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UNDERGRADUATE PERSONALITY AND ACHIEVEMENT

An Empirical Study of Anxiety-Stability,
Introversion-Extraversion, and Organizational
Study Behaviour as Components of
an A.T.I. System, and Notes Towards
Some Epistemological Issues

Thesis Submitted by

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in January, 1979

as partial fulfilment of the requirements for
the Degree of Doctor of Philosophy in
the Department of Education at
the James Cook University of North Queensland.

'You seem to imagine people do everything on purpose. But people do hardly anything on purpose. They behave as they do because they can't help it; that's what they happen to be like. "I am that I am"; Jehova's is the last word in realistic psychology. I am what *I* am - a sort of transparent jelly-fish. While you're what *you* are - very tightly shut, opaque, heavily armoured: in a word, a giant clam. Morality doesn't enter; it's a case for scientific classification.'

Aldous Huxley, 'After the Fireworks', in *Brief Candles*. London: Chatto & Windus, 1930.

I could only weave a net of verbiage ... like a psychologist, and talk about masochism and guilt-sense, or introversion and extraversion, or some such foolery.

R.G. Collingwood,
An Autobiography.
Harmondsworth (Mddx.):
Penguin Books, 1939.

ABSTRACT

The differentiation of task performance as a function of relevant personality and study strategy dimensions was explored in the present study within a broadly conceived Aptitude-Treatment-Interaction system. Following an inspection of research findings pertinent to undergraduate academic achievement, Anxiety-Stability, Introversion-Extraversion, and an Organizational Study Behaviour scale were entered as aptitudes, and the prescribed assessment tasks in a course of study in Education at the James Cook University of North Queensland were entered as treatments. The personality domain was structured *via* factor analyses of items drawn from relevant aspects of research into student achievement, and the Study Behaviour scale was taken directly from the work of Biggs (1973). Performance domain variables were subjected to task analysis in order to devise appropriate predictions relating each performance task to the system of reference variables.

The Aptitude-Treatment-Interaction model was applied using well established procedures, except for a systematic confounding of the dependent variable set with the treatments used. Differentiations of performance were studied both within tasks and in contrasts involving two levels of inter-task analysis; at the first level each task was compared with all other tasks

taken together, and at the second level comparisons were made task by task. Throughout these analyses the specific role of a three-way compound involving the Anxiety-Stability/Introversion-Extraversion/Study Behaviour variable set was under close scrutiny as a particular reflection of the essential characteristics of an Aptitude-Treatment-Interaction research model.

The results of the study provided clear, though somewhat uneven, support for the interactive system that had been formulated; however this support was only evident in those cases where inter-task comparisons were made. There was no indication that the three-way compound of specific interest in the analyses was relevant across subjects within tasks.

Where detailed analytic competencies were identified as task infraskills, and in the case of performance in small group tutorial settings, relative success was characterized by low Anxiety, moderate levels of Extraversion, and well organized Study Behaviour. By contrast, relative success on more conventionally defined Essay tasks was characterized by higher levels of Anxiety and Introversion, with Study Behaviour evidently having little impact. The results consistently pointed up the importance of Anxiety-Stability in the differentiations studied.

These findings were interpreted with special reference to the need for a content-based articulation

of undergraduate assessment programmes and the significance of a non-unitary concept of academic achievement. Within the broader philosophical arena, the results were considered to offer support for the substantial dominance of subject matter over more radically individualistic orientations in the acquisition of knowledge.

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ACKNOWLEDGEMENTS

The encouragement and detailed guidance offered by Professor E. Scott of the Department of Education at the James Cook University of North Queensland are warmly acknowledged. Similarly, the students who willingly participated in the study reported here deserve appropriate recognition. The permission of the James Cook University's Administration to draw upon student records was gratefully received, and the ready assistance given by staff of the University's Computer Centre was an invaluable asset.

Many useful suggestions for the conduct of the present study were made by staff in the University's Department of Education, and they too are thanked for their interest. In addition Mr. G.R. Elsworth, of Melbourne, provided much guidance in the early stages of the research, and Professor J.B. Biggs, of Newcastle, kindly allowed me to make use of his Study Behaviour inventory.

Ms. M. Houston's painstaking care in typing the final manuscript and her equanimity throughout were reassuring. And the consideration extended by Dr. A. Cumming and Mr. K. Orr in their assistance with aspects of the proofing was greatly appreciated. Finally, my thanks go to my wife and children for their forbearance over the period of the study, and at other times.

DECLARATION

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

I.A.R. Jackson
5th January, 1979.

INTRODUCTION

It is a commonplace of daily classroom existence that teachers treat students in different ways. While the particularities of this differential treatment vary greatly from one occasion to another its nature is typically determined by the specific characteristics of a given pupil at a certain stage in his learning of some predetermined bit of subject-matter. When a teacher endeavours to take account of this complex set of variables in a systematic way he is said to be individualizing instruction. But it seldom happens that the individually different approaches a teacher might adopt towards students having different characteristics are based on an articulation of the network of relationships among the characteristics involved, the approach selected, and the intended learning outcomes.

The attempt to formulate a system of this kind and to explore its viability beyond the factitious level of laboratory experimentation had its most recent origins little more than two decades ago in L.J. Cronbach's now famous address to the American Psychological Association (1957). Although the case he put was psychologically oriented, he also drew upon statistical and economic ideas for additional support, and these three fields of study have continued as

the main pillars on which the Aptitude-Treatment-Interaction (ATI) model has rested (Bracht, 1970; Cronbach & Snow, 1969; Mitchell, 1969; Tobias, 1976). A fourth but rarely considered pillar may be identified, grounded in epistemology.

In the present chapter these four pillars are considered in so far as they contribute to a particular meta-theory arising primarily from the work of Cronbach (1957; 1967) and Cronbach & Snow (1969). Their unification of correlational and experimental traditions in research and the impact this has had on the ways in which problems in teaching and learning have come to be conceptualized (*cf.* Snow, 1973, pp.97ff.) are reformulated and amplified in the following discussion. The main concern at this broader level is with epistemological issues and, as a consequence, the meta-theory which is formulated under the term 'limitedism' rests unequally on the pillars reviewed here. The sense in which a limitedist principle amplifies and re-states existing ideas may be found in its pointed attempt to reflect the theoretical significance of a specific intersection of events from ideographic and nomathetic sources, thus traversing Cronbach's territory but in more distinctly epistemological mode.

An essentially psychological stance will be adopted in approaching the issues to be discussed within the domain of epistemology. A principal source

at this point is the work of Piaget (1971a, 1971b, 1973) whose genetically based radical constructivism has profoundly influenced contemporary views about the nature of knowledge (see *e.g.* Magoon, 1977). Piaget's application of Structuralist principles in his studies of cognitive development has led him to view the process by which knowledge is acquired in terms of a cybernetic model that places an active knower (the *epistemological subject*) at the focus of an operational system which generates new structures by 'reflective abstraction', *i.e.*:

. . . a mode of thought characteristic of modern mathematics and logic . . . which does not derive properties from *things* but from our ways of *acting on things*, the operations we perform on them; perhaps, rather, from the various fundamental ways of *co-ordinating* such acts or operations - "uniting", "ordering", "placing in one-one correspondence", and so on.

(Piaget, 1971-b; p.19)

What is known is thus neither a passive mirroring of the logic found in the objective world, nor is it the mechanism by which intelligence functions, but rather the *outcome* of a dialectical cognitive process in the plane of operativity. When conceived in this way, knowledge is the product of a psycho-epistemic interaction, and a study of the nature of knowledge may therefore legitimately be pursued within the psychological arena.

A Note on the Four Pillars

Of the four pillars listed at the outset, the economic is of least immediate relevance for the present discussion. Its influence has remained more in the planning and administrative spheres where a concept of 'pay off' has emerged which, though seldom spelt out, relies upon estimates of productivity in student performance under conditions where the treatment is tailored to correspond with task-relevant pupil or group characteristics, as contrasted with student productivity on comparable tasks but under treatment conditions that are undifferentiated. The focus of interest on such issues as instructional effort, investment costs per student, performance gain, and overall system efficiency, has little to do with the thesis underlying the present inquiry. This pillar may therefore be put aside.

Similarly, but to a lesser degree, the statistical pillar must be regarded as of indirect, though crucial, importance. Its value emerges chiefly through the patterns of change by which originally agricultural research traditions have been modified or abandoned in Education over recent years, thus acknowledging a major shift in the researcher's concept of experimental error and, as a concomitant of this, the recognition that intra-subjective factors must be taken into account more directly. Given the advances in computer

software and technology that have more than kept pace with these trends, the way has been cleared for the use of research designs which are sensitive to the typically multivariate contexts of teaching and learning (*e.g.* Cohen & Cohen, 1975; Finn, 1974; Kerlinger & Pedhazur, 1973). In this respect the statistical pillar must be counted as having provided what might ultimately be the decisive instrumental force so far as the empirical study of epistemological problems is concerned. By providing the techniques which actively encourage a multivariate conceptualization of research problems (*e.g.* Anderson, *et al.*, 1971; Biggs, 1973; Elsworth, 1978; Everett, 1971; Sundqvist, 1973;) it has led Educational inquiry that much nearer to a fundamental re-examination of the ways in which knowledge is acquired. Thus, the search for relevant aptitude variables or, more pointedly, for relevant sub-sets of aptitudes whose elements combine in differing ways to yield typological patterns which enter into stable and systematically predictable relationships with achievement offers the necessary empirical basis for testing hypotheses at F-Theory level (Snow, 1973, pp.82ff) but with immediate implications for C-Theory and, less directly, B-Theory. It is at this grade of theory that epistemological issues come most clearly into focus by providing Educational inquiry with a vital source for its particular form of pragmatic eclecticism.

It remains true, however, that the instrumental character of the statistical pillar deprives it of immediate relevance in formulating a meta-theory for the use of an ATI model in Education. Having admitted that it would be strategically impossible to pursue such a model without the recent development of appropriate statistical tools, the researcher must then turn to a direct consideration of those components that are of direct relevance for an ATI meta-theory. The present study was designed with its immediate focus on aspects of the psychological pillar, but having mediate epistemological relevance. Its purpose was to explore a particular set of psychological elements within an ATI model which was actively conceived with reference to the main epistemological forces that must be taken into account. While the selection of psychological elements was, of necessity, carried out in terms of relevant theory and research in the field of student achievement, the study's epistemological reference called for a review of the principal current lines of debate in that arena as an essential prior step.

It will be argued that the ATI model, by virtue of its interactive structure, clearly recognizes the major role played by an individual in acquiring knowledge, and that this is substantially more than a tacit re-statement of the principle of an active subject. In its most strident form the model's implied

approach is coterminous with a radical subjectivism which is seldom encountered in discussions about the theory of knowledge, even though its principles are firmly established. The case for an active knower is immanent in much epistemological writing from Hume onwards, and has reappeared during the last two decades with new vigour. Specifically in the field of Education the work of Piaget alluded to previously has indicated that the way in which people acquire knowledge is not independent of their individual qualities nor of the knowledge that is involved, and hence that the search for principles of structure in epistemology must reflect this.

There are two key aspects to this introductory discussion. First, a distinction drawn by Lakatos (1968) between the logic of justification and the logic of discovery will be re-stated; and second, within the logic of discovery a further distinction will be drawn between monist and pluralist orientations so as to prepare the ground for what will be labelled a 'limitedist' position.

The Logic of Justification and the Logic of Discovery

A general recognition that the scientific method of inquiry is sustained in some degree by irrational processes was the direct consequence of Hume's influence. His analysis of the inductive foundations

of scientific knowledge led to the construction of a hierarchy of levels underlying the way people deal with events in the natural world, thus:

Level 0 - Sensory reports;

Level 1 - Observational reports about things;

Level 2 - Empirical generalizations about things;

Level 3 - Exact and universal laws of mathematical physics.

(After Watkins, 1968).

Hume pointed out that no purely logical connection exists to link, for instance, the zero-order and first-order levels; our observational statements which are intended to describe sensory impressions, while they may claim psychological validity, have no comparable logic to support them. On the psychological plane we are forced to make inferences from one level to another, but the logical purist who endeavours

to abstain from such inferences would be condemning himself to a state of solipsism and paralysis against which his animal instincts would soon rebel.

(Watkins, 1968).

Both sanity and science thus demand a robust, inventive, but systematic illogicality.

The character of this de-rationalized activity continued to follow the received Baconian path of inductive ascent, steadily advancing from rigorously proven truth to proven truth according to a 'drip-drip' principle of inductive validation leading to theories of ever higher order (Lakatos, 1968). But

the content of a Level 2 statement, for example, goes far beyond, indeed infinitely far beyond, any consistent assembly of Level 1 statements, which renders the whole system logically top heavy (Watkins, 1968). Carnap's efforts to re-rationalize the structure by introducing a probabilistic 'degrees of confirmation' principle were unsuccessful because of the inverse relationship which holds between the substantive content of an evidential statement and its theory-based truth value. For any theoretical statement, the probability that it is true with respect to the evidence is at a maximum when it is devoid of new content; the truth value of a tautological assertion is unity and its value as a falsifier is zero.

In his discussion of the problem of inductive logic, Lakatos (1968) separated issues related to the foundations of knowledge (or the logic of justification) from those related to the growth of knowledge (or the logic of discovery). It will be evident that in such a division Carnap's work falls within the area of justification or what Lakatos refers to as weak confirmation. By contrast Popper's work addressed itself to the re-rationalizing exercise first by denying the assertion that our thinking is inductive (and therefore illogical), and second by developing a purely deductive methodology by which rational choices can be made between competing theories without involving inductive

inferences from one level to another in the hierarchy (Watkins, 1968). Popper was thus very much concerned with the logic of discovery as an aspect of scientific method. This becomes clearer if we look at his notion of 'acceptability' as it has been analysed by Lakatos (1968).

Popper's critical empiricism distinguished the method of discovery from that of corroboration in science and he rejected the undifferentiated appraisal of hypotheses which characterized traditional empiricism. He also acknowledged that people do in fact behave illogically (Popper, 1968), often forming their beliefs on the basis of one event only; and he admitted the dispositional nature of all assertions:

... all universals are dispositional terms, even such apparently observational terms as 'red'. A body is red if its surface is disposed to reflect red light, that is, light of certain frequencies.

(Popper, 1963, p.118)

But even 'looking red' is a dispositional term. 'It describes the disposition of a thing *to make onlookers agree that it looks red*' (Popper, 1964, p. 118).¹

Popper thus emphasized the centrality of the individual, and elsewhere in similar vein argued that there can never be a pure observational language because of the theory-laden or contaminated nature of our observations (Popper, 1968). While this does not mean that the choices we make between competing theories are

1. Italics added

methodologically irrational, it locates the context in which theories emerge beyond the rational domain. We can still be absolutely rational in the methods we use to choose between two wholly irrational hypotheses.

Given that a theory-laden and, in the last analysis, irrational hypothesis comes forward for serious consideration, Popper's approach would make separate appraisals of its acceptability. The first, which Lakatos (1968) subscribes *acceptability*₁, admits it to the body of scientifically testable ideas if it is bold, *i.e.* if it implies excess content over its rivals and is consequently testworthy. The only judgment that is ever entered about a theory's content therefore is this comparison of it, relative to the evidence, with its alternatives.

The second appraisal takes theories which have withstood severe criticism and testing and examines their corroborability.

Bold theories, after having been severely tested, undergo a second 'posterior' appraisal. A theory is '*corroborated*' if it has defeated *some* falsifying hypotheses, that is if *some* consequence of the theory survives a severe test. It then becomes '*accepted*₍₂₎' in the body of science. A theory is '*strictly corroborated at time t*' if it has been severely tested and not refuted up to time *t*.

(Lakatos, 1968)

This may be represented by *acceptability*₂.

Finally there is *acceptability*₃ which is contingent upon a theory's evidential support and offers an appraisal of its future performance. *Acceptability*₃ dominated the all-purpose judgments of traditional empiricist method but was of less interest to Popper. Nor has it any immediate bearing on the present attempt to identify the specifically personal character of the logic of discovery.

For Popper, rapid potential growth (*acceptability*₁) and rapid actual growth (*acceptability*₂) are essential to the existence of science.

Slow growth is not good enough to live up to Popper's ideal image of science. If imagination does not fly fast enough ahead of the discovery of facts, science degenerates. The Popperian model exposes this degeneration . . .

(Lakatos, 1968)

In his explicit recognition of the importance of imagination in Popper's ideas, Lakatos identified a key issue having to do with the more general role played by non-cognitive factors in the methods we use to expand our knowledge. If imagination is to be allowed, as it must be, we should have no objection to accepting its diversity of expression among different individuals - their *styles* of imagining, conceiving, and supposing; and if this is admitted, the whole question whether a fixed method, or even a fixed theory of rationality, obtains must be raised.

The most emphatically stated case to have been developed along these lines appears in Feyerabend's *soi-disant* anarchism (1970, 1975). His focus of concern, like Popper's, is the logic of discovery, but his line of attack is through an advanced form of pluralism which extended Popper's falsificationist principle and elevated it to the point where it becomes a methodological imperative. He argued that the only path to progress is that which maintains an unremitting attack on existing theories and their implied ontology; we must go beyond the naive *acceptance*₁ level of the Popperian model by actively inventing or fabricating ideas that are calculated to refute and reject existing theories without being too troubled by the problem of content; we must operate both inductively and *counter-inductively*, and be willing to allow, even to promote, conceptual instability in our search for rational meaning, thereby recognizing the atavistically contaminated nature of evidential statements:

To those who look at the rich material provided by history, and who are not intent on impoverishing it in order to please their lower instincts, their craving for intellectual security as it is provided, for example, by clarity and precision, to such people it will seem that there is only *one* principle that can be defended under all circumstances, and in all stages of human development. It is the principle: *Anything goes*.

(Feyerabend, 1970).

Feyerabend asked whether the historical phenomenon of (scientific) knowledge might not contain ingredients that defy rational analysis even though they may be amenable to psychological or sociological study.

The rules which create order in the world of ideas

will most likely be entirely inappropriate for creating order in the brains of living human beings The numerous deviations from the straight and rather boring path of rationality which one can observe in actual science may well be *necessary* if we want to achieve progress with the brittle and unreliable material (instruments; brains; assistants; etc.) at our disposal.

(Feyerabend, 1970)

The seeds of a stridently radical subjectivist epistemology lie very close to the surface of Feyerabend's method against method. And it is possible to argue that they would be completely exposed if he were to go beyond the exclusively scientific reference which particularly concerned him. Feyerabend's profound questioning of the conventional positivist stance and his rejection of the prevailing view of scientific inquiry based on a disjunction between subjective and objective reality had an important precursor in Polanyi's book *Personal Knowledge* (1962) which set out to show that objectivity, in its usual sense, is a delusion and a false ideal. Polanyi's ideas extend Feyerabend's subjectivist method to embrace the content of our knowledge as well, putting doubt and belief in a prominent position as tacit but vitally

active components in a *Gestalt*-structuring exercise:

Like the tool, the sign or the symbol
can be conceived as such only in the
eyes of a person who *relies on them*
to achieve or to signify something.
This reliance is a personal commitment
which is involved in all acts of
intelligence by which we integrate
some things subsidiarily to the centre
of our focal attention.

(Polanyi, 1962, p.61)².

Polanyi seized upon this notion of commitment as a dynamic act signifying the personal participation of a scientist in his own knowledge - his active attempts to make sense out of his experience and to determine its trustworthiness, for instance in the specification of probability levels and confidence limits which Polanyi regards as classic sources of evidence for the subjective components of our knowledge (and cf. Miller, 1968). Discovery and knowing are passionate acts which are guided by one's sense of obligation towards an ultimately subjective reality. We share our understanding of truth to the extent that these intellectual passions are 'convivial', *i.e.* to the extent that they exhibit what he calls a 'civic coefficient' or index of inter-subjective agreement. Polanyi rests his case finally on the role which each individual person must play as an active agent both in discovering and in justifying the knowledge he acquires:

2. Original Italics

What then can we do? I believe that to make this challenge is to answer it. For it voices our self-reliance in rejecting the credentials both of medieval dogmatism and modern positivism, and it asks our own intellectual powers, lacking any fixed external criteria, to say on what grounds truth can be asserted

. . . .

(Polanyi, 1962, p. 265)

It will be evident at this point that a pluralist, even reductively subjectivist epistemology is actually being defended, however this can only be done at the expense of what Polanyi has called the civic coefficient. With each degree's increase in subjectivity there is a corresponding loss of inter-subjective agreement, and the search for a purely monist basis on which to build our knowledge becomes the more futile and misdirected to that extent. But radical subjectivism incurs its own penalty in the severe constraints it imposes on consensus, though these are felt more at the *acceptance*₂ and *acceptance*₃ stages within the logic of justification than in the logic of discovery. There must be *some* measure of agreement, of inter-subjectivity, before knowledge can become public (Ziman, 1968).

A major contribution towards the search for a basis on which principles of consensus might be established is to be found in theories about the structure of knowledge. Writers like Phenix (1964), Hirst (1969), and Schwab (1964), for example, have

defended a case for the differentiation of structures along specific disciplinary lines. Each discipline is considered to have substantive and syntactical features which mark it off in such a way that we should be able to discover

what makes art art, language language, and science science - in short, what characterizes any class of knowledge as what it is and not some other class - so that the appropriate ways of knowing will be used with assurance, clarity, and skill

(Phenix, 1964).

Some seven or eight, and occasionally nine, such differentiated structures have been posited, each involving distinctive forms of judgment located within the fields of mathematics, the physical sciences, the human sciences and history, literature and the fine arts, morals, religion and philosophy (Hirst, 1969). With reference to the distinctive rational judgments that are used, 'each structure involves elements which are irreducible to any of the others, singly or in combination' (Hirst, 1969). By these means an essentially monist reduction of knowledge to the smallest coherent number of substantively and syntactically discrete premisses has been effected yielding an impersonal, purely content-based epistemology with its historical roots firmly established in an ultimately Platonic, idealistic world.

There are two unresolved issues in all this. First, do such discrete structures actually exist? And second, if structures can somehow be identified, what is their nature, and how did they emerge?

So far as the first issue is concerned, Phillips (1974) has questioned the view that all disciplines possess a unique body of concepts interrelated by laws and theories in such a way that they exhibit the kind of structures being discussed. Phillips tried, with little success, to distinguish *substance* from *syntax* in scientific discourse, and was led to ask if there are any grounds at all for concluding that the syntactical differences between researchers in, say, quantum mechanics and physical optics are less significant than those between the quantum theorist and historian. How, for instance, does the structure of knowledge as Hirst might view it, aid us in our understanding of the role of mathematics in the physical and human sciences? And what is the extent to which Phenix might willingly go in allowing interactions among his facts, forms, and norms? Phillips accused both Hirst and Peters of having argued in cyclic fashion by taking 'catagoreal' concepts defined as important by each discipline and using them to establish that discipline's disciplinary existence.

Phillips puts a compelling case that cannot be dismissed lightly. He forces us to re-examine the question whether identifiable structures exist at all,

and to search for pointers to their defining features beyond the substantive and syntactic domains. One such domain which has been given some attention in the present discussion is that which embraces the individual himself. In the context of a system involving a body of concepts assembled into theoretical structures of some kind, and an active knower confronted by these structures in circumstances characterized by many of the features of a discovery process, it is entirely reasonable to set about exploring those qualities of personality organization that will plausibly act to moderate the outcome. To the extent that moderating influences are detected it may then be said that the epistemic system being examined is a personal one:

...on the one hand, the psychological structure of knowledge is a derivative of subject-matter content abstracted from the logical structure of knowledge, and psychological meaning is an idiosyncratic elaboration of logical meaning; on the other hand the logical structure of knowledge is a topically systematized reorganization of the psychological structure of knowledge as it exists in mature scholars in a particular discipline.

(Ausubel, 1964).

The dualistic psycho-physical correspondence theory of former times thus has its modern counterpart in a psycho-epistemic interactionism.

In its most compressed form the present discussion has focussed on an essential tension between structurally oriented monism and functionally oriented pluralism.

When considered in terms of its day-to-day manifestations, this tension is not so sharply defined, taking on a less distilled character in undergraduate studies, for example, as an interaction involving ordinary students faced with more or less established fields of knowledge which have to be mastered in largely traditional terms. It is in one such context that the inquiry reported here was cast. The underlying epistemological issues which have been dealt with up to this point served to inform the present study's fundamental theoretical orientation as one of several ways in which these issues might be explored. The subjects for the study were undergraduate students who had gained entry to a first year course in the Faculty of Education at the James Cook University of North Queensland. Their confrontation with the subject matter and required reading was looked on as a specific form of the more general case that could be used to exemplify the processes of knowledge acquisition.

It remains to define the strategic terms within which the research was conceived. As an integral aspect of the study, this task is appropriately essayed in Chapter I through the formulation of a particular application of the limitedist principle. By means of this cryptic label the more assertive kinds of pluralism no less than emphatically monist positions are equally rejected in attempting to

account for epistemic behaviour. In their place is set a point of view that acknowledges an overriding constraint imposed by the nature of communication itself which necessarily imposes a profound imbalance on systems of knowledge because of the need to emphasize consensual rather than idiosyncratic meaning. The aim of the present inquiry is to explore the extent to which selected idiosyncratic qualities of individual functioning have a limiting impact on the measured forms of achieved knowledge in a given field of study.

CHAPTER I

THE PROCEDURAL FRAMEWORK

The present study was designed as one approach to the investigation of epistemological issues raised in the Introduction within the confines of a given empirical setting. To this end, a research strategy was set up according to the general structure shown schematically in Figure I.1. The underlying argument in defence of this strategy was that it represented, in necessarily restricted form, a test of the extent to which the data collected for the study could be seen to support a pluralist as distinct from a monist stance. If it were shown, for example, that by the application of suitable analytic techniques, diverse but consistent and systematically meaningful patterns of differentiation were to emerge relating the input, processing, and output segments, a clear measure of pluralism would thereby have been demonstrated. And the degree of clarity or separation attaching to these patterns could be regarded as an index of the strength of support it should be accorded. But the emergence of relatively undifferentiated patterns, and thus of a more or less global system without any clear evidence of separation, would have to be construed as supporting a monist position. In so far as differentiations were to prove indistinct or non-existent, it would be necessary to reject the

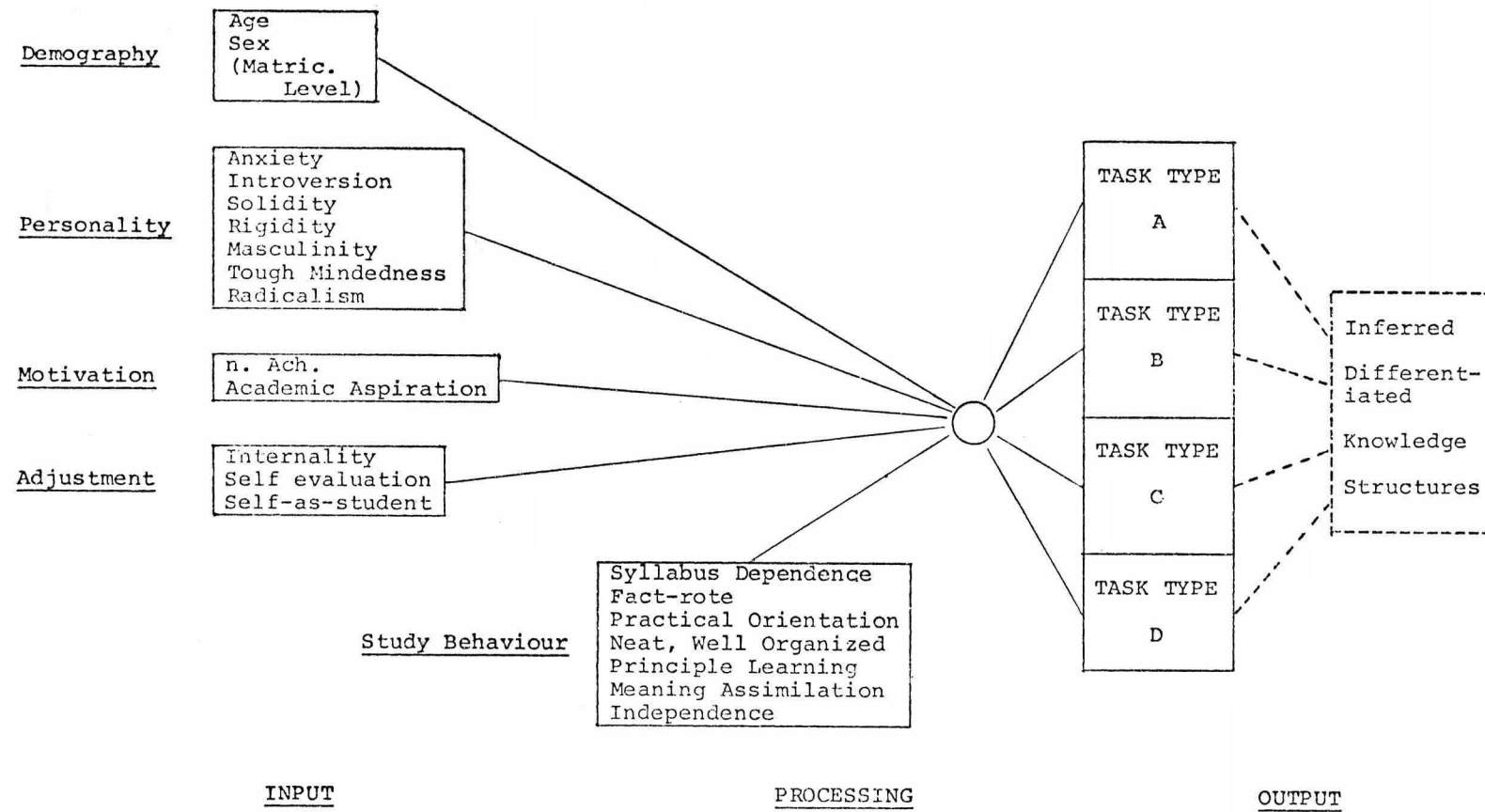


FIGURE I.1: *Schematic Interactive Network for Undergraduate Performance.*

view that essentially personal knowledge systems are an aspect of achievement.

The schema outlined in Figure I.1 was thus looked on as a strategic device or matrix for the derivation and application of an appropriate research format to provide useful data in an ultimately epistemological debate. It was devised in an attempt to point up the pluralist-monist issue through the use of an Aptitude-Treatment-Interaction (ATI) network that would be sensitive to the peculiarly individual but task-relevant qualities of student achievement. It therefore represents that assemblage of components which currently predominate in the relevant areas of research and which consequently serve as a basis for the selection of sub-components that best meet the needs of the present inquiry. From this network a choice must be made of those elements which are likely to be manageable, subject both to the inevitable limitations of parsimony and cogent efficiency, and subject also to the practical constraints imposed by the analytic mechanism available as well as the need to make sense of what those mechanisms produce.

The Input Components

In the realm of undergraduate student performance the selection for any given field of study has to draw upon four major sources of input. These represent the demographic, personality, motivational, and adjustment

domains, with general intelligence either counted under personality or separated for independent consideration on specific empirical grounds, to be adduced subsequently.³ Within each of these domains there exists an adequate body of established research for the development of hypothesized interactions. Thus, in the demographic domain, relevant variables have been identified by Barnett *et al.* (1968), Entwistle & Brennan (1971), Goldman & Hudson (1973), Hamilton (1970), Sundqvist (1973), and Wilson (1971). The key variables include age as a generally negative predictor,⁴ sex and faculty as partially interdependent variables, and general measures of performance at entry such as matriculation or college entrance test scores which have heavy saturations of intelligence. As the present discussion has indicated, and the accompanying display in Figure I.1 shows, these demographic variables are incontrovertible data which have little to offer the counsellor, instructor, or course organizer (though they do have limited value for the epistemologist). In a broad spectrum study of achievement, Sundqvist (1973) found these variables, as general predictors of success, to be reliably more prominent than variables from other

3. See pp. 167, *infra*, and Appendix M.

4. But *cf.* Barnett *et al.* (1968) who showed that age entered into curvilinear relationship with success when intelligence and number of years in secondary school were also considered.

domains, yet as a group they represent the least manipulable because most characteristically genetic. Nonetheless this set of variables, with the inclusion of a measure of general ability, commonly accounts for approximately half the achievement variance in studies of academic performance (Naylor, 1972, pp.53f; Scott & Elsworth, 1978, p.47), though it has yet to be shown whether such estimates are appropriate for undergraduate students.

In terms of potential interactions as part of an ATI system the demographic set is consequently rather static, at least when compared with the personality, motivation, and adjustment domains. In differing respects these three sources embrace sets of variables that remain sufficiently stable to be employed in ATI research but have medium term lability within an undergraduate programme of studies. They consequently represent domains having fairly immediate counselling payoff in addition to their epistemological significance.

This is most clearly the case in the personality domain; indeed the established view of aptitudes within ATI studies has tended to attribute to them most of the characteristics of personality traits. It is least evident in the motivation and adjustment domains where the model has had more restricted use. Baumgart & Johnson (1973), Dunham (1973), Entwistle *et al.* (1974), Everett (1971), Goldman & Hudson (1973), for example,

have reported on the significance of student characteristics relating to the acceptance of authority and the control of guilt, the benefits of a non-conforming stance and of competitiveness based on high need for achievement. While clear hints were apparent in their work that, even with the undifferentiated performance measures used, meaningful patterns of predictor variables could be distinguished for identifiable groups of students, the value which these findings might have in a thoroughly articulated system has yet to be more fully explored.

The focus of research interest in the present study was located chiefly within the personality domain, with a concomitant interest in study skills. Both these areas of concern reflect aspects of the psychological pillar in ATI studies, although it has been mainly from personality theory that ATI models have derived their elements. Aptitudes have been defined, like traits, as relatively stable and enduring dispositional entities which, when activated, direct behaviour in consistent and predictable ways, and have even been seen by Cronbach (1967) in typological terms. This identification as essentially genotypic does not mean that a phenotypic or state-theory interpretation would be inadmissible provided one of two conditions were to be satisfied: either the aptitude-as-state must remain constant throughout the treatment, or monitoring

procedures have to be devised that are sensitive to aptitude variations so that appropriate adjustments can be made as treatment progresses.

It will be apparent that the aptitude sub-components of an ATI model, while lending themselves naturally to a trait-based conceptualization, need not be confined to it. Biggs (1973), Bracht (1970), and Tobias (1976), for example, have in several ways amplified the concept of an aptitude, effectively weakening its links with personality trait theory. It remains true however that ATI research can only benefit from a trait concept of aptitudes because of its relative stability and generality, not to mention the practical difficulties that are likely to arise if an ATI network were to become unduly labile.

This broadening of the definition of an aptitude has been accompanied by a greater emphasis on the multivariate features of ATI designs. In particular, a better articulation of the treatment component has come out of the work of Saloman (1972) and Rhetts (1974). The development of preferential, compensatory, and remedial sub-models, and the explicit recognition within each, of the need for specific task and treatment analyses have contributed substantially to the *input* as well as the *processing* phases of the ATI model (Tobias, 1976). There has been considerably less attention paid to the *output* phase, in order to discover whether

the impact of a multi-trait $\times$ multi-treatment procedure is evident in what is learnt. Having shown that there are multiple paths leading to success, for instance, Entwistle *et al.* (1974) gave no further attention to the implications this had for the nature of the outcome.

So far as the present research was concerned, aptitudes were defined in largely conventional terms as the equivalent of personality traits. And their viability for the undergraduate samples employed was investigated by factor analytic procedures following the general approach adopted by Cattell (1973, *passim*) and Eysenck (1972). The relative stability of aptitude entities conceived as traits and the secure basis they offered for the identification of individual differences relevant to achievement were important considerations in this respect.

The Processing Phase

In its most clearly established form, the ATI model calls for two or more aptitude-related treatments having differentiating potential for some aspect of performance. Treatments thus represent the essential dynamic element of an ATI design. As indicated in Figure I.1, the framework for the present study modified established procedures at this point in two ways. First, the Study Behaviour component was placed within the Processing phase, but towards the Input side of a schematic pivot. It was argued that, as indicated in

several published reports, prior assumptions about the value of a given trait profile for achievement on particular tasks should take account of that profile as a dynamic system under the activating influence of a specific approach to the work involved (see *e.g.* Baumgart & Johnstone, 1973; Duke & Nowicki, 1974; Entwistle, *et al.*, 1974). In the undergraduate field for instance, the reported disadvantages of Extraversion for general academic achievement could plausibly be offset where efficient programmes of study and review are developed, or under the motivating influence of a strong academic interest orientation. While clearly not a treatment, the Study Behaviour component nevertheless embraced key dynamic elements that were appropriately located within the processing phase.

Second, the four performance tasks which constituted the assessment requirements set for students in the course of their studies were also placed in the Processing phase, even though they represented a naturalistic group of dependent variables. For this reason they were located towards the Output side of the pivot, but their dynamic features and the role they played in the overall structure gave them the character of treatment components in an ATI system.

This approach is in close agreement with the view taken by Rhett (1974) that a key aspect of the strategy used for the development of ATI networks should be a

detailed task analysis. An attempt was made in the present study to spell out the characteristics of each task in terms of the Input Components, and hypotheses were developed accordingly. Under this 'achievement tasks as treatments' design however, the status of assessed performance as the natural dependent variable was blurred, though it will be apparent that the often tenuous linkage between treatments and tasks in ATI research was thereby strengthened very considerably in this case, there being no disjunction within the present design.

The Output Phase

In the terms set out in Figure I.1 the components of the Output phase were not subjected to direct scrutiny. To the extent that differentiable patterns were to emerge from the analyses of Input and Processing elements, the necessary foundations for drawing inferences about the nature of system output would have been established. The Output phase of the present design thus corresponds with that section of more conventional research studies which deals with the general significance and theoretical implications of what is discovered. It is not to be confounded with traditional patterns of research organization where 'output' would be defined strictly by reference to a particular dependent variable estimate.

Summary

The Aptitude-Treatment-Interaction research model was employed within a broadly conceived meta-theory drawn from the current epistemological debate in which a form of radical subjectivism is contrasted with a more traditional type of discipline oriented monism. The ATI design was applied without altering the basic concept of an aptitude, but the treatment component was extended by virtue of its dynamic properties to embrace the Study Behaviour domain as well as a more conventionally defined set of performance tasks. While to some extent this vitiated the status of the dependent variable, the options at this point were limited since it was an integral aspect of planning that the study should, as far as possible, adhere to the naturalistic events of undergraduate course organization.

In its applied form the ATI model was constructed in terms of patterns of relationships between multi-trait and multi-task systems under the moderating constraints imposed by study behaviour. In so far as these patterns were found to be diverse but theoretically consistent in their capacity to differentiate performance, it was argued that a pluralistic subjectivism would be supported; but if these patterns failed to emerge it would be necessary to acknowledge the monistic, inter-subjectivist stance.

CHAPTER II

PERSONALITY AND UNDERGRADUATE ACHIEVEMENT

Studies of the relationships between undergraduate academic performance and selected personality variables have, until quite recently, tended to focus upon direct rather than moderated patterns of association. They have also, with very few exceptions, employed a global measure of achievement such as degree result (Everett, 1971) or first year scores (Entwistle & Entwistle, 1970; Kline & Gale, 1971). As a consequence of these trends a substantial body of information is now available identifying that sub-set of personality traits most likely to be of use in the direct prediction of general academic achievement among undergraduate students in Universities and Colleges of Education. While it could never be claimed that the research has yielded consistent and univocal results, the emergence of a limited number of personality dimensions having demonstrated salience as predictors of achievement offers a firm basis for the next stage of inquiry.

Relevant Personality Traits

Personality traits are here conceived as dynamic and relatively stable behavioural dispositions having an empirical basis in factor analytic studies modelled

on the work of Cattell (Hundleby, *et al*, 1965; Cattell, 1973) and Eysenck (1970). As factor score estimates, traits are linearly additive vectors. Where curvilinear relationships are indicated in the following review it will therefore be necessary to take particular account of them and to recommend appropriate strategies for their manipulation.

Two personality source traits can be identified which are relatively stable dispositional entities and at the same time have repeatedly been shown to have a clear bearing on academic achievement. They are Anxiety-Stability and Introversion-Extraversion. A third trait, Syllabus Bound-Syllabus Free, which has affinities with Rigidity-Complexity, will also be considered but with less evidence for its inclusion.

Anxiety-Stability

Trait Anxiety as a correlate of academic performance has been examined more extensively than any other personality variable. Its usefulness derives in large part from the fact that it can be measured with considerable objectivity by means of such diverse indices as self-report questionnaires, rating scales, pulse rates, blood pressure, and manifest behavioural signs like restlessness and distractibility (Gaudry & Spielberger, 1971). More important, however, is the fact that the concept of Anxiety rests on solid theoretical foundations which unite aspects of Psychoanalytic and Drive theory in systematic ways.

The general construct of Anxiety refers to an undifferentiated and characteristically objectless sense of fear or threat (Chaplin, 1975). Its function has been described in Psychoanalytic Theory as an ego defence but its effectiveness as a defence mechanism depends on its drive or motive properties as an initiator of appropriate (facilitating) or inappropriate (debilitating) behaviour (Pervin, 1975 pp.162f.; Eysenck, 1972).

Research evidence on the relationship between Anxiety and academic achievement has yielded extraordinarily consistent trends. Given the two qualifications to be discussed below, Anxiety and achievement are negatively correlated, and there is strong additional evidence to indicate that the role played by Anxiety in this association is dynamic; that is to say, academic performance is actively depressed under the debilitating impact of Anxiety, but performance recovers when Anxiety is removed (Kight & Sassenrath, 1966; Mandler & Sarason, 1952; O'Neil, *et al*, 1969).

The two qualifications that must be taken into account deal first with the effects of intelligence, and second with task difficulty. Studies which have compared the performance of high and low Anxious students at different I.Q. levels have reported both ordinal and disordinal interactions generally favouring bright students with high Anxiety (Gaudry & Spielberger, 1970;

Denny, 1966; Spielberger & Weitz, 1964; Gaudry & Fitzgerald, 1971). This apparent inversion of the typically negative relationship between Anxiety and performance is probably accounted for by the fact that high levels of intelligence tend to carry with them higher levels of general behavioural competence. It may be expected therefore that the more intelligent students will have developed appropriate coping mechanisms to manage their Anxiety and to turn it to useful purposes. For these students Anxiety is a motivating force that is absent in their equally bright but low Anxious peers whose performance tends to be marginally lower. Still lower is the performance of low-intelligent, non-Anxious students, and lowest of all is the performance of low-intelligent, high-Anxious students among whom coping mechanisms are presumably least developed; Anxiety for this group is considerably more debilitating than facilitating on that account.

When task difficulty is taken into consideration the performance trends described above continue to hold, *ie.* bright students outperform dull ones for all levels of task difficulty. But these trends are not maintained over trials for easy tasks; low-intelligent students tend to catch up to their high-intelligent counterparts with practice on these tasks, and this is so for all levels of Anxiety.

It has generally been taken for granted that measures of undergraduate academic performance represent high levels of task difficulty. While this assumption is reasonable, at least where contrasts between Grade Point Average and P-A learning are drawn, for instance, it will also be true that a definition of task difficulty must embrace both task content and task mode or style. It will be argued below, following the theoretical discussion advanced by Mandler and Sarason (Mandler & Sarason, 1952; Sarason, 1959), that such tasks as writing a synoptic prose essay or discussing theoretical issues in a group tutorial might appear to be equally difficult as exercises in scholarship, but actually impose unequal demands upon students as a more or less stable function of their personality attributes. The Extraverted student, for example, is likely to be more at ease (i.e. less Anxious) in a tutorial setting than is the Introverted one, and the reverse might be true for essay writing.

A theoretical argument for the general case may be expressed in the following terms: Anxiety comprises both trait and state elements; at the trait level it is a relatively enduring and stable entity such that individuals who register high on A-trait are consistently more prone to register high on A-state independently of circumstance (Spielberger, 1966; Sarason, 1959); as a personality defence mechanism, Anxiety is

innate but it has learned components (Mandler & Sarason, 1952; Prociuk & Breen, 1973); this means that it will be situationally evoked, while at the same time being subject to the pattern of defences which operates at any given time; thus, for any particular individual, A-state level will vary as a function of A-trait in interaction with the nature of the setting, and the constraints imposed by that individual's associated personality structures (*cf.* Sinclair, *et al.*, 1974).

Empirical evidence may be adduced to support this general case, first in terms of the relationship between Anxiety and the situation in which it occurs, and second in terms of selected personality trait variables. Gynther (1957) generated 'stress' and 'nonstress' conditions for high- and low-Anxious groups whose members were assigned randomly from the upper twelve per cent and lower fourteen per cent of 307 Psychology students. When tested for the clarity with which they were able to express themselves on questions that were considered hard to answer ('communicative efficiency'), the low-Anxious group ($p < .025$) and the low-stress group ($p < .005$) were superior, though the Anxiety-stress interaction was non-significant. While Gynther's results provide no support for the peculiarly interactionist stance being adopted in the present inquiry, her study is highly pertinent because of the clear evidence it offers regarding the effect of Anxiety on

performance in an expressly oral mode (and *cf.* Geer, 1966 on speaking in front of a group).

In two more recent studies, interaction effects involving Anxiety and situational factors proved to be statistically significant. The first study, by Tallmadge & Shearer (1971), explored interaction patterns among teaching methods (inductive *versus* deductive), learning styles (rote *versus* understanding), and subject matter among 353 Naval ratings. The study was primarily concerned to distinguish between type of teaching and type of learning as relative contributors to the interactions which had emerged in earlier work. The authors were largely unsuccessful in this, but their data allowed them to examine subjects' criterion test scores as a function of a composite predictor based on adjustment scales from the EPI and 16PF. They labelled this composite 'Anxiety' since it was made up of Eysenck's Neuroticism scale, and Cattell's Emotional Stability and Apprehensiveness scales. When the regression lines were plotted for Expository-Deductive *versus* Inductive-Discovery teaching methods, a disordinal interaction was formed indicating the benefits enjoyed by Low-Anxious subjects taught deductively ($\bar{x} = 50.64$) by comparison with the Low-Anxious/Inductive ($\bar{x} = 48.27$) and High-Anxious/Deductive ($\bar{x} = 48.63$) combinations ($F_{\text{Interaction}} = 8.0$; $df = 1, 349$; $p < .01$). Tallmadge & Shearer remark: 'The relationship found in the present

study between anxiety and [inductive *versus* deductive] teaching methods, while not impressively large, was sufficiently robust to stand up for [*sic*] two different types of learning, two different subject matters, and probably at least two difficulty levels.' (*Op.cit.*) They further remark that this level of robustness is seldom encountered in ATI research.

In the second study (Dowaliby & Schumer, 1973), teacher- and student-centred modes of classroom instruction were devised for use in a junior college course on introductory Psychology involving 69 students. Underlying these two teaching modes was a notion of structure which was more evident in the teacher-centred than the student-centred approach. Following Spence's (1958) emotional reactivity hypothesis that high-Anxious people react more emotionally in a given situation than do low-Anxious people, Dowaliby & Schumer predicted that the relative lack of structure to be found in a student-centred teaching mode would suit low- rather than high-Anxious students, the latter group being likely to react in emotional and hence debilitating ways. Conversely, students low on Anxiety were expected to perform better in a student-centred situation. The teaching modes were distinguished in clearly defined ways. For teacher-centred instruction a lecture format was adopted in conjunction with demonstrations by the instructor; students' questions and other student-

initiated aspects of class activity were relegated as far as possible to a brief period at the close of each lecture, and no attempts were made to elaborate upon the issues raised. For student-centred instruction, a discussion format was used and students were encouraged to ask questions and to carry out various tasks themselves rather than merely watch the demonstrator; when questions arose the lecturer so answered them that the ideas under discussion were integrated within the lecture material, often by way of counter-questions or leading statements, and the tenor of classroom activity was kept relatively warm and supportive by the use of expressions such as 'That's interesting' or 'Good' following a correct response. Two dependent measures were used based on course content, each consisting of 35 four-alternative multiple-choice items. A comparison between unadjusted group means yielded no significant difference, however when the test scores were regressed on previously collected Taylor Manifest Anxiety (MAS) scores the resulting disordinal interaction reached statistical significance ($p < .05$) for both tests. The student-centred teaching mode was associated with higher test achievement than the teacher-centred mode for students with low MAS scores, whereas the teacher-centred mode was associated with higher achievement than the student-centred mode for students with high MAS scores. (A subsequent

Johnson-Neyman analysis of the data confirmed these trends, though with small adjustments to the range of MAS scores for which a region of non-significance could be defined.)

Dowaliby and Schumer interpreted their results according to Spence's emotional reactivity principle as a function of teaching structure. They suggested that, where course instruction is offered in student- and teacher-centred modes for example, overall achievement would be enhanced if students were advised to enter the appropriate mode - those sufficiently low in manifest Anxiety taking the student-centred, those high in manifest Anxiety the teacher-centred approach.

The evidence so far discussed provides direct support for a model of performance which must be sensitive to the differential impact of Anxiety as a function of particular situational variables. The question arises whether such a model should be extended to take account of intra-individual factors other than Anxiety which may plausibly serve to moderate this system. Supportive evidence for extending the model is presently available but it is indirect. It is to be found in that substantial body of published research which deals with the personality correlates of Anxiety. Given that Anxiety may generate contrary reactions depending on an individual's past experiences in the circumstances which provoke it, and given additionally that other

personality traits, which also have learned components, are likely to be used to ameliorate threat among high A-trait cases, it is reasonable to ask whether this ameliorative pattern of trait usage is sufficiently stable to be predictive.

Research at the elementary and secondary school levels (Rosenberg, 1953; Sarason, *et al*, 1960; Connell *et al.*, 1975) indicates a reliably close relationship between Anxiety and feelings of inadequacy. Furthermore this self-depreciation is accompanied by greater cautiousness and a generally larger number of negative personality qualities (Gaudry & Spielberger, 1971), the overall impact of these characteristics being one of poor adjustment to a degree that is fairly readily noticeable among classmates, teachers (Cowen, *et al*, 1965), and parents (Davidson, 1959).

It is immediately apparent that such a personality configuration is internally sensible and altogether consistent with poor academic achievement. When research among University and College students is examined this broad trend is maintained, though with substantially less clarity; that is, the evidence points to the detrimental influence of Anxiety but there is as much evidence to suggest that it is also beneficial. Indeed at a gross level the evidence seems quite contradictory; thus, Furneaux (1962) Kelvin, *et al.* (1965), Entwistle, *et al.* (1971), Lucas &

Stringer (1972), and Griffiths & Crocker (1976) have all reported trends favouring students with slight to moderate Anxiety (or Neuroticism in most British studies). By contrast, Savage (1962), Lynn & Gordon (1961), Lavin (1967), Kline & Gale (1971), Wankowski (1968), Wilson (1971), and Entwistle & Entwistle (1970) have found Stability (i.e. low Anxiety/Neuroticism) to be related to successful performance.

The results of these studies might be wholly trustworthy, in which case there is little point in pursuing the matter. It is possible, however, that their contradictory nature masks a coherent set of underlying linkages deserving of further study. Smithers & Batcock (1970), for example, reported a positive correlation between achievement and Stability, but this held only for social science students who were also relatively Introverted; it did not apply to students in the health and medical sciences. Similarly, when Wilson (1971) looked at Neuroticism and Introversion-Extraversion in relation to performance, only among female students reading Arts was there a clear association between failure and Stability (i.e. low Neuroticism).¹

1. There might even have been a further dimension based on the characteristics of different kinds of institutions - technical colleges, colleges of education, and universities; Entwistle's investigations of this have yielded no consistent pattern of results to date (Entwistle, *et al.*, 1971).

In an Australian study of post-graduate Diploma in Education students, Rowell & Renner (1975) compared high and low scorers on Eysenck's N (Neuroticism) scale according to their performance on essays, written examinations, or some combination of these with a *viva*. High N students who chose essay assessment throughout the year outstripped both their low N colleagues as well as those who elected other kinds of assessment regardless of their N scores. Rowell & Renner, in an explanatory note after the fact, commented as follows:

If N scores provide an indication of change in arousal level with stress, the opportunity to pace one's efforts and be assessed on a number of essays rather than a "one shot" end of year examination *may* provide the high N with *one* of the conditions necessary for him to realise his potential - a relatively non-stressful situation.

(Rowell & Renner, 1975)

The tenor of research findings based on the studies reported thus clearly supports the established view of Anxiety as a strong and pervasive force in learning and performance. Increasingly however the evidence has indicated the need to reject strategies which examine Anxiety in unconstrained, bivariate relationships with achievement in favour of studies that take account of the role of specific moderator variables. It will be evident from the present review that at least three sets of variables have been found to act as moderators. These sets deal with task

structure, with intelligence, and with a class of variables that may be thought of in terms of coping behaviour, *i.e.* strategies to maximize performance. In the work examined so far, coping strategies have been represented passively in preferred teaching styles, but they could be expected to take on active properties, as study habits for example, or as deliberate preferences for methods of teaching and learning.

The clearly demonstrated salience of Anxiety for undergraduate academic performance should also be qualified in terms of its direct relationship with achievement. This is necessary because of the evident correspondence between certain aspects of the published findings and the Yerkes-Dodson principle that fear, conceived as a drive, and task performance enter into a curvilinear relationship with each other (Harlow, 1953). The extension of this linkage beyond its origins in the behaviour of rats in various states of shock and starvation to embrace human behaviour (*e.g.* Harlow, 1953; Levitt, 1967, pp.116ff) has been most thoroughly attempted by Atkinson (1974). Atkinson developed a set of theoretically compelling postulates to account for measured levels of performance as a function of three levels of motivation for three different types of task. For simple tasks amenable to overlearning, performance can be expected to improve as a simple linear function of gross motivational level. For more

complex activities involving discriminations among alternatives, increases in gross motivational level might have a detrimental effect on performance efficiency. And for some tasks 'perhaps those which require a very cautious, deliberate, or relaxed approach' (Atkinson, 1974, p.199), the relationship may be expected to be negative over most of the range of motivation (see Figure II.1).

Atkinson's analysis of the general question whether the relationship between Achievement and performance is monotonic and the conditions under which monotonicity can be expected to break down advances the present discussion in three important respects. First, it identifies the primary role played by Anxiety as a motivation to avoid failure and thus characterizes it as an inhibitor under certain conditions. Second, it acknowledges the impact of other motivational factors in the concept of gross motivational level ('tendency to act'). And third, it places the *task* at a key point in the pattern of events as a determiner of the ultimate shape of the trend line. In particular, the nature of the association for all tasks regarded as complex is predicted to take an inverted 'U' form. It is this function which must be considered in the analysis of undergraduate academic achievement, but with due recognition that the inhibiting influence of Anxiety may be

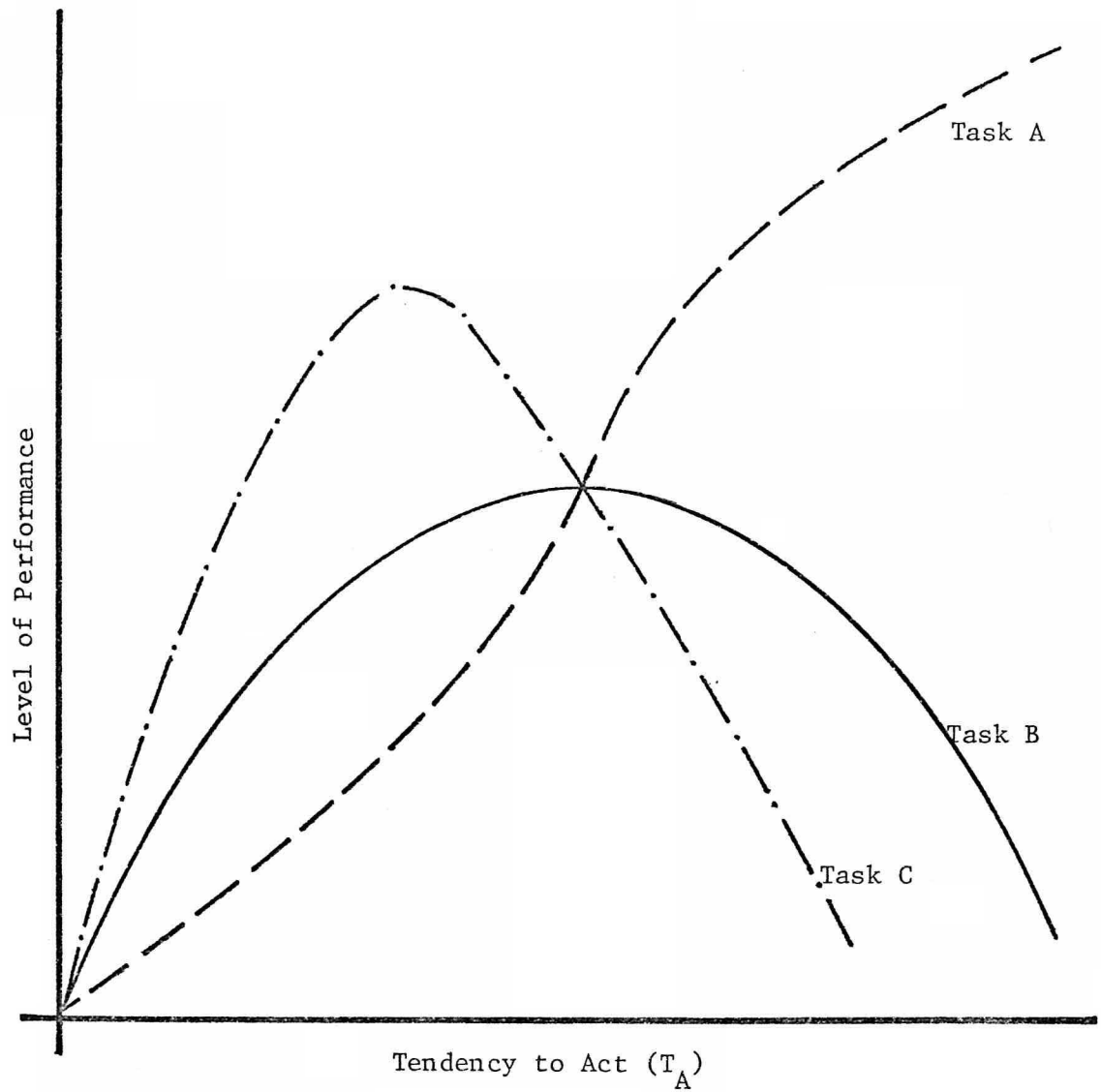


FIGURE II.1: *Postulated Levels of Performance on Three Tasks as a Function of Amount of Motivation (T_A)*
(After Atkinson, 1974, p.199)

masked or even reversed by other motivational or strategic devices, and that close attention to the structure and properties of the task involved must be counted an essential requirement.

Introversion-Extraversion

A second variable that has potential explanatory power when undergraduate achievement is examined in conjunction with Anxiety is the personality trait Introversion-Extraversion. Moreover, the contribution to personality theory of research based on factor analysis indicates that the relevance of Introversion-Extraversion to this association is based on fundamental aspects of structure rather than on some accident of history (Pervin, 1975, pp.329ff.).

R.B. Cattell in North America, and H.J. Eysenck in the United Kingdom have been the principal figures in this aspect of research. Their work has provided substantial empirical foundations for a concept which has its origins *ca.* 200 A.D. in Galen's doctrine of the temperaments but which, in its modern form, springs from the writings of Carl Jung (Fordham, 1966). Jung's theory of psychological types distinguished two differing modes of reaction among individuals characterized on the one hand by a certain negative, and on the other by a positive relation to objects. He labelled these reactions Introversion and Extraversion respectively. The introverted attitude is one of withdrawal

and concentration upon the subjective aspects of any given situation and may be sufficiently habitual to constitute a type. Jung's description of the 'introverted type' is of an individual who lacks confidence in personal associations and therefore tends to be unsociable, and who prefers reflective rather than active pursuits. By contrast the extraverted attitude is directed outwards having an interest in events, people, and objects in the individual's environment. The 'extraverted type' is confident in social situations and is usually on good terms with the world. Extraverts are outgoing and sociable, and tend to be optimistic and enthusiastic in their approach to life. Introverts are most at ease when alone or in small groups; they tend to be over-conscientious, somewhat pessimistic, and often unconventional.

Jung's fundamental types have reappeared as bipolar factors in correlational studies spanning two decades and several countries, and based upon samples involving many thousands of people. For both Cattell and Eysenck, the Introversion-Extraversion dimension emerges as a higher order factor at what Cattell has called the secondary and Eysenck refers to as the type level. Cattell's factor QI is the first of eight secondaries. He named it Exvia-Invia to express its outward *versus* inward polarity but its sensitivity to the conjoint impact of the three primaries, F (surgency -desurgency), E (dominance-submissiveness), and

A (affectia-sizia), clearly point to established Introversion-Extraversion qualities: relative prudence, caution, emotional flatness and withdrawal, contrasted with impulsiveness and a happy-go-lucky independence, combined with emotional warmth (Cattell, 1973).

On methodological grounds Cattell has put a strong case for his eight second order factors (Banks & Broadhurst, 1965; Hundleby, *et al.*, 1965; Cattell, 1973), however it may be noted that the two dimensions of particular interest for this review, *viz.* Anxiety-Stability and Introversion-Extraversion, are not only the two most prominent at the second order level, they are also among those which have enjoyed the strongest empirical support up to the present time:

There are now no fewer than fourteen researches...on higher order factors among the primary factors fixed by the Sixteen Personality Factor Questionnaire. They agree extremely well in defining five second order factors, two of which, anxiety and extraversion (the precise extraversion-introversion factor defined by Warburton, 1962) are very easily recognized in terms of the classical Freudian and Jungian concepts.

(Cattell, *in* Banks &
Broadhurst, 1965)

Eysenck's work on Introversion-Extraversion (as on Neuroticism) has been every bit as extensive and thorough as that of Cattell, though more in keeping with the so-called London School. He has chosen to extract a smaller number of factors at the first order

or primary level on the grounds that his underlying descriptive model of personality allows him to tap trait-level responses and that these responses adequately reflect their habit-level bases. By subjecting trait-level reactions to factor analytic study therefore Eysenck is essentially factoring what Cattell has called primaries, and comparisons between the two approaches should consequently be made at the type (Eysenck) or secondary (Cattell) level. When this is done there is very substantial agreement between them about the Introversion-Extraversion dimension (Cattell's QI) and Anxiety/Neuroticism-Stability (Cattell's QII).

Eysenck's characterization of the extraverted type is best illustrated in six questionnaire items designed for use as a short E scale (Eysenck, 1958):

1. Do you prefer action to planning for action?
2. Are you happiest when you get involved in some project that calls for rapid action?
3. Do you usually take the initiative in making new friends?
4. Are you inclined to be quick and sure in your actions?
5. Would you rate yourself as a lively individual?
6. Would you be very unhappy if you were prevented from making numerous social contacts?

When administered to a quota sample of 1600 men and

women from all parts of England stratified by age, sex, and social class, this short E scale yielded a split-half reliability coefficient of 0.71. In addition the six questions were factorially pure when administered as part of a larger set of personality assessment items.

In association with various colleagues (S.B. Eysenck, Hendrickson, Howarth, Lynn, Rachman, Soueif, White, *et alii.*) Eysenck has demonstrated four important properties of his general construct of Extraversion. First, as a result of studies carried out in London using equal groups (N=13) of male monozygotic (MZ), female monozygotic, male dizygotic (DZ), and female dizygotic twins, with age partialled out of the results, Eysenck (1956) argued that heredity plays a significant part in the causation of Extraversion. The intraclass correlations for all MZ twins (0.499) and all DZ twins (-0.331) differed significantly ($t = 2.09$); $p < .02$)².

Second, Eysenck (1967) administered a test of salivary reaction to 93 men and women. Four drops of lemon juice were placed on each subject's tongue for 20 seconds, and salivation increments were compared with a neutral condition. The theory under test was

2. The negative value for DZ twins was interpreted in this study by Eysenck as being a chance, and non-significant, deviation from zero. It ran counter to his theoretical expectation that the figure would be positive.

that introversion is a product of cortical arousal, mediated by the reticular formation; introverts are habitually in a state of greater arousal than extraverts, and consequently they show lower sensory thresholds, and greater reactions to sensory stimulation.

(Eysenck, 1956)

When Eysenck analysed lemon test results by means of a factor analysis of all EPI items and the lemon test increment score, the factor loading for the lemon test was -0.74 on the Extraversion-Introversion factor. Furthermore there appeared to be strong evidence that E test items had high factor loadings on the E factor and at the same time entered into correlations with the lemon test which were roughly proportional to the factor loadings. Eysenck consequently advanced the view that Introversion-Extraversion constituted a unitary and independent dimension of personality.

Third, in the context of a principle of cortical arousal linking Introversion with excitation (i.e. greater cortical arousal), Eysenck (1966) predicted that the relationship between scores on his Introversion scale and certain aspects of conditioning would be positive. Specifically he hypothesized that Introverts would condition more readily than Extraverts under each of three sets of circumstances: under partial rather than 100 per cent reinforcement schedules; where weak rather than strong unconditioned stimuli are applied; and with small rather than large conditioned stimulus-

unconditioned stimulus intervals. Subjects were classified Introvert or Extravert on the basis of their scores on the Maudsley Personality Inventory, and were then tested under all possible combinations of pairs of reinforcement intervals, unconditioned stimulus strengths, and reinforcement schedules. In graphic displays of his results and in his text, Eysenck asserted the demonstrated support which these hypotheses enjoyed. Moreover the correlation between Introversion and conditioning under the most and least favourable conditions respectively was 0.40 and -0.31, a difference significant at the 0.01 level. Eysenck's additional comment is instructive:

If these data can be assumed to be generally valid, then it would seem that extraverts are much more at the mercy of conditions, while intraverts ultimately reach reasonable levels of conditioning regardless of conditions...The results clearly show that the conditions which are favourable for the formation of conditioned responses *on the whole*, are, in this experiment at least, also those which are favourable to extraverts and unfavourable to introverts respectively.

