A Quantitative Approach to Linguistic Model Validation

Ph.D. Thesis

by

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DECLARATION

I hereby declare that this thesis represents my own work and that it has not been previously submitted to this university or other institutions in application for a degree, diploma or other qualification.

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Abstract of thesis entitled

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The thesis is an attempt to identify a method of statistical analysis whereby theoretical linguistic models can be validated, to some degree, via analysis of language user perception of text structure. Such a tool of validation is indispensible but has yet to be identified. There are two areas of linguistic model validation where the proposed method of analysis can make a substantial contribution: a - in validating linguistic models, qua *descriptive* models, as *explanatory* models, and b - in establishing grounds for comparison among competing and/or conflicting linguistic models in the same area of linguistic investigation.

The study has a clear methodological emphasis and explores new empirical procedures of text analysis. The statistical technique for such a validation study is *repertory grid analysis* (Kelly 1955, Slater 1977). This technique is widely used in psychotherapy but is used for the first time in linguistic investigation. Repertory grid analysis offers two very important contributions. It is, on the one hand, one of the most rigorous quantitative methods for the study of human perception; at the same time, it allows for qualitative analysis of the data, which is very desirable in the study proposed. The area of linguistics to be studied is the signalling approach to text analysis proposed by Winter (1977, 1982) and Hoey (1979, 1983).

An informal pre-pilot was first carried out to examine broad features and potential problems of the application of repertory grid analysis to the investigation planned. A proper pilot was then carried out to investigate closely the feasibility of the study. Results from the pilot indicated that the proposed approach was usable.

The main study was then performed on a representative sample of a target population (*i.e.* a sub-population of undergraduate students in Hong Kong). Besides analyses associated with the repertory grid technique, an ANOVA design was used for the investigation of aspects within the experimental situation that may be of relevance. The *independent variables* include relative English language proficiency and the major academic disciplines of the experimental subjects, different methods of grid elicitation, and variation in text structure. The data were analysed first on individual perception of text structure and then on the agreement between the theoretical model and subject perception both as individuals and as a group. In the analyses, both a quantitative and a qualitative approach were used.

The results of the study indicated very clearly that repertory grid analysis was able to make interesting and informative comparisons between the theoretical model and subject perception of text structure and should be a usable technique for linguistic model validation as first hypothesized. In particular, individual characteristics of perception were uncovered; and the consensus view of the sample was captured. Furthermore, the present application of repertory grid analysis also enabled a qualitative analysis of the data which threw additional light on and provided much needed details for the research.

The study has important implications for linguistics. Firstly, an objective and statistically based technique for rendering linguistic models susceptible to validation procedure, so far unavailable, has now been identified. Furthermore, the study certainly helps to establish applied linguistics as an academic discipline at once independent from and contributing to theoretical linguistics.

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CHAPTER ONE

Initial Influences, Objectives & The Methodology of The Study

1.1 *Introduction*

It may seem blatantly obvious to state that every piece of research work begins with a research question, *i.e.* the well known " *I wonder if* ...". However, it is not as obvious to know why the research question is asked in the first place and how the answer will be provided. These are intimately related to the researcher's personal history as well as his/her academic inclination. For this reason, it seems necessary to begin this thesis by presenting a brief account of *a* - initial influences of the current state of linguistic and applied lingustic research on the present study, *b* - its content area, *c* - objectives and *d* - scope.

1.2 *Current state of linguistics and applied linguistics*

It must be admitted that it is sometimes rather bewildering for students of linguistics and a-fortiori for lay observers to witness the variety of theories and models in any one area of linguistics. Such a proliferation of theories and models may, indeed, be a sign of vitality in the discipline;

nonetheless, the multiplicity of approaches may lead one to wonder whether they are, in fact, different ways of putting the same jigsaw puzzle together.

There is another rather irritating phenomenon, particularly for linguists trying to do research in a second or foreign language. This is the near-standard procedure of relying on *native speaker's intuition* as a criterion for the goodness of fit of linguistic data. Such an approach is irritating because, while the non-native speaker linguist has difficulty claiming authority over the data, the naive native speaker has no claim on knowledge of the theory. This leaves, then, the native speaker linguist with a double-edged sword to maneuver.

The problem just described is twofold. There appear to be incompatibilities among theories on the one hand; and a gap between linguists' and naive language users' perception of language phenomena on the other. Solutions to such problems are certainly much needed. Indeed, a number of linguists have tried to describe and to explain variation in language use. For example, Elliott *et al.* (1969) attempted to establish an implicational scale for grammatical acceptability judgments. Labov's (1978) effort in formulating the *variable rules* for syntax aimed to demonstrate the possibility of providing a statistico-mathematical representation of variations in language phenomena, including theoretical models proposed by linguists. In his turn, Bailey (1973) tried to capture the structured variability of language use from both a diachronic and a synchronic point of view, using a quasi-implicational scaling model. All such attempts fall under either Sankoff's (1974) *quantitative paradigm* (*e.g.* Labov 1978) or Bickerton's (1973b) *dynamic paradigm* (*e.g.* Elliott *et al.* 1969, Bailey 1973) in linguistic investigation, and can be labelled as *quantitatively oriented* linguistic analysis methods.

The main contribution of the quantitatively oriented methods to linguistics seems to lie in making available a common language via quasi mathematical modelling through which comparisons among different theoretical models can be meaningfully made, and where naive language users' perception of the language can be taken seriously. Such is the starting point from which the present research project took its initial inspiration.

1.3 *The domain of the research*

The domain of the present study is related to a long-standing personal interest of the investigator in the linguistic/applied linguistic aspects of the reading behaviour, particularly as regards English as a second/foreign language. The focus on the linguistic dimension has to be stressed. Research into reading is generally directed to the psychological aspects of the behaviour, particularly to the physiological and the mental processes involved. Whatever research undertaken on the linguistic aspects of reading has very often been a by-product of abstract linguistic model building for text or discourse.[1] It is often assumed that, once an abstract linguistic model has been devised (a *descriptive* model), it can automatically be used to account for real language behaviour (an *explanatory* model). Such an assumption will certainly be challenged by those working in the field of model building (*e.g.* Ghosal *et al.* 1975, Hoaglin *et al.* 1982).

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1 The distinction between *text* and *discourse* will be discussed later in 1.5.1.

1.4 *Objectives of the present research project*

The present study is an attempt to identify and to test a methodology which can be used to establish the goodness of fit of *descriptive* models for the description of written texts as *explanatory* models. (Ackoff 1968, p.61.) Such an investigation is not only an enterprise worth being undertaken; it is, the investigator would venture to say, imperative for applied linguistics as a discipline. This is so for two reasons.

Firstly, to follow the assumption that once an abstract descriptive model has been found, it can be applied to reality is to commit a grave logical fallacy of crisscrossing between universes of discourse. This is so notwithstanding the claim that theoretical linguistic conclusions are derived from actual linguistic data. The goodness of fit of such descriptive models to serve also as explanatory models has to be investigated and validated. Examples of such crisscrossing can be found in the efforts to hypothesize on the relative ease or difficulty in learning a foreign language on the basis of the relative distance between the L1 and the target language systems provided by contrastive analysis (*e.g.* Lado 1957, Alatis 1968) and in the early attempt to use transformational generative grammar (Chomsky 1957, 1965) in the language classroom (*e.g.* Thomas & Kintgen 1974).

Secondly, it is not uncommon even for applied linguists to view the field of applied linguistics as merely consisting of applications of theoretical linguistic models and conclusions, *e.g.* Perren & Trim (1971), Pit Corder (1973) and Allen & Davies *eds.* (1977). Such a view would not be conducive to the advancement of applied linguistics as an academic discipline. It would, for instance, lead many practitioners in the field (*e.g.* language teachers) into very frustrating experiences because they find that many of the suggestions from applied linguists very often just don't work;

and, more damagingly, it would reduce applied linguistics to an ancillary role. It is the investigator's view that, if applied linguistics were to become an academic discipline independent of theoretical linguistics, it would have to establish a relationship vis-a-vis theoretical linguistics similar to that found between applied mathematics and pure mathematics. It is well known that applied mathematics survives not only as a discipline independent of pure mathematics; it very often surpasses pure mathematics in importance and popularity.

To sum up, the present research focuses on the identification and the application of a suitable method of linguistic analysis to identify the agreement or otherwise between a linguist's perception of the structure of written English texts as expressed by an abstract theoretical model and the language users' perception of such structures.

1.5 *Delimitations of the study*

It may be necessary, at this point, to make a number of clarifications regarding the scope of the study:

1.5.1 Text and discourse

The first refers to the distinction already made between *text* and *discourse* . The term *text* is used in the sense of Widdowson (1984):

> "Meaning, in this view, is a function of the interaction between participants which is mediated through the language. I will refer to this process as discourse. The language used to mediate the process can be recorded or transcribed and studied in detachment. This I will refer to as text: the overt trace of an interaction, which can be used as a set of clues for reconstituting the discourse." (5 p.58)

The study of written language, viewed from this perspective, would be dominated by the study of text rather than discourse because the interactions of participants are not easily, if ever, obvious to the researcher. Written language data would, therefore, tend to be predominantly those of the text.

It is true that real language phenomena can only be found within a discoursal (*i.e.* interactional) frame of reference. However, this should not bar any attempt to investigate text phenomena as an area of research, distinct from discourse and as realizations, or carriers of discoursal meaning. de Beaugrande (1985), for example, states:

> "Though the levels interact extensively in everyday discourse, experimental methods can dissociate them."

It is, therefore, possible that text phenomena can be focused in an analysis without violating their embeddedness in discourse if an appropriate experimental design were chosen. This can be done even with a clear understanding that there may be discourse phenomena not realized by text elements. Indeed, it is precisely the question of how much and to what extent discourse phenomena (*i.e.* perception of discourse pattern) can be accounted for by text element patterning that is the central research question here.

From a research planning point of view it is considerably simpler to make text the *independent* and discourse the *dependent* variable. This is because text elements can easily be manipulated while discourse phenomena cannot. As a consequence, the basic research strategy in this study is to vary text as input and to measure the interaction of readers with the text as output. This means that the study will, by virtue of its orientation, concern itself with the decoding rather than the encoding of text. In this connection it must be pointed out that it is the view of the investigator that language encoding and decoding are not just mirror images of each other, and, consequently, the equating of the decoding and the encoding processes should not be simplistically assumed as it has been by a number of researchers. Widdowson (1984) expresses a similar point and maintains that the production of text is primarily a process of expansion, while the comprehension of a text is a process of reduction. However, the basis on which the writer expands and the result of the reader's reduction do not necessarily correspond. (pp.75-79)

1.5.2 Text structure

Like so many other terms used in linguistics, particularly in discourse and text analysis, the term *text structure* is one that is frequently used but not consistently defined among linguists. It is, therefore, necessary to specify an operational definition for the term.

> By *text structure* is meant here the patterning of text units, however defined and specified by a text analysis theory, which form the totality of units making up a text as understood by that theory.

The first observation to be made regarding the above definition is that the term *structure* is not used in the sense of *system/structure* opposition of systemic linguistics. In the present context the term *structure* is more akin to *pattern* . In fact, the term *discourse/text pattern* is used by a number of linguists (*e.g.* Hoey 1983b) even though *text structure* seems to be more commonly used.

The definition is a general one and does not relate to any particular text analysis theory. *Text units* and *text pattern* can refer to surface structure as well as semantic or psycholinguistic elements. The definition's only specification is that the units be conceived by the theory as constituting the building blocks of text.

Finally, it must be pointed out in the present context that, while text/discourse patterning is very much a matter of individual creativity of the language user, it is, in most cases, regulated also by social convention of text structuring. The notion of *schema* and its cognates, for example, have been employed in cognitive psychology to capture the perceptual constraints of text and discourse, which has a social/conventional origin. In particular, Bower & Cirilo (1985) make mentioning of *global text structures* like *story schemata* and *expository schemata*. In terms of linguistic structuring of texts Hoey (1983c) holds that discourse patterns are culturally popular patterns of expectations associated with certain groups of language users or cetain types of texts.

1.5.3 The reading process

The research question under investigation is not directed to the reading process as a whole. Reading is a complex language phenomenon which involves a good number of linguistic and extra-linguistic factors; the research question being addressed here, however, concerns itself with the textual characteristics as one aspect of the reading process. Naturally, the reading process as such is not a divisible activity. Nonetheless it is entirely feasible to single out the textual aspects of reading through research design and through the choice of an appropriate analysis procedure.

1.5.4 Scope of the Study

There is a narrower and a wider scope in the present research. As its immediate objective, the study aims to establish a method whereby a theorist's perception of text structure as revealed within a particular text analysis model can be compared with naive language users' perception of the same text structure in order to pinpoint the extent and the areas of agreement and disagreement. This has relevance not only for linguistic theory but also for research into the reading process, *e.g.* the concomitant variation between text structure and theorist-language user agreement.

The wider scope of the study aims to identify a methodology which can be used to conduct validation studies on theoretical linguistic models via actually occurring language behaviour. This, as has been pointed out, is an important and vital aspect of research for applied linguistics.

CHAPTER TWO

Alternative Models of Text Analysis

2.1 *Introduction*

Being a still relatively young and burgeoning discipline, text analysis receives input from a good number of fields of research and can be pursued from several distinct and widely different theoretical perspectives. (See de Beaugrande & Dressler 1981, van Dijk 1985b and 1985c.) It is related to the study of grammatica and rhetorica in Greco-Roman times. In more modern times, text analysis can be associated with *Russian formalism* in the 20s, *Czech structuralism* in the 20s and 30s, and *French structuralism* in the 60s.

As an area of research, text is investigated by a good number of academic disciplines including *systemic grammar, text linguistics, functional linguistics, speech act theory, ethnography of speaking, anthropological linguistics, language variation, psychology* and *artificial intelligence.* The unifying feature of such a diversity of academic disciplines and approaches is the focus on linguistic phenomena beyond the sentence and on language use.

As a consequence of the complexity of the field of text analysis, only a limited sample of some of the major approaches in text analysis can be included in the overview that follows. The choice is determined by the relative relevance of the approaches to the area of research under discussion. These are a - *tagmemics*, b - *text linguistics*, c - *schema theory* and d - *text signalling*. The selection is certainly limited. In particular, there are, according to Longacre (1976) three important precursors to text analysis as we know it doday. These are a - *the Prague school* (*e.g.* Mathesius 1915, Firbas 1964, 1974, Danes 1974) particularly with its later development of *Functional Sentence Perspective* (FSP), b - *Hjelmslev* (1953) and c - *Firth and the neo-Firthians* (*e.g.* Firth 1951a, 1951b, Halliday & Hasan 1976, Halliday 1974). These will not be discussed even though many of the ideas of Halliday, particularly his treatment of the English thematization devices (Halliday 1967, 1968), are very interesting and have been seriously considered by the author at one stage.

2.2 *The Tagmemic approach*

2.2.1 Overview

Pike (1976) makes reference to four generalized concepts of the tagmemic approach. The first is the *observer standpoint*. Behavioural data are to be viewed from the point of view of the observer rather than as things-in-themselves. The observer standpoint comprises two aspects: an outsider versus an insider point of view. The former gives rise to *etic* and the latter to *emic* units in communication and behaviour systems, *e.g.* language. The distinction between etic and emic units is most clearly understood by reference to the sound system of a language. Phonetic features (etic units) are what can be perceived from outside the language system, while the phonological elements (emic units) constitute what is referenced from within the decoder and the encoder.

The second concept is the *hierarchical structure* of behavioural systems. These are organized into levels of embedded *slots* to be occupied by *fillers*. *Tagmeme* is the generic name given to all types of filler (thus the term tagmemics). Depending on the level, tagmemes are given different names: *phoneme*, *lexeme*, *syntagmeme*, *uttereme*, etc. These are organized hierarchically with tagmemes embedded within hypertagmemes at a higher level. Theoretically, the hierarchical structure goes beyond the linguistic system to all behavioural systems. In fact, Pike (1967) does that and introduces the term *behavioreme* .

The third concept is the *indeterminacy* of behavioural data. This refers to accepting behavioural data as they actually are (*i.e.* as rarely clear-cut) and not according to a predefined conceptual framework. This is well accepted in behavioural sciences. Reality can never be fully captured using discrete categories. The boundaries among specimens of behaviour, especially, are always fuzzy. Indeed, it is legitimate to view behaviour as a continuous flow of waves. Speech, for example, is a continuous sound stream.

The fourth concept is that language is just one variety of a host of human behavioural systems. Here it is the embeddedness rather than the hierarchical structure is stressed as is the case of the second concept described above. As a consequence, language has to be analysed always within the total context of human behaviour.

