU	4.36	.000
SSU	3.87	.000
FRI	3.60	.000
NAI	4.74	.000
SEI	3.17	.002
FRT	4.99	.000
NAT	4.91	.000
SST	9.04	.000
Autism	3.37	.001
Information	10.41	.000
Interest	8.44	.000
Conflict	4.69	.000

APPENDIX 4

ABSTRACT OF

Relations between and within the 16PF, MAT, GPP, and GPI

The primary goal of this study was to assess the degree of correspondence between factors from what have been termed the dynamic and temperament modalities of personality trait organization.

The investigation consisted of two separate studies employing the same, main instruments, the 16 Personality Factor Questionnaire (16PF) and the Motivation Analysis Test (MAT), but with different samples of participants. The Gordon Personal Profile (GP) and Gordon Personal Inventory (GI) were also included in the second study. In the first study, 243 university students completed the two tests, while in the second study, 151 high school students took part in the study.

The data from each study were analysed by means of stepwise, multiple regression analyses, oblique factor analyses, and multirethod factor analyses. A comparison was made between the factor analytic results of the two studies by means of congruence coefficients.

The results indicated very little sharing of variance between modalities but considerable evidence of relations within the temperament modality.

APPENDIX 4

It was concluded that knowledge of the apparent independence of modalities could be useful for predictive purposes, and was an interesting phenomena worthy of study in its own right, particularly from a developmental point of view. The relations within modalities were viewed as potentially helpful for making possible a more flexible usage of psychological tests in both applied and theoretical settings.