(Eysenck, 1966)

And fourth, Eysenck (1971) formulated six predictions concerning probable differences between Introverts and Extraverts in aspects of their reported sexual behaviour. Six hypotheses were developed, each springing directly from what is already known about Extraversion, *viz.* that the higher sensory thresholds

characteristic of extraverts should lead them to seek stronger sensory stimulation ('sensation-seeking behaviour'); and that since Extraverts are less easily conditioned, they will form the conditioned responses necessary for socialized behaviour less readily, and will consequently be less likely to act in a socially approved manner. Two sets of data were reported, both of which provided moderate to very strong support for all six hypotheses, especially among the 423 males in Eysenck's sample.³ The general picture which emerged also favoured Eysenck's predictions. Extraverts were characterized by a relatively low-stress promiscuity in their sexual behaviour. They emerged as happy philanderers who enjoy their sexual lives and are untroubled by any homosexual feelings or a sense of guilt about their robust sexual appetites and somewhat permissive stance. By contrast, Introverts were more orthodox in their preferences. They endorsed the Christian view of fidelity and chastity and placed less emphasis on purely biological considerations.

Taken to their extremes, these approaches become the 'libertine' and the 'puritan' respectively, but if not taken to excess they are probably both viable modes of adjustment.

(Eysenck, 1971)

3. There were 379 females; all respondents were unmarried students.

Eysenck's attempts to demonstrate the unitary nature of Extraversion as a type-level personality construct have yielded compelling results, and his work on the innate component of Introversion-Extraversion has also been substantial. While there has been some trans-Atlantic support for his theories at the trait level based on skin conductance responses (Fowles, 1977), it should also be acknowledged that Eysenck's work has not gone unquestioned. In a close analysis of the evidence Eysenck has adduced for his theories, Hamilton (1959) found serious weaknesses in method and in the cogency of argument, especially as these were concerned with discriminations involving extreme clinical cases. Furthermore, Hamilton was able to identify points in Eysenck's theoretical formulations which confounded molar and molecular levels in his construction of hypotheses, thus putting his experimental and theoretical deductions at risk on the grounds that alternative explanations had not been ruled out.⁴ He concluded that Eysenck's Introversion-Extraversion dimension was therefore deficient as a starting point for further hypotheses of the specific kind Eysenck had pursued for his research into pathological Extraversion, or hysteria. Similarly, but at an experimental level

4. In particular, Hamilton found a competing case in Eysenck's tabled data based on the relationship between intelligence and conditionability.

of inquiry, Sweetbaum (1963) failed to support Eysenck's postulated links between Introversion-Extraversion and conditionability. His results strongly supported the Spence-Taylor theory regarding Anxiety as a generalized drive in the formation of eyeblink conditioned responses, but without any evidence for the impact of Introversion-Extraversion (as measured by Guilford's *R* scale). And in a study of students' expressed preferences for types of punishment, Parker (1976) found no evidence to support Eysenck's predicted association between Extraversion and corporal punishment *versus* detention.⁵

In the context of these qualifications to Eysenck's continuing thematic research, the Introversion-Extraversion personality dimension must continue to be regarded as potentially salient in any study of undergraduate achievement subject to three limitations. First, the development of research predictions using the I/E dimension should remain at the molar level until it becomes possible to derive better theoretical connections with molecular behaviour; relatively global responses such as general motor activity or multiply defined social behaviours offer better grounds for

5. Frost (1969) might also have been included at this point, but his critique is largely a re-statement of Hamilton's analyses, and of the study by Sweetbaum. The data he presents for discussion arising from his own work rest upon a murky and ill-defended linkage between the I/E dimension and specific subject achievement scores.

hypothesis construction than do precise sub-cortical and autonomic reactions. Second, studies at the pathological levels of the dimension should be carried out in conjunction with, or as extensions of, studies which explore the full range of response. This would ensure that its contribution to the understanding of behaviour is given a balanced treatment. And third, there is some evidence for a need to attend more vigorously to the dimension itself as it is employed in any given research study, even to the use of thoroughly analyzed pilot work specifically designed to determine whether and to what extent the I/E scale, or some modification of it, is pertinent for the sample under investigation.

Within the broad ATI framework of the present study, the Introversion-Extraversion personality dimension is of value to the extent that a theoretically defensible relationship can be formulated which links aspects of performance with particular trait characteristics. Thus, it could be anticipated that tasks involving interpersonal associations would favour extraverts while tasks that require more analytic and theoretically reflective activity would favour introverts, especially in so far as such tasks are solitary. For the extravert a seminar discussion or group tutorial setting should, *ceteris paribus*, represent a stimulating environment providing those conditions most likely

to promote achievement: outer-directedness, interpersonal sociability, the expression of emotional warmth and enthusiasm. For the Introvert this pattern will be reversed, so that the conditions most likely to promote achievement will be those of social withdrawal, emotional flatness, reflective contemplation, and an over-conscientious but pessimistic caution. Favourable settings will therefore include solitary study (of an analytic kind), theoretical writing, and formal examinations.

The evidence pertinent to a crossing of performance $\times$ task trend lines for Introverts when compared with Extraverts is limited, but generally supports the interaction. In the paper by Rowell & Renner (1975) referred to previously under Anxiety (*supra* pp.24f.), Introverts and Extraverts were assessed on their performance with respect to structured (Psychology) and unstructured (Sociology) courses respectively. The comparison was based on earlier work carried out by Furneaux (1962) and Leith (1973) which found that Extraverts are more tolerant than Introverts of ambiguous and relatively unstructured teaching situations. Significant mean differences were found for each group which gave evident support to the authors' predictions, but the specifically interactive nature of their results was not studied. Eysenck's EPI scale was also used by Griffiths & Crocker (1976) to

explore interactions involving Introversion-Extraversion and mass *versus* individualized teaching methods in a college Chemistry course. The interaction occurred, but it fell marginally short of significance when relevant intellectual competencies were taken into account as covariates. In a third study, Norman and Watson (1976) reported clearly significant differences between Introverts and Extraverts in their reactions to interpersonal disagreements and to cognitive inconsistency. Introverts found interpersonal disagreement in attitudes significantly more unpleasant than did Extraverts ($p < .01$), and they also showed greater attitude change than Extraverts ($p < .01$) when confronted with dissonance inducing circumstances modelled on the work of Festinger (1957).

It appears therefore that a stable, if not always statistically significant, relationship exists between preferences for and achievement in relatively unstructured, ambiguous, and essentially threatening social situations on the one hand and Extraversion on the other, and that a converse pattern exists for Introversion. Furthermore these relationships are wholly consistent with what has previously been reported about the Introversion-Extraversion dimension as a factor-based personality trait construct - its unitariness, conditionability, socio-emotional orientation, pessimism-optimism, cautiousness-adventurousness, reflectivity-

impulsivity. Given that these are relatively enduring aspects of personality structure which *ipso facto* cannot be altered but which enter into the kinds of interrelationships with performance tasks that have emerged in the present review, it follows that parallel or compensatory systems of teaching and assessing may be constructed to provide those options which would maximize student achievement. Contrariwise, where courses structured in this way already exist, it should be possible to demonstrate their respective benefits for Introverts and Extraverts in the systematic terms which have been described.

Once again, however, certain constraints have to be acknowledged. These derive from the more general ATI formulation which admits a student's active preference for particular modes or styles of teaching and learning as potentially relevant variables and which, by a natural extension of this, must also countenance his no less active coping strategies designed to maximize performance for any given set of conditions. A review of one such strategy follows and represents an attempt to draw together the peculiarly interactive elements to have emerged so far.

The Syllabus Bound-Syllabus Free Strategic Dimension

The terms Syllabus Bound (SYLB) and Syllabus Free (SYLF) are of recent stock having their immediate origins in the work of Parlett (*in* Hudson, 1970). An

inspection of Parlett's 26 item True-False inventory reveals the quintessential SYLB as a student who adheres meticulously to a set programme of topics, assignments, and required texts (and prefers his teachers to do the same); who rarely questions the material to be learnt or explores peripheral issues; and who bends his energies to the prescribed work whether it captures his interest or not. SYLFs, by contrast, prefer to follow their particular interests and are unperturbed if this carries beyond their stipulated reading; they value assignments less and their independence more than do SYLBs; and they have more extensive interests beyond their studies which often serve to distract them.

In its general characterization the SYLB/SYLF differentiation may be expressed in terms of specificity, closure, convergence, and orderliness. But since these terms appear as key descriptors or underlying ideas with respect to the psychological constructs of Rigidity, Dogmatism, and Field Dependence-Field Independence, some clarification is required. This is to be found in the work of Schaie (1955) who identified Gestaltist, Functionalist, and attitudinal components in discussions of rigidity which dealt respectively with the independence of personality elements, the degree of motor perseveration, and aspects of behavioural inflexibility. Schaie sought to explore the unitary

nature of Rigidity at an empirical level by subjecting performance data from six widely used tests of Rigidity to a multiple group factor analysis followed by oblique rotation.⁶ Schaie's results forced him to accept a three factor solution representing motor-cognitive speed, motor-cognitive rigidity, and personality-perceptual rigidity. All three factors were interpreted as adjustment or coping mechanisms, however it is Schaie's personality-perceptual factor that is of special relevance here. This was described as the ability 'to adjust readily to new surroundings and change in cognitive and environmental patterns.'

(*Loc. cit.*) It will immediately be evident that this factor corresponds substantially with what is commonly referred to as trait Rigidity, i.e. inflexibility of attitude, opinion, or manner of adjustment (Chaplin, 1975); and it will also be evident that it goes beyond the specifically perceptual reference to be found in Witkin's (Witkin, *et al.*, 1954; 1962; and 1977) Field Dependence-Field Independence to embrace the cognitive domain. Thus, Witkin's reference to analytic skill as a feature of articulated or Field Independent responses is a direct function of perceptual activity which necessarily *precedes* any imposition by an individual of

6. The six tests were: i) the Luchins Jar Test; ii) the Capital Letters Test; iii) the Rigidity Index (after Lankes); iv) the Opposites Test; v) a perseveration Alphabet Test; and vi) Gough's Rigidity Scale.

a context-free (but conceptually based) structure.

Further evidence to support this interpretation can be found in Rokeach (1960) whose studies of Dogmatism led him to distinguish between analysis and synthesis as perceptual-cognitive tasks. Both open and closed minded individuals were equally competent in analysis but not in synthesis. By contrast Witkin's Field Independent subjects were reportedly able to impose structure on perceived stimuli following their analytic differentiation of those stimuli:

The person who perceives in an articulated fashion tends to perceive items as discrete from background, when the field is organized, and to impose structure on a field, and so perceive it as organized, when the field has relatively little inherent structure.

(Witkin, 1977)⁷

Witkin's Field Independent category thus corresponds with Rokeach's Open Minded category and with certain aspects of non-Rigid behaviour, particularly in terms of the context-free but active imposition by a Field Independent person of a structured synthesis. The specification of analytic skill as a defining quality is therefore misleading beyond the strictly perceptual level.

A further source of evidence on Rigidity as a personality trait can be found in the work of Cattell (1971).

7. And cf. Witkin, 1962, p.12 (footnote 4).

After an extensive review of his own and others' research using the 16P.F. and H.S.P.Q. inventories, Cattell decided to abandon Rigidity as a broad capacity and to work instead with Ideational Flexibility-Tenacity in the cognitive domain, and perceptual-motor rigidities based on pattern execution in the psychomotor domain.⁸ While his broad conclusion was that Rigidity 'is the most overused and under-analyzed term in the whole of personality psychology' (1971, p.412), Cattell nonetheless acknowledged a class of abilities comprising ideational and associational flexibility at one pole and general dispositional rigidity at the other. He rejected any suggestion that these traits could be regarded as a form of perceptual intelligence.

So far as the present review is concerned, a case may be put at the conceptual level to support a Syllabus Bound-Syllabus Free dimension *via* aspects of Rigidity, Dogmatism, and to a lesser extent Field Dependence-Field Independence as theoretically plausible contributors to an identifiable moderating effect on undergraduate student performance. Although lacking the strong trait-based support enjoyed by Anxiety and Introversion-Extraversion, the Syllabus Bound-

8. Cattell regarded field-independence as 'an outcropping in the perceptual performance realm' of his Source Trait UI19, General Temperamental Independence.
(See Cattell, 1971, pp.362f.)

Syllabus Free construct clearly taps stylistic properties of behaviour which are demonstrably supported by extensive research. The principal characteristics of concern are specificity, an orderliness approaching the obsessive, unquestioning obedience, narrowness, convergence, a sense of dependence, non-distractibility, and a general inflexibility of manner and adjustment.

It is reasonable to imagine that so pervasive a coping potential would play an important strategic role in student academic performance, and there is some empirical basis for this expectation. Hudson's studies, for example, offer considerable evidence of an Arts type-Science type distinction that supports the SYLB/SYLF dimension, and his later work (Hudson, 1975) provides additional details of the SYLB's preference for impersonal settings, his obsession for hard and characteristically mathematical or scientific work, and his discomfiture in the face of strong emotion. Hudson has suggested that the SYLB's essentially convergent style is a defence against Anxiety, thus identifying its peculiarly strategic or coping nature; and Entwistle *et al.* (1974) have put a similar argument for its moderating potential. Obsessive-compulsive reactions combined with Authoritarianism (Rogers and Wright, 1975) and generally lower aptitudes (Rogers and Ballering, 1976) have also been linked empirically with Rigidity, and Cattell (1971) has added inflexibility in following instructions and in working under

several structures at once. Simon *et al.* (1972) defined Rigidity in terms of the active search for order and an avoidance of change; and both Imam (1974) and Witkin (1977) have reported significant findings that relate the degree of incidental or peripheral learning to non-Rigid and Field Dependent stances respectively. Finally, Heslin, *et al.* (1977) found that Open and Closed Minded individuals differed in the confidence they placed in information given them according to its source (Open Minded) or its evident consistency (Closed Minded). It was concluded that those high on Dogmatism were more influenced by surface indicators of validity whereas Open Minded respondents employed a more diverse but largely internal reference system.

One further topic of inquiry pertinent to a SYLB/SYLF dichotomy remains to be examined, *viz.* study behaviour. If the SYLB/SYLF dimension is to be regarded more in terms of a coping strategy than as a type or trait-level construct, its qualities might better be tapped *via* students' expressed preferences for different study behaviour biases. This is reinforced in the discussion so far when stylistic features were encountered, *e.g.* in the SYLB's orientation towards impersonal and emotionless settings, his meticulous, even obsessive attention to detail and to the dictates of the task, and his general inflexibility of procedure. Such habits, when translated into a study regimen,

have predictably been found to be associated with success. Rutkowski & Domino (1975) clearly illustrated this in a correlational inquiry into study skills based on the Brown & Holtzman (1966) Survey of Study Habits and Attitudes (SSHA) as these related to eighteen CPI scales and to the Verbal and Quantitative components of the SAT. They found the relationship between personality variables and study skills variables to be 'definite and pronounced'. Using an eigenvalue of 1 as cutoff they identified five factors, one of which (Factor IV) clearly reflected study organization. Varimax loadings for CPI scales on this factor were highest for Achievement *via* Independence (.61) and Flexibility (-.47), and the authors saw this factor as an expression of traditional, well-organized, and responsible study habits. Of particular interest in their approach however was Rutkowski & Domino's attempt to analyse student personality clusters in terms of their SSHA profiles. Thus, students with good overall study behaviour had particular CPI strengths on scales measuring socialization, maturity, responsibility, and intellectual efficiency. By comparison, students whose study habits were marked specifically by promptness had CPI strengths on scales measuring activity, conscientiousness, self-control, diligence, good organization, resourcefulness, and a cautious, methodical approach. And students whose SSHA endorsements indicated

efficient work methods had CPI strengths on scales measuring self-assurance, personal maturity, and achievement potential. From this work it can be inferred that success may be won *via* any of several study strategies and is in this respect, as in the personality domain, not a unitary thing. It is apparent, however, that a Protestant work ethic is broadly represented: maturity, responsibility, efficiency, conscientiousness, diligence, self-control, and organization.

Study behaviour research reported by Biggs (1973) supports the non-unitary character of these findings, though it proved difficult to identify the anticipated interactions according to sex and Faculty using adjusted Grade Point Average as the dependent variable. Biggs found three R-analysis study behaviour factors to be linked with undergraduate performance in first year. Two of them, Academic Interest and Study Skills, were associated with superior achievement, and represented a high level of intrinsic academic motivation and a thoroughly organized, systematic programme of study and review respectively. The third, Academic Neuroticism, tapped anxieties relating to unfamiliar material, teaching methods and the pressure of work. This factor was associated with poor performance. When Biggs re-examined his data using a Q-analysis, the main (Q1) factor to emerge drew six of its twelve items

from the Study Skills (R5) scale and the remainder from scales expressing anxiety reactions⁹ (work pressures, test results) and academic or intellectual aspirations. Moreover this Q1 factor so dominated Biggs's further analyses of achievement (*i.e.* Grade Point Average) that two additional Q factors under consideration could add nothing to it. Q1 thus appeared to reflect 'a general pattern of study behaviour that is related to achievement irrespective of faculty membership. . . .' (Biggs, 1973), however it should be noted that the pattern of study behaviour expressed in Q1 seemed more closely related to Science than to Arts performance when G.P.A. was adjusted for High School (Matriculation) achievement.

Two further studies of the relationship between study skills and academic performance yielded substantially the same results as those so far reported. In the first (McCausland & Stewart, 1974) a direct examination was made of the SSHA-GPA association in conjunction with matriculation and college entry scores. After these two were removed (accounting for 62 percent of G.P.A. variance) individual SSHA sub-scales made little contribution, but there were clear indications that, when viewed overall, successful students worked

9. One of the three items from Academic Neuroticism to be included in the Q1 factor could as easily have come from the Study Skills factor. It read 'I rarely keep up to date with suggested readings that are meant to keep pace with the lectures.'

more methodically, completed assignments more promptly, accepted academic standards more willingly, and were generally more organized and efficient than unsuccessful ones.¹⁰ The second study (Gadzella & Fournet, 1976) looked at study habits indirectly through the perceptions of a group of high ($N = 162$) and one of low ($N = 120$) achievers. Self-ratings were obtained from these students on three occasions during one semester and the results plotted. Group, Occasion, and Group $\times$ Occasion interaction effects were each significant, the high achievers' perceptions of their study behaviour showing a marked rise against an equally marked fall for low achievers. Successful students are therefore not only more likely to employ better study techniques, they rapidly come to an awareness of the value of those techniques.

The last group of studies to be considered in this section dealt with study behaviour and performance in the context of personality. Cowell & Entwistle (1971) extended the work of earlier investigations in Universities and Colleges of education by examining the performance of technical college students. The results corresponded with what had previously been found. As in colleges and universities, stable

10. A fifth order SSHA-GPA polynomial was found to reach significance ($p < .05$) indicating that very low, mid-point, and very high SSHA scorers achieved disproportionately high GPA levels. But this took no account of student ability, and in any case the quintic trend was swamped by the linear trend ($p < .001$).

Introverts were generally favoured by instructors and had distinctly better study methods; and all SSHA sub-scales entered into significant relationships with examination marks at the final examination.

In a similarly conceived but broader study Wilson (1971) analyzed patterns of predictor variables for successful and unsuccessful students separately. Good study methods proved significant in the prediction of success for Science men only, but in Arts this was true for both men and women in predicting failure. And in a third study (Entwistle & Brennan, 1971) no fewer than 23 variables were entered into a cluster analysis involving 875 undergraduates. Of twelve clusters identified, three were consistently associated with high levels of attainment. They indicated that success (and failure) may be achieved in different ways and, more particularly, that study habits other than those commonly linked with high achievement must be acknowledged. For example, the cluster with highest achievement evidently compensated for a less than ideal study strategy by an outstanding competence in the technique of sitting examinations, whereas the lowest achieving cluster did not have any redeeming motivational or strategic qualities whatever; indeed their study habits appeared only to compound against success. At the same time the two clusters which, on the face of it, exemplified the best combination of

study behaviours were both close to average in academic performance, possibly on account of their poorer verbal and numerical levels. For these groups, efficient study methods were arguably the key to their modest but continued success. Entwistle and Brennan summarized their results thus:

It would appear that there are a variety of causal paths leading to each level of performance The high attainment groups have good A-level grades, and two of the (three) clusters contain stable introverts with high motivation and good study methods. The low attainment groups have poor A-level grades and two (of the three) clusters contain a majority of extraverts who work very little.

(Entwistle & Brennan, 1971)

While it is true that Entwistle *et al.* (1974), in a subsequent discussion of study behaviour and motivation, returned to a more unitary view of the competent student as one who plans carefully, is conscientious, independent, ambitious, and obsessively correct, the more articulated structures of the earlier studies remain compellingly naturalistic. Finally, three studies reported by Biggs (1970a; 1970b; 1973) can be adduced in order to highlight the principal issues. In these studies Biggs used his Study Behaviour Questionnaire (SBQ)¹¹ to explore relationships between undergraduate study characteristics and Faculty

11. This inventory was an earlier, 72 item version of the questionnaire used by Biggs for the work reported in 1973 which was discussed earlier.

affiliation (1970a), aspects of personality (1970b), and differentiated task achievement. Study behaviour was conceived of in strategic terms as 'the translation, in the context of study, of certain enduring personality characteristics, into a series of operations or strategies'. (Biggs, 1970a) Among Arts Faculty students, SBQ data yielded results largely compatible with those which had been expected. The importance of an organizing strategy and of intrinsic motivation was evident, particularly among females; and SBQ factors representing Tolerance for Ambiguity (Factor II) and Dogmatism (Factor V) as well as Intrinsic Motivation (Factor IV) discriminated mean factor scores by Faculty at a significant level ($p < .02$), for end-of-year data). Science students proved to be less tolerant, more dogmatic, and had higher intrinsic motivation than students from Arts. While the overall results were viewed as inconclusive in the face of an undifferentiated performance measure, the findings indicated the presence of underlying person-task interactions which vitiate any notion that a single best study method can be identified. At the same time they suggest ways in which personality traits such as Dogmatism and the need for organizational structure have a moderating effect, through preferred study patterns, on student performance.

In Biggs's second report (Biggs, 1970b), this

aspect of the SBQ dimensions was explored. Personality marker tests were selected to assess tolerance of ambiguity, dogmatism, and convergence-divergence (after Guilford and Hudson), these choices being dictated by the theoretical structure of the SBQ. Performance was again undifferentiated, the measure being a simple sum of each student's marks in his or her four first year subjects. The results clearly supported the proposition already discussed that no single best study method exists, and they supported an earlier suggestion that the relatively dogmatic strategies will be negatively related to tolerance of ambiguity. Biggs also noted, in his comments on these findings, that introverted students would tend to avoid discussion with other students, at least as a specific study technique. But the clearest trend to emerge from this study related not to the direct linkage between personality and performance but rather to the way SBQ dimensions appeared to act as moderators between personality and performance.

In the third study (Biggs, 1973), Biggs differentiated test formats in an undergraduate programme of assessment. A factor analysis of performance tasks yielded three orthogonal (Varimax) rotated factors, two of which were identified as representing objective test and essay achievement respectively. When these were entered as dependent variables in analyses of

variance to study their relationships with selected SBQ scales together with scale $\times$ scale interactions, clear evidence was found to show that the objective test and essay tasks were related in different ways to the set of study behaviours; a convergent style of approach was generally best for the objective format while a fact-rote strategy was best for the essay format. Although the sample size for this study was somewhat modest, the generally plausible and entirely consistent results that were realized give strong support to a manifold conception of achievement as a partial function of strategic elements which are themselves systematically related to underlying aspects of personality (*cf.* Biggs, 1970a).

The main conclusion to be drawn from this review of research on study behaviour is that the attributes involved are coextensive, in important respects, with the personality domain. It is nonetheless difficult to argue beyond an essentially strategic, stylistic level which draws upon aspects of Rigidity, Dogmatism and the Syllabus Bound dimension, but which lacks the fundamental unitariness required of a trait. When considered in these terms, a Syllabus Bound-Syllabus Free study strategy dimension can be expected to have substantial potential as an index of academic achievement, and this is well supported by the evidence. But the evidence also points up the need to explore this

potential within a moderated, interactive framework in order to sense the multidimensional character of the forces at work and especially to take account of the particular moderating role which study behaviour appears to play.

There is considerable evidence, too, for a need to refine or articulate the dependent variable. This has rarely been done in spite of the existence of a very plausible theoretical argument to support it. In the final section of the present review, this argument will be considered together with its supporting evidence.

Undergraduate Performance as a Dependent Variable

The need to specify the components of learning tasks is fundamental in educational measurement (Glaser & Nitko, 1971, pp.632ff.). However the analysis and definition of performance domains have been pursued mainly at the primary and secondary school levels using hierarchical models of task analysis (*e.g.* Gagné, 1968) in association with taxonomies like that of Bloom (Bloom, *et al.*, 1971, Appendix). As a result, components of student achievement have been identified which reflect both the logical and psychological aspects involved, but it cannot be assumed that a logical pattern of relationships for a particular subject field will necessarily correspond with its associated psychological pattern. Furthermore, as Glaser & Nitko point out, these psychological hierarchies or

structures need not be unique:

...it may well be that several such hierarchies exist, each of which is 'valid' with different kinds of learners, but none of which taken singly is valid for all learners.

(1971, p.637)

Following upon the work of Bloom, Glaser & Nitko, and Gagné, it might be expected that measures of undergraduate performance in universities and colleges, particularly in the field of Education, would exhibit these measurement principles through the use of an analytically based, articulated assessment programme. It will be apparent, however, that the studies reviewed up to this point have, with a few exceptions, employed undifferentiated measures of general achievement. For studies which emanate from North America the typical measure of performance is Grade Point Average (see *e.g.* Biggs, 1970a, 1970b, 1976; McCausland & Stewart, 1974; and Prociuk & Breen, 1973), while in the United Kingdom a student's degree class or end-of-year gross total is most commonly reported (see *e.g.* Lucas & Stringer, 1972; Entwistle & Wilson, 1970; Entwistle *et al.*, 1974). It will immediately be evident that these measures represent widely diverse criteria. The GPA estimate of achievement, for instance, might express the sum of marks awarded for class tests, laboratory assignments, essays, *viva voce* exercises, or end-of-course written examinations of various types, or it might express some

combination of these marks. When GPA is averaged over one or two semesters, it is likely to represent the marks assigned for a number of such tasks over several courses. Similarly a student's degree award after three or four years of study (Class I, IIa, IIb, *etc.*) typically represents a weighted sum of individual course results over several courses in each year. While this usually means results in end-of-course examinations of a traditional type, there are occasions when on-course assessment is also used (*e.g.* Entwistle & Entwistle, 1970). As a dependent variable therefore, undergraduate academic performance may differ substantially from one study to another and is frequently so broadly conceived and essentially non-unitary as to be potentially confounding.

The manifold nature of academic achievement can be argued in both systematic and empirical terms. Thus, it is unlikely that a particular GPA or degree class won by different students will reflect the same admixture of competencies in each case; indeed courses are often so arranged that, within certain limits, a given result will always represent one of many permutations of component scores. Where course assessments are structured systematically to take account of relevant skills, for example by following Bloom's (1956) taxonomic categories, weak scores on *analysis*, say, or *application* may be compensated by strong scores

elsewhere; and this situation will likewise hold for a taxonomy of course content. When performance is measured over several courses the same argument will continue to apply, *a fortiori*. Nor will it be ameliorated where courses are highly circumscribed as to content since the taxonomy of skills still provides the basis for a systematic articulation of performance measures no matter how specific the subject matter might be. Finally, where assessment strategies ignore these taxonomies it does not follow that the argument is lost but rather that compensations are likely to operate without being recognized or acknowledged by the examiners. On systematic grounds therefore, academic performance can be regarded as manifold and this raises the question whether its use in many studies as a unitary entity is appropriate.

In empirical terms the evidence for undergraduate achievement as a manifold rather than unitary variable is clear, though generally somewhat indirect. It rests in part on the demonstration by researchers such as Biggs (1970a, 1970b), Entwistle & Brennan (1971), and Lucas & Stringer (1972) that success, even when measured in undifferentiated terms, may be won in quite different ways by different students, and might therefore represent different patterns of component achievements from one student to another. And, in greater part, it rests on the fact that when differentiated measures of performance are used (Baumgart &

Johnstone, 1973; Biggs, 1973; Jernstedt, 1976; Rowell & Renner, 1975) theoretically consistent patterns of relationship have emerged linking specific tasks (multiple-choice tests, essays, traditional examinations, tutorial work) with particular student attributes and learning or study strategies.

But the most compelling evidence is to be found in the reported levels of relationship among differentiated performance tasks. Baumgart & Johnstone (1973), for instance, found that inter-correlations for scores on an objective test, a major written assignment, tutorial preparation, and a final examination ranged from 0.21 to 0.39. While all but the lowest of their correlations were statistically significant (at $p < .05$), the shared variance (0.4% - 15.2%) remained small.

Hence,

although some students are tending to score consistently, other students differ quite markedly in their grades from one assessment component to another.

(Baumgart & Johnstone, 1973).

And in a detailed examination of multiple and partial correlation data for essay and multiple-choice test formats, Huxham & Lipton (1974) confirmed their previous findings which indicated that essay tests measure factors not measured by multiple-choice tests (and *vice versa*) and that this was not an artifact of topic coverage in each case.

On theoretical and empirical grounds therefore, there is clear support for the articulated differentiation of undergraduate academic achievement as a dependent variable. The form which this articulation should take will be determined by the subject-matter involved and the results of appropriate task analysis, though its ultimate defence will inevitably rest upon *ex post facto* correlational evidence and the extent to which the articulated structures enter into theoretically sensible patterns of relationship with other variables.

The Present Study

The overriding theme which has emerged from the discussion so far is that performance in the realm of undergraduate academic achievement must be conceived of as manifold, complex, and multiply determined. Its manifold nature is apparent at all three stages - input, processing, and output. At the input stage there is clear, if diverse, evidence of the role played by Anxiety-Stability and Introversion-Extraversion within the personality domain, over and above the major contribution from general intellectual ability.¹² At the processing stage the strategies which students employ in pursuing their studies have proved to be differentiated in ways that are entirely consistent

12. And over and above other dimensions from the more strictly defined personality domain not reviewed here.

with their longer term goals and the purposes they want those studies to serve. And at the product stage, a case has been presented questioning the view which has commonly been adopted in this area of research that measured academic achievement can be regarded as unitary; both as a function of substantive content and of the component skills which are plausibly associated with that content it was argued that the assessed product must be thought of as a non-unitary entity.

Even without the evidence that is available concerning interactions within this network of elements it would have been reasonable to expect, by virtue of individual differences alone, that complex sub-patterns of relationship would be evident. Moreover this appears to be the case for different faculty groups and for most *versus* least successful students, though it ought to be emphasized that sub-patterns which have emerged in this respect have rarely been explored in terms of a theoretically based articulation of the performance domain.

Given the manifold and complex nature of this system as having been demonstrated at both the input and processing stages, and given further that such a system is likely to yield a manifold product, two questions may be asked; first - Is the product systematic such that its components are more or less stable functions of antecedent events? And second -

If there are systematic linkages of this kind, what does this signify? That is, what are its implications for undergraduate teaching and learning, and how does it bear upon the way in which the product itself is defined?

The present study represents one approach to the exploration of these two issues. Within the framework of a broadly conceived Aptitude-Treatment-Interaction design, personality traits having established relevance for undergraduate achievement were identified in association with a strategic component of the study behaviour domain. The personality traits, regarded as aptitudes, were each considered in terms of their theoretical properties and relevant empirical findings to have potential value for an ATI system because of the plausible linkages in each case involving specific dimensional poles with one or more postulated aspects of performance. In the case of study behaviour, clear affinities were evident regarding strategic aspects of undergraduate study patterns and the Rigid-Dogmatic components of personality. This association, while less substantial than those of the personality domain, was nonetheless acknowledged as representing a pervasive coping strategy with probable catalytic value having an influence most likely to be of particular benefit where personality structures that are commensurate with task performance already exist. Under the preferential sub-model (Tobias, 1976) for an ATI system, the effects of

an organizational study strategy when used in conjunction with an appropriate aptitude structure for any given task can be expected to enhance the level of achievement. It thus becomes necessary to define the aptitude structures considered to be appropriate in the successful performance of specific tasks. Since these structures are regarded as instrumental to task performance, the tasks themselves must first be examined in order to identify the relevant components which may be postulated to have aptitude linkages (*cf.* Rhetts, 1974).

Performance Tasks in the Present Study

The context within which performance tasks were structured was that of a first year course of undergraduate Bachelor of Education degree reading. The course itself was located at the beginning of a four year sequence of integrated Education and non-Education subjects designed to prepare students for teaching in Australian secondary schools. All students working towards the B.Ed. degree were required to have done the first year reading, however the course was also available to students enrolled in Arts, Commerce & Economics, and Science, who did not necessarily intend to become school teachers.

The programme of studies required of students reading Child and Adolescent Development (Education 111) in the Faculty of Education was designed to

introduce the basic elements from Developmental Psychology of direct relevance to school teaching. The essential facts of human physical growth from conception to maturity, and of cognitive, social, and emotional development were examined within a multi-theory context deriving from Neobehaviourist, psycho-analytic, and Piagetian sources. The course was taught by means of lectures coupled with tutorial sessions that were intended to provide a detailed treatment of selected aspects of the lecture content through group discussions based on set reading and exercises. This strategy was believed to reflect the nature of Developmental Psychology as a field of study, that is, its intermediate status between the exact sciences characterized by 'a much greater area of indisputable and essential knowledge that has simply to be mastered' (Corbett, 1964; pp.24f) and Arts subjects which 'are, and doubtless will always remain, controversial' (Corbett, 1964, p.25). Tutorial sessions were structured in such a way that students were confronted throughout the course with the disputational aspects of Child Development and the need for interpretation.

While lectures and tutorials constituted the active teaching strategies it was also recognized that the written assignments required of students constituted what might be described as passive teaching mechanisms. In specifically ATI terms, the tasks set for

student assessment could be regarded as treatments which, in conjunction with personality and study behaviour components, formed the basis for an interactive system.

Five assessment tasks were set for completion. They were designed when the course of studies was originally planned to represent diverse but distinctive competencies of direct pertinence to the course objectives. Four of these five tasks were employed as elements in the present study. They were an Essay, an Analytic Report, a Child Study, and the continuous assessment of tutorial participation from week to week.¹³ Each of these will be considered in turn.

(a) The Essay By virtue of its probably being well understood among students, the essay was set first in the sequence of five course assignments. It was not, strictly speaking, a prescribed task, but one of a group of four from which students were invited to select three as contributors to their total score. The task requirements followed widely used and

13. The fifth assessable task for the course was an end-of-year multiple-choice test. It was last in the group of four assignments from which students were asked to select three to make up their total score. Its place in the sequence of assignments meant that most students had a fair knowledge of their overall course performance by the time the test was to be taken. A substantial number of students elected to omit this task to free them at examination time for other work. No attempt was made in these circumstances to include the test in this study.

essentially traditional models of essay writing by emphasizing the organizational aspects of topic selection (from a list of six topics), library research based on select bibliographies for each topic, the co-ordination of materials and ideas and the synthesis of diverse points of view, and the presentation of a suitably documented case in 1500 words of relatively unambiguous prose. These requirements, together with a general guide for the preparation of written work in the Faculty (based on Anderson, *et al.*, 1970) were distributed to all students when the course started.

It will be evident from the summary description offered that a set of what may be termed infraskills can be specified for essay writing of which the main element appears to be organizational and systematic competence. This is apparent at all stages in the preparation of an essay from the initial planning and library phase through the orderly scheduling of time and effort, to the development of a final draft. An additional key element has to do with clarity and specificity of purpose in constructing a focussed argument; and, further to this, its explication in a prose style suited both to the topic and the field of study.

The correspondence between these skills and relevant predictor variables is readily drawn in terms of the organizational strategies of Biggs's (1973)

SBQ Scale 5, 'Study Skills and Organization'. This scale refers to work patterns which follow a consistent plan of regular and well organized study, review, and scheduled effort. Rather less obvious, but of considerable importance, is the amount of persistence and concentration required of students if they are to maintain this degree of application in their work. It is in this respect that Anxiety as a generalized drive must be acknowledged, subject to its recognized limitations under the Yerkes-Dodson principle. In general it would most likely be true that a drive of this type coupled with robust SBQ Scale 5 levels should combine in a mutually supportive way as contributors to achievement.

The influence of Introversion-Extraversion in the writing of essays is not as simply delineated. Its role must be inferred from its characteristics as previously reviewed. They point up the advantage enjoyed by relatively Introverted students in the face of tasks which call for the management of one's affairs in a self-disciplined way, and the execution of a programme of study requiring concentration, a reflective stance, and some measure of independence that would, in various ways, be co-extensive with a solitary style of work.

These parallels between Introversion and the postulated infraskills of essay writing also serve to

account, at least in part, for the frequent reports that Introverts tend to excel in the final years of secondary school and at undergraduate level generally. Essay writing, and the competencies associated with it, have traditionally been used extensively to assess performance in these sectors.

The personality structures with the closest fit to this pattern of inferred infraskills would thus be characterized by relatively high, or at least curvilinearly moderate, levels of Anxiety conjoined with Introversion. And the advantages of such a structure should be increased where a conscientious organizational study strategy is adopted.

(b) The Analytic Report Of the five performance tasks used in the first year course, the Analytic Report was the most distinct. Its specifications were, in modified and limited form, those of a research paper in Child Development. It required the selection of two published articles from a specified group to serve as the basis for a developed case designed to further students' analytic competencies. Following a close examination of the substance, purpose, and internal consistency of each article, students were asked to identify elements common to both using a matrix sampling procedure. A single, integrated research issue or hypothesis was required deriving from this analysis, but so formulated that its possible resolution could be argued for within

the limits of the papers chosen for study and the material covered in lectures and tutorials. The three sorts of activity demanded by this assignment were thus recognition and discrimination, the analysis and testing of logical and empirical consistencies, and the extension of an integrating argument or thesis. The recommended format for this task was that it be submitted entirely in note form under five headings:

- (a) The Problem; (b) Major Relevant Findings;
- (c) The Argument or Thesis; (d) Research Implications; and (e) Educational Implications.

A deliberate focus of interest in the Analytic Report was on those aspects of studies in Child Development that most nearly approximated a scientific activity. The task's structure was intended to emphasize analytic precision, specificity, logical rigour, and critical detachment. In keeping with these expectations, students were supplied with a detailed guide which specified the task's components and orientation in terms of these requirements.

The infraskills associated with Analytic Report achievement which were deduced from the foregoing description of the task were those believed to characterize scientific inquiry; and relevant personality attributes were consequently sought in traits commonly found to typify Science rather than Arts practitioners. These include such key qualities

as detachment, a cool, impersonal, objective stance, relative lack of emotional involvement or reactive expression, a tendency to closure and a narrow convergence on detail, rigidity in personal affairs and attitudes, and a concomitant preference for a systematic and orderly study regimen (Hudson, 1975, pp.165ff.; and 1970, p.305).

So far as the predictor domains in the present study were concerned, these qualities most nearly corresponded with low levels of Anxiety reflecting detachment and the absence of emotional reactivity, a bias towards Introversiion as an expression of the scientist's impersonal stance, and a better than average score on the organizational Study Behaviour Scale. There was, however, a firm basis for the prediction that these three components would interact. As with the Essay, it was counted likely that strengths in one or other of the task infraskills could be expected to compensate, or even to remedy, deficiencies in the total set; thus, for example, the student whose drive level is less than optimal might nonetheless do well on account of better planning or a natural preference for solitary and uninterrupted work, or both. The compounded scores for such a case would therefore reflect aspects of performance not expressed by the predictor elements taken separately.

(c) The Child Study The third performance task set for completion was designed as an integrated exercise involving both observational and interpretive requirements. Although it belonged to the set of four assignments offered under a limited system of choice, its value as a learning activity and its central importance to the aims of the course meant that very few students elected not to submit it.

The Child Study required first that two separate observational records of one child's behaviour at different times be compiled, in note form, and second that these notes should then be augmented by a 1000 word theory-based interpretive essay. All three sections of this study (observations at time A and time B plus interpretation) were then submitted so that the degree of interdependence and cogency of work could be evaluated. Students were instructed that under no circumstances were they to intervene in their subject's activities, and that their focus of observational interest must stay within the bounds of propriety. An additional requirement that the study should be designed longitudinally proved too demanding and was relaxed, a fact that serves to highlight organization and planning as pertinent infraskills. This is further supported when it is pointed out that students were expected not only to arrange their access to a particular child and manipulate the

circumstances appropriately to gather organized data, but also to prepare an interpretation of their observations with reference to one or more of the major theories of child development studied in their Education course. Students whose notes were systematized in an orderly way and whose work schedules included periodic revision were clearly much better placed to do what was asked.

With reference both to Anxiety and to Introversion it was unclear how their influence would be likely to differ in this task from their impact in the case of Essay writing. The merits of persistence and determination as motivating forces are evident, and their interactive effect (expressed in Anxiety as a general drive) in association with organizational competence was therefore acknowledged as a plausible hypothesis. But the role of Introversion was considered generally less relevant to the Child Study because of the need for some degree of interpersonal sensitivity in arranging its execution as well as the sympathetic treatment of data. At the same time it had to be recognized that Introverts would probably enjoy some advantages in the section devoted to interpretation because of its essay structure. The overall impact of Introversion was thus counted somewhat indeterminate, though of arguably greater benefit than its polar opposite.

(d) Tutorial Participation This performance task stood apart in several ways. First, it was not grouped with the set of assignments offering limited choice; this meant that the final mark for the course always contained a student's tutorial score. Second, the tutorial programme operated in conjunction with weekly lectures; a student's mark for tutorial work was the sum of marks earned each week rather than a global mark assigned on a single occasion. Third, the evaluation procedure for tutorial participation was directed exclusively towards the quality of students' spoken contributions based on questions set for consideration each week. No account was taken of written notes or any other preparatory work a student might have done except in so far as this preparation became evident in discussion and argument. And fourth, the progress of each tutorial session was actively monitored by tutors specifically appointed for this purpose. The tutors were also responsible for assessing student performance which necessitated their balanced rotating among the groups.

The criteria for judging student performance in tutorials were made known when the course began and a three week period of grace was allowed before cumulative marks were awarded. Marks were assigned when a student's contribution exhibited his or her knowledge or understanding of the issues that were central to each

week's reading and discussion questions, however it was accepted that credit should be given not only for the fruits of preparatory work but also for demonstrations of those skills needed to pursue issues as discussion proceeded. The principal infraskills thus regarded as likely to contribute to achievement were those of discussion, debate, and rational argumentation, under the important constraint imposed by the existence of a specialist tutor, a small group of student peers, and a set of detailed requirements in the form of specific text-based questions which the group was asked to explore.

Given this set of underlying competencies the predictable importance of Extraversion was, on first inspection, considered self-evident. But the emphasis placed on a thorough grasp of the substance of each week's readings, and students' clear recognition that tutorial time had equal weighting with lecture time served to raise both Study Behaviour and Anxiety in importance as potential contributors to achievement. The regular week by week planning that was a feature of the tutorial programme clearly pointed up the probable benefit to students of a thorough and orderly study strategy and this, in association with a bias towards Extraversion, appeared to reflect that conjunction of aptitudes most likely to predict successful performance.

The postulated advantage of Anxiety in Tutorial participation was not so readily defined. While a *prima facie* case can easily be recognized linking tutorial performance in small group settings with low Anxiety, and while this case has clear empirical backing (*e.g.* Gynther, 1957; and Geer, 1966), the possible countervailing impact of Anxiety as a drive must be acknowledged. In the absence of research findings that might provide guidance for the development of hypothesized net effects, it was predicted that Anxiety would enter into a curvilinear association with tutorial performance, but that the point of curve inflection was likely to be situated closer to the low Anxious than the high Anxious pole.

The structure which was thus believed most likely to characterize successful performance on this task involved a conjunction of Extraversion and moderate or low Anxiety in association with well organized and systematic study techniques. It may be noted that, but for the Extraversion dimension, this structure was aligned with the structure postulated for successful performance on the Analytic Report.

The four tasks used in the present study were thus considered to have idiosyncratic features which marked each one off, in varying degrees, from its fellows. It will be clear however from the details set out in Table II.1 that the Essay and Child Study

TABLE II.1: Postulated Task Infraskills and Associated Personality Attributes

Task Details ^a	Attributes
(a) Essay - library research; co-ordination of material and ideas; comprehension and synthesis of points of view; generalized motivation.	Study Skills Introversion Anxiety
(b) Analytic Report - analysis of research papers (substance, purpose, internal consistency); discrimination of issues, problems, main theme and its resolution.	Study Skills Introversion Stability
(c) Child Study - observational skills; co-ordination of issues and material; the formulation of a theoretically defensible interpretation of data.	Study Skills Anxiety Introversion(?)
(d) Tutorial Work - discussion and argument in group setting; text-based weekly assignments to explore and amplify course content.	Study Skills Extraversion Stability

a. See Appendix L for a facsimile of the Assessment Schedule.

form one sub-group having common elements, and the Analytic Report and Tutorial tasks form a second sub-group in terms of the inferred linkages between the infraskills involved and the particular attributes of specific concern here.

Ordinal Effects Among Performance Tasks

An important consideration for the present study was the problem of task order. As an aspect of experimental design this problem was insurmountable since each task had been structured in such a way that it capitalized progressively on specific aspects of the course. The essay, as indicated earlier, was set first on the grounds that students would have developed essay type skills prior to their entering university, but were less likely to have practised the skills pertinent to other sorts of assignment. Since Education as a field of study was, for the great majority of students, a new area of inquiry, a relatively familiar evaluation technique had much to recommend it at the outset. The Child Study, for similar reasons, might have been placed second in order. But this would have deprived it of its value as a later exercise since it required students to have read all three major developmental theories and to apply their reading in relation to a particular child's behaviour. On systematic grounds therefore it had to be set close to the end of the year.

Because of its distinct quality, the Analytic Report was located shortly after the Essay. This allowed some tutorial time for students to practise what was required by the task under a tutor's supervision and then to use the skills they had developed throughout the rest of their course work. If it were to be used at all in evaluating student achievement, this task was best placed early, though not too early, in the teaching programme.

The organization of tutorials in weekly sessions provided an inbuilt assessment strategy. After three weeks' practice, students were assessed at each session. Their progress was recorded on a master list at three points during the course and they were told what they had earned and whether or not they were considered to be performing satisfactorily. In this case therefore, ordinal effects were present within the assessment device as well as between it and others, for it was only to be expected that students would weigh their progress from time to time in terms of the entire assessment programme in order to make adjustments wherever possible. Herein lay the problem of ordinal effects; moreover the problem was such that one entire assessment device, the end-of-course multiple choice test, had to be dropped from consideration for want of cases. And those who chose to sit this test were regarded as too biased a sample for

dependable analyses since they were often the students who were using it as their last hope of overall success in the course. Since no other assessment device bore quite this relationship to its fellows, its loss was counted unavoidable.

At the same time it was in the nature of the assessment programme that random or counter-balancing designs were out of the question. The plain fact was that ordinal effects were an aspect of detailed planning as an integrated part of the course. *Ex post facto* statistical controls were consequently the only appropriate way to deal with the problem.

The Treatment Component

In his discussion of the ATI research model, Bracht (1970) enumerated seven points requiring close inspection for its implementation. They have to do with the nature of the treatment task (controlled *versus* uncontrolled) and of the aptitude variables (factorially simple *versus* factorially complex), the type of dependent variable employed (specific *versus* general) the interaction effects being examined (ordinal *versus* disordinal), the need to relate treatments directly to aptitudes and performance, and the special advantages where treatment-relevant aptitudes have low or non-significant intercorrelations among themselves.

Throughout Bracht's comments it is taken for granted that the treatment component is an essentially active element in the system and is clearly distinguishable,

both conceptually and in practice, from the performance component. In the present study the treatment component was defined in terms of four assessment tasks set for completion during the course of an undergraduate programme of teaching and was therefore both passive and, in Bracht's terms, uncontrolled since no direct attempt was made to monitor its progress. Moreover this general approach meant that since no independent measures of treatment effects were taken, the practical distinction between treatments and performance was blurred. At the same time (and for the same reasons), the dependent variables were highly specific since they were in each case related directly to objectives that were immediately relevant to the treatments. It must nonetheless be recognized that the status of the treatment component was uncontrolled and that, as a consequence, this aspect of the study was largely inferential.

Bracht's observations concerning the aptitude component offered valuable guidance in the present research. In particular an important aspect of the design was its close attention to the detailed structural properties of Anxiety-Stability, Introversion-Extraversion, and Organizational Study Behaviour as these were defined within the specific sample under investigation. Furthermore, the use of factor-based scales in the personality domain following orthogonal

rotation of the factor axes maintained the independence of aptitudes with respect to each other, thereby ensuring the maximum allocation of performance variance in non-overlapping ways.

Finally, Bracht's remarks on the definition of interaction were noted. A disordinal interaction was defined as significant non-zero treatment differences at two levels of the personological variable with intersecting regression slopes (but not necessarily differently signed). Where the regression slopes fail to intersect but the remaining conditions are fulfilled, the interaction was defined as ordinal.

Summary

A broadly conceived framework was established within which to implement an Aptitude-Treatment-Interaction design for the investigation of undergraduate academic performance in a course of studies in Education. Following a review of the principal relevant variables in the personality and study behaviour domains, Anxiety-Stability and Introversi-on-Extraversi-on were identified as salient contributors to achievement in association with organizational study skills as a moderating element. When performance tasks were examined to determine their inferred patterns of infraskills, postulated linkages were set up relating the infraskill structures with each of the aptitudes. The study's proximate interest lay in the extent to

which these postulated relationships could be sustained at an empirical level. Its ultimate concern was to explore a particular aspect of the broader epistemological question how far the products of learning tasks might enter into theoretically stable functions based on aptitude and treatment characteristics.

CHAPTER III

HYPOTHESES

The system under examination comprised three domains of general inquiry. They were first the personality domain, second the study strategy domain, and third the performance domain. These may also be designated independent, moderating and dependent variable sets respectively and the pattern of associations thus formed may be depicted as set out in Figure III.1.

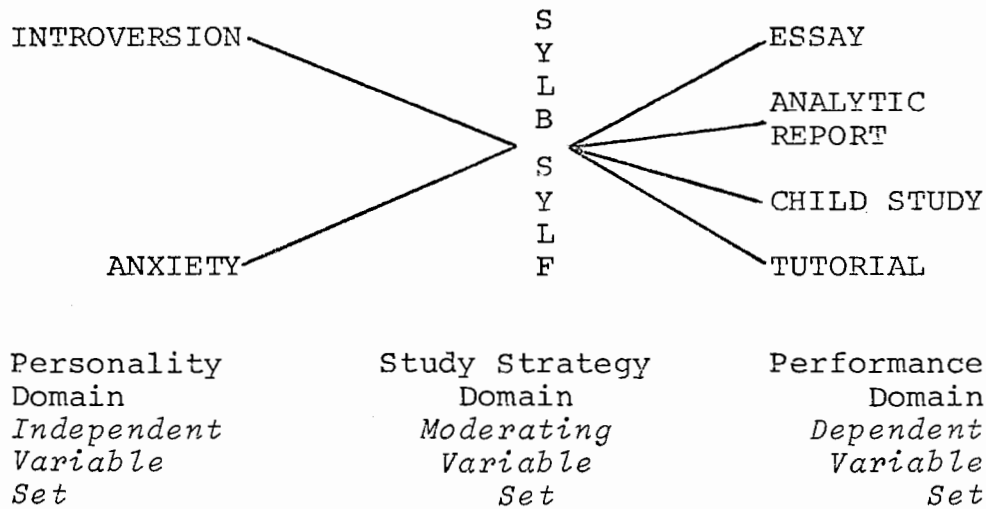


FIGURE III.1: *Systematic Relationships for Three Domains of Inquiry into Academic Achievement*

In formulating hypothesized interactive relationships of potential significance in terms of the system shown in Figure III.1 it was necessary to take into account three sets of prior assumptions underlying the

personality, study strategy, and performance domains severally. For the present study these assumptions constituted prior or first level hypotheses to be examined as a basis for the development of more specifically ATI lines of inquiry. When expressed as substantive hypotheses these assumptions do no more than assert the measurable presence of constructs within each domain as metric entities. Given that these constructs can be defended in appropriate metric terms it then becomes possible to test second level hypotheses which take account of the interactions. A subsequent or third level may then be explored comprising two essentially descriptive branches; in the event that hypothesized relationships are found to exist at or beyond the pre-set *alpha* level, regions of significance may be determined which embrace that range of scores for the independent variables associated with significant group differences on the dependent variable (Kerlinger & Pedhazur, 1973, pp.256ff.). But in the event that interactive relationships are found not to exist at a significant level or, if significant, fail to contribute meaningfully to performance variance, it becomes necessary to explore group differences in more global terms in order to discover whether the hypothesized interactions and their components are in any way important for the system under examination.

Diagrammatically the four levels at which hypotheses in the present study were investigated are shown in

Figure III.2. It will be apparent from the diagram that the path from Level I through Level IIA to Level IIIA' may be continued to Levels IIIB' and IV asymmetrically, hence the unidirectional arrow linking IIIA', IIIB' and IV.

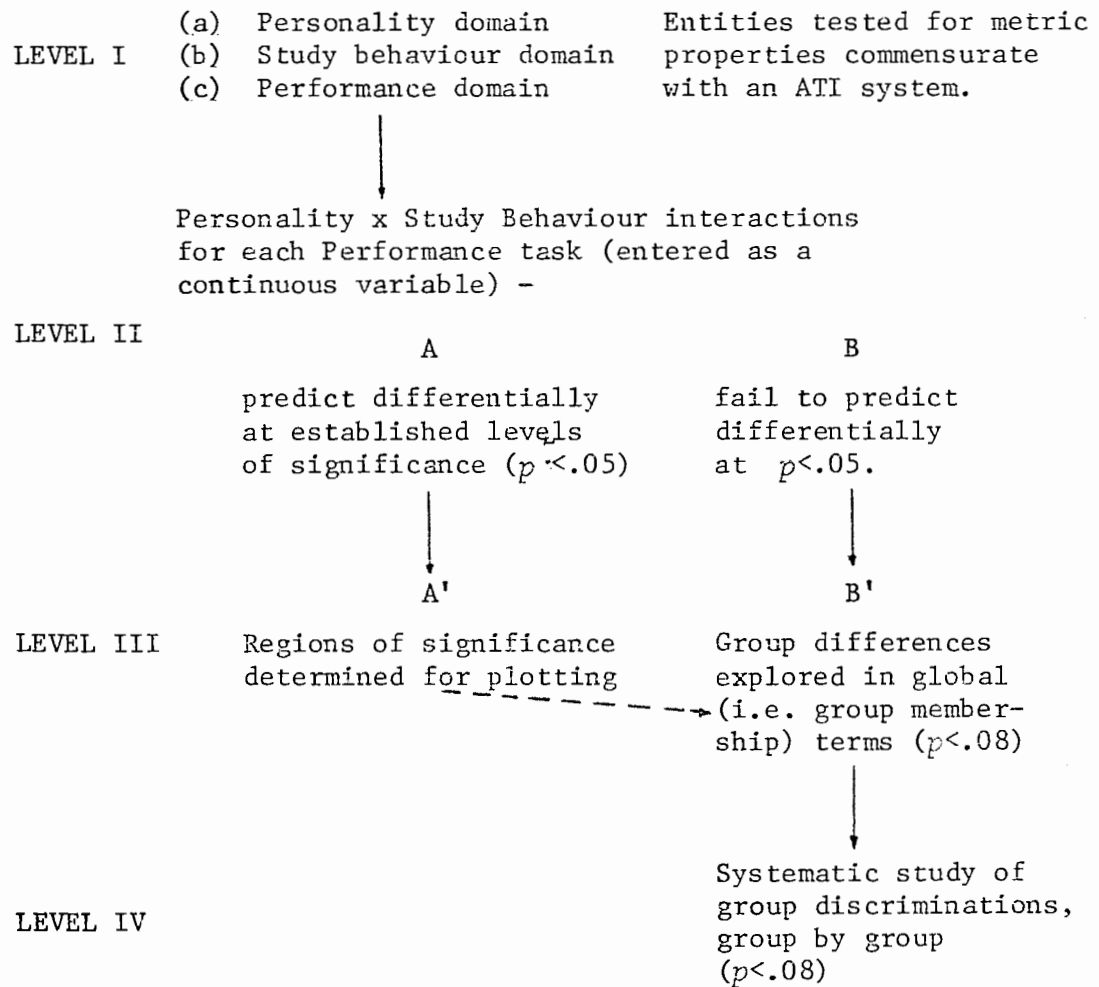


FIGURE III.2: *Hierarchic Structure for the Development of Research Hypotheses*

Level I Hypotheses - (a) The Personality Domain

A review of the research into relationships between undergraduate academic achievement and selected personality attributes clearly established the salience of Introversion-Extraversion and Anxiety/Neuroticism-Stability. In terms of the present sample, these constructs are likely to enter into significant interactions only to the extent that their salience can be independently demonstrated. Accordingly it was necessary to determine, with specific reference to the samples employed, whether the Introversion and Anxiety constructs were distinct and stable personality response dimensions which were commensurate with established measures. In the context of a self-report inventory covering a broad sample of personality items from eight main areas, it was therefore hypothesized:

- H: I(a)1 That Introversion-Extraversion is a stable factor-based bipolar personality response construct with metric scale properties.
- H: I(a)2 That Anxiety/Neuroticism-Stability is a stable factor-based bipolar personality response construct with metric scale properties.

These hypotheses were investigated first in terms of the factorial structure of inventory data, and second by conventional scale and item analysis methods.

Level I Hypothesis - (b) The Study Strategy Domain

An extension of the review of undergraduate academic achievement as it relates to personality identified the Syllabus Bound-Syllabus Free study strategy as a salient element having affiliations with the personality domain principally *via* Rigidity. The peculiarly organizational and strategic nature of the Syllabus Bound-Syllabus Free (SYLB-SYLF) dimension and the relative absence of clear evidence to support it at the level of a personality trait led to its consideration as an intervening variable moderating personality trait components in interactive relationships with the components of the performance domain.

As in the case of the personality constructs however, the dimensional status of the SYLB-SYLF construct must be determined prior to its use as a moderating vector for the particular sample under inspection. Accordingly it was hypothesized:

H: I(b) That responses on a Study Behaviour Inventory (the SBQ) exhibit metric scale properties on an organizational (SYLB-SYLF) construct.

Since this hypothesis was investigated in terms of an established instrument (Biggs's *Study Behaviour Questionnaire*), its scale properties were inspected directly using Cronbach's *alpha* statistic in association with a confirmatory factor analysis of the inventory.

Level I Hypothesis - (c) The Performance Domain

The present research was carried out in the relatively naturalistic setting of an ongoing course of undergraduate study in the Faculty of Education. In keeping with these conditions it was appropriate, when selecting the components to be designated as Dependent Variables, to employ the actual assignments which were part of the course assessment, subject to the metric constraints imposed on the components in each of the other two domains. These constraints require that the vectors to be used reach acceptable levels of internal consistency which in turn draw upon a theoretically defensible rationale, or upon a demonstration of independence in factorial (or comparable) terms, or both.

It was argued (*supra*, pp. 65ff.) that the performance measures used in this study were specifically designed to reflect those component skills regarded as fundamental to the course objectives. These objectives had to do with competence in synoptic and synthetic skills, in analytic skills, in observational and interpretive skills, and in skills related to expressive discussion and rational argument. While it has been suggested that these four sets of skills may plausibly be expected to represent somewhat different underlying competencies, it has also to be acknowledged that varying degrees of overlap may be encountered. This could

occur, for example among synoptic-synthetic and analytic skills, for it is self-evident that some analytic ability is pre-requisite to an adequate synthesis; likewise both analytic and synthetic skills might be expected to overlap with the skills of observation and interpretation, and there will also be overlap in the case of discussion and argumentation with reference to all of the others - analysis, synthesis, and interpretation.

It follows from this that the methodological requirement that each of the performance variables should be independent with respect to the other three would probably not be satisfied. At the same time, since three of the four components under discussion were single scores based on assignment grading, it was not possible to apply statistical measures of internal consistency using *alpha* or split-half reliability indices. In these circumstances the most satisfactory way to deal with the set of variables in the performance domain was to impose independence upon it by means of statistical manipulation. Such an approach would only be counted acceptable, however, if it could be shown that its effects on the elements of the performance variable set were unlikely to threaten their naturalistic properties. Its use was therefore regarded as contingent upon the emergence, in subsequent analyses, of acceptably low multiple correlations among the performance tasks.

It was also recognized that the orthogonal structure thus imposed upon elements of the performance domain effectively resolved a key issue concerning the dependent variable (DV) set which would otherwise have been investigated as a fully formed research hypothesis. For this reason the hypothesis that was devised could not be regarded in the same terms as hypotheses from other research domains. Accordingly, one general assertion was formulated subject to the need to balance, as far as possible, the advantages of independence in the performance variable set against the concomitant but inverse degrees of cost to the naturalistic setting in which performance measures were gathered; and subject also to its acceptance as a pseudo-hypothesis since it was intended to reflect a condition imposed on the data. It was hypothesized:

H: I(c) That performance variable scores are orthogonal estimates of achievement with metric scale properties.

Level II Hypotheses - The Interactions

The major focus of concern in the present study was at Level II. Following a review of the evidence dealing with the likely patterns of relationship for undergraduates between salient aspects of the personality domain, the study behaviour domain, and the performance domain, it was concluded that theoretically

defensible predictions at the interactive level offered a potentially fruitful guide to further inquiry. In summary terms, Anxiety-Stability and Introversion-Extraversion were conceived of as trait-based aptitudes which, under the moderating effects of adaptively acquired study behaviours, could be expected to enter into interactive relationships with performance tasks conceived as treatments. To the extent that the tasks under consideration could be shown to entail personality attributes which correspond with those selected for study from the personality domain, there is likely to be theoretically consistent evidence of differential achievement.

Of the five tasks which were set for students to complete in the course of their work, four were chosen for detailed study in the present research. In the order of their completion these tasks were first a conventional Essay, second an Analytic Report, and third a Child Study; the fourth task, tutorial participation, was completed among small groups which met in weekly sessions under staff supervision. Four hypotheses must therefore be countenanced. They will be considered *seriatim*.

(a) The Essay It was argued that the infraskills of essay writing are likely to correspond with or benefit from all three of the elements under consideration. Anxiety, both in linear and quadratic form, should

reflect the established facts associated with general drive theory (after Spence, 1958); likewise, but in linear form only, Introversion would be expected to contribute directly to achievement; and study behaviour, as an adaptation of trait Rigidity affecting students' organizational competencies, will similarly be likely to have a direct, linear impact on performance. As an interactive compound, it was further argued, internal compensations could be predicted such that deficiencies with respect to Anxiety or Introversion or study methods could be balanced, but in any case it will be true in general that an overall positive relationship involving Essay achievement could be predicted. It was therefore hypothesized:

H: II(a) That Essay achievement is a linear function of the interaction involving Anxiety, Introversion, and the organizational skills of Study Behaviour (SBQ).

(b) The Analytic Report The Analytic Report was represented such that its infraskills were likely to correspond more extensively with qualities having science-type characteristics. As indicated by prior research (Hudson, 1968, 1970) these characteristics were detachment, some measure of Introversion, and a probable (though not necessary) organizational competence. It was argued that, given an essential

minimum degree of Anxiety as basic drive, the commonly reported quadratic relationship with performance would be observed, but at a lower point than for the Essay in keeping with the predicted need for a lower general level of emotional reaction. In the case of Introversion, greater detachment appeared commensurate with relatively limited interpersonal engagement; Introversion was thus counted likely to contribute positively to analytic skills. Similarly, the Rigidity-based Study Behaviour dimension was seen to correspond in its essential respects with important elements in the catalogue of science-type characteristics. The organizational aspects of Study Behaviour were therefore likely to enter, to some extent, into a direct relationship with achievement. The interactive compound relevant to the prediction of Analytic Report achievement thus referred to low Anxiety, high Introversion, and moderate to high degrees of organizational study skills. Under this pattern of expectancies, it was therefore hypothesized:

H: II(b) That Analytic Report Achievement is a linear function of the interaction involving Stability, Introversion, and the organizational skills of Study Behaviour (SBQ).

(c) The Child Study A close inspection of the infraskills plausibly associated with work required in the Child Study yielded no directly assessed components that distinguished it from the infraskills associated with the Essay. While the task was structured in a way that might have capitalized on some degree of Extraversion, its evaluation was such that students who were able to draw heavily upon the skills pertinent to essay writing were seen to be equally well placed for success in this case. In particular, Anxiety (both linear and quadratic), and Study Behaviour expressed as competence in planning and executing the assignment were counted of special value; and the indeterminate effects of Introversion-Extraversion were not considered likely to upset these general trends, thus yielding a predicted linear relationship embracing the interactive compound of Anxiety, Introversion, and Study Behaviour, on the one hand, and Child Study achievement on the other. It was therefore hypothesized:

H: II(c) That Child Study achievement
 is a linear function of the
 interaction involving Anxiety,
 Introversion, and the organ-
 izational skills of Study
 Behaviour (SBQ).