The four concepts relate to three dimensions which need to be considered in any analysis of human behaviour. They are a - *units* (concept 1), b - *hierarchy* (concept 2) and c - *context* (concepts 3 & 4). Pike writes:

> "If units were to be lost, no persons, trees, or songs could be recognized by native performers. If hierarchy were to be lost, performers could never intuit the relation of part to whole. If the relevance of context were to be lost, communication of meaning and purpose would disappear." (pp.93-94)

The Tagmemic approach, therefore, emphasizes an a-posteriori and quasi inductive approach to linguistic research, taking practical convenience in data analysis rather than any predetermined theoretical perspective as a starting point (Pike 1981, Baily 1981). According to Baily (1981)

> ".. tagmemics addresses language on all fronts at the same time. If there is no theory to account for a given 'level', then some solution, however tentative, must be found to allow the work of description to go forward. ... the description is not to be judged solely against the standards of elegance, simplicity, and thoroughness but on the practical grounds of efficiency" (p.viii)

It may be necessary to point out here that Tagmemics is an approach to linguistic study capable of various and different applications. Well known studies subsumed under the label of Tagmemics include very different approaches to research such as Grimes's (1975) pioneering work on the tagmemic approach to discourse analysis, Meyer's (1975) study on reading, Clements's (1979) study of the *staging* effect and comprehension, Longacre's (1979) study on paragraph structure, and Pickering's (1980) modification of Grimes's approach, to mention just a few. Most of these studies focus on discourse with the exception of Meyer and Clements, whose approach is very strongly based on text. These two then will be examined in details because of their relevance to the present study.

2.2.2 Meyer (1975)

Meyer's (1975) approach is based on Grimes's (1975) Semantic Grammar of Propositions. In its most general outline, it takes as its basic point of view that a text is a complex proposition decomposable into sub-propositions. The result of such an analysis is a tree structure of propositions which should represent the *content structure* of the text. Propositions are composed of a predicate and its arguments. The most general form of a proposition and ultimately that of the content structure of a text is that *Form* (*F*) is composed of one or more *Predicates* (P_1^*) associated with zero or more *Arguments* (A_0^*). This can be expressed in the form of

$$F \dashrightarrow P_1^* A_0^*$$

Form is a generic term which covers the full range of textual elements from a single sentence to a whole text. Furthermore, the basic rule allows an indefinite number of levels of embedding within the *A* constituent. The whole text, then, is one single Form (*F*) which branches into a tree structure representing the content structure of that text. The tree structure thus generated is multi-dimensional in the sense that the various type of semantic relationships remain distinct.

Of particular interest is Meyer's distinction between *Lexical Predicates*, which refer to semantic roles very similar to Fillmore's (1968) case grammar, and *Rhetorical Predicates*, which take as arguments either single ideas relating to the content of the text or further propositions. This latter, in particular, enables the establishment of relationships between clauses and is employed by Meyer very efficiently to account for clause subordination.

2.2.3 Clements (1979)

Clements's (1979) approach is based on Grimes's (1975) notion of *Staging*. Staging refers to the foregrounding of textual elements effected by their linear organization within a text. It may be viewed as a generalized thematization process understood in a Hallidayan (1967, 1968) sense of the term. Grimes (1975) writes:

> "Every clause, sentence, paragraph, episode, and discourse is organized around a particular element that is taken as the point of departure. It is as though the speaker presents what he wants to say from a particular perspective." (p.323)

Clements expresses the notion of staging somewhat differently:

> "Staging is a dimension of prose structure which identifies the relative prominence given to various segments of prose discourse." (p.287)

It should be pointed out that Clements sees staging as more than foregrounding, which is principally a stylistic device, and holds that, through staging, the semantic structure of a discourse finds its expression in text. He maintains that "staging provides one component of the required mapping between the base and surface structure." (p.291)

In his analysis, Clements applies seven types of *staging rules : Topic rule, Old/new rule, Coordination rule, Subordination rule 1, Subordination rule 2, Minimum depth rule, Explicit precedence rule* and *Conflict rule.* It may not be the case here to go into detail of these rules. However, even a cursory examination of the above list reveals that the classification is based on at least two different criteria: syntactic and textual. This would certainly give rise to overlapping classification. It may be for this reason that the *Conflict rule* is included as an all-purpose conflict resolution rule. It must be pointed out that there is a rather clear impression of arbitrariness in the staging rules, which are not given sufficient and consistent theoretical support. As a classification system, therefore, it must be said that Clemnts's is far from satisfactory and appears rather ad hoc.

The outcome of an analysis using the staging rules is, as in the case of Meyer, a tree structure, which, unlike the tree structure in Meyer, is uni-dimensional, because the different types of semantic relationships have all been translated into the dimension of *staging levels*. However, as indicated above, the unidimensionality is more apparent than real.

2.3 *Schema Theory*

2.3.1 Overview

Even though not predominantly dealing with text analysis as understood in this study, the approach which encompasses what can be broadly included within the so-called *schema* theory deserves mentioning. This is so for the simple reason that the concept of schema or its cognate has become important in a broad range of academic disciplines, including linguistics.

Historically speaking, it was Bartlett (1932) who first used the term *schema* in psychology. Other psychologists who adopted either the term or the concept include Rumelhart (1975), Abelson (1975, 1976). Bateson (1972) and Frake (1977) are the principal proponents of the approach in anthropology, while Hymes (1974) and Goffman (1974) introduce it to ethnography of speaking and sociology respectively. It is, however, in the field of artificial intelligence that the schema approach has seen some of the most interesting development. Here, Minsky (1975), Bobrow & Norman (1975) and Schank & Abelson (1975) are some of the representative researchers. In the field of linguistics, Chafe (1977a,b), Fillmore (1975, 1976), van Dijk (1977), de Beaugrande & Dressler (1981) and Widdowson (1983) all make schema part of their theory.

One of the most outstanding characteristics of the schema approach is certainly the number of terms available for the description of very similar phenomena (*e.g. schema, frame, script*). This constitutes also one of the greatest difficulties for anyone trying to have an overall perspective of the theory. To make the situation even more complicated, some of the scholars employ more than one term in their writings, even though each scholar usually has one preferred term (*e.g. schema* - Head 1920, Bartlett 1932, Rumelhart 1975, Fillmore 1975, Chafe 1977a, Widdowson 1983, 1984; *script* - Schank & Abelson 1977; *frame* - Bateson 1972, Hymes 1974, Goffman 1974, Minsky 1975).

2.3.2 Schema

The notion of *schema* was first popularized by Bartlett (1932) according to whom a person "has an overmastering tendency simply to get a general impression of the whole; and, on the basis of this, he constructs the probable detail". (p.206) It should be pointed out that Bartlett considers schemata as "active, developing patterns" which keep on being modified through the inclusion of new information. According to Bartlett, therefore, schemata form the basis of but, at the same time, are modified by perception.

Chafe (1977a) makes use of the notion of schema in investigating the processes necessary for a person to convert predominantly non-verbal knowledge into verbal output. But perhaps the most extensive use of the notion is found in artificial intelligence (AI) research. In particular, Rumelhart (1975) and Bobrow & Norman (1975) use the concept as the basis for the construction of a computer representation of the human memory structure. Widdowson (1983), applying the notion to human language, maintains:

> "A schema, ..., is a stereotypic pattern derived from instances of past experience which organizes language in preparation for use. In relation to the illocutionary activity of discourse, to what is being said, shemata can be thought of as frames of reference. In relation to the illocutionary activity of discourse, to what is being done, they may be thought of as rhetorical routines." (p.37)

2.3.3 Script

The notion of *script* is principally associated with Abelson (1976) who uses it in the study of human belief systems besides story understanding. Abelson is mainly interested in the predictability of the human belief system and the match/mismatch between attitude and behaviour. In the study of story understanding Abelson collaborates with Schank (Schank & Abelson 1975) and uses the notion of script to deal with the conceptual structure of event sequences in story understanding.

2.3.4 Frame

The term *frame* is possibly the most widely used of all the terms discussed here. Bateson (1972) uses the analogy of the picture frame and the mathematical set to explain why signals transmitted by humans or even animals come to be understood. Hymes (1974) takes frames as culturally determined and as forming the basis for the framework for social interaction. Frake (1977) applies the notion to structural linguistics and maintains an interactive interpretation. Minsky (1975), on the contrary, uses a more static interpretation and applies it to the study of artificial intelligence. Finally, Fillmore (1975) makes the distinction between *scenes* which refer to the coherence of human experience and linguistic *frames* which refer to the system of linguistic choices.

2.3.5 Observations

Even a cursory examination of the terms relating to the schema approach such as the above reveals that underlying the variety of terms and perspectives there is a fundamental common notion of *expectation* in human perception. Human beings are directed (or even controlled) by their expectation in perceiving the world. This system of human expectation is structured partly by the social group and partly by the individual's personality. The former is the basis for objectivity and agreement while the latter gives rise to subjectivity and idiosyncrasies. The notion of expectation also emphasizes the fact that human perception is interactive and not merely passive vis-a-vis reality.

The different terms described in the previous sections may serve to focus on different aspects of human perception. In the study of text organization, for example, *frame* places emphasis on a frame of reference or order of discourse organization; *schema* highlights the progressional aspect of discourse, while *script* is related to participant roles in discourse. As de Beaugrande and Dressler (1981) put it, these labels describe "how a topic might be developed (*frames*), how an event sequence will progress (*schemas*), ... and how situations are set up so that certain texts can be presented at the opportune moment (*scripts*)". (p.91, italics mine)

The study of written text within the schema approach focuses on the specification of structure of various kinds of texts (*e.g.* story schemata, expository schemata). Such schemata are prototypical patterns of text organization which may include patterns like argumentation, problem-solution, question-answer, etc. Bower & Cirilo (1985) and Kintsch (1985) provide both a cognitive psychological model and sample analysis for such an approach. The resultant analysis is a text structure organized in terms of the patterning of the propositonal content of a text. Admittedly, there is a similar prototypical patterning of surface linguistic elements as well. However, this does not constitute an area of investigation for the schema approach and forms the central problem of the text signalling approach in 2.6 below.

2.4 *Text Linguistics*

Text Linguistics (van Dijk 1977, de Beaugrande & Dressler 1981) focuses on the link between text and context. Its central concern is, therefore, discourse.

2.4.1 van Dijk

van Dijk (1977) views discourse as consisting of two systematically related components: a *semantic* and a *pragmatic* component. The *semantic* component is taken to refer to the linguistic aspects of discourse while the *pragmatic* component is taken to refer to the extra-linguistic aspects. The systematic relation is understood as a pair of matching relationship running through all the aspects of the two components.

In terms of the structure of discourse, van Dijk (1977, 1985a) identifies several levels of organization. The first refers to the sequencing of propositions (*coherence*) and of the corresponding surface structure expressions (*cohesion*). The second relates to information processing constraints of a cognitive (*e.g.* old/new or topic/comment relations) or an interactional (*e.g.* general communicative principles as described in Grice 1975) nature. The third level has to do with the overall (or global) coherence of the discourse as a whole. Here van Dijk proposes a most general organizing notion called *Macro-Structure* in the semantic and *Macro-Speech Act* in the pragmatic aspect of discourse.

2.4.2 de Beaugrande & Dressler

The central concern of text linguistics, according to de Beaugrande (1985) is the study of *language use* as distinct and different from the *language system* . The former are labelled *actualized* systems and the latter *virtual* systems, which constitute the field of conventional linguistics. From the point of view of text linguistics, the distinction is quite fundamental in that the very units of description and analysis cannot be invariantly defined as in conventional linguistics if the environment of language use is considered.

In terms of paradigmatic choice, for example, the relationship between invariant linguistic units and their variants cannot be uniquely defined in an environment free fashion. MacNeilage (1970) demonstrates in the case of phonemes that the number of environment free allophones for a phoneme run into over 100,000 in some cases, which is a psycholinguistic impossibility. Such a number would be drastically reduced if some kind of systemic network in terms of various environmental features is allowed to serve as a filtering device.

In terms of syntagmatic structure, there are strong indications that in actual linguistic processing the units do not coincide with abstract linguistic specification (*e.g.* in terms of words). This can be observed in phenomena like tip-of-the-tongue and slip-of-the-tongue.

As far as the descriptive apparatus for text linguistics is concerned, de Beaugrande & Dressler (1981) have, as their principal aim, the establishment of what they call *Regulative principles* of textual communication. These "define and create the form of behaviour identifiable as textual communicating, and if they are defied, that form of behaviour will break down". (p.11) The emphasis on discourse is clear. de Beaugrande & Dressler proposes seven such standards of textuality: *cohesion*, *coherence*, *intentionality*, *acceptability*, *informativity*, *situationality* and *intertextuality*. Not all of these, it is apparent, relate to text.

2.4.3 Specimen text analysis

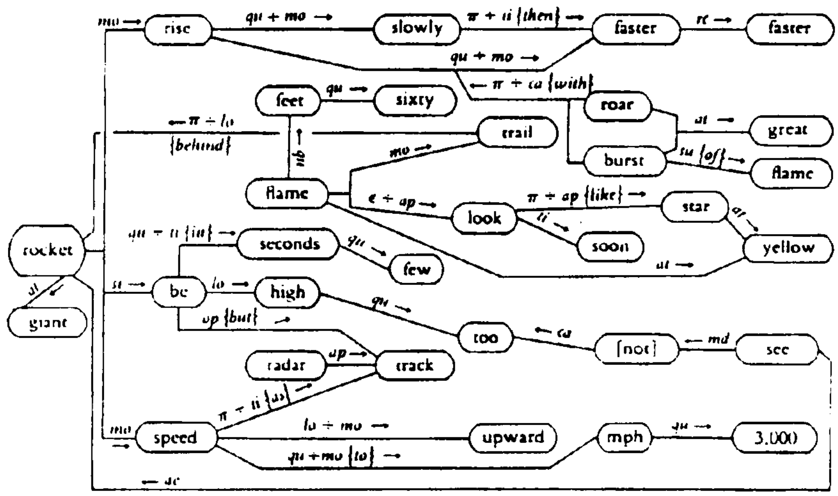
The main data description device in text linguistics is some type of logical network representation which can serve as a common symbolic system (or language) mapping onto both text and the world of reality. van Dijk uses a form very close to symbolic logic and particularly predicate calculus (a convention adopted by most modern linguistic semanticists), while de Beaugrande & Dressler use a network-like representation called *Augmented Transition Network* which can be described as a multi-branching flowchart. Examples of both van Dijk and de Beaugrande & Dressler are included below:

1 - **de Beaugrande & Dressler** (1981 p.103)

The text:

"With a great roar and burst of flame the giant rocket rose slowly at first and then faster and faster. Behind it looked like a yellow flame. Soon the flame looked like a yellow star. In a few seconds, it was too high to be seen, but radar tracked it as it sped upward to 3,000 mph."

The Representation:



Key: ae: affected entity; ap: apperception of; at: attitude of;
ca: cause of; lo: location of; md: modality of; mo: motion of;
op: opposed to; qu: quantity of; re: recurrence of; su: substance of;
ti: time of; e: entry; π: proximity

2 - **van Dijk** (1977 p.134)

The Text:

"A little town called Fairview is declining because it cannot compete with another town called Bentonville."

The Representation:

town(a) & town(b) & [~CANa (compete with (a,b))](e) & cause(e,f) & [decline(a)](f)

2.4.4 <u>Observations</u>

The complexity of the descriptive devices in the examples above is of two levels. The first relates to the more obvious level of the code itself. In this respect, van Dijk's formulation is highly abstract and remote from natural languages while de Beaugrande & Dressler's formulation looks very complicated because of its network structure. The second level relates to the less obvious but more important problem of combining the *real* and the *text* world into the same descriptive paradigm with the result that, from a text analysis point of view at least, it may be very difficult to tell when one switches from one world to the other or when the same element of structure incorporates characteristics from both worlds.