(d) Tutorial Participation A natural focus on discussion and argumentation as key infraskills in tutorial work among small groups led to the clear expectation

that Extraversion would contribute directly to success. The influence of Anxiety was again acknowledged in terms of classic drive theory but the point of curve inflection for a quadratic analysis was impossible to predict in the face of postulated but complex intra-individual compensatory forces. In general it was considered that low rather than high Anxiety levels would be related to this task. Study Behaviour skills were regarded as relevant by virtue of the substantive aspects of the task (in specific contrast with procedural aspects) and on account of their correspondence with the regular timing of and concomitant planning for tutorial sessions. When entered as an interactive compound, all three elements were predicted to relate directly to task achievement, but with evident emphasis upon the Extraversion component. It was therefore hypothesized:

- H: II(d) That achievement in Tutorial participation is a linear function of the interaction involving Extraversion, Stability, and the organizational skills of Study Behaviour (SBQ).

Level III Hypotheses - Consequential Analyses

The evidence adduced by way of support for each of the Level II hypotheses was strongest where simple relationships were concerned. Predictions involving

interactions, though theoretically both plausible and elegant, were ill-supported in the literature and thus somewhat hazardous. In these circumstances it was essential to construct a branching strategy contingent upon the outcome of work done at Level II. For hypotheses at that level which were subsequently found to be confirmed, the appropriate consequential analysis was by application of the Johnson-Neyman statistical technique to circumscribe regions for the independent variables associated with significant group differences on the dependent variable. For those hypotheses at Level II which were subsequently disconfirmed and for which the Johnson-Neyman procedure was not appropriate, an alternative analysis was the global examination of group differences in an attenuated regression model based on coded group membership rather than a continuous dependent variable.

These two strategic alternatives, which are shown in Figure III.2 as A-A' and B-B' respectively, cannot be treated in the predictive terms applied to Levels I and II since they represent essentially *ex post facto* explorations of the data consequent upon the testing of research hypotheses. It was nonetheless appropriate to describe the steps that were structured in this way as hypotheses in order to delineate more clearly how the study was intended to proceed at this point.

Four consequential hypotheses were formulated at

Level IIIA', each focusing upon the application of the Johnson-Neyman technique to the performance measures taken one by one. They were:

- H: IIIA'(a) That regions of significance for Anxiety, Introversion, and organizational Study Behaviour as interactive predictors are associated with Essay performance scores.
- H: IIIA'(b) That regions of significance for Stability, Introversion, and organizational Study Behaviour as interactive predictors are associated with Analytic Report performance scores.
- H: IIIA'(c) That regions of significance for Anxiety, Introversion and organizational Study Behaviour as interactive predictors are associated with Child Study performance scores.
- H: IIIA'(d) That regions of significance for Extraversion, Stability, and organizational Study Behaviour as interactive predictors are associated with performance score in Tutorial participation.

Paralleling this set, four consequential hypotheses were also formulated at Level IIIB'. These represented weaker versions of the general regression model through the use of category codes for dependent variable scores designed to identify those respects in which high achievers for each performance task could be discriminated from others, but with specific reference to the three-dimensional interaction already discussed.

Level III B' hypotheses were thus intended to provide for two aspects of inquiry. First, the test of group discriminations with reference to three-way interactions involving Anxiety, Introversion, and Study Behaviour, was the natural sequel, as a more global analysis, to those hypotheses disconfirmed at Level II. And second, regardless of the fiducial status of Level II hypotheses, further inquiries to identify particular differentiating components were valuable in their own right over and above those specifically directed towards the interaction effects that were primarily of interest. In carrying out the discriminant analyses it was therefore considered sensible to so formulate the relevant hypotheses that the effects of Anxiety-Stability, Introversion-Extraversion, and Study Behaviour taken both severally as main effects and in paired form could be entered as possible contributors to group differentiations in addition to the three-way compound.

The four hypotheses which were construed to serve these purposes were as follows:

- H: IIIB'(a) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Essay achievers *versus* others.

H: IIIB'(b) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Analytic Report achievers *versus* others.

H: IIIB'(c) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Child Study achievers *versus* others.

H: IIIB'(d) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Tutorial participation achievers *versus* others.

Finally, the existence of four mutually exclusive achievement groups constructed to reflect potentially distinguishable kinds of task provided for the testing of a set of hypotheses based on the systematic comparison of groups taken two at a time. This set, designated Level IV in Figure III.2, represented an investigation of student achievement with specific reference to a differentiation of types of success rather than, as in Levels II, IIIA' and IIIB', discriminations based on degrees of success. Accordingly, six

hypotheses were formulated after the model established in IIIB' for group comparisons since the nature of this aspect of inquiry was mainly descriptive. The six hypotheses were:

- H: IV(a) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Essay achievers *versus* high Analytic Report achievers.
- H: IV(b) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Essay achievers *versus* high Child Study achievers.
- H: IV(c) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Essay achievers *versus* high achievers in Tutorial participation.
- H: IV(d) That Anxiety-Stability, Introversion-Extraversion, and the organizational aspects of Study Behaviour, severally and in joint interaction contribute significantly to group discriminations for high Analytic Report achievers *versus* high Child Study achievers.

- H: IV(e) That Anxiety-Stability,
Introversion-Extraversion,
and the organizational
aspects of Study Behaviour,
severally and in joint
interaction contribute
significantly to group
discriminations for high
Analytic Report achievers
versus high achievers in
Tutorial participation.
- H: IV(f) That Anxiety-Stability,
Introversion-Extraversion,
and the organizational
aspects of Study Behaviour,
severally and in joint
interaction contribute
significantly to group
discriminations for high
Child Study achievers
versus high achievers in
Tutorial participation.

For tests applied at Levels II and IIIA' the *alpha* adopted for statistical significance was set at 5% in accordance with conventional usage. Beyond Level IIIA' the study's procedure was largely exploratory, though the explorations that were planned flowed directly out of the theoretical predictions at earlier levels. It was considered appropriate in these circumstances to relax the conventional significance limits. *Alpha* regions associated with tests applied to hypotheses at Levels IIIB' and IV were therefore expanded to 8% because of the less rigorous character of the explorations and descriptions being studied¹.

1. With the exception of those occasions when pseudo-hypotheses were considered, the *alphas* adopted were applied in tests of operational hypotheses expressed in null form. These are given *infra* at appropriate points in the presentation of results.

CHAPTER IV
RESEARCH DESIGN - FIRST PHASE

General Design, Procedure and Results, Level I

In its general design the present study comprised three phases as outlined in Table IV.1. At the First Phase, research was directed towards the three sets of primary reference variables, *i.e.* the variables required to serve as a foundation for subsequent correlational analysis. Variables in the Personality domain were determined on the basis of two investigations designed to confirm and refine those traits which had been identified as salient in studies of undergraduate achievement. In the Study Behaviour domain an established inventory was administered in conjunction with the second personality investigation to test the appropriateness of a Rigidity based organizational study strategy. And in the Performance domain the tasks set for completion by students were analyzed in relation to those specific components in the Personality and Study Behaviour domains which had been confirmed as secure bases for further investigation.

At the Second Phase, the systematic study of Personality $\times$ Study Behaviour $\times$ Performance relationships was undertaken. Procedures at this point in the research were governed by the strategy set out in Figure III.2 for hypothesis testing. While the general approach in this Phase was defined by the ATI principles

TABLE IV.1: The Research Design

FIRST PHASE <u>Primary Reference Variables</u> (Hypotheses at Level I)	SECOND PHASE <u>Interactive Relationships</u> (Hypotheses at Levels II, III, IV)	THIRD PHASE <u>Follow-Up Inquiry</u>
<u>Personality Domain</u> Research to establish salience of Anxiety-Stability and Introversion-Extraversion as stable factor-based trait dimensions for the sample under study. (Pilot, 1975; Target Sample, 1976) <u>Study Behaviour Domain</u> Administration of established SBQ scales to determine the suitability of a SYLB-SYLF Rigidity-based organizational dimension. (Target Sample, 1976) <u>Performance Domain</u> Task analysis of performance variables in terms of implied personality and study behaviour components. (Four samples, 1973-1976)	Patterns of interactive relationships explored for personality and study behaviour variables as defined by work in First Phase. Focus of research directed to three-way Anxiety $\times$ Introversion $\times$ Study Behaviour compound as an element in the differential prediction of performance for each dependent variable measure.	Exploratory extension of analyses beyond the set of primary reference variables to embrace the remaining predictors found to be salient at First Phase of study. Construction of type profiles and definition of modal performance.

laid down in Chapter II, the detailed aspects of the several components involved were a direct function of work carried out at the First Phase.

In keeping with the correlational-descriptive and exploratory nature of the Second Phase, a Third Phase was included to provide for the aspects of follow-up inquiry. Given that well defined and appropriately significant ATI patterns were evident at the Second Phase, modal performers for each task could be identified and subjected to closer study with a view to the construction of incipient type profiles. Given ill-defined or non-significant results the question would arise whether the best system of aptitudes had been employed and hence whether, within the limits of the present inquiry, better definition could be achieved. The Third Phase was consequently structured in more open-ended terms to account for these additional aspects.

An important feature of this general design was the pattern of dependencies it entailed. Within the Personality domain it was considered essential, following a review of appropriate research, to test the relevance of the traits which had emerged as salient for the specific undergraduate samples being used. In the event that Anxiety-Stability and Introversion-Extraversion could be defended in the present study as personality dimensions comparable with those of previous research, the study of interactions at the

Second Phase could be pursued in established and straightforward terms. To the extent that these traits were found to differ, however, or in the face of evidence that for the samples used they were not among the most prominent dimensions, their subsequent use would have to be reconsidered. Similarly, the particular aspects of the Study Behaviour Domain that were selected for analysis in the Second Phase depended on the prior emergence of adequate scales based upon the SBQ inventory. Specific references in study behaviour research to the benefits of organizational skills, and the theoretical links which these skills were considered to have with aspects of trait Rigidity called for some empirical confirmation prior to the consequential study of interactive relationships.

So far as the Performance domain was concerned, the requirements at the First Phase were of a different order. Since performance tasks constituted the natural dependent variables in the study, and since it was the main intention of the research to explore these tasks as distinguishable entities with reference to the Personality and Study Behaviour domains, it would have been redundant initially to go beyond a theoretically based content analysis of each task in association with that level of empirical inquiry which was essential in order to determine their dependent variable status. It was of the nature

of the present investigation that by treating the performance tasks as dependent variables, their consideration at the First Phase was necessarily cast in terms of potential rather than actual differentiations.

In implementing this general design it was necessary to establish a full set of results at the First Phase before entering the Second. This procedure required the presentation of research design and methods in two parts - Part A for the research carried out at the First Phase to test Level I hypotheses, and Part B for the strategy used in the Second Phase to test hypotheses at Levels II, III, and IV.

Research Procedures for Level I Hypotheses - the Personality Domain

The investigation of personality structures in the present study took its methodological direction from the theoretical work reviewed previously. Both Eysenck and Cattell, in particular, have employed factor analysis as a major statistical tool, and have thus accepted an essentially actuarial approach in developing their theories. While the focus of interest here was directed towards the personality trait constructs of Anxiety-Stability and Introversion-Extraversion, the specific questions had to do not with the presence or absence of these traits since this has been extensively researched, but first with

the extent to which they could be replicated in a specific undergraduate sample, and second with their degree of stability over successive student intakes.

Following the compilation of a bank of personality items considered to have face validity in those aspects of personality that were counted likely to influence student academic performance, a pilot study was undertaken to explore the factor structure associated with student responses. On the basis of data gathered in the pilot study a revised inventory was administered to the target sample one year later. This procedure was equivalent to the execution of tandem studies and will be reported accordingly.

Two research hypotheses were under investigation at this point. As set out in Chapter III, they were formulated to test the extent to which Introversion-Extraversion and Anxiety-Stability could be defended as stable factor-based bipolar personality constructs having metric scale properties. These hypotheses were examined by means of factor and scale analysis, by a matrix comparison procedure, and by item matching against established reference constructs. No attempt was made in these circumstances to formulate null hypotheses since the various procedures and their associated conventions were so diverse in character.

The Pilot Study

METHOD

The Sample The subjects for the pilot study were 152 students reading Education 111, Child and Adolescent Development, in the Faculty of Education at the James Cook University of North Queensland. This course constitutes half the required study programme for students enrolled in first year Education and accepts candidates from the Faculties of Arts, Commerce and Economics, Education, and Science. There were 65 men and 87 women.

Instrument A total of 124 items were selected from the item bank. These were initially drawn from established personality inventories in order to reflect appropriate content, and they were then re-cast into a suitable common format for use with undergraduate students. The inventories culled for this purpose and the relevant personality dimensions represented in each case were:¹

A. Edwards Personality Preference Schedule (EPPS)

1. Deference
2. Autonomy
3. Order

1. The following list is alphabetically ordered. For detailed item identification, see Appendix A.

B. Eysenck Personality Measures

1. Introversion-Extraversion (EPI)
2. Neuroticism (EPI)
3. Radicalism
4. Tough Minded-Tender Minded

C. IPAT

1. Anxiety

D. Omnibus Personality Inventory (OPI)

1. Anxiety
2. Autonomy
3. Masculinity-Femininity
4. Rigidity-Complexity
5. Introversion

E. 16 P.F.

- | | |
|-----------------------------|-------------------------------|
| 1. Affectia-Sizia | } Exvia-Invia |
| 2. Dominance-Submissiveness | |
| 3. Surgency-Desurgency | |
| 4. Ergic tension | } (Extraversion-Introversion) |
| 5. Ego strength | |
| 6. Parmia-Threctia | |
| 7. Protension-Alaxia | |
| 8. Premsia-Harria | } Anxiety |
| 9. Autia-Praxenia | |
| 8. Premsia-Harria | } Cortetia-Pathemia |
| 9. Autia-Praxenia | |
| | (+El) |

F. State-Trait Anxiety Index (STAI)

1. Trait anxiety

G. Syllabus Bound-Syllabus Free Scale

(Parlett, Hudson)

H. Taylor's Manifest Anxiety Scale (MAS)

1. Trait anxiety

The items were cast as first person descriptive statements of a general type. Each respondent was asked to estimate the extent to which the statements were true descriptions of his or her own opinions by marking an appropriate point on a five point line scale, thus:

I usually study only what

I am required to study. T F

And:

I would rather be at

home on my own than go

to a boring party. T F

The selection of items was designed to sense the personality characteristics of Trait Anxiety, Introversion-Extraversion, Rigidity-Complexity, and the Syllabus Bound-Syllabus Free dimension. Items were therefore chosen from established inventories if they were keyed specifically for these scales, but additional items were also drawn from scales of Autonomy, Deference, Masculinity-Femininity, Radicalism-Conservatism, and Tough Minded-Tender Minded. These additional items were chosen, on face validity alone, for their relevance to one or more of the four personality

characteristics of central interest in the study.

The personality dimensions employed, together with sample items for each, were as follows:

Anxiety-Stability

I am usually calm and not easily upset.

I shrink from facing a crisis or difficulty.

Autonomy

Unquestioning obedience is a virtue.

I like to do things in my own way, without regard to what others may think.

Masculinity-Femininity

I like to be with a crowd who play jokes on one another.

I sometimes let my actions get swayed by feelings of emotion.

Radicalism-Conservatism

The laws against abortion should be abolished.
Only by going back to religion can civilization hope to survive.

Rigidity-Complexity

I like to have a place for everything, and everything in its place.

I don't like having to follow a set schedule.

Introversion-Extraversion

I could happily live alone, far from everyone, like a hermit.

I enjoy being in a crowd just to be with people.

Syllabus Bound-Syllabus Free

I often follow up my own ideas when I am supposed to be studying.

I prefer not to be left to work in my own way as I get nothing done.

Tough Minded-Tender Minded

I think crimes of violence should be punished by flogging.

I think we treat criminals too harshly; we should try to cure, not punish them.

The order in which the 124 items appeared on the final form of the inventory was randomly determined without regard to scale.

Procedure All students reading Education 111 in 1975 were invited to participate in the study. They were informed of the study's general aims and design and told that personality inventory data would be treated confidentially, but that individual students were welcome to seek details of their own response profiles. It was also made clear that the study was not in any sense a required aspect of the course and that students were consequently under no obligation to take part, nor to reveal their names. Inventories were distributed at a tutorial session midway through Lent term for completion and return within a period of approximately thirty minutes, thus allowing respondents some 15 seconds for each item. About 30 students missed the tutorial session and their participation was sought privately.

An exact index of response rate could not be calculated because of the failure of many students who withdraw from courses to notify their withdrawal promptly. A total of 152 completed inventories were collected at a time when the official enrolment was 171. Only one of the completed inventories was returned anonymously.

Analysis of Data The first stage of analysis was concerned with the screening of inventory items for eventual factoring. Means and standard deviations were calculated for each item together with standardized estimates of item skewness and kurtosis (Veldman, 1967, pp.182f). These estimates indicated that fourteen items lacked discriminatory power and they were consequently dropped (together with one item found to have been repeated). The fourteen items were:

Skewness

- | | |
|---|-------|
| i. Women are not the equals of men in intelligence, organizing ability, etc.
(False) | -12.5 |
| ii. I like to be able to come and go as I want to. (True) | 7.2 |
| iii. I feel more comfortable about assignments if I know exactly what I am supposed to be doing and how important it is (T) | 29.3 |

Skewness

iv.	Ultimately I think private property should be abolished and complete socialism introduced. (F)	-9.3
v.	When I know I'm doing the right thing I find my task easy. (T)	11.2
vi.	There are times each day when I want to enjoy my own thoughts uninterrupted by others. (T)	11.5
vii.	I work much harder when studying the subject I like most. (T)	12.6
viii.	I am happy most of the time. (T)	7.2
ix.	I am more interested in learning facts than in relating them to my ideas and previous experiences. (F)	-7.5
x.	The idea that sickness comes as much from mental as physical causes is much exaggerated. (F)	-6.4
xi.	I am ill at ease with members of the opposite sex. (F)	-6.8
xii.	I think it is wrong that men should be permitted greater sexual freedom than women by society. (T)	8.7
xiii.	I sometimes laugh at a dirty joke. (T)	8.6

Skewness

xiv. I feel *any* job should be done

thoroughly if it's done at all. 8.8

The new total of 110 items formed the basis for the construction of a correlation matrix which was used in calculating eigenvalues in order to estimate the probable number of factors to be dealt with in subsequent factor analysis. The BMD Computer program 08M (Factor Analysis) was used for these calculations (Dixon, 1970), and a common factor analysis model (Rummel, 1970, pp.104ff) was applied² following a test to determine its suitability (Guttman, 1953)³. This model, unlike that for principal components, is not concerned with 'the reduction of a large body of data to a more manageable set' (Harman, 1967, p.135). Rather it aims to generate that solution which will maximally reproduce the original correlations among the variables. The common factors are designed to account for these correlations and to exclude unique and error variance. Since the present inquiry was directed towards the replication of previously delineated factor entities which had elsewhere been represented as unitary, a common factor model was deemed appropriate.

-
2. Initial communality estimates were squared multiple correlations (Harman, 1967, pp.86f.) subsequently iterated to a tolerance of .001 (Dixon, 1970, p261).
 3. For all off-diagonal elements of the inverted correlation matrix, the absolute mean was 0.31; 86 elements exceeded ± 0.50 .

RESULTS

As indicated by the details shown in Figure IV.1, Cattell's scree principle suggested that seven factors could be sustained by the data, accounting for 34% of the total variance. The loadings for these factors were rotated to an orthogonal solution by the Varimax Method⁴ and this rotated structure was inspected to identify inventory items having negligible loadings or items for which the loadings on two or more factors were similar.⁵ Following this inspection, 39 items were removed (see Appendix B) and the 71 remaining variables were subjected to item analysis (Veldman, 1967: Program TESTAT). By allocating items to scales for this analysis on the basis of the rotated factor loadings, *alpha* coefficients for each of the seven scales so formed proved to be entirely adequate, however for two items in Scale 7 the item-scale correlations were abnormally low. These items were also discarded⁶. A second item analysis of the final

4. Recommended by Harman (1967, pp.312ff.) to preserve factorial invariance.

5. According to the Burt-Banks formula (Child, 1970, pp.97f.) a loading $>.21$ was statistically significant at $p<.01$. For the screening of variables at this stage, however, variables with loadings $<.4$ were regarded as negligible. All cases of similarity were found also to involve negligible loadings under this definition.

6. The items and their associated correlations with the scale (original *alpha*, .51) were:

I often disagree with my teachers. (.09); and
I can usually make accurate decisions quite quickly. (.11).

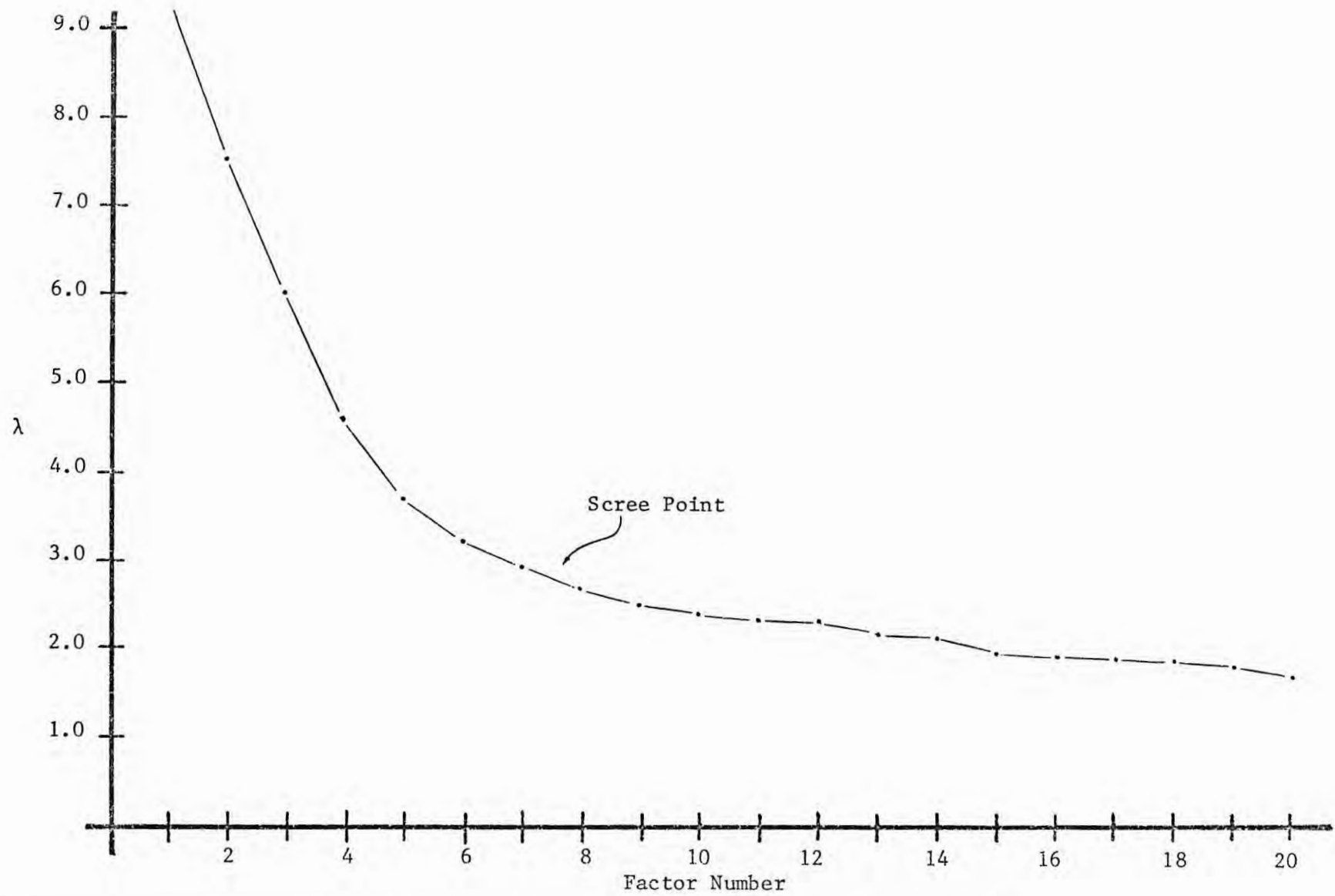


FIGURE IV.1: *Scree Slope Diagram for Personality Data - Pilot (1975)*

TABLE IV.2: Item Analysis Summary Statistics for
Seven Scales and 69 Items (Sample N=152)

Scale No.	1	2	3	4	5	6	7
Item N	10	10	10	9	12	8	10
Means	32.73	24.09	39.71	32.37	31.22	24.16	28.74
Standard Deviations	8.04	7.90	8.56	7.90	7.77	6.81	6.58
Alphas	0.79	0.80	0.78	0.79	0.73	0.74	0.60

version of the inventory yielded results which are summarized in Table IV.2. While the *alpha* for Scale 7 remained low it was nonetheless acceptable; but it will be clear that the scales defined by rotated Factors I - IV form a group with very substantial internal consistency (see Appendix C for the complete factor loadings). Scales 1 - 4 will therefore be reported in full, and scales 5 - 7 will be summarized briefly:

Scale 1 (Based on Rotated Factor I; 9.4% of total variance)

1. I hesitate to use my own ideas for fear they might be impractical. (Factor I loading, $-.60$)
2. I have several well-developed intellectual interests outside my studies. ($.58$)
3. I find it hard to address a large group. ($-.57$)
4. I avoid getting involved in social responsibilities and organizations. ($-.53$)
5. I am certainly lacking in self confidence. ($-.49$)

6. I prefer known ways of doing things rather than trying out new ones. (-.47)
7. I prefer to know that something will really work before I take a chance on it. (-.47)
8. I enjoy reading Shakespeare's plays. (-.46)
9. I am considered a very enthusiastic person. (.45)
10. I like to discuss philosophical problems. (.41)

The ten items of Scale 1 depict a characteristically general first factor which in this case contrasted items reflecting a confident, adventurous, intellectually keen stance with their bipolar counterparts. The items are drawn from several original scales including Autonomy, Masculinity-Femininity, Rigidity, Syllabus Bound, Introversion-Extraversion, and Anxiety. As no single original scale predominated, this set was designated an Adventurous-Cautious scale.

Scale 2 (Based on Rotated Factor II; 7.3% of total variance)

1. I like to have a place for everything and everything in its place. (Factor II loading, -.68)
2. I like to plan and organize the details of work I have to do. (-.66)
3. I like to keep my things neat and orderly on my desk. (-.66)
4. I like planning things carefully, well ahead of time. (-.64)

5. I like my written work to be precise, neat and well organized. (-.64)
6. I always see to it that my work is carefully planned and organized. (-.61)
7. When I see sloppy and untidy people I get annoyed. (-.47)
8. I don't like things to be uncertain and unpredictable. (-.46)
9. Straight-forward thinking appeals to me more than imagery and metaphor. (-.37)
10. Nothing in life is worth the sacrifice of losing contact with your family. (-.31)

The items of this scale very evidently reflect classical Rigidity. With the sole exception of a rather weak item 10, all items were drawn originally from scales of Rigidity. Their reappearance as a homogeneous set in this study clearly confirms them as estimates of a theoretically coherent pattern of item endorsements.

Scale 3 (Based on Rotated Factor III; 5.7% of total variance)

1. On social occasions I prefer to stay quietly in the background. (Factor III loading, -.57)
2. I usually enjoy parties. (.55)
3. I would hate to be where there wouldn't be a lot of people to talk to. (.51)
4. I have decidedly fewer friends than most people. (-.49)

5. I consider myself a very sociable, outgoing person.
(.48)
6. I could happily live alone, far from everyone,
like a hermit. (-.47)
7. I enjoy being in a crowd, just to be with people.
(.47)
8. I would rather be at home on my own than go to a
boring party. (-.46)
9. Most of the people I know would regard me as an
amusing talker. (.43)
10. I prefer to work with others rather than alone.
(.41)

All ten items in this scale were drawn originally from scales of Introversion-Extraversion. As with Scale 2 in the case of Rigidity, this set of items manifestly confirms Introversion-Extraversion as a unitary and homogeneous pattern of item endorsements.

Scale 4 (Based on Rotated Factor IV; 4.3% of total variance)

1. I take disappointments so keenly that I can't put
them out of my mind. (Factor IV loading, -.63)
2. I am more sensitive than most people. (-.62)
3. I am a fairly high-strung person. (-.59)
4. I become tense and upset when I think about my
present concerns. (-.58)
5. I often get over-excited and rattled. (-.57)
6. I am usually calm and not easily upset. (.54)

7. I believe I am no more nervous than most people.
(.50)

8. I work under a great deal of tension. (-.43)

9. I'm a pretty easy-going person. (.42)

Eight of the nine items in this scale were drawn from inventories originally designed to measure Anxiety, and the ninth ('I'm a pretty easy-going person'), while originating as an Extraversion item, can be readily incorporated into the present set as an index of general tension. It is clear therefore that the pattern of item endorsements for this scale confirms the existence in the present sample of a unitary set of responses based on Anxiety reactions.

Scale 5 (Based on Rotated Factor VI⁷; 2.5% of total variance)

Nine of the twelve items in this scale were taken originally from Parlett's Syllabus Bound-Syllabus Free inventory. The heaviest loaded of these dealt with the pursuit of ideas outside or beyond a prescribed syllabus and the inclination to put scheduled study aside in order 'to follow up my own ideas'. Reflective Introversion, Rigidity, and Anxiety scales supplied the other three items, all being consistent with a Syllabus Bound-Syllabus Free dimension (*e.g.* 'I don't

7. *Sic.*

like having to follow a set schedule' from a Rigidity Scale). Original loadings were generally lower than for items in Factors I-IV, and no less than eight hovered around the .40 cutoff. When viewed in conjunction with item and scale analysis data, this scale is weaker than those considered so far, but strong enough to confirm the presence of a coherent Syllabus Bound-Syllabus Free response pattern.

Scale 6 (Based on Rotated Factor V⁸; 3.1% of total variance)

In terms of the original factor loadings, this scale is virtually defined by three items, two from Radicalism scales (approval of trial marriages; the need for a return to religious values), and one from a Rigidity scale (on the strict observance of moral laws). A fourth item concerning abortion laws and a fifth expressing a dislike of regulations exhaust the principal loadings, leaving three items without strong support as elements of the scale. (These three were taken originally from Rigidity, Masculinity, and Autonomy scales - in descending order of loadings.) While there can be little doubt that Scale 6 represents a Radicalism-Conservatism dimension having a distinctly moral flavour, it is evident that item endorsements from the present

8. *Sic.*

sample lack factorial unitariness to the extent achieved in earlier scales though they are comparable with published research on Radicalism-Conservatism (*e.g.* Eysenck, 1952, esp. p.193; where a reliability of .56 is indicated).

Scale 7 (Based on Rotated Factor VII; 2.0% of total variance)

The items for Scale 7 all loaded significantly on Factor VII (at $p < .01$; loadings $> .21$)⁹ but only two exceeded the more stringent 0.3 level referred to above. Taken as a group these ten items reflect aspects of a Tough Minded-Tender Minded pattern of endorsements in conjunction with the Syllabus Bound-Syllabus Free dimension. But the scale gives little evidence of homogeneity, as is indicated by the modest *alpha* of 0.60 (see Table IV.2). As a duplication of some theoretically coherent personality trait, this scale must be counted inadequate.

DISCUSSION

It was the object of the present study to explore the extent to which otherwise well established and theoretically defensible personality trait constructs were replicable in an undergraduate sample of Education students at James Cook University. This exploration was

9. Calculated according to the Burt-Banks formula.

carried out first *via* a common factor analysis procedure and second by constructing scales for item and scale analysis based on the factors so formed. The evidence from these two sources offered strong grounds for the acceptance of three constructs, *viz.* Rigidity (Factor Scale 2), Introversion-Extraversion (Factor Scale 3), and Anxiety-Stability (Factor Scale 4). Whether viewed in terms of defensible common factors, or in terms of scale *alpha* levels, or in terms of the proportion of items drawn from relevant original scales, these three constructs emerged as coherent and internally stable sub-sets of items which corresponded closely with appropriate theoretical structures in each case, (*cf.* Green, S.B., *et al.*, 1977).

Comparable results for Scales 5-7 were not realized, although a Syllabus Bound-Syllabus Free dimension together with Radicalism-Conservatism clearly found support as separate but weaker scales. It must be presumed therefore that, in keeping with the tenor of personality research findings, the Syllabus Bound-Syllabus Free construct is less salient than either Introversion or Anxiety, at least for the undergraduate sample used here. It should also be pointed out that, contrary to what might have been expected, a marked differentiation between Rigidity and Syllabus Bound-Syllabus Free responses has occurred in the present data.

When these results are compared with the list of personality trait characteristics which served as a frame for the construction of an initial item bank (*supra.* pp.110f.), it becomes clear that an essentially type-level factor organization has emerged which closely parallels Cattell's higher order factors (Exvia-Invia, Anxiety, Cortetia-Pathemia). Together with the general first factor which characteristically reflected an admixture of elements, these three type-factors largely submerged Deference, Autonomy, Radicalism, Masculinity-Femininity, and Tough-Tender Minded items.

The Target Study

The pilot study's successful replication of Introversion-Extraversion and Anxiety-Stability personality constructs, in conjunction with the strong evidence it yielded for a distinct Rigidity-Complexity factor apart from the Syllabus-Bound dimension, provided the necessary basis for further work. One objective in the target study was to discover how far the results of the pilot study would continue to obtain when comparable procedures were used with a new intake of students. If the personality dimensions which were of central interest proved to be stable over successive samples, aspects of the study's generalizability deriving from the personality domain would be secure. A second objective, more immediate to the study's

purpose, was to collect relevant and dependable personality data from that sample of undergraduate students which was to serve as the target for subsequent work. At the same time, the second study offered a valuable opportunity to improve the quality of personality scales where this could be done.

METHOD

The Sample The subjects for the target study were 95 students enrolled in the Child and Adolescent Development course at the James Cook University in 1976. As was the case in the pilot study, the Faculties of Arts, Commerce and Economics, Education, and Science were again represented, with students from the Faculty of Education predominating.¹⁰ There were 34 men and 61 women.

Instrument Of the 69 items which had been developed on the basis of data gathered in the pilot study, all but one were incorporated unchanged into the inventory for this study.¹¹ Two other items from the 1975 inventory were also used since they had approached the 0.4 cutoff. The first ('I shrink from facing a crisis or difficulty') was from an Anxiety scale, and the

10. The actual distribution of the 95 students was: Arts, 22; Commerce and Economics, 4; Education, 68 ; and Science 1.

11. The exception was item 10, Scale 1: 'I like to discuss philosophical problems'; loading .41; item-scale $r=.53$. Its omission was entirely accidental.

second ('I enjoy art, sculpture, and architecture') was a Masculinity-Femininity item. Additionally, 18 new items were used, all of which were chosen from the previously listed inventories to represent a moderate degree of neurotic depression and psychosomatic reaction in an undergraduate sample. This was done because the level of Anxiety represented by the items of Scale 4 at the pilot study had been comparatively low. Since Anxiety has played so important a part in reports on student performance, there were good reasons to aim at a scale that would cover a greater range; alternatively, the absence of more extreme items might have constrained the factor structure, and their inclusion therefore would allow for the existence of separate factors reflecting the classic theoretical differentiation between obsessive-compulsive reactions and generalized chronic tensions.

The 18 items newly included in the inventory were:

1. I often need cheerful, sympathetic company to cheer me up.
2. I often have a restless feeling that I want something but do not know what.
3. I sometimes feel happy, sometimes depressed without any apparent reason.
4. I have frequent ups and downs in a mood either with or without apparent cause.
5. I often find that I have made up my mind too late.

6. I sometimes feel 'just miserable', for no good reason at all.
7. I find it hard to fall asleep at bedtime.
8. I am often troubled by feelings of guilt.
9. I seldom worry about my health.
10. I wake up fresh and rested most mornings.
11. I have often felt listless and tired for no good reason.
12. I seldom or never have dizzy spells.
13. I have very few headaches.
14. My hardest battles are with myself.
15. Sometimes I let small things get on my nerves too much.
16. I need to have things 'just so' in order to concentrate on my work.
17. I feel well adjusted to life and its demands almost all the time.
18. I have a tendency to be a rather over-cautious pessimist.

In its final form, the personality inventory for the main study contained 88 items (see Appendix D). Item format and style of grammatical presentation were identical to those of the previous study, the 18 new items simply being incorporated randomly within the existing set.

Procedure All students reading the Education 111 course were invited to participate according to the terms and

conditions that were employed in the Pilot study. The inventories were again distributed in a small group tutorial setting for completion and return within about 30 minutes. Although there were no anonymous inventories returned, the total number of completed returns was noticeably lower than for 1975 (*viz.* 95 compared with 152). This appeared to be related simply to the generally lower levels of lecture and tutorial attendance by comparison with the previous year,¹² and to the smaller enrolment of 131.

Analysis of Data Items were screened first on skewness and kurtosis estimates. Only one item was dropped for this reason, *viz.* 'I seldom or never have dizzy spells' (skewness - 6.3). The remaining 87 items were then used for the construction of a correlation matrix for factoring. The same computer program (BMD 08M; Dixon, 1970) and common factor model (Rummel, 1970, pp.104ff) were employed as before, but with less statistical support for the model, as evaluated by the Guttman (1953) test.¹³ Since it was the object of the present analysis to replicate factor entities delineated beforehand for a corresponding sample rather than to explore an otherwise factorially unknown domain, the

12. Neither lectures nor tutorials imposed compulsory attendance.

13. The mean absolute value for off-diagonal elements of the inverted correlation matrix was 0.90.

results of Guttman's test were given less weight than might have been the case.

A preliminary factor analysis was carried out to identify items having weak loadings in a rotated solution involving seven factors. This was followed by a second factor analysis of the remaining items as a basis for the construction of scales and individual factor scores.

RESULTS

According to the details displayed in Figure IV.2, the choice of a seven factor solution for 1976 data based on the analysis of results from 1975 was supported by the scree slope discontinuity (Rummel, 1970, pp.364f.). An inspection of the rotated varimax loadings at this point led to the removal of seven items whose loadings did not exceed 0.3 (see Appendix E).

When intercorrelations for the 80 remaining items were analysed, scree test data continued to indicate that a seven factor solution was appropriate. The varimax rotated matrix of seven factors was examined to remove all remaining items having weak factor loadings. Fourteen items were identified by these means, many of which had previously registered low loadings but were allowed to remain as uncertain items pending further analysis.¹⁴ (The items dropped at this

14. Items which maintained substantial loadings across several analyses and items having a mixed record including at least one substantial loading were always retained.

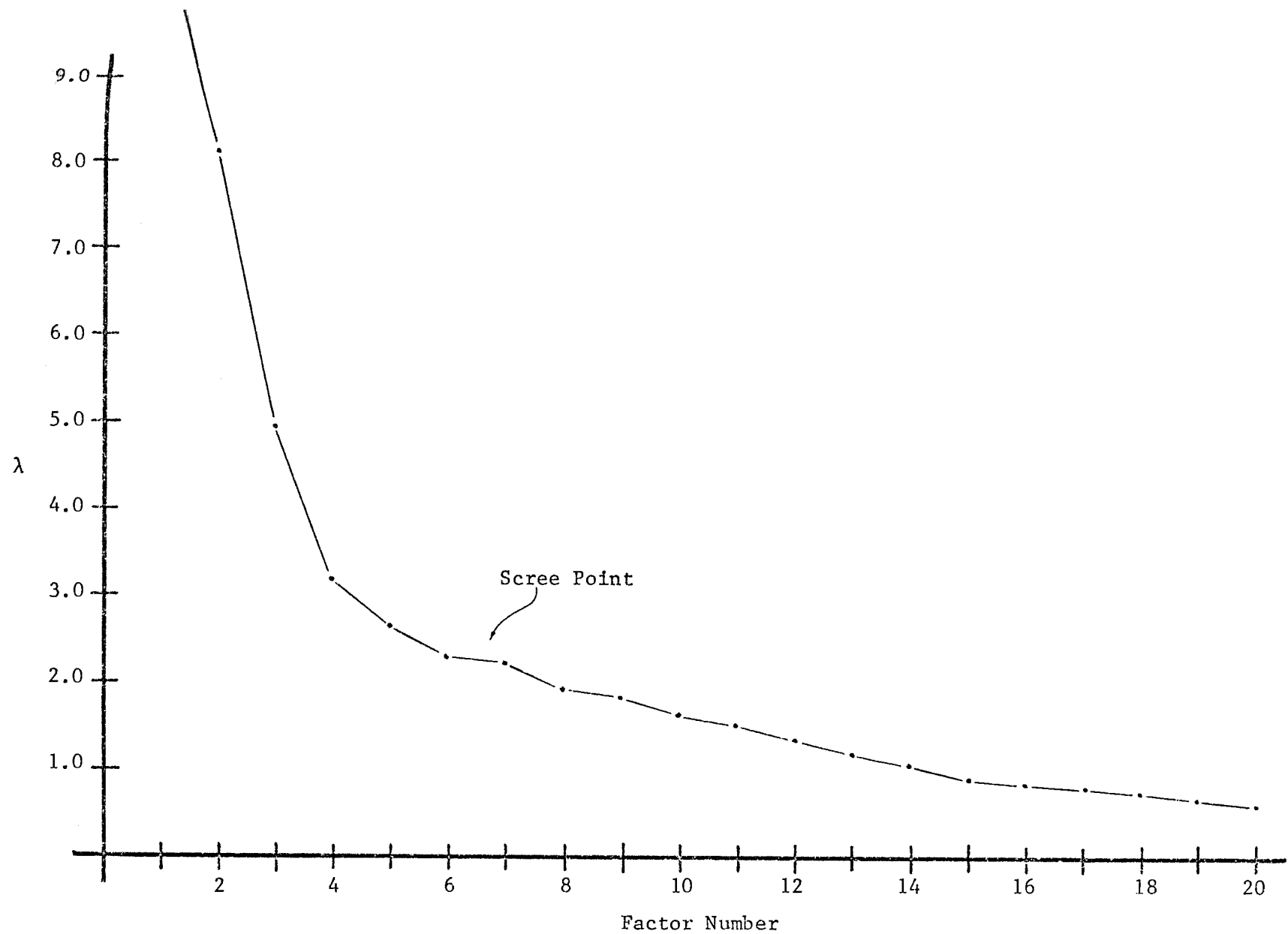


FIGURE IV.2: *Scree Slope Diagram for Personality Data - Preliminary (1976)*

stage appear as Appendix F.)

Following the removal of these items, a third and final factor analysis was carried out using the 66 items which had survived all previous analyses. A common factor model was again adopted with initial communality estimates being squared multiple correlations. (The final correlation matrix for this set is given in Appendix G.) A plot of the eigenvalues derived from the 66-item correlation matrix (see Figure IV.3) indicated the existence of six common factors based on scree discontinuity. Six factors, accounting for 41.3% of total variance, were therefore entered for orthogonal (Varimax) rotation and the matrix of rotated loadings was used to allocate items to appropriate scales. (This matrix appears as Appendix H.) The adequacy of the six scales formed in this way was tested by the use of scale analysis (Program TESTAT: Veldman, 1967, pp.170ff.) and these results are summarized in Table IV.1. Since the *alphas* for all six scales reached very satisfactory levels, a full account of each scale will be offered.

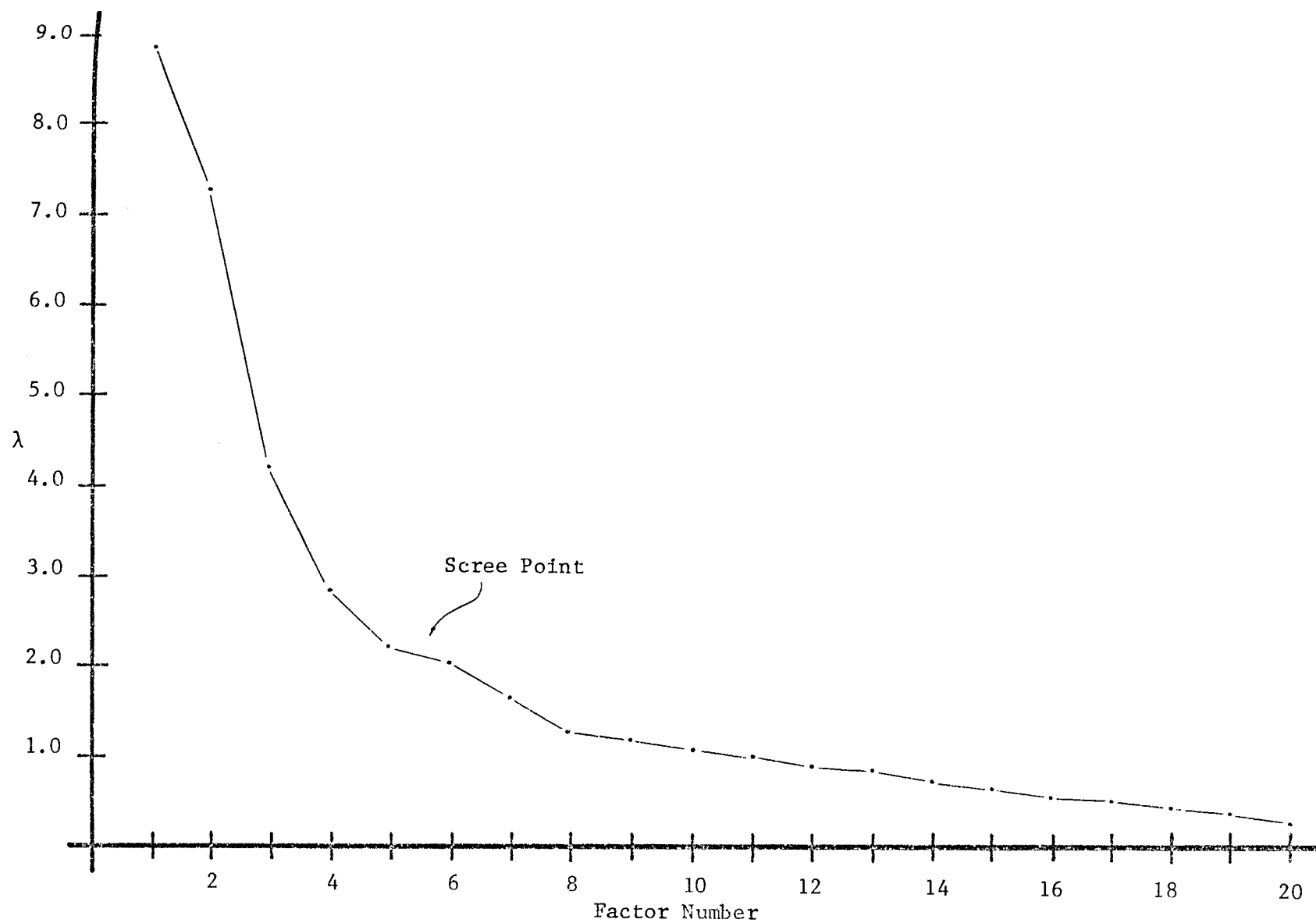


FIGURE IV.3: *Scree Slope Diagram for Personality Data - Final Version (1976)*

TABLE IV.3: Item Analysis Summary Statistics for Six Scales and 66 Items. (Sample N=95)^a

Scale No.	1	2	3	4	5	6
Item N	13	9	14	11	8	11
Means	41.61	31.78	40.05	34.22	25.03	29.77
Standard Deviations	9.59	7.36	11.02	7.28	7.29	9.24
Alphas	0.83	0.84	0.87	0.74	0.82	0.84

a. Item-Scale Correlations are included as Appendix I.

Scale 1 (Based on Rotated Factor I; 13.2% of total variance)

1. I hesitate to use my own ideas for fear they might be impractical. (Factor I loading, .68)
2. I would like to play around with certain ideas of my own even if they do not come to much. (-.67)
3. I prefer known ways of doing things rather than trying out new ones. (.66)
4. I frequently think of experiments or issues I would like to tackle. (-.53)
5. I prefer to know that something will really work before I take a chance on it. (.51)
6. I have several well-developed intellectual interests outside my studies. (-.48)
7. I think we treat criminals too harshly; we should try to cure, not punish them. (-.48)
8. I like to work on independent projects. (-.48)

9. I would rather pursue my own ideas than follow a syllabus. (-.44)
10. I enjoy art, sculpture, and architecture. (-.44)
11. I find it hard to address a large group. (.42)
12. I often learn more from studying along my own lines than by completing set assignments. (-.44)
13. I like teachers who stick to the syllabus and do not digress. (.34)

The items of Scale 1 were again drawn from several original scales relating to Rigidity, Autonomy, Masculinity-Femininity, Syllabus Bound, and Introversion-Extraversion. When compared with its counterpart in 1975 however, only five items were found to be common.¹⁵ The present scale is more clearly aligned with the Syllabus Bound-Syllabus Free dimension from which it has drawn 7 of its items. While the scale's cautious-adventurous character is very clearly maintained, its increased Syllabus Bound content suggests that the sense of cautious reserve for the present student sample was more closely tied to academic matters than to the broader issues of social and intellectual life.

15. Items 1, 3, 5, 6 and 11.

Scale 2 (Based on Rotated Factor II; 11.0% of total variance)

1. I like to keep my things neat and orderly on my desk. (Factor II loading, $-.69$)
2. I like my written work to be precise, neat and well organized. ($-.67$)
3. I like planning things carefully, well ahead of time. ($-.66$)
4. I like to plan and organize the details of work I have to do. ($-.64$)
5. I like to have a place for everything and everything in its place. ($-.61$)
6. I always see to it that my work is carefully planned and organized. ($-.58$)
7. I need to have things 'just so' in order to concentrate on my work. ($-.58$)
8. I don't like things to be uncertain and unpredictable. ($-.53$)
9. I don't like having to follow a set schedule. ($.36$)

The substantial correspondence between this scale and Scale 2 in the 1975 data (seven common items)¹⁶ serves to confirm Rigidity as a powerful and highly stable pattern of item endorsements. Once again there is only one item which was not drawn originally from a Rigidity scale, but in this case the exception (item 7), though

16. Items 1, 2, 3, 4, 5, 6, and 8.

initially constructed to tap Neuroticism, can be easily located within the Rigidity domain.

Scale 3 (Based on Rotated Factor III; 6.3% of total variance)

1. I have frequent ups and downs in moods, either with or without apparent cause. (Factor III loading, $-.72$)
2. I often get over-excited and rattled. ($-.62$)
3. I am a fairly high-strung person. ($-.62$)
4. I sometimes feel happy, sometimes depressed, without any apparent reason. ($-.59$)
5. I am usually calm and not easily upset. ($.58$)
6. Sometimes I let small things get on my nerves too much. ($-.58$)
7. I feel well adjusted to life and its demands almost all the time. ($.56$)
8. I sometimes feel 'just miserable' for no good reason at all. ($-.55$)
9. I am certainly lacking in self confidence. ($-.54$)
10. I am more sensitive than most people. ($-.52$)
11. I believe I am no more nervous than most people. ($.51$)
12. I take disappointments so keenly that I can't put them out of my mind. ($-.50$)
13. I become tense and upset when I think about my present concerns. ($-.48$)
14. I have very few headaches. ($-.41$)

The present Scale 3 has its counterpart in Scale 4 of the previous study. The correspondence between them is more real than apparent because while both scales represent classical Anxiety in seven shared items, Scale 3 has drawn six of its fourteen items from items added to reflect responses nearer the neurotic pole. As a unitary pattern of endorsements based on Anxiety, the present scale strongly confirms the previous results.¹⁷ It also corresponds with factor analytic solutions reported by Sherrill & Salisbury (1971) in which manifest anxiety and neuroticism were highly interrelated.

Scale 4 (Based on Rotated Factor IV; 4.2% of total variance)

1. On social occasions I prefer to stay quietly in the background. (Factor IV loading, .71)
2. I would hate to be where there wouldn't be a lot of people to talk to. (-.59)
3. I usually enjoy parties. (-.54)
4. I consider myself a very sociable, outgoing person. (-.53)
5. I enjoy being in a crowd just to be with people. (-.53)

17. New Items: 1, 4, 6, 7, 8, 14.

6. I avoid getting involved in social responsibilities and organizations. (.50)
7. I could happily live alone, far from everyone, like a hermit. (.42)
8. I am considered a very enthusiastic person. (-.38)
9. I would rather be at home on my own than go to a boring party. (.37)
10. I like playing cards for money. (-.30)
11. I don't like having to carry on small talk with people. (-.25)

Scale 4 re-confirms the existence, following the analysis of 1975 responses, of Introversion-Extraversion as a strong and evidently stable dimension. Its correspondence with Scale 3 in the previous study is evident, seven items being common to both.¹⁸ It should be noted, however, that the *alpha* level of 0.74 for the present scale was marginally lower than that for its 1975 version (0.78). It was the only case where a fall of this kind was recorded.

Scale 5 (Based on Rotated Factor V; 3.4% of total variance)

1. I think people should observe moral laws more strictly than they do. (Factor V loading, .81)
2. Men and women have the right to find out whether

18. Items 1, 2, 3, 4, 5, 7, and 9.

- they are sexually suited before marriage (*e.g.* by trial marriage). (-.59)
3. Only by going back to religion can civilization hope to survive. (.59)
 4. The laws against abortion should be abolished. (-.53)
 5. I favour the strict enforcement of all laws no matter what the consequence. (.51)
 6. I have always hated regulations. (-.47)
 7. Politically I am probably something of a radical. (-.42)
 8. Unquestioning obedience is a virtue. (.41)

With the sole exception of item 5, this scale replicated the items of Scale 6 in the first study, but with an increase in scale *alpha* (from .74 to .82). The items reflect a contrast involving somewhat rigid moral and religious conservatism at one pole and relatively permissive radicalism at the other. Their reappearance over successive samples in this homogeneous grouping served to strengthen the case for a Moral Conservatism *versus* Moral Radicalism dimension.

Scale 6 (Based on Rotated Factor VI; 3.2% of total variance)

1. I often find it hard to keep my mind on a task or job. (Factor VI loading, .78)
2. Outside interests often make me neglect my studies. (.66)

3. I often follow up my own ideas when I am supposed to be studying. (.62)
4. I tend to be erratic sometimes working well, sometimes badly. (.62)
5. I often find that I have made up my mind too late. (.54)
6. I have often felt listless and tired for no good reason. (.53)
7. Without the stimulus of exams I doubt whether I would do much effective studying. (.50)
8. I usually study only what I am required to study. (.48)
9. I often have a restless feeling that I want something but do not know what. (.45)
10. I shrink from facing a crisis or difficulty. (.44)
11. I would enjoy actual laboratory work more than textbook studies for a course. (.44)

The eleven items of Scale 6 were drawn from two main groups of items initially designed to measure Anxiety and Syllabus Bound responses. The order of their appearance here suggests that aspects of distractibility underlie this scale, contrasted with single mindedness in academic work. This scale has no readily identifiable counterpart in the pilot study, but its *alpha* level (.84) for the present sample is substantial.

The Comparison of Factor Patterns

Varimax rotated factor loadings for the 7-factor solution based on Pilot data were compared with the loadings on six factors for the Target sample using a matrix comparison technique (Program RELATE; Veldman, 1967, pp.238ff.). This program compares factor structures which have orthogonal reference axes by calculating a matrix of cosines among factor vectors for the two patterns. 'These cosines represent the relationships between the factors after the two sets of test vectors have been aligned for maximum contiguity' (*Ibid.*, p.239). Veldman further states that the diagonal elements of a second matrix of cosines between all pairs of test vectors may be inspected as an index of item constancy across the two analyses. In both these matrices the cosines may be interpreted as correlations.

For the studies presently under consideration there were 56 common items. The Varimax loadings for all 56 variables on the seven Pilot study factors were entered into the RELATE program as matrix A, and loadings for the six Target study factors were entered as matrix B. Cosines among the factor axes are displayed in Table IV.4, and indices of inter-item correlation appear as Table IV.5

TABLE IV.4: Matrix Comparison Cosines among Factor
Axes - A (1975) x B (1976)

		B					
		1	2	3	4	5	6
	1	-.733	.212	-.044	-.318	-.014	-.504
	2	.141	.959	-.080	.007	-.123	.194
	3	.102	-.040	.058	-.888	.081	.196
A	4	.007	.094	.939	.045	-.048	-.095
	5	-.071	.142	.014	.152	.949	-.069
	6	.615	.062	-.078	-.119	.007	-.773
	7	-.224	.022	-.069	.266	.275	-.243

In the absence of recognized tests of significance for the data of Tables IV.4 and IV.5, three descriptive points will be made. First, the mixture of values appearing in column B1 of Table IV.4 indicates a relative failure to replicate Factor I over the two samples. Second, the same judgment may be entered, *mutatis mutandis*, with reference to column B6. And third, items which registered low values in Table IV.5 may be used as a guide to the principal differences between response patterns for subjects in the two studies.

TABLE IV.5: Inter-item Correlation Indices for
56 Paired Items

1. .901	15. .955	29. .873	43. .900
2. .877	16. .912	30. .461	44. -.812
3. .911	17. .867	31. .871	45. .908
4. .697	18. .550	32. .935	46. .889
5. .803	19. .912	33. .778	47. .885
6. .697	20. .719	34. .923	48. .884
7. .799	21. .979	35. .934	49. .863
8. .250	22. .765	36. .760	50. .940
9. .977	23. .854	37. .911	51. .878
10. .825	24. .915	38. .707	52. .958
11. .933	25. .823	39. .759	53. .827
12. .864	26. .630	40. .922	54. .933
13. .878	27. .921	41. .929	55. .944
14. .808	28. .974	42. .963	56. .911

DISCUSSION

Two estimates of the extent to which the second study replicated the results of the first study have been found to offer substantial confirmatory evidence for cross-sample stability in four personality dimensions. The first estimate was based on a direct comparative inspection of scales which were constructed by allocating inventory items according to the absolute

sizes of their rotated factor loadings. When judged in terms of the number of items common to appropriate scale pairs, a strong case emerged to support Rigidity Complexity (Scale 2 - Pilot; Scale 2 - Target) as a replicated dimension with seven shared items from a total of nine. Similarly, though with the important qualification that six entirely new items were involved, Anxiety/Neuroticism Stability was clearly replicated across seven of a possible eight shared items (Scale 4, Pilot; Scale 3, Target). And a Radicalism-Conservatism dimension also drew upon seven items of a possible eight that were common to both Scale 6 (Pilot)¹⁹ and Scale 5 (Target). Finally, an evident Introversion-Extraversion scale replication appeared (Scale 3, Pilot; Scale 4, Target) which again involved seven shared items, but from a larger total of eleven.

No other paired scales demonstrated these levels of inter-item correspondence, though it was possible to discern limited parallels involving Scale 1 in each case. Scales 6 (Pilot and Target) and 7 (Pilot only) exhibited still more limited correspondences and could not be defended as replicated dimensions.

The second estimate of cross-sample stability took the form of statistical indices of the intercorrelations among all pairs of elements in the two rotated

19. Scale 6, 1975, was based on rotated Factor V.

factor patterns. These indices were supported by inter-item correlations, both sets of correlations being necessarily restricted to the 56 inventory items which were common to the two samples. These correlations lent additional and very considerable support to the conclusions based on a comparative inspection of scales. For three of the factors, substantial correlations were recorded (Rigidity, .959; Anxiety, .989; Conservatism, .949), and the fourth (Introversion, -.888) fell only marginally short of the level reached by this group. For the remaining comparisons involving Factors I, VI and VII (Pilot) and Factors I and VI (Target) the associated tests of relationship yielded markedly lower indices which were entirely consistent with the outcome of prior scale comparisons.

The general conclusion which appears to be altogether justified by these results is that cross-sample stability has been amply demonstrated in the case of four personality dimensions based on data from successive undergraduate student intakes. These dimensions may be labelled Rigidity-Complexity, Anxiety-Stability, Introversion-Extraversion, and Conservatism-Radicalism. Furthermore, this demonstration of stability itself rested on the prior selection of personality inventory items intended to reflect constructs in the personality domain that were well founded theoretically.

In terms of the present study's focus on Anxiety and Introversion there is strong evidence in these results to encourage their use in systematic relationships with achievement. Not only have they emerged as theoretically cohesive and well-founded dimensions based on the responses of an undergraduate student sample, but their manifest stability over two consecutive samples gives them added generalizability. So far as the Syllabus Bound dimension is concerned, however, such definite conclusions are harder to defend. While no common SYLB-SYLF factor emerged from the analyses, a substantively related Rigidity dimension proved both salient and highly stable. And the concurrent appearance of an equally salient and stable Conservatism dimension which bears in part on the SYLB-SYLF construct must also be taken into account. This aspect of the results, rather than serving to deprecate the SYLB-SYLF construct, would appear to recommend either that its relationship with achievement be explored less directly through Rigidity, or that the measures employed here cannot be regarded as appropriate where SYLB-SYLF reactions are at issue. It would thus be necessary to use specifically designed tests such as those developed by Biggs (1973) or Brown & Holtzman (1966) and to acknowledge the shortcomings of items chosen for the present study on the basis of the work reported by Parlett (in Hudson, 1970).

In the light of these findings it was concluded that the specific research hypotheses under investigation at this point had been supported. The personality constructs of Anxiety-Stability and Introversion-Extraversion had been shown to be stable factor-based entities which satisfied the conventional requirements for use as scales.

Research Procedure for Level I Hypothesis - the Study Behaviour Domain

Following a review of the Syllabus Bound-Syllabus Free dimension the principal conclusion reached in Chapter II was that its trait qualities had not been clearly established. While its components were largely coextensive with personality attributes, its role as an index of academic achievement was considered more appropriately explored in terms of its moderating effects within an interactive system. Scale items from relevant SYLB-SYLF inventories were nonetheless used in explorations of the Personality domain to ensure its adequate recognition in the present study. But the results which emerged following investigations in the Pilot study offered only modest support for a SYLB-SYLF factor, and this, in conjunction with the existing uncertainties based on the review of research, offered sufficient grounds to set it aside in favour of a specifically constructed study behaviour instrument.

For an Australian undergraduate sample the Study Behaviour Questionnaire (SBQ) as developed and modified

by Biggs (1970a; 1970b; 1973) represented the most natural choice. This instrument, which emerged from research carried out in Australia and Canada, was peculiarly suited to the present study's needs first because it had been conceived within the same general framework of personality theory and second because in four of the ten scales which it contained, a specifically strategic orientation had been adopted in close correspondence with the interpretation discussed in Chapter II. Additionally, two of the four study strategy scales were of direct interest here since they appeared to tap essential aspects of the SYLB-SYLF dimension.

The hypothesis under investigation at this point was relatively open ended to allow the selection of that SBQ Scale which best satisfied two sets of conditions. In the first place it was essential that one of the four strategic scales should be used, preferably drawn from those having a defensible SYLB-SYLF character (*viz.* Scales 5 and 7). And secondly, since the instrument had been introduced into the present study largely on account of the weak Pilot Study support for a SYLB-SYLF personality dimension, much depended on the outcome of factor and scale analysis for one sample only; it was desirable therefore to pursue only that scale which was well supported in these terms and for which a substantial

correspondence existed with work reported for other samples. As set out in Chapter III, the hypothesis being studied was that responses on the Study Behaviour Questionnaire exhibit metric scale properties on a SYLB-SYLF construct.

METHOD

The Sample The subjects were 72 students enrolled in the first year Child and Adolescent Development course at the James Cook University. They were volunteers from the larger group of 95 subjects who had provided personality data for the target sample.

Instrument Form J of the Study Behaviour Questionnaire (Biggs, 1975) was used without alteration. This inventory consists of ten factor-based scales employing a total of 80 Likert-type items cast as first person descriptive statements. For each item, respondents were asked to say how true the statement was of their own approach to study by marking a five point scale; '1' was defined as never or very rarely true, and '5' as always or almost always true. (A copy of the complete questionnaire appears as Appendix J.) Biggs (1973) has described each of the ten scales briefly as follows:

Scale 1: *Academic Aspiration* ($\alpha = .75$; 10 items)

Pragmatic, grade-oriented, university as means.

Scale 2: *Academic Interest* ($\alpha = .73$; 10 items)

Intrinsically motivated, study as end.

Scale 3: *Academic Neuroticism* ($\alpha = .64$; 7 items)

Confused, overwhelmed by demands of course work.

Scale 4: *Internality* ($\alpha = .55$; 8 items)

Sees 'truth' coming from within, not external authority.

Scale 5: *Study Skills & Organization* ($\alpha = .58$; 8 items)

Works consistently, reviews regularly schedules work.

Scale 6: *Fact-rote Strategy* ($\alpha = .59$, 8 items)

Centres on facts, details, rote learns.

Scale 7: *Dependence* ($\alpha = .47$; 6 items)

Rarely questions instructors, texts; needs support.

Scale 8: *Meaning Assimilation* ($\alpha = .79$; 8 items)

Reads widely, relates to known, meaning oriented)

Scale 9: *Test Anxiety* ($\alpha = .79$; 6 items)

Very concerned about tests, exams, fear of failure)

Scale 10: *Openness* ($\alpha = .44$; 9 items)

University place where values are questioned.

The four scales having a special bearing on the present research were Scales 5, 6, 8 and 7, in approximate order of predicted relevance. Scale 5 was clearly the most pertinent being made up of eight items designed to reflect organized study patterns of a thoroughly conscientious kind that were tied closely to the contents of lectures and required reading.

This scale corresponded substantially with the view expressed in Chapter II that aspects of Rigidity in organizational strategies were likely to be affiliated with a syllabus bound stance. The items in the order administered were:

1. I try to do all of my assignments as soon as they are assigned.
2. I try to work consistently throughout the term and review regularly when exams are close.
3. After a lecture or lesson I re-read my notes to make sure they are legible and that I understand them.
4. I keep neat, carefully arranged notes.
5. I try to keep up with all of the suggested readings that go with the lecture.
6. I summarize suggested readings and include these as part of my notes on a topic.
7. When a test is returned, I go over it carefully correcting all errors and trying to understand why I made the original mistakes.
8. I keep reviewing important topics until I understand them completely.

Scale 6 also comprised eight items, but its focus was on Rigidity as expressed in memorizing and factual drill. The items were:

1. I think most people can actually learn better when they are given the facts about a topic instead of having to figure them out by themselves.
2. I learn some things by rote, going over and over them until I know them by heart.
3. I prefer subjects with a lot of factual content to more theoretical kinds of subjects.
4. I prefer to learn the facts and details about a topic rather than a theoretical understanding of it.
5. I make a point of studying set readings in detail rather than attempting to cover both required and optional readings.
6. I find that the best lecturers work from carefully prepared notes and outline major points neatly on the blackboard.
7. I prefer a text which lays things out carefully in point form and contains frequent tables and summaries, to one which is written almost entirely in paragraph form.
8. I find that most class discussions are a waste of time because they usually refer to opinions rather than to hard facts.

While both Scales 5 and 6 reflect aspects of Rigidity, its expression in terms of rote memorization in Scale 6 is less appropriate as a study strategy in undergraduate work than the systematic organizational approach depicted in Scale 5.²⁰ A fact-rote scale would certainly be less useful in the moderating role envisaged here than the procedures embodied in Scale 5. But the prospect that response patterns for the target sample would identify Scale 6 as the best strategic expression of Rigidity were sufficient to justify its close inspection at this stage.

The third scale regarded as pertinent to a Rigidity-Syllabus Bound-Syllabus Free orientation was Scale 8 which again contained eight items. This scale reflected study procedures of a Syllabus Free and Complex type; high scorers would be those students who actively tried to integrate their studies and to grasp new material at a level of meaning beyond factual recall. The items of this scale were:

1. I try to relate new material, as I am reading it, to previously learned material.
2. I try to relate what I have learned in one subject to that in another.

20. Biggs (1973) reported Scale 6 to be more associated with High School than with University performance.

3. In reading new material I often find that I'm continually reminded of material I already know and see the latter in a new light.
4. When I am reading fresh material, I try to think of what I already know that is related to it and frame questions on this basis that the new material may answer.
5. When I approach a new piece of reading material, I try to note both the basic factual knowledge it contains and the general theoretical points: I rote learn the former and think about and chew over the latter until both parts complement each other, and the whole hangs together.
6. While I am studying, I often think of real life situations in which the material that I am learning would be handy, and useful to know.
7. I try to understand what a lecturer is saying about a new topic rather than taking down all of the details for later study.
8. When a lecturer makes a point which I don't understand, I try to question him until I can grasp what he is saying.

The fourth and last scale of immediate concern for the present study was Scale 7. The six items of this scale reflect a dependent student orientation that accepts text books and lecturers unquestioningly and is troubled by any disagreement among the received sources of information. This scale thus taps a kind of Syllabus Bound Rigidity related to Dependency. The items were:

1. If I like a lecturer, it is easier to learn from him even if his actual teaching isn't all that good.
2. I am very aware that lecturers and textbook writers know a lot more than I do and so I rely on their judgment rather than my own.
3. I take seriously anything that I have been lectured about, or that is in my textbooks, so that I would change my interpretations only on the strongest evidence.
4. I would question the statements and and ideas of my lecturers only under special circumstances.
5. I prefer to accept what my lecturers say even though it sometimes means that I have to change my own ideas.

6. I prefer texts which present a unified point of view and are written by an authority instead of a collection of articles by various authors on a topic.

Procedure The SQB (Form J) was administered to students during the first three weeks of the final (Michaelmas) term of the teaching year. The conditions under which students completed the inventory varied because its return was set for the end of the third week, thereby allowing students to work on it in their own time. In all other respects such as voluntary participation, confidentiality, and the availability of results, the procedure was identical to that used for the Personality domain.

Analysis of Data The most straightforward approach to SBQ data in this study would have been to test the established scales for reliability and select that scale from the set already identified (Scales 5, 6, 8, 7) which proved strongest. Although this was the main strategy used, an additional analytic check was applied by way of a forced factor analysis of the SBQ data, even though the sample size was too small to yield reliable information. This was in keeping with the other aspects of the study and offered additional evidence on which to base an informed selection of that SBQ scale which was more likely to be factorially homogeneous. The original development of SBQ scales

was based on an oblique multiple group method of factor analysis (Biggs, 1973) not available for the present analysis. A common factor solution was used instead followed by orthogonal rotation. While this approach differed from that used by Biggs it was considered sufficient merely as a checking device to assist in identifying the best scale of the four which had been pre-selected for further work.

RESULTS

A factor analysis of the SBQ data was carried out using BMD08M (Dixon, 1970) to construct a forced ten-factor solution accounting for 48.5% of total variance. Comparative scale $\times$ factor data are displayed in Table IV.6 with specific reference to the four SBQ scales of direct interest. Scale-factor correspondence was registered for six of the eight items in Scale 6 and this considerably exceeded the correspondence level for any other case.

Essential scale analysis data for Target sample respondents appear as Table IV.7. Levels of *alpha* reported by Biggs from the original study are given in parentheses. In compiling this table, items were assigned to the original scales as defined by Biggs (1973)²¹. While the small sample size employed for

21. Additional scale details were supplied in a private communication.

TABLE IV.6: Study Behaviour Questionnaire Data for Items by Original Scale and Subsequent Orthogonal Factor Analysis (N = 72)

Original Scale							
5		6		7		8	
Item (Factor)		Item (Factor)		Item (Factor)		Item (Factor)	
5 (2)		6 ^a		25 (2)		7 (3)	
14 (2)		15 (4)		33 (1)		16 (1)	
23 (2)		24 (4)		41 (4)		26 (5)	
31 (2)		32 (1)		47 (1)		34 (7)	
39 (2)		40 (4)		61 (1)		42 (6)	
46 (1)		60 (1)		69 (4)		48 (3)	
59 (2)		68 ^a				53 (3)	
67 (4)		76 (6)				80 (8)	

a. No clear factor allocation

Table IV.7: Item Analysis Summary Statistics for Four SBQ Scales (Sample N = 72)^b

Scale No.	5	6	7	8
Item N	8	8	6	8
Means	22.75	25.26	18.83	26.81
Standard Deviations	5.68	4.91	3.72	4.02
Alphas	.745	.634	.531	.548
	(.58)	(.59)	(.47)	(.79)

b. See Appendix K for the complete table.

the tabled data demand considerable caution, the more robust levels in the present study are worthy of note. In particular, the *alpha* value reported for Scale 5 was higher than any other, including the original set, and proved to be the highest of all ten scales used with the Target sample.

DISCUSSION

The Study Behaviour Questionnaire's value for the present research was tested first in terms of the substance of particular scales as adequate indices of a Rigidity-Complexity/Syllabus Bound-Syllabus Free construct. Of four scales regarded as pertinent to the study's needs Scale 5, Organizational Study Skills, best satisfied the requirements but Scales 6, 8 and 7, in that order, were also considered. The second test used was a direct analysis of the statistical properties of the four SBQ Scales in terms of the Target sample; the results provided considerable support for Scale 5 as a relatively homogeneous and adequately reliable index. Although none of the four scales considered registered an *alpha* value below .50, SBQ Scale 5 was the only case in which the more desirable level of .80 was approximated (Green, *et al.*, 1977). Taken in conjunction with the support which this scale enjoyed in an exploratory, if imperfect, factor analysis when six of its eight items were located within the same nine-item factor, the scale analysis

data offered still further support for the use of Scale 5 in the study's second phase.

On the basis of these results it was concluded that the prerequisite conditions for an adequate scale in the Study Behaviour domain had been satisfied by the evidence available for SBQ Scale 5. This scale was therefore used as the relevant strategic component for ATI analyses in association with the previously established Anxiety and Introversion factor-based scales.

Research Procedures for Level I Hypothesis - the Performance Domain

Performance tasks used in the study were integral components in the undergraduate programme of work required of students reading Education 111. The complete assessment schedule was distributed to all students during an introductory lecture session in conjunction with notes for guidance concerning basic policy and organizational details of importance for the preparation of assignments (A copy of the assessment schedule used with the Target sample is included as Appendix L.) In this aspect of the research, every effort was made to ensure that Departmental administrative conventions were followed so as to preserve the naturalistic character of the investigation.

Three of the four assessment tasks were submitted in the form of written assignments; these were the Essay, the Analytic Report, and the Child Study. Each

student's work was examined either by the present author (who was in charge of the course) or the full-time tutor appointed to assist in the tutorial programme. For the Analytic Report and Child Study tasks, assignments were allocated to one or other of these examiners in simple alphabetical fashion, but according to an alternating plan so that no student was examined by the same person twice. For the Essay, students' papers were first grouped by topic and allocated to whichever examiner was best read in the area.

For each exercise, task check-lists of expectations were employed following consultation between the examiners, and regular cross-reference marking was carried out on one assignment in every seven to maintain comparability. All written assignments were returned to students within three weeks of the submission dates and students were encouraged to discuss their marked work with the examiners.

Similar procedures were adopted in the tutorial programme. Tutorial sessions were supervised on a rotating principle which ensured that the assessment of tutorial performance for each group of students was shared by the two examiners. In this way, each student's progress was monitored from week to week and reports were made available for student guidance at four points in the course: after an initial period

covering three tutorial sessions when assessment was not counted, and at the end of each term's work. However, students were strongly advised to consult the tutors at any time if a need arose, and this effectively transformed the tutorial component into a fully continuous assessment schedule.

This approach to the detailed guidance offered to students by way of performance feedback was augmented for a small number of cases for whom tutorial participation was a new or difficult task. Individual (one-to-one) sessions were provided for these students to develop basic discussion skills and to help overcome their diffidence in the tutorial setting. But the evaluation of tutorial work was always confined to the scheduled group sessions. A total of seventeen students took advantage of this additional assistance at various times during the course. In all these respects the procedures adopted for the Target study were identical to those of the Pilot study.

The complete number of cases used in the final analysis of performance tasks excluded five students who were repeating Education 111 from previous years, and included all others for whom data were available. The sample thus represented all those students who were reading the course for the first time, including four students from Faculties other than Education who were in the second year of their degree programme,

and one student who was a Science graduate. Because the numbers available for the study were small, it was decided to retain these cases even though they were not first year students in the strict sense. The study was not, therefore, a study of first year performance, but a study of performance in a first year course.

The Independence of Performance Tasks

As was pointed out in the introduction to the present chapter, the preliminary analysis of variables in the Performance domain must necessarily be limited to essential non-redundant checks designed to establish their usefulness. The inquiry that was undertaken at this point was meant to determine whether and to what extent the four assignments were distinguishable as performance tasks. An important aspect in developing the research hypothesis for the Performance domain was the formulation of a case to defend the potential independence of the four assigned tasks in terms of their substance and character. But an examination of the infraskills associated with each assignment indicated that although the underlying competencies in each case differed in important respects, there was likely to be some degree of overlap. While it was methodologically desirable that each of the four performance variables should be independent with respect to the other three, no prior assumptions could be made that this would occur. At the same time, since the

four components under discussion were single scores based on assignment grading, it was not possible to apply statistical measures of internal consistency using *alpha* or split-half reliability indices. In these circumstances the most straightforward test of independence was the matrix of zero-order correlation coefficients. Accordingly, data for student performance on comparable tasks over four years were inspected (see Tables IV.8-IV.11). It was clear from the tabled

TABLE IV.8: Correlations among Performance Tasks - 1973
(N = 117)

	2	3	4
1. Essay	.249*	.101	.317**
2. Analytic Report		.218*	.346**
3. Child Study			.138
4. Tutorial Participation			

* $p < .05$

** $p < .01$

TABLE IV.9: Correlations among Performance Tasks -
1974; (N = 114)

	2	3	4
1. Essay	.142	.310*	.050
2. Analytic Report		.173	.069
3. Child Study			.005
4. Tutorial Participations			

* $p < .01$

data that correlations for 1973, 1974, and the Target sample in 1976 offered strong *prima facie* evidence supporting the view that performance tasks such as those used here could be distinguished in terms of

TABLE IV.10: Correlations among Performance Tasks - 1975; (N = 121)

	2	3	4
1. Essay	.951*	.912*	.775*
2. Analytic Report		.920*	.757*
3. Child Study			.784*
4. Tutorial Participation			

* $p < .01$

TABLE IV.11: Correlations among Performance Tasks - 1976; (N = 85) (a)

	2	3	4
1. Essay	.098	.217*	.098
2. Analytic Report		.121	.108
3. Child Study			.055
4. Tutorial Participation			

(a) The options available to this sample led many students to omit one of the assignments; this table refers only to those who submitted all assignments for the year.

* $p < .05$

their zero-order intercorrelations. For the data in Tables IV.8, IV.9, and IV.11, the mean Pearson r overall was .16, and in no table did the mean level exceed .23. While there were individual values which reached a 1% level of statistical significance, the proportion of shared variance was never greater than 15%. It might be argued that of the 85% variance remaining to be accounted for, general intelligence could be expected to remove all but 35%, and the 15% already accounted for in performance data would thus be regarded as substantial. But the population under consideration, being first-year University undergraduates, was already extensively restricted on general intelligence. It was reasonable to suppose therefore that a measure of intelligence would account for a rather smaller proportion of common variance than is typically reported for performance scores in elementary and secondary schools. (See Appendix M.)

At the same time it was no less clear that the intercorrelations reported for 1975 in Table IV.10 stand in dramatic contrast to those in the other tables. Furthermore the differences are so consistent and of such a magnitude that they could only be explained by some factor of very considerable importance and of direct relevance to student performance in that year. A close re-inspection was made of procedures adopted in 1975 to discover whether the assessment programme had

been changed in any substantial ways, or whether course content and staffing might have influenced the data, or whether some striking change had taken place in the student body. All these possibilities were dismissed since no variations were evident in each case that might conceivably have accounted for the differences; and in the case of student personality, research had made it abundantly clear that students in 1975 and 1976 were very much alike.

Only one aspect of course management was identified as sufficiently immediate and prepotent so far as student performance was concerned to have isolated the 1975 data in this way. In that year, but in no other year for which data were available, the course was taught wholly within the first semester. Although it is far from self-evident that this particular change was responsible for the tabled data, it remained the sole variation of consequence which distinguished 1975 from all other years. Thus it could be imagined that the increased pace and compression of course work might have been a limiting factor, exacerbated perhaps by the fact that students were in the first few months of their first year, and were reading a course which the great majority would have found new.

A counter argument may be advanced, based on random error, invalidities of assessment, and unreliabilities among examiners. This would suggest that the

data for Table IV.10 were probably correct and that explanations should be sought for the abnormally low intercorrelations reported elsewhere. This argument must be taken very seriously, though it remains moot how far it should be favoured. If it is found that theoretically defensible and consistent relationships emerge involving aspects of performance and other student behaviours, a basis will then exist for this choice.

There was an additional problem of underlying method associated with the use of zero-order correlation coefficients. It was that tables are available to test the significance of a correlation against zero and thus to indicate when two scores covary similarly, but no comparable test is available to determine whether a correlation coefficient is significantly close to zero. And it would be a misuse of the existing table (and a misapplication of logic) to argue that a correlation coefficient which fails to reach significance at some pre-set level must be an index of significant dissimilarity. In short, a non-significant difference cannot be presumed to be a significant non-difference.

This same difficulty would also be encountered in using t or z tests as discussed by Levy (1977), since the formulae he has explored yield observed statistics specifically constructed to test

$$H_0 : \rho = \rho_0$$

against the alternative

$$H_1 : \rho \neq \rho_0.$$

The reasoning in this case is directed towards the question whether or not the population correlation between two variables equals zero. But the t and z tests described are actually concerned with significant *departure* from zero.

Three possible courses of action could have been pursued as partial solutions in these circumstances. The first was to make use of r^2 as a measure of common variance and to declare an arbitrary upper limit as some fraction, *e.g.* 15%, beyond which those variables involved in such a relationship would be dropped. The second and third would impose independence on the members of the dependent variable set by statistical manipulation. This could be achieved by factoring the DV correlation matrix to satisfy a Varimax solution, then employing the resultant orthogonal factor scores as the new dependent variables. But since the separate identity of the elements in the DV set would have suffered in this process an alternative method for imposing statistical independence was preferred. As described by Cohen & Cohen (1975, pp.440f.) this method is appropriate where

interest extends only to the unique aspects of each of a group of p dependent variables, and therefore not to any variance they may share ...

A new set (Y_r) of dependent variables may be formed being the regressed residuals of each variable with respect to the remaining $p-1$ variables.

Applying this procedure to the present study with $p = 4$, the DV set was defined as follows:

$$Y_{r_1} = y_1 \cdot y_2 y_3 y_4,$$

$$Y_{r_2} = y_2 \cdot y_1 y_3 y_4,$$

$$Y_{r_3} = y_3 \cdot y_1 y_2 y_4,$$

$$Y_{r_4} = y_4 \cdot y_1 y_2 y_3,$$

where:

$$y_1 = \text{Essay}$$

$$y_2 = \text{Analytic Report}$$

$$y_3 = \text{Child Study}$$

$$y_4 = \text{Tutorial Participation.}$$

By means of this approach the general requirement of independence was met, though it was recognized that the naturalistic quality of the DV set was lost in proportion to the size of the multiple correlations involved. In the light of relatively low zero order correlations reported above, and the modest (but significant) multiple correlations associated with them (see Table IV.12), the approach recommended by Cohen & Cohen was pursued.

TABLE IV.12: Multiple Correlations for Each
Dependent Variable in Terms of
its Fellows. (N = 120)

Variable	Mult. R	R^2	p
1. Essay	.344	.12	<.01
2. Analytic Report	.282	.08	<.05
3. Child Study	.298	.09	<.05
4. Tutorial Participation	.226	.05	NS

It was also recognized that the use of residualized values in this way to ensure independence among the variables constituted a resolution by statistical fiat of one major aspect of the DV set which would otherwise have been examined as a research hypothesis.

Regressed residual scores were computed for each subject on each dependent variable using BMD program 03R (Dixon, 1970). The data entered for these calculations were standardized performance scores for all students who had completed the four tasks even though a number had not provided Personality and Study Behaviour data. This ensured that the multiple regression estimates actually used were the most stable that could have been derived in the circumstances. The regression equations derived from these computations are displayed in Table IV.13.

TABLE IV.13: Regression Equations for Each Dependent Variable in Terms of its Fellows ^a

$$\hat{Y}_{X_1} = .200X_2 + .272X_3 + .067X_4 + 6.701$$

$$\hat{Y}_{X_2} = .166X_1 + .106X_3 + .073X_4 + 10.512$$

$$\hat{Y}_{X_3} = .189X_1 + .089X_2 + .043X_4 + 13.280$$

$$\hat{Y}_{X_4} = .176X_1 + .220X_2 + .162X_3 + .784$$

- a. X_1 : Essay;
 X_2 : Analytic Report;
 X_3 : Child Study;
 X_4 : Tutorial Participation

It will be evident that the impact of these procedures was effectively to reduce the status of Hypothesis I(c) to that of a pseudo-hypothesis since the independence requirement was satisfied by way of statistical manipulation. Furthermore, by using standardized scores for each performance variable an attempt was made to fulfil the metric scale requirements at interval level. This aspect of the data was checked by inspecting the relevant skewness and kurtosis indices as reported in Table IV.14. It was concluded that, when considered together with regression details, these results provided adequate grounds for the use of performance scores in the present study and for

their acceptance as orthogonal estimates of achievement with metric scale properties. But it was also acknowledged that the procedures adopted rendered this an essentially pseudo-hypothesis.

TABLE IV.14: Performance Data Distributional Indices^a

	Skewness	Kurtosis
Essay	-2.07	0.26
Analytic Report	-3.26	0.84
Child Study	-3.05	3.88
Tutorial Participation	1.49	-1.22

a. Standardized estimates of skewness and kurtosis based on Veldman (1967, pp.182f.)

Summary

The aim of this phase of the present study was to establish the bases on which the Second Phase could be developed. The interactive patterns of interest linking three domains of behaviour were unlikely to emerge in any compelling way in the absence of clear evidence that their components were distinguishable entities. sufficient in their own right to serve the needs of further inquiry. In the Personality domain, both Anxiety-Stability and Introversion-Extraversion were examined within the broader context of achievement-related personality dimensions, and both were accepted

as stable and appropriately salient constructs. In the Study Behaviour domain, Biggs's Study Behaviour inventory provided a comparable setting for the identification of a suitable scale reflecting organizational skills. And *ex post facto* statistical controls were employed to impose independence on the Performance domain scores. These measures were considered adequate to satisfy the terms set out in Hypotheses I(a)1, I(a)2, I(b), and I(c), and thus to provide a foundation for the execution of work planned at the Second Phase to explore hypothesized interactive relationships.

CHAPTER V
RESEARCH DESIGN - SECOND PHASE

Research Procedure, Levels II - IV

The First Phase identification of relevant variables in the Personality, Study Behaviour, and Performance domains provided the necessary basis for analyses at the Second Phase. Research at this point was concerned directly with the question of interaction within the broadly conceived ATI framework described in Chapter II. As set out in the sequence of research hypotheses, the study of interactions was articulated across three levels. At Level II the postulated relationships embraced performance scores as continuous variables, at Level III the analysis was directed towards a comparable end but employing group membership codes in global terms, and at Level IV the analysis of interactive relationships was planned on a group-by-group basis. Throughout the Second Phase a common sample, instrumentation and procedure were used. Following an account of these aspects, methods of data analysis and the null hypotheses for this Phase will be set out.

The Sample The subjects used in the Second Phase of the study were 64 undergraduate students reading the first year Child and Adolescent Development course (ED111) at the James Cook University. These 64 cases represented all students from the Target study who had complete data in the Personality, Study Behaviour, and Performance domains. There were 24 males and 40 females.

Instruments In the Personality domain the final form of the inventory described in Chapter IV was used. It comprised six factor-based scales employing a total of 66 items having a mean scale *alpha* of .82. The two Personality scales of specific interest for each level of the Second Phase were Scale 3 measuring Anxiety-Stability (14 items, *alpha* .87) and Scale 4 measuring Introversion-Extraversion (11 items, *alpha* .74). Both scales were considered to have met criteria of theoretical and statistical adequacy, being unitary and factorially homogeneous measures of widely established personality dimensions.

In the Study Behaviour domain Scale 5, Organizational Study Skills, from Biggs's (1975) Study Behaviour Questionnaire (Form J) was used. This scale comprised eight items (*alpha* .75) and had affinities with aspects of the Personality domain which recommended it for the needs of the present study. The entire inventory was made up of 80 items forming ten scales with a mean scale *alpha* of .62.

Performance domain instruments were taken directly from the assessment requirements for the ED111 course. They were presumed to represent more or less distinctive measures of task characteristics and thus to reflect relatively independent sources of performance variance. The four measures that were employed were an Essay, Analytic Report, Child Study, and Tutorial participation,

each having been found to satisfy general requirements of independence at the zero-order correlational level over several years and with approximately equivalent samples.

Procedure As set out in Chapter IV, all data for the three domains were gathered from the target sample of students reading the Child and Adolescent Development course in 1976. Personality, and Study Behaviour inventories were distributed to students for completion entirely on a voluntary basis and with an option for anonymity, but the performance data were taken directly from student records. Final sample numbers were thus constrained by the need for complete data in three somewhat disparate areas, and this was reflected in the small total of 64 cases.

Analyses of Data Of their very nature, ATI studies invite the use of a variety of multivariate research procedures. In the study by Biggs (1973) for instance, both R and Q factoring techniques were employed in an ATI design, and Sundqvist's (1973) work in Sweden made use of the Automatic Interaction Detector computer program developed by Andersen, *et al.* (1971); Everett (1971) adopted a grouping technique based on a discrepancy function to generate hierarchical dendritic structures in his search for a student typology based on subsets of reference variables.

The present study's requirements at Levels II, III and IV called for three types of regression analysis.

Initially the presence of interactions was tested by the use of multiple linear regression after the approach recommended by Kerlinger & Pedhazur (1973, pp.258ff.). They describe a branching decision strategy in the analysis of data under an ATI model beginning with a test based on the coefficient of determination for the full set of main effects plus interaction to determine whether the variance accounted for is an adequate basis for further inquiry.

Whether R^2 is significant or not, if
 . . . its magnitude has little substantive meaning, there is no point in going further.

(Kerlinger & Pedhazur, 1973, p.259)

If the R^2 is meaningful the interaction may then be tested by the use of Cohen's incremental F test (Cohen, 1968). A significant F value for the step-down difference between coefficients of determination with and without the interaction term means that separate regression equations should be calculated to account for the interaction. The appropriate device at this point would be the Johnson-Neyman analytic technique first discussed over forty years ago by Johnson & Neyman (1936) and subsequently developed more fully by Johnson & Hoyt (1940), Johnson & Fey (1950), Abelson (1953), and Potthoff (1964). This procedure represents an extension of the analysis of covariance by estimating the magnitude of differences between adjusted means. It defines regions of significance which circumscribe

those sub-populations, in terms of the control variables, for which the conclusion of significant difference in mean performance may be held (Johnson & Fey, 1950). In operational terms, the null hypothesis will continue to be refuted for all samples whose mean values on the control variables fall within the region of significance. The Johnson-Neyman techniques is thus of special value when ATI effects are being studied because of its greater sensitivity to the specifically interactive components of the system.

In the event that Cohen's incremental F test were to yield a non-significant value, tests are then required to determine the significance levels associated with a common regression weight and the intercept for the groups. As set out in Figure IV.2, the strategy adopted in the present study called for group discrimination techniques at this point. This was based on Huberty's (1975) review in which two pertinent aspects of discriminant analysis were pointed up; first, its sensitivity to the contribution of individual variables to group separation, designated *discrimination* by Huberty; and second, its associated capacity to generate estimates of inter-population distances and of the degree of relationship between response variables and group membership, designated *estimation* by Huberty. Whether or not overall group differences prove to be significant, discriminant analysis thus provides the

essential statistics for the representation of inter-group distances in terms of group centroids and at the same time yields data for the characterization of inter- and intra-group qualities *via* Linear Discriminant Function (LDF) correlations in conjunction with MANOVA group mean and *F* ratio details.

The three procedures for the analysis of data in this phase of the present study were comparable in that all represented different aspects of regression analysis. In each analysis the variables entered were those derived from the First Phase: Anxiety-Stability, Introversion-Extraversion, and the Study Behaviour scale SBQ5. For each subject the interaction term was first constructed being the simple product of transformed ($z + 10$) main variable scores for Anxiety-Stability, Introversion-Extraversion, and SBQ5. Scale orientations were adjusted before these compounds were formed so as to correspond with the predictions in each case. Thus for example, where Anxiety, Extraversion, and SBQ5 constituted the relevant polarities, the Anxiety scale was reflected to maintain comparable directionalities since the factor score orientations had located Stability and Extraversion at the positive pole for each scale. Similar adjustments were made throughout the analysis as indicated *infra* to correct for what could otherwise have been an unwanted compensatory masking of the particular interactions being studied.

The use at Level III of mutually exclusive performance groups for discriminant analysis required that appropriate groups be formed in accordance with the study's main intentions. Groups were therefore set up on a principle of intra- rather than inter-individual relativism. Common practice would have required the construction of groups such that cases assigned to an Essay group, for example, would represent some arbitrary fraction of the total, say 15-25%, starting at the highest score and proceeding downwards. The key underlying assumption in such an approach is that an entity exists which might be called Essay Ability, and that this entity can be explored in more or less pure form, depending on the fraction employed, without reference to other entities which in the present study would be called Analytic Report Ability, Child Study Ability, and Tutorial Participation Ability. These entities could also be explored, of course, but under the same conditions as were outlined for the Essay. Inevitably, cases assigned to the Essay group would often be expected to appear in one or more of the other three groups, thus emphasizing a grouping principle that might be regarded as an impersonal form of hypostesization. This underlying assumption informed the tests used for hypotheses at Levels I and II, in keeping with well established conventions. But the ATI principles which guided the present research strategy were as well or

better served by structuring groups so as to point up the specifically personological aspects of the interactive system under examination. The research question at issue was less concerned with a removed, pure entity like Essay Ability than with a relativistic concept that regarded Essay Ability as one element in a system made up of personological elements as well as performance components other than the Essay. At this point therefore the particular question being asked had to do with the way groups might be formed to reflect both intra- and inter-individual sets of relativities, but with primary stress on the former set. Given low or negligible correlations among performance variables, as in the present study, or given their statistically imposed independence (as also in the present study), an exclusively intra-individual principle of relative performance would yield groups not very different as to membership from groups formed more conventionally; but the essential principle of bias towards an intra-individual comparison would be a paramount consideration, thus attenuating to some degree the impersonal character of the hypostesization.

For these reasons, cases were allocated to groups solely on the basis of their individual residualized z scores. Each case was placed in the group which corresponded with his or her single best achievement score; thus, four mutually exclusive groups were

constructed, each being viewed as representing Essay Ability, Analytic Report Ability, Child Study Ability, and Tutorial Performance Ability respectively, in relativistic terms within rather than between cases. The analysis of data from groups formed in this way was considered more likely to preserve the naturalistic quality of the exercise by acknowledging each student's particular strength as the focal source of information. It was also seen to be more in keeping with the 'limitedist' epistemology discussed at the outset in that it effectively directed the analyses towards a specifically person $\times$ task objective.

Research Hypotheses It follows from the discussion contained in the foregoing section that different statements of the study's principal hypotheses must be formulated to account for the particular analyses employed. The first decision point at Level II was approached in terms of multiple linear regression analysis as outlined by Kerlinger & Pedhazur (1973, pp.258ff.). It was necessary, prior to any attempt to explore the interactions under examination, to determine whether the full model R^2 was sufficient (*i.e.* both significant and meaningful) to justify reduction. Null hypotheses were therefore formulated for each task having the general form:

$H_{O_{IIA(a)g}}$: that the coefficient of determination (R^2) for Essay/Analytic Report/Child Study/Tutorial achievement as a linear function of Anxiety-Stability, Introversion-Extraversion, Study Behaviour (SBQ5) and their joint interaction is not significant at $p < .05$.

While Kerlinger & Pedhazur do not say what constitutes a meaningful R^2 it was considered reasonable to set the Type I error at 5% as a minimal expectation in view of the relatively small numbers in the present example.

Given the rejection of this hypothesis, the strategy called for a step-down analysis *via* Cohen's (1968) incremental F test. This procedure uses the F -ratio to test the significance of any increment to an R^2 and is of special value where the predictor or independent variables are correlated because it accounts for the *order* in which variables are entered. The general formula is:

$$F = \frac{(R^2_{Y.A,B} - R^2_{Y.A})/b}{(1 - R^2_{Y.A,B})/(n - a - b - 1)}$$

with $df = b$ and $(n - a - b - 1)$; where -

$R^2_{Y.A,B}$ is the incremented R^2 based on $a + b$ independent variables (*i.e.* predicted from the combined sets of A and B variables);

$R^2_{Y.A.}$ is the smaller R^2 based on a independent variables (*i.e.* predicted from the A set alone); a and b are the number of original (a) and added (b) independent variables.

In the present case the A set comprised four terms, *viz* Anxiety-Stability (X_1), Introversion-Extraversion (X_2), Study Behaviour (X_3), and the compound term $X_1.X_2.X_3$ (X_4); and the B set comprised three terms, *viz.* X_1 , X_2 , and X_3 . Four null hypotheses were constructed, one for each performance task, having the general form:

$H_{O_{IIA(b)g}}$: that the Cohen incremental F -ratio for the addition of the interactive element X_4 to its components X_1 , X_2 , and X_3 treated as main effects is not significant at $p < .05$ in accounting for performance variance.

Given the rejection of the hypothesis, the strategy then required the application of the Johnson-Neyman technique in order to determine significance regions for the personological variables within which significant differences in performance were registered. For this purpose the sample was split at the median on SBQ5 scores so as to construct two groups from which the necessary means, standard deviations, and product-moment correlations could be formed as input. In its general form the null hypothesis formulated at this point was:

$H_{O_{IIIA'}}^i$: that no region of significance
 g exists at $p < .05$ for Study
 Behaviour groups on performance
 task scores for any combination
 of Anxiety-Stability and
 Introversion-Extraversion.

So far as the present strategy was concerned this hypothesis represented the most refined level of analysis contemplated. It was the natural end point for strategic options emanating from multiple linear regression (MLR) analyses employing continuous dependent variable scores.

A parallel set of analytic options was designed to account for the initial failure of hypothesized effects under a multiple linear regression model with continuous dependent measures. As set out in Figure IV.2, these analyses were based on mutually exclusive groups and represented a coarser exploration of the data. At Level IIIB', global group comparisons were planned involving each performance group in contrast with all others combined, thus pursuing a principle of generalized task competence corresponding with the MLR procedure, but with forced group membership as the dependent variable. Once again, four null hypotheses were devised having the general form:

$H_{O_{IIIB'}}^i$: that group discrimination between
 g the Essay/Analytic Report/Child

Study/tutorial group and the non-Essay/. . . group is not significant at $p < .08$;

- ii: that Anxiety-Stability, Introversion-Extraversion, and SBQ Scale 5 in joint interaction and severally do not contribute significantly to group separation at $p < .08$.

A Type I error rate of .08 was considered appropriate in view of the more exploratory nature of analysis at this level; similarly, group differentiations were studied in terms of a more extensive set of variable relationships under section (ii) of each hypothesis. As described by Huberty, each test of group discrimination was carried out according to a two-step variable reduction scheme. All relevant variables were entered at step 1 together with theoretically salient quadratic and interaction terms. At step 2 a sub-set of step 1 variables was selected for re-analysis based on initial LDF correlations in association with univariate F -ratio statistics and the need to minimize redundancy.

At level IV (Figure IV.2) which was the final level in the study's second phase, this same procedure was followed for the analysis of group discriminations taking the groups two at a time. Six paired tests were planned, the general form of the null hypothesis being as set out above for Level IIB', but for section (i).

This was formulated as follows:

$H_{O_{IVg}}$: that group discrimination between
 the *A* group and the *B* group is
 not significant at $p < .08$;

where *A* and *B* represent systematic group pairings among the four groups.

Throughout the analyses at Levels III and IV, all variables were entered at step 1 in accordance with the predicted directionalities in each case as originally set out in the substantive hypotheses given in Chapter III. But the exploratory character of these analyses and the stepwise approach adopted provided for a closer inspection of directional trends at step 1 and hence for group-relevant adjustments at step 2 as indicated by them. While it was recognized that, in varying degrees, such changes threatened the study's detailed predictions, it was also readily conceded that the precise directional effects postulated for elements of the independent variable set were at several points based on thin empirical foundations. Thus, the specific role played by Anxiety-Stability in the case of Tutorial participation and the relevance of Introversion-Extraversion in the case of Child Study achievement were pointed examples of relatively indeterminable predictions.

CHAPTER VI

RESULTS - SECOND PHASE

The results set out in this Chapter bear directly on the study's principal objectives. The analytic strategy for Levels II, III and IV was designed to focus specifically upon the interactive relationships as postulated in Chapter II.

Analyses at Level II

The procedures adopted for the testing of hypotheses at Level II followed the recommendations of Kerlinger & Pedhazur (1973, pp.258ff.). Four experimental hypotheses were designed to test the interactions being studied, one for each performance task. While these hypotheses were explicitly concerned with the interactions however, it was necessary to examine a prior null hypothesis for each case in accordance with Kerlinger & Pedhazur's recommended strategy to determine whether a full model R^2 was sufficient (*i.e.* both significant and meaningful) to justify reduction. In each of the four cases therefore the first hypotheses to be tested were:

$H_{O_{IIA(a)}}$: That the R^2 for Essay achievement as a linear function of Anxiety, Introversion, SBQ5, and Anxiety $\times$ Introversion $\times$ SBQ5 is not significant.

- $H_{O_{IIA(b)}}$: That the R^2 for Analytic Report achievement as a linear function of Stability, Introversion, SBQ5, and Stability $\times$ Introversion $\times$ SBQ5 is not significant.
- $H_{O_{IIA(c)}}$: That the R^2 for Child Study achievement as a linear function of Anxiety, Introversion, SBQ5, and Anxiety $\times$ Introversion $\times$ SBQ5, is not significant.
- $H_{O_{IIA(d)}}$: That the R^2 for Tutorial participation achievement as a linear function of Stability, Extraversion, SBQ5, and Stability $\times$ Extraversion $\times$ SBQ5 is not significant.

Tests of these hypotheses were computed using the BMD03R multiple regression program (Dixon, 1970). The relevant data for each test are displayed in Table VI.1. Since none of the F values associated with these tests exceeded the levels that had been set, all four null hypotheses were accepted.¹ Furthermore, although no predetermined R^2 value was specified as meaningful in the present context, the proportions of variance

1. The strong theoretical links between SQB5 and Rigidity, as measured in this study, offered grounds for calculating identical statistics to those in Table VI.1 replacing SBQ5 scores with Rigidity. For the sample of (N=45) cases with relevant data, the calculations yielded similar results to those in Table VI.1. Details appear in Appendix N.

TABLE VI.1: Multiple Regression Data for Student Performance on Four Tasks as a Function of Three Predictors and their Joint Interaction

Task	Full Model Mult. R	Mult R ²	Regression ANOVA		
			df	F	p
(a) Essay	.148	.022	4,59	<1	ns
(b) Analytic Report	.229	.052	4,59	<1	ns
(c) Child Study	.188	.035	4,59	<1	ns
(d) Tutorial	.243	.059	4,59	<1	ns

accounted for in each case (from 2.2% to 5.9%) were clearly too small to justify further analysis. In accordance with the strategy adopted for developing research hypotheses, the results set out in Table VI.1 represented the failure of predicted differentiations at Level IIA and, as a consequence, it was necessary to put aside the four Level IIA' hypotheses based on Johnson-Neyman analyses for the specification of regions of significance. In their stead, coarser group discriminations were explored *via* hypotheses at Level IIIB'. The groups employed for this aspect of the analysis were constructed according to the intra-individual principles enunciated in the preceding chapter; each group represented that sub-set of the student sample which registered its best individual achievement on the same task (*viz.* Essay, Analytic Report, Child Study, and Tutorial Participation).

Analyses at Level IIIB'

Consequent upon the failure of preliminary hypotheses at Level IIA employing continuous measures as dependent variable scores, the B-B' option was taken up (see Figure IV.2). As indicated previously, hypotheses under this option were weaker forms of the multiple regression model because continuous dependent variable scores were replaced by group membership category codes. For each hypothesis at Level IIIB' the four groups constructed as outlined above were re-grouped according to the following pattern:

- (a) Group 1: High Essay group;
Group 2: All other groups.
- (b) Group 1: High Analytic Report group;
Group 2: All other groups.
- (c) Group 1: High Child Study group;
Group 2: All other groups.
- (d) Group 1: High Tutorial Participation group;
Group 2: All other groups.

Each pair was subjected to a discriminant analysis (program DSCRIM: Veldman, 1967) in order to discover whether and to what extent Anxiety-Stability, Introversion-Extraversion, Study Behaviour (SBQ) Scale 5, and their several interactive compounds were significant contributors to the group discriminations that emerged. While groups analyzed in this way yielded information commensurate with the intra-individual principles

previously discussed, the inspection of performance data for each group contrasted with all others combined represented but a small step in the relativistic direction by comparison with the analyses reported for Level II; *i.e.*, relative success in each task in general rather than in terms of each of the other tasks was under examination at this point.

Four two-stage null hypotheses were set up. The first stage was designed to test overall group differentiation in each case, and the second was directed towards a test of the contribution of specific variables. The four hypotheses were:

- $H_{O_{IIIB'}}(a)$
- i: That group discrimination between that Essay Group and the non-Essay group is not significant (at $p < .08$);
 - ii: That Anxiety, Introversion, and SBQ Scale 5 in joint interaction, and severally, do not contribute significantly to group separation (at $p < .08$).
- $H_{O_{IIIB'}}(b)$
- i: That group discrimination between the Analytic Report Group and the non-Analytic Report Group is not significant (at $p < .08$);
 - ii: That Stability, Introversion, and SBQ Scale 5 in joint interaction, and severally, do not contribute

significantly to group separation
(at $p < .08$).

$H_{O_{III B'}(c)}$ i: That group discrimination between
the Child Study Group and the non-
Child Study Group is not significant
(at $p < .08$);

ii: That Anxiety, Introversion, and SBQ
Scale 5 in joint interaction, and
severally, do not contribute
significantly to group separation
(at $p < .08$).

$H_{O_{III B}(d)}$ i: That group discrimination between
the Tutorial Participation Group
and the non-Tutorial Participation
Group is not significant (at $p < .08$);

ii: That Extraversion, Stability, and
SBQ Scale 5 in joint interaction,
and severally, do not contribute
significantly to group separation
(at $p < .08$).

Data relevant to the testing of these hypotheses appear
in Tables VI.2 - VI.5. The discriminant analysis
procedure was used to provide information regarding
group separation, group discrimination, and estimates
of group $\times$ variable relationships, as these applications
are defined by Huberty (1975) for *a priori* groups.

In addition, and as a sequel to the failure of

hypothesized interactions under the terms of the analyses carried out at Level II and the clear evidence that R^2 values did not reach significance, an attempt was made to capitalize on the exploratory potential of analyses at Level IIIB' while remaining within the strict theoretical framework of the study. To this end, variables were selected for entry at the first stage of each discriminant analysis to represent that set of discriminators having both theoretical support and manageable interpretability. Eight elements were used in order to test overall group comparisons at stage 1 and to allow for variable reduction at stage 2. These were:

1. Anxiety-Stability (ANX)
2. Introversion-Extraversion (INT)
3. Study Behaviour Scale 5 (SBQ5)
4. Anxiety $\times$ Anxiety (A^2)
5. Anxiety $\times$ Study Behaviour (AS)
6. Introversion $\times$ Study Behaviour (IS)
7. Anxiety $\times$ Anxiety $\times$ Study Behaviour (A^2S)
8. Anxiety $\times$ Introversion $\times$ Study Behaviour (AIS)

In terms of the study's detailed objectives, each of these eight elements represented a specific potential differentiator, but the set taken in its entirety necessarily maximized discriminator redundancy to allow for the step-down selection of variables. For all analyses at Levels IIIB' and IV, these eight variables constituted the initial discriminator set.

Null Hypothesis IIIB'(a): On the basis of the results displayed in Table VI.2, null hypothesis IIIB'(a)i was accepted. There was no significant group differentiation between the Essay and non-Essay groups as a function of the elements under consideration. Moreover, an inspection of the univariate F values associated with these results indicated that null hypothesis (a)ii should also be accepted for the elements taken severally and in various interactive combinations. Of the three main effects considered, none approached significance at an acceptable level, and one (SBQ5) even ran counter to the predicted direction. It was noted that, while the difference was not significant, the Essay group was somewhat more introverted than the non-Essay group.

Null Hypothesis IIIB'(b): Data relevant to the testing of null hypothesis IIIB'(b)i are set out in Tables VI.3 (a) and VI.3(b). Of the eight elements under examination, univariate F tests identified Anxiety in linear and quadratic forms, and the interactions involving Anxiety (both linear and quadratic) in conjunction with the SBQ5 scale as significant contributors to group differentiation. When these were removed selectively for independent study the null hypothesis was rejected; there was significant group discrimination between the Analytic Report and non-Analytic Report groups at $p < .08$. While null hypothesis (b)ii was rejected with respect to the elements identified in Table VI.3(a), *viz.* Anxiety

TABLE VI.2: Group Discrimination Data for the Essay/non-Essay Groups as a Function of Anxiety, Introversion, and SBQ5^a

Group (N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
	Group			Means				
1. Essay (14)	9.93	9.70	10.29	99.64	102.17	99.89	967.71	988.56
2. Non-Essay (50)	10.03	10.04	9.93	101.50	99.72	99.92	1019.12	1005.21
Univariate <i>F</i> Values	.11	1.52	1.39	.10	.29	.00	.65	.08
<i>p</i> estimates	.74	.22	.24	.76	.60	.99	.57	.77
LDF Correlations	.12	.45	-.43	.11	-.20	.00	.39	.11
Wilks' Lambda:	.881							
R ² :	.119							
Chi ² :	7.561 , df = 8 ; <i>p</i> = .374							

a. Reflected SBQ5 Scale Score; high SBQ5 - low score.

TABLE VI.3(a): Group Discrimination Data for the Analytic Report/non-Analytic Report Groups as a Function of Anxiety, Introversion^a, and SBQ5

Group (N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
	Group			Means				
1. Analytic Report (12)	10.64	10.06	10.04	113.72	106.90	101.41	1142.57	1077.32
2. Non-Analytic Report (52)	9.86	10.03	9.98	98.18	98.25	100.19	976.79	986.03
Univariate <i>F</i> Values	6.64	.01	.04	6.66	4.27	.06	6.56	2.81
<i>p</i> estimates	.02	.90	.84	.02	.04	.80	.01	.10
LDF Correlations	.85	.04	.07	.85	.69	.09	.71	.57
Wilks' Lambda:	.866							
R ² :	.134							
Chi ² :	8.556	.	df = 8 ;	<i>p</i> = .287				

a. Reflected Introversion Scale Score; high I = high score.

TABLE VI.3(b): Analytic Report/non-Analytic Report Groups Discrimination Data for Selected Predictors

	ANX	ANX $\times$ SBQ5	ANX ² $\times$ SBQ5
F values:	6.637	4.270	6.561
p estimate:	.012	.041	.012
LDF			
Correlations:	.946	.773	.941
Wilks' Lambda:	.892		
R^2 :	.108		
Chi ² :	7.027,	df=3;	$p=.070$

(linear term), Anxiety (quadratic term), and the Anxiety $\times$ SBQ and Anxiety² $\times$ SBQ compounds, it was accepted in the case of Introversion, and also for the three-way Anxiety $\times$ Introversion $\times$ SBQ5 interaction. An inspection of group means indicated that the Analytic Report group was more Stable and scored higher on the Stability² $\times$ SBQ5 interaction. The Anxiety-Stability term as a quadratic effect was separately examined in graphic form as illustrated in Figure VI.1. It was evident that the Analytic Report group registered scores over a smaller range than its counterpart, and that scores were concentrated towards the Stability pole.

Null Hypothesis IIIB'(c): Data for the testing of null hypothesis IIIB'(c) are shown in Tables VI.4(a) and VI.4(b). Univariate F tests indicated that only Anxiety (both linear and quadratic) reached significance, and a

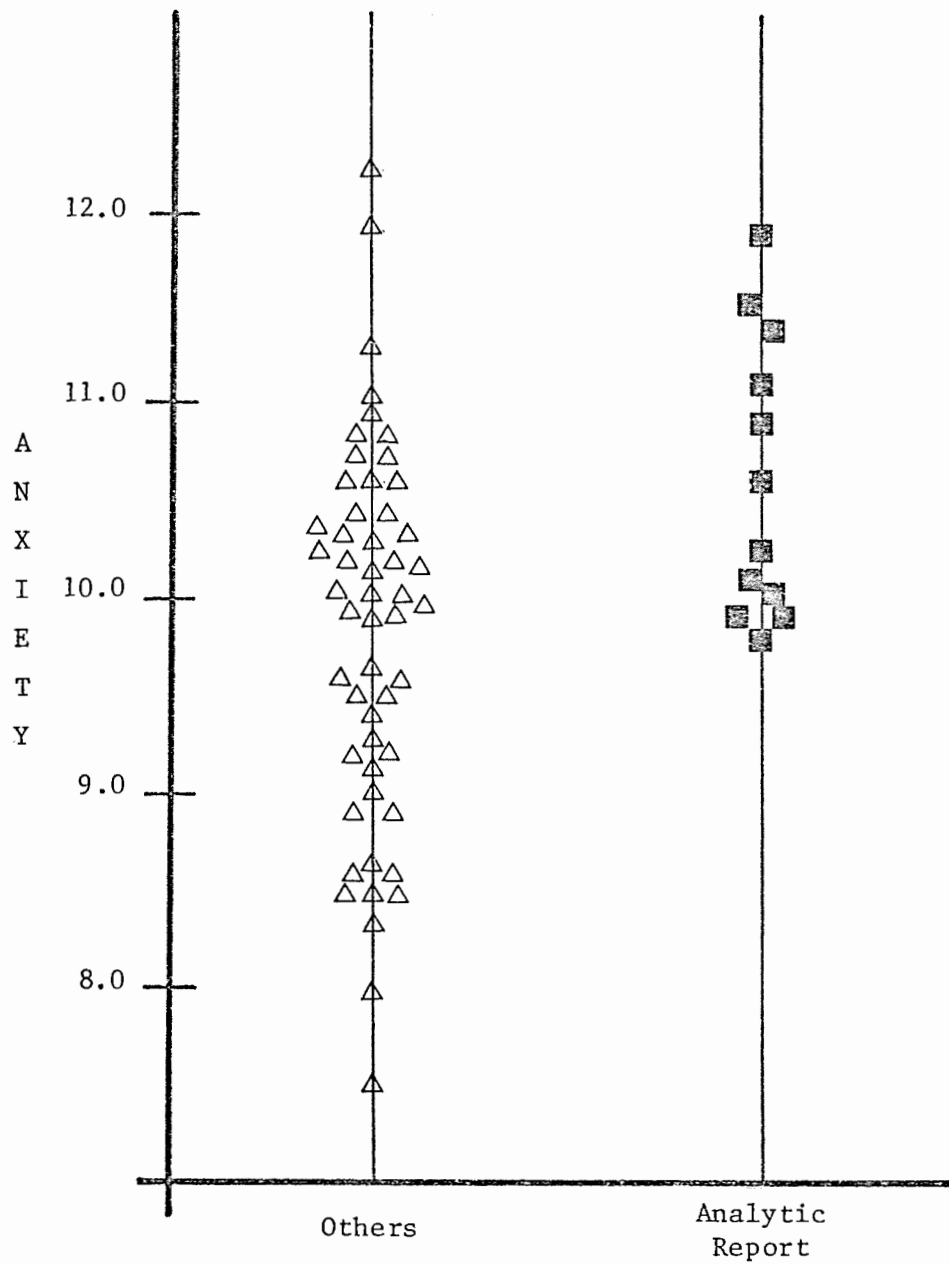


FIGURE VI.1: *Anxiety-Stability as a Quadratic Discriminator for the Analytic Report Group and All Other Groups Combined*

TABLE VI.4(a): Group Discrimination Data for the Child Study/non-Child Study Groups as a Function of Anxiety, Introversion, and SBQ5^a

Group (N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
	Group			Means				
1. Child Study (18)	9.61	9.98	10.21	93.64	98.51	102.08	909.09	987.34
2. Non-Child Study (46)	10.16	9.96	9.93	104.01	100.94	99.07	1046.53	1007.14
Univariate <i>F</i> values	4.22	.01	.95	3.77	.33	.52	5.93	.14
<i>p</i> estimates	.04	.94	.67	.05	.57	.52	.02	.71
LDF Correlations	.65	-.03	-.32	.62	.19	-.24	.69	.12
Wilks' Lambda:	.850							
<i>R</i> ² :	.150							
Chi ² :	9.703,	df = 8 ;	<i>p</i> = .207					

a. Reflected SBQ5 Scale Score; high SBQ5 = low score.

comparison of group means showed further that the directional prediction in the case of Study Behaviour had been confounded. Anxiety and its interactions were separated for the analysis reported in Table VI.4(b), and the reflected SBQ scores were returned to their original polarity as the most powerful test available of the three-way interaction. The data reported in

Table VI.4(b): Child Study/non-Child Study Groups
Discrimination Data for Selected
Predictors

	ANX	ANX ² $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
<i>F</i> values:	4.218	5.928	3.765
<i>p</i> estimates:	.042	.017	.054
LDF Correlations:	.836	.961	.792
Wilks' Lambda:	.909		
R ² :	.091		
Chi ² :	5.881, df = 3; <i>p</i> = .117		

Table VI.4(b) failed to support the hypothesized group discrimination and null hypothesis (c)i was therefore accepted. Following the adjustment to SBQ Scale 5 scores and their re-analysis as reported in Table VI.4(b), null hypothesis (c)ii was rejected with respect to Anxiety, and the Anxiety² $\times$ SBQ5 and Anxiety $\times$ Introversion $\times$ SBQ5 compounds. Although there was no

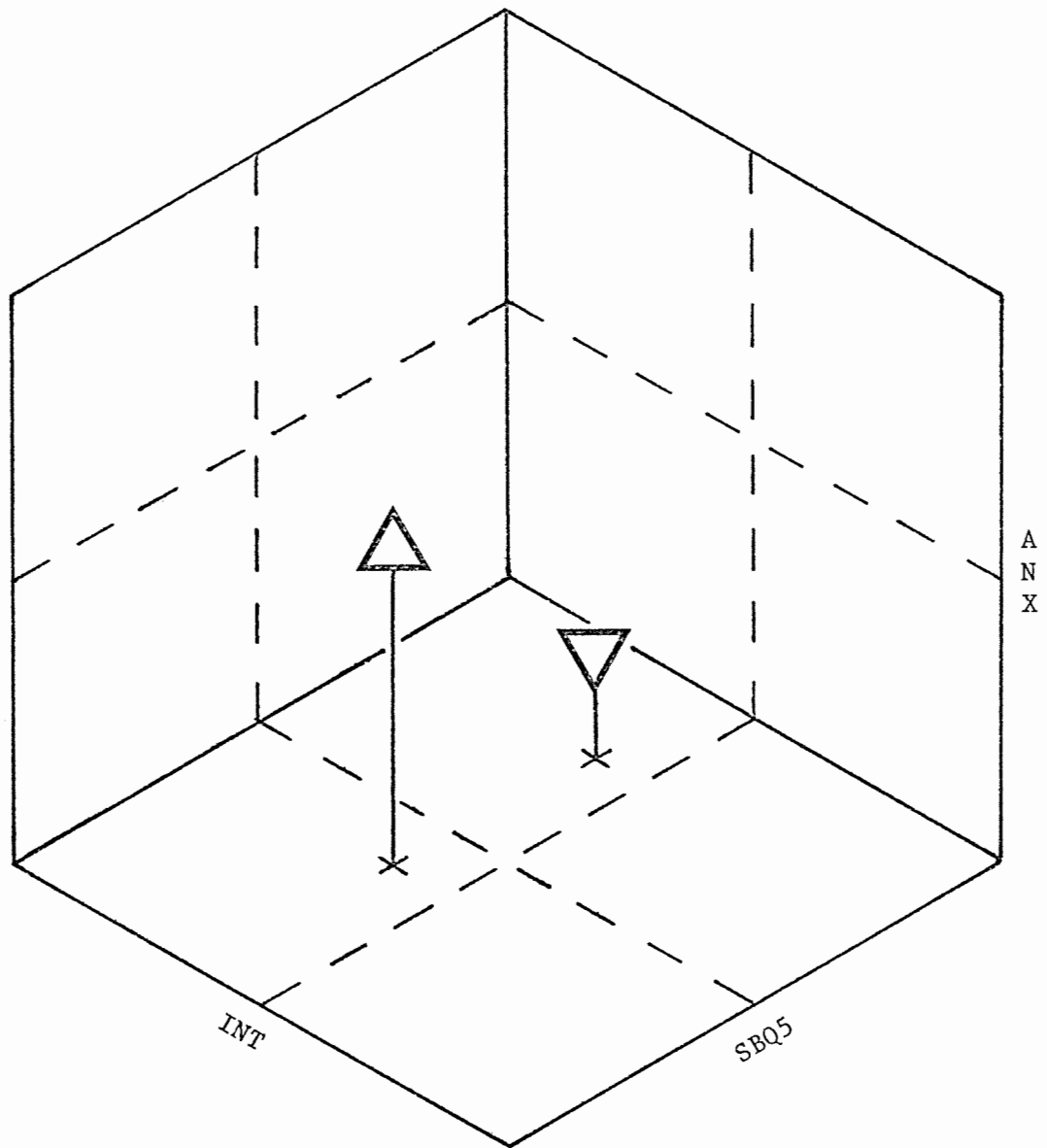


FIGURE VI.2: *Three Dimensional Locations for the Child Study Group (∇) and All Other Groups Combined (Δ).*

support for the predicted group differentiation, these three elements, together with Anxiety² from Table VI.4(a), were associated with significant univariate F values. The three-way compound is displayed in diagrammatic form in Figure VI.2.

Null Hypothesis IIIB'(d): Tests of null hypotheses IIIB'(d)i and (d)ii yielded the data displayed in Tables VI.5(a) and VI.5(b). In selecting variables for separate analysis on the strength of univariate F tests, SBQ5, Introversion, and the three-way interactive compound (Anxiety $\times$ Introversion $\times$ SBQ5) were chosen. As indicated in Table VI.5(b), the elements separated for analysis in this way, while significant as group discriminators in each case, failed to support group differentiation under null hypothesis (d)i and the null hypothesis was accepted; there was no significant group differentiation between the Tutorial and non-Tutorial groups as a function of the elements under consideration. With respect to the variables included in Table VI.5(b), null hypothesis (d)ii was rejected, but accepted in the case of the Stability (both linear and quadratic), Extraversion, and compound elements. The three-way compound for this comparison appears in diagrammatic form as Figure VI.3.

A brief summary of the results so far is given in Table VI.6. In terms of the variables selected for study, the Analytic Report group was the only group to satisfy the pre-set level of significance for group discrimination.

TABLE VI.5(a): Group Discrimination Data for the Tutorial/non-Tutorial Groups as a Function of Anxiety, Introversion, and SBQ5

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
Group					Means				
1. Tutorial	(20)	10.04	10.16	10.34	99.81	103.14	104.82	1044.07	1051.44
2. Non-Tutorial	(44)	9.99	9.88	9.83	101.30	98.52	96.96	991.42	968.35
Univariate <i>F</i> values		.02	1.26	3.49	.07	1.32	5.80	.86	4.13
<i>p</i> estimates		.87	.26	.06	.78	.25	.02	.64	.05
LFD Correlations		-.05	.39	.64	-.10	.40	.81	.26	.69
Wilks' Lambda:		.869							
R ² :		.131							
Chi ² :		8.388	df = 8 ; <i>p</i> = .300.						

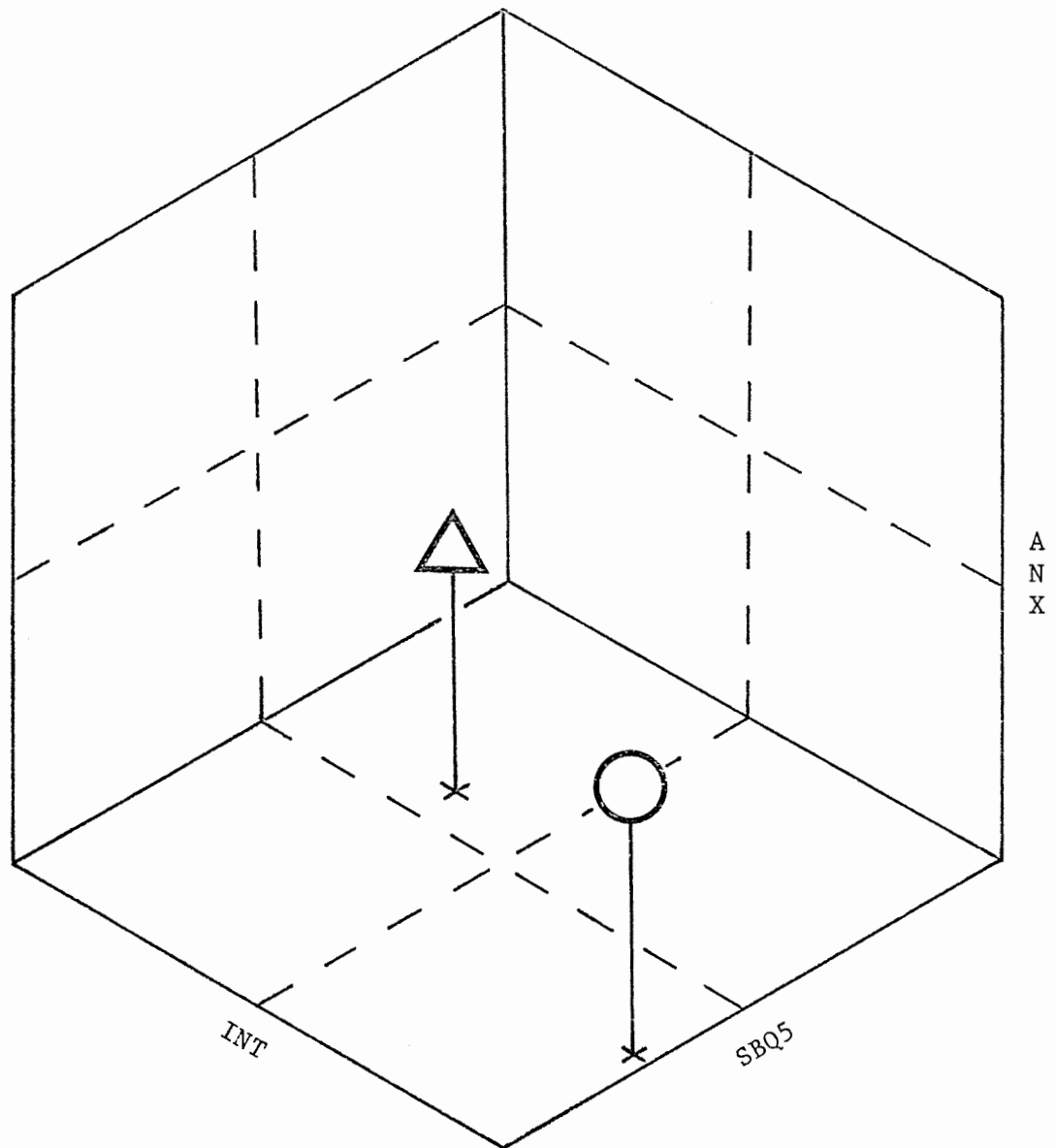


FIGURE VI.3: *Three Dimensional Locations for the Tutorial Group (O) and All Other Groups Combined (Δ).*

TABLE VI.5(b): Tutorial/non-Tutorial Groups
Discrimination Data for Selected
Predictors

	SBQ	INTxSBQ	ANXxINTxSBQ
<i>F</i> values:	3.486	5.799	4.129
<i>p</i> estimates:	.063	.018	.044
LDF Correlations:	.773	.979	.837
Wilks' Lambda:	.911		
R^2 :	.989		
Chi ² :	5.744 ,	df = 3;	<i>p</i> = .124

TABLE VI.6: Summary Results - Level IIIB'

Group Contrast	(<i>p</i> est.)	Relevant Predictors	(<i>p</i> est.)
1. Essay x All others	(.374)	(Nil)	---
2. Analytic Report x All others	(.070)	Anxiety	(.012)
		Anxiety ²	(.041)
		Anxiety x SBQ5	(.012)
3. Child Study x All others	(.117)	Anxiety	(.042)
		Anxiety x SBQ5	(.019)
		Anxiety x Introversion x SBQ5	(.054)
4. Tutorial x All others	(.124)	SBQ5	(.063)
		Introversion x SBQ5	(.018)
		Anxiety x Introversion x SBQ5	(.044)

Analysis at Level IV

The investigation of group differentiations was extended at Level IV to take account of individual group-by-group pairings. Analyses at this level were based on the application of group discrimination procedures as in Level III, but the particular concern here was to discover whether the underlying assumption for the initial construction of performance groups was tenable. The groups had been formed so as to represent distinguishable types of success in each case and this meant that theoretically defensible relationships between certain predictor variables and performance were liable to be masked when groups were joined. Thus, Anxiety was expected to function as a generalized drive for the Essay and Child Study groups, while Stability was postulated as the relevant pole for the Analytic Report and Tutorial participation groups. In any system involving these groups in various combinations when contrasted with any other group, Anxiety scores would tend to cancel each other. The same problem, *mutatis mutandis*, also arose in linking groups with compensating Introversion scores.

Research hypotheses at Level IV were specifically directed to the question whether differentiation was possible in terms of the predictor set, between the four performance tasks as distinguishable types of achievement. Each of the six hypotheses associated

with this aspect of the study was expressed in null form as before, subject to directional constraints. Thus, analyses involving the Essay or Child Study groups, for instance, were tied to the Anxiety-Introversion-SBQ5 system, while analyses involving the Analytic Report and Tutorial groups were tied to Stability-Introversion-SBQ5 and Stability-Extraversion-SBQ5 systems respectively. For each paired comparison other than the Essay/Child Study therefore, two sets of contrasting polarities were under inspection. The six analytic comparisons were carried out in accordance with the testing strategy set out in Table VI.7. In terms of the study's underlying concerns, paired contrasts at this level represented the most pointed test of the role played by the predictor set as differentiators of relative achievement.