2.5 *Text Signalling Approach*

2.5.1 Clause relation & signalling devices

Finally, there is the approach developed by E.O. Winter and his associates (Winter 1977, 1982, Hoey 1979, 1983a, Hoey & Winter 1986 and Jordan 1984). This approach is based on the notion of *signalling* in texts, which is effected by what Winter (1977, 1982) calls *clause relations*. According to Hoey

> "A clause relation is the cognitive process whereby we interpret the meaning of a sentence or group of sentences in the light of its adjoining sentence or group of sentences." (Hoey 1983a p.18)

However, Hoey & Winter (1986) gives the following extended definition of the term:

> "A CLAUSE RELATION IS THE COGNITIVE PROCESS, AND THE PRODUCT OF THAT PROCESS, WHEREBY THE READER INTERPRETS THE MEANING OF A CLAUSE, SENTENCE, OR GROUP OF SENTENCES IN THE CONTEXT OF ONE OR MORE PRECEDING CLAUSES, SENTENCES, OR GROUPS OF SENTENCES IN THE SAME DISCOURSE. IT IS ALSO THE COGNITIVE PROCESS AND

THE PRODUCT OF THAT PROCESS WHEREBY THE CHOICES THE WRITER MAKES FROM GRAMMAR, LEXIS, AND INTONATION IN THE CREATION OF A CLAUSE, SENTENCE, OR GROUP OF SENTENCES ARE MADE IN THE CONTEXT OF THE OTHER CLAUSES, SENTENCES, OR GROUPS OF SENTENCES IN THE DISCOURSE." p.123

Winter (1977) identifies three major types of signals for clause relations: *vocabulary 1* - sentence subordinators, *vocabulary 2* - sentence connectors, and *vocabulary 3* - open lexical items with clause relating functions. Hoey & Winter (1986) add a further type: *lexical repetitions*. These include *lexical reiteration, pronominalization* and *paraphrase.*

Winter (1982) identifies two basic clause relations: *matching relations* and *logical sequence* and Hoey & Winter (1986) offers the following classification:

Matching Relation:

Contrast
Compatibility
Generalization-Example
Preview-Detail
Topic Maintenance

Logical Sequence:

Cause-Consequence
Conditions-Consequence
Evaluation-Basis
Instrument-Achievement
Time Sequence

Of these Topic Maintenance and Time Sequence are the simplest clause relations in the Matching Relation and the Logical Sequence category respectively.

It may be necessary to observe in this juncture that, while Hoey (1979, 1983a) refers to the members in clause relations as sentences, Winter (1977, 1982) makes a distinction between clause and sentence and maintains that any set of clauses, bound together by various clause relations, is labelled by Winter *sentence*. This is defined as "consisting of one or more clauses, at least one of which is an independent declarative clause." (1982, p.23) It is clear from the above that a sentence in Winter's sense of the term would include instances where there are more than one independent clause in a single sentence.

2.5.2 Discourse pattern

In so far as the relationship between clause relations and the overall text organization of texts is concerned, Hoey (1983c) offers some interesting insight. He proposes three metaphors: the *machine*, the *ventriloquist* and the *cat's cradle*. He writes:

> "We have suggested in this paper that monologues are organized not only in terms of cohesive ties, though these are of considerable importance, but also in terms of semantic relationships holding between the (groups and parts of) sentence of a discourse. These relationships can only be adequately described for any monologue, it has been argued, if it is seen as hierarchically organized 'machine', as interactively organized 'ventriloquist's dummy', and as 'cat's cradle' manifesting a web of connections. ... The 'cat's cradle', I suggest, represents the analyst's final word and the reader's fullest possible processing of the discourse. The 'machine' is a logical sub-set of the cradle and represents the writer's attempt at control of the multiple relations and at answering the potential high-level/low-level questions of a reader. Interaction with the monologue as 'ventriloquist's dummy' represents the reader's simplification of the 'cat's cradle', with the writer's active connivance in the form of signals to the readers to which relations are to be regarded as important." (p.50)

Hoey (1979, 1983a) goes beyond clause relations and proposes overall semantic organization for texts called *discourse patterns*.[1] He identifies four main types of basic discourse patterns: *Problem-Solution, Matching Compatibility, Matching Contrast, General-Particular.* Discourse patterns are hierarchical in organization and represent the highest level for the description of information structure of texts. These patterns, according to Hoey (1983c), are culturally popular patterns of expectations associated with certain groups of language users or cetain types of texts.

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1 Apparently Hoey does not maintain the distinction between *text* and *discourse* as does this study. From the point of view of this study *discourse pattern* in Hoey's term should be taken to mean *text pattern* . The term discourse pattern will be maintained in describing Hoey's approach, while text pattern will be used in the rest of the study.

CHAPTER THREE

The Text Analysis Approach Adopted

3.1 *Introduction*

There are, as is evident from Chapter One, two major decisions to make in regard to the present study. First of all, a choice needs to be made, from among the various text analysis approaches examined in Chapter Two, one that will be used; then, a method of analysis has to be identified to perform the validation on the text analysis approach chosen. The former will be dealt with in the present chapter, while the latter in the chapter that follows.

As an investigation on the methodology of validation, the choice of the text analysis approach to be used should not, in theory, constitute any problem; the method of validation should work irrespective of whatever the text analysis approach adopted. The actual choice of the text analysis approach, therefore, is very much the result of practical considerations. Naturally enough, the first consideration should be the extent to which the text analysis approach chosen helps to achieve the objective of the study in a most straightforward manner. The second consideration would be the extent to which the text analysis approach chosen would lend itself most easily to be analysed by a quantitatively oriented method.

3.2 *Criteria for choice*

The choice of the text analysis approach to be used would depend on the following criteria:

a the text analysis approach selected should be text-based; and

b the data generated should be codable as statistical data.

3.2.1 Being text-based

The first criterion will be for deciding on which of the approaches described in Chapter Two will be used in the present research. Naturally, being text-based is a relative term and is a matter of degree. No approaches can be exclusively discourse- or text-based. In applying this criterion of comparison, therefore, the approach which is the most text-based among those sampled, would be chosen. It needs to be pointed out that the choice of a text-based approach is purely a question of research methodology and strategy. It is entirely possible and feasible to conduct the same type of analysis on discourse-based approach or an approach which includes both discoursal and textual elements. It is the research question being addressed to in this study, as well as the decision to delimit the scope of the research within manageable bounds that makes it necessary to specify this first criterion.

3.2.2 Being codable

The term *codability* as used here means *a* - that the units of a text specified for analysis can be unambiguously assigned a value (at least within a nominal scale) and *b* - that no parts of the text should be uncoded in the way just described. This is to ensure that all the elements in a text would be included in the coding. An additional condition has also been introduced. Since the study would involve naive language users to code the data according to their subjective perception of a text, the units for coding should be as self-evident as possible. A high degree of face validity of the units of text, therefore, has to be achieved so that language users have little difficulty in identifying those units.

3.2.3 Surface textual features

The underlying concern in the criteria just described is the researcher's view that, in the present study, the data should be derived from surface textual features rather than any other aspects of the text. This is necessary in order to provide a basis which is rigorous and unambiguous enough for the quantitative analysis planned. This is also necessary, the author would tend to think, for text analysis as a discipline in its present state of development. A wide enough ground on surface textual features need to be covered empirically to support theorizing on underlying phenomena. Without such support, theorizing would appear rather weak indeed.

3.3 *Evaluation of the text analysis approaches*

Following the criteria laid down above, the four approaches are examined below. The exposition is given in a reverse order of the suitability of each for inclusion in the study.

3.3.1 The Schema approach

It can be seen from the exposition in 2.3 that the Schema approach is associated principally with disciplines like artificial intelligence, cognitive psychology, social psychology, and that linguistic investigations using the approach have been anything but piecemeal and have tended to focus on the cognitive correlates of linguistic phenemena.

In Chafe's (1977a) attempt to examine the process of verbalization using the schema approach, for example, we find a three stage process of the identification of an event via a schema, a sentence level semantic role specification through a frame and an event naming stage via what Chafe calls a *category*. Fillmore (1975), to take another example, relates linguistics with the schema approach by associating *scene* with "any kind of coherent segment of human beliefs, actions, experiences or imaginings" (p.124) and *frame* with "any system of linguistic choices ... that can get associated with prototypical instances of scenes" (*ibid.*) Widdowson's (1984) distinction between *systemic* and *schematic* knowledge of a language goes a considerable way to clarify the relationships between the schemata approach and linguistics. In particular, the notion of *procedure*, used by Widdowson, is extremely helpful in relating schematic knowledge to the discourse process of language in use.

It is easily seen that the attempts to use the schema approach in linguistic investigation just described focus on the cognitive and perceptual basis of the discourse process rather than the linguistic organization of texts as such. They lie, therefore, outside the scope of the present study. (See 2.1.) It is certainly true that schematic knowledge plays an important part in discourse processes and that schemata have also linguistic characteristics as pointed out by Widdowson (1984). However, since the research on the psychological and the psycholinguistic processes associated with language use is, at present, rather sketchy and tentative and since the present study focuses on the text as such, considerations of schematic knowledge will certainly cause serious codability problems and are not of immediate relevance here. It is clear, then, that the schema approach cannot be used in the present study.

It must be admitted that, as a general theory on the phenomenology of perception, the schema approach is relevant in a general way and needs to be referenced in the study. In particular, it is vitally important to make explicit the theory of human perception followed in choosing the method of analysis to be used in this study. It is in this particular area that the schema approach will have some relevance.

3.3.2 Text Linguistics

Even though text linguistics has been described primarily as encompassing '... any work in language science devoted to the text as the primary object of inquiry' (de Beaugrande & Dressler 1981 p.14), the main emphasis of text linguistics is on the logical relationships among textual elements rather than the surface signals of text structure as such. As has been observed in 2.5 above, the emphasis of text linguistics is on *discourse* rather than *text*, and more importantly, the two aspects of linguistic organization are taken to be nearly inseparably interwoven and have to be analysed together.

Thus, as a text analysis method, text linguistics allows textual, semantic and extralinguistic elements to be so interwoven that it may not be possible to focus on any one particular aspect. Even though what is envisaged by text linguistics is in reality what really constitutes *actual systems* (to use a de Beaugrandian term), the investigation of actual systems is not within the scope of the present study. Indeed, it is the author's contention that at the present state of text analysis and particularly of empirical study of text phenomena (as is the case of this study) it is too early to consider actual systems. A more realistic goal would be to focus on one specific system of text while not forgetting the more complex picture of the actual system. Indeed, the complexity of the actual system has considerable implication for the codability of data as well.

Both van Dijk's and de Beaugrande & Dressler's approaches may be too complex for any straightforward coding to be done, and require mutlivariate and multidimensional statistics for their analysis. It is true that both multivariate and multidimensional statistics are well established analysis techniques; however, it seems premature to apply them to the analysis of data generated from text linguistics, because of the still tentative nature of the approach.

3.3.3 The Tagmemic approach

The Tagmemic approach, as has been described (See 2.3.), covers a very broad spectrum of research interests. Of the examples mentioned Meyer's (1975) work on reading comprehension and Clements's (1979) work on staging are of particular interest, particularly because both developed a coding system for their data.

Meyer's (1975) tree structure is totally based on an underlying semantic network derived from Frederickson (1972). Her analysis, therefore, does not focus on the text as such. It must be pointed out, however, that Meyer's treatment of sentence subordination using Rhetorical Predicates is quite promising.

Clements's (1979) staging analysis is strictly textual and has the advantage of a uni-dimensional coded outcome. However, its treatment of sentence subordination is not entirely satisfactory. Furthermore, the rules for resolving conflicts in applying individual staging rules have not been presented with sufficient justification. The most serious problem with the Clements analysis is that, when doing the actual statistical analyses of staging effects on his data, Clements collapses units in his staging analysis data into chunks using, again, Frederickson's (1972) semantic network. These chunks, then, become the actual units of analysis. In doing so, Clements may, in fact, change from a purely textual to a semantic perspective and may mask the true effects of staging through chunking.

3.3.4 Text Signalling approach

The Text Signalling approach seems to be the best fitted for the purpose of the study amongst the four approaches. As a descriptive apparatus, it is predominantly directed to the text. The unit of analysis is the clause, which is seen by most language users as a very naturalistic unit in a written text. Furthermore, text patterns can easily be coded as there are only a limited number of patterns in any one text and a limited number of component sections in each pattern; furthermore, text patterns are mutually exclusive at any one level, even though they can be embedded within a higher level pattern. For example, the Problem section of a highest level Problem-Solution pattern may itself be composed of a Preview-Detail pattern. The signalling of Clause Relationships can also be easily coded as the signalling by Vocabularies 1, 2 and 3 is again very straightforward. In coding data using the text signalling approach, values can be unambiguously assigned to clearly identifiable text units.

3.4 *Conclusion*

The choice of the signalling approach as the theoretical linguistic model in the study would, on the one hand, facilitate a quantitatively oriented analysis, and, on the other, be the most manageable theoretical linguistic model for the present research. The importance of the latter should not be overlooked. Choosing a manageable theoretical model for quantitative analysis serves to eliminate potential data collection problems, which would make the application of any analysis tool problematic. It is hoped that by making the data collection procedure as straightforward as possible, the application of the analysis procedure can receive due attention and be tested much more rigorously. In doing so the researcher seems to be slightly over-careful. This is so for a very valid reason. It is true in all experimental work that, while an inadequate analysis procedure can be improved or even substituted, a poor data set can only be discarded.

CHAPTER FOUR

Statistical Discussion: An Introduction to the Research Methods

4.1 *Introduction*

In choosing a method of inquiry for applied linguistics discussions need to be made regarding a number of fundamental issues on the rationale of and the justification for the choice. These include questions on the nature of the data and of the method of analysis. The following points will, therefore, be examined:

- **a** the nature of the data to be collected and the method of analysis;
- **b** the justification for choosing repertory grid analysis as the method to be adopted;
- c a comparison of some of the most popular approaches to repertory grid analysis and the decision on which to use.

4.2 *The nature of the data to be collected and the method of analysis*

4.2.1 <u>Scientific research</u>

Scientific inquiry is regarded by not a few as based solely on the rigour and the logical cogency of the argument presented. Accordingly, very little, and if possible, nothing should be taken for granted in establishing a scientific argument. This may indeed be a remnant of Cartesian rationalism which is obsessed with starting any intellectual inquiry from nothing short of one single self-evident (perhaps a-priori) *cogito*. Such an obsession with rationality and logic can be expressed as a distrust of common-sense knowledge in scientific research. Thus, judging the lengths of two straight lines by way of mere visual inspection is considered pre-scientific and inaccurate, while the use of a ruler in such a case is taken to be scientific and accurate. On closer examination, however, it should be realized that the difference between the two methods is not fundamental but rather concerns their being based on two different sets of assumptions, both of which are derived from common-sensical observation. There is, in its ultimate analysis, no inherent accuracy and consequently superiority associated with measuring with a ruler. In fact, in many situations pure visual inspection can be more efficient than measuring with an instrument, *e.g.* the long shot of a professional basket-ball player or an olympic marksman.

Contemporary philosophy of science thus questions the truthfulness of the independence of science from common-sense knowledge on the one hand and the scope of the Cartesian *methodic doubt* on the other. Campbell (1978), for example, writes:

> "If we opt for total skepticism or solipsism, we give up 'knowing' or science. ... One aspect of the process which makes the cumulative revision of science possible is the practice of trusting (tentative at least) the great bulk of current scientific and common-sense belief ('knowledge') and using it to discredit and revise one aspect of scientific belief." (p.187)

There is, according to Campbell, a continuity between common-sense and scientific knowledge, and a *Doubt-Trust Ratio* in the collective world of scientific knowing. Campbell maintains that the "ratio of the doubted to the trusted is always a very small fraction". (p.187) This way, the stability of the collective epistemological world is maintained. Quine expresses the same point as follows:

> "The totality of our so-called knowledge or belief, from the most causal matters of geography and history to the profoundest laws of atomic physics or even of pure mathematics and logic, is a man-made fabric which impinges on experience only along the edges ... A conflict with experience at the periphery occasions readjustments in the interior field ... But the total field is so undetermined by its boundary conditions, experience, that there is much latitude of choice as to what statements to re-evaluate in the light of any single contrary experience ... A recalcitrant experience can ... be accommodated by any of various alternative re-evaluations in various alternative quarters of the total system, ... but ... our natural tendency is to disturb the total system as little as possible." (Quine 1953 pp.42-44.)

To sum up, the gist of the argument developed so far is that, at the micro level, common-sense and scientific knowledge are complementary to each other in any scientific inquiry; and, at the macro level, there is seldom an overhaul of the whole of scientific knowledge.

4.2.2 Quantitative and qualitative research

In terms of the method of behavioural research, there is an ever-increasing opposition between *quantitative* and *qualitative* research, particularly with the growing popularity of the latter. The two methods of behavioural research are variously labelled as traditional vs alternative, conventional vs naturalistic; positivistic vs phenomenological; sample/population oriented vs individual oriented, and psychology vs sociology and anthropology.

The issue has become rather emotional because the two perspectives are often presented (or at least have been made to be seen) as two mutually exclusive alternatives, and to profess allegiance to one must lead to the denunciation of the other. Furthermore, while quantitative research is criticized by the opposite camp as uncaring for the individual and, by implication, inconsequential in terms of the person, qualitative research is being branded as anecdotal and, therefore, unscientific.

The apparent incompatibility has, it seems, a predominantly historical origin. The association of quantitative research with psychology and qualitative research with anthropology and sociology at the initial stage of development of the two fields could be the explanation for the present situation. From the purely conceptual point of view the two methods should not be incompatible with each other as they are based on two different sets of postulates. It is true that, if behavioural research is to be of consequence, it should focus on the person which is necessarily individualistic and idiosyncratic. On the other hand, if behavioural research is to be scientific, it has to make generalizations about idiosyncratic variations from a dimension which is common and comparable across individuals. Such a dimension cannot represent the individual as such. There should, however, be no inherent difficulty to allow the use of both methods to investigate these two dimensions within the same research situation. The difficulty is rather in finding or in devising a method of inquiry which can perform both methods of research.

Ultimately, the opposition between quantitative and qualitative research appertains to a more fundamental opposition between two different paradigms of scientific inquiry : the *conventional* and the *naturalistic* . The term *paradigm* as used here can be defined as:

> "a world view , a general perspective, a way of breaking down the complexity of the real world. As such, paradigms are deeply embedded in the socialization of adherents and practitioners telling them what is important, what is legitimate, what is reasonable. Paradigms are normative; they tell the practitioner what to do without the necessity of long existential or epistemological considerations." (Patton 1980, p.9)

Guba (1985) identifies five dimensions where naturalistic paradigm is different from the conventional. He calls these axioms which are schematically described below.

Conventional paradigm	Naturalistic paradigm
Axiom 1: The nature of reality (ontology)	
Reality is single, tangible, consisting of variables which can be controlled.	Reality is multiple constructed and can be examined only holistically.
Axiom 2: Subject-object dualism	
The inquirer and the object of inquiry can and should be kept distinct and independent.	The inquirer and the object of inquiry are, by necessity, interrelated and mutually influencing.
Axiom 3: The purpose of inquiry	
Nomological generalisations in the form of truth statements independent of both time and context is the aim of inquiry.	An idiographic body of knowledge consisting of descriptions of individual cases is the aim of inquiry.
Axiom 4: The nature of explanation	
Events are viewed as asymmetrically related by cause/effect relations.	Events are mutually influencing and mutually shaping.
Axiom 5: The role values in inquiry	
Inquiry has to be value free.	Inquiry is value bound.

Paradigm, therefore, refers to the fundamental outlook of the whole of scientific research. It covers, therefore, a very wide scope and refers to all aspects of scientific enquiry. It can be seen from the above that the naturalistic paradigm is first and foremost a reaction against using a physical science methodology to investigate social and behavioural phenomena, as pointed out by Brenner *et al.* (1978):

> "Whereas theorizing has mainly been as an activity geared towards an understanding of the social *qua* social, this has not been the case on the level of method. Research designs, data collection procedures, forms of error control in measurement and data analysis techniques have been modelled after a paradigm which is essentially non-social and which is, in its epistemological assumptions, equivalent to the idea of method in the natural sciences." (p.9)

This Brenner *et al.* (1978) see as a paradox between theorizing about social phenomena and empirical exploring. This is so not because of any inherent incompatibility between natural, and social and behavioural sciences, but because of the fact that the requirements of natural science methodology very often distort social and behavioural phenomena. The clearest example here is in the control of error and confounding variables. Many confounding variables within a natural science paradigm, *e.g.* experimenter/subject interaction, are in effect constituent variables within a social or behavioural science paradigm. To try to exert control over such variables would be to do injustice to a situation which the very research aims to study. Guba (1978) sums up such a situation very nicely:

"... the conventional inquirer leans towards the laboratory setting for his investigation, while the naturalistic inquirer carries out his inquiry in a natural, i.e. non-contrived, environment. ... The conventional inquirer seeks to control conditions; the naturalist opens his inquiry to uncontrolled conditions as much as possible." p.16

The opposition regarding error and variable control between the conventional and the naturalistic paradigm has its roots in the predominant use of statistically oriented quantitative techniques in the former and ethnographic qualitative techniques in the latter. There is, however, no inherent opposition to the use of statistical techniques within the naturalistic paradigm as evidenced by the writings of representative scholars professing a naturalistic orientation (*e.g.* Guba 1981, Lincoln 1985b, Lincoln & Guba 1985, Strctic 1985). Guba (1985) holds the view that a distinction between paradigm and method has to be maintained. The contrast between the conventional and the naturalistic paradigm is not equivalent to the contrast between quantitative and qualitative methods. There does not seem to be any fundamental objection to quantitative methods within the naturalistic paradigm. Lincoln & Guba (1985) write:

"Qualitative methods are stressed within the naturalistic paradigm not because the paradigm is antiquantitative but because qualitative methods come more easily to the human-as-instrument. ... the naturalistic and conventional paradigms are so often - mistakenly - equated with the qualitative and quantitative stance, ... Indeed, there are many opportunities for the naturalistic investigators to utilise quantitative data ..." p.198

The exclusion of quantitative techniques in the naturalistic paradigm and vice versa is, thus, the result of historical development within the two paradigms rather than of incompatibility at a theoretical level. It is true that a number of quantitative methods, particularly of a univariate or bivariate nature, do require rather stringent control of variables. This would certainly make some quantitative methods not viable within the naturalistic paradigm. The situation would be quite different, if we take into account multi-variate statistical techniques. Indeed Guba (1985) seems to acknowledge this albeit with some reservation. He writes:

> "Multiple regression, multivariate analysis (with delineation of interactions to third, fourth, and even higher orders), path analysis, and other techniques of modern statistics seem, to the positivist mind, to be ideal means for handling the contextual complexities that plague the analyst : technical means for handling what are, at bottom, merely technical problems. ... But of course this approach ignores the fact that phenomena are not only *influenced* by the factors of time and context *but derive their very meaning from them* ." p.99

The author, for one, is more optimistic and thinks that a creative and innovative use of multi-variate statistics may provide at least partial answers to the bridging of the two paradigms. Multivariate statistical techniques are becoming increasingly able to handle complex field situations without needing to place excessive control over variables. At the same time, the interpretation of many multivariate statistical results (*e.g.* factor analysis) is very much qualitative in orientation, relying to a very large extent on the researcher's subjective judgment. Perhaps, the two paradigms are not as incompatible as many would think. Indeed, Guba

(1978) maintains that naturalistic inquiry "is always a matter of degree". (p.6) In this regard, the words of Argyle (1978) may be opportune. Commenting on a series of papers advocating a naturalistic shift for the social sciences, he writes:

> "While I consider that what they have to say is very important, I believe that they have gone too far in the abandonment of procedures of verification, in giving up hope of discovering useful generalizations, and in rejecting nearly everything that has gone before. I believe that their main doctrines can be incorporated in a broadened but still rigorous kind of social science." (p.237)

4.3 *Sources of behavioural data*

There are four major types of phenomena which constitute sources of data in behavioural research:

a demographic information about a person which any other person can have access to (*e.g.* age, sex, etc);

b factual information about a person which that person can have access to through recollection or personal record (*e.g.* the time or the times spent on certain activity);

c physiological and behavioural data that can either be directly measured or self-reported (*e.g.* pulse rate, frequency of certain activity);

d psychological phenomena about a person which can be accessed either directly through introspection of the person concerned or indirectly through psychological testing instruments (*e.g.* self-reporting on anxiety, anxiety test score).

It can be safely assumed that types **a**, **b** and **c** are more or less uncontroversial. As regards type **d**, if the data ars generated through testing instruments, the problems associated with construct validity of the instruments are very numerous and difficult to handle; and, if the data are generated through self-reporting by the subjects, the problem is two-fold. As almost standardly applied, self-reported data of the kind just described are obtained through the subject's own verbalization the interpretation of which is rarely a simple and straightforward process. Additionally, it is quite possible in the process of introspection the self-reporting person may, unwittingly, use the same label to refer to different psychological phenomena or to employ different labels when, in reality, the same psychological phenomenon is being referred to. Such a situation would again put the construct validity of the data into serious question.

One way to get around such difficulties is to use sensory stimuli to elicit the self-reported data. This can be illustrated by using the famous duck-rabbit ambiguous figure in Jastrow (1900), Wittgenstein (1953), Hanson (1958), Kuhn (1962) which is reproduced in Figure 1 below. It is apparently futile to force any observer to label the figure as duck or rabbit. It is, however, entirely possible to ask observers to describe the shape and the relative positions of the various component parts of the figure. This can then become an objective basis for comparison across observers. If the observers agree on such a description (and no doubt they will in this case),

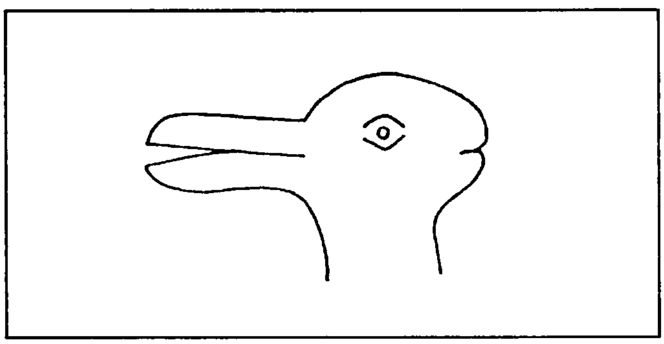

Figure 4.1: Do you see a Duck or a Rabbit?

then they agree in their perception even though they may label the figure differently.

4.4 *Relevance to the present research*

As a study of perception of text structure it is expected that the source of data will be exclusively of a self-reporting/introspectional nature. This being so, factors like individual differences in and idiosyncrasies of perspectives and frames of reference, as well as the verbalization of one's perception have to be taken into account in the data collection procedure as discussed in 4.3 above. This is done so that comparisons among observers can be made despite the existence of such differences.

Furthermore, there is pressure to follow both the naturalistic and the conventional paradigm. The study of human perception is most meaningfully carried out within a naturalistic paradigm and the conclusions therefrom are most revealing if they were formulated in idiographic and ethnographic terms. On the other hand, as an attempt at validating linguistic models, there is need of abstract and context-free generalizations using a conventional paradigm approach. Such an approach should not be taken as contradictory. As argued in 4.2.2, the two paradigms form a continuum. It is, therefore, legitimate to combine the two paradigms within the same study.

However, to achieve the dual aim just mentioned, there is first of all the need to identify a quantitative method of analysis which would satisfy both a naturalistic and a conventional orientation, a method that, while generalizing, would not obliterate individual differences. Such a method of inquiry, it seems to the author, is found in *repertory grid analysis*.

It should be pointed out that the use of naturalistic inquiry envisaged is not merely the application of repertory grid analysis, which constitutes only one dimension in the multi-source approach to data collection advocated within a naturalistic approach. It is fundamental to data validation in naturalistic inquiry to examine the field of inquiry from as many perpectives as possible. Such an approach is necessary for drawing conclusions and making statements of an idiographic nature. This is known as *triangulation*.[1] In the present study, besides the results from repertory grid analysis other sources of data will be triangulated.

4.5 *Repertory Grid Analysis*

4.5.1 Personal Construct Psychology and Repertory Grid Analysis

Repertory grid analysis is based on George A. Kelly's (1955) *Personal Construct Psychology* . Kelly maintains that every human person perceives the world according to an ever refining construct system which becomes a frame of reference for and at the same time is modified by perception. Kelly first used repertory grid analysis, which also originated from him, in psychotherapy. However, before long, a number of researchers (*e.g.* Slater 1977, Thomas *et al.* 1977, Shaw 1980, Bannister and Fransella 1981, Fransella 1981) extended the concept of Personal Construct Psychology and the technique of repertory grid analysis to several other areas of research, including market research, architectural design, and education. The Centre for the Study of Human Learning at Brunel University, Middlesex, which is one of the principal centres for the

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1 Triangulation is the attempt to validate an assertion concerning a field of inquiry by subjecting it to a variety of data sources, analytic methods or theoretical perspectives in order to strengthen its internal validity.

application of repertory grid analysis, has been doing considerable research in language, especially in reading.

4.5.2 Characteristics of Repertory Grid Analysis

Central to repertory grid analysis is Kelly's model of man the scientist. It refers to Kelly's view that in engaging in his/her everyday cognitive activities, the human person is very much performing a hypothesis forming and testing activity not very different from what scientists are engaging in. Such a notion is much more complex than it first appears. It implies the breakdown of the barrier **a** - between scientific inquiry and common, everyday activity of any human being: educated or non-educated, trained or untrained, healthy or sick; **b** - between scientist and non-scientist so that the former is no longer entitled to the privileged position of the expert and the one who provides all the answers; and **c** - between the researcher and the experimental subject so that the latter is not just merely an entity to be manipulated. From the viewpoint of Personal Construct Psychology, to engage in behavioural research using a physical science paradigm does not do justice to human behaviour as such. People as experimental subjects cannot be studied and controlled using the criteria of physical science. Human interactions can be and are found among the experimenter and his/her subjects. Such interactions among conscious participants have to be taken as part and parcel of the experimental situation, and the subjects, particularly, have to have full knowledge of whatever aspects of the experiment as he/she wishes to have and be allowed to contribute as human beings.

Bannister (1981) sums up the position of Personal Construct Psychology using the term *reflexivity* . He writes:

> "From a construct theory viewpoint, the difference between psychologist and subject is at best only a matter of level of abstraction: psychologists are trying to make sense out of the way in which their subjects make sense." (p.194);

and further on he continues:

> "An acceptance of the need of reflexivity is intrinsically a denial of the doctrine that scientists think and are purposive while their subjects are mechanical and determined. ...
>
> Viewed reflexively the psychological experiment is simply a formal instance of people trying to understand people and psychologists might do better to experiment conjointly with rather than on them." (pp.194-195)

The main emphasis here is on allowing the experimental subjects to exhibit behavioural characteristics that would constitute the desired data without being unduly influenced by the experimenter. Furthermore, within this framework, the possibility is allowed so that communicative interaction can flow between and among the experimenter, the subjects and the content area of the research.

Jahoda and Thomas (1965) employs the notion of *conversation* which is characterized by interaction between all relevant participants within the experimental context just described: researcher, subject and all other entities, physical as well as psychological. In the context of the present research, the notion of conversation just described will enable the investigation of the language user's perspective in relation to the written text (*conversation with the text*) and the comparison among different language users regarding the similarities and the differences in their perspectives on the same text (*conversation among language users*) and the comparison between language user's perspective and a linguistic theoretical model (*conversation between language user and theory*).

The definition of conversation as described above brings into very sharp relief the relevance of repertory grid analysis to qualitative research in that the individual (both the researcher and the experimental subject) have paramount importance in the experimental set-up. In fact, in a number of publications dealing with qualitative research (*e.g.* Reason and Rowan 1981, Goetz & LeCompte 1984) repertory grid analysis is explicitly subsumed under the label of qualitative research. In addition, it has been pointed out that conversation can be effected among a group of individuals. As a consequence, the possibility of performing qualitative research using repertory grid analysis is thus opened.

4.6 *The general characteristics of repertory grid analysis*

4.6.1 General outline

In its most general outline, repertory grid analysis investigates the patterning of a person's perception of objects (called **Elements**) and their association with the person's particular points of view (called **Constructs**), which, according to kelly, are construed along two opposing poles. In doing the analysis, only the elements need be clearly and unambiguously defined; constructs can be either *supplied* by the experimenter or *elicited* from the subject or both. In doing linguistic analysis with the repertory grid analysis the elements can be linguistic units defined within the area of investigation and the constructs can either be a particular theoretical model (**Supplied constructs**) or the subject's own intuition (**Elicited constructs**).

4.6.2 Repertory grid analysis and linguistics

The application of repertory grid analysis envisaged in this study takes as elements *clauses* in an written text; these are quantified by being assigned values vis-a-vis their position within networks of clause relations, and their being constituent members of the overall text pattern. These parameters become the constructs in the repertory grid analysis.

As described in 4.6.1, constructs can be either supplied or elicited. In the present study, supplied constructs consist of the parameters which contribute to the building up of the structure of the text based on a text analysis model; and the elicited constructs are derived from the parameters of text structure perceived by the experimental subjects. The constructs are elicited using a number of standard methods of comparison and contrast for construct generation used in all repertory grid analysis methods.[2]

The grid is obtained by first identifying the clauses of the text (the *elements*) to be used. Then the relevant constructs are either supplied or elicited. The experimental subjects are then asked to associate the clauses (elements) with various parameters in the text (*constructs*), and rate each elements on all constructs to generate the grid.