The relevant null hypotheses and the data for each are dealt with *seriatim*.

The Essay Group

Null Hypotheses IV(a)

- $H_{O_{IV(a)}}$ i: That group discrimination between the Essay Group and the Analytic Group is not significant at $p < .08$;
- (a)ii: That Anxiety, Introversion and SBQ Scale 5 in joint interaction and severally, do not contribute

significantly to group separation
at $p < .08$.

TABLE VI.7: Hypothesis Scheme for Level IV Analyses

Group Comparison		Predictor Set Orientation ^a
(a)	1. Essay Group 2. Analytic Report Group	} ANX; INT; SBQ5 } STAB; INT; SBQ5
(b)	1. Essay Group 2. Child Study Group	} ANX; INT; SBQ5 } ANX; INT; SBQ5
(c)	1. Essay Group 2. Tutorial Group	} ANX; INT; SBQ5 } STAB; EXT; SBQ5
(d)	1. Analytic Report Group 2. Child Study Group	} STAB; INT; SBQ5 } ANX; INT; SBQ5
(e)	1. Analytic Report Group 2. Tutorial Group	} STAB; INT; SBQ5 } STAB; EXT; SBQ5
(f)	1. Child Study Group 2. Tutorial Group	} ANX; INT; SBQ5 } STAB; EXT; SBQ5

a. ANX = Anxiety; STAB = Stability;
INT = Introversion; EXT = Extraversion;
SBQ5 = Study Behaviour Questionnaire, Scale 5.

Data relevant to the testing of these hypotheses are displayed in Tables VI.8(a) and VI.8(b). Univariate F statistics identified Anxiety (in linear and quadratic forms) as relevant to group separation and these terms were entered, together with the Anxiety $\times$ Introversion $\times$ SBQ5 interaction, as discriminating variables for

TABLE VI.8(a): Group Discrimination Data for the Essay/Analytic Report Groups as a_b Function of Anxiety-Introversion-SBQ5^a versus Stability-Introversion^b-SBQ5

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
Group					Means				
1. Essay	(14)	9.93	9.70	9.71	99.64	102.17	99.89	1025.12	988.56
2. Analytic Report	(12)	10.64	9.94	10.04	113.72	106.90	101.41	1142.57	1077.32
Univariate <i>F</i> value:		3.84	.52	1.11	3.39	.93	.08	1.92	2.35
<i>p</i> estimate:		.06	.52	.30	.07	.65	.78	.18	.13
LDF Correlation:		.59	.23	.33	.55	.30	.09	.43	.47
Wilks' Lambda:		.597							
<i>R</i> ² :		.403							
Chi ² :		10.833	,	df = 8	;	<i>p</i> = .212			

a. Reflected SBQ5 for Essay Group interaction terms.

b. Reflected INT for Analytic Report Group interaction terms.

TABLE VI.8(b): Essay/Analytic Report Groups
Discrimination Data for Selected
Predictors

	ANX	ANX ²	ANX $\times$ INT $\times$ SBQ5
<i>F</i> value:	3.843	3.393	2.353
<i>p</i> estimates:	.059	.075	.135
LDF Correlation:	.717	.679	.577
Wilks' Lambda:	.732		
R ² :	.268		
Chi ² :	7.345	df = 3;	<i>p</i> = .061

additional analysis. As shown in Table VI.8(b), the selected subset yielded a significant level of group separation (at $p < .07$) between the Essay and Analytic Report groups; null hypothesis (a)i was therefore rejected. Null hypothesis (a)ii was also rejected, but only in the case of the Anxiety component (*i.e.*, linear and quadratic elements). The three-way compound of particular interest did not reach the pre-set level of significance ($F_{1,24} = 2.35$; $p < .14$), however it was noted that it was one of the three contributors to overall group separation. An inspection of the data displayed in Table VI.8(c) revealed that the Analytic Report group was marginally (and non-significantly) more Extraverted but had lower SBQ5 scores than the Essay group after adjustments were made to correspond with predicted directional trends. This ran counter

TABLE VI.8(c): Adjusted Group Means for Key Variables

	ANX	INT	SBQ5
Essay	9.930	9.698	10.423
Analytic Report	10.641	9.979	10.043

to the expectation that unadjusted SBQ5 scores would mask the interaction effect, the adjusted scores on this occasion serving to restrict group differences. To determine how much impact this had on the present data, an additional analysis was carried out as reported in Table VI.8(d). Under this reversal of SBQ

TABLE VI.8(d): Essay/Analytic Report Groups
Discrimination Data for Selected
Predictors (Unadjusted SBQ5 Scores)

	ANX $\times$ SBQ5	ANX ² $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
F value:	4.666	4.546	6.865
p estimate:	.039	.041	.014
LDF Correlation:	.810	.801	.947
Wilks' Lambda:	.752		
R ² :	.248		
Chi ² :	6.697	df = 3;	p = .082

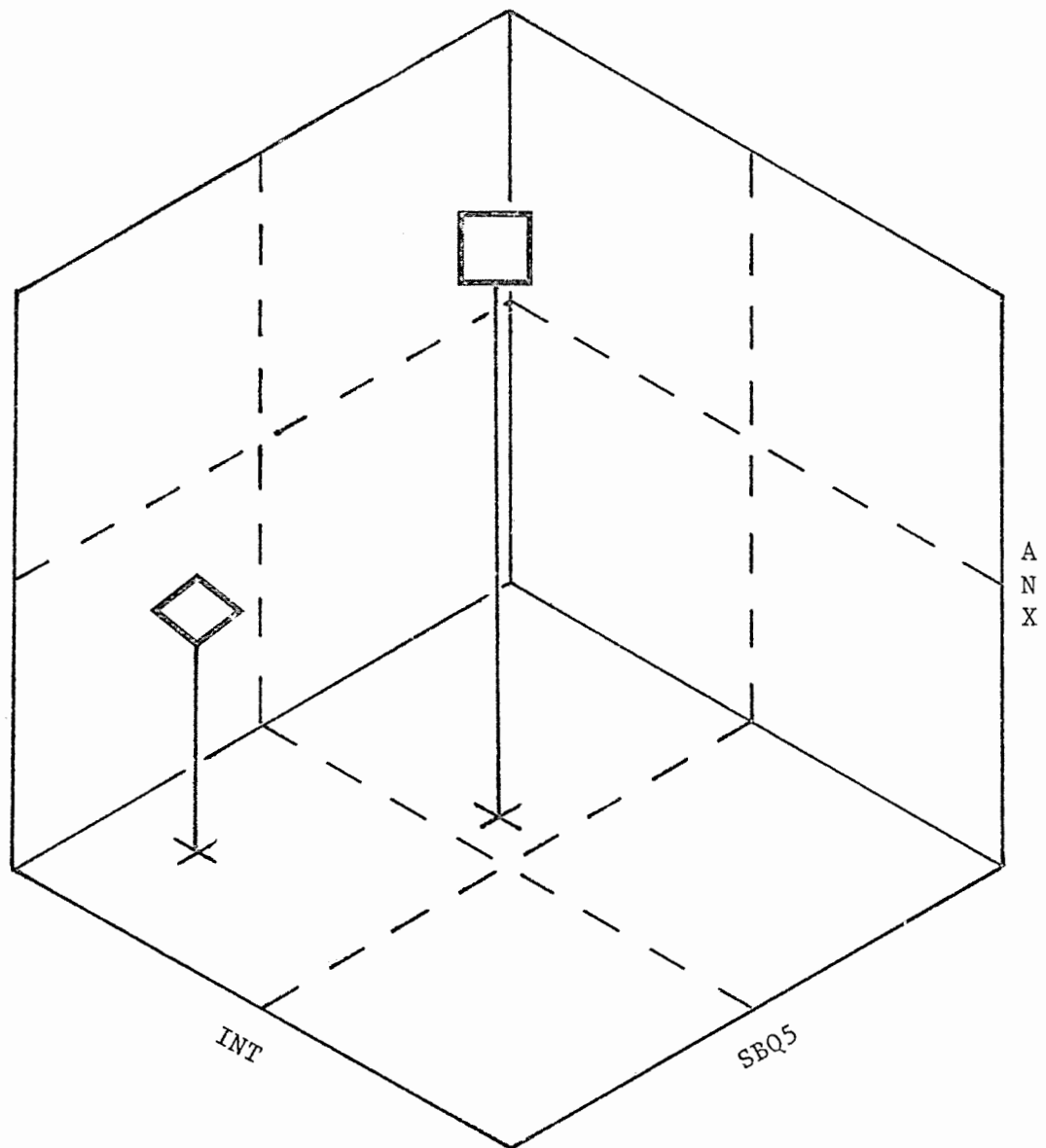


FIGURE VI.4: *Three Dimensional Locations for the Essay Group ($\diamond$) and the Analytic Report Group ($\square$).*

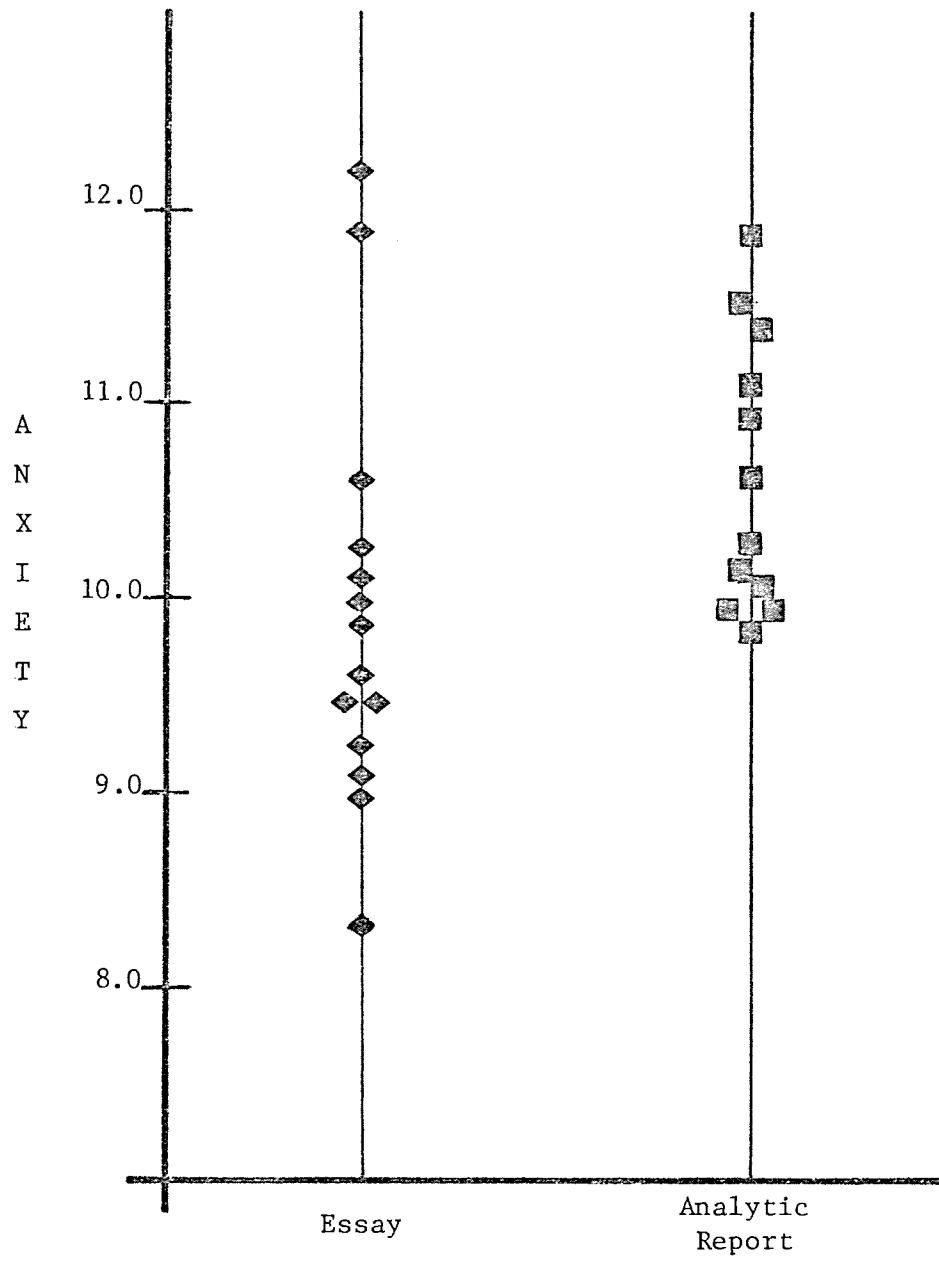


FIGURE VI.5: *Anxiety-Stability as a Quadratic Discriminator for the Essay and the Analytic Report Groups*

scores to their original polarity, the three-way compound clearly emerged, as a powerful element in group separation, but in conflict with the postulated system for Essay achievement by virtue of the Essay group's initially depressed SBQ5 scores. (This compound is illustrated diagrammatically in Figure VI.4). At the same time it was observed that the directional hypothesis in the case of Anxiety was supported, the Analytic Report group being significantly more stable than the Essay group; and in the case of Introversion the Analytic Report group was marginally nearer the Extraversion pole. The quadratic affect of Anxiety-Stability was again separated for graphic display and appears as Figure VI.5.

Null Hypothesis IV(b)

- $H_{O_{IV(b)}}$ i: That group discrimination between the Essay group and the Child Study group is not significant at $p < .08$;
- (b)ii: That Anxiety, Introversion, and SBQ Scale 5 in joint interaction and severally, do not contribute significantly to group separation at $p < .08$.

The data for these hypotheses appear as Table VI.9. Both null hypotheses (b)i and (b)ii were accepted; there was no evidence to support the hypothesized differentiation of groups, and none of the elements in the

TABLE VI.9: Group Discrimination Data for the Essay/Child Study Groups as a Function of Anxiety-Introversion-SBQ5^a versus Anxiety-Introversion-SBQ5

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
		Group			Means				
1. Essay	(14)	9.93	9.70	9.71	99.64	102.17	99.89	1025.11	988.56
2. Child Study	(18)	9.61	9.98	9.79	93.64	98.51	102.08	963.72	987.34
Univariate <i>F</i> values:		.64	.85	.06	.59	.38	.18	.78	.00
<i>p</i> estimates:		.56	.63	.81	.54	.55	.68	.60	.98
LDF Correlations:		.32	-.36	.10	.30	.25	-.17	.34	.01
Wilks' Lambda:		.791							
R ² :		.209							
Chi ² :		6.464	df = 8;		<i>p</i> = .512				

a. Reflected SBQ5 for both group interaction terms.

predictor variable set was associated with a significant F value. The Essay and Child Study groups were not distinguishable.

Null Hypothesis IV(c)

$H_{O_{IV(c)}}$ i: That group discrimination between the Essay group and the Tutorial group is not significant at $p < .08$;

(c)ii: That Anxiety, Introversion, and SBQ Scale 5 in joint interaction and severally, do not contribute significantly to group separation at $p < .08$.

The data for these hypotheses are set out in Tables VI.10(a) - VI.10(c). It was again noted that the SBQ5 scores for the Essay group ran counter to the predicted direction and that the difference in this case was significant. All other differences between the two groups, though non-significant, were as hypothesized. When the best subset of predictor elements was selected from Table VI.10(a) for re-analysis it was again found that the level of group separation failed to reach significance (see Table VI.10(b); $p > .08$). Following the re-alignment of SBQ5 scores for further inspection of these data the Anxiety $\times$ Introversion $\times$ Study Behaviour compound emerged as a significant element (see Figure VI.6), but this

TABLE VI.10(a): Group Discrimination Data for the Essay/Tutorial Groups as a Function of Anxiety-Introversion-SBQ5^a versus Stability-Extraversion-SBQ5

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
		Group			Means				
1. Essay	(14)	9.93	9.70	9.71	99.64	102.17	99.89	1025.12	988.56
2. Tutorial	(20)	10.04	10.16	10.34	101.24	103.63	104.82	1044.07	1051.44
Univariate <i>F</i> values:		.12	1.98	3.60	.06	.11	1.17	.07	1.59
<i>p</i> estimates:		.73	.17	.06	.80	.74	.29	.78	.21
LDF Correlations:		.11	.44	.58	.08	.11	.35	.09	.40
Wilks' Lambda:	.703								
R ² :	.297								
Chi ² :	10.232	df = 8;		<i>p</i> = .250					

a. Reflected SBQ5 for Essay Group interaction terms.

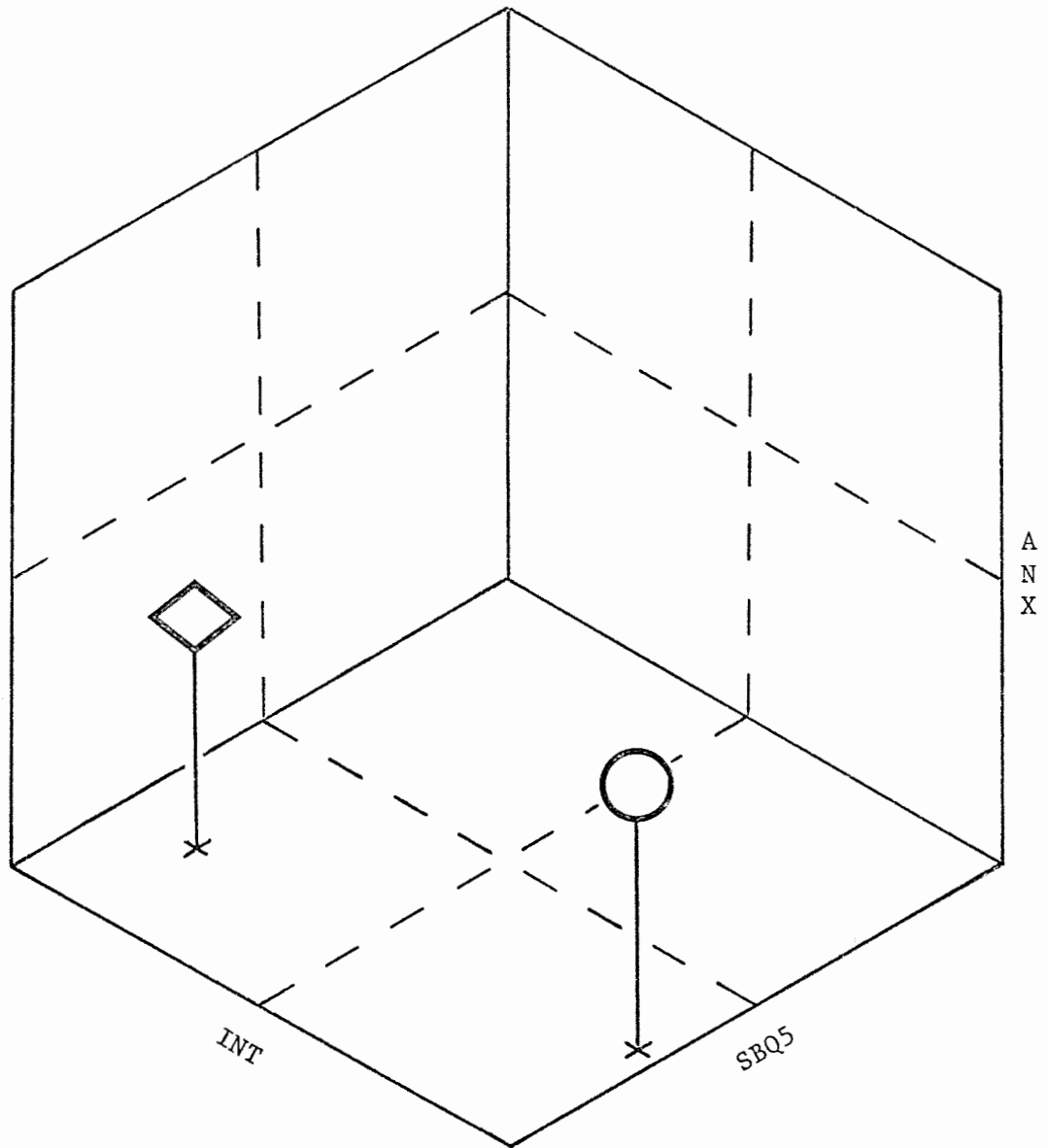


FIGURE VI.6: *Three Dimensional Locations for the Essay for the Essay Group (◇) and the Tutorial Group (○).*

TABLE VI.10(b): Essay/Tutorial Groups Discrimination Data for Selected Predictors

	INT	SBQ5	ANX $\times$ INT $\times$ SBQ5
<i>F</i> values:	1.980	3.595	1.586
<i>p</i> estimates:	.166	.064	.215
LDF Correlations:	.573	.754	.516
Wilks' Lambda:	.822		
R^2 :	.178		
Chi ² :	6.164	df=3;	<i>p</i> =.103

adjustment did not correspond with the predicted effects of SBQ5 scale scores on the interaction. It was nonetheless noted that this re-adjustment to SBQ5 scores led to a marked increase in group discrimination such that χ^2 estimate reported in Table VI.10(c) closely approached the pre-set level of .08 for statistical significance. With the exception of inequalities in the SBQ5 scores, the hypothesized discrimination between groups on the basis of the variables under examination was not confirmed (at $p < .08$); none of the relevant variables or compounds was a significant contributor to group separation under the directional predictions for this group contrast. Both null hypothesis (c)i and (c)ii were consequently accepted.

Summarizing the three sets of data relating the Essay group with each of the other groups, the results

TABLE VI.10(c): Essay/Tutorial Groups Discrimination
Data for Selected Predictors
(Unadjusted SBQ5 Scores)

	INT	SBQ5	ANX $\times$ INT $\times$ SBQ5
<i>F</i> value:	1.980	3.595	6.131
<i>p</i> estimates:	.166	.064	.018
LDF Correlations:	.560	.737	.929
Wilks' Lambda:	.814		
R^2 :	.186		
Chi ² :	6.489	df=3;	<i>p</i> =.089

for each paired test supported the predicted group differentiations, at a less stringent level of statistical significance ($p < .08$), in one comparison (Essay/Analytic Report groups), approached significance in a second comparison (Essay/Tutorial groups, $p < .09$) and failed in the third (Essay/Child Study). For both comparisons where statistical significance was either reached or approached, the three-way Anxiety $\times$ Introversion $\times$ Study Behaviour (Scale 5) interaction was prominent, but as a function of low rather than high SBQ5 scores in the Essay group. This was in conflict with the expectations at this point. Scale directionalities for other relevant variables were as predicted. It was noted that estimates of R^2 based on the Wilks' Lambda statistic (*viz.* $1 - \lambda$) indicated that from 18.6% to 40.3% of variance was accounted for in these analyses.

TABLE VI.11(a): Group Discrimination Data for the Analytic Report/Child Study Groups as a Function of Stability-Introversion^a-SBQ5 *versus* Anxiety-Introversion-SBQ5.^b

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
Group					Means				
1. Analytic Report	(12)	10.64	9.94	10.04	113.72	106.90	101.41	1142.57	1077.32
2. Child Study	(18)	9.61	9.98	9.79	93.64	98.51	102.08	963.72	987.34
Univariate <i>F</i> values:		7.46	.02	.39	7.48	1.83	.01	3.70	1.32
<i>p</i> estimates:		.01	.89	.54	.01	.18	.91	.06	.26
LDF Correlations:		.83	-.04	.21	.83	.45	-.04	.62	.38
Wilks' Lambda:	.691								
R ² :	.309								
Chi ² :	9.232	df = 8;		<i>p</i> = .324					

a. Reflected INT for Analytic Report Group interaction terms.

b. Reflected SBQ5 for Child Study Group interaction terms.

The Analytic Report Group

Null Hypothesis IV(d)

$H_{O_{IV(d)}}$ i: That group discrimination between the Analytic Report group and the Child Study group is not significant at $p < .08$;

(d)ii: That Stability, Introversion, and SBQ Scale 5 in joint interaction and severally, do not contribute significantly to group separation at $p < .08$;

Primary data for these hypotheses appear as Table VI.11(a). When appropriate elements were selected for further analysis, null hypothesis (d)i was rejected (at $p < .06$); it was possible to differentiate the Analytic Report and Child Study groups as a function of the variables under consideration. With respect to null hypothesis (d)ii, Anxiety in both linear and quadratic form (See Figure VI.7) and the $ANX^2 \times SBQ5$ compound emerged as significant elements, but Introversion and all terms which contained it proved not to be significant. The Analytic Report group registered a significantly higher level of Stability than the Child Study group. It was also evident however that, as in the previously reported Essay group comparisons, the predicted directional effects (and hence the corrective scale reflections based on them) were

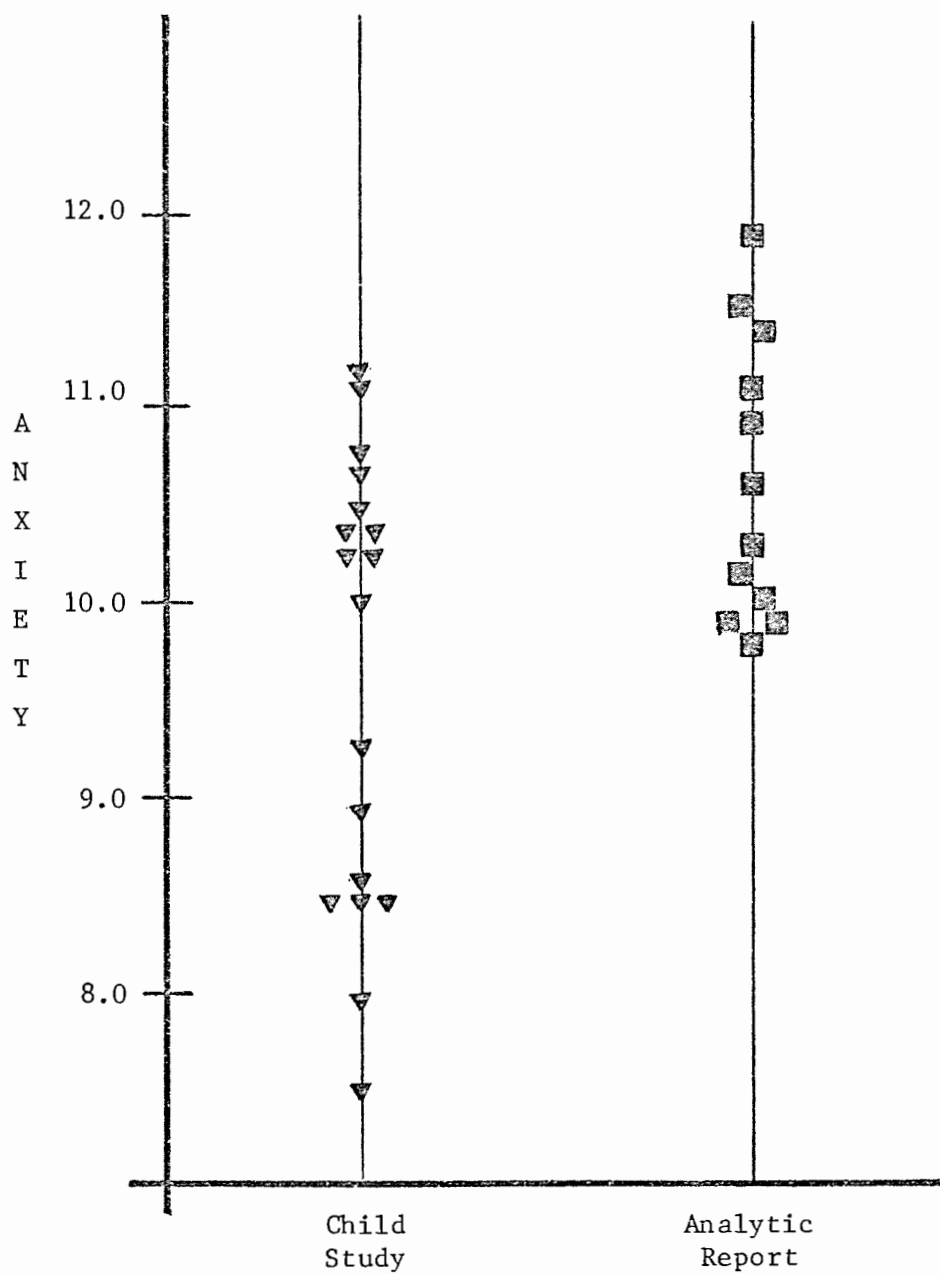


FIGURE VI.7: *Anxiety-Stability as a Quadratic Discriminator for the Child Study and the Analytic Report Group*

TABLE VI.11(b): Analytic Report/Child Study Groups
Discrimination Data for Selected
Predictors

	ANX	ANX ²	ANX ² $\times$ SBQ5
<i>F</i> values:	7.461	7.480	3.704
<i>p</i> estimates:	.011	.010	.062
LDF Correlations:	.928	.930	.692
Wilks' Lambda:	.756		
R^2 :	.244		
Chi ² :	7.697	df = 3;	<i>p</i> = .052

confounded by the data, since the Analytic Report group recorded non-significantly higher SBQ5 scores by contrast with the Child Study group. Accordingly a further analysis was performed in order to find out how far this unexpected masking of group differences was affecting group separation. Following the re-orientation of SBQ5 scores for the Child Study group and the additional selection of key variables, group discrimination statistics as reported in Table VI.11(c) were derived. While it was evident that the separation function remained significant (at $p < .08$), though at an expanded fiducial level, it was also clear that the re-oriented scores yielded a marked increase in the contributions to group separation for all terms containing SBQ5 as an interactive element in association

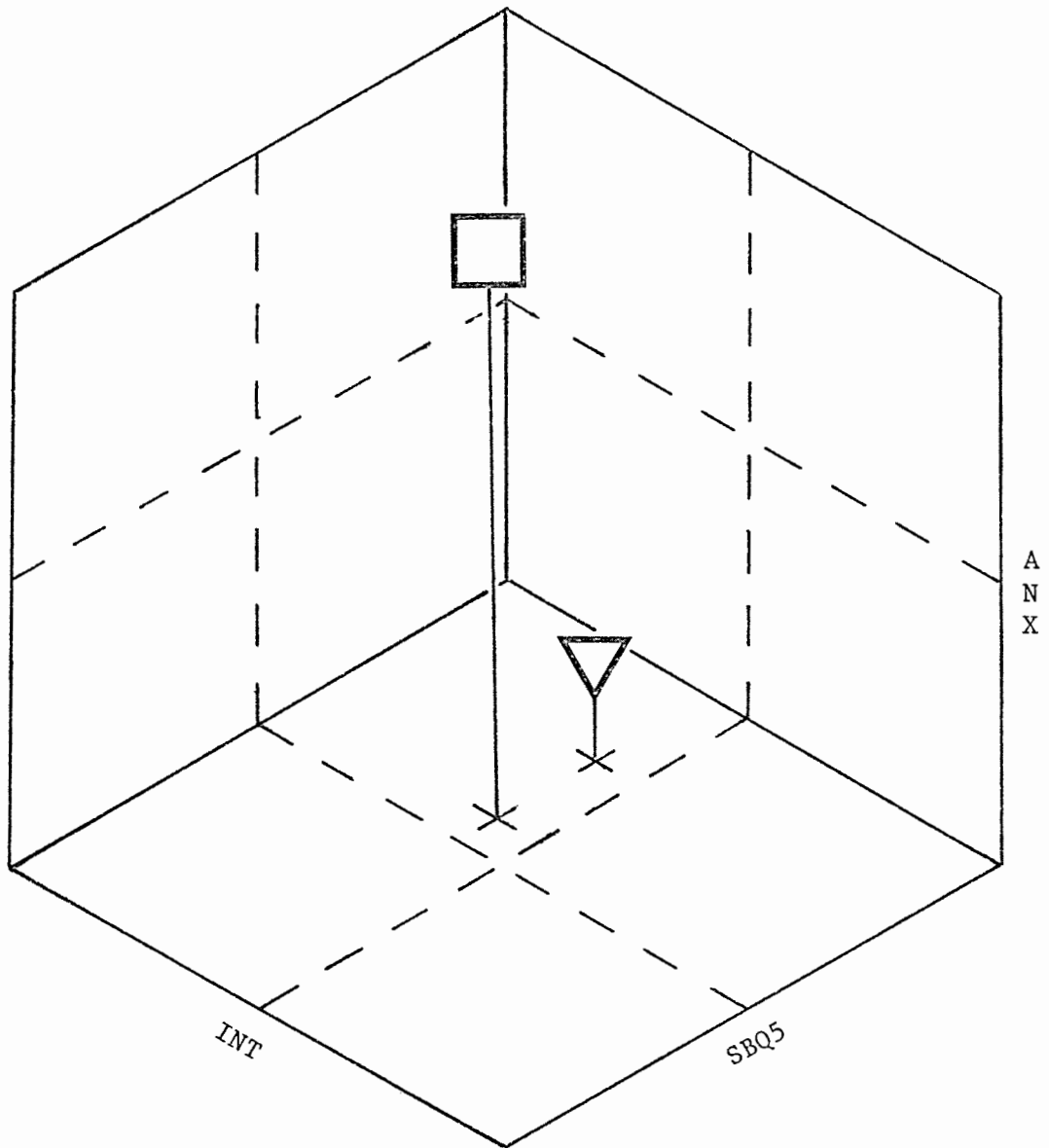


FIGURE VI.8: *Three Dimensional Locations for the Analytic Report Group ($\square$) and the Child Study Group (∇).*

with Anxiety. The significant three-way compound is illustrated in diagrammatic form in Figure VI.8.

TABLE VI.11(c): Analytic Report/Child Study Groups
Discrimination Data for Selected
Predictors (Unadjusted SBQ5 Scores)

	ANX	ANX $\times$ SBQ5	ANX ² $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
<i>F</i> value:	7.461	7.441	9.685	4.745
<i>p</i> estimate:	.011	.011	.004	.036
LDF Correlation:	.873	.872	.965	.725
Wilks' Lambda:	.724			
R^2 :	.276			
Chi ² :	8.715	df = 4;	$p = .068$	

Null Hypothesis IV(e)

$H_{O_{IV(e)}}$ i: That group discrimination between the Analytic Report group and the Tutorial group is not significant at $p < .08$;

(e)ii: That Stability, Introversion, and SBQ Scale 5 in joint interaction and severally, do not contribute significantly to group separation at $p < .08$.

The relevant data for these hypotheses are set out in Tables VI.12(a) and VI.12(b). Null hypothesis (d)i was accepted; there was no significant group differentiation between the Analytic Report and Tutorial groups as a function of the elements under consideration. Null hypothesis (e)ii was rejected only in the case of Anxiety (both linear and quadratic) and was accepted for all other elements. Anxiety-Stability in quadratic form is displayed graphically in Figure VI.9.

In summary, the contrasts between the Analytic Report group and the Child Study and Tutorial groups respectively offered clear support for group differentiation as a function of the hypothesized variables in the case of the Child Study group, but failed to support the prediction in the case of the Tutorial group. For both comparisons, Anxiety was found to be prominent as a contributor to group separation both as a linear and as a quadratic term. Anxiety was also salient as a predictor in significant interaction with the Study Behaviour scale. The estimates of shared variance for these analyses ranged from 23.3% to 30.9%.

TABLE VI.12(a): Group Discrimination Data for the Analytic Report/Tutorial Groups as a Function of Stability, Introversion, and SBQ5^a

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
Group					Means				
1. Analytic Report	(12)	10.64	9.94	10.05	113.72	106.90	101.41	1142.57	1077.32
2. Tutorial	(20)	10.04	10.16	10.34	101.24	103.63	104.82	1044.07	1051.44
Univariate <i>F</i> values:		5.08	.37	.61	5.15	.54	.40	2.31	.20
<i>p</i> estimates:		.03	.55	.55	.03	.52	.54	.14	.66
LDF Correlations:		.81	-.22	-.32	.81	.30	-.21	.61	.20
Wilks' Lambda:	.767								
R ² :	.233								
Chi ² :	7.155	df = 8; <i>p</i> = .521							

a. Reflected INT Scale for all interaction terms.

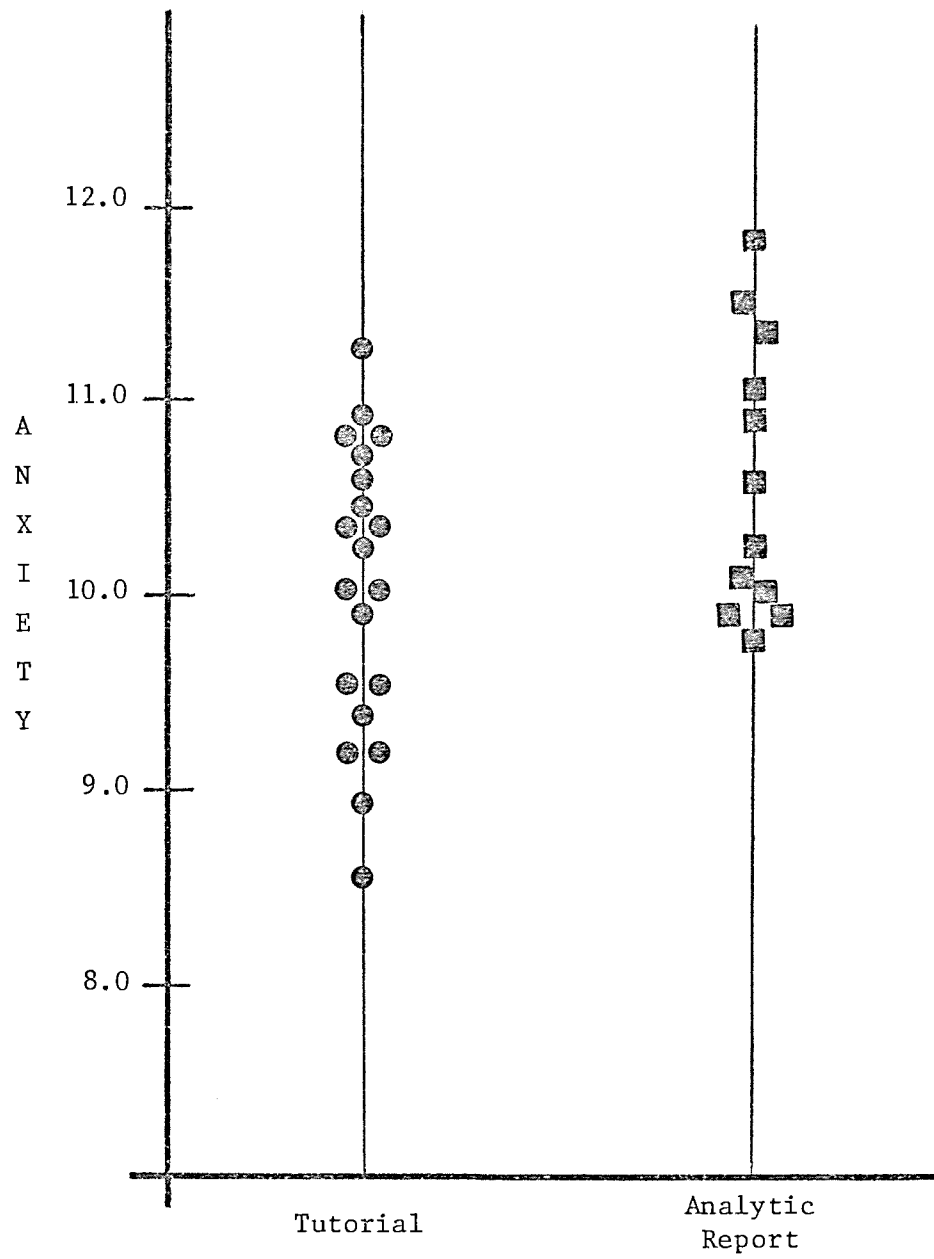


TABLE VI.12(b): Analytic Report/Tutorial Groups
Discrimination Data for Selected
Predictors

	ANX	ANX ²	ANX ² x SBQ
F values:	5.082	5.152	2.310
p estimates:	.030	.029	.136
LDF Correlations:	.970	.976	.681
Wilks' Lambda:	.846		
R ² :	.154		
Chi ² :	4.932	df = 3;	p = .176

The Child Study Group

Null Hypothesis IV(f)

H₀_{IV(f)} i: That group discrimination between
the Child Study group and the
Tutorial group is not significant
at $p < .08$;

(f)ii: That Anxiety, Introversion, and
SBQ Scale 5 in joint interaction
and severally, do not contribute
significantly to group separation
at $p < .08$.

The data for these hypotheses are set out in
Tables VI.13(a)-VI.13(c). It was clear from the group
means reported in Table VI.13(a) that, as in the
previous comparisons, the directional prediction

TABLE VI.13(a): Group Discrimination Data for the Child Study/Tutorial Groups as a Function of Anxiety-Introversion-SBQ5^a versus Stability-Extraversion-SBQ5

Group	(N)	ANX (A)	INT (I)	SBQ5 (S)	A ²	AS	IS	A ² S	AIS
Group					Means				
1. Child Study	(18)	9.61	9.98	10.21	93.64	98.51	102.08	955.82	987.34
2. Tutorial	(20)	10.04	10.16	9.66	101.24	97.09	98.37	978.09	989.59
Univariate <i>F</i> values:		1.85	.31	2.22	1.60	.07	.49	.26	.00
<i>p</i> estimates:		.18	.59	.14	.21	.79	.50	.62	.97
LDF Correlations:		.48	.20	-.52	.45	-.10	-.25	.18	.01
Wilks' Lambda:		.788							
R ² :		.212							
Chi ² :		7.961	df = 8;		<i>p</i> = .337				

a. Reflected SBQ5 for Child Study Group interaction terms.

associated with SBQ5 scores was in error, thereby serving to confound the impact of the compound effects. Two separate follow-up analyses were therefore carried out. In the first, variables were selected for closer inspection in terms of the study's predictions, and in the second, variables were selected following the re-orientation of SBQ5 scores. Results of the first

TABLE VI.13(b): Child Study/Tutorial Groups
Discrimination Data for Selected
Predictors

	ANX	SBQ	ANX ²
<i>F</i> value:	1.845	2.221	1.603
<i>p</i> estimate:	.180	.141	.211
LDF Correlation:	.509	-.556	.476
Wilks' Lambda:	.812		
<i>R</i> ² :	.188		
Chi ² :	7.404	df = 3;	<i>p</i> = .060

analysis are set out in Table VI.13(b). Null hypothesis (f)i was rejected on the basis of the data contained in this table; the Child Study and Tutorial groups were distinguishable as a function of the variables under consideration. While the overall level of group separation was significant however (at $p < .07$), none of the contributing elements in the separation function

was associated with a significant univariate F value. It was thus necessary to accept null hypothesis (f)ii.

Results for the second analysis are reported in Table VI.13(c). The impact of the decision to return SBQ5 scores to their original polarity was marked in the case of the three compounds included in the tabled results, but at the same time there was a clear fall in

TABLE VI.13(c): Child Study/Tutorial Groups
Discrimination Data for Selected
Predictors (Unadjusted SBQ5 Scores)

	ANX $\times$ SBQ5	ANX ² $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
F values:	5.647	4.725	5.201
p estimates:	.022	.034	.027
LDF Correlations:	.962	.929	.890
Wilks' Lambda:	.854		
R^2 :	.146		
Chi ² :	5.621	df = 3;	p = .131

the level of separation by virtue of the redundancy of elements. Throughout these comparisons it was evident that Anxiety-Stability continued, as in other comparisons, to play a prominent role, particularly when compounded with Study Behaviour scores as originally measured. (Figure VI.10 illustrates the significant three-way interaction diagrammatically.) In no case were differences associated with the Introversion-Extraversion dimension significant.

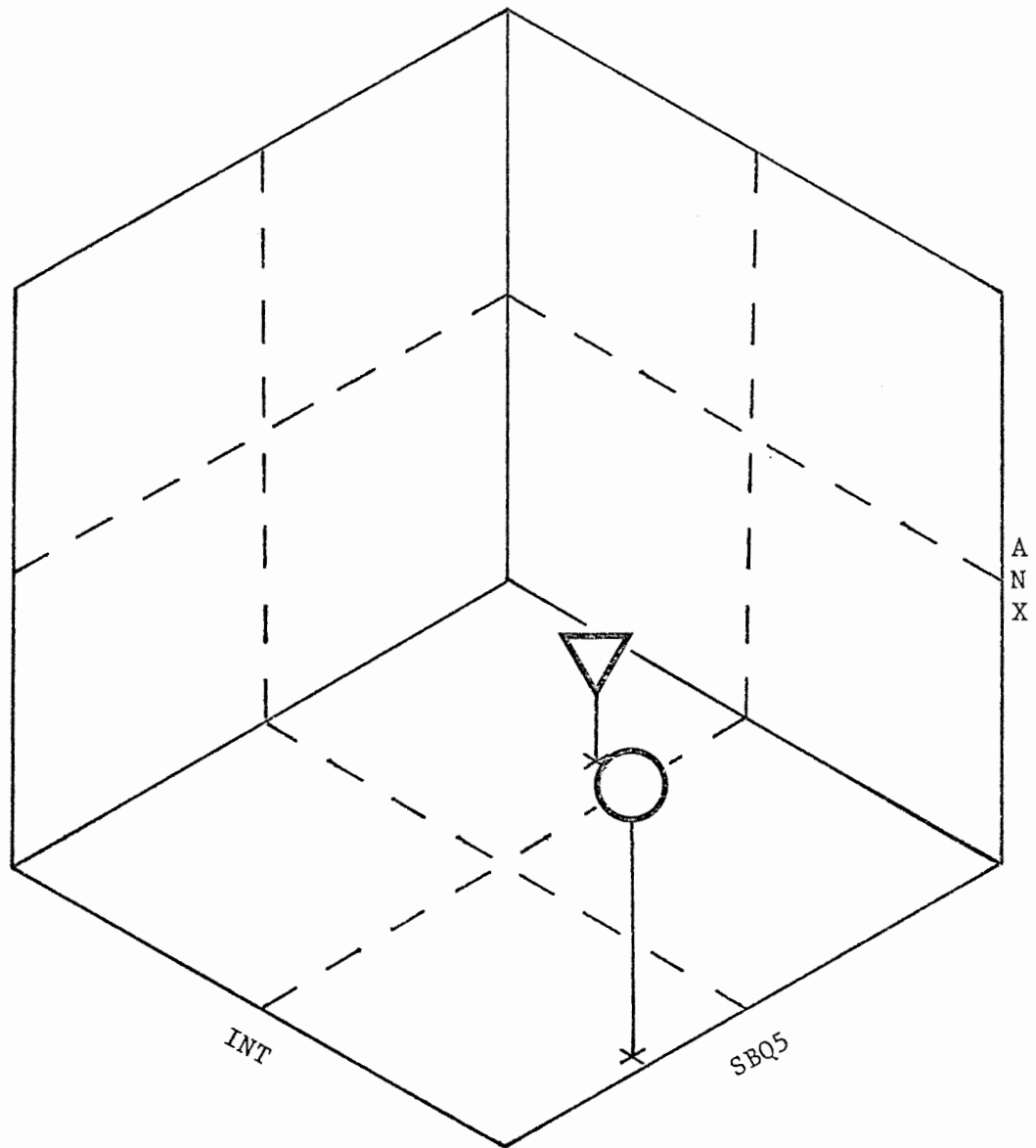


FIGURE VI.10: *Three Dimensional Locations for the Child Study Group (∇) and the Tutorial Group ($\circ$).*

TABLE VI.14: Summary Details of Level II Results

Hypothesis	Result
(a) Essay as a function of Anxiety, Introversion, SBQ5, and three-way interactive compound (ANX $\times$ INT $\times$ SBQ)	Significance test on F value for total R^2 : NS. Cohen's incremental F test not applied.
(b) Analytic Report as a function of Stability, Introversion, SBQ5, and three-way interactive compound (STAB $\times$ INT $\times$ SBQ)	Significance test on F value for total R^2 : NS. Cohen's incremental F test not applied.
(c) Child Study as a function of Anxiety, Introversion, SBQ5, and three-way interactive compound (ANX $\times$ INT $\times$ SBQ)	Significance test on F value for total R^2 : NS. Cohen's incremental F test not applied.
(d) Tutorial performance as a function of Stability, Extraversion, SBQ5, and three-way interactive compound (STAB $\times$ EXT $\times$ SBQ)	Significance test on F value for total R^2 : NS. Cohen's incremental F test not applied.

General Summary of Second Phase Results

The focus of primary concern in Second Phase analyses was directed towards the interaction effects involving Anxiety-Stability, Introversion-Extraversion, and Study Behaviour as these were postulated to relate differentially to performance on four distinguishable tasks. At Level II, where hypotheses were formulated

in terms of the multiple linear regression analysis of data, entering performance scores as continuous dependent variables (see Table VI.14), all four null hypotheses were accepted in the face of non-significant total R^2 indices. No test was therefore contemplated of the incremental contribution to each R^2 expressed in the Anxiety $\times$ Introversion $\times$ Study Behaviour term and no attempt was made to apply Johnson-Neyman analyses to the data. In their stead an alternative analytic strategy was pursued based on coarser group membership data classifications. Analyses under this strategy explored group characteristics in terms of hypothesized differentiations, expressed in the form of coded group membership, as a function of Anxiety-Stability, Introversion-Extraversion, and organizational aspects of Study Behaviour all entered as continuous variables (see Table VI.15). Global discriminations at this level were not supported by the results except in the case of the comparison involving the Analytic Report group in contrast with all other groups taken together. The group discrimination for this comparison was significant at a relaxed fiducial level ($p < .08$). While the other three tests of group separation failed to reach significance, it was evident that Anxiety-Stability, both as a linear and quadratic term, and the interactive compound involving Anxiety-Stability and the Study Behaviour elements were prominent as significant

TABLE VI.15: Summary Details of Level III Results

Hypothesis	Result
(a) Essay/non Essay group membership in terms of Anxiety, Introversion, SBQ5, and interactive compounds.	No group discrimination at $p < .08$, no element or compound significant at $p < .08$.
(b) Analytic Report/non-Analytic Report group membership in terms of Stability, Introversion, SBQ5, and interactive compounds.	Group discrimination at $p < .08$, STAB, STAB ² , STAB $\times$ SBQ and STAB ² $\times$ SBQ significant at $p < .05$.
(c) Child Study/non-Child Study group membership in terms of Anxiety, Introversion, SBQ5, and interactive compounds.	No group discrimination at $p < .08$; ANX, ANX ² , ANX ² $\times$ SBQ, and ANX $\times$ INT $\times$ SBQ significant at $p < .05$, for adjusted SBQ5.
(d) Tutorial/non-Tutorial group membership in terms of Stability, Extraversion, SBQ5, and interactive compounds.	No group discrimination at $p < .08$; SBQ, EXT $\times$ SBQ, and STAB $\times$ EXT $\times$ SBQ significant at $p < .07$.

contributors to group separation. But the three-way interaction involving Anxiety, Introversion, and the SBQ5 Scale reached significance for only one contrast, *viz.* the Tutorial *versus* non-Tutorial groups.

At Level IV which was the last stage of analysis in the Second Phase, group comparisons were tested by taking groups two at a time. Based on the hypothesized relationships between predictors and task performance,

six pairwise tests were carried out (see Table VI.16). In three of these contrasts, *viz.* the Essay *versus* Analytic Report, Analytic Report *versus* Child Study, and Child Study *versus* Tutorial comparisons, group discriminations were registered at the pre-set ($p < .08$) level and in a fourth (Essay *versus* Tutorial) the discrimination approached it ($p < .11$). For the two remaining group comparisons, separation was not achieved at a significant level. With the exception of the Essay *versus* Child Study comparison in which none of the predictor elements or compounds contributed significantly to group discrimination, significant differences were registered at a number of points. In particular, Anxiety-Stability as a linear and quadratic term, either taken alone or in interactive compound with Study Behaviour, was a prominent element in contrasts involving the Essay/Analytic Report, Analytic Report/Child Study, and Analytic Report/Tutorial pairings. For comparisons involving the Essay and Child Study groups it was found that the predicted SBQ5 effects were not supported by the data, and adjustments to these scores regularly served to confound the study's postulates regarding a three-way interaction based on the Anxiety-Stability: Introversion-Extraversion: Study Behaviour compound. When follow-up analyses were performed using unadjusted SBQ5 scores, this compound emerged as a significant element in the discriminant

TABLE VI.16: Summary Details of Level IV Results

Hypothesis	Result
<u>The Essay</u> (testing for Anxiety, Introversion, SBQ5, and compounds):	
(a) <i>versus</i> Analytic Report (Stability: Introversion; SBQ5)	Group discrimination at $p < .08$; ANX, ANX ² terms significant at $p < .08$; ANX $\times$ SBQ5 compounds significant for unadjusted SBQ scores (at $p < .05$)
(b) <i>versus</i> Child Study (Anxiety; Introversion; SBQ5)	No group discrimination at $p < .08$; no element or compound significant at $p < .08$.
(c) <i>versus</i> Tutorial (Stability; Extraversion; SBQ5)	Group discrimination at $p < .11$; SBQ5 term significant at $p < .07$; ANX $\times$ INT $\times$ SBQ5 significant (at $p < .02$) for unadjusted SBQ5 scores.
<u>The Analytic Report</u> (testing for Stability, Introversion, SBQ, and compounds):	
(d) <i>versus</i> Child Study (Anxiety; Introversion; SBQ5)	Group discrimination at $p < .06$; STAB; STAB ² , and STAB ² $\times$ SBQ5 significant at $p < .07$; STAB $\times$ SBQ5 and STAB $\times$ INT $\times$ SBQ5 significant for unadjusted SBQ5 scores (at $p < .04$).
(e) <i>versus</i> Tutorial (Stability; Extraversion; SBQ5)	No group discrimination at $p < .08$; STAB and STAB ² significant at $p < .04$.
<u>The Child Study</u> (testing for Anxiety, Introversion, SBQ5):	
(f) <i>versus</i> Tutorial (Stability, Extraversion, SBQ5)	Group discrimination at $p < .07$; no element or compound significant at $p < .08$; ANX $\times$ SBQ5, ANX ² $\times$ SBQ5, and ANX $\times$ INT $\times$ SBQ5 significant for unadjusted SBQ5 scores (at $p < .04$).

function for the Essay/Tutorial, Analytic Report/Child Study, and Child Study/Tutorial comparisons. In each case however, this reorientation of SBQ5 scores amounted to the refutation of one aspect of the study's expectations.

CHAPTER VII

DISCUSSION OF SECOND PHASE RESULTS

In the interpretation of results from the study's second and principal phase of analysis it is important to recognize that at each level, the statistical technique used to explore the data yielded information which effectively answered three somewhat different questions. At Level II, the relevance of a highly sensitive multiple regression approach for delineating regions of statistical significance was under investigation, but with specific reference to each performance task taken severally across the entire sample. The results at this point were therefore pertinent to the question whether there was an intersection of performance trend lines as a function of within-task achievement. While this question had an obvious bearing on the issues raised in the present research, the information it provided was of a preliminary kind to that achieved from group comparisons. Had it been found, for example, that incremental R^2 values were sufficient to justify the use of Johnson-Neyman procedures, subsequent comparisons between tasks would still have been required in order to answer the central question which the study was designed to explore.

The results at Level II were uniform and unequivocal. There was no evidence to indicate that,

for the sample as a whole, within-task measures of achievement shared a sufficient proportion of variance with the predictors selected for analysis to warrant closer inspection. The variance accounted for at this level was slight, ranging from 2.2% to 5.9% and averaging 4.2% across all four tasks. While these proportions were non-significantly small, they are in close agreement with results from similar analyses of ATI performance data reported by Scott & Elsworth (1978) where non-intellective factors accounted for 9%-12% of raw achievement variance, and interaction effects ranged from 1% to 3%. Moreover these findings correspond with the general tenor of results summarized by Cronbach & Snow (1977).

There is therefore no reason to look on the four performance tasks in the present study as in any way distinguished by their functional relationships with Anxiety-Stability, Introversiion-Extraversiion, and the SBQ5 Scale. And there is consequently no evidence to suggest that within-task achievement in each case is systematically predictable from the structures that were hypothesized on the basis of prior task analyses.

While it is self-evident that null findings of this kind are likely to be a function of inadequate measuring devices, particularly in the performance domain, the R^2 values which emerged were so slight that an actual null relationship must be seriously acknowledged. The unavoidable conclusion at this point must

be that achievement within each task does not reflect the differential impact of the predictor elements, either taken severally or in compound form.

It follows from this general conclusion at Level II that whatever it is that was measured by the assessment procedures involved, performance scores do not appear to be functioning to any substantial degree as indices of the personality characteristics under examination. At the same time it appears from the details given in Appendix M that the separate measures of performance could not be simply explained in terms of an index of general ability (the Tertiary Entrance Score). Since the estimate of explained variance following Level II analysis remains in the region of 5%, attempts to speculate about the unexplained portion are exceedingly hazardous and will not be pursued. Instead, results following the analyses at Levels III and IV will be considered.

The coarser analyses at Level III based on group membership were designed to answer the question whether each of the performance tasks, when set in contrast with all other task groups combined, could be differentiated in terms of the predictor set. A small though crucial step was thus taken at Level III towards the more detailed investigation of between-task performance as a function of Anxiety-Stability, Introversion-Extraversion, and the SBQ5 Scale. In

keeping with this important shift in emphasis, group discrimination techniques were employed with group membership as the effective dependency.

Of the four discrimination analyses carried out at this Level, there was clear support for group differentiations in only one case. This involved the Analytic Report group. Group separation proved to be a function of Stability, the SBQ5 Scale, and the Stability $\times$ SBQ5 compound together with Stability scores expressed in quadratic form. Although none of the remaining three attempts at group discrimination reached an acceptable level of statistical significance, the importance of Anxiety-Stability as a contributing element in discriminations involving the Child Study *versus* Others, and Tutorial *versus* Others was clearly demonstrated; and the compound involving Study Behaviour Scale 5 and Anxiety (in quadratic form) was also prominent.

The sole occasion at Level III when the three-way Anxiety $\times$ Introversion $\times$ SBQ5 compound exceeded the study's pre-set fiducial limit (of $p < .08$) involved the Tutorial Group *versus* Others. Although overall group discrimination was not achieved, the benefits of relative Stability, Extraversion, and Organizational Study Behaviour skills were apparent on this occasion in the compounded form which had been predicted.

No differentiations were registered at Level III

apart from those referred to above, and the general character of these findings remained, as in Level II, largely devoid of any consistent support for the hypothesized effects. In the comparison involving the Essay group with all other groups combined, there was no indication whatever to link group membership with any of the key reference variables. While it is necessary to conclude, therefore, that Level III analyses yielded generally null results, several aspects of detail should be looked at more closely. First, the successful differentiation in the case of the Analytic Report group as a function of Stability was in close agreement with the postulated structure of infraskills for this task. As an exercise that most nearly approximated an essentially science-type activity, competent Analytic Report writing was considered likely to reflect those characteristics commonly associated with the science-type personality, *viz.* a cool, detached, impersonal stance marked generally by low levels of Anxiety. The results are entirely consistent with these expectations; the Analytic Report group was significantly more Stable (at $p < .02$) than all other groups combined. In this respect there was clear evidence to indicate that the measure of successful performance for this task was to some extent reflecting a specific personality dimension.

Second, the study's particular focus on interactive

compounds was justified in part by the prominence of Stability $\times$ SBQ5 as a significant term for Analytic Report group separation. Moreover, this emerged even though the Study Behaviour scale on its own was quite unrelated to group membership. It appears that organizational study skills are of no very direct benefit to students for this task, but have substantial indirect value in conjunction with low levels of Anxiety. SBQ5 scores in this case thus appear to have taken on a moderating impact in keeping with the study's expectations, but only in association with Anxiety-Stability.

Third, Anxiety-Stability also proved salient as an element in Child Study group membership. When compared with all other groups combined, mean Anxiety scores were significantly lower (at $p < .04$) for the Child Study group, indicating a higher actual level of Anxiety for this group. This result also agreed with expectations based on the postulated task infraskills and the generalized drive properties associated with Anxiety.

Fourth, the theoretical speculation that Anxiety as a drive would be likely to enter into a curvilinear relationship with achievement under the Yerkes-Dodson principle was evidently justified with reference to group membership for both the Analytic Report and the Child Study groups. Furthermore, in both cases the Anxiety-Stability term in quadratic form was also

associated with the SBQ5 score to yield a significant compound element. Once again these results lend considerable support to the study's specific interest in conjoint effects of this kind, with Study Behaviour continuing to function as predicted in a moderating way, except that the Child Study group's SBQ5 mean was marginally (and non-significantly) lower than the mean for the other groups combined. In general the results for both the Analytic Report and Child Study groups following Level III analyses were in close agreement that drive-based curvilinear effects of the Yerkes-Dodson type were significant in their own right and also when compounded with the SBQ5 score. It was apparent that the impact of Anxiety-Stability for these two groups followed contrasting patterns such that moderate to high, but not extreme, levels of Anxiety (Child Study) and Stability (Analytic Report) were associated significantly with group membership.

The final aspect of importance to flow out of the analyses at Level III bears directly on the three-way Anxiety $\times$ Introversion $\times$ SBQ5 compound. In two of the four discriminant analyses, *viz.* the Child Study *versus* Others and Tutorial *versus* Others, this term emerged as a significant element (at $p < .06$ and $p < .05$ respectively), although the specific effect of the SBQ5 scale for the Child Study group ran counter to the study's initial expectation. Group membership in this case was

associated with Anxiety, Introversion, and relatively (though non-significantly) lower Study Behaviour scores reflecting a marginally less well organized schedule of study. In view of the fact that a significant level of overall group separation was not achieved with the Child Study group, it would be unwise to emphasize the three-way interaction in this case. It should be noted, however, that its significance as a contributing element highlights a behaviour pattern which has often been associated with successful performance in undergraduate work. For this reason it is particularly instructive to compare it with the corresponding pattern for the Tutorial group. In this comparison the Stability and Extraversion poles were linked, in association with significantly higher SBQ5 scores ($p < .07$); moderated effects were again evident, neither of the personality components being significant when considered alone.

On the face of it, the identification of relative success in tutorial work with a behaviour pattern which compounds low Anxiety and Extraversion with a well organized study schedule is fairly unremarkable. When set beside the results for the Child Study in which a contrasting polarity was identified for each element, the relevance of a behaviour-pattern $\times$ task differentiation becomes evident. In this respect the results appear to offer modest support for the view that concepts of competence and achievement in performance at the undergraduate level should be

non-unitary and might even embrace some otherwise contradictory elements.

There is every reason at this point to reiterate the general conclusion that Level III findings failed to provide strong or consistent support for the study's expectations. It will be evident though, in view of the several qualifications that have been discussed, that some of the results corresponded with what had been predicted, particularly those relating to the role played by Anxiety-Stability as a drive, and to some aspects of interaction. It remains true however that for three of the four tasks under study at Level III, there were no grounds on which to claim that the relevant groups were distinguishable in contrasts involving all other groups taken together. It was not possible to link relative task competence with the characteristics regarded as important for each task so as to achieve significant group separation for these three tasks. With the exception of the Analytic Report group and a small number of elements or compounds in contrasts involving the Child Study group and the Tutorial group, the results following Level III analyses were consistent with a somewhat global view of achievement as a function of the specific predictors that were used.

The last set of results to be discussed here was generated by analyses at Level IV. These were based on six paired group-by-group contrasts and were designed

to answer the question whether group membership, as a reflection of relative task achievement, was functionally related to the elements of the predictor set. By employing each group in paired comparisons with each of the remaining groups, quite specific differentiations were explored having a direct bearing on the articulation of performance components.

When compared with the results reported for analyses at the two previous Levels, results following Level IV analyses offered rather stronger support for the study's expectations. In three of the six attempts to differentiate the groups, an acceptable level of group separation was achieved, and in two of these the Anxiety $\times$ Introversion $\times$ SBQ5 compound was found to be a relevant contributing term; it was also prominent in one other case where overall group separation did not reach significance. Once more there emerged consistent evidence linking Anxiety-Stability with group membership in both linear and quadratic forms and in compounds with the SBQ5 scale. And it was again evident that the Analytic Report and Tutorial groups were distinguished by relative Stability whereas the Essay and Child Study groups were relatively more Anxious. These findings agreed with the study's detailed predictions and gave further support to the general argument concerning the differentiation of achievement. It appears that, to a limited extent, the infraskills which may be postulated as basic

elements of specific performance tasks were effectively tapping personality resources in a systematic way. In particular the Essay and the Child Study groups, which were indistinguishable from all other combined groups under the analyses carried out at Level III, were clearly differentiated at Level IV when contrasted specifically with the Analytic Report group (for both Essay and Child Study) and the Tutorial group (Child Study only).

When these results are placed beside data from the three occasions on which the Anxiety $\times$ Introversion $\times$ SBQ5 compound made a significant contribution to group separation, the case for varying degrees of group differentiation is reasonably well supported. For each group there were three effective tests of discrimination, and differentiation was reported for one of these in the case of the Essay (*versus* Analytic Report) and one in the case of the Tutorial (*versus* Child Study), and for two in the case of the Analytic Report as well as the Child Study since they were also differentiated from each other. At the same time it was evident that no separation of groups was achieved for the Essay *versus* Child Study comparison, and this was in general agreement with similarities between these groups as expressed in the set of infraskills postulated for each task.