The identification of the elements and the supplied constructs in the repertory grid analysis proposed is described in the following sections.

4.6.3 Identification of the elements

As the Text Signalling approach is chosen as the linguistic model for the study, clauses, which are the units of text structure in that approach, are the elements for the repertory grid analysis.

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2 See Easterby-Smith 1981 for details.

It must be pointed out that the traditional view of giving independent clauses a certain degree of prominence and semantic independence is not upheld in Winter's theory. Following Winter's formulation, clause relations are found among independent-dependent clause clusters as well as among independent-independent clusters with the condition that there should at least be one independent clause within a clause relation network. Independent and dependent clauses are structurally different only in terms of the lexical signals they contain.

Winter identifies three types of lexical signals which he calls Vocabulary 1, 2, and 3. (See 2.5.)

He also identifies the following clause types:

1	Independent clause;	
2	Subordinate clause	Noun clause Relative clause Adverbial clause
3	Apposition	
4	Interpolation	
5	Clef/Pseudo-clef clause	
6	Non-finite clause	

4.6.4 Specification of the constructs

The supplied constructs to be included in the repertory grid analysis are as listed below.

	Left Pole	**Right Pole**
I - *at the level of discourse pattern*		
1	-Situation	+Situation
2	-Problem	+Problem
3	-Solution	+Solution
4	-Evaluation	+Evaluation
5	-Compatibility	+Compatibility
6	-Contrast	+Contrast
7	-General	+General
8	-Example	+Example
9	-Preview	+Preview
10	-Detail	+Detail

II - *at the level of clause relations*

11	-Main Clause	+Main Clause
12	-Logical Sequence	+Logical Sequence
13	-Compatibility Cl.	+Compatibility Clause
14	-Contrast Clause	+Contrast Clause
15	-Evaluation Clause	+Evaluation Clause
16	-Clef/Pseudo-cleft	+Cleft/Pseudo-cleft
17	-Interpolation	+Interpolation
18	-Apposition	+Apposition

III - *at the lexical signal level*

19	-Vocabulary 1	+Vocabulary 1
20	-Vocabulary 2	+Vocabulary 2
21	-Vocabulary 3	+Vocabulary 3
22	-Lexical repetition	+Lexical repetition

4.6.5 Configuration of the constructs

Two points need to be made regarding the construct list above. Firstly, the list contains the maximum number of constructs that may be included in a grid. It is expected that few grids would require all the constructs in the list. Secondly, the constructs at the level of discourse patterning can be nested within one another. As a consequence, there could be an internal hierarchy among the constructs within that level. To distinguish different ranks of constructs of discourse patterning, the constructs at the highest level would be labelled as they are in the list. Nested discourse patterning constructs would be marked by asterisks the number of which will depend on the depth of the nesting. Thus, for example, at the first level of nesting the construct *Preview* would be labelled *Preview* *.

4.7 *Comparison of repertory grid analysis methods*

4.7.1 Introduction

Repertory grid analysis is a very general problem solving tool. To use it in the present research it is necessary to investigate the likelihood of success, and the precise manner of application, many of which are specific and peculiar to the study on hand. The following areas will, therefore, be examined in this section:

a a comparison between the *INGRID*[3] and the *FOCUS* package to decide on which of the two is suitable for the study;

b the derivation and the analysis of a grid based on the perspective of the text analysis procedure adopted. (Such a grid will be labelled the **theoretical grid** in the study.)

4.7.2 Repertory grid analysis methods

As regards the method of repertory grid analysis, the two most popular packages available are : **a** - **INGRID** and the related suite of programs by P. Slater (1977) and **b** - the *Integrated Repertory Grid* package (or popularly known as the *FOCUS* package) by the Centre for the Study of Human Learning at Brunel University, Middlesex.

4.7.2.a *INGRID* uses *Principal Component Analysis* as its basic statistical tool. Both Q and R techniques are applied so that the components would include both elements and constructs. Through the patterning of loadings on each component, the relationships among elements and among constructs, as well as between elements and constructs can be identified. Furthermore, the *INGRID* package can handle a maximum grid size of 40x40 using the **INGRID**, sub-programme and can perform comparisons of

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3 For ease of reference, names of repetory grid analysis programming packages will be referred to using the italised form *INGRID*, while individual programs using bold characters, *e.g.* **INGRID**.

groups of grids which may be aligned to various degrees in terms of elements, constructs or both.

4.7.2.b *FOCUS* uses *Hierarchical Cluster Analysis* as its basic statistical tool. Through cluster analysis the patterning of both elements and constructs are identified. Such a pattern would represent the subject's perception of the structure of a text, since the elements are the clauses in a written text and the constructs are the dimensions of the text structure as identified through the text analysis procedure or elicited from the subjects themselves.

4.7.2.c Undoubtedly, both packages have their individual strengths and weaknesses. It would, therefore, be necessary to compare both methods to find out which of the two would suit the specific purpose of the study, notwithstanding Easterby-Smith's (1981) comment:

> "...the *INGRID* package may be preferred for research-oriented applications; whereas the *FOCUS* package may be preferred for 'operational' applications." (p.29 italics added)

The main issue of contention between the proponents of *FOCUS* and *INGRID* is the controversy between the use of either hierarchical cluster analysis or principal component analysis as the basic statistical tool. This is evident from the rather heated but inconclusive debate on the issue between Rump (1974) and Slater (1974). The discussion that follows will centred on both the theorectical and the statistical basis of both techniques, and their application to an actual repertory grid analysis.

4.7.3 Theoretical and statistical considerations

It must be pointed out at the outset that the differences between hierarchical cluster analysis and principal component analysis may have been unduly exaggerated. This is understandable because, while cluster analysis uses a non-geometrical (non-parametric) method of analysis, principal component analysis is based on a geometrical (parametric) method. It may be noted that Gordon (1980) holds in regards to clustering (what he calls *classification*) that "... the aim of classification, as perceived in this account, is to *uncover* the structure in the data rather than to impose some inappropriate structure on them" (p.5) and includes in his taxonomy of classificational methods both non-geometrical and geometrical methods. More interestingly, Gordon (1980) highlights the near complete isolation of cluster analysis from other multivariate statistical techniques (which are all geometrical in nature) but indicates that there are increasing attempts in terms of research efforts to forge links between cluster analysis and other multivariate statistical procedures. In particular, Gordon cites the example of Scott and Symons's (1971) attempt to link cluster analysis to a multivariate normal component model which looks very similar to the principal component analysis used in *INGRID* . Gordon concludes:

> "It seems likely that the future will see further investigations of the links between classification and other more formal statistical methodology. Such studies could provide a deeper understanding of the properties of various classification procedures, and facilitate a more informed approach to the exploratory analysis of multivariate data." (p.53)

It appears, then, that the controversy surrounding the debate on the use of cluster analysis or principal component analysis in repertory grid analysis has been emotional rather than substantial. This is evident also from the tone of Slater's (1974) reply to Rump (1974).

Needless to say that the decision to choose between the two methods of repertory grid analysis should solely be based on statistical grounds. Cluster analysis methods concentrate on "investigating the relationships within a set of objects by imposing some structure on the data, for example a partition or set of partitions. These methods can force unwarranted structure on a data set, suggesting misleading results." (*op. cit.* p.80)[4] On the other hand, geometrical methods of classification, including principal component analysis, aim to represent a set of data as points in some Eucledean space with the result that points are patterned in relative internal coehsion as well as external isolation. The configuration of points will then be examined to determine whether there is an underlying structure in the data. Gordon, thus has good reason to write:

> "The problem is that each clustering criterion is predisposed to finding particular 'types' of clusters, and may well considerably distort the data towards this ideal. ... different geometrical methods of classification are also based on different underlying assumptions about the data. ... If the form of the structure in the data were known, one might be able to suggest an appropriate classification method for detecting it. When stated like this, the circularity is immediately apparent: in general, the underlying structure is not known; the investigation is being undertaking precisely in order to determine it." (p.122)

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4 It should be reminded that Gordon (1980) considers *cluster analysis* as one of the techniques within *clustering* (classification).

The Text Used in the Study

Situation
[1]Helicopters are very convenient for dropping freight by parachute
Problem
[2]but this system has its problems. [3]Somehow the landing impact has to be cushioned to give a soft landing. [4]The movement to be absorbed depends on the weight and the speed [5]at which the charge falls. [6]Unfortunately most normal spring systems bounce the load [7]as it lands, 8sometimes turning it over.
Solution
[9]To avoid this, [10]Bertin, developer of the aero-train, has come up with an air-cushion system [11]which assures a safe and soft landing. [12]It comprises a platform [13]on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions. [14]These are fed from compressed air cylinders equipped with an altimeter valve [15]which opens [16]when the load is just over six feet from the ground. [17]The platform then becomes a hover craft, [18]with the balloons reducing the deceleration [19]as it touches down.
Evaluation
[20]Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second. [21]The charge weighed about one-and-a-half tons, [22]but the system can handle up to eight tons. [23]At low altitudes freight can be dropped without a parachute.

The question is, therefore, not which of the two methods of analysis in repertory grid analysis is inherently better than the other but rather which method suits a particular research situation better.

4.8 *An Empirical Investigation*

4.8.1 The text

The text chosen for the pilot study is a passage used by Hoey (1979) to exemplify the problem/solution discourse pattern (pp.36-37). The text is entitled *Balloon and Air Cushion the Fall* from *Technology Review, New Scientist*, (1970). (The passage can be found in the next page.) This text is chosen because it has a simple and straightforward discourse pattern, and consequently would make the pilot study more manageable. A theoretical grid for the text is then derived, based on the text analysis procedure outlined in 4.6.3 and 4.6.4 above.

4.8.2 Methods of analysis

An analysis is then performed on the theoretical grid using both **INGRID** and **FOCUS**. Comparison of both methods would help to decide on which of the two would be appropriate. Finally, a small sample of subjects is chosen and data analysed using repertory grid analysis.

4.9 *Generating the Theoretical Grid*

4.9.1 The constructs

As the constructs for the theoretical grid are all pre-defined by the theory, they are all supplied and not elicited through *triads*[5] as is customery.

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5 See 5.2.1.b for a definition of triad.

The grid is directly generated through rating each element on every construct identified in 4.6.4. Naturally, some of the constructs do not have any variation because they are not applicable to the text chosen. The grid thus generated has fifteen constructs (features of text) and twenty-three elements (clauses) and can be found in Table 4.1 below. The elements are labelled **CL.1** to **CL.23**.

4.9.2 The grid

The constructs are all bipolar and are rated according to whether a particular feature is found *present* or *absent* in respect of the elements. It should be noted that the values for the ratings found in Table 4.1 are 1s and 2s representing *absence* and *presence* respectively. This is the standard output by **FOCUS**. When **INGRID** is used the values are recoded into **0**s and **1**s as customarily the case for bipolar measurements.

4.10 *Analysis Using FOCUS*

4.10.1 Cluster analysis

The cluster analysis used in *FOCUS* is closest to what Everitt (1974) calls *the nearest neighbour or single link method*. The clustering is done by identifying the closest pair of items (constructs or elements). The pairs are then indexed by a *matching scores* to indicate the strength of association between the two. These matching scores can take a maximum value of 100 and a minimum value of 0 with signed values indicating direction of association. To allow for multivariate relationship between items, matching scores are computed at different levels with the first (*lowest*) level referring to adjacent items and the *n*th level referring to the *n*th item from a specific item. Thus, at the fourth level, a matching score refers to the fourth item (to the left or to the right) from a specific item.

CONSTRUCT POLE RATED - 1 | CONSTRUCT POLE RATED - 2

ELEMENT

CONSTRUCT POLE RATED - 1		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		CONSTRUCT POLE RATED - 2
-SITUATION	C1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C1	+SITUATION
-PROBLEM	C2	1	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C2	+PROBLEM
-SOLUTION	C3	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	C3	+SOLUTION
-EVALUATION	C4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	C4	+EVALUATION
-PREVIEW	C5	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	1	1	1	C5	+PREVIEW
-DETAIL	C6	1	1	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	1	2	2	2	C6	+DETAIL
-MAIN CL.	C7	2	2	2	2	1	2	1	1	1	2	1	2	1	2	1	1	2	1	1	2	2	1	2	C7	+MAIN CL.
-LOGICAL SEQUENCE	C8	1	1	1	1	1	2	2	2	2	2	1	1	1	1	1	2	1	2	2	1	1	1	1	C8	+LOGICAL SEQUENCE
-CONTRAST CL.	C9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	C9	+CONTRAST CL.
-VOC.1	C10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	C10	+VOC.1
-VOC.2	C11	1	1	1	1	2	1	2	1	1	1	2	1	2	1	2	2	1	1	2	1	1	1	1	C11	+VOC.2
-VOC.3	C12	1	2	1	1	1	2	1	2	2	1	1	1	1	1	1	2	1	1	1	1	1	1	1	C12	+VOC.3
-EVALUATION CL.	C13	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	C13	+EVALUATION CL.
-PREVIEW CL.	C14	1	1	1	2	1	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	1	1	1	C14	+PREVIEW CL.
-DETAIL CL.	C15	1	1	1	1	2	1	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	1	1	C15	+DETAIL CL.

CL.23
CL.22
CL.21
CL.20
CL.19
CL.18
CL.17
CL.16
CL.15
CL.14
CL.13
CL.12
CL.11
CL.10
CL.9
CL.8
CL.7
CL.6
CL.5
CL.4
CL.3
CL.2
CL.1

Table 4.1: The Raw Grid for the Theoretical Grid.

4.10.2 Data display

Of the various methods for the display of results from the hierarchical cluster analysis used by FOCUS , the *Spaced Focused Grid* and the *Trigrid Layout* are reported below. The Spaced Focused Grid translates the matching scores at the first level into relative distances between adjacent items, so that the strength of association of the clusters at the first level has a high degree of visual appeal. The Trigrid Layout is a form of display which includes matching scores at all levels. The Spaced Focused Grid for the theoretical grid is found in Table 4.2, while the Trigrid Layout is found in Table 4.3 below.

4.10.3 The Spaced Focus grid

Visual inspection of Table 4.2 reveals that there is a very clear cluster of constructs comprising Evaluation (Construct 4), Contrastive Clause (Construct 9), Vocabulary 1 (Construct 10), Situation (Construct 1), and Evaluation Clause (Construct 13). There is also an inversely related pair of constructs comprising Preview (Construct 5) and Detail (Construct 6). As regards the clustering of elements, it is clear from Table 4.2 that Clauses 16 and 19 form a closely related pair with clause 18 being a highly possible third member to form a cluster. Other closely linked pairs include Clauses 13 and 15, 12 and 14, 21 and 23, Less strongly related pairs include Clauses 6 and 8, 3 and 4.

Even though quite convenient as a visual display, the Spaced Focused Grid is unable to reveal clusters beyond the first level. To do this, the Trigrid Layout would be more helpful. The interpretation of the Trigrid Layout is dependent on the matching scores between items of the grid listed on the top and the right hand side of the grid as found in Table 4.2. Clustering is determined by choosing specific matching scores (from highest downward). The items linked by the score would be clustered

ELEMENTS

CONSTRUCT POLE RATE - 1 -		E11	E10	E09	E18	E16	E19	E15	E13	E05	E07	E08	E06	E03	E04	E12	E14	E17	E02	E01	E20	E23	E21	E22		CONSTRUCT POLE RATE - 2 -
-LOGICAL SEQUENCE	C8	1	2	2	2	2	2	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	C8	+LOGICAL SEQUENCE
+MAIN CL.	RC7	2	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	RC7	-MAIN CL.
-VOC.2	C11	2	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	C11	+VOC.2
-DETAIL CL.	C15	2	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C15	+DETAIL CL.
-PREVIEW CL.	C14	1	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	C14	+PREVIEW CL.
-EVALUATION	C4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	C4	+EVALUATION
-CONTRAST CL.	C9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	C9	+CONTRAST CL.
-VOC.1	C10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	C10	+VOC.1
-SITUATION	C1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	C1	+SITUATION
-EVALUATION CL.	C13	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	C13	+EVALUATION CL.
-PREVIEW	C5	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	C5	+PREVIEW
+DETAIL	RC6	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	RC6	-DETAIL
-VOC.3	C12	1	1	2	1	1	1	1	1	1	1	2	2	1	1	1	1	2	2	1	1	1	1	1	C12	+VOC.3
-PROBLEM	C2	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	2	1	1	1	1	1	C2	+PROBLEM
+SOLUTION	RC3	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	RC3	-SOLUTION

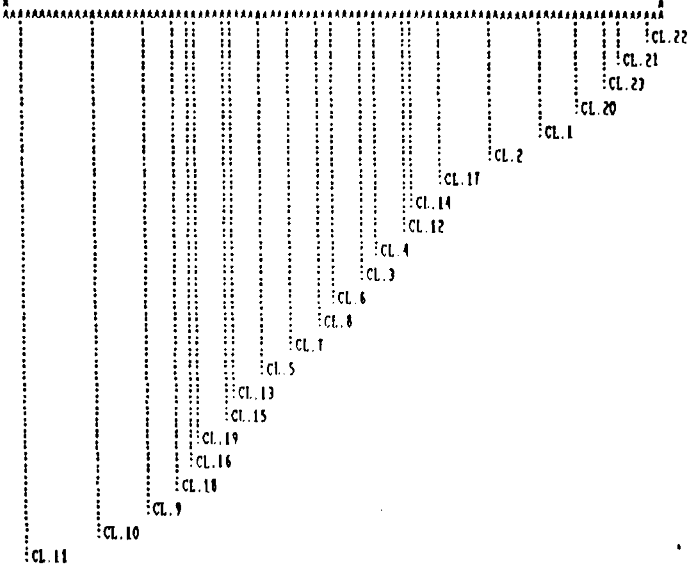

Table 4.2: Spaced Grid for the Theoretical Grid.

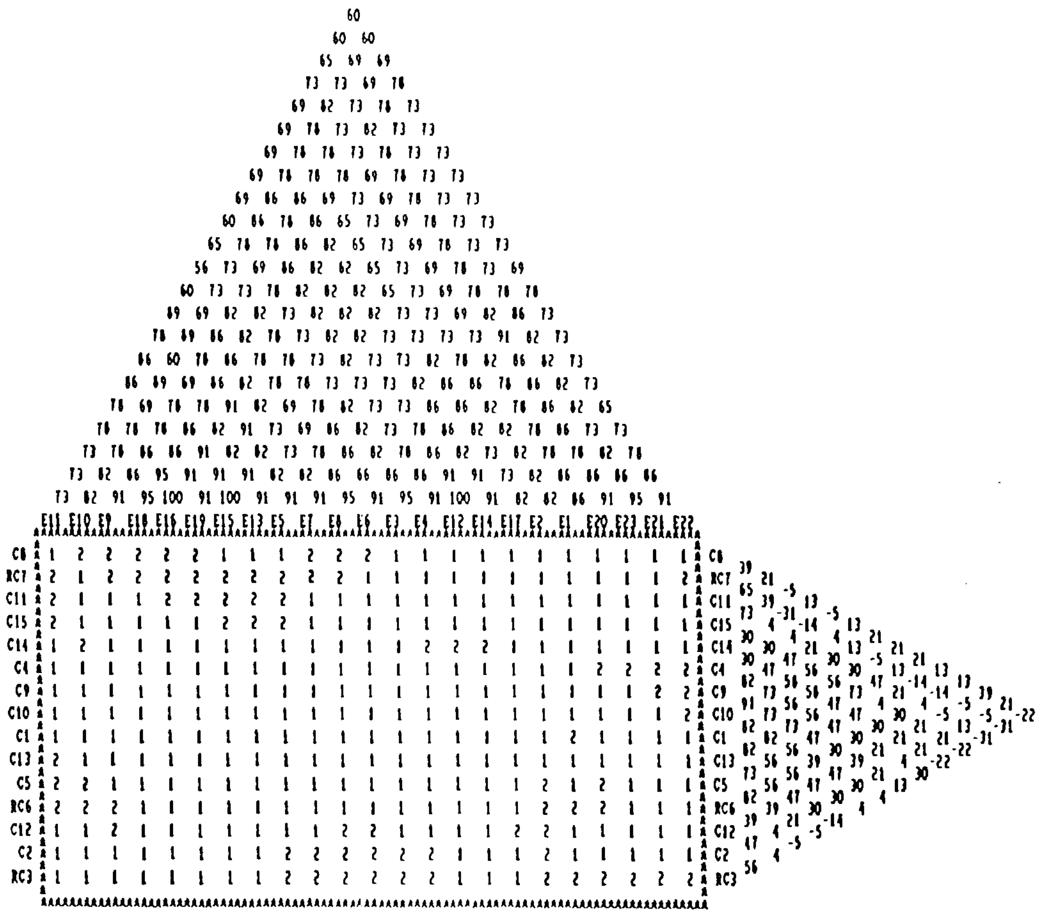

Table 4.3: Trigrid Layout for the Theoretical Grid.

together. For example, the first score of 100 at the first level for elements would relate Clauses 16 and 19; and the first score of 95 at the second level would relate Clauses 18 and 19.

Since Clauses 16 and 19 are already clustered together and the three matching scores of 95 and 100 at level one and 95 at level two form a triangle, Clauses 18, 16, and 19 would form a cluster. Multivariate relationships can, thus, be identified between items and clusters can be gradually expand to encompass more items. In this connection, it may be relevant to take note of the construct cluster of Evaluation (Construct 4), Contrast clause (Construct 9), Vocabulary 1 (Construct 1), Situation (Construct 1) and Evaluation clause (Construct 13).

4.10.4 Comments on FOCUS

The following observations need to be made regarding the analysis using FOCUS. If the aim of statistical techniques used in repertory grid analysis is to make explicit the relationships between constructs and elements, FOCUS flares rather poorly. The relative importance of items within a cluster is not totally clear, even though such a pattern of relative importance is deducible from the size of the matching scores. Moreover, relationships between elements and constructs and possible multivariate dimensions of elements and constructs are not explored.[6] It is true that the interpretation of the results from the cluster analysis is made easy and

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6 It must be pointed out that the failure to explore multivariate relationships is specific to **FOCUS** because of the use of hierarchical cluster analysis which limits the variables to only one cluster. Within cluster analysis techniques, however, there are methods, e.g. clumping (Everitt 1974, pp.52-54) that allow multivariate clusters known as overlapping clusters. The comments regarding **FOCUS** remains, in any case, valid.

rather intuitive, and can be understood without extensive training. This seems to be a strong point in favour of the package, particularly in a clinical and counselling context where the experimental subjects have to be given as much control over the experiment as the experimenter. This is in line with the basic approach within personal construct psychology. The greatest strength of *FOCUS*, therefore, seems to lie in the opinion that to analyse a raw grid using cluster analysis would make it possible "to get back in a common-sense way from the results of the analysis to the original grid data" (Thomas *et al.*1985, p.142), thus reducing the "danger of mystification". (*ibid.*)

4.11 *Analysis using INGRID*

4.11.1 Principal component analysis

The principal component analysis[7] which constitutes the basic statistical method in **INGRID** is derived from the covariance rather than the variance matrix of the variables as is customarily the case. The use of both the **R** and the **Q** technique enables both the elements and the constructs to be compared. There are also other related descriptive statistics generated by the program.

The latent roots from the principal component analysis on the theoretical grid are found in Table 4.4 below.

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7 Only very general features of the principal component analysis used in *INGRID* are described here. Detailed discussions will be presented in 7.3.

Component	Root	%
1	13.7	26.08
2	9.14	17.36
3	8.23	15.62
4	6.72	12.75
5	5.5	10.45
6	3.18	6.03
7	2.07	3.92
8	1.54	2.93
.	.	.
.	.	.
.	.	.

Table 4.4: Latent roots in the PCA.

Four components are extracted based on the Bartlett test[8] results and the matrix of loadings can be found in Table 4.5 below.

From the percentages of the latent roots it can be seen that the decrease in the first four components is rather gradual. This indicates that the four components extracted would have a percentage of covariance high enough to be reasonably informative, and that these components are equally significant.

Component 1 can be defined as one containing the contrast between **Solution** and **Evaluation** with **Vocabulary 2** signalling, **Detail clause** characterizing **Solution** and **Main clause** characterizing **Evaluation**. Such a pattern of the loadings in Component 1 can be understood, if the loadings of the elements are also considered. The high loadings on the elements (Elements 1, 3, 4, 20, 21 and 23) are all associated with main clauses outside

8 The Bartlett test is a test of significance for the components. It is used as a decision rule for the number of significant components to include in the PCA.

		Component 1	2	3	4
Element					
1		-.72	-.42	.005	.35
2		**-1.02**	.20	.64	**1.15**
3		-.71	.52	-.29	.05
4		**-.83**	.30	-.12	-.23
5		.65	.69	**-.80**	.68
6		-.62	**1.13**	.58	-.03
7		.55	**1.12**	-.10	.17
8		-.07	**1.34**	.47	.06
9		.39	.04	**1.09**	-.01
10		-.24	**-.95**	**1.19**	-.02
11		**1.11**	**1**	.02	**1.27**
12		-.26	.68	.16	**-.82**
13		**1.21**	-.30	-.52	.1
14		-.26	-.68	.16	**-.82**
15		**1.21**	-.30	-.52	.10
16		**1.12**	.13	.18	-.42
17		-.26	-.19	.38	-.42
18		.61	.08	.37	-.64
19		**1.12**	.13	.18	-.42
20		**-.97**	-.78	-.16	.75
21		**-.87**	-.21	**-.97**	-.33
22		-.34	.005	**-1.23**	-.28
23		**-.78**	-.19	-.71	-.24
Construct					
1	*Situation*	-.19	-.14	.002	.13
2	*Problem*	-.56	**1.75**	.13	**.72**
3	*Solution*	**1.55**	**-1.22**	**.94**	-.80
4	*Evaluation*	**-.80**	-.39	**-1.07**	-.04
5	*Preview*	-.30	**-.83**	.59	**1.22**
6	*Detail*	.39	.96	**-.96**	**-1.35**
7	*Main Clause*	**-2.04**	-.64	.30	-.24
8	*Logical Seq.*	.77	1	**1.38**	-.50
9	*Contrast Cl.*	-.33	-.07	-.77	-.24
10	*Voc. 1*	-.09	.001	-.43	-.11
11	*Voc. 2*	**1.88**	.16	-.54	.57
12	*Voc. 3*	-.43	**.83**	**1.10**	.29
13	*Evaluation Cl.*	.30	-.33	.01	.49
14	*Preview Cl.*	-.43	-.67	.49	**-.72**
15	*Detail Cl.*	**1.13**	-.30	-.64	**.83**

Table 4.5: Loadings of a PCA.

the Solution section of the passage. *Component 2* shows the contrast between **Problem** and **Solution** with **Detail, Logical sequence**, and **Vocabulary 3** signalling as the principal parameters for **Problem**, and with **Preview** as the principal characteristic for **Solution**. Such a contrast is exemplified by the two clusters of elements 6, 7 and 8 on the one hand, and 10 and 11 on the other. *Component 3* contains again the contrast between **Solution** and **Evaluation**. However, unlike Component 1, here the contrast lies in the predominant use of **Detail** in **Evaluation**, and **Logical sequence** and **Vocabulary 3** signalling in **Solution**. Finally, *Component 4* is characterized by the contrast between **Preview** and **Detail**.

4.11.2 Observations

From the rather brief analysis above it is clear that using principal component analysis to perform repertory grid analysis would provide rather interesting results. In the first place, element and construct clusters are not only identified within element or construct group, but are also related to each other, making explicit the relationships between elements and constructs. Secondly, the loadings on the elements and the constructs would help to define the component by reference to their relative size within a component. Thirdly, multivariate relationships of elements and constructs can be easily captured by the components as the same elements or constructs can appear in more than one component. Finally, the latent roots would provide valuable information on the relative importance of the clusters within each component.

The pattern of loadings across all components can serve to reveal the structure of the text as perceived by the theoretician, the analyst or the naive language user. Each of the four components in Table 4.5 includes the comparison of the features of text pattern identified by a text analysis theory. Furthermore, the configuration of such comparisons, specific to the text being analysed, is also revealed. Thus, from the results obtained, it can be seen that the comparison between **Solution** and **Evaluation** in *Component 1* is constituted by the contrast among **Vocabulary 2** signalling, **Detail clause**, and **Main clause.** By reference to the loadings of the elements in the same component the information structure of the text is made explicit. It must be admitted that the results so far are based on the theoretical grid. Analyses of the theoretical grid and the grid elicited from language users' perception will provide valuable information in terms of the study of the phenomenology of the structure of written text.

As pointed out earlier, the use of the covariance matrix as the starting point for the principal component analysis in *INGRID* is sometimes open to criticism. However, the debate is still inconclusive (*e.g.* Slater 1977, Thomas *et al.* 1985). Two points of a general nature may be considered with benefit regarding the use of the covariances in principal component analysis. Neter & Wasserman (1974) think that covariance analysis reduces the experimental errors and makes the experiment a more powerful one for studying treatment effects. In addition, Johnson & Wichern (1982) are of the opinion that principal components depending solely on the covariance matrix are much closer to the raw data than principal components derived from a correlation matrix which contain normalized covariances.

4.12 *Conclusion*

FOCUS has certainly the advantage of a direct and immediate appeal in the display of analysis results and keeps close to the raw data. For this reason, it may be preferred to *INGRID* in counselling situations where feedback from the client is essential to the success of the counselling work. *INGRID* is, on the other hand, very informative in the statistics produced and may be preferred in research situations as already noted by Easterby-Smith (1981). For this reason, *INGRID* seems to be more suitable for the present research than *FOCUS*. Furthermore, implemented mostly in an computing environment using mainframe computers, *INGRID* has certainly an advantage in speed of processing, number of grids that can be handled in any grid comparison programs, and the variety of data editing facilities in most mainframe machines. Such features may not be as apparent in *FOCUS* which runs exclusively on micros with rather restricted processing capabilities (*e.g.* 64K RAM Apple II Plus), at least at the time of writing.

CHAPTER FIVE

Implementing Repertory Grid Analysis

5.1 *Introduction*

Chapter Five describes the feasibility studies on the experimental work planned for the present research. The principal aim of these pilot studies is to examine the various aspects of data collection and analysis particularly in regard to the application of repertory grid analysis. This is necessary since the present study is among the first attempts to employ repertory grid analysis in linguistic / applied linguistic research. The following three areas will be investigated:

- **a** the specification of the procedure for administering repertory grid analysis;
- **b** an informal pre-pilot study to examine a possible experimental procedure;
- **c** a pilot study on a small sample of subjects.

5.2 *The implementation of repertory grid analysis*

A typical repertory grid analysis consists of two major stages: the elicitation of the grid/s, generally called the raw grid, and the analysis of the grid/s using one among several possible methods of analysis, *e.g. INGRID* .

5.2.1 Elicitation of the grid

The elicitation of a raw grid involves also two stages:

a identification of the elements;

b specification of the constructs.

5.2.1.a *Identification of elements:* From the viewpoint of repertory grid analysis, there is little restriction as to specific domains where elements of a grid can be drawn from. However, in choosing the elements the overriding concern is that of *specificity*. This means that the elements should be unambiguously and uniquely identifiable. Three characteristics seem to be associated with specificity:

a the elements must be drawn along a single homogeneous dimension;

b they have to have a representative coverage of the domain under investigation; and

c they must be as transparent as possible.

As suggested by Easterby-Smith (1981) the elements in a grid can be chosen by simply being supplied by the experimenter, or elicited from the subject either through open-ended discussions, or identified through the definition of the general domain of investigation.

5.2.1.b *Specification of constructs:* Specification of constructs can also be done using a number of methods. The simplest is certainly that of being supplied by the experimenter. The most common method of construct specification, however, is by eliciting from the subjects using what is known as triads. A *triad* is a set of three elements chosen in such a way that two out of the three have a common characteristic within the field of investigation while the third does not. Such a configuration would lead the subject to focus very sharply on the dimension of contrast which would become the basis for an elicited construct.[1] A third possible method of construct specification is known as laddering. This is done through extensive and in-depth discussion between the experimenter and the subject on a specific aspect of the field of investigation. Characteristically, the discussion would be conducted from the general to the specific; this way, the experimenter and the subject would come to an understanding as to what the dimensions are which are significant to the subject and meaningful to the experimenter. There are also other methods of construct specification which are not considered here.

The method of construct specification to be adopted in a particular study depends very much on the nature of the study and the whole configuration of research implementation and situational factors. It is also possible to combine more than one method of construct specification in the same analysis.