An additional index of the extent to which Level IV results support a general case for group identity may

be found in the reported R^2 estimates for each paired contrast. While these values were not always associated with acceptable levels of statistical significance, they are nonetheless important as guides to the proportion of variance accounted for by group membership. For the present analyses the estimates ranged from 14.6% for selected variables in the case of the Child Study *versus* Tutorial group comparison, to 40.3% for the complete set of predictors in the comparison involving the Essay and Analytic Report groups. Typically the proportion was of the order of 20%, or twice as much as that encountered at Level III and more than four times the estimates at Level II.

In the discussion up to this point, the character of Level IV results has clearly been favourable in so far as the study's basic concern was with group separation. It was evident at a number of places, however, that detailed predictions were not supported. First, the moderating role played by the Study Behaviour scale served to confound expectations in comparisons involving the Essay and Child Study groups with other groups since both these groups scored marginally lower SBQ5 scores by contrast with the Analytic Report and Tutorial groups. And in the second place, tests of group discrimination for contrasts between the Tutorial group on one hand and the Essay and Analytic Report groups respectively on the other did not reach

significance even though the predictions in both cases appeared to be entirely consistent with the infraskill structures derived from task analyses.

So far as the first of these two issues is concerned it appears that the Study Behaviour component has emerged from the present analyses as a relatively low level descriptive element in the majority of contrasts. It has clearly not been found to act in the dynamic, moderating fashion that was postulated. But the typically non-significant group differences in SBQ5 scores, indicating that Essay and Child Study group members were less organized than their Analytic Report and Tutorial group counterparts in approaching their work, served to accentuate group differences when compounded with Anxiety and Anxiety $\times$ Introversion. While the initial differences, being non-significant, would ordinarily call for little discussion, the circumstances encountered here require some additional explanation. Thus, students whose best performance located them in the Analytic Report group were thought of in terms of a science-type pattern of traits, and organizational study skills are altogether commensurate with this; those similarly allocated to the Tutorial group were likewise expected to be systematic in their work since the tutorial programme operated on a regular weekly schedule that was expected to suit an orderly study regimen. By contrast, it seems that relative success for the Essay and Child Study groups was characterized by marginally

lower SBQ5 scores, which suggests that the tasks involved were not so dependent on organizational routines of this kind.

With reference to the second issue having to do with the non-significant differentiations for Tutorial/Essay and Tutorial/Analytic Report group comparisons, results in the former case offered some support for the study's predictions, but in the latter case, anticipated patterns of Introversion-Extraversion for these groups were not observed. The Tutorial and Analytic Report groups were sufficiently alike in this respect, as in their SBQ5 scores, that group separation was virtually dependent on differences in Anxiety-Stability. While these proved to be significant, and conformed with the expectation that the Analytic Report group would be characterized by greater Stability, the differences were not enough to effect overall group separation.

Some Comments on the Main Trends

The principal focus of interest in the present research was directed towards the relevance for undergraduate performance of an Aptitude-Treatment-Interaction model. In the discussion of detailed results considered so far, this model has enjoyed very uneven support. There was no evidence, following the analyses at Level II, which acknowledged its value, and the evidence at Level III was generally quite insufficient as a basis for its recommendation. But at Level IV there

were definite indications that the aptitude components selected for study were functioning systematically and differentially in task-relevant ways. Furthermore, at several points in the findings there emerged reliable evidence bearing on the importance for group discriminations of compound elements involving Anxiety-Stability, and the three-way Anxiety $\times$ Introversion $\times$ Study Behaviour term of particular interest as a research issue.

While these trends were not universal, and at some points were actually at variance with the detailed predictions, their implications for the appropriateness of an ATI model are clear. The point has already been made that hypotheses at Level IV represented the most refined formulation of the ATI paradigm since they dealt specifically with comparisons based on individual tasks in terms of the predictor set. In this context, the support for a preferential ATI model built upon the infraskill structures that were postulated attached chiefly to those paired groups for which contrasting trait polarities had been identified. The most sharply defined contrasts of this type involved the Essay/Tutorial and Child Study/Tutorial analyses, of which one yielded significant results for overall group separation as well as for the three-way compound, and the other was significant for the compounded term but not at the level of group separation.

Less sharply defined in terms of contrasting polarities was the set of groups for which only one key predictor was involved. This set included the Essay/Analytic Report, Analytic Report/Child Study, and Analytic Report/Tutorial analyses. Only the last member of this set failed to yield significant results for group separation, however there was little support in these three comparisons for the postulated relevance of Anxiety $\times$ Introversion $\times$ SBQ5. In this set it was evident that the principal impact was associated with Anxiety-Stability, the Analytic Report group having been found to score significantly higher than all other groups on Stability.

The least sharply defined paired group contrast, involving the Essay and Child Study groups, was also the least successful in terms of statistical significance. There was no evidence to support group separation in this case, and none of the individual predictors was found to make a significant contribution to the discrimination function. It appears that these two groups are virtually indistinguishable so far as the predictor set is concerned, since in no case did the univariate F values exceed unity.

As an *ex post facto* ordering of the study's findings, this correspondence between comparative task structures and hypothesized aptitude systems is reasonably compelling, at least within Level IV

analyses. And this remains true even when the case against Study Behaviour as a general moderating influence is taken into account, though it was largely because of this that the compound Anxiety $\times$ Introversion $\times$ SBQ5 term proved not to enjoy the degree of support expected.

At their most particularized level, therefore, the study's hypothesized effects were sufficiently congruent with an ATI model to justify its further development and application in the undergraduate arena. When allocated to groups on the basis of their relative (*i.e.* intra-subjective) task achievement, the students from each group could be distinguished from the members of one or more of the remaining groups on systematically defensible, task-related attributes. This pattern of results expresses the essence of an ATI network.

Throughout the results for both Levels III and IV, Anxiety-Stability proved the most salient element in the system. For all cases except the Essay/Child Study comparison, Anxiety taken independently or in compounds involving SBQ5 and Introversion entered significantly into the separation function; and its importance, as Stability, for the Analytic Report and Tutorial groups was a key aspect in discriminations involving the Essay and Child Study groups. In this respect the results have provided strong grounds for a higher level grouping *via* a merging of the Essay and

Child Study groups, and a parallel merging of the Analytic Report and Tutorial groups. This aspect will be explored in follow-up work reported as Phase Three.

At the same time there is cause to remark the consistent absence, at a univariate level, of Introversion-Extraversion from the list of elements contributing to group discrimination. This was particularly unexpected where the Tutorial group was involved since it was confidently predicted that students whose best work was done in tutorial settings would be relatively outgoing, socially assured and confident, in line with traditionally Extraverted behaviour patterns. The results from Level III analyses which compared the Tutorial group with all other groups combined showed that the group mean on Introversion-Extraversion was higher (*i.e.* less Introverted) for the Tutorial group, and similar results were noted in all contrasts at Level IV, but none of these differences was associated with a significant univariate *F* value.

When seen against the three occasions at Level IV which yielded significant results for the three-way compound term that included Introversion-Extraversion, these non-significant findings would suggest that it is the Introversion term rather than Study Behaviour that is acting to moderate the system. As a differentiator of relative achievement, Introversion-Extraversion proved consistently to be in agreement with

the predictions that were derived from the infraskill structures, and it appears that for this reason its failure as a significant term when taken alone did not extend into its conjoint effects with companion variables.

In addition to these general comments on substantive trends, some reference should be made to the status of the dependent variable set. In a weak, recursive sense, the tasks that have been studied were found to be distinguishable, at least in so far as they were represented by a set of groups composed according to the relativistic principle adopted. It can quite readily be argued that, since the detailed task analysis on which predictions were based was solely concerned with tasks as isolated rather than relative entities, predictions that were subsequently confirmed for the existing set of groups also have a clear bearing on task achievement. This argument has to be qualified by the fact that students were allocated to groups not in terms of their raw achievement scores for each task but in accordance with a residualized score from which the variance associated with each of the remaining tasks had been removed. The 'tasks' that were thus dealt with in the present study were statistically rarefied to the extent given in the appropriate multiple regression equations. It remains true nevertheless that, weak and recursive though the linkages are, a case may be

discerned to relate the findings more or less directly to task performance.

The recursive nature of the argument at this point might also be used in part to resolve one of the study's methodological weaknesses. This arose from the naturalistic context of the research which employed the actual performance tasks set for completion by students in the course of their year's work. While every effort was made to ensure that student assignments were assessed strictly in accordance with the specific objectives in each case, the schedule of inter-examiner tests of agreement on student submissions and the active policy of consultation between examiners throughout the course for all aspects of the teaching and assessment programme meant that statistical estimates of concordance were of uncertain value. In these circumstances the appearance of systematically defensible and theoretically reasonable patterns of traits in association with the dependent measures provides a small measure of support for the view that the tasks were being assessed in appropriate ways.

In the discussion so far, the significance of Second Phase results has been considered in systematic terms with exclusive reference to the value of an ATI model. The findings have importance at a broader theoretical level however, and may also serve to guide aspects of Educational practice. The discussion in

these two areas is more suitably placed after the results for Third Phase analyses have been presented in Chapter VIII.

Summary

The results of multiple linear regression analyses provided no grounds for an exploration of performance data in terms of within-task interactions using the Johnson-Neyman procedure. The overall R^2 estimates were, in each case, associated with F -ratios which did not exceed unity. When a coarser multiple regression technique was used in order to contrast each performance task with all remaining tasks taken together, group differences were found to exist, but only to a limited degree. Consistent evidence was noted in the case of Anxiety-Stability to indicate its relative strength as a differentiating element, and some anticipated curvilinear effects were also apparent.

A more detailed inspection of group-by-group discriminations yielded additional results in line with these trends. It was clear that an ordinal pattern of data could be discerned which corresponded with the extent of initially postulated differences in the task infraskills previously identified. The findings at this level of analysis generally confirmed the existence, with some qualifications, of a preferential ATI system.

CHAPTER VIII

RESULTS - THIRD PHASE

The results dealt with in this chapter represent an extension of the analyses at Levels II, III, and IV. Two lines of further inquiry were indicated by the analytic procedures outlined in Chapters III and IV. Both were intended to provide answers to the general question whether the best sub-set of predictor elements had been used. In view of the fact that the predictors actually selected were drawn initially from larger sets, useful follow-up analyses were possible employing additional elements from the Personality or Study Behaviour domain. Since the major interest in the study had to do with the differentiation of tasks with reference to personological characteristics, the follow-up investigations were carried out in the Personality domain. This approach was also considered reasonable on the grounds that Scale 5 of the Study Behaviour inventory was found to be the most appropriate, in both theoretical and statistical terms, for the sample employed. But the theoretical appropriateness of Anxiety-Stability and Introversion-Extraversion was not as well reinforced by the factor and scale analysis results; a general factor labelled Adventurousness, followed by Rigidity, put Anxiety and Introversion into third and fourth positions respectively.

Third Phase analyses were pursued without any detailed theoretical defence for the specific personality components employed, but the strategy was not, on this account, merely opportunist. It was essentially a natural development of the work carried out in Phase Two, and an exercise having direct relevance for the broader ATI issues raised by the study. In this respect, the same basic problem was being investigated, *viz.* the extent to which task-based groups could be differentiated within a personological system, and hence the role played by person- or group-specific factors in identifying performance tasks. And the same underlying reasoning informed this Phase; if it could be shown that groups may be clearly distinguished, the elements involved in separating them can be used as important components in the general case for a differentiated conceptualization of the knowledge structures implied by the tasks being examined.

There were three specific points of interest. First, an attempt was made to explore group separations after the procedures followed at Levels III and IV; *i.e.* groups were analyzed in contrasts involving all other groups taken together, and in contrasts where groups were paired. Second, for all levels of group contrast, the particular role of Anxiety $\times$ Introversion $\times$ SBQ5 was paid special attention at the stage which yielded a best subset of predictors for each case. And third,

a higher order regrouping of the four groups into two (Essay/Child Study *versus* Analytic Report/Tutorial) was investigated based on the postulated infraskill structure and on an inspection of results at Level IV.

Apart from the use of an expanded set of factor-based Personality variables, the procedures in Phase Three were identical to those already described for the study. The original set of eight Personality, Study Behaviour, and associated compound terms entered at Levels III and IV was expanded by adding those Personality elements not previously considered. A new total of twelve first-step variables were thus entered for step-down treatment in $z + 10$ form. The full set was:

1. Adventurousness-Cautiousness (as a description of Personality Factor I, 13.2% of total variance);
2. Complexity-Rigidity (Personality Factor II, 11.0% of total variance);
3. Anxiety-Stability (Personality Factor III, 6.3% of total variance);
4. Introversion-Extraversion (Personality Factor IV, 4.2% of total variance);
5. Radicalism-Conservatism (Personality Factor V, 3.4% of total variance);
6. Distractibility-Single Mindedness (Personality Factor VI, 3.2% of total variance);

7. Study Behaviour Questionnaire, Scale 5 -
Organizational Study Skills;
8. Anxiety (in quadratic form);
9. Anxiety $\times$ SBQ5;
10. Introversion $\times$ SBQ5;
11. Anxiety (quadratic) $\times$ SBQ5;
12. Anxiety $\times$ Introversion $\times$ SBQ5.

Throughout the analyses reported in this chapter, the polarities for each variable were set according to the best indications from results already considered. This meant that all terms were entered for analysis in unreflected mode. The tables of results which follow deal only with details at the second step, representing the most successful level of group separation that could be achieved for each comparison.

The Essay Group

Group discrimination data for the first comparison involving the Essay group contrasted with all other groups taken together are set out in Table VIII.1. While the Introversion $\times$ SBQ5 and Anxiety $\times$ Introversion $\times$ SBQ5 terms each yielded univariate F values associated with p estimates within the pre-set limits, it again proved impossible to generate a separation function in this case that achieved overall significance. It was noted, however, that the three-way compound term, freed of all adjustments to the polarities for each element, reached significance at the 8% level. This term is

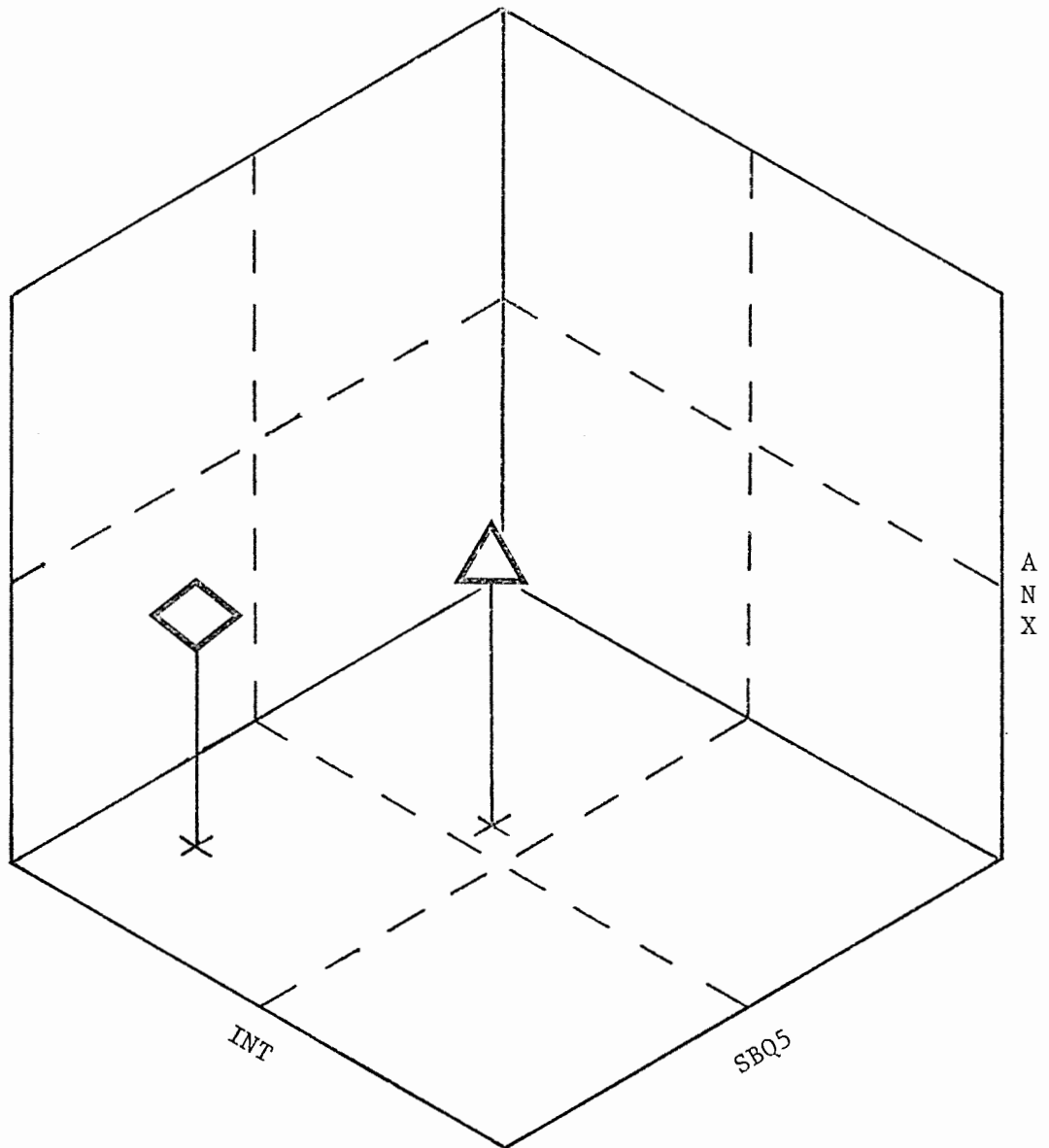


FIGURE VIII.1: *Three Dimensional Locations for the Essay Groups ($\diamond$) and All Other Groups Combined (Δ).*

TABLE VIII.1: Essay/non-Essay Groups Discrimination
Data for Selected Variables. (from
Expanded Personality Set)

Group	RAD	INT $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
	Group Means		
1. Essay (N=14)	9.58	94.06	931.62
2. Others (N=50)	10.07	100.92	1011.87
Univariate $F_{1,62}$:	2.70	3.38	3.01
p estimate:	.10	.07	.08
LDF Correlation:	.618	.688	.417
Wilks' Lambda:	.891		
R^2 :	.109		
Chi ² :	7.05	df = 3;	$p < .133$

expressed in diagrammatic form in Figure VIII.1.

Step-down results for the second comparison involving the Essay group contrasted with the Analytic Report group indicated that the best sub-set of predictors from the expanded set was identical to that employed in the analysis at Level IV, but with unadjusted SBQ5 scores. Since the relevant details are set out in Table VI.8(d), they will not be tabled again. The three-way compound was a significant term (at $p < .02$) and overall group separation was associated with a Chi² value of 6.697 ($p = .082$).

For the third comparison involving the Essay group and the Child Study group, no overall group separation was achieved, and none of the individual elements was associated with significant F values. These results were strictly comparable with those reported at Level IV and clearly indicate that, even with an expanded set of Personality components as predictors, these two groups remained indistinguishable.

The fourth and last comparison involving the Essay group was with the Tutorial group. The relevant data in this case appear as Table VIII.2. Three terms were found to yield a significant degree of discrimination, including the Anxiety $\times$ Introversion $\times$ SBQ5 compound. The evident value to this analysis of Adventurousness is to be noted in its impact on the overall separation of groups. In the earlier results for these two groups, the separation function did reach significance, but the inclusion of a non-redundant term, though not itself significant, has substantially altered the overall p estimate in this case.

TABLE VIII.2: Essay/Tutorial Groups Discrimination
Data for Selected Variables (from
Expanded Personality Set)

Group	ADV	INT	ANX $\times$ INT $\times$ SBQ5
	Group Means		
1. Essay (N=14)	10.23	9.70	931.62
2. Tutorial (N=20)	9.80	10.16	1051.44
Univariate $F_{1,32}$:	1.28	1.98	6.13
p estimate:	.27	.17	.02
LDF Correlation:	-.410	.505	.839
Wilks' Lambda:	.772		
R^2 :	.228		
χ^2 :	8.16	df=3;	$p < .05$

The Analytic Report Group

The first test of group discrimination for the Analytic Report group in terms of an expanded set of Personality components involved its comparison with all other groups taken together. This analysis revealed that the most successful level of group separation with additional variables was identical to the results already achieved at Level III. The best sub-set of elements included Anxiety together with Anxiety $\times$ SBQ5 and Anxiety² $\times$ SBQ5, and yielded a χ^2 estimate of 7.03 ($p < .08$). The relevant details

are contained in Table VI.3(b) and are not re-tabled here.

The second test involving the Analytic Report group contrasted it with the Child Study group. As the details given in Table VIII.3 indicate,

Table VIII.3: Analytic Report/Child Study Groups Discrimination Data for Selected Variables (from Expanded Personality Set)

Group	ADV	ANX	ANXxSBQ5
	Group Means		
1. Analytic Report (N=12)	9.70	10.64	106.90
2. Child Study (N=18)	10.28	9.61	93.70
Univariate $F_{1,28}$:	3.96	7.46	7.44
p estimate:	.05	.01	.01
LDF Correlation:	-.600	.782	.781
Wilks' Lambda:	.656		
R^2 :	.344		
Chi ² :	11.61		
	df=3;	$p < .01$	

separation on this occasion was clear, again based in part on the contribution made by Adventurousness. Moreover, the results following analyses at the first

step for this comparison showed that Anxiety $\times$ Introversion $\times$ SBQ5 was also significant ($F=4.74$; $df=1,28$; $p<.04$) but it was not included in the optimal set. When the tabled data for this contrast are compared with the parallel analysis at Level IV it is apparent that a distinct improvement in group separation has occurred. This was effected by the inclusion of a new, non-redundant Adventurousness term.

Preliminary data for the third and final group contrast involving the Analytic Report group compared with the Tutorial group revealed that no group separation was possible. As was found in the earlier analysis at Level IV, both linear and quadratic forms of the Anxiety-Stability term were associated with significant univariate F values ($p<.03$ in each case), however the overall χ^2 test fell considerably short of significance. For this comparison therefore, the use of an expanded predictor set did not represent any gain over the null group results already reported.

The Child Study Group

Table VIII.4 provides group discrimination data for the Child Study group in comparison with all other groups taken together. Optimal separation in this case was achieved using three elements including the Radicalism element from the expanded Personality set. Although the three way (Anxiety $\times$ Introversion $\times$ SBQ5) compound term also reached significance in the

preliminary results, it did not enter into the optimal sub-set. It was again apparent that the results shown in Table VIII.4, when compared with those from Level IV shown in Table VI.4(b), have been strongly influenced by the inclusion of a non-redundant term from the expanded Personality set.

TABLE VIII.4: Child Study/non-Child Study Groups
Discrimination Data for Selected
Variables (from Expanded Personality
Set)

Group	ANX	RAD	ANX ² x SBQ5
	Group Means		
1. Child Study (N=18)	9.61	10.32	909.09
2. Others (N=46)	10.16	9.82	1046.53
Univariate $F_{1,62}$:	4.22	3.49	5.93
p estimate:	.04	.06	.02
LDF Correlation:	.631	-.577	.738
Wilks' Lambda:	.840		
R^2 :	.160		
Chi ² :	10.74	df=3;	$p < .02$

The remaining contrast for the Child Study group involved the Tutorial group. Relevant data for this analysis are set out in Table VIII.5. While the Anxiety x Introversion x SBQ5 compound was the only

individual term to register significance as a contributor to group separation, overall discrimination was itself clearly significant. Once more, by including the first of the expanded set of Personality elements in this analysis (*viz.* Adventurousness), the level of group separation achieved at Level IV has been strengthened (*cf* Table VI.13(b), *supra*).

TABLE VIII.5: Child Study/Tutorial Groups Discrimination Data for Selected Variables (from Expanded Personality Set)

Group	ADV	ANX ²	ANX _x INT _x SBQ5
		Group	Means
1. Child Study (N=18)	10.28	93.64	935.36
2. Tutorial (N=20)	9.80	101.24	1051.44
Univariate $F_{1,36}$:	3.04	1.60	5.20
p estimate:	.09	.21	.03
LDF Correlation:	-.609	.451	.776
Wilks' Lambda:	.791		
R^2 :	.209		
Chi ² :	8.35	df=3;	$p<.04$

The Tutorial Group

The final table in this sequence of analyses contains detailed results for the Tutorial group in contrast with all other groups taken together (see Table VIII.6). Yet again, the Adventurousness term has been included among the optimal sub-set for establishing group differentiation which on this occasion was significant (at $p < .07$). When compared with the parallel analysis at Level III the present results show a clear improvement in the level of overall group separation (see Table VI.5(b) *supra*).

TABLE VIII.6: Tutorial/non-Tutorial Groups Discrimination Data for Selected Variables (from Expanded Personality Set)

Group	ADV	INT $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
	Group Means		
1. Tutorial (N=20)	9.80	104.82	1051.44
2. Others (N=44)	10.11	96.96	968.35
Univariate $F_{1,62}$:	1.37	5.80	4.13
p estimate:	.25	.02	.04
LDF Correlation:	-.442	.881	.752
Wilks' Lambda:	.890		
R^2 :	.110		
Chi ² :	7.19	df=3;	$p < .07$

The Analysis of Re-grouped Data

A close inspection of results which emerged following the analyses at Level IV indicated that in several respects, the primary groups that had been constructed for the present study were marked by systematic inter-group affinities. To some extent, this had been evident in the table of infraskill components which identified similar patterns for the Essay and Child Study groups in particular, but also pointed up common aspects for the Analytic Report and Tutorial groups. In subsequent group-by-group analyses, this pattern of similarities was reflected in the consistent failure for each of the relevant contrasts to differentiate these pairs, though varying degrees of group separation were found for all other paired comparisons.

The four performance groups were accordingly re-grouped into two new groups by combining the Essay and Child Study groups on the one hand and the Analytic Report and Tutorial groups on the other. The intention at this point was to determine the degree of group separation and also to discover which of the expanded set of elements was pertinent in forming the separating function.

Details for the analysis of re-grouped data are presented in Table VIII.7. Six elements were selected for entry to yield the optimum level of group separation

TABLE VIII.7: Essay/Child Study *versus* Analytic Report/Tutorial Groups Discrimination Data for Selected Variables (from Expanded Personality Set)

Group	ADV	ANX	ANX $\times$ SBQ5	INT $\times$ SBQ5	ANX ² $\times$ SBQ5	ANX $\times$ INT $\times$ SBQ5
	Group		Means			
1. Essay/Child Study (N=32)	10.26	9.75	94.89	96.03	934.73	933.72
2. Analytic Report/Tutorial (N=32)	9.76	10.26	104.85	102.81	1081.01	1054.91
Univariate $F_{1,62}$:	4.40	4.54	10.11	4.96	8.64	11.33
p estimate:	.04	.03	.01	.03	.01	.01
LDF Correlation:	-.478	.485	.695	.505	.649	.730
Wilks' Lambda:	.710					
R^2 :	.290					
Chi ² :	20.57	df=6;		$p < .003$		

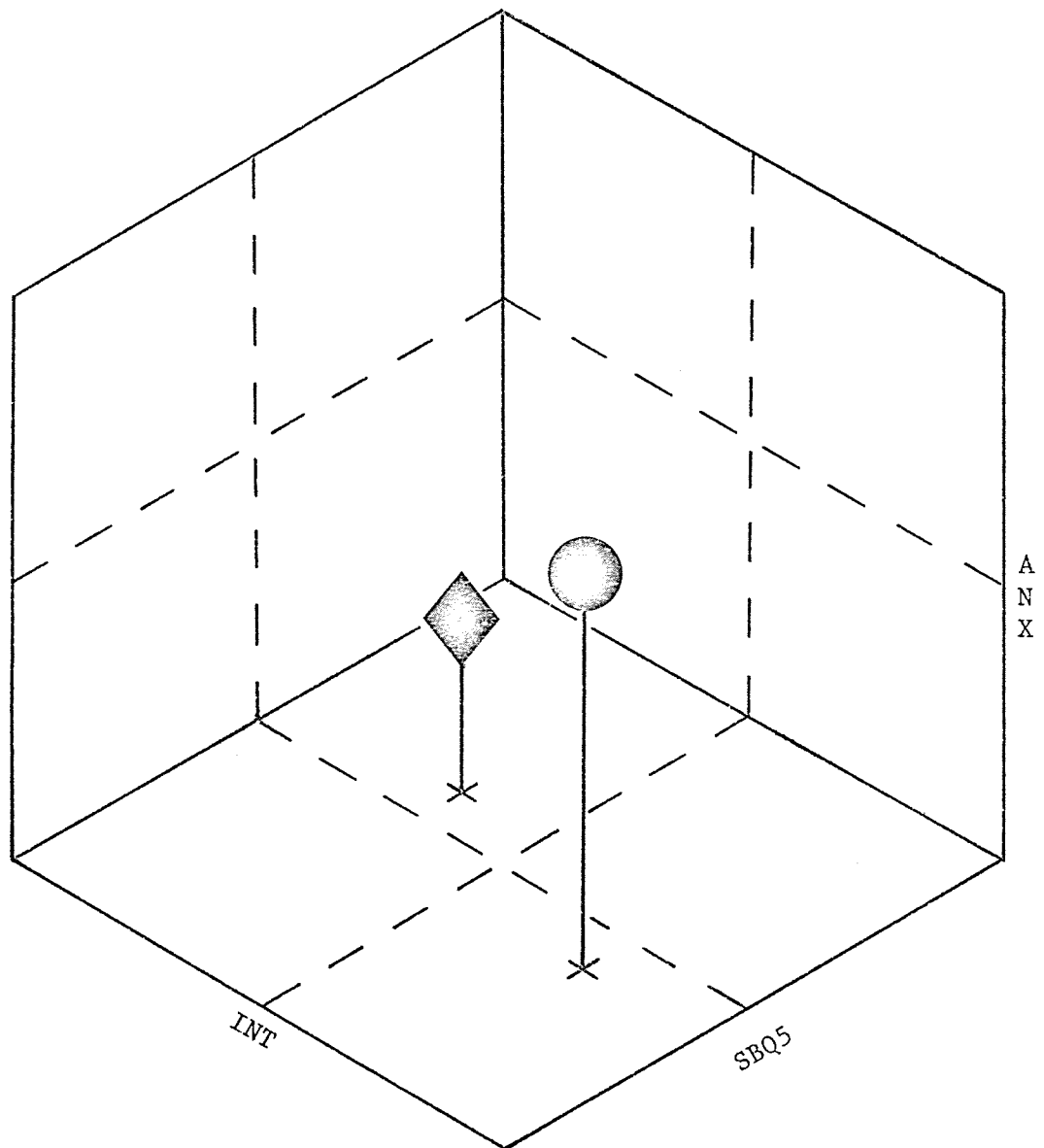


FIGURE VIII.2: *Three Dimensional Locations for Re-Structured Groups - Essay/Child Study (◆) and Analytic Report/Tutorial (●).*

which was associated with a Chi^2 estimate that clearly achieved significance. It was noted that for this higher order grouping, Adventurousness was again selected from the expanded set, but that all other terms were drawn from the basic set (comprising Anxiety-Stability, Introversion-Extraversion, and Study Behaviour) which had informed the present research. An inspection of the tabled group means indicates that the combined Analytic Report/Tutorial group was relatively more Adventurous (low score equated with high ADV) and relatively more stable; and that significantly greater Stability in association with higher (but not significantly higher) scores on Extraversion and the Study Behaviour Scale 5 yielded significant compound elements, including the three-term interaction component. (This component is represented diagrammatically in Figure VIII.2 and in Appendix P where an attempt was made to derive contrasting trait surfaces based on the paired group data.) By comparison, the combined Essay/Child Study group was characterized by relative Cautiousness, greater Anxiety, and consequentially lower compound terms arising from its greater degree of Introversion and generally lower scores in the SBQ5 scale.

Summary

Ten follow-up tests of group discriminations were carried out at the Third Phase of research analysis, together with an investigation of group differentiation based on indications that a higher order grouping was justified. For each test an expanded set of Personality dimensions was used in an attempt to amplify the results from analyses at Levels III and IV.

It was found that only two new terms from the expanded set were actually required, *viz.* Adventurousness-Cautiousness and Radicalism-Conservatism, and that the former of these was of substantial value in improving the estimated levels of group separation. All other terms required in the formation of the separation function for optimal differentiation were drawn from that set of Personality and Study Behaviour elements, or their compounds, employed in the Second Phase of the study.

In group contrasts involving each performance group tested individually against all other groups taken together, no improvement was registered in Essay/non-Essay or Analytic Report/non-Analytic Report results over results from previous (Level III) analyses. For tests involving the Child Study/non-Child Study and Tutorial/non-Tutorial comparisons, definite gains were recorded which placed these two estimates of group separation beyond the .08 level of statistical significance accepted for the study.

In group contrasts which tested each group by pairing it with each of the remaining groups, three out of a possible six comparisons yielded no improvement over the results following analyses at Level IV in which fewer predictors were employed. For the three remaining comparisons there was a clear increase in the degree of group separation. These three involved the Essay/Tutorial, Analytic Report/Child Study, and Child Study/Tutorial contrasts.

It was noted that for seven of these ten comparisons, whether the level of overall separation proved significant or not, the three-term Anxiety $\times$ Introversion $\times$ SBQ5 compound was found to make a significant contribution in the analyses. But it was not always included among the sub-set of best predictors for group discrimination.

A final discriminant analysis was explored in which the four groups were re-grouped into two higher-order groups. The Essay/Child Study pair served as one new group in a comparison with the Analytic Report/Tutorial pair as a second. The separation for this analysis was clearly significant based on six elements drawn from the expanded predictor set.

CHAPTER IX
GENERAL DISCUSSION

The main purpose of the present study was to investigate the extent to which a broadly conceived Aptitude-Treatment-Interaction model was appropriate to explain student achievement in a specific course of studies within the undergraduate domain. In pursuit of this general aim, two trait-structure aptitudes were selected based on personality theory, and these were entered as key elements in an ATI system in association with a strategic Study Behaviour component. The four tasks used as treatments were analyzed in terms of a preferential ATI model with a view to the development of hypothesized infraskill profiles that could be used as differentia. The entire system, so conceived, was located within a wider epistemological context whose principal focus was the contrast between a subject-matter dominated monist view of the acquisition of knowledge, and a person-dominated pluralist view.

In its detailed formulation, the specific aptitudes chosen represented those traits which have most commonly been reported to have significance for undergraduate achievement, *viz.* Anxiety-Stability and Introversion-Extraversion. The Syllabus Bound-Syllabus Free dimension, which was originally considered pertinent to an ATI framework, was replaced by Biggs's (1973) Study Behaviour Scale 5 (Organizational Study Skills)

as a more adequate index of strategic aspects. And the Performance domain was explored in terms of four tasks comprising a conventional Essay, an Analytic Report based on a detailed analysis of published research papers in Child Development, an observational Child Study, and the continuous assessment of Tutorial participation from week to week throughout the academic year.

The analyses that were undertaken to investigate this network were carried out at several levels according to the needs of the study at each phase. It will therefore be appropriate to review the study's results for each key aspect of the research before attempting to draw any general or thematic conclusions. To this end, Table IX.1 has been compiled as a summary of the study's findings.¹

Anxiety-Stability

The Anxiety-Stability personality trait was a principal element in the study on the grounds of its widely demonstrated predictive potential. It was conceived as a dynamic, generalized trait component having powerful drive qualities commensurate with a system involving high levels of task difficulty in association with high levels of general intelligence. It was anticipated that in such a system, the almost universally reported negative relationships between Anxiety and achievement should emerge, but that this

1. This Summary Table may be found at the end of the present chapter.

would not hold for all performance tasks. In conditions involving a substantial degree of stress, where relative indifference to stress is a plausible aspect of successful achievement, Stability should take the salient role. But for achievement conditions which are differently structured so as to allow the drive properties of Anxiety to operate, relative sensitivity to stress may be expected to be advantageous.

This pattern of expectations was substantially influenced by the findings reported earlier in the work of Gynther (1957), Tallmadge & Shearer (1971), and Dowaliby & Schumer (1973). In each case the results clearly indicated that the nature of the task or setting had to be taken into account in order to explain what would otherwise have been contradictory performance trends.

The evidence which has emerged in the present study confirmed these expectations first in so far as Anxiety-Stability was found to play a consistently prominent part in the results tabled for Levels III and IV, as well as for the Third Phase analyses; and second by supporting a task-relevant conceptualization of the way in which Anxiety-Stability relates to performance. As a contributor to the separation of performance groups, the Anxiety dimension has proved to be unquestionably more salient than any other element employed here. Moreover this remained true even though it was third

in order of importance among the personality factors derived for the study. Thus, when an expanded set of personality elements was employed in analyses at Phase Three, neither Adventurousness nor Rigidity (based on Factors I and II respectively) was found to play a more consistently important role. Even the simplest count of occasions when group discrimination analysis successfully identified at least one element associated with a significant univariate F value reveals the striking fact that Anxiety-Stability was involved in every case.

But the sheer pervasiveness of effect which Anxiety has been found to demonstrate throughout the analyses, while important in itself, does not advance the thesis being pursued here. The crucial results so far as this study is concerned are those which indicate that while the Anxiety pole is functioning to the evident benefit of some groups, it is the Stability pole which appears to be of significance for others. Furthermore, this differentiation of effect has been found to be consistent with a systematically derived set of task infraskills that were postulated for each of the groups under investigation.

Such firmly stated general conclusions as these are in no way vitiated by the results that were tabled following multiple regression analyses. It was not the specific purpose at that point in the treatment of data to explore discriminations between the task-based

groups, but rather to discover whether systematic differences existed *within* each task as a function of the chosen predictor set. The discovery in subsequent group-by-group analyses that Anxiety-Stability has emerged as a remarkably consistent and theoretically predictable dimension in group differentiation must be acknowledged for its substantial value independently of the multiple regression data.

In addition to these major trends in the results, the Anxiety-Stability dimension has also been found to function as a salient discriminator both directly, as a term on its own, and indirectly in compounds involving the Study Behaviour and Introversion-Extraversion dimensions. Indeed, but for the Analytic Report *versus* Child Study comparison when Anxiety-Stability in both linear and quadratic forms were the only significant elements, for every case of group discrimination involving at least one significant element or compound, the Anxiety term was included. In the most frequently occurring compound, Anxiety was associated with the Organizational Study Behaviour Scale such that groups appear to have been differentiated as a function of non-significantly low (Child Study) or high (Analytic Report and Tutorial) SBQ5 scores compounded with significantly greater Anxiety (Child Study) or Stability (Analytic Report, Tutorial).

A parsimonious interpretation of these results is

that they are the product of a statistical artifact; that the already very powerful Anxiety term has merely been boosted by an otherwise accidental feature of the Study Behaviour dimension. This interpretation is clearly supported by the fact that the compound involved was always associated with a significant univariate F value in contrasts which also included the Anxiety term as a significant element taken on its own. It seems necessary therefore to regard the artifactual interpretation as the one to be favoured. Its alternative, however, is not entirely implausible, since it is reasonable to expect that the marginally poorer organizational study competencies registered by the Child Study group were actually being compensated by the additional drive properties of higher Anxiety. But in the absence of well founded predictions to support such a case it would be unwise to speculate after the fact.

A final but important aspect of the Anxiety-Stability results must be considered. It has to do with the evidence which has emerged linking its effects with the Yerkes-Dodson law. There were four occasions on which Anxiety-Stability as a quadratic term was found to be associated with a significant univariate F value in the discriminant analyses. All involved group contrasts between the Analytic Report and one or more other groups, and each case was illustrated graphically at the respective points in Chapter VI (*q.v.*). It

should also be noted that for each case in which the quadratic term reached significance, Anxiety as a linear term was also significant; but it did not always follow from this that one and only one of the two terms was included in the optimal separation function (*vide* Essay/Analytic Report, Child Study/Analytic Report, and Tutorial/Analytic Report).

An inspection of the graphic data in Figures VI.1 VI.5, VI.7, and VI.9 indicates that the principal contributing feature is the spread of Anxiety scores in each case. Whereas the members of the Analytic Report group have all tended to fall within a relatively small range (from approximately 9.75 to 11.75) around the group mean (of 10.64), the other three groups have been considerably more widely spread (from approximately 7.48 to 12.21). The curvilinear effect therefore can readily be seen to have emerged from these distinctive patterns of variance which clearly favour mid-range scores for the Analytic Report group by contrast with significantly higher (Tutorial) or lower (Essay, Child Study) means and variances in other groups and group combinations.

Once more it is moot whether these results are theoretically compelling or no more than artifactual. But in this case the essential supporting theory was both available before the fact and was given serious consideration in prior discussion; and, more important still, it was made the subject of a specific expectation.

In these circumstances the Yerkes-Dodson law has to be acknowledged with reference to the comparisons dealt with and it may be concluded that Analytic Report group membership clearly favoured moderate rather than very low or very high levels of Anxiety-Stability; it may also be presumed that, in accordance with previous task analysis, the structure of the task itself was a decisive factor.

In summary terms, the Anxiety-Stability dimension has been found to correspond with the effects that were anticipated and to represent a consistently powerful element throughout the analyses. In all these respects it has functioned in a way entirely commensurate with expectations based on the substantial body of research now available.

Introversion-Extraversion

The decision to include Introversion-Extraversion as a key element in the present study was less well substantiated in the research literature than was that for Anxiety-Stability. As an established personality dimension, Introversion-Extraversion undeniably rests on firm foundations, but its precise status as a well defined variable continues to be the subject of dispute, and its role in the field of undergraduate performance is far from clear. It is nevertheless true that Introversion-Extraversion has often been employed in studies of the present type, though its relevance on

this occasion derived in large part from the presumed value it had for tutorial performance.

In the face of these somewhat compelling reasons for including the Introversion-Extraversion dimension, the results it has yielded in the present study have been, with rare exceptions, extraordinarily unremarkable. As an independent term it failed to reach significance for each occasion when group comparisons were made; and its joint effect in association with the Study Behaviour Scale was, in all but three cases, equally non-significant. Since two of these three cases also involved the SBQ5 term as a significant element when taken independently, the evidence at this point must be regarded as merely probabilistic.

It is thus quite impossible to dispute the overwhelming evidence contained in the results that have been tabled. The Introversion-Extraversion personality dimension has been found uniformly to be lacking in discriminating power so far as the present set of groups was concerned. The only qualification that should be entered has to do with the fact that the non-significant differences that were registered for Introversion-Extraversion closely agreed in their directional trends with the predictions which had been formulated on the basis of postulated task infraskills. For the ten group comparisons that were made at Levels III and IV (four taking each group with all other groups, and six taking each with each of the other groups), all but one agreed with directional expectations, the Child Study

group being slightly *less* Introverted than all other groups combined.

In general, these differences were modest, or even trivial, and do not carry much weight beyond the fact that a theoretically sensible and highly predictable pattern has actually emerged. It is essential therefore to recur to the earlier discussion of Introversion-Extraversion in relation to achievement so as to see how best to interpret the present findings. Four studies were considered, in the review of research, to have cast doubt on the possible existence of a clear relationship; they were those of Frost (1969), Hamilton (1959), Parker (1976), and Sweetbaum (1963). It will be recalled that Hamilton's theoretical analysis of Eysenck's work gave rise to three recommendations, *viz.* that predictions based on the Introversion-Extraversion dimension should be at the molar level, that pathological studies should be supported by studies within the normal range of personality functioning, and that close attention should be given to the status of the dimension for the samples used. All three of these recommendations guided the present study. The predictions that were formulated were of a molar kind in that they dealt with gross behaviour rather than specific acts such as autonomic reflexes, the sample could not be regarded as pathological, and the dimension itself was subjected to rigorous scrutiny over two successive intakes of students with every indication that the final measure was stable and pertinent.

Each of the other three studies reported empirical findings which, as in the present case, failed to confirm the expectations that had been set up when Introversion-Extraversion was used in conjunction with specific measures of behaviour. And as a consequence, each found it necessary to question whether the dimension could be employed in studies of this type.

It will be apparent from the pattern of results tabled in earlier chapters that, while non-significant, the predictive consistency of the present findings must be acknowledged and the case for appropriately conceived studies by way of further inquiry should clearly be allowed. At the same time it is evident that the search for significant patterns of relationship involving Introversion-Extraversion as an independent effect without regard to interactive or moderated associations will need to be carried out with close attention to the detailed measures used as these reflect the specific trait-performance connection under investigation. While this is not to recommend the use of molecular dependent variables, it does focus attention on the molecular aspects of the postulated linkages.

Organizational Study Behaviour (SBQ Scale 5)

In its original formulation, the present study set out to explore the Syllabus Bound-Syllabus Free dimension following the work of Parlett (*in* Hudson, 1970).

The SYLB-SYLF construct was incorporated as an element in the general design to provide what was conceived of as an essential stylistic or strategic component. It was argued that this was needed, particularly with reference to Anxiety-Stability, because of the evidence which indicated that a moderated system was required in order to account for the otherwise contradictory results that have been reported for undergraduate performance. More particularly it appeared that student achievement might be best approached as a non-unitary and complex phenomenon, at least so far as personality and study methods were concerned, and that compensatory forces were plausibly to be found in the methods of study adopted by students.

Given this line of reasoning, the principal interest for this aspect of inquiry lay more in its compound effects than in the role it played when taken alone, and these are considered *infra*. But an important initial point for discussion must be dealt with. It has to do with the fact that pilot work with the SYLB-SYLF dimension yielded insufficient grounds on which to proceed; as a result it was necessary to turn to the Study Behaviour Questionnaire developed by Biggs (1973) and to explore the relevant scales it contained in order to establish a defensible basis for further work. While it proved entirely reasonable, in substantive terms, to use Biggs's work in this way since the SYLB-SYLF construct

was well reflected in several SBQ scales, the fact remains that initial attempts to develop a reliable measure out of Parlett's items were unsuccessful. By contrast the results that were reported for Scale 5 of the SBQ inventory, taken in conjunction with this scale's construct validity for the present needs, were regarded as entirely adequate.

When data from the analyses at Levels III and IV were inspected it was immediately evident that the SBQ5 scores were not acting in any general way as group differentiators, but several trends were noted. Though non-significant, a clear difference emerged indicating that the Essay group was less orderly and well planned in its study techniques than the other three groups, and a significant difference was registered favouring the Tutorial group, also in comparison with all others. This latter difference was also encountered in the Essay/Tutorial groups contrast, and again (though non-significantly) in the Child Study/Tutorial comparison, but beyond these effects the differences were minimal. Since the SBQ scale data were gathered near the end of the year there is every reason to view these differences as valid reflections of established patterns of work and thus to accept the clear evidence of superior organizational study behaviour among members of the Tutorial group, at least with respect to the Essay group taken alone and also in the comparison with all other groups taken together. This is quite consistent with the

requirement of tutorial work for orderly week by week planning whereas all other performance tasks were strictly occasional assessment exercises.

But the study's concern with the Organizational Study Behaviour Scale was directed less towards its simple main effects and more towards its postulated impact as a moderator at the 'processing' stage of the interactive system. It is this aspect of the present findings which will now be discussed.

Interaction Effects

The multiple regression strategy adopted for analyses at Level II did not support an investigation of interactions by the Johnson-Neyman procedure. For this reason a more exploratory strategy was employed at Levels III and IV, and this was expanded in the study's Third Phase. Of the eight terms entered for initial tests of group discrimination however, five were compounds of the Anxiety-Stability, Introversion-Extraversion, and SBQ Scale 5 basic set, but only two of these compounds had been appropriately defended in theoretical terms. The first was Anxiety as a quadratic element, and this has already been considered. And the second was the three-way compound involving all members of the basic set, subject to specific adjustments in the case of the Study Behaviour Scale.

At Level III, this compound was a significant discriminator on two occasions, first involving the Child

Study/Others and second the Tutorial/Others contrasts. But the form in which these three elements were entered to achieve significance in the two tests did not correspond with the detailed predictions that had been made. It was expected that the polarities for the Child Study group would involve Anxiety and Introversion, and that well organized study schedules, as reflected in relatively high SBQ5 scores, would so combine with these two poles that the gross effect would achieve significance. It was evident, however, that the Child Study group actually registered non-significantly *lower* SBQ5 scores and that the gross effect was also non-significant as a consequence. Only when the SBQ5 term had been restored to its unadjusted polarity, did the three-way compound reach significance. This clearly suggests that the predictions so far as the Study Behaviour component was concerned were inappropriate. Moreover it established a key trend that was evident throughout all remaining analyses, *viz.* that the hypothesized moderating effects of the SBQ5 dimension could not be confirmed and that group differentiations based on the three-way term would only be realized if the SBQ5 component were employed as a descriptive rather than a moderating element. It appears therefore that in common with the Essay and Analytic Report tasks, the Child Study task was not distinguishable in terms of the competencies expressed in the SBQ5 Scale, but that when

this fact is admitted as an element in the compound, the compound itself may be used as a discriminator.

In order to interpret this set of events it is essential to recall the basis on which groups were formed. The principle of intra-individual relativism that was used meant that each group represented that sub-set of students who had achieved their best individual marks, relative to the other assessment tasks, on a given assignment. Within this relativistic framework therefore, the SBQ5 scores have been found to be comparatively unrelated to Child Study group membership; but these scores have nonetheless served, in a descriptive and unexpected way, to aid in characterizing the group. The significance of the compound score can thus be seen to highlight the *fact* that Study Behaviour skills are of no specific value for relative achievement in the Child Study exercise.

When employed as a descriptive element in the way described, and when linked with Stability and Extraversion in accordance with the predicted network, the three-term compound achieved a significant level in the Tutorial/Others groups contrast without adjustments. While this was in strict accordance with the study's expectations, it is no longer possible to pursue a mediational interpretation in the light of the results so far discussed. Once again, the SBQ5 scores appear to be reflecting the simple effects of a straightforward

independent variable which, in the case of the Tutorial group, reached significance in its own right as well as in compounded form.

In one important respect, Tutorial group data closely approximated the pattern of theoretical expectations which had informed the present research. This was to be found in the fact that while group differences for Anxiety and Introversion as simple effects were non-significant, the compounded system clearly achieved significance, thus confirming that an interactive network was indeed of value in attempting to account for group membership. It could therefore be argued that relative success in tutorial work may plausibly be conceived of in relation to a pattern of characteristics comprising moderate levels of Stability and Extraversion in association with a substantial degree of organizational study competence. While such a pattern is altogether sensible when the nature of the exercise is considered, the research into undergraduate performance has so far failed to isolate it in this form; its nearest counterpart is, in fact, to be found in work carried out at the primary and lower secondary school levels. (*cf.* Elsworth, 1978).

The two other relevant tests at Level III involved the Essay/Others and Analytic Report/Others comparisons. Results in both cases failed to yield significant univariate F values in the case of Anxiety $\times$ Introversion

x SBQ5, though it was noted that on the second of these occasions the three-way compound was associated with an F -ratio of 2.81 ($p < .10$) and that the directional trends bore a close relationship to what had been predicted. Apart from this there was no indication that the hypothesized effects were present.

By far the clearest indication that the study's particular focus on compound effects was justifiable emerged following the analyses at Level IV. In three of the six group-by-group contrasts, the three-way interaction term was found to reach significance such that each group was distinguishable from one other (Essay from Tutorial; Analytic Report from Child Study), and additionally the Child Study group was also distinguishable from the Tutorial group. It was possible to characterize the groups at this stage largely in accordance with the predictions based on task infraskills, but with due recognition of the descriptive nature of SBQ5 scores. Both the Essay and Child Study groups were distinguished by relatively higher levels of Anxiety and Introversion for all group comparisons (except, of course, the comparison for these two specific groups when the Essay group proved to be slightly less Anxious and slightly more Introverted than the Child Study Group); and the Analytic Report and Tutorial groups were reliably more stable, marginally more Extraverted, and comparatively better organized

in their study patterns (again with the exception of the comparison for this specific pair, the Tutorial group being clearly more Anxious, marginally more Introverted, and better organized than the Analytic Report group).

When these details are viewed in terms of the broad pattern that has become evident there can be little doubt that the results have been found to offer no more than slight support for the specific directional predictions that were initially formulated. It is altogether apparent that the study was overly ambitious in this respect. At the same time there have been consistent and substantial indications throughout the results that, given a relaxation of the strict directional expectations, the compounding of simple effects derived from a close analysis of task structure has proved entirely defensible. This became more evident in the follow-up work carried out as Phase Three. In these analyses it was more readily demonstrated how far group discriminations could be established with the additional power of an expanded set of mutually independent variables, and in the light of Level IV results. The three-way compound regularly served to contribute to group separation, even though it was not always included in the optimal set.

In summary, the general principle on which a preferential Aptitude-Treatment-Interaction model of student achievement rests has enjoyed varying degrees of support. While the predictors chosen for study could

not be shown to confirm the presence of an ATI system when performance tasks were studied independently, successive stages of group-by-group analysis yielded increasing support for the model. In its strongest form, group differentiation was highly significant as a function of Anxiety-Stability, Introversion-Extraversion, and Organizational Study Behaviour considered singly or in interactive compounds, and effectively divided the four groups into two pairs. Analytic Report and Tutorial groups were shown to be relatively Stable, Extraverted, and better organized in their study behaviours, while Essay and Child Study groups were the reverse. These trends were consistently evident in comparisons between specific group pairs, and served to reinforce the appropriateness of an ATI model in this field of research.

Educational Implications

As a research study that was conceived and executed wholly within the essentially naturalistic setting of an ongoing course of undergraduate studies, the present findings are of substantial practical value. First, and most important, is the question of assessment. It may reasonably be claimed that adequate evidence has been tabled to support a firmly stated case for the systematic diversification of assessment programmes. The dominant principles would be expected to derive from a detailed examination of the nature of the subject

matter since it is this, rather than the characteristics of the student, which must remain as the starting point for such an exercise. Even in the absence of the results of a study like the present one of course, it would seem that few courses of undergraduate study would be likely to be so narrowly unitary in structure and substance that one and only one type of assessment could be used; but the detailed findings set out here will leave small room to doubt that student achievement is best understood as a complex and manifold entity and that the measures employed to assess it should be sensitive to this.

At least two and possibly three types of assessment components may be identified on the basis of the present study. The first relates to analytic skills and was represented principally in the Analytic Report, though aspects of it were also to be noted in the Tutorial exercise. As indicated in the higher order group analysis, the Analytic Report and Tutorial groups combined were significantly more stable, marginally more Extraverted and better organized as students; and this compound of elements yielded the largest univariate F value to emerge (*viz.* 11.33, $p < .002$).

The second type of component relates more closely to synoptic skills and to interpretive competencies. It was represented fairly equally in the Essay and Child Study tasks and appears to have been aligned with relatively high Anxiety, and marginally greater

Introversion together with a somewhat indifferent and relatively less organized study regimen.

These two patterns were sufficiently clear and consistent, as well as being theoretically compelling, that they may be accepted as incipient type complexes. When set beside the published findings of Biggs (1970a, 1973a), Cowell *et al.* (1971), Entwistle & Brennan (1971), Goldman & Hudson (1973), and Hudson (1970), some affinities can be noted in terms of an Arts/Science stylistic dichotomy, and in this context it will be recalled that the Analytic Report was specifically designed in the present exercise to reflect those aspects of the study of child and adolescent development which most nearly corresponded with a scientific exercise.

The third component was less securely identified. It relates to the distinctive features of the Tutorial task which were associated with well organized study behaviour in conjunction with moderate rather than high levels of Stability and similarly moderate Extraversion. While this pattern was not distinguishable from that of the Analytic Report group, it represented a particular case where the match between task structure and student characteristics had seemed most compelling.

It does not follow, of course, that a tutorial assessment device should be recommended for all undergraduate courses of reading. Indeed the essence of the present study's results is that the ways in

which assessment measures are planned should be guided by the nature of the subject matter being taught. However there do seem to be sufficient grounds for recommending that a quite general distinction ought to be drawn in constructing assessment schedules between analytic and synthetic tasks or between the analytic and synthetic aspects of any particular task. There is every reason to expect that if this were done, a more appropriately sensitive evaluation strategy would result, both in terms of the nature of the task and the infra-skill competencies of the student. Thus it could be expected that a suitably structured assessment schedule for a major course of undergraduate studies would employ synoptic essay tasks, analytic studies, and individual or group tutorial assignments in association with other tasks not considered here, such as project work and multiple choice or short answer tests. In this way an examiner will be most able to reflect the manifold nature of his subject and at the same time succeed in tapping a diverse range of related skills.

Beyond these practical concerns lie three levels of theoretical debate which call for comment. The most immediate has to do with the concept of achievement and has already been referred to at several points. It will be re-stated here in terms of what may be referred to as performance equity. This notion is meant to embrace both sides of the achievement coin, with its obverse

being taken to express structures inherent in the task and its reverse those systematically matching structures of student behaviour identifiable in patterns of derived infraskills. If there are good reasons to employ a substantively articulated diversity of assessment tasks for a given subject domain there are equally good reasons to presume that each such task will draw upon more or less differentiated sub-sets of concomitant skills. And it would thus be inequitable, so far as students are concerned, to restrict the range of assessment types.¹

The general ATI model occupies the second level of theoretical debate. This model was fundamental to the study's conceptual strategy, though its effective success in naturalistic classroom research has continued to prove an elusive thing (*cf.* Elsworth, 1978; Cronbach & Snow, 1977). It may nonetheless be claimed that, subject to an important qualification, the results of the present study have provided a substantial measure of support for the model. The qualification has to do with the fact that a debased version of the model was used which confounded the treatment in each case with the dependent variable. But it remains true that a clear pattern of trait-by-task interactions was

1. I am indebted to Associate Professor Parker (James Cook University) for his suggestion that a notion of 'equity' may be discerned in the results of this study.

identified for just over half of the specific group comparisons that were analyzed and that the trends in each largely confirmed the study's theoretical expectations. Relative task competence has been found to be a function of an aptitude system which has differential impact from task to task.

It will be apparent that one important consequence flowing from the ATI system which has emerged is the inappropriateness of analyses at a global level. This can best be illustrated by speculating on the effects of rearranging the four groups differently so that Essay and Tutorial *versus* Analytic Report and Child Study groups, for example, were to be contrasted as two paired groups. Within each newly formed group, compensatory patterns of aptitude scores would submerge the systematic interactions which have been central to the present exercise, and uniformly null results might thus be misinterpreted as actual null relationships. The present findings caution against this form of methodological naïveté.

An inevitable and familiar set of specific reservations must, of course, be admitted. To begin with, the sample was very small and was drawn from a provincial Australian university still in its institutional infancy. Second, the measures of task achievement were open to criticism being no more than the elements of an otherwise standard set of course

assignments; this, however, is a strength as well as a weakness since the very ordinariness of the circumstances in which the data were gathered has a distinct bearing on the generalizability of results. Third, a recursive form of reasoning was pursued which set up an aptitudes-task relationship postulated on the basis of hypothesized task infraskills in order to explore group differentiations as a function of the aptitudes; inferences from these events back to the tasks were at best of an indirect kind.

As a counter to these points it is possible to adduce particular strengths, for instance in the thorough development of variables within the Personality domain and the correlational stability in performance tasks over several years. But the most compelling strength must finally reside in the extent to which theoretically well founded predictions, when tested empirically, yield sensible results.

The final level of debate returns the thesis to its original epistemological concern with the principle of Limitedism. This term was intended to define a particular orientation in the getting of knowledge which fell towards the monist or subject-matter dominated pole of a psycho-epistemic continuum, but which admitted the limited role an individual might be expected to play in such a system. Given the serious flaw in a principle of this kind in that it can be made to embrace virtually

every pattern of events and is thus not refutable, some attempt has to be made to assess its status.

It is difficult to avoid the conclusion that the general tenor of findings reported for the present study would be to maintain the psycho-epistemic balance distinctly nearer the monist than the pluralist pole. While it is certainly possible to focus upon particular aspects of the results and to interpret them as evidence for a proto-subjectivism of this or that type, the findings taken *en bloc* cannot be used in this way; for every confirming instance there is a corresponding failure to confirm the presence of a subjectivist bias in the data. That this does not constitute a decisive affirmation of the principle of limited subjectivism has to be conceded, but neither is it in any sense a refutation. And it remains very much an area of potentially fruitful inquiry with the clear prospects that the differentiations explored in the present study have served to establish.

Implications for Further Research

The many weaknesses in a study of this kind are valuable instigators to further work in the area. Chief among them is the inadequate sample size and representativeness. A substantially increased sample selected across institutions, or at least across Faculties within a particular institution, would satisfy an evident need to replicate the study and at the same

time could provide an essential comparison based on the Science/Arts dichotomy which has found some additional support here. The principal obstacle to such an enterprise of course is the daunting problem of co-ordinating, matching, administering and assessing the tasks without distorting the naturalistic flavour of the exercise. A large Faculty of Arts, which tends to admit the most varied range of courses as well as of student enrolments, would represent the most promising starting point.

A second recommendation, also based on a shortcoming in the present study, would be for some standardization of the dependent variable set. This would, in fact, be mandatory if the research were to be extended across several courses; however once again the question arises how far the naturalistic features of the work might thereby suffer. And there is the added danger that a core aspect of the underlying theory would also be threatened. This has to do with the subject-relevant dimension and would call for a crossed design to accommodate the courses-by-assignment task component.

A third recommendation derives from the follow-up work carried out as Phase Three. It was at this point that a well defended research based set of predictors from the Personality domain was augmented by the use of theoretically *ad hoc* elements. For only three cases did the additional variables reach significance when

considered alone, but their presence in the separation function was marked by enhanced levels of overall group discrimination for all comparisons which included them. There are grounds therefore to recommend not only that a broader range of predictors be explored but that some attempts be made to investigate what can only be described as a bewildering array of potentially valuable interactive compounds. Recent advances in computer program design to facilitate large scale explorations of this type have removed a great deal of the associated labour and tedium.

This should not be taken to mean that research can proceed in a theoretical vacuum. As the results of the present study demonstrated, third and fourth level Personality factors can serve as powerful systematic discriminators when supported by a cogent theoretical structure. But future studies cannot be bound too narrowly, and it is necessary to countenance an initial aspect of the research strategy which precedes the major exercise by extending exploratory work beyond that attempted here. In the light of this study's results it may be claimed that the benefits of a preliminary exploration will be in direct proportion to its detail and rigour.

The fourth recommendation is based on the study's use of a preferential ATI model and is effectively two-pronged. In one respect it emphasizes the need to

explore a wider range of likely predictors selected in terms of their sympathetic integration into the dispositional patterns of student behaviour; at the same time it will be recognized that a parallel but compensatory model could be used within an experimental framework. To effect this it would be necessary to devise training programmes designed, for example, to improve the study behaviours or the analytic skills of students, or to buttress their sense of confidence in competitive tutorial settings. But the essential precursor to experimentation along these lines is a demonstration of the kind attempted in this research study that relevant and salient dimensions actually exist; without this largely diagnostic and descriptive account of the differentiations that are worth pursuing, there can be little justification for experimentation.

TABLE IX.1: Summary Details of the Study's Findings

	Substantive Hypothesis	Result
<u>PHASE I</u>		
<u>Level I</u>	(a) i: That Introversion-Extraversion is a stable, factor based entity with metric scale properties.	Confirmed
	(a)ii: That Anxiety-Stability is a stable, factor based entity with metric scale properties.	Confirmed
	(b) : That responses on a Study Behaviour inventory exhibit metric scale properties on an Organized (SYLB-SYLF) construct.	Confirmed
	(c) : That performance scores are independent estimates of achievement with metric scale properties (Pseudo-hypothesis status)	Confirmed
<u>PHASE II</u>		
<u>Level II</u>	A(a) : That Anxiety, Introversion, SBQ Scale 5, and the three-way interactive compound are significant predictors in a multiple linear regression analysis of Essay performance scores.	Not Confirmed
	A(b) : That Anxiety, Introversion, SBQ Scale 5, and the three-way interactive compound are significant predictors in a multiple linear regression analysis of Analytic Report performance scores.	Not Confirmed
	A(c) : That Anxiety, Introversion, SBQ Scale 5, and the three-way interactive compound are significant predictors in a multiple linear regression analysis of Child Study performance scores.	Not Confirmed
	A(d) : That Anxiety, Introversion, SBQ Scale 5, and the three-way interactive compound are significant predictors in a multiple linear regression analysis of Tutorial performance scores.	Not Confirmed
	A'(a): That regions of significance can be circumscribed for Essay performance as a function of the joint interaction of Anxiety, Introversion, and the SBQ Scale 5.	Not Tested
	A'(b): That regions of significance can be circumscribed for Analytic Report performance as a function of the joint interaction of Anxiety, Introversion, and the SBQ Scale 5.	Not Tested
	A'(c): That regions of significance can be circumscribed for Child Study performance as a function of the joint interaction of Anxiety, Introversion, and the SBQ Scale 5.	Not Tested
	A'(d): That regions of significance can be circumscribed for Tutorial performance as a function of the joint interaction of Anxiety, Introversion, and the SBQ Scale 5.	Not Tested

TABLE IX.1: Summary Details of the Study's Findings (Continued)

Substantive Hypothesis		Result
<u>PHASE II</u>		
<u>Level III</u>		
B'(a) i:	That the Essay group can be discriminated from all other groups taken together.	Not Confirmed
ii:	That significant levels will be associated with the contribution to group separation of -	
	Anxiety-Stability (A):	Not Confirmed
	Introversion-Extraversion (I):	Not Confirmed
	SBQ5(S):	Not Confirmed
	AIS:	Not Confirmed (a)
B'(b) i:	That the Analytic Report group can be discriminated from all other groups taken together.	Confirmed
ii:	That significant levels will be associated with the contribution to group separation of	
	Anxiety-Stability (A):	Confirmed
	Introversion-Extraversion (I):	Not Confirmed
	SBQ5 (S):	Not Confirmed
	AIS:	Not Confirmed
B'(c) i:	That the Child Study group can be discriminated from all other groups taken together.	Not Confirmed
ii:	That significant levels will be associated with the contribution to group separation of -	
	Anxiety-Stability (A):	Confirmed
	Introversion-Extraversion (I):	Not Confirmed
	SBQ5 (S):	Not Confirmed
	AIS:	Confirmed
B'(d) i:	That the Tutorial group can be discriminated from all other groups taken together.	Not Confirmed
ii:	That significant levels will be associated with the contribution to group separation for -	
	Anxiety-Stability (A):	Not Confirmed
	Introversion-Extraversion (I):	Not Confirmed
	SBQ5 (S):	Confirmed
	AIS:	Confirmed
<u>Level IV</u> (a) i:	That the Essay group can be discriminated from the Analytic Report group.	Confirmed
ii:	That significant levels will be associated with the contribution to group separation for -	
	Anxiety-Stability (A):	Confirmed
	Introversion-Extraversion (I):	Not Confirmed
	SBQ5 (S):	Not Confirmed
	AIS:	Confirmed ^a

(a) Subsequently confirmed for unadjusted SBQ5 scores at Phase Three
a Following SBQ5 Scale adjustment.

TABLE IX.1: Summary Details of the Study's Findings (Continued)

Substantive Hypothesis	Result
<u>PHASE II</u>	
<u>Level IV (Cont.)</u>	
(b) i: That the Essay group can be discriminated from the Child Study group.	Not Confirmed
ii: That significant levels will be associated with the contribution to group separation for -	
Anxiety-Stability (A):	Not Confirmed
Introversion-Intraversion (I):	Not Confirmed
SBQ5 (S):	Not Confirmed
AIS:	Not Confirmed
(c) i: That the Essay group can be discriminated from the Tutorial group.	Not Confirmed
ii: That significant levels will be associated with the contribution to group separation for -	
Anxiety-Stability (A):	Not Confirmed
Introversion-Extraversion:	Not Confirmed
SBQ5 (S):	Confirmed
AIS:	Confirmed ^a
(d) i: That the Analytic Report group can be discriminated from the Child Study group.	Confirmed
ii: That significant levels will be associated with the contribution to group separation for -	
Anxiety-Stability (A):	Confirmed
Introversion-Extraversion (I):	Not Confirmed
SBQ5 (S):	Not Confirmed
AIS:	Confirmed ^a
(e) i: That the Analytic Report group can be discriminated from the Tutorial group.	Not Confirmed
ii: That significant levels will be associated with the contribution to group separation for -	
Anxiety-Stability (A):	Confirmed
Introversion-Extraversion (I):	Not Confirmed
SBQ5 (S):	Not Confirmed
AIS:	Not Confirmed
(f) i: That the Child Study group can be discriminated from the Tutorial group.	Confirmed
ii: That significant levels will be associated with the contribution to group separation for -	
Anxiety-Stability (A):	Not Confirmed
Introversion-Extraversion (I):	Not Confirmed
SBQ5 (S):	Not Confirmed
AIS:	Confirmed ^a

^a Following SBQ5 scale adjustment.

APPENDIX A

ORIGINAL PERSONALITY INVENTORY
FOR PILOT SAMPLE (1975), KEYED
FOR SOURCE AND SCALE

<i>Source Code</i>	EPPS: Edwards Personality Preference Schedule
	MAS: Manifest Anxiety Scale
	OPI: Omnibus Personality Inventory
	STAI: State-Trait Anxiety Index

(Scale Legend Appears at the Foot of this Appendix).

	Item	Origin	Scale
1.	I like planning things carefully, well ahead of time.	Eysenck (1968)	N
2.	Unquestioning obedience is a virtue.	OPI	AUT
3.	I consider myself a very sociable, outgoing person.	Cattell, 16PF	INT
4.	Women are not the equals of men in intelligence, organizing ability, etc.	Eysenck (1970)	RAD
5.	The topics I get specially interested in are ones I come across in the required reading of my course.	Parlett (<i>in</i> Hudson, 1970)	SYLB
6.	I like to be able to come and go as I want.	EPPS	AUT
7.	I prefer to work with others rather than alone.	OPI	INT
8.	I usually enjoy parties.	OPI	INT
9.	There is something noble about poverty and suffering.	OPI	AUT
10.	Nothing in life is worth the sacrifice of losing contact with your family.	OPI	AUT
11.	I enjoy reading Shakespeare's plays.	OPI	MAS
12.	I work under a great deal of tension.	OPI	ANX
13.	Men and women have the right to find out whether they are sexually suited before marriage (e.g. by trial marriages)	Eysenck (1970)	RAD
14.	I can't help feeling that war is inherent in human nature.	Eysenck (1970)	RAD
15.	I dislike mathematics.	OPI	MAS
16.	In constructing something I prefer to work on my own.	Cattell, 16PF	AUT

	Item	Origin	Scale
17.	I feel more comfortable about assignments if I know exactly what I am supposed to be doing and how important it is.	Parlett (<i>in</i> Hudson, 1970)	SYL
18.	I think society puts too much restraint on the individual.	OPI	AUT
19.	I could happily live alone, far from everyone, like a hermit.	Cattell, 16PF	INT
20.	I am always able to keep the expression of my feelings under firm control.	Cattell, 16PF	MAS
21.	I have several well developed intellectual interests outside my studies.	Parlett (<i>in</i> Hudson, 1970)	SYL
22.	I think we treat criminals too harshly; we should try to cure, not punish them.	Eysenck (1970)	TTM
23.	I do not like to be closely supervised in my work.	Parlett (<i>in</i> Hudson, 1970)	SYL
24.	On social occasions I prefer to stay quietly in the background.	Cattell, 16PF	INT
25.	I prefer not to be left to work in my own way as I get nothing done.	Parlett (<i>in</i> Hudson, 1970)	SYL
26.	Most of the people I know would regard me as an amusing talker.	Cattell, 16PF	INT
27.	I don't like having to carry on small talk with people.	(<i>Vide</i> note <i>infra</i>)	INT
28.	I often disagree with my teachers.	Hudson (1968)	SYL
29.	I would hate to be where there wouldn't be a lot of people to talk to.	Cattell, 16PF	INT
30.	I often follow up my own ideas when I am supposed to be studying.	Parlett (<i>in</i> Hudson, 1970)	SYL

Item	Origin	Scale
31. I tend to be erratic, some-times working well, some-times badly.	Hudson (1968)	SYL
32. I am not unusually self-conscious.	OPI	ANX
33. Ultimately, I think private property should be abolished and complete socialism introduced.	Eysenck (1970)	RAD
34. I sometimes let my actions get swayed by feelings of emotion.	Cattell, 16PF	MAS
35. I am usually calm and not easily upset.	Taylor, MAS	ANX
36. I would like to learn more about the history of human thought.	OPI	INT
37. When I know I'm doing the right thing I find my task easy.	Cattell, 16PF	RIG
38. I think present laws clearly favour the rich as against the poor.	Eysenck (1970)	RAD
39. I think crimes of violence should be punished by flogging.	Eysenck (1970)	TTM
40. I like teachers who stick to the syllabus and do not digress.	Hudson (1978)	SYL
41. Religion should be principally a social force or institution.	OPI	MAS
42. I prefer known ways of doing things rather than trying out new ones.	OPI	RIG
43. I always have enough energy when faced with difficulties.	Taylor, MAS	ANX
44. I take disappointments so keenly that I can't put them out of my mind.	STAI (Trait)	ANX

	Item	Origin	Scale
45.	I shrink from facing a crisis or difficulty.	OPI	ANX
46.	I favour the strict enforcement of all laws no matter what the consequences.	OPI	AUT
47.	There are times each day when I want to enjoy my own thoughts uninterrupted by others.	Cattell, 16PF	INT
48.	I am a reflective person and dislike being hurried in my thinking.	(<i>Vide note infra.</i>)	INT
49.	I would rather pursue my own ideas than follow a syllabus.	Hudson (1968)	SYL
50.	I work much harder when studying the subject I like most.	Parlett (<i>in</i> Hudson, 1970)	SYL
51.	I become tense and upset when I think about my present concerns.	STAI (Trait)	ANX
52.	If I think about the amount to be covered in my course work I sometimes get anxious.	(Not known)	ANX
53.	I don't like having to follow a set schedule.	OPI	RIG
54.	I find it hard to address a large group.	Cattell, 16PF	INT
55.	I frequently think of experiments or issues I would like to tackle.	Parlett (<i>in</i> Hudson, 1970)	SYL
56.	I would enjoy being a famous person.	OPI	MAS
57.	I like to have a place for everything and everything in its place.	OPI	RIG
58.	I think the best method of learning is by completing all assignments and required reading.	Parlett (<i>in</i> Hudson, 1970)	SYL

	Item	Origin	Scale
59.	I like to plan and organize the details of work I have to do.	EPPS	RIG
60.	I believe I am no more nervous than most people.	OPI	ANX
61.	I often find it hard to keep my mind on a task or job.	OPI	ANX
62.	I enjoy art, sculpture and architecture.	OPI	MAS
63.	I like to do my planning alone without interruptions and suggestions from others.	Cattell, 16PF	AUT
64.	I always see to it that my work is carefully planned and organized.	OPI	RIG
65.	I am happy most of the time.	OPI	ANX
66.	I hesitate to use my own ideas for fear they might be impractical.	Cattell, 16PF	AUT
67.	I think nationalizing the major industries will lead to inefficient bureaucracy and stagnation.	Eysenck (1970)	RAD
68.	I am more sensitive than most people.	OPI	ANX
69.	Only by going back to religion can civilization hope to survive.	Eysenck (1970)	RAD
70.	I like playing cards for money.	OPI	MAS
71.	Without the stimulus of exams I doubt whether I would do much effective studying.	Parlett (<i>in</i> Hudson, 1970)	SYL
72.	I am more interested in learning facts than in relating them to my ideas and previous experiences.	OPI	INT
73.	When I see sloppy and untidy people I get annoyed.	Cattell, 16PF	RIG

Item	Origin	Scale
74. The idea that sickness comes as much from mental as physical causes is much exaggerated.	Cattell, 16PF	MAS
75. I am ill at ease with members of the opposite sex.	OPI	INT
76. I usually study only what I am required to study.	Parlett (<i>in</i> Hudson, 1970)	SYL
77. I think the death penalty is barbaric and ought to be abolished.	Eysenck (1970)	TTM
78. The laws against abortion should be abolished.	Eysenck (1970)	RAD
79. Every citizen has a duty to support his country right or wrong.	OPI	AUT
80. Outside interests often make me neglect my studies.	Hudson (1968)	SYL
81. I would like to play around with certain ideas of my own even if they do not come to much.	Parlett (<i>in</i> Hudson, 1970)	SYL
82. I often find myself questioning things that I hear in lectures and classes.	Parlett (<i>in</i> Hudson, 1970)	SYL
83. I would enjoy actual laboratory work more than textbook studies for a course.	OPI	INT
84. I prefer to know that something will really work before I take a chance on it.	OPI	RIG
85. It's a good rule to accept nothing as certain or proved.	OPI	RIG
86. I am considered a very enthusiastic person.	Cattell, 16PF	MAS
87. I like modern art.	OPI	MAS

	Item	Origin	Scale
88.	I often study and analyze my own motives and reactions.	OPI	INT
89.	In general assignments give me little freedom and I would like them to be less structured.	Parlett (<i>in</i> Hudson, 1970)	SYL
90.	I cover assigned work equally well whether I find it interesting or not.	Parlett (<i>in</i> Hudson, 1970)	SYL
91.	I am certainly lacking in self-confidence.	OPI	ANX
92.	Jews are as valuable, honest and public spirited as any other group.	Eysenck (1970)	RAD
93.	People with serious hereditary defects and diseases should be compulsorily sterilized.	Eysenck (1970)	TTM
94.	I would like to have more choice in what I study.	Hudson (1968)	SYL
95.	I often get over-excited and rattled.	STAI (A-State)	ANX
96.	I like to work on independent projects.	Partlett (<i>in</i> Hudson, 1970)	SYL
97.	I don't like things to be uncertain and unpredictable.	OPI	RIG
98.	I avoid getting involved in social responsibilities and organizations.	Cattell, 16PF	INT
99.	I envy the man who can walk up to anybody and tell him off.	OPI	MAS
100.	I work hard when I am interested and slack when I am not.	Hudson (1968)	SYL
101.	Assignment marks help me to evaluate my intellectual potential.	Parlett (<i>in</i> Hudson, 1970)	SYL
102.	I am a fairly high-strung person.	Taylor, MAS	ANX

Item	Origin	Scale
103. I often learn more from studying along my own lines than by completing set assignments.	Parlett (<i>in</i> Hudson, 1970)	SYL
104. I think it is wrong that men should be permitted greater sexual freedom than women by society.	Eysenck (1970)	TTM
105. I like to be with a crowd who play jokes on one another.	OPI	MAS
106. It takes a lot of argument to convince most people of the truth.	OPI	MAS
107. I sometimes laugh at a dirty joke.	Eysenck (1969)	MAS
108. I like to discuss philosophical problems.	OPI	INT
109. I think people should observe moral laws more strictly than they do.	Cattell, 16PF	RIG
110. I like to do things in my own way without regard to what others may think.	EPPS	AUT
111. I enjoy being in a crowd just to be with people.	OPI	INT
112. I would rather be at home on my own than go to a boring party.	Eysenck (EPI)	INT
113. I'm a pretty easy-going person.	Eysenck (EPI)	INT
114. I have decidedly fewer friends than most people.	Cattell, 16PF	INT
115. I have always hated regulations.	OPI	RIG
116. Straight-forward reasoning appeals to me more than imagery and metaphor.	OPI	RIG
117. Politically I am probably something of a radical.	OPI	RIG

Item	Origin	Scale
118. I like my written work to be precise, neat and well organized.	EPPS	RIG
119. I can usually make accurate decisions quite rapidly.	(<i>Vide note infra.</i>)	INT
120. I avoid spending time dreaming about what might have been.	Cattell, 16PF	INT
121. I like to keep my things neat and orderly on my desk.	EPPS	RIG
122. I enjoy work that requires conscientious, exacting skills.	Cattell, 16PF	RIG
123. Facts appeal to me more than ideas.	OPI	INT
124. I feel <i>any</i> job should be done thoroughly if it's done at all.	Cattell, 16PF	RIG

Scale Legend:

ANX = Anxiety-Stability

AUT = Autonomy

INT = Introversion-Extraversion

MAS = Masculinity-Femininity

N = Neuroticism

RAD = Radicalism-Conservatism

RIG = Rigidity-Complexity

SYL = Syllabus Bound-Syllabus Free

TTM = Tough Minded-Tender Minded

Note: Items 27, 48, and 119 were devised by the author.

APPENDIX B

PERSONALITY ITEMS REMOVED
FROM INVENTORY FOLLOWING
ANALYSIS OF PILOT DATA

Item	Max. Loading
1. The topics I get specially interested in are ones I come across in the required reading of my course. (Appendix A, No. 5)	.324
2. There is something noble about poverty and suffering. (A9)	.331
3. I dislike mathematics. (A15)	-.229
4. In constructing something I prefer to work on my own. (A16)	.370
5. I think society puts too much restraint on the individual. (A18)	.274
6. I am always able to keep the expression of my feelings under firm control. (A20)	-.332
7. I do not like to be closely supervised in my work. (A23)	-.394
8. I prefer not to be left to work in my own way as I get nothing done. (A25)	.249
9. I am not unusually self-conscious. (A32)	-.357
10. I sometimes let my actions get swayed by feelings of emotion. (A34)	.377
11. I would like to learn more about the history of human thought. (A36)	-.371
12. I think present laws clearly favour the rich as against the poor. (A38)	.300
13. I think crimes of violence should be punished by flogging. (A39)	-.399
14. Religion should be principally a social force or institution. (A41)	-.300
15. I always have enough energy when faced with difficulties. (A43)	-.383
16. I shrink from facing a crisis or difficulty. (A45)	.333

	Item	Max. Loading
17.	If I think about the amount to be covered in my course work I sometimes get anxious. (A52)	.313
18.	I would enjoy being a famous person. (A56)	-.278
19.	I think the best method of learning is by completing all assignments and required reading. (A58)	.364
20.	I enjoy art, sculpture and architecture. (A62)	-.307
21.	I like to do my planning alone without interruptions and suggestions from others. (A63)	.308
22.	I think nationalizing the major industries will lead to inefficient bureaucracy and stagnation. (A67)	.249
23.	Every citizen has a duty to support his country right or wrong. (A79)	-.393
24.	I often find myself questioning things that I hear in lectures and classes. (A82)	-.350
25.	It's a good rule to accept nothing as certain or proved. (A85)	-.226
26.	I like modern art. (A87)	-.307
27.	I often study and analyze my own motives and reactions. (A88)	-.327
28.	I cover assigned work equally well whether I find it interesting or not. (A90)	.358
29.	Jews are as valuable, honest and public spirited as any other group. (A92)	.139
30.	People with serious hereditary defects and diseases should be compulsorily sterilized. (A93)	-.291
31.	I would like to have more choice in what I study. (A94)	.316

Item	Max. Loading
32. I envy the man who can walk up to anybody and tell him off. (A99)	.352
33. I work hard when I am interested and slack when I am not. (A100)	.380
34. Assignment marks help me to evaluate my intellectual potential. (A101)	-.288
35. I like to be with a crowd who play jokes on one another. (A105)	-.338
36. It takes a lot of argument to convince most people of the truth. (A106)	.334
37. I like to do things in my own way without regard to what others may think. (A110)	-.200
38. I enjoy work that requires conscientious, exacting skills. (A122)	.337
39. Facts appeal to me more than ideas. (A123)	.265

APPENDIX C

ROTATED FACTOR MATRIX
FOR FINAL VERSION OF
PERSONALITY INVENTORY, PILOT SAMPLE (1975)

Variable No.	Factor						
	I	II	III	IV	V	VI	VII
1	.164	-.641	-.135	.053	-.018	.127	.008
2	-.111	-.268	.148	-.121	.226	.036	-.198
3	.354	.030	.479	.172	-.259	-.015	-.379
4	-.125	.020	.410	.084	.314	.029	-.299
5	.035	-.037	.553	.289	-.024	-.119	-.136
6	-.129	-.313	.109	.028	.113	-.049	-.135
7	.456	.092	.105	-.146	.119	.039	.113
8	-.084	.065	-.298	-.425	-.099	-.125	-.145
9	.097	-.029	.132	.049	-.755	-.211	-.108
10	-.066	-.071	-.015	-.146	-.110	.147	-.348
11	.076	.118	-.468	-.092	.014	-.132	-.125
12	.579	-.015	-.023	.074	-.208	-.074	.161
13	-.023	.055	-.053	.087	.023	.005	.447
14	-.257	-.040	-.574	-.067	.244	.004	.184
15	.285	-.009	.430	-.077	-.076	-.133	-.036
16	.025	-.130	-.324	-.020	.049	-.176	.332
17	-.103	-.138	.512	-.092	-.063	.035	-.028
18	.056	.114	.030	.010	-.036	-.461	.006
19	-.168	.191	.062	-.202	-.143	-.277	.010
20	-.027	-.050	.149	.543	-.050	-.236	.041
21	-.141	-.115	-.061	.006	.084	.247	-.257
22	-.465	-.073	-.124	-.078	-.047	.244	-.178
23	-.091	-.009	-.068	-.629	.038	-.052	-.218
24	-.050	-.184	-.118	-.094	.073	.031	-.379
25	-.221	-.067	-.157	-.124	-.017	-.388	.195
26	.129	.234	-.136	-.040	-.310	-.538	.124
27	-.230	-.011	.109	-.578	-.075	-.031	-.159
28	.012	.422	-.060	-.044	-.163	-.408	.137
29	-.574	.047	-.103	-.052	.270	-.060	.096
30	.296	-.239	-.050	-.023	.006	-.355	-.033
31	-.025	-.682	-.004	-.149	-.081	.077	-.095
32	.081	-.656	-.062	.013	-.040	.069	.145
33	.088	.040	.098	.502	-.248	.065	-.014
34	-.328	.284	.267	-.177	-.029	-.390	-.066
35	.276	-.606	-.149	.027	-.011	.199	.014
36	-.603	-.051	.178	-.270	.110	.035	.034
37	.012	-.102	-.113	-.615	.099	-.099	.130
38	.003	.068	-.024	-.098	.718	.095	.063
39	.030	.025	-.033	-.016	-.257	-.084	-.066
40	-.317	.185	.168	-.001	-.069	-.065	-.267
41	.054	-.470	.005	.089	.105	.043	-.188
42	-.479	.111	.124	-.071	-.014	-.148	-.385
43	.105	.137	-.111	-.147	.020	.027	.383
44	.052	.061	.158	.017	-.482	-.066	.009
45	-.177	.261	.135	-.099	-.111	-.340	-.042
46	.253	.054	.045	-.015	-.130	-.634	.056
47	.142	-.095	.052	.068	.091	-.336	-.294
48	-.469	-.137	.016	-.158	-.039	.160	-.214
49	.445	-.188	.342	.089	.006	-.011	-.032

Variable No.	Factor						
	I	II	III	IV	V	VI	VII
50	-.030	.162	-.056	.124	-.109	-.404	-.060
51	-.489	-.033	-.217	-.397	.162	-.127	.090
52	-.022	.056	.225	-.572	.082	-.019	.027
53	.316	-.078	-.013	.180	-.073	-.344	.191
54	-.255	-.463	.217	-.212	-.045	.241	-.019
55	-.531	.156	-.328	-.198	-.077	.150	.128
56	.059	.035	-.134	-.594	-.137	-.065	-.006
57	.299	.111	-.189	-.077	-.155	-.330	.053
58	.408	.097	.066	-.215	-.089	-.168	.120
59	.005	-.162	-.203	-.087	.702	-.030	-.082
60	-.147	-.053	.473	.046	.023	.018	-.023
61	.078	-.110	-.460	-.018	.052	.008	.081
62	.047	.001	.266	.415	-.080	-.180	-.127
63	-.167	.002	-.492	-.272	-.015	.100	-.017
64	.107	.300	-.128	-.029	-.393	-.325	.245
65	-.261	-.369	-.113	.166	.060	-.068	-.008
66	.302	.066	-.048	-.016	-.347	-.257	.018
67	-.043	-.644	.081	-.040	.125	.061	-.035
68	.233	-.177	-.038	.336	-.152	.110	.273
69	-.030	-.664	.100	-.024	-.006	.072	-.066

APPENDIX D

FINAL VERSION OF PERSONALITY
INVENTORY FOR TARGET SAMPLE (1976),
KEYED FOR SOURCE AND SCALE

(Source Code as for Appendix A)

	Item	Origin	Scale*
1.	I like planning things carefully, well ahead of time.	Eysenck (1968)	N
2.	Unquestioning obedience is a virtue.	OPI	AUT
3.	I consider myself a very sociable, outgoing person.	Cattell, 16PF	INT
4.	I often need cheerful, sympathetic company to cheer me up.	Eysenck (1969)	N
5.	I prefer to work with others rather than alone.	OPI	INT
6.	I usually enjoy parties.	OPI	INT
7.	Nothing in life is worth the sacrifice of losing contact with your family.	OPI	AUT
8.	I enjoy reading Shakespeare's plays.	OPI	MAS
9.	I work under a great deal of tension.	OPI	ANX
10.	Men and women have the right to find out whether they are sexually suited before marriage (e.g. by trial marriage)	Eysenck (1970)	RAD
11.	I cannot help feeling that war is inherent in human nature.	Eysenck (1970)	RAD
12.	I often have a restless feeling that I want something but do not know what.	Eysenck (1970)	N
13.	I could happily live alone, far from everyone, like a hermit.	Cattell, 16PF	INT
14.	I have several well-developed intellectual interests outside my studies	Parlett (<i>in</i> Hudson, 1970)	SYL

* Scale legend as for Appendix A

	Item	Origin	Scale
15.	I think we treat criminals too harshly; we should try to cure, not punish them.	Eysenck (1970)	TTM
16.	I sometimes feel happy, sometimes depressed, without any apparent reason.	Eysenck (196a)	N
17.	On social occasions I prefer to stay quietly in the background.	Cattell, 16PF	INT
18.	Most of the people I know would regard me as an amusing talker.	Cattell, 16PF	INT
19.	I have frequent ups and downs in moods, either with or without apparent cause.	Eysenck (1969)	N
20.	I don't like having to carry on small talk with people.	(<i>Vide</i> note <i>infra.</i>)	INT
21.	I often find that I have made up my mind too late.	Eysenck (1969)	N
22.	I often follow up my own ideas when I am supposed to be studying.	Parlett (<i>in</i> Hudson, 1970)	SYL
23.	I would hate to be where there wouldn't be a lot of people to talk to.	Cattell, 16PF	INT
24.	I tend to be erratic some-times working well, some-times badly.	Hudson (1968)	SYL
25.	I sometimes feel 'just miserably' for no good reason at all.	Eysenck (1969)	N
26.	I like teachers who stick to the syllabus and do not digress.	Hudson (1968)	SYL
27.	I find it hard to fall asleep at bedtime.	Eysenck (1969)	N
28.	I am often troubled by feelings of guilt.	Eysenck (1969)	N

	Item	Origin	Scale
29.	I prefer known ways of doing things rather than trying out new ones.	OPI	RIG
30.	I am usually calm and not easily upset.	Taylor, MAS	ANX
31.	I seldom worry about my health.	Eysenck (1947)	N
32.	I take disappointments so keenly that I can't put them out of my mind.	STAI (Trait)	ANX
33.	I favour the strict enforcement of all laws no matter what the consequence.	OPI	AUT
34.	I am a reflective person and dislike being hurried in my thinking.	(<i>Vide</i> note <i>infra</i> .)	INT
35.	I wake up fresh and rested most mornings.	Eysenck (1969)	N
36.	I would rather pursue my own ideas than follow a syllabus.	Hudson (1968)	SYL
37.	I shrink from facing a crisis or difficulty.	OPI	ANX
38.	I don't like having to follow a set schedule.	OPI	RIG
39.	I find it hard to address a large group.	Cattell, 16PF	INT
40.	I frequently think of experiments or issues I would like to tackle.	Parlett (<i>in</i> Hudson, 1970)	SYL
41.	I become tense and upset when I think about my present concerns.	STAI (Trait)	ANX
42.	I seldom or never have dizzy spells.	Eysenck (1969)	N
43.	I like to have a place for everything and everything in its place.	OPI	RIG
44.	I believe I am no more nervous than most people.	OPI	ANX

	Item	Origin	Scale
45.	I often find it hard to keep my mind on a task or job.	OPI	ANX
46.	I like to plan and organize the details of work I have to do.	EPPS	RIG
47.	I enjoy art, sculpture and architecture.	OPI	MAS
48.	I like playing cards for money.	OPI	MAS
49.	I usually study only what I am required to study.	Parlett (<i>in</i> Hudson, 1970)	SYL
50.	I have often felt listless and tired for no good reason.	Eysenck (1969)	N
51.	I always see to it that my work is carefully planned and organized.	OPI	RIG
52.	I have very few headaches.	Eysenck (1969)	N
53.	I hesitate to use my own ideas for fear they might be impractical.	Cattell, 16PF	AUT
54.	Without the stimulus of exams I doubt whether I would do much effective studying.	Parlett (<i>in</i> Hudson, 1970)	SYL
55.	I am more sensitive than most people.	OPI	ANX
56.	Only by going back to religion can civilization hope to survive.	Eysenck (1970)	RAD
57.	My hardest battles are with myself.	Eysenck (1969)	N
58.	When I see sloppy and untidy people I get annoyed.	Cattell, 16PF	RIG
59.	Sometimes I let small things get on my nerves too much.	Eysenck (1969)	N
60.	Outside interests often make me neglect my studies.	Hudson (1968)	SYL

Item	Origin	Scale
61. The laws against abortion should be abolished.	Eysenck (1970)	RAD
62. I would enjoy actual laboratory work more than textbook studies for a course.	OPI	INT
63. I would like to play around with certain ideas of my own even if they do not come to much.	Parlett (<i>in</i> Hudson, 1970)	SYL
64. I prefer to know that something will really work before I take a chance on it.	OPI	RIG
65. I am considered a very enthusiastic person.	Cattell, 16PF	MAS
66. In general, assignments give me little freedom and I would like them to be less structured.	Parlett, (<i>in</i> Hudson, 1970)	SYL
67. I need to have things 'just so' in order to concentrate on my work.	Eysenck (1969)	N
68. I am certainly lacking in self confidence.	OPI	ANX
69. I often get over-excited and rattled.	STAI (A-State)	ANX
70. I like to work on independent projects.	Parlett (<i>in</i> Hudson, 1970)	SYL
71. I don't like things to be uncertain and unpredictable.	OPI	RIG
72. I avoid getting involved in social responsibilities and organizations.	Cattell, 16PF	INT
73. I think the death penalty is barbaric and ought to be abolished.	Eysenck (1970)	TTM
74. I am a fairly high-strung person.	Taylor, MAS	ANX
75. I often learn more from studying along my own lines than by completing set assignments.	Parlett (<i>in</i> Hudson, 1970)	SYL

	Item	Origin	Scale
76.	I feel well adjusted to life and its demands almost all the time.		
77.	I think people should observe moral laws more strictly than they do.	Cattell, 16PF	RIG
78.	I enjoy being in a crowd just to be with people.	OPI	INT
79.	I have always hated regulations.	OPI	RIG
80.	I would rather be at home on my own than go to a boring party.	Eysenck (EPI)	INT
81.	I'm a pretty easy-going person.	Eysenck (EPI)	INT
82.	I have decidedly fewer friends than most people.	Cattell, 16PF	INT
83.	Politically I am probably something of a radical.	OPI	RIG*
84.	Straight-forward reasoning appeals to me more than imagery and metaphor.	OPI	RIG
85.	I avoid spending time dreaming about what might have been.	Cattell, 16PF	INT
86.	I like my written work to be precise, neat and well organized.	EPPS	RIG
87.	I have a tendency to be a rather over-cautious pessimist.	Eysenck (1969)	N
88.	I like to keep my things neat and orderly on my desk.	EPPS	RIG

Note: Items 20 and 34 were devised by the author.

* *sic*

APPENDIX E

ITEMS REMOVED FROM PERSONALITY
INVENTORY FOLLOWING PRELIMINARY
TARGET SAMPLE (1976) ANALYSIS

Item	Max. Loading ^a
1. Nothing in life is worth the sacrifice of losing contact with your family.	.17
2. I work under a great deal of tension.	.30
3. I cannot help feeling that war is inherent in human nature.	.25
4. I find it hard to fall asleep at bedtime.	.29
5. I seldom worry about my health.	.30
6. I am a reflective person and dislike being hurried in my thinking.	.29
7. I have decidedly fewer friends than most people.	.29

a. Seven-factor solution.

APPENDIX F

ITEMS REMOVED FROM PERSONALITY
INVENTORY FOLLOWING SECOND
TARGET SAMPLE (1976) ANALYSIS

Item	Max. Loading ^a
1. I often need cheerful, sympathetic company to cheer me up.	.40
2. I prefer to work with others rather than alone.	.40
3. Most of the people I know would regard me as an amusing talker.	.30
4. I am often troubled by feelings of guilt.	.42
5. I wake up fresh and rested most mornings.	.43
6. My hardest battles are with myself.	.31
7. When I see sloppy and untidy people I get annoyed.	.39
8. In general, assignments give me little freedom and I would like them to be less structured.	.33
9. I think the death penalty is barbaric and ought to be abolished.	.38
10. I'm a pretty easy going person.	.38
11. Straight-forward reasoning appeals to me more than imagery and metaphor.	.37
12. I avoid spending time dreaming about what might have been.	.34
13. I have a tendency to be a rather over-cautious pessimist.	.39
14. I enjoy reading Shakespears's plays.	.23

a. Seven-factor solution.

APPENDIX G

BASIC STATISTICS FOR PERSONALITY
INVENTORY, TARGET SAMPLE (1976)

Means, Standard Deviations, and
Pearson Product-Moment Correlation
Matrix (Upper Triangular Elements
Excluding the Principal Diagonal)

Item	Mean	Standard Deviation
1.	2.463	1.192
2.	3.631	1.305
3.	2.715	1.027
4.	2.084	1.199
5.	2.315	1.475
6.	2.410	1.379
7.	3.957	1.254
8.	2.852	1.328
9.	2.978	1.352
10.	2.715	1.527
11.	3.200	1.284
12.	2.873	1.460
13.	2.621	1.230
14.	3.031	1.425
15.	2.347	1.318
16.	2.978	1.375
17.	2.336	1.357
18.	3.242	1.396
19.	3.736	1.289
20.	3.284	1.226
21.	2.515	1.236
22.	3.052	1.331
23.	3.736	1.186
24.	3.094	1.246
25.	3.368	1.176
26.	3.210	1.228
27.	2.389	1.362
28.	2.231	1.197
29.	2.884	1.253
30.	2.610	1.475
31.	2.157	1.378
32.	2.852	1.406
33.	1.989	1.076
34.	2.589	1.526
35.	3.957	1.359
36.	2.642	1.508
37.	3.073	1.346
38.	2.736	1.150
39.	2.147	1.304
40.	2.968	1.250
41.	3.094	1.451
42.	2.568	1.208
43.	3.200	1.455
44.	2.189	1.214
45.	2.242	1.285
46.	2.789	1.649
47.	2.368	1.321
48.	2.178	1.120
49.	2.642	1.166
50.	2.610	0.914

Item	Mean	Standard Deviation
51.	2.600	1.347
52.	2.968	1.283
53.	3.315	1.187
54.	0.242	0.108
55.	0.249	0.128
56.	0.320	0.133
57.	3.242	1.334
58.	2.936	1.427
59.	2.283	0.996
60.	2.789	1.295
61.	2.547	1.278
62.	3.305	1.263
63.	2.200	1.455
64.	3.726	1.371
65.	1.936	0.954
66.	2.410	1.387

Variable 1

.3159	-.2039	-.2432	-.0296	-.2203
-.2074	-.0303	.0919	-.1022	.1125
.1073	.0339	-.2091	-.3875	.0903
-.3012	-.0872	.3429	.2074	-.0988
.2994	.2224	-.2159	.0515	-.3506
.1104	-.0903	.0647	.4181	-.1809
-.3395	.5756	.1874	-.0600	-.2618
-.2136	.6947	-.0922	-.0686	-.2714
.0590	.1054	.0343	-.2890	-.0040
-.1500	-.1185	.3347	.0013	.2026
.2043	.0759	-.0864	.3343	.0147
-.0110	.0924	.0223	.1189	-.0495
-.2078	-.0010	.0003	.4841	.4176

Variable 2

.1511	-.0072	-.2871	-.0628	-.1331
-.2157	-.1431	-.1064	.0190	-.0247
.0711	.0635	-.1597	.1319	-.1214
-.2248	.3020	.2589	.0926	.1582
.5136	-.1941	.0616	-.3029	.1354
-.2150	.0972	.3778	-.1211	-.0994
.1486	.1408	.0032	.0350	-.1660
.2323	.1072	.2406	.0298	.1679
.3080	.0512	-.0667	-.2687	-.0500
-.2673	.3598	.0211	.1754	.1898
.0690	-.2643	.2996	.0183	-.0032
-.0412	.0323	.3563	.1541	-.3568
-.1064	-.3006	.0922	.3076	

Variable 3

.3129	.2493	.0156	-.1414	-.0699
.0569	-.0994	-.5122	-.0879	-.0104
.0498	.1442	.2139	.2371	-.0553
-.0891	-.1631	.3007	-.1444	-.0184
.0544	-.1852	-.0111	-.2467	.0627
-.1579	-.2141	.0320	.0664	-.0220
.0944	.1359	.0023	-.1154	-.0909
.2220	.0012	-.0174	-.1255	.0313
-.0502	.1975	.0145	.1406	.0077
.0030	.3790	-.1520	-.2971	-.0826
.0035	-.1258	-.2530	-.0889	.0891
.2147	-.1812	.2168	-.0226	-.1180
-.0935	-.1920	-.1560		

Variable 4

-.0092	.3194	-.1390	.0012	-.0841
.1931	-.5010	.0608	-.1799	-.0327
-.0388	.2975	.1261	.1146	-.0405
-.0164	.1999	-.1692	-.1113	-.0338
.0305	.0384	.0253	-.0803	.0278
-.1255	.0047	.0831	-.1311	.1120
.3021	.1168	.0027	-.1456	.0124
.2571	.1541	-.1434	-.0707	.0766
.1177	.0467	.0205	-.1696	.0598
.0399	.0474	-.1916	-.0413	-.2150
.0485	-.1635	-.1657	-.1086	-.0024
-.2417	.1916	-.0873	-.3447	.0206
-.0789	-.0977			

Variable 5

-.0121	.1453	.2140	.1260	-.0306
-.1347	.0730	.0139	-.0402	.1672
-.3112	.1641	.0709	-.2466	-.3384
.1139	-.1873	-.2558	.1687	-.0432
.1861	-.1465	.2712	-.1814	-.2264
.0223	-.0299	-.0381	.2047	.1128
-.1925	.0578	-.0571	-.0576	-.2368
-.1085	-.0122	-.5450	-.0516	.1331
.3817	-.0003	.1264	-.2366	.0764
-.2729	-.3261	-.2215	.1351	-.2569
-.2001	-.0122	.3935	.1554	-.6161
-.1547	.3358	.0941	.2377	-.1141
-.2511				

Variable 6

.1761	-.0943	-.0295	.4193	-.1068
.3533	.0362	.3017	.1955	.0886
.3173	.4004	-.0761	.0812	-.0818
.0634	-.1217	.0575	.1614	.1870
.1404	.1414	.2922	.0846	.0606
.3988	-.2119	.0152	.2417	.2145
.3041	-.1926	-.1640	.3159	.1975
.0819	-.0360	.3150	.1832	-.1205
.1904	.0139	.0460	-.1080	.1579
.1575	.0694	-.1022	.0461	.0879
.0494	.0997	-.1090	-.1594	.0582
.0372	-.0837	-.0187	-.2224	.0555

Variable 7

.0345	.1061	.1325	.2165	.0958
.2860	.0186	.1569	-.4259	-.0041
.1273	-.0332	.0425	.0142	-.0496
-.1433	.2611	.0178	.2407	.1093
.1623	.0781	-.0722	.0100	.1472
-.1894	.1020	.0239	.2338	.2223

Variable 7 (Cont.)

-.1405	-.0222	.0399	.1775	.1985
-.1119	.1800	.1119	.0728	-.1446
.1190	-.0759	.0134	.2177	.1379
-.0267	.1068	-.0726	.2850	.0189
.1590	-.0073	-.1561	-.2842	.1693
.1445	.0674	-.3133	-.2895	

Variable 8

.2824	-.0051	-.1633	-.1468	.0956
-.0481	.0902	-.2345	-.1196	-.0092
-.1222	-.3266	.0856	-.0797	-.1193
.3617	-.1078	.2344	-.2558	.2155
-.2978	-.2358	.1813	-.0971	-.1201
.3948	-.0094	-.2177	-.1009	.0161
.1109	-.4063	-.2353	-.0268	-.1496
-.2265	-.0972	.1750	-.0172	.2967
-.3365	.0311	-.1877	-.3333	-.0511
.3085	-.3550	-.1093	-.1177	.2418
.1123	-.0986	-.1775	.1411	.0814
.2111	-.1417	-.1688		

Variable 9

-.0441	-.0404	.0256	.1422	-.1487
.0220	-.1489	-.0135	.0365	-.1678
-.2465	.1274	.1896	-.1625	.2851
-.1355	.0155	-.2668	.2591	-.0391
-.2121	.0303	-.0296	.1605	.3256
-.0815	-.1289	-.1101	.0853	-.0585
-.3213	-.2211	.0530	-.0573	.0219
-.0949	.1887	-.0790	.2834	-.1127
.1911	.0362	-.0310	.0439	.3388
-.1650	-.0271	.0618	.2142	.0282
-.2090	-.1225	.1718	.0508	.2377
.0649	-.0634			

Variable 10

-.0141	.5607	.1119	.2681	.0706
.0477	.2211	.7455	-.1841	.0549
-.3102	.1016	-.1004	.1204	.2187
.2024	.0742	.0015	.3382	-.0780
-.2614	.2427	-.0730	.1137	.1427
.1262	.5119	-.1399	-.2190	.2069
.2041	.3017	.0354	.4481	.1221
-.0536	-.0108	.1233	-.0219	-.0420
-.0196	.1961	.2142	-.0937	.0615
.0282	.2533	.1283	-.2958	-.1058
.0206	.0730	.1311	-.0020	-.1584
-.1050				

Variable 11

-.0317	.1359	.0895	-.0226	-.3045
-.1488	-.0273	.1284	.2674	-.1594
.1119	.1535	-.0452	.1407	.0607
.2649	-.0719	.1334	.1145	.1141
.0518	.0784	-.0282	-.2082	.1032
.0836	.0360	-.0939	.0768	.0297
.0699	.0409	.1459	-.0554	.0100
-.0313	-.0547	-.0227	-.3586	.0958
.3908	.1046	.0152	.1325	.3985
.0769	-.1786	-.1612	.1598	-.2488
.0341	.2059	-.1436	.1232	.0847

Variable 12

-.0269	.2677	.1777	.0198	.2739
.5470	-.0517	.0856	-.3582	.2769
-.0623	.0943	.3741	.1455	.2869
.0473	.4335	.1004	-.3810	.3068
-.0617	.0910	.1312	.1338	.3672
-.0453	-.2805	.1376	.2365	.4449
-.1331	.5176	.1581	-.0553	.0519
-.0381	.0981	-.1249	-.0313	.3724
.3239	-.1537	.1241	.1114	.4307
.1645	-.4795	-.2054	-.0082	.0903
.0520	.0835	-.0821	-.0266	

Variable 13

-.1023	-.0950	-.2875	.0072	.0663
.1040	.0439	.0389	.0253	-.0544
.0652	-.1377	-.0030	.0889	.1251
.0126	-.0822	-.0020	-.0818	.1013
.1259	.0603	.0924	.0363	.1542
-.0775	.0751	.0024	.0462	-.0285
.0058	-.1095	-.0397	-.1357	.1269
-.0436	.1889	-.1437	.0934	-.0337
.0569	-.1222	-.0052	.0111	.1315
.1668	.0162	-.3267	.1436	.3100
-.0432	-.0931	-.0761		

Variable 14

.3620	.1577	.4069	.3595	-.0012
.1592	-.1965	.2009	.1622	-.0556
.2976	.0387	.0977	.0455	.2045
.0616	-.0296	.5490	-.2286	-.2336
.1489	.2726	.4367	-.2479	-.0598
.1379	.2762	.0759	.1508	.2486
.3499	-.3501	.2197	-.0969	-.0251
-.2272	.1340	.2099	.2141	-.1872
-.0492	.0470	.2420	-.1663	-.3585
.1765	.0079	-.1058	.0174	-.2459
-.1706	.1763			

Variable 15

.0392	.4033	.1560	-.0708	-.1669
-.0132	-.0832	-.1584	.2320	.1772
.2105	-.0583	.2380	.0439	-.1703
-.0071	.4178	-.3120	.0346	.0260
.2717	.2370	-.2896	.1678	-.1223
.2826	-.0318	-.1529	.0515	.5771
.0731	.3958	.2599	-.2710	.0075
-.0108	-.0563	-.0912	.0601	-.1587
.0992	.1028	-.0052	-.1407	-.1684
-.0067	.1782	-.1086	.1237	-.1683
-.2008				

Variable 16

.1861	.1411	.1167	.0414	-.1311
.1515	.0422	-.1973	.0048	-.0351
-.0296	-.2100	.1404	.0536	-.1497
.1688	.0860	-.0801	.2326	.1860
.1386	.0838	-.0101	.1171	.1554
-.0311	.2358	.0024	.1893	-.1660
.2442	-.1908	.2406	.1372	.1904
.0900	.1799	-.1291	.0840	-.0615
.1534	-.1848	-.1508	.1646	.5087
-.2043	-.3590	-.0707	.0381	.1829

Variable 17

.4053	.0390	-.0070	-.0159	-.0746
-.2877	.1318	.2812	.1293	-.0142
.1478	.1919	-.0985	.0793	.4219
-.1358	-.0917	.2152	.1946	.3122
-.3241	-.0283	.1129	.3075	-.0985
-.0183	.1197	.4830	-.0535	.2622
-.0471	-.1045	-.0560	.1384	.0001
.0125	-.0539	-.0781	.0505	.1189
.0385	-.1738	-.1347	.1501	.2929
-.1152	.0158	-.1723	.1065	

Variable 18

-.1296	.1085	-.2517	.1360	-.1216
.0966	.2559	.1498	.0729	.1378
.4171	-.1344	-.1968	.2999	.0159
.0321	.2182	.2031	.5502	-.0989
-.2416	.1933	.2561	.1445	-.0345
.4117	.2572	-.1669	.0088	.0332
.0276	-.0253	.0294	.1586	.1971
-.1589	.0628	.0537	.2307	.1411
-.3098	-.1361	.0203	.0240	.0021
.0627	-.1879	-.0189		

Variable 19

.4581	-.0541	.0577	.2531	-.3613
-.0125	-.3138	.1073	-.1322	.1585
.2977	-.0242	-.1096	.2277	-.0176
-.1519	.0495	-.1479	.2396	-.0336
.1729	.0135	-.0532	.1360	.0933
-.0061	-.0713	-.1173	-.3646	.2620
-.1329	.2019	.2583	.1104	-.2008
.2458	.2164	.0930	-.2517	-.0157
.2020	-.0408	-.2438	-.2436	-.1013
.1937	.2393			

Variable 20

-.2030	.1536	.2639	-.2892	.2364
-.2521	.4296	-.3712	.3746	.3500
-.1779	.1109	.1554	-.2781	-.0055
.2684	.1418	.1290	-.0930	.5195
.2895	-.0456	.2718	.2921	.0301
-.1489	-.0653	-.4711	.5034	-.3367
.3012	.4586	.2373	-.2902	.5368
.4007	.1135	-.2206	-.3106	.1988
-.0460	-.2557	-.1156	-.2885	.0610
.2621				

Variable 21

-.2686	-.0080	.0508	-.1832	.0188
-.2025	.0550	-.3317	-.0287	.3012
-.2005	-.0997	.0965	.0890	-.0597
-.2914	-.0307	.2558	.0175	-.0275
-.2623	-.0047	-.3917	-.0192	.0538
-.0850	.0402	-.0551	.2454	.0357
-.3783	-.3875	.1058	-.0952	-.2180
-.4955	-.1019	.5101	-.0709	.0349
.0275	-.1170	.0465	.1451	.0613

Variable 22

.2579	.0290	.0147	-.2865	.0413
-.0477	.2140	.1838	-.3117	.0155
.1932	.0421	.0130	-.0488	.0868
.3563	-.1760	.0010	-.0851	.3315
.0110	.3226	-.1628	-.1111	-.0595
-.0706	.0808	-.0878	.2015	.3494
.3930	-.0155	-.0030	.1737	.2681
.0186	-.2759	.0928	-.0609	-.2877
.0658	.0371	.1366	.2242	

Variable 23

-.2489	-.0593	-.2243	.1167	-.2036
.0508	.3661	-.0459	-.0617	.0478
-.1307	-.1322	.0122	.0056	.1903
-.0159	.0875	-.0224	.1944	.2463
.0350	-.0415	-.2677	.0218	-.2763
.1772	.0614	.2926	.1900	.3012
-.2017	.2184	.0874	.0071	-.1794
-.2059	.3026	.1170	-.4210	-.0123
-.2865	.1073	.3376		

Variabel 24

.0412	.4731	-.1534	.2131	-.0405
-.3845	.0655	.0748	-.2607	.0877
.1153	-.0157	-.0549	-.1752	.0567
-.1619	-.0814	.1192	-.2333	-.0190
.0320	.2322	.2627	.3990	-.2764
.1074	-.3000	-.0978	.0227	.3233
-.3344	-.0627	-.0011	.4516	-.0733
-.2575	-.0663	.2650	.1243	.3263
-.1737	-.2625			

Variable 25

.1225	.3209	-.1970	.3105	.0713
.0293	.3482	-.0221	-.0334	.1960
.1890	.3654	-.1320	-.1536	.2467
.3219	.0232	.1056	.2113	.2147
-.1624	.1650	-.0748	.2212	-.1904
.1006	.2543	.0377	-.1641	.3069
.1559	.0510	.0520	-.2990	.0863
.1192	.0667	-.1988	-.1082	.0967
.1149				

Variable 26

-.0495	.1328	-.0324	-.2948	.1247
.2214	-.2764	.0409	.0563	-.0278
.2156	-.3745	-.1059	-.1134	.0901
.1837	-.2440	-.0056	.1088	.2637
.1877	.1502	-.2588	.0454	-.2570
-.0362	.0196	.2834	-.2887	.0130
.0335	.1775	-.1103	-.2794	.0817
.3283	.0774	.0977	-.2427	-.2385

Variable 27

-.1927	.3567	.2826	-.1633	.0802
.0318	-.1934	.0434	.1772	.1987
.0186	-.2241	.3882	.1317	.0708
.0890	.2507	.0306	-.2187	.0494
-.2831	.3028	-.2953	.1900	.4814
.3176	-.1549	.2832	.3079	.1465
-.1239	-.2547	.0710	-.1787	.0352
.0461	-.2497	.0355	.1958	

Variable 28

-.1095	-.0707	.1065	.0394	-.0476
.2969	.0126	-.0537	-.0041	-.1560
.0392	-.3502	-.2146	.0110	-.1427
.0426	.1704	.1326	.0665	.5078
.2218	.1803	-.0343	-.1266	-.1791
.1612	-.3028	-.1824	-.0221	.2512
.1403	-.0779	-.2782	.0652	.1440
.0972	-.0522	-.0130		

Variable 29

.2745	-.2355	.2919	.0858	-.0585
-.1464	.2929	.3013	-.0214	-.2757
.3710	.2224	.1071	.1119	.4059
.0638	-.1765	-.0061	-.1366	.3716
-.1511	.3060	.5133	.3107	-.1121
.3589	.2940	.3794	-.0160	-.3140
-.0479	.0466	-.0110	-.0280	.0309
.0827	.2050			

Variable 30

-.0531	-.0485	.3389	-.1993	-.0878
-.0681	-.1139	.3526	-.0196	.2240
-.0273	.0420	.1902	.2200	-.0227
-.1302	-.0730	-.1956	.4870	-.1925
.4397	.3923	.1681	-.2084	.5619
.1698	.0916	-.1431	-.0542	.2795
.0466	-.3464	-.0129	-.2162	.3677
.6714				

Variable 31

.1548	-.0705	.0918	-.0702	-.0646
-.1439	-.1010	.1171	.0091	-.0554
-.2843	.0106	-.2405	.1162	-.0601
.1546	.0917	-.1233	-.0013	.0973
-.2496	-.2778	.1539	-.1164	.0116
-.3679	.0213	.2303	.0009	.0470
-.0035	-.0742	-.0050	.0400	.0659

Variable 32

-.2890	-.0731	.1858	.4914	.4832
-.3135	.0526	.0699	.4758	.1499
.0873	.2782	.4846	-.2841	.4131
.0979	.0453	-.1857	.1313	.2213
.1683	-.0703	.1171	.2541	.2006
-.0047	-.3038	.1463	.0690	.1273
-.0686	-.0156	-.1972	.0041	

Variable 33

.1592	.0215	-.2709	-.1902	.5903
-.0443	-.0951	-.3804	-.0281	.0081
.0178	-.1288	.0467	-.0870	.0721
.1410	.1254	.2023	.1229	.0276
-.0325	.3108	.0459	-.1389	.0549
.1218	.0136	-.1426	-.1305	-.0733
.0052	.4341	.3803		

Variable 34

-.1007	-.1153	-.1456	.1196	-.0601
-.3971	-.2559	.1105	-.1973	-.0379
-.0843	.2188	.0125	.3483	-.2089
.1739	-.0134	-.1370	-.0803	.2206
-.1663	-.0063	-.1387	.1686	.0705
-.2378	-.0308	.1208	-.0440	.2405
.1281	-.2009			

Variable 35

.1067	.2050	-.0412	.0575	.1557
.1421	-.0630	-.1086	.0693	.1580
-.1273	.1923	.0609	-.0230	.0637
-.1021	-.1714	-.0971	-.1318	-.0305
-.1713	-.1116	.1630	-.0146	-.0413
.0991	.1066	-.1462	.0508	-.1578
-.1035				

Variable 36

.4479	-.2694	.1136	.1801	.4820
.0836	.0717	.0955	.3414	-.2016
.1309	-.0184	.2046	-.0559	.0283
.2084	.0638	-.1990	.1525	.2845
.1281	-.2626	-.1581	.0862	-.0408
.1193	-.1899	.0293	-.3411	-.1375

Variable 37

-.3101	-.1637	.1151	.3881	.2354
.0087	.3362	.2906	-.1797	.1042
.0164	-.0101	-.0542	.0926	.2352
.2314	-.0650	-.0335	.1694	.2563
-.0363	-.2853	.0090	.0319	.1429
.0195	-.0120	-.2943	-.1245	

Variable 38

.0616	-.0058	-.1951	.0322	.0445
-.1010	-.2873	-.0295	-.2225	-.0951
.2383	.0532	.1441	.1384	.0381
-.1061	.2253	.0347	-.0689	.1387
.1216	.0552	-.0746	-.1856	-.0889
.0617	.3432	.3283		

Variable 39

-.0297	.0431	-.0537	.0515	-.1857
.1561	-.0200	.1040	.1274	-.0419
.1111	-.1718	-.2704	-.3807	-.0592
-.0819	-.0232	-.2468	-.1435	.2867
.1570	-.0298	-.0598	-.1894	-.0723
-.1035	-.1043			

Variable 40

.3475	-.1218	.2198	.2072	.0644
-.2406	-.1024	-.5049	.3497	-.2249
.1818	.279	.0355	-.3031	.2941
.1123	.0684	-.1919	-.1037	.0353
.2307	-.1891	-.0959	-.1974	.0429
.1241				

Variable 41

.1024	.0766	.1888	.4377	.2226
.1036	.1086	.3218	.2364	.0576
.1672	.0133	.2816	.2650	.2099
.2022	.1408	.2541	.0899	.1782
.0594	.0493	.0937	.2336	.0829

Variable 42

.0895	.3680	.0963	.0140	.0340
.0577	.0402	.0099	.0222	.0259
.3480	.0464	.0567	.1729	.3820
.1073	.2769	.0093	.0452	.0103
.0314	.0720	.0977	.0138	

Variable 43

.0217	.0205	.4164	.0940	.2179
.2619	.1071	.2960	.2254	.2154
.1277	.2589	.0505	.0186	.0962
.0103	.5866	.1006	.3400	.0793
.2973	.1470	.2599		

Variable 44

.1679	.0520	.0820	.0878	.2738
.2107	.1573	.3656	.3418	.2222
.3069	.3442	.3915	.1297	.3264
.0121	.0196	.1698	.1288	.1282
.0446	.0986			

Variable 45

.0259	.3038	.0361	.0442	.0087
.1424	.0533	.0715	.1954	.0426
.1080	.1143	.1017	.2120	.0649
.0739	.1111	.1114	.0138	.1868
.0444				

Variable 46

.1303	.1473	.1281	.0620	.1340
.1338	.1830	.0796	.1258	.0048
.0234	.1298	.0756	.4739	.1214
.1536	.1019	.2093	.0320	.2268

Variable 47

.1203	.1275	.1024	.0299	.0495
.0471	.1130	.1021	.0664	.0270
.0689	.0642	.0723	.2636	.1676
.1161	.0562	.0777	.0037	

Variable 48

.2843	.2142	.1775	.1514	.2029
.3305	.1875	.2165	.0933	.3796
.2208	.0116	.1360	.2916	.2322
.1914	.0192	.1367		

Variable 49

.2020	.3276	.3264	.0825	.3161
.6366	.1560	.1383	.1479	.1313
.2101	.2114	.2571	.1203	.2148
.2471	.3482			

Variable 50

.0846	.3097	.1207	.1239	.1780
.4676	.0701	.1602	.3446	.1149
.1206	.0157	.0048	.0753	.0325
.0487				

Variable 51

.1340	.1063	.0943	.3912	.1870
.0130	.2675	.1442	.2254	.2272
.1649	.0727	.0092	.4763	.5779

Variable 52

.5161	.0742	.3701	.3082	.4888
.0011	.4171	.2582	.0866	.2300
.1002	.1983	.0418	.2582	

Variable 53

.0030	.1264	.2486	.5219	.1060
.4184	.1820	.0251	.1287	.0185
.1293	.0292	.1336		

Variable 54

.3024	.0220	.0710	.2297	.1535
.1327	.0451	.2925	.0941	.2350
.0361	.1158			

Variable 55

.2330	.1091	.0581	.2103	.2354
.1570	.2900	.1783	.3081	.2942
.5045				

Variable 56

.0741	.0883	.3234	.1293	.2709
.0076	.0340	.0977	.0903	.0069

Variable 57

.0863	.4443	.0482	.0836	.0254
.1555	.0157	.1382	.0025	

Variable 58

.0801	.1108	.0625	.1523	.1136
.1649	.0654	.1210		

Variable 59

.0304	.0065	.1247	.0557	.1743
.0750	.0391			

Variable 60

.0768	.3372	.0508	.3141	.1268
.3090				

Variable 61

.1111	.2996	.0378	.1682	.1359
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Variable 62

.1226	.3555	.0897	.3391	
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Variable 63

.0064	.0597	.0727		
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Variable 64

.1167	.2813			
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Variable 65

.4536				
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APPENDIX H

STATISTICAL DETAILS FOR
FINAL VERSION OF PERSONALITY
INVENTORY, TARGET SAMPLE (1976)

- Part 1: Communalities Estimates, Eigenvalues,
and Rotated Factor Matrix.
- Part 2: Factor Score Coefficients, and
Estimated Factor Scores for
Complete Sample (N=95).

Item No.	Communality Estimates	
	Initial	Final
1.	0.848	0.652
2.	0.747	0.334
3.	0.807	0.345
4.	0.811	0.456
5.	0.867	0.429
6.	0.722	0.312
7.	0.776	0.318
8.	0.794	0.291
9.	0.714	0.266
10.	0.868	0.468
11.	0.837	0.550
12.	0.854	0.661
13.	0.673	0.088
14.	0.784	0.470
15.	0.840	0.435
16.	0.889	0.505
17.	0.900	0.460
18.	0.899	0.513
19.	0.764	0.253
20.	0.818	0.618
21.	0.789	0.385
22.	0.752	0.389
23.	0.801	0.357
24.	0.889	0.350
25.	0.801	0.307
26.	0.841	0.315
27.	0.777	0.366
28.	0.809	0.313
29.	0.790	0.473
30.	0.852	0.536
31.	0.705	0.326
32.	0.867	0.685
33.	0.916	0.508
34.	0.867	0.280
35.	0.712	0.173
36.	0.817	0.361
37.	0.838	0.476
38.	0.867	0.485
39.	0.651	0.207
40.	0.871	0.518
41.	0.835	0.470
42.	0.783	0.308
43.	0.800	0.375
44.	0.830	0.454
45.	0.794	0.451
46.	0.766	0.309
47.	0.852	0.274
48.	0.911	0.483
49.	0.828	0.468
50.	0.823	0.309

Item No.	Communality Estimates	
	Initial	Final
51.	0.829	0.468
52.	0.853	0.616
53.	0.753	0.491
54.	0.611	0.286
55.	0.866	0.548
56.	0.818	0.385
57.	0.784	0.428
58.	0.820	0.271
59.	0.826	0.415
60.	0.853	0.608
61.	0.850	0.334
62.	0.837	0.363
63.	0.716	0.221
64.	0.749	0.241
65.	0.825	0.507
66.	0.857	0.613

Eigenvalues ^a		Cumulative Proportion of Total Variance
1.	8.753	0.133
2.	6.843	0.236
3.	4.197	0.300
4.	2.842	0.343
5.	2.218	0.377
6.	2.106	0.400
7.	1.601	0.433
8.	1.321	0.453
9.	1.151	0.470
10.	1.080	0.487
11.	1.016	0.502
12.	0.929	0.516
13.	0.865	0.529
14.	0.691	0.540
15.	0.560	0.548
16.	0.549	0.557
17.	0.468	0.564
18.	0.441	0.570
19.	0.373	0.576
20.	0.325	0.581
21.	0.283	0.585
22.	0.267	0.589
23.	0.239	0.593
24.	0.182	0.596
25.	0.151	0.598
26.	0.118	0.600
27.	0.094	0.601
28.	0.062	0.602
29.	0.025	0.602

a. Positive values only.

ROTATED FACTOR MATRIX

Variable No.	I	II	Factor III	IV	V	VI
1.	.008	-.661	-.173	.048	.029	-.398
2.	.263	-.234	-.023	-.115	.412	-.152
3.	-.077	.142	.170	-.532	-.029	.051
4.	.246	.076	.038	-.544	-.229	.127
5.	-.263	.117	.050	-.037	-.585	.012
6.	.057	-.004	-.265	-.122	-.144	.454
7.	-.019	.247	-.093	.424	-.215	.152
8.	-.485	.138	.108	.060	-.140	-.085
9.	-.477	-.128	-.069	.055	-.168	-.068
10.	-.033	.113	-.593	-.081	-.158	.283
11.	.103	-.108	-.037	.710	.123	.056
12.	.043	-.046	-.719	-.035	-.221	.272
13.	-.091	.051	-.049	.255	-.066	-.093
14.	.048	.101	-.248	-.019	.323	.541
15.	-.216	.153	.042	-.009	-.093	.626
16.	.142	-.135	-.141	-.587	.266	.163
17.	.000	.026	-.065	-.190	-.139	.621
18.	-.003	.021	-.546	-.125	-.196	.412
19.	.337	-.321	.020	.088	.156	-.103
20.	.662	-.254	-.193	.224	.154	.077
21.	-.052	-.027	.583	-.169	-.087	-.043
22.	-.103	-.241	-.498	.046	.215	-.121
23.	.149	-.187	-.098	.004	.511	-.140
24.	-.440	.257	-.077	.065	-.245	.126
25.	.237	-.134	-.192	.072	-.050	.440
26.	-.225	.355	-.070	.068	-.250	.251
27.	.423	-.133	-.251	.290	.038	.122
28.	-.529	-.009	.055	.066	-.124	.159
29.	.276	-.264	-.475	.106	-.031	.283
30.	.281	-.607	-.082	.114	.255	-.027
31.	-.127	-.040	.514	.090	.016	.197
32.	.003	.111	-.165	.038	.167	.783
33.	-.065	-.640	-.052	.000	-.061	-.272
34.	-.435	-.156	-.014	-.016	-.280	-.065
35.	.052	.097	-.049	-.303	-.131	.224
36.	.282	.200	-.072	.079	.095	.482
37.	.083	.233	-.439	.053	.012	.534
38.	-.002	-.584	-.030	.044	-.009	-.412
39.	-.030	.104	.412	-.091	.130	.043
40.	.682	-.043	-.089	-.075	.015	.144
41.	.423	.196	-.099	-.002	.041	.500
42.	-.123	.066	-.519	.101	.096	-.017
43.	.166	-.133	.014	-.057	.588	.027
44.	.153	-.129	-.585	.092	-.042	.252
45.	.048	.044	.068	-.112	-.037	.659
46.	-.161	.006	.027	.071	-.532	-.170
47.	-.194	.000	.051	-.165	.079	.440
48.	-.672	.040	.040	.090	-.133	.164
49.	.510	-.411	-.132	-.052	.124	.023
50.	-.365	.038	.110	-.382	.038	-.140

Variable No.	Factor					
	I	II	III	IV	V	VI
51.	.138	-.581	.000	-.019	.224	.247
52.	.245	-.225	-.544	.359	.257	.088
53.	.021	-.029	-.619	.069	.308	-.010
54.	-.477	.068	.106	.164	-.101	-.054
55.	.476	-.531	-.135	.039	.122	.082
56.	.251	-.092	-.162	.498	.043	.199
57.	.036	.080	-.619	.057	.117	.067
58.	-.413	.031	-.218	.000	-.246	-.055
59.	-.179	.022	.557	-.100	-.107	-.246
60.	.077	-.082	.019	.135	.809	.045
61.	.120	-.058	.020	-.532	.140	.139
62.	-.217	.252	.094	.188	-.047	.225
63.	-.197	.170	-.140	.371	-.005	-.146
64.	-.303	.031	.027	-.025	-.423	.014
65.	-.049	-.670	.132	-.014	.037	-.142
66.	.082	-.690	-.012	-.058	.344	.047

Part 2

- (a) Factor Score Coefficients for
Final Version of Personality
Inventory, Target Sample (1976).
(Output from Program BMD08M -
Factor Analysis; Dixon, 1970)
- (b) Estimated Factor Scores for
Complete Personality Inventory
Sample (N=95).