5.2.2 Repertory grid analysis using *INGRID*

INGRID is a set (or suite) of computer programs for performing repertory grid analysis. It is named after the most basic program in the package, which consists of six programs : **INGRID**, **DELTA**, **SERIES**, **NUCOIN**, **ADELA**, and **PREFAN**. Of the six programs **INGRID** is for the analysis of individual grids while the other five are for comparative analysis of more than one grid; these can have different alignments of elements and/or

1 It is Kelly's (1955) view and is accepted by all theoreticians and practitioners that constructs are construed by an individual as having two contrasting poles.

constructs. Figure 5.1 below is a good summary of the general pattern of element and/or construct alignment among grids.

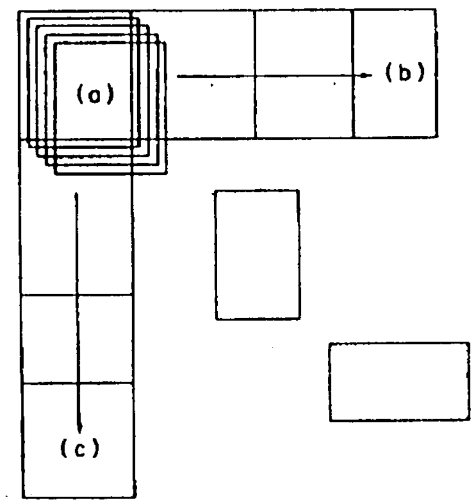

Figure 5.1: General pattern of grid alignment.

5.2.3 INGRID

INGRID is the basic program in the package. It can analyse a grid of a maximum size of 40 elements by 40 constructs and has a good number of descriptive and variable reduction statistics generated. The most commonly used are

a construct mean and variation;

b correlations between pairs of constructs and their angular distances derived from the cosines between pairs;

c distances between elements;

d principal component analysis of both elements and constructs.

Statistics **a** to **c** are simply descriptive while statistic **d** aims at the reduction of the number of meaningful dimensions which underlie the variables.[2]

5.2.4 The other programs

Both **DELTA** and **SERIES** are for the analysis of grids which are aligned in both elements and constructs. The two are different in that **DELTA** can compare only two grids at a time while **SERIES** can accept more than two grids.

NUCOIN and **ADELA** are used in situations where the grids to be compared are aligned in their constructs but not in their elements. The difference between the two lies in the statistics associated with them. **NUCOIN** focuses on individual construct statistics across all the elements in the grids, while **ADELA** focuses on variable reduction statistics in the combined data matrix. What **ADELA** does is basically to combine all the grids in the analysis to form a giant grid, aligning them along constructs, and then to perform an **INGRID** type analysis on that grid.

PREFAN caters for the configuration where the grids to be compared are aligned in their elements but not in their constructs. It performs a similar analysis procedure as **ADELA** by combining the grids into a giant grid aligned along the elements.

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2 For a detailed description of the statistics here, please see Slater, P. NOTES ON INGRID 72, Academic Department of Psychiatry, St. George Hospital, London.

5.3 *The Pre-pilot study*

5.3.1 Introduction

Data collection and data analysis constitute the two major stages of behavioural research work. Considerations, therefore, have to be given not only to the nature of data to be collected and the procedure of data analysis to be used, as has been done in Chapter 4 and 5.2 above, but also to the total environment of data collection and the relationships between the method and the environment of data collection and the data analysis procedure adopted. This is a very important issue and does not always receive the attention it deserves from researchers. All data analysis procedures have their underlying assumptions regarding both the field situation and the methods of analysis, statistical or otherwise. Mismatch between the data collection environment and the analysis procedure may result in either the data collected being not usable because of their poor quality or because of their violating the specifications and/or the assumpitons of the analysis technique chosen.

This is particularly true in the present case as there is very little previous research experience to draw from. For this reason a small-scale study of an informal nature is carried out to examine some of the broad characteristics in the field and the possible problems of the application of repertory grids analysis in such a situation. The main emphasis is on the applicability of repertory grid analysis to applied linguistic investigations and, in particular, the identification of possible experimental administration problems.

5.3.2 The Study

5.3.2.a *The Experimental Subjects:* Three native speakers of English were chosen as subjects for the experiment. By choosing native speakers, it can be assumed that all the subjects were competent in the language, thus eliminating the confounding factor of possible divergent English language proficiency levels if non-native speakers had been used. A second possible confounding factor is that of the relative training in linguistics/applied linguistics of the subjects in the experiment. To control such a situation, one subject trained in applied linguistics and two untrained ones were chosen.

5.3.2.b *The Grid:* The same text that was used in the analysis of the theoretical grid, (described in 4.8.1), was used in the experiment. The clauses in the text were numbered to ease identification of elements by the subjects (*Appendix 1a*). The triads for construct elicitation were chosen on the basis of the pattern of variable loadings in the principal component analysis from the analysis done on the theoretical grid reported in 4.11.1. A set of decision rules was set up to serve as guidelines for choosing the triads. They were:

1 Only those constructs that have a relative high loading were chosen.

2 The bi-polar contrast within a triad was provided by choosing a pair of elements with high loading in the same component where the construct in question was found, and the third element with a high loading with an opposite sign or a low loading the decision on which would depend on Rule 3 below.

3 Following a general rule in triad identification, all the elements were included, as far as possible, equal number of times in the grid, as recommended by Easterby-Smith (1981).

Eleven constructs were found with high loadings in one or more componentsin the principal component analysis. These were Constructs *2*: Problem, *3* : Solution, *4* : Evaluation, *5* : Preview, *6* : Detail, *7*: Main Clause, *8* : Logical Sequence, *11* : Vocabulary 2, *12* : Vocabulary 3, *14* : Preview Clause and *15* : Detail Clause. The triads included in each of the above constructs, using the decision rules just described were as below.

Elements	Construct
8,6,10	2
23,21,9	3
12,14,2	4
7,11,10	5
15,16,20	6
8,6,11	7
13,9,4	8
11,2,14	11
22,21,9	12
12,5,22	14
15,16,4	15

The grid, thus, contained eleven constructs, all *elicited* , and twenty-three elements.

It must be pointed out that the method adopted for construct and element inclusion in the grid was almost entirely based on the principal component analysis results from **INGRID**. Such a dependence on statistical results for identifying constructs and triads was adopted because of the nature of the pre-pilot study. This is neither the only method for grid construction available nor the experimenter's personal preference. The principal reason for such a strategy was that it was a main objective of the pre-pilot to determine the strength of *INGRID* in the analysis of text structure. For this reason, the exclusive use of *elicited* constructs would be able to test the goodness of fit of the constructs based on the theory. As the triads were chosen on the basis of the principal component analysis of both elements and constructs, using the same triad patterning to elicit constructs from experimental subjects would help to determine the extent of agreement and disagreement between the constructs perceived by the subjects and the constructs derived from the theory. In the main study, however, both *supplied* and *elicited* constructs will need to be used.

5.3.2.c *The Experiment:* The grid was administered to the subjects in individual sessions. The subjects were first given the text to read. Then a construct elicitation table (*Appendix 1b*) was given to them on which they had to define the eleven constructs using the standard method of elicitation by triads. The subjects were then given the grid (*Appendix 1c*) to rate every element along all constructs.

At the outset of the experiment, the experimenter made it a point to leave the subjects alone as far as possible. Only minimum required instructions were given. This was done in order to find out whether the experimental procedure was transparent to the subjects. As is well known in behavioural research (*e.g.* Rosenthal & Rosnow 1969, Nunnally 1978), experimenter artifacts can easily creep into an experimental situation so that the experimenter, unwittingly, influences the outcome. For this reason, it was decided that the experimenter should interfere as little as possible with the experimental subjects. It was also thought that it would be better to err by insufficient rather than by possibly excessive intervention on the subjects, the experimenter would be able to know how much more assistance to provide in the actual experiment in order to be helpful without being intrusive.

The day after each experimental session a follow-up discussion was held for each subject individually to obtain feedback on the subject's reaction to the experimental session.

5.3.2.d *The Results :* The average time for the subjects to complete the experiment was about one and three quarter hours. It is worth noting that the linguistically trained subject took longest to complete the grid (over two hours). In all cases, the greatest proportion of the time spent was on defining the constructs (nearly three quarters of the total time for each subject).

As regards the experimental procedure, the experimenter failed to brief the first subject sufficiently on the specific dimensions of the research (*i.e.* patterning of text structure) and on not repeating the same construct in defining. As a result, that particular subject repeated one construct (*Complete vs. Incomplete sentence*) seven times. This was then corrected with the other two subjects.

As a consequence of the administration fault just described, the first subject was able to define only five constructs. However, even without detailed briefing, he came up with three constructs on the structure of the text as he perceived it.[3] On the other hand, even with initial briefing, the other two subjects were not able to generate all the eleven constructs required. (The second linguistically naive subject generated nine constructs while the linguistically trained subject generated ten.)

Of the constructs generated, the linguistically naive subjects tended to provide constructs relating to the semantic structure while the linguistically trained subject tended to focus on linguistic features of a local syntactic nature, *e.g. without lexical connection* (Clause 9) vs. *talking about weight* (Clauses 21 and 22). This last example showed that not all the constructs were defined in strictly contrasting terms.

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3 For details of the constructs specified by each of the experimental subjects in the pre-pilot please see Appendix 1e.

5.3.3 Observations

The first observation to be made is that the results indeed show the importance of the pre-pilot. This is evident from the adminstration fault of insufficient briefing to one experimental subject discovered. It is instructive to note that this happened despite the fact that an initial briefing had been planned as part of the experimental procedure.

Secondly it is clear from the pre-pilot that the subjects found the task of specifying as many as eleven constructs and to rate twenty three elements very demanding. This is evident from the time they took to specify the constructs, their inability to specify all eleven constructs and from the follow-up interview.

The follow-up discussion sessions further revealed that the subjects had some difficulty in various aspects of the experimental procedure, particularly in working out the contrasts within the triads. Subjects found it hard, for example, to single out in every triad the one element which was different from the rest.

There are a number of explanations for such a situation. In the first place, it may be that the elements, which were identified through the application of a linguistic theory, were not as self evident as everyday objects, which are used as elements in most repertory grid analysis studies. Furthermore, a piece of text can be viewed from different perspectives psychological, contextual, discoursal besides textual. Without any indication from the experimenter there was no guarantee that the textual dimension would be focused upon by the subjects or that the subjects would remain consistently within one single dimension throughout the experiment. In fact, this was what the pre-pilot tried to find out. The principal explanation for the problem seemed to lie in the fact that the experimenter gave no help in filling the grids. The difficulties experienced by the subjects thus suggest that the experimental procedure was not as transparent as the experimenter at first had thought and that, perhaps, the experimenter will need to provide some direction in the experimental procedure in future.

Another possible explanation is that the exclusive use of elicited constructs might not yield the desired results and made the experimental procedure too demanding for the subjects. This was due to the fact that the linguistic concepts the pre-pilot aimed to elicit were not easily construed by the subjects. It may, therefore, be necessary to use both *supplied* and *elicited* constructs in the main study so that the former help to focus the subject's attention on the dimension of text structure. This would then lead the subjects to focus on the dimension of text structure when the latter set of constructs are elicited. In addition, the reliance on the loadings in the principal component analysis to extract the triads did not seem totally appropriate, even though there was a good reason to do so for the pre-pilot.

Based on the observations above, it was decided for the pilot study proper

a that the size of the grid to be elicited should be reduced in dimension in terms of the number of both elements and constructs;

b that there should be a certain degree of direction from the experimenter so that the subjects would be guided towards viewing the text from the perspective of text organization in Winter's and Hoey's sense;

c that, to this end, there should be some constructs which would be supplied in order that the subjects could be more clearly guided and that the supplied constructs should form a minimum common basis for comparison among the subjects and between the theory and the subjects. (A grid with partially supplied and partially elicited constructs may even prove to be a more interesting research design than a grid with only one type of constructs, since it opens up the possibility of comparing the two types of constructs in the same experiment.); and

d that, as a consequence of the difficulties encountered in identifying the contrast within the triads, in the pilot study the clauses making up a triad should be based on the theoretical grid rather than on the statistics generated from it, as had been the case in the pre-pilot.

5.4 *The Pilot Study*

5.4.1 Objectives

The main objective of the pilot study was to investigate whether *INGRID* would produce the kind of results expected on a typical sample of data. Furthermore, it also aimed to examine a representative sample from a possible population for the research. Finally, several research design features were built in to test further the goodness of fit of *INGRID* in terms of the research questions posed.

5.4.2 The design

The population in the pilot as well as in the main study was undergraduate ESL students at Hong Kong Baptist College. As far as statistical analysis was concerned, the main focus was on whether *INGRID* would yield meaningful results in terms of the comparison between a theoretical grid as described in 4.9 and the grids elicited from experimental subjects on the same text. As a pilot study, however, only broad areas of comparison were examined; detailed analysis had to be left to the main study.

In terms of research design, two conditions were specified for the pilot *a* - whether agreement or otherwise with the theoretical grid was associated with relative ESL proficiency level,[4] and *b* - whether agreement is an outcome due to the relative explicitness of text pattern (again in the Hoeyan sense of the term). The research design is thus a 3x2 ANOVA design.

5.4.3 <u>The sample</u>

A representative sample of the 1986-1987 academic year intake of the Hong Kong Baptist College was taken, which comprised of twenty-four from a population of two hundred and thirty year-one undergraduate science students. In drawing up the sample for the three English language proficiency levels, care was taken that between each level there was a clear score range separating them. This was to ensure that the three levels formed three really distinct bands of English language proficiency. The resulted sample had, therefore, eight subjects per proficiency level.

5.4.4 <u>The texts</u>

Again the Problem/Solution pattern was used in the pilot study. Two texts were chosen in such a way that one had an explicit Situation-Problem-Solution-Evaluation pattern, and the other had some of the stages missing or expressed in an implicit manner.

The explicit text was the same used in 4.8.1, labelled henceforth as the *Helicopter* text (*Appendix 2a*). However, the text was shortened from twenty-three to fifteen clauses to reduce the size of the grid to be elicited. The clauses deleted were Clauses 4, 5, and 14 to 18 in the original text. All

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4 The three proficiency levels used were: *high*, *mid*, *low*. These were based on the reading subtest in an English for Academic Purposes test battery administered to all incoming students at Hong Kong Baptist College.

the clauses concerned described Details of the Problem and the Solution section. It should be noted that, after the deletions, the text still contained the four stages in the Problem/Solution pattern.

The implicit text was taken from Jordan (1984, Example 17). The subject-matter is a brief account of a computer seminar, henceforth labelled the *Computer* text (*Appendix 3a*). The Situation, the Solution and the Evaluation section in this text are clearly identifiable. The Problem section is very much implicit in the first clause : "*A two day seminar on effective use of computers in manufacturing management is being organized by the IProdE's manufacturing management activity group.* ". The Problem section is signalled by the Vocabulary 3 item "*effective use*" because it implies possibly the Problem of *ineffective use* of computers (see *Appendix 3a*).

5.4.5 The constructs

As stated in 5.3.2 the number of constructs to be used in the pilot study had to be limited, and the constructs had to include both supplied and elicited ones. The decision was then made to have four constructs representing the text pattern (*Situation*, *Problem*, *Solution* and *Evaluation*) as supplied constructs. It is hoped that through this set of supplied constructs subjects' attention would be drawn to text structure. The elicited constructs were restricted to the three clause relation signalling constructs of Vocabulary 1, 2 and 3. There are also instances of the Preview-Detail structure in both texts (Clauses 10 & 11 in the *Helicopter* text, and Clauses 1 to 4 and Clauses 7 to 11 in the *Computer* text) and it seemed necessary to include this embedded pattern in the grid. There is, however, a problem in that Preview and Detail are presented in the Hoeyan model as opposite in some way and should, therefore, be the two opposite poles of the same construct. From the grid elicitation design point of view, though, it may be more convenient to have Preview as the positive pole and take the negative pole (*i.e.* -Preview) to represent Detail. The total number of constructs in the grid, therefore, is eight, four of which are supplied and the other four elicited.

The list of constructs thus specified for the two texts are found in Table 5.1 below.

Construct		Type
Construct 1	Situation	*Supplied*
Construct 2	Problem	*Supplied*
Construct 3	Solution	*Supplied*
Construct 4	Evaluation	*Supplied*
Construct 5	Preview	*Elicited*
Construct 6	Voc. 1	*Elicited*
Construct 7	Voc. 2	*Elicited*
Construct 8	Voc. 3	*Elicited*

Table 5.1: Construct list for the texts.

5.4.6 The theoretical grids

Two theoretical grids, one for each of the two texts, were then derived based on the eight constructs listed in Table 5.1. The theoretical grids were completed by the researcher himself based on the Winter-Hoey model. Reactions from the two linguists were then sought albeit rather informally; and their confirmation received.