FACTOR SCORE COEFFICIENTS

Variable No.	I	II	Factor III	IV	V	VI
1.	.074	-.296	.006	.075	.034	-.039
2.	.003	.038	.077	-.057	-.052	-.035
3.	.006	-.026	-.053	-.014	-.051	-.029
4.	-.117	-.030	-.043	-.109	.100	.010
5.	.056	.025	.136	-.101	.128	-.054
6.	.015	-.024	-.007	-.031	.019	.046
7.	-.027	-.002	.088	.005	.092	-.064
8.	.060	-.043	.039	.076	.039	-.012
9.	.013	.004	-.046	.013	-.003	-.049
10.	-.002	.013	.116	-.037	-.000	-.033
11.	-.059	-.040	-.113	.329	-.042	.087
12.	-.020	-.020	.360	-.158	.185	-.056
13.	.023	-.015	.060	-.010	.023	.009
14.	-.015	.068	.006	.019	-.124	.092
15.	.078	-.089	.080	-.012	-.074	.176
16.	-.053	-.010	.152	-.377	-.032	.017
17.	-.110	-.048	-.094	-.038	.150	.033
18.	.097	-.015	.076	.004	.032	.144
19.	-.005	.034	-.064	.014	-.030	.031
20.	-.206	-.047	.010	.042	.062	-.033
21.	.002	-.014	-.080	-.087	.030	.031
22.	.061	-.010	.091	-.042	-.049	-.054
23.	-.002	-.027	.040	-.110	-.061	-.031
24.	.140	.012	.031	-.037	-.006	.141
25.	-.016	-.032	.007	-.025	.027	.078
26.	-.013	.061	.004	-.050	.111	-.091
27.	-.062	.023	-.098	.076	-.011	.055
28.	.075	-.025	.016	-.011	-.016	.062
29.	-.053	-.050	.023	.049	.004	-.049
30.	-.016	-.104	-.148	.100	-.061	.142
31.	.023	-.048	-.041	.002	-.021	.012
32.	.169	-.062	-.062	.044	-.109	.448
33.	.119	-.196	.018	-.125	.046	.060
34.	.036	-.006	-.052	-.020	.000	.033
35.	.002	-.008	-.006	.024	.018	-.012
36.	-.008	.015	-.062	-.011	.030	-.000
37.	-.070	.079	.003	.009	-.004	.052
38.	-.040	.004	.007	-.045	.062	-.179
39.	.013	.020	-.011	-.070	-.035	.006
40.	-.232	.060	-.018	-.012	.055	-.003
41.	-.017	.032	-.023	.044	-.066	.131
42.	-.022	.018	-.043	.089	-.080	-.022
43.	.068	.020	.006	-.069	-.085	.013
44.	.068	-.044	.150	-.056	.041	.034
45.	-.035	-.024	-.103	.048	.031	.088
46.	.015	.031	-.022	.075	-.006	.012
47.	-.001	.034	.034	-.051	-.007	-.037
48.	.138	-.028	.071	.036	.112	-.019

Variable No.	Factor					
	I	II	III	IV	V	VI
49.	-.112	-.060	-.018	.030	.023	.033
50.	.071	.032	.006	.065	-.137	.061
51.	.079	-.166	.099	-.042	.052	.086
52.	.047	-.064	.219	.209	-.038	.004
53.	.045	.063	.196	-.038	-.111	-.081
54.	.091	-.001	-.043	.032	-.028	.035
55.	-.213	-.024	.023	-.108	.096	-.077
56.	-.020	-.013	.047	.227	.036	.035
57.	.038	.005	.134	-.083	.041	-.059
58.	.026	-.046	-.069	.024	.023	.051
59.	-.035	-.053	-.048	-.036	.126	-.021
60.	.023	.069	-.034	.042	-.396	-.058
61.	.073	-.041	-.023	-.083	-.051	.084
62.	.062	-.019	.035	.046	.016	.110
63.	-.004	.052	-.034	.016	-.009	-.049
64.	-.031	-.008	-.021	.017	.016	-.013
65.	.050	-.210	-.059	.016	.097	-.016
66.	.100	-.209	-.016	.047	-.153	.090

FACTOR SCORES

Case No.	Factor					
	I	II	III	IV	V	IV
1.	-0.390	-2.013	1.295	-0.755	-0.567	-0.724
2.	-0.689	1.282	-0.348	0.344	0.450	-1.033
3.	0.923	-0.846	0.119	-0.612	-0.047	-0.193
4.	0.383	0.168	-0.186	-0.196	0.031	-0.529
5.	0.157	0.540	0.379	0.997	0.941	0.586
6.	1.326	0.465	-0.568	-0.427	2.066	-0.638
7.	-0.251	-1.349	0.360	-1.214	0.757	0.561
8.	1.186	-0.703	-0.259	0.033	0.041	-0.534
9.	0.004	0.664	1.173	-0.374	1.179	-0.109
10.	-0.256	0.954	-0.589	1.032	0.384	0.017
11.	-0.239	0.100	1.055	1.423	1.427	-1.852
12.	1.069	0.060	0.700	1.816	-0.800	0.374
13.	0.148	0.874	-0.173	-1.506	-0.492	-1.711
14.	0.303	-0.196	1.129	-0.633	0.048	1.544
15.	-1.278	-0.040	2.213	-1.553	0.912	0.103
16.	0.875	0.662	-0.541	-0.575	-1.598	-0.458
17.	0.162	0.694	-0.243	-0.281	1.471	-1.531
18.	0.447	1.491	0.421	-2.385	0.363	1.849
19.	0.629	0.708	-1.561	0.762	0.352	-0.178
20.	-1.256	1.380	-0.824	0.298	-0.583	1.004
21.	-0.404	0.620	-0.365	1.308	-0.738	0.373
22.	-0.300	1.452	0.030	0.541	0.362	0.001
23.	-0.059	-0.680	-1.399	1.284	0.644	0.820
24.	-0.908	1.099	-0.213	-1.558	-0.994	-0.926
25.	0.496	-0.502	-1.066	-0.179	1.313	-0.088
26.	-1.716	0.259	0.573	-0.620	0.817	-1.465
27.	-1.787	-1.112	-0.903	0.359	-0.618	0.839
28.	-0.243	0.062	-0.856	0.839	-0.763	0.290
29.	0.676	-0.541	-1.083	-1.813	1.088	1.909
30.	-1.646	1.248	-0.611	1.137	-0.833	-0.091
31.	0.075	0.218	0.115	0.428	-0.199	0.803
32.	-1.738	0.143	1.361	-1.892	-1.057	0.211
33.	1.037	-0.289	-0.383	0.712	-0.892	-0.831
34.	-0.001	-0.334	-1.552	-0.011	-1.230	0.868
35.	0.997	0.160	1.555	-0.077	-0.849	0.869
36.	-0.329	0.076	0.299	0.862	0.620	-0.084
37.	0.315	1.343	0.135	01.755	0.597	-1.194
38.	1.564	0.861	-0.076	0.110	-2.535	-0.071
39.	1.629	-1.723	1.890	-0.455	-0.846	0.301
40.	-0.574	0.955	1.094	1.089	-1.069	0.312
41.	-2.457	-0.308	0.084	-1.990	-0.810	0.038
42.	-2.069	-1.493	-1.445	-1.707	-0.300	-0.472
43.	0.800	0.445	-0.093	0.297	0.611	-0.447
44.	0.190	-0.027	1.161	0.590	-0.366	1.011
45.	1.869	-1.308	-1.409	-0.345	-0.254	-0.653
46.	-0.272	0.490	-2.524	0.189	1.053	0.452
47.	0.866	0.445	0.424	0.364	-0.997	0.379
48.	-0.416	0.703	-0.631	-0.429	-0.570	-1.464

Case No.	Factor					
	I	II	III	IV	V	VI
49.	0.413	-0.064	0.228	-0.183	-0.204	1.501
50.	-0.830	-0.562	1.245	0.152	-0.379	-0.599
51.	0.043	0.765	0.192	0.178	-0.737	0.526
52.	-0.309	-0.896	0.106	-0.978	0.004	0.439
53.	0.922	-1.541	-0.144	0.835	-1.242	1.497
54.	0.235	-0.838	0.680	0.568	0.591	-1.020
55.	1.449	-0.030	-1.344	-1.318	0.950	2.131
56.	0.163	1.234	-0.764	0.259	-1.226	-0.399
57.	0.288	-1.803	0.633	0.784	1.193	-0.481
58.	-2.160	0.660	0.396	-1.087	-0.631	1.555
59.	0.165	0.368	0.633	-0.451	0.879	-0.285
60.	0.163	0.432	0.117	0.835	1.157	0.527
61.	-0.940	-2.860	-0.457	0.242	-1.014	-0.094
62.	-0.129	0.123	0.259	0.160	0.315	0.675
63.	-0.124	-0.318	1.595	-0.631	1.058	0.876
64.	-1.165	1.007	-0.587	0.741	0.307	-0.622
65.	1.769	-0.991	1.235	-0.432	0.232	-0.365
66.	-1.248	-1.025	-0.073	0.545	-2.021	0.971
67.	-0.108	1.068	-0.937	-0.838	-0.568	-0.594
68.	-1.269	-0.276	-0.954	2.405	0.267	0.181
69.	0.708	0.958	-0.491	0.285	0.692	1.416
70.	0.083	-0.167	0.596	1.135	-0.386	-1.631
71.	0.032	-0.395	-2.025	-0.636	1.441	-0.429
72.	1.477	0.867	0.793	0.509	1.596	0.551
73.	0.653	0.693	-0.646	0.101	-1.294	0.544
74.	-0.883	-0.982	0.916	0.899	-1.589	-0.634
75.	1.139	0.020	-1.553	0.238	-0.201	-0.980
76.	0.186	-0.009	0.787	-0.299	-0.373	1.586
77.	1.355	1.574	0.794	-0.099	-1.652	-1.392
78.	0.544	-0.445	-1.394	-0.996	1.489	-1.490
79.	0.136	-0.536	0.883	0.640	0.181	0.042
80.	-0.855	1.389	0.709	0.667	0.406	-0.351
81.	-1.474	1.145	1.472	0.463	1.371	2.038
82.	-0.589	-0.771	-0.041	-0.182	-0.199	-0.025
83.	-0.017	-0.342	1.867	0.702	1.752	-0.676
84.	0.961	-0.297	0.403	-0.292	0.815	1.122
85.	0.934	0.008	0.221	-1.020	0.143	1.329
86.	-1.266	-0.883	-0.460	1.220	0.720	-0.265
87.	-0.767	-2.511	-1.673	-0.462	-0.034	-0.475
88.	-0.255	-1.517	0.026	0.686	-0.147	-1.834
89.	-0.422	-1.488	0.722	0.618	-0.593	-0.726
90.	0.381	0.696	-1.550	-1.167	-0.736	0.457
91.	-0.141	0.031	0.689	1.719	0.446	0.864
92.	-0.248	0.269	0.043	0.347	-0.025	0.353
93.	0.586	0.499	-0.083	-0.870	-0.343	-1.392
94.	-0.242	0.725	-0.732	0.435	0.734	1.032
95.	0.805	-0.146	0.003	0.087	-0.664	-1.035

APPENDIX I

ITEM ANALYSIS DATA FOR
FINAL VERSION OF PERSONALITY
INVENTORY, TARGET SAMPLE (1976)

<u>Scale Key</u>	1. Adventurousness-Cautiousness
	2. Rigidity-Complexity
	3. Anxiety-Stability
	4. Introversion-Extraversion
	5. Radicalism-Conservatism
	6. Distractibility-Single Mindedness.

Item	Scale	Mean	Standard Deviation	Correlation with Scale
1	2	3.54	1.186	0.705
2	5	3.63	1.298	0.620
3	4	3.28	1.023	0.530
4	4	3.92	1.194	0.605
5	5	3.68	1.467	0.723
6	6	2.41	1.373	0.510
7	4	3.96	1.247	0.503
8	1	3.15	1.322	0.612
9	1	3.02	1.345	0.559
10	3	3.28	1.519	0.634
11	4	3.20	1.278	0.674
12	3	3.13	1.453	0.759
13	4	2.62	1.224	0.406
14	6	3.03	1.418	0.660
15	6	2.35	1.312	0.630
16	4	3.02	1.369	0.673
17	6	2.34	1.350	0.641
18	3	2.76	1.390	0.601
19	1	3.74	1.283	0.482
20	1	3.28	1.220	0.707
21	3	2.52	1.238	0.633
22	3	2.95	1.325	0.513
23	5	3.74	1.181	0.573
24	1	2.91	1.240	0.574
25	6	3.37	1.170	0.502
26	2	3.21	1.222	0.536
27	1	2.39	1.356	0.502
28	1	3.77	1.192	0.552
29	3	3.12	1.247	0.617
30	2	3.39	1.468	0.748
31	3	2.16	1.371	0.528
32	6	2.85	1.399	0.810
33	2	4.01	1.071	0.670
34	1	3.41	1.518	0.551
35	4	2.04	1.353	0.393
36	6	2.64	1.500	0.607
37	6	3.07	1.340	0.644
38	2	3.20	1.157	0.668
39	3	2.15	1.298	0.464
40	1	2.97	1.244	0.665
41	6	3.09	1.444	0.634
42	3	3.43	1.202	0.529
43	5	3.20	1.448	0.712
44	3	3.81	1.208	0.667
45	6	2.24	1.279	0.681
46	5	3.15	1.648	0.668
47	6	2.37	1.314	0.476
48	1	3.76	1.158	0.700
49	1	2.64	1.160	0.559
50	4	3.39	0.910	0.362

Item	Scale	Mean	Standard Deviation	Correlation with Scale
51	2	3.40	1.341	0.623
52	3	3.03	1.277	0.637
53	3	2.68	1.181	0.645
54	1	3.58	1.082	0.536
55	2	3.51	1.280	0.668
56	4	3.20	1.327	0.506
57	3	2.76	1.328	0.684
58	1	3.00	1.422	0.555
59	3	2.28	0.991	0.634
60	5	2.79	1.289	0.809
61	4	3.39	1.292	0.602
62	5	2.63	1.240	0.636
63	4	2.20	1.448	0.551
64	5	2.21	1.329	0.591
65	2	4.00	1.016	0.549
66	2	3.53	1.406	0.732

APPENDIX J

THE STUDY BEHAVIOUR
QUESTIONNAIRE
(Form J)

The Organizational Study Skills (Scale 5)
Comprises Items 5, 14, 23, 31, 39, 46, 59,
and 67 of this Appendix.

C O N F I D E N T I A L

Name _____

UNIVERSITY OF NEWCASTLE
DEPARTMENT OF EDUCATION

STUDY BEHAVIOUR QUESTIONNAIRE: FORM J

There is no one single best method of study. Academic success can be attained through various approaches to study. Some students adopt methods that will suit both their own way of working and their particular course demands, but others use study methods that are not so appropriate.

On the following pages are a number of questions about your habitual or usual study methods. These questions are carefully selected to give a comprehensive picture of how you see your own attitudes and approaches to study.

For each item there is a 5. point scale:

1. This is never or very rarely true of me.
2. This is sometimes true of me.
3. This is true of me about half the time or cannot decide.
4. This is frequently true of me.
5. This is always or almost always true of me.

Circle the number that corresponds to your immediate reaction to the item. If you have difficulties about deciding, score '3'. Remember agreement scores high (4, 5); disagreement low (1, 2). Don't dwell for too long on any particular item and please respond to all of them. Do not worry about projecting what might seem to be a good image: individual item responses will not be identified at any time.

Although this is a research project, any student who wishes to consult me about their study profile is welcome to do so.

1. In choosing between two courses, I put more emphasis on how practical rather than on how interesting a course may be. 1 2 3 4 5
2. I usually become increasingly absorbed in my work the more I do. 1 2 3 4 5
3. I find a new and unfamiliar approach to an already learned topic confusing and depressing. 1 2 3 4 5
4. When I have worked something out for myself and I really believe my view to be sound, I will stick to it if the class or even the lecturer clearly disagree with me. 1 2 3 4 5
5. I try to do all of my assignments as soon as they are assigned. 1 2 3 4 5
6. I think most people can actually learn better when they are given the facts about a topic instead of having to figure them out by themselves. 1 2 3 4 5
7. I try to relate new material, as I am reading it, to previously learned material. 1 2 3 4 5
8. I worry a lot about how I am going to do when I am studying for a test. 1 2 3 4 5
9. I have found that my university studies raise more questions than they settle. 1 2 3 4 5
10. I question the value of undergraduate courses which take a theoretical, academic approach instead of a practical approach. 1 2 3 4 5

- | | | | | | | | | |
|-----|--|----|----|---|---|---|---|---|
| 11. | I have a strong desire to excel in all my studies. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 12. | The continual pressure of work, the drive to meet assignment deadlines and the constant competition make my life at university tense and depressing. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 13. | I have to be sure of something in my own mind before I will accept it as being valid or true. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 14. | I try to work consistently throughout the term and review regularly when the exams are close. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 15. | I learn some things by rote, going over and over them until I know them by heart. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 16. | I try to relate what I have learned in one subject to that in another. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 17. | I am discouraged by a poor mark on a test and worry about how I will do on the next test. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 18. | My university studies have changed my views about such things as politics, my religion, and my philosophy of life. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 19. | As long as I do well on the examinations, I don't worry much about the particular content of a course. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 20. | I find most new topics interesting and often spend extra time trying to obtain more information about them. | .. | .. | 1 | 2 | 3 | 4 | 5 |
| 21. | I rarely keep up to date with suggested readings that are meant to keep pace with the lectures. | .. | .. | 1 | 2 | 3 | 4 | 5 |

22. While I realise that truth
is forever changing as
knowledge is increasing, I
feel compelled to discover
what appears to me to be
the truth at this time. 1 2 3 4 5
23. After a lecture or lesson
I reread my notes to make
sure they are legible and
that I understand them. 1 2 3 4 5
24. I prefer subjects with a lot
of factual content to more
theoretical kinds of subjects. 1 2 3 4 5
25. If I like a lecturer, it is
easier to learn from him even
if his actual teaching isn't
all that good. 1 2 3 4 5
26. In reading new material I
often find that I'm continually
reminded of material I already
know and see the latter in a
new light. 1 2 3 4 5
27. I think that one important
benefit of my university
career will be to give a
more general viewpoint to me. 1 2 3 4 5
28. I am at university mainly
because I feel that I will be
able to obtain a better job
if I have a university degree. 1 2 3 4 5
29. When writing an assignment or
essay, I find that the topic
rapidly becomes more and more
complex and I have great
difficulty in typing up all
the loose ends at the finish. 1 2 3 4 5
30. I believe strongly that my main
aim in life is to discover my
own philosophy and belief
system and to act strictly
in accordance with it. 1 2 3 4 5
31. I keep neat, carefully arranged
notes. 1 2 3 4 5

32. I prefer to learn the facts and details about a topic rather than a theoretical understanding of it. 1 2 3 4 5
33. I am very aware that lecturers and textbook writers know a lot more than I do and so I rely on their judgment rather than on my own. 1 2 3 4 5
34. When I am reading fresh material, I try to think of what I already know that is related to it and frame questions on this basis that the new materials may answer. 1 2 3 4 5
35. I am concerned about how poor results on a test will affect my overall grade in a course. 1 2 3 4 5
36. I find that I am very interested in trying to understand the point-of-view of other students, especially those from different backgrounds than myself. 1 2 3 4 5
37. I would rather take a difficult, interesting course instead of an easy, uninteresting course. 1 2 3 4 5
38. It is inevitable that at first one's understanding of a subject will be confused, but I find this initial confusion very distressing. 1 2 3 4 5
39. I try to keep up with all of the suggested readings that go with the lectures. 1 2 3 4 5
40. I make a point of studying set readings in detail rather than attempting to cover both required and optional readings 1 2 3 4 5
41. I take seriously anything that I have been lectured about, or that is in my textbooks, so that I would change my interpretations only on the strongest evidence. 1 2 3 4 5

42. When I approach a new piece of reading material, I try to note both the basic factual knowledge it contains and the general theoretical points: I rote learn the former, and think about and chew over the latter until both parts complement each other, and the whole hangs together.
(Rate yourself according to whether this is a deliberate and conscious strategy.) 1 2 3 4 5
43. I think that the university should encourage experimentation and change in our society. 1 2 3 4 5
44. I think that a person should specialize in some particular area so that his degree will be more attractive to prospective employers. 1 2 3 4 5
45. I find university more relevant than high school because I am able to study areas which really interest me. 1 2 3 4 5
46. I summarize suggested readings and include these as part of my notes on a topic. 1 2 3 4 5
47. I would question the statements and ideas of my lecturers only under special circumstances. 1 2 3 4 5
48. While I am studying, I often think of real life situations in which the material that I am learning would be handy, and useful to know. 1 2 3 4 5
49. I believe that while at university students should be exposed to all kinds of political and social viewpoints. 1 2 3 4 5
50. I resent having to spend four years of my life at university but feel that the end results will make this worthwhile. 1 2 3 4 5

51. I find that I have to do enough work on a topic so that I can form my own point of view before I am satisfied. 1 2 3 4 5
52. I find I personally have to see a cooperative venture (say a group project) through to the end rather than delegate responsibility to a colleague. 1 2 3 4 5
53. I try to understand what a lecturer is saying about a new topic rather than taking down all of the details for later study. 1 2 3 4 5
54. I think that a university student should be allowed to conduct his life in any way he wants to as long as he doesn't interfere with someone else. 1 2 3 4 5
55. I want top grades in most or all of my courses so that I will be able to select among the best positions available when I graduate. 1 2 3 4 5
56. I feel that virtually any topic can be highly interesting once I get into it. 1 2 3 4 5
57. I feel threatened when a lecturer asks me a question or when I am forced to participate in a class seminar. 1 2 3 4 5
58. I feel that I might have some power eventually, to change things in the world that I see now to be wrong. 1 2 3 4 5
59. When a test is returned, I go over it carefully correcting all errors and trying to understand why I made the original mistakes. 1 2 3 4 5

60. I find that the best lecturers work from carefully prepared notes and outline major points on the blackboard. 1 2 3 4 5
61. I prefer to accept what my lecturers say even though it sometimes means that I have to change my own ideas. 1 2 3 4 5
62. I worry that a lecturer will try and trick me on a test even though I know the material well. 1 2 3 4 5
63. I try to select my courses on the basis of their practical value for my career plans rather than for their academic interest. 1 2 3 4 5
64. I spend a lot of my free time finding out about interesting topics which have been discussed in different classes. 1 2 3 4 5
65. I think that it is unreasonable for a lecturer to expect a completely original term paper from an undergraduate student. 1 2 3 4 5
66. When I have come to an important conclusion, I feel an overpowering urge to convince other people that it is right. 1 2 3 4 5
67. I keep reviewing important topics until I understand them completely. 1 2 3 4 5
68. I prefer a text which lays things out carefully in point form and contains frequent tables and summaries, to one which is written almost entirely in paragraph form. 1 2 3 4 5
69. I prefer texts which present a unified point of view and are written by an authority instead of a collection of articles by various authors on a topic. 1 2 3 4 5

70. When a lecturer makes a point which I don't understand, I try to question him until I can grasp what he is saying. 1 2 3 4 5
71. Even when I have studied hard for a test, I worry that I may not be able to do well in it. 1 2 3 4 5
72. I believe that a lecturer has the right to expound any viewpoint he wishes as long as he is sincere in doing so. 1 2 3 4 5
73. I chose my present courses to enable me to secure a position with a top starting salary and above average earning potential. 1 2 3 4 5
74. I find that studying academic topics can at times be as exciting and gripping as reading a good novel. 1 2 3 4 5
75. "Inner certainty" is more important to me than modifying my views to fit more easily with what other responsible people think. 1 2 3 4 5
76. I find that most class discussions are a waste of time because they usually refer to opinions rather than to hard facts. 1 2 3 4 5
77. I worry about what my lecturer will think of me if I do poorly on a test. 1 2 3 4 5
78. I believe that a lecturer has the right to critically discuss controversial questions although this may offend some members of his class. 1 2 3 4 5
79. I feel that one of the most important considerations in choosing a course is whether or not I will be able to get top marks in it. 1 2 3 4 5

80. After I graduate I hope to
work at a job which is
academically rather than
commercially oriented.

.. .. 1 2 3 4 5

J.B. Biggs
23 April 1975.

APPENDIX K

SUMMARY ITEM ANALYSIS STATISTICS
FOR THE STUDY BEHAVIOUR QUESTIONNAIRE
(FORM J)

<u>Scale Key</u>	1. Academic Aspiration
	2. Academic Interest
	3. Academic Neuroticism
	4. Internality
	5. Organizational Study Skills
	6. Fact-rote Strategy
	7. Dependence
	8. Meaning Assimilation
	9. Test Anxiety
	10. Openness.

TABLE K.1: Scale Statistics for Study Behaviour Inventory, Target Sample (N=72)

Scale No.	1	2	3	4	5	6	7	8	9	10
Item N	10	10	7	8	8	8	8	6	9	6
Means	29.25	34.13	20.99	26.76	22.75	25.26	26.81	21.67	32.79	18.83
Standard Deviations	6.23	5.62	4.46	3.98	5.68	4.91	4.02	4.45	4.39	3.72
Alphas	0.69	0.70	0.57	0.53	0.75	0.63	0.55	0.70	0.54	0.53

TABLE K.2: Item Statistics for Study Behaviour
Inventory, Target Sample (N=72)

Item	Scale	Mean	Standard Deviation	Correlation with Scale
1	1	2.89	1.22	0.579
2	2	3.99	0.90	0.562
3	3	2.51	1.13	0.495
4	4	3.01	1.09	0.461
5	5	2.26	1.24	0.603
6	6	2.75	1.01	0.408
7	7	3.69	0.99	0.659
8	8	3.99	1.17	0.760
9	9	3.53	1.29	0.448
10	1	3.31	1.24	0.538
11	2	3.93	1.08	0.463
12	3	2.78	1.14	0.639
13	4	3.96	0.88	0.429
14	5	3.40	1.23	0.635
15	6	3.25	1.28	0.516
16	7	3.68	1.06	0.547
17	8	4.03	1.10	0.648
18	9	2.24	1.30	0.468
19	1	2.46	1.20	0.450
20	2	2.79	0.99	0.432
21	3	3.17	1.15	0.421
22	4	3.46	0.91	0.512
23	5	2.40	1.28	0.640
24	6	3.28	1.23	0.604
25	10	3.19	1.29	0.283
26	7	3.69	0.84	0.564
27	9	3.76	1.02	0.392
28	1	3.57	1.22	0.442
29	3	2.88	1.24	0.459
30	4	3.14	1.20	0.357
31	5	3.25	1.26	0.661
32	6	3.07	1.14	0.613
33	10	3.42	1.03	0.619
34	7	3.43	0.96	0.642
35	8	4.29	0.88	0.316
36	9	3.83	0.98	0.431
37	2	3.56	1.11	0.604
38	3	3.43	1.25	0.678
39	5	2.64	1.09	0.772
40	6	3.17	1.16	0.523
41	10	3.14	1.03	0.593
42	7	2.90	1.01	0.169
43	9	3.51	1.01	0.545
44	1	3.10	1.12	0.549
45	2	3.71	1.26	0.427

Item	Scale	Mean	Standard Deviation	Correlation with Scale
46	5	2.44	1.18	0.518
47	10	3.39	1.11	0.717
48	7	3.85	1.05	0.595
49	9	3.97	0.91	0.557
50	1	2.61	1.41	0.442
51	2	3.44	0.83	0.433
52	4	3.89	0.93	0.418
53	7	3.07	1.11	0.395
54	9	4.03	0.98	0.460
55	1	3.19	1.17	0.484
56	2	3.32	1.11	0.471
57	3	2.90	1.31	0.464
58	4	2.53	1.09	0.648
59	5	3.15	1.13	0.566
60	6	3.69	1.24	0.614
61	10	2.71	1.03	0.624
62	8	2.96	1.39	0.539
63	1	3.24	1.19	0.608
64	2	2.24	0.99	0.594
65	3	3.32	1.14	0.561
66	4	3.03	1.09	0.564
67	5	3.19	0.99	0.377
68	6	3.71	1.06	0.466
69	10	2.99	1.25	0.518
70	7	2.49	1.11	0.395
71	8	3.74	1.22	0.776
72	9	3.89	1.04	0.523
73	1	2.64	1.21	0.568
74	2	3.43	1.24	0.654
75	4	3.75	0.95	0.497
76	6	2.35	1.08	0.469
77	8	2.67	1.22	0.698
78	9	4.03	0.84	0.359
79	1	2.25	1.18	0.460
80	2	3.72	1.14	0.585

APPENDIX L

THE ASSESSMENT SCHEDULE
FOR ED111, CHILD AND ADOLESCENT
DEVELOPMENT, TARGET SAMPLE (1976).

A Facsimile of the Instructions
Provided for Students at
the First Lecture Session.

ASSIGNMENT NO. 1

DUE April 6th, 1976Essay

Write an essay of not more than 1500 words on one topic selected from the list provided below. The presentation of your essay must conform in all respects with the requirements set out in the document "Directions Concerning the Submission ... of Assignments in Education".

TOPIC A

Unlike the concept of puberty which can be defined with some degree of exactness using measurable physical indices (although even here some arbitrariness cannot altogether be excluded) the more popularly favoured concept of adolescence, loosely meaning 'growth into maturity' is bedevilled with arbitrary and confusing connotations.

Connell, W.F. *et al.*,
12 to 20 Sydney: Hicks
Smith & Sons, 1975, p.8.

Following a critical examination of the evidence concerning adolescence in Western society, formulate and defend a definition of the term.

References

- Ausubel, D.P. *Theory and problems of adolescent development*, N.Y.: Grune and Stratton, 1954.
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- Connell, W.F., *et al.*, *Growing up in an Australian city*, Melbourne: A.C.E.R., 1959.
- Connell, W.F., *et al.*, *12 to 20: Studies of City Youth*, Sydney: Hick Smith & Sons, 1975.
- Douvan, E. & Adelson, J., *The adolescent experience*, Wiley, 1966.

References

- Erikson, E.R. (Ed.), *The challenge of youth*, N.Y.: Basic Books, 1965.
- Fleming, C.M. *Studies in the social psychology of adolescence*, London: Routledge and Kegan Paul, 1951.
- Friedenberg, E.Z. *The vanishing adolescent*, Boston: Beacon Press, 1960.
- Friedenberg, E.Z. *Coming of age in America*, N.Y.: Random House, 1965.
- Grinder, R.E. *Studies in adolescence*, N.Y.: Macmillan Co., 1963.
- Havighurst, R.J. *Developmental tasks and education*, N.Y.: David McKay Co. Inc., 1972.
- Muuss, R.E. *Theories of adolescence*, N.Y.: Random House, 1968.
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- Piaget, J. *The growth of logical thinking from childhood to adolescence*, N.Y.: Basic Books, 1958.
- Rogers, D. *Issues in adolescent psychology*, N.Y.: Appleton-Century-Crofts, 1969.

TOPIC B

Review and evaluate the state of research in moral development from infancy to adulthood. How adequately does Social Learning theory account for what is currently known?

References

- Bandura, A. & Walters, R.H. *Social learning and personality development*, N.Y.: Holt, Rinehart & Winston, 1963.
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- Haan, N., et al., Moral reasoning of young adults, *Journal Pers. and Soc. Psych.*, 1968, 10, 183-201.
- Hoffman, M.L., Child rearing practices and moral developments: generalizations from empirical research, *Child Dev.*, 1963, 34, 295-318. (also in Grinder, R.E. *Studies in adolescence*, N.Y.: Macmillan Co., 1963, pp.275ff.)
- Kay, W. *Moral development*, London: George Allen & Unwin Ltd., 1968.

References

- Kohlberg, L. Moral development and identification, *In Child Psychology*, 63rd N.S.S.E. Yearbook, Pt. 1.
- Kohlberg, L. Development of moral character and moral ideology, *In Hoffman, M. & L.W. (Eds.), Review of Child Developmental Research*, 1964.
- Kohlberg, L. Moral education in the schools; a developmental view, *School Rev.*, 1966, 74/1.
- Turiel, E. Stage Transition in Moral Development, Chap. 23 *In Travers, R.M.W. (Ed.), Second Handbook of Research on Teaching*, Chicago: Rand McNally & Co., 1973.

TOPIC C

"...cognitive activity achieves something for the organism".

(Bruner, J.S. *et al.*, *A study of thinking*, N.Y.: Science Editions, 1956, p.16).

So far as the work of Jean Piaget is concerned, what is it that cognitive activity achieves and how does it do it? (Confine your discussion to the period of concrete operations.)

References

- Baldwin, A.L. *Theories of child development*, N.Y.: John Wiley & Sons, 1967.
- Flavell, J.H. *The developmental psychology of Jean Piaget*, Princeton, (N.J.): D. Van Nostrand, 1963.
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- Piaget, J. *The psychology of intelligence*, London: Routledge & Kegan Paul, 1950.
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- Piaget, J. *Genetic epistemology*, N.Y.: Columbia Uni. Press, 1970.
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- Wadsworth, B.J., *Piaget's theory of cognitive development*, N.Y.: David McKay Co., 1971.

TOPIC D

Summarily discuss the present state of theory and research on the concepts of intelligence in human behaviour. In particular compare the approach based on a psychometric with that based on a developmental point of view.

References

- Bereiter, C. The future of individual differences, *Harv. Educ. Rev.* 1969, 39, 310-18.
- Butcher, H.J., *Human intelligence, its nature and assessment*, London: Methuen & Co., 1968.
- Crow, J.F. Genetic theories and influences: comments on the value of diversity, *Harv. Educ. Rev.*, 1969, 39, 301-09.
- Ellsind, D. Piagetian and psychometric conceptions of intelligence, *Harv. Educ. Rev.*, 1969, 39, 319-37.
- Flavell, J.H. *The developmental psychology of Jean Piaget*, Princeton, (N.J.): D. Van Nostrand, 1963.
- Hunt, J. McV., Has compensatory education failed? Has it been attempted? *Harv. Educ. Rev.*, 1969, 39, 278-93.
- Jensen, A.R. How much can we boost IQ and scholastic achievement? *Harv. Educ. Rev.*, 1969, 39, 1-88.
- Jensen, A.R. Social class, race and genetics: Implications for education. *Amer. Educ. Res. T.*, 1968, 5, 1-42.
- Jensen, A.R. *Educability and group differences*, London: Methuen & Co. Ltd., 1973.
- Wiseman, S. (Ed.) *Intelligence and Ability*, Harmondsworth: Penguin Books Ltd., 1973.

TOPIC E

"Imagine a medical man going in for dreams when there are so many serious things even in neuropathology and psychiatry - tumors as big as apples compressing the organ of the mind, haemorrhages, chronic inflammation, in all of which the changes in the tissues can be demonstrated under the microscope! No, dreams are much too trivial, and unworthy to be an object of research."

(Freud, S. *Introductory Lectures on Psychoanalysis*, Harmondsworth (Mddx.): Penguin Books Ltd., 1974, p.112)

Critically evaluate Freud's work related to dreams, particularly with reference to our understanding of child and adolescent development. To what extent does he refute his own wry assertion quoted above?

References

- Brown, J.A.C. *Freud and the Post-Freudians*, Harmondsworth (Mddx.): Penguin Books Ltd., 1961.
- Fine, R. *Freud: A critical re-evaluation of his theories*. London: Allen & Unwin, 1963.
- Freud, S. *Major Works*, Chicago: Encyclopaedia Britannica Inc., 1952.
- Freud, S. *Two Short Accounts of Psycho-Analysis*, Harmondsworth (Mddx.), Penguin Books Ltd., 1962.
- Lee, S.G.M. (Ed.) *Freud and Psychology*, Harmondsworth, (Mddx.) Penguin Books Ltd., 1970.
- Stafford-Clark, D. *What Freud Really Said*, Harmondsworth, Penguin Books Ltd., 1965.
- Thompson, C.M. *et al.* *An Outline of Psycho-Analysis*, N.Y.: Modern Library, 1955.

TOPIC F

"It should be possible to arrange institutional settings where children now culturally deprived by the accident of the social class of their parents can be supplied with a set of encounters with circumstances which will provide an antidote for what they have missed."

(Hunt, J.McV. The psychological basis for pre-school enrichment, *Merrill-Palmer Quarterly*, 1964, 10, 241.)

In the light of current research and theory on the situational determinants of early development, discuss this assertion by Hunt.

What would be the psychological components of the institutional settings he refers to?

References

- Ashby, G.F. *Pre-school theories and strategies*, Melbourne, Melb. Univ. Press, 1972.
- Bereiter, C. and Engelmann, S. *Teaching disadvantaged children in the pre-school*, N.Y.: Prentice Hall, 1966.
- Hess, R.D. & Baer, R. (Eds.), *Early Education*, Chicago: Aldine, 1968.
- Hess, R.D., Shipman, V.C., Brophy, J.E., & Baer, R.M., Mother-child interaction, In Gordon, I.J. *Readings in research in developmental psychology*, Glenview (Ill.): Scott, Foresman & Co., 1971.
- Jensen, A.R. *Educability and group differences*. London: Methuen & Co. Ltd., 1973.
- Krumboltz, J. (Ed.), *Learning and the educational process*, Chicago: Rand McNally, 1965.
- Lemos, M. de, Current trends in pre-school education, *Quarterly Rev. Aust. Educ.*, 1968, Vol. 1; also see supplement to this volume.
- Piaget, J. *The origins of intelligence in children*, N.Y.: International Univ. Press, 1952.
- Piaget, J. *Play, dreams and imitations in childhood*, N.Y.: Norton, 1951.
- Rutter, M. *Maternal deprivation reassessed*, Harmondsworth (Mddx.) Penguin Books, 1972.

ASSIGNMENT NO. 2

DUE June 8th, 1976Analytical Report and Thesis

This assignment is intended to develop your ability to evaluate evidence critically and, on the basis of your evaluation, to extend an integrating and consistent argument towards some conclusion, i.e. to formulate a thesis.

The component tasks of the assignment require that you:

- (a) recognize and discriminate the substance of research reports and the contributions of their several parts, e.g. the procedures used, the data offered in evidence, the results presented, and the authors' interpretations;
- (b) test the logical and empirical consistency of each report and discern the agreements and conflicts that arise within and between them;
- (c) formulate an integrating and consistent argument extending from the reports under examination to a critical conclusion based on the analysis carried out.

The assignment must be presented in the form of brief notes, say one point per line of note-making. The niceties of style (together with its many potential redundancies), and the mechanics of scholarly presentation do not apply to this exercise.

The assignment is to be set out in five sections structured according to the following general scheme:

Section 1: THE PROBLEM (ca. 1511)

(Title; description of problem under consideration; its relationship to the central issue raised in the research articles).

Section 2: MAJOR FINDINGS (ca. 1p.)

(Summary statements of major findings from each article which bears on the problem).

Section 3: THE ARGUMENT (*ca.* 2pp.)

(The thesis: an argued case developed with reference to (a) the problem, and (b) the available evidence; the thesis must represent a pointed attempt to solve the problem set out in Section 1).

Section 4: RESEARCH IMPLICATIONS
(*ca.* 2011)

(Major points arising out of the analysis that call for further examination).

Section 5: EDUCATIONAL IMPLICATIONS
(*ca.* 1511)

(Suggestions concerning the practical considerations of school life and classroom functioning).

In preparing this assignment you should draw on two (2) research reports selected from the following list:

- (a) Bandura, A., Grusec, J.E., and Menlove, F.L., Vicarious extinction of avoidance behavior, *In* Mussen, P.H. *et al.*, (Eds.), *Readings in Child Development and Personality*, N.Y.: Harper & Row, 1970. Second Edition, pp.365ff.
- (b) Bernstein, B., and Henderson, D. Social class differences in the relevance of language to socialization, *In* Mussen, P.H. *et al.*, (Eds.), *op.cit.*, pp.228-47.
- (c) Purcell, K. Assessment of psychological determinants *In* Mussen, P.H. *et al.*, (Eds.), *op.cit.*, pp.188-203.
- (d) Schaffer, H.R. and Emerson, P. Patterns of response to physical contact in early human development, *In* Mussen, P.H. *et al.* (Eds.), *op.cit.*, pp.188-203.

The only allowable pairings for this assignment are:

- 1. (a) and (b)
- 2. (a) and (c)
- 3. (a) and (d)
- 4. (c) and (d).

ASSIGNMENT NO. 3

DUE August 3rd, 1976Child Study Exercise

A Report of an Observational Study

The general purpose of this assignment is to direct your attention to the actualities of children's behaviour and to provide you with an opportunity to introduce a measure of theory-based system into your interpretative comments.

The assignment should be submitted in two distinct sections. Section 1 should comprise the full set of observational notes, diagrams, tape recordings, photographs, typescripts, or other raw data that you have collected; and Section 2 is to take the form of a cogent statement, in continuous prose, of your interpretation of the raw data presented in Section 1.

In formulating your interpretation you should use one or more of the theories of child behaviour and development studied this year to inform your work or, if you think some other theory offers a more compelling interpretative and explanatory framework, you should draw upon it.

When carrying out your study you are to satisfy the following conditions:

- (a) the study must deal with (1) subject;
- (b) the study must be longitudinal in method (see references, *infra*);
- (c) the study must be observational. You are not to intervene in any way in the subject's behaviour, for instance by administering tasks, asking questions, offering advice or assistance, or in some other respect actively involving yourself.

The study may cover a brief period of time, say an hour or two, or it may be spread over many months; it may be concerned with infancy, childhood, or adolescence depending on your interests and, inevitably, upon circumstance; it may deal with any topic you wish subject to the ordinary proscriptions of good taste and fair dealing.

In your presentation of Section 2 you must adhere to the proper format for submitting written work, and your interpretative remarks are not to exceed 1000

words. No such restrictions are placed on the way Section 1 is to be set out, nor is there any prescribed length.

References

- Arrington, R. Time sampling in studies of social behaviour: a critical review of techniques and results with research suggestions, *Psych. Bull.*, 1943, 40, 8-124.
- Bayley, N. Research in child development: a longitudinal perspective, *Merrill-Palmer Quarterly*, 1965, 11, 183-208.
- Kodlin, D., and Thompson, D.J. The longitudinal method
In Meyer, W.J. (Ed.), *op.cit.*, pp.29-34.
- Mussen, P.H. (Ed.) *Handbook of research methods in child development*, N.Y.: Wiley, 1960.

APPENDIX M

THE T.E. SCORE AS AN INDEX OF
TASK PERFORMANCE

Multiple linear regression analyses were carried out in order to estimate the extent to which a general measure of academic ability could have influenced each of the performance scores, and hence the interpretation of results. For this set of analyses the general measure employed was the Tertiary Entrance Score (TES) gleaned directly from student admission records. The TES index is a composite score based on student performance at the secondary school level. As its name implies it is the common metric used by Queensland's Universities and Colleges of Education for student matriculation. Since it is derived from the academic performance of secondary school students over several years in a range of subjects, the TES is not equivalent to a conventional measure of intelligence, though it could be expected to reflect a much higher saturation on general intelligence than on any other characteristics. Of its nature, however, it will unavoidably represent some aspects of the very personality components under investigation here. But it was the most appropriate measure for the present needs since it adequately expresses a student's level of academic competence on entry to the first year of University studies.

The analyses were performed so as to satisfy the requirements of Cohen's (1968) incremental *F* test. The multiple R^2 statistic was calculated for a selection of key personality variables both with and

without the TE scores, and the values of the associated F -ratios were inspected. The variables selected for analysis in conjunction with the TE scores were those regarded as broadly representative of the personality domain so far as the present study was concerned. They were Adventurousness-Cautiousness, as the first general Personality factor scale, Anxiety-Stability as a quadratic term, and the three-way compound (Anxiety $\times$ Introversion $\times$ SBQ5).

Of the 64 students used in the study, 54 were found to have complete data including the TE score. The ten remaining cases were special or provisional matriculants and had no TE scores; they were mature age students or had completed their matriculation requirements outside Queensland.

The relevant multiple regression data are displayed as Table M.1 and were provided by computer program

TABLE M.1: Multiple Regression Statistics as Estimates of Tertiary Entrance Score Contribution to Performance Task Variance (N = 54)

Task	Full Model R^2	Red. Model R^2	Cohen's F
Essay	.128	.127	<1
Analytic Report	.066	.047	1.003
Child Study	.067	.055	<1
Tutorial	.128	.121	<1

BMD03R (Dixon, 1970). In no case did the incremented F statistic approach significance, nor did the F -ratio for the overall regression reach the .05 level (of 2.56, $df = 4, 49$). The results were interpreted as strong *prima facie* evidence that the influence of general academic ability was slight as a contributor to performance task variance in each case. This was largely in agreement with expectations based on the relatively narrow range of general ability represented in an undergraduate sample and the specificity of performance tasks.

APPENDIX N

MULTIPLE LINEAR REGRESSION ANALYSIS
OF KEY PERSONALITY PREDICTORS

Rigidity-Complexity used in Place of
Study Behaviour Scale 5 as a
Check on Comparability.

MULTIPLE REGRESSION DATA FOR STUDENT PERFORMANCE
ON FOUR TASKS AS A FUNCTION OF ANXIETY-STABILITY,
INTROVERSION-EXTRAVERSION, RIGIDITY-COMPLEXITY,
AND THEIR JOINT INTERACTION

Task	Full Model Mult R	Mult R ²	Regression ANOVA		
			$\frac{\text{Regression}}{\text{df}}$	$\bar{F}$	$\frac{\text{ANOVA}}{p}$
(a) Essay	.451	.203	3,41	3.32	<.05 ^a
(b) Analytic Report	.354	.125	3,41	1.86	ns
(c) Child Study	.319	.102	3,41	1.55	ns
(d) Tutorials	.203	.041	3,41	<1	ns

- a. R² for Reduced Model: .162 ($p < .05$); Cohen's Incremental F (2,41): 1.01 (ns). Since the interaction did not contribute significantly to the overall regression there was no justification for the application of the Johnson-Neyman procedure on the Essay results for these data.

APPENDIX P

DERIVED TRAIT SURFACE CONTRAST
DIAGRAMS FOR RE-GROUPED
DATA ON THREE DIMENSIONS

In view of the substantial level of statistical significance associated with the discriminant analysis of re-grouped data, an additional study was made of these data with specific reference to the three-way compound involving Anxiety-Stability, Introversion-Extraversion, and the Organizational Study Behaviour Scale (Scale 5). For each of the two newly formed group pairs, *viz.* Essay/Child Study in comparison with Analytic Report/Tutorial groups, a plane surface was derived in order to illustrate the form of the relationships under investigation.

Trait surfaces were constructed as linear functions of the three principal dimensions. Two linear regression equations were calculated for each group, the first being the regression of SBQ5 scores (X -axis) on Introversion-Extraversion Scores (Y -axis), and the second being the regression of these two variables on Anxiety-Stability (Z -axis). The regression details are as follows:

1. The Essay/Child Study Group -

$$Y_{INT} = .00199X_{SBQ} + 9.6684$$

$$Z_{ANX} = -.26354X_{SBQ} - .095Y_{INT} + 13.2578.$$

2. The Analytic Report/Tutorial Group -

$$Y_{INT} = -.10874X_{SBQ} + 11.735$$

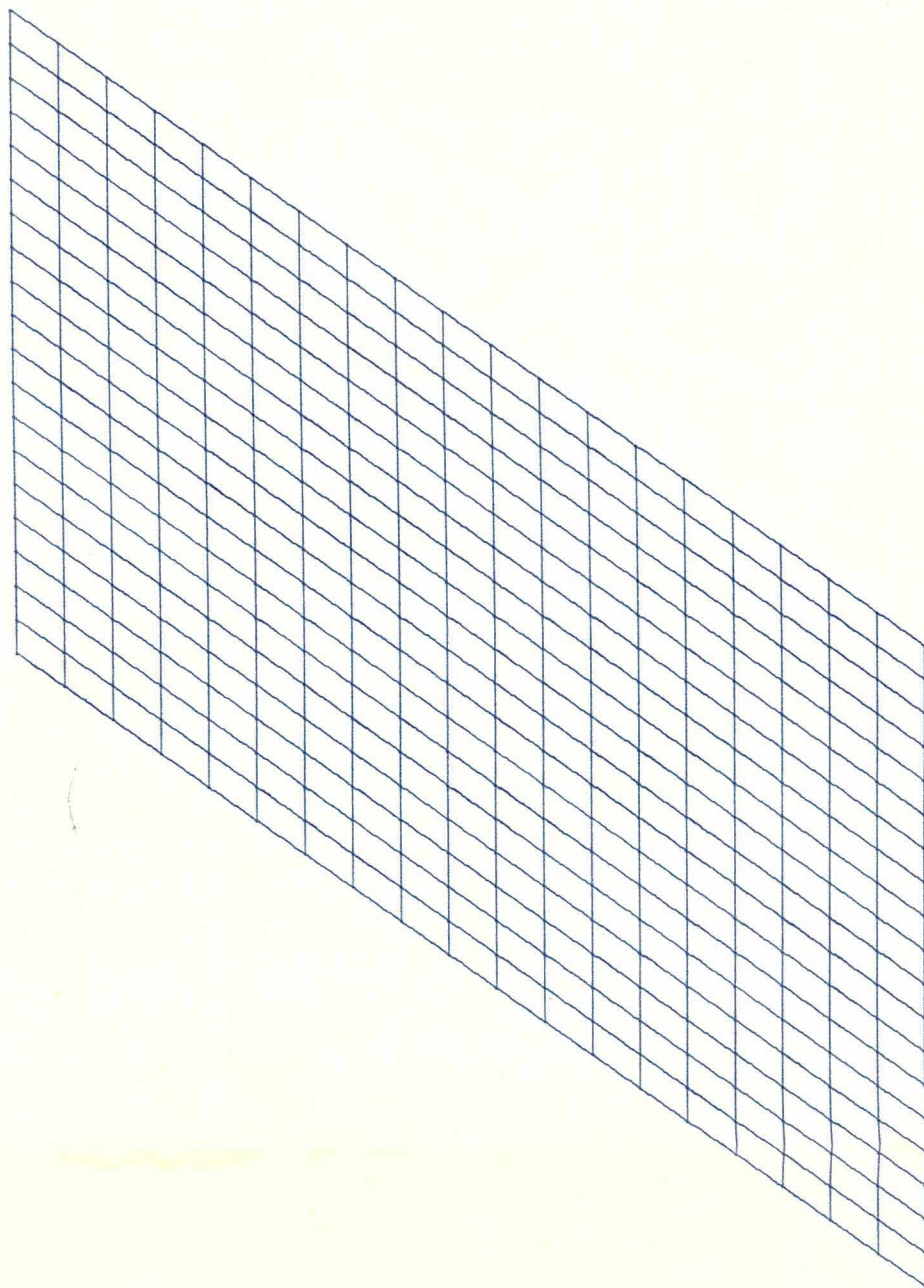
$$Z_{ANX} = -.08896X_{SBQ} + .08142Y_{INT} + 10.3525.$$

The requirements of the computer program used for three-dimensional plotting were that a grid be defined

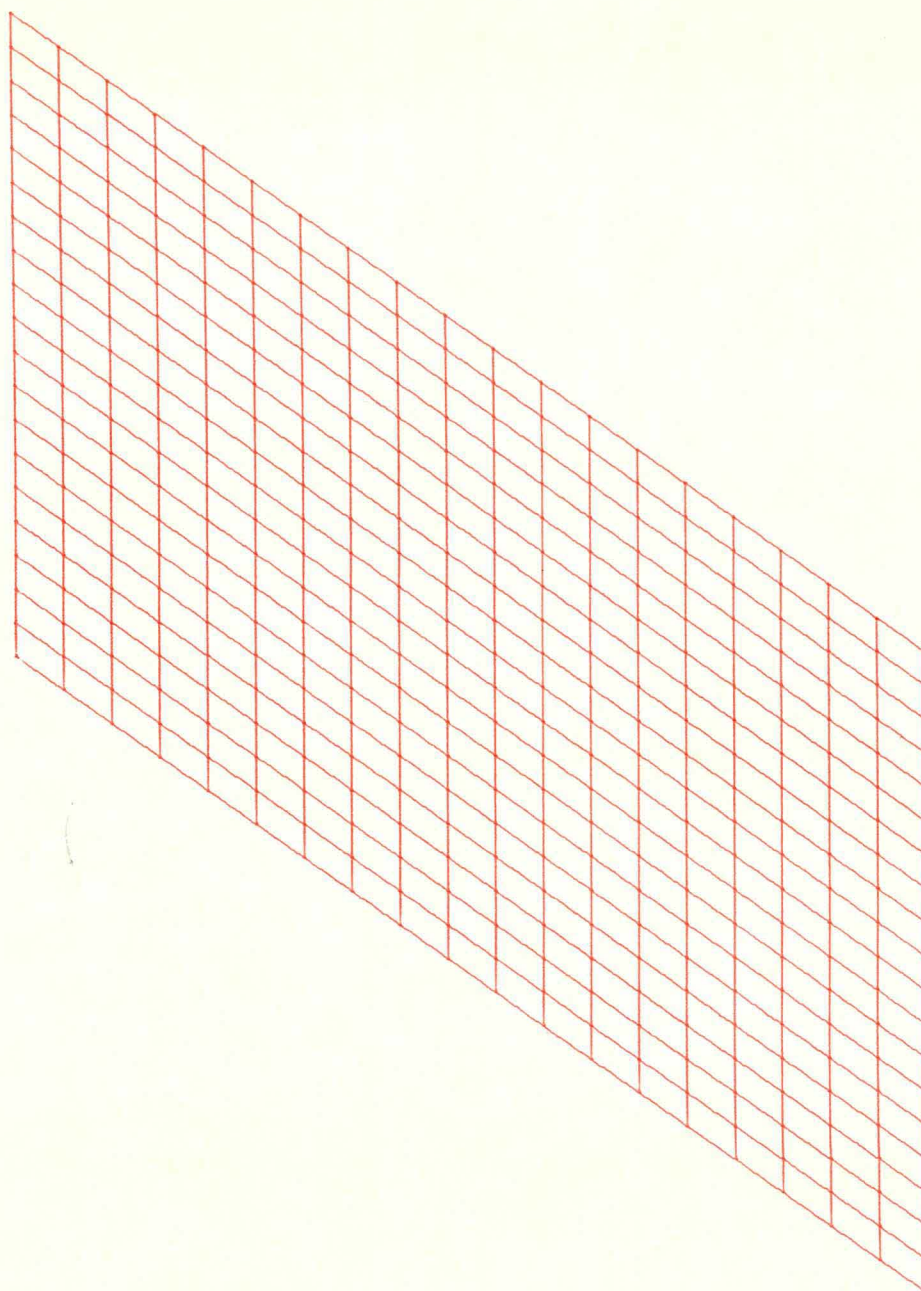
by the X and Y axes over specified ranges for the projection of Z-axis co-ordinates. The linear relationships employed in depicting each group's trait surface by these means were intended to serve as detailed illustrations of the contrasting group patterns expressed in centroid form in Figure VIII.2; but the numbers involved in each group (*viz.* 32) were so small, even with combined groups, that the regression functions derived for this purpose were necessarily regarded as unstable. It was for this reason that the exercise is reported as an Appendix rather than as an aspect of the text. Similarly, no attempt was made to plot the three-way compound for other group contrasts in which it was found to be significant since in every other case there were too few subjects.

The program was based on Basinger, D., and Grildys, J. Three dimensional graphical representation of surfaces by computer (Fast Reactor Containment Program). Argonne (Ill.): Argonne National Laboratory, 1971. Plotting was carried out by the Calcomp plotter at the James Cook University's Computer Centre.

Note: The graduations employed for this contrast did not expose the pertinent differences. Further work is in progress to derive more sensitive plots; the details may be had by writing to the author.



		ART/TUT	SURFACE		
ALPHA =	90.00	XMIN =	0.00E+00	XMAX =	0.48E+02
BETA =	0.00	YMIN =	0.00E+00	YMAX =	0.48E+02
GAMMA =	-45.00	ZMIN =	0.66E+01	ZMAX =	0.11E+02



ESA/CST SURFACE-----
 ALPHA = 90.00 XMIN = 0.00E+00 XMAX = 0.48E+02
 BETA = 0.00 YMIN = 0.00E+00 YMAX = 0.48E+02
 GAMMA = -45.00 ZMIN = -0.19E+00 ZMAX = 0.12E+02

APPENDIX Q

SUBJECTS' SCORES BY GROUP

Transformed ($z + 10$) Personality Factor Scores, Study
Behaviour Questionnaire Scale 5, and Four Performance
Measures

<i>Code:</i>	ADV:	Adventurousness-Cautiousness
	COM:	Complexity-Rigidity
	ANX:	Anxiety-Stability
	INT:	Introversion-Extraversion
	RAD:	Radicalism-Conservatism
	DIS:	Distractibility-Single Mindedness
	SBQ5:	Organizational Study Skills
	ESA:	Essay
	ANT:	Analytic Report
	CST:	Child Study Report
	TUT:	Tutorial Performance

THE ESSAY GROUP

CASE	ADV	COM	PERSONALITY DOMAIN			DIS	STUDY	PERFORMANCE DOMAIN			TUT
			ANX	INT	RAD		BEHAVIOUR SBQ5	ESA	ANT	CST	
5 SBEN	11.326	10.465	9.431	9.573	12.066	9.362	10.391	11.132	10.845	10.740	10.317
14 DBUR	8.721	9.959	12.213	8.446	10.912	10.104	9.176	11.126	9.407	10.082	9.330
15 JBYR	10.875	10.663	9.469	9.424	8.402	9.542	10.217	10.821	9.972	10.058	9.437
24 DFOR	8.284	10.259	10.573	9.379	10.818	8.535	10.043	12.089	8.559	9.163	10.170
25 HFRA	8.213	8.888	9.096	10.360	9.382	10.840	8.481	11.046	9.066	10.011	10.439
30 BHEG	11.038	9.710	9.617	10.713	9.108	9.168	9.002	11.260	8.962	9.026	9.822
34 MHOU	10.316	11.343	10.136	8.245	10.597	8.805	9.349	10.349	7.480	9.937	9.219
35 JHOU	11.565	10.861	9.924	10.111	7.464	9.928	10.217	11.012	10.152	9.147	10.529
36 JHUR	11.629	8.277	11.891	9.544	9.153	10.302	10.391	11.883	10.756	8.651	9.171
47 TMAC	11.044	10.766	10.192	10.178	9.263	10.527	9.002	11.117	8.898	10.057	10.155
48 KMAS	10.923	8.458	9.855	10.836	8.758	11.500	9.349	10.763	10.737	10.042	8.732
51 AMGN	10.163	11.234	9.236	10.259	8.773	9.601	10.564	11.466	8.567	10.903	11.209
60 FPIS	9.892	11.068	9.063	9.161	9.432	9.405	10.564	11.938	10.842	8.256	9.349
82 KTIE	9.232	7.488	8.326	9.538	9.966	9.525	9.176	10.755	10.561	10.030	9.059

THE ANALYTIC REPORT GROUP

CASE	ADV	COM	PERSONALITY DOMAIN				STUDY	PERFORMANCE DOMAIN			
			ANX	INT	RAD	DIS	BEHAVIOUR SBQ5	ESA	ANT	CST	TUT
12 VBRD	10.149	10.875	9.826	8.493	9.507	8.288	9.523	10.286	10.944	10.930	9.978
13 DBRO	10.304	9.804	11.130	9.367	10.049	11.545	10.391	9.785	11.150	10.500	8.325
32 DHOL	10.998	10.161	11.556	9.922	9.151	10.869	9.176	9.550	11.111	11.082	10.642
38 AJET	7.543	9.691	10.085	8.009	9.190	10.038	11.432	8.335	11.466	11.399	10.305
40 AJOZ	10.800	10.446	9.906	10.297	10.612	9.552	9.523	9.455	9.742	9.082	9.550
54 TMEN	10.166	10.368	10.634	9.549	10.879	9.714	11.259	9.385	10.988	10.236	9.780
55 PMIL	10.164	10.433	10.117	10.836	11.158	10.527	10.043	10.175	11.112	7.886	10.244
56 KMUE	9.871	10.124	10.259	10.161	10.316	10.676	10.911	10.045	11.245	10.131	8.904
59 KPAR	8.752	8.975	9.927	10.546	7.979	10.971	8.481	9.681	11.244	10.164	9.402
67 AROM	9.116	9.018	10.916	10.899	8.411	9.366	9.176	9.316	11.702	9.334	10.678
76 LSOU	8.525	11.145	11.472	10.463	11.372	12.039	10.738	9.181	10.738	9.357	9.391
78 MSTO	9.983	9.658	11.868	10.702	11.753	9.324	9.870	7.626	11.139	9.285	10.040

THE CHILD STUDY GROUP

CASE	ADV	COM	PERSONALITY DOMAIN				STUDY BEHAVIOUR		PERFORMANCE DOMAIN		
			ANX	INT	RAD	DIS	SBQ5	ESA	ANT	CST	TUT
6 MBEN	9.748	8.650	10.360	8.786	10.757	10.562	8.308	9.475	10.526	11.305	9.841
8 PBIR	10.005	10.665	11.173	9.625	11.179	9.891	10.043	7.727	9.797	10.189	9.829
21 SDON	9.699	11.452	10.030	10.541	10.363	10.001	7.960	9.301	9.688	9.846	9.332
22 JDRA	9.940	9.320	8.600	11.284	10.644	10.820	9.870	10.754	9.163	11.297	8.972
27 NGIB	10.676	9.459	8.916	8.187	11.089	11.910	10.911	10.352	10.034	11.034	10.693
31 EHIN	9.999	9.666	8.448	9.989	8.769	10.869	11.259	10.153	9.872	10.162	10.141
37 HUTC	9.425	10.995	11.094	11.089	8.930	10.313	7.787	10.853	8.945	11.183	9.889
42 MLAF	9.728	10.490	7.476	10.190	11.054	10.452	10.564	9.057	10.380	11.292	10.967
43 JLAN	10.867	10.445	10.425	10.364	9.002	10.379	10.738	7.656	9.965	10.143	10.113
45 ALIN	10.413	9.936	10.228	9.816	9.796	11.501	11.779	9.926	9.380	11.295	10.399
64 NREN	10.032	9.604	7.974	9.364	11.442	9.570	9.523	7.890	9.569	10.300	8.943
65 ARIN	11.477	10.868	10.793	10.509	11.597	10.552	10.043	10.348	10.944	11.064	9.361
68 EROP	11.140	10.021	8.446	10.238	9.798	9.019	8.828	9.543	10.603	11.357	9.221
79 DSUH	10.962	9.702	10.404	9.707	10.815	11.123	9.523	10.315	10.906	11.038	9.671
80 JTAN	10.934	10.009	10.222	8.979	10.143	8.670	8.828	10.804	8.555	11.311	9.505
86 GWIL	10.382	10.697	8.449	8.832	9.264	10.458	10.217	9.835	8.776	11.505	9.753
87 JWIL	9.858	10.032	10.689	11.730	10.446	10.865	9.002	10.637	9.695	11.230	9.058
91 TYIN	9.757	10.725	9.267	10.436	10.734	11.033	11.085	10.003	10.298	11.384	9.456

THE TUTORIAL GROUP

CASE	ADV	COM	PERSONALITY DOMAIN				STUDY BEHAVIOUR		PERFORMANCE DOMAIN		
			ANX	INT	RAD	DIS	SBQ5	ESA	ANT	CST	TUT
4 FBAT	10.157	10.540	10.379	10.998	10.942	10.586	12.127	9.325	10.457	10.437	10.586
11 SBON	11.069	10.061	10.701	11.817	9.199	10.374	10.217	9.384	9.989	10.200	11.276
17 ACOO	10.447	11.492	10.422	7.614	10.363	11.849	11.779	10.138	9.734	9.268	11.907
19 SCUM	8.744	11.381	9.176	10.298	9.417	11.005	12.300	10.301	10.309	10.828	12.007
23 WFLO	10.497	9.498	8.933	9.820	11.313	9.911	11.606	9.894	9.409	10.254	10.544
26 KFRA	9.757	10.062	9.144	10.839	9.236	10.291	9.523	9.436	10.732	10.986	12.061
28 PGRE	8.354	11.249	9.389	11.137	9.166	9.909	10.564	10.391	8.299	9.261	10.637
33 SHOS	9.671	10.077	10.299	10.862	10.621	9.916	9.696	9.040	10.681	8.813	11.263
39 PJOH	7.931	8.506	8.555	8.293	9.699	9.528	9.870	7.511	10.095	9.164	12.456
46 NLIS	9.170	9.438	11.245	10.152	9.620	9.401	10.043	9.211	8.977	11.355	11.903
53 DMEN	7.839	10.661	10.397	8.913	9.369	11.556	11.432	10.343	10.590	9.731	12.104
62 SPRI	10.708	10.959	9.509	10.286	10.693	11.416	10.911	9.934	10.082	9.430	10.685
63 SRAF	10.084	9.832	10.597	11.136	9.614	8.369	9.002	9.000	9.217	10.487	10.844
69 KROS	10.187	9.990	10.788	9.701	9.627	11.586	10.738	10.134	10.783	10.902	11.210
71 PRYA	11.356	11.574	10.795	9.901	8.348	8.608	10.043	9.168	10.141	9.326	10.380
74 SCHU	10.136	9.464	10.884	10.640	10.181	10.042	9.002	10.854	10.742	8.614	11.559
81 STHO	8.734	9.117	9.539	11.221	10.721	9.734	10.043	7.764	7.801	11.023	11.072
88 WLLI	9.751	10.270	10.043	10.347	9.975	10.354	10.391	10.612	10.232	9.914	10.624
90 RWO0	10.587	10.499	9.917	9.130	9.657	8.608	8.655	10.993	10.247	5.961	11.251
92 LYOU	10.806	9.853	10.003	10.087	9.336	8.965	8.828	9.776	10.938	9.925	11.381

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