5.4.7 The triads

The triads for construct elicitation to be used in the pilot were based on the theoretical grids. Furthermore, the general rule for triad extraction of having as many elements as possible included in, as far as possible, equal number of occurences was strictly followed. (See 5.3.2.b.) The triad lists for both texts can be found in *Appendices 2b* and *3b* .

5.4.8 The experiment

5.4.8.a *Organizing the experimental sessions :* The research design for the pilot study is a 3x2 ANOVA design with two treatment variables: ESL/EFL proficiency (with three levels) and text type (with two levels). With a total of twenty-four subjects, the six cells in the design had four subjects each. These were randomly assigned. Since there was not enough time to hold individual experimental sessions, subjects were invited to the experimental sessions in groups of five to seven, which did not seem to be too large for individual subject monitoring during the experimental sessions. Care was taken that in each session all the English language proficiency levels were represented. Furthermore, in each of the experimental session both texts were administered and were randomly assigned within each stratum of ESL proficiency.

The time of one hour was uniformly given to each session; however, subjects were not pressured to finish within the specified time. In reality, none of the subjects took more than an hour to finish the tasks and the average time took to finish was roughly fifty minutes.

5.4.8.b *Conducting the experimental sessions :* At the beginning of the experimental session the subjects were briefed on the objective of the experiment. They were assured that the session was not a language test, that there were no right and wrong answers and that it was how they understood the text structure that mattered. The experimenter administered all the sessions and followed an identical set of briefing procedure and useed an identical set of briefing notes.

The texts were then distributed to the subjects to read, who were encouraged to ask any questions about the text in case they had difficulty understanding them. It turned out that none of the subjects found the texts difficult.

The list of triads (*Appendices 2b* and *3b*) for the elicited constructs was then given to the subjects together with the construct definition table (*Appendices 2c* and *3c*). After the tables were filled in, the grid for the texts was given out. The subjects were then given a very brief and a very general introduction to the text pattern of Situation-Problem-Solution-Evaluation. It was made clear to them that this was only one possible way of looking at the structure of a text and that they had the freedom to disagree. The subjects were then instructed to complete the grid.

5.4.8.c *Analysing the grids :* The completed grids and the two theoretical grids were then analysed using **INGRID** for individual grid analysis. Since the grids had only four out of eight constructs in common, but had the same elements throughout, **PREFAN** was used for grid comparison analysis. (See 5.2.4.)

5.4.9 Results

5.4.9.a *Aim of this section :* The main emphasis of the pilot study is to establish the goodness of fit of *INGRID* as a method for comparing theorist's and language users' perception of text structure. The report that follows will thus concentrate on those aspects of the results relevant to this question.

5.4.9.b *Construct elicitation through triads :* The first question concerns the suitability of the method of construct elicitation through triads. It should be remembered that, in each triad, construct elicitation is effected by having always one element set against the other two in the triad. This element then is labelled here the *target* element in the sense that it is this element that would bring out the contrast necessary for defining the construct in question. When the subjects filled in the construct definition table (*Appendices 2c* and *3c*), they were instructed to indicate the element they considered the odd-one-out. To the extent that the target elements were correctly identified by the subejcts, a prima-facie evidence is obtained regarding the goodness of fit of the triads being able to bring out the desired contrasts.

To do this, a frequency count was taken on the elements singled out by the subjects and these were tabulated against the target elements in the theoretical grid. The results are reported in Tables 5.2 and 5.3 below. (Target elements of the theoretical grid are bold-faced and underlined, and correct identification is indicated by an *. Thus, *Element 3* in Table 5.2 and *Element 12* in Table 5.3 are target elements and were both correctly identified by nine subjects.) The results in Tables 5.2 & 5.3 show that correct identifications of the target elements are over half of the subjects reading that text[5], with the exception of *Element 10* in the Helicopter text and *Element 2* in the Computer text, both with five correct identifications. This should be sufficient indication that the triads were fulfilling their function.

As is evidenced in the present discussion, particular care has been given to the establishment of the method of construct elicitation through triads. Triading is a near standard method of construct elicitation in

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5 The number of subjects reading a particular text was twelve.

Element	Subject High 1	2	3	4	Mid 1	2	3	4	Low 1	2	3	4	Total
1			*						*				2
2													
3	*	*	*	*		*	*		*		*	*	9
4		*		*		*					*		4
5					*		*	*		*		*	5
6		*			*	*				*	*	*	6
7	*	*	*	*	*	*			*	*	*		9
8													
9													
10		*		*	*				*	*			5
11		*		*						*			
12													
13									*		*		2
14							*	*				*	
15						*		*					2
On target	2	4	2	3	3	3	1	0	3	3	3	2	

Table 5.2: Target element hits in the Helicopter text.

Element	Subject High 1	2	3	4	Mid 1	2	3	4	Low 1	2	3	4	Total
1													
2			*					*	*	*	*		5
3										*			1
4				*									1
5		*		*	*	*	*	*	*	*		*	9
6	*	*			*	*				*			6
7	*	*	*	*	*	*	*	*	*	*	*	*	12
8													
9													
10													
11			*							*		*	3
12	*		*	*	*	*	*	*			*	*	9
13										*			1
On target	2	2	3	3	3	3	3	4	3	3	3	3	

Table 5.3: Target element hits in the Computer text.

repertory grid analysis and is expected to be used in a pioneering application like the present one. However, there may be problems of face validity associated with triading clauses in a text. Empirical evidence, therefore, needs to be presented in support of triading in the present application of repertory grid analysis. Other methods of construct elicitation (*e.g.* laddering) would have a higher degree of face validity and do not need the kind of validating evidence if used in the present research. For this reason, *Laddering* will be included in the main study as an alternative mode for construct elicitation.

5.4.9.c *Comparison with the theoretical grid:* Comparison with the theoretical grids was done for each text separately by a combined analysis using **PREFAN** on the theoretical grid and all the subject grids. The principal aim is to examine, using the principal component analysis results, the relative agreement between the constructs in the theoretical grid and their corresponding constructs in the subject grids. Typically, **PREFAN** performs an **INGRID** type analysis on a combined grid aligned according to elements. By comparing the loadings of the constructs in the subject grids corresponding to the theoretical grid, the agreement with the latter can be identified.

There are two problems encountered. In the first place, as the combined grids for use in **PREFAN** are very large (15 elements by 104 constructs in the *Helicopter* text and 12 elements by 104 constructs in the *Computer* text) the statistics from **PREFAN** cannot be easily interpreted, particularly if the question is on the overall picture of the results rather than details. To resolve this it was decided that only the first component in the principal component analysis would be analysed. This is justified because the first component has a percentage of common covariance of some significance (33 % for the *Helicopter* text group and 30 % for the

Computer text group) and should be considered sufficient for the purpose of the pilot study. Omitting the other components in the principal component analysis will undoubtedly lead to omissions of details in the results. However, as the main purpose of the pilot study is to investigate whether there is a solid enough basis to implement a proper experiment, the possible omissions should not be taken as serious, while making the results of the pilot study much more easily interpretable.

The second problem is related to the fact that the *Helicopter* and the *Computer* text are taken as two levels of measurement of the same treatment variable; and yet the results from **PREFAN** are not directly comparable as they are taken as different sets of data by the program. Some form of standardization through data transformation is, therefore, necessary to render the two sets of results comparable. To do this the bi-polarity of the loadings within a component is used as the basis of the data transformation. (See *Appendix 5* for the pattern of loadings in a principal component analysis.) As can be seen in Appendix 5, loadings on a component are, typically, divided into a group with positive loadings and another with negative loadings. (In Component 1, *Constructs 2* and *7* have negative while the other constructs have positive loadings.) Constructs bearing the same sign can be regarded as in agreement because they lie on the same pole of the reference axis which represents the component. The data transformation procedure adopted for the grids involves firstly matching the constructs across all grids. Comparisons are then made between the theoretical grid and the subject grids. If the loading on a particular construct in the component for a subject grid bears the same sign as the corresponding construct in the theoretical grid, agreement between the two grids on that construct is assumed. A matrix of agreement between subject grids and the theoretical grid can thus be drawn up for each of the texts. Furthermore, the two matrices can now be combined into one single matrix of agreement making the two texts two levels of the same treatment variable. The combined agreement matrix is reported below in Tables 5.4 & 5.5. (Agreement is indicated by an *.) Observations similar to those on

Construct	Subject High				Mid				Low				
	1	2	3	4	1	2	3	4	1	2	3	4	**Total**
1	*	*	*			*	*		*	*	*		8
2	*	*	*	*	*	*	*		*	*	*	*	11
3	*	*	*	*		*	*		*	*		*	9
4	*	*	*	*	*	*	*	*	*	*	*	*	12
5	*	*	*	*	*			*		*			7
6		*	*		*	*	*	*		*	*	*	9
7		*		*	*	*	*		*	*		*	8
8		*		*	*			*		*	*	*	7

Table 5.4: Construct agreement in the Helicopter text

Construct	Subject High				Mid				Low				
	1	2	3	4	1	2	3	4	1	2	3	4	**Total**
1	*	*	*	*	*	*		*	*	*	*		10
2										*			1
3		*	*			*			*			*	5
4	*					*					*	*	4
5	*	*		*	*	*			*	*		*	8
6	*			*	*							*	4
7				*							*		2
8	*	*	*	*		*	*	*	*	*	*		10

Table 5.5: Construct agreement in the Computer text.

the use of the first component for grid comparison can be made regarding the data tranformation procedure adopted. By basing the data transformation on the sign of the loadings alone, the data have been made cruder. This is, in a way, unavoidable. The loadings in the two PREFAN analyses being from different sets of data do not have the same interpretation in terms of their magnitude. The only feature that can be transferred between them is, in fact, the sign of the loadings. As already mentioned previously, the main focus of the pilot study is on the feasibility of repertory grid analysis and not the details of the results. For this purpose, the data transformation procedure adopted should be sufficient.

An inspection of Table 5.4 reveals that there is a very high degree of agreement between the theoretical grid and the subject grids. This is particularly true in the *Helicopter* text, where the agreement is always over half of the sample in all the constructs. In particular, Construct 2 (Problem) has a near perfect and Construct 4 (**Evaluation**) has a perfect agreement. There is more variation in the extent of agreement in the Computer text. However, in this case Construct 1 (**Situation**), Construct 5 (**Preview**) and Construct 8 (**Voc. 3**) have all very high degree of agreement. Instances of lack of agreement are also instructive. Construct 2 (**Problem**) and Construct 4 (**Evaluation**) in the *Computer* text have the lowest agreement. This is a result very much in line with the implicitness of the text pattern. In terms of text signalling, Construct 6 (**Voc. 1**) and Construct 7 (**Voc. 2**) have also very low agreement, while Construct 8 (**Voc. 3**) shows very strong agreement. Patterns of results like this will certainly need to be examined carefully and will provide valuable data for a more refined analysis of the Winter & Hoey model.

To answer the question whether relative ESL/EFL proficiency and/or text pattern (*i.e.* explicit or implicit) constitutes a significant variable on agreement, two sets of Chi-square analysis were performed: *agreement* by *ESL/EFL proficiency* and *agreement* by *text pattern* . The null hypothesis is that the two variables in the cross-tabulations are independent. The results are reported in Appendix 6 and show that the null hypothesis fails to be rejected in the case of ESL/EFL proficiency, which means that ESL/EFL proficiency is not a significant factor for the agreement observed. This is true across all constructs. However, the null hypothesis is rejected in the case of text pattern in Constructs 2 (**Problem**) and Construct 4 (**Evaluation**) at $p < .001$, and in Construct 7 (**Vocabulary 3**) at $p < .02$, while in Construct 3 (**Solution**) there is only a trend of $p = .0977$, which is generally taken as statistically not significant for the rejection of the null hypothesis. In the constructs just mentioned, then, text pattern is a significant factor for agreement. This means that, of the two texts chosen, one text generates a significantly higher degree of agreement, according to this method, than the other. The overall results regarding the two factors of ESL/EFL proficiency and text pattern indicate, therefore, that proficiency level is less of an influence on the perception of text structure than is the relative explicitness of text structure.

5.4.10 Observations

5.4.10.a *Target element identification :* The results of target element hits in Tables 5.2 & 3 show that the choice for triad elicitation (*Constructs 5* to *8*) in the pilot study should be considered satisfactory. In any case, the results can be used to improve the choice of elements in the triads if more target element hits are desired. However, it must be strongly emphasized that in the pilot study the extent of target element hit should not be considered in any decision on whether to go ahead with an analysis by

INGRID or not. At the construct elicitation stage it is still the labelling of constructs that is in question, and labelling alone is not a decisive factor in determining the feasibility of the use of *INGRID*.

5.4.10.b *Comparison with the theoretical grid:* The results from the comparison with the theoretical grids show that such comparisons can be meaningfully made using *INGRID*. It is particularly encouraging to find that variation in the explicitness of text pattern results in variation in subjects' perception. In fact, the constructs of text pattern: Situation, Problem, Solution and Evaluation have very high agreement in the *Helicopter* text, which has an explicit text pattern, while only the construct of Situation has a high agreement in the *Computer* text. This is in complete agreement with theoretically generated claims.

The four elicited constructs are interesting in their own right. For example, it needs further investigation to find out whether the high agreement observed in a particular case is due to the nature of the text signalling features or is the consequence of the explicitness of the overall text pattern. There are indications in the data on hand. Even though it is beyond the scope of the pilot study to go into this, otherwise, very interesting aspect, attempts will be made in the main study to examine the issue.

5.4.10.c *Analysis of individual subject grids:* The analysis of individual subject grids is not described in the pilot study. It will certainly be necessary in the main study. This is so particularly because it is the author's contention (see 4.4.) that *INGRID* is, in fact, that statistical method which can bridge the gap between *quantitative*, and *qualitative* research by allowing both to be performed within the same statistical method of analysis. Doing analysis on individual grids would provide very good examples of how *qualitative* research can be done using repertory grid analysis.

5.4.11 Conclusion

The main objective of the pilot study to establish the methodology for the research project seems to have been achieved. On the other hand, it also reveals a number of research areas which can or need to be followed up in the remainder of the study. It appears, then, that a foundation solid enough has been laid for the proposed research project.

CHAPTER SIX

The Experiment and Further Research Design Issues

6.1 *Introduction*

Chapter Six describes the major stages of planning and administration of the main study and further research design issues which did not arise in the discussion of research methods (Chapter 4) or in the pilot studies (Chapter 5). These include the identification of the target population, the sampling procedure, the research design and the statistical techniques to be used. This is done firstly to serve as a record of the experimental procedure adopted; and second, to provide the necessary context for the understanding of the experimental work.

6.2 *The Exprimental Procedure*

6.2.1 The population and the sample

In making decisions on the choice of the population and the sample to be studied, a number of factors need to be considered. There is the question of how widely applicable the conclusions need to be; there is also the question of how practicable a sampling exercise can be carried out; finally, considerations have to be given regarding the nature of the research and the constraints arising from the research design. Consequently, the size of the population is a relative concept and does not refer to any absolute minimum required number of individuals. Thus, a-priori decisions cannot be made in an absolute fashion as to whether a sample needs to be one hundred or five hundred in order to qualify as a good sample.

The population chosen for the experiment comprises about a hundred and eighty year-one undergraduate students in a B.Sc. (Combined Science) programme and about two hundred and forty in a B.B.A. programme at Hong Kong Baptist College in the year 1987-88. This was done to enable analyses of possible relationship between text stucture perception and sub-population characteristics to be performed.

A sample of twenty-four students was chosen for each of the two sub-populations making a total of forty-eight experimental subjects. It is a blocked random sample from three strata which are specified according to three levels (*i.e.* **High**, **Mid** and **Low**) in a reading comprehension test.[1] The reading test in question has been designed to tap text structure processing skills and forms part of an English language proficiency test battery in use at Hong Kong Baptist College. As has been done in the pilot study, the three strata were chosen from three non-contiguous score ranges in the reading test with a gap of 20 score points out of 100 between strata. This is to ensure that the strata do represent three clearly different English language proficiency levels. The sample thus chosen, though small, is truly representative of the population in question. It is also large enough for a methodological investigation like the present study and manageable for the

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1 See *Appendix 9* for the actual scores of the reading test.

application of an individual oriented analysis technique like repertory grid analysis.

6.2.2 Grid elicitation

The texts used in the main study were the same ones in the pilot study: the *Helicopter* and the *Computer* text. The constructs in the grid were the same in the pilot study. As regard construct elicitation, triading was used with the same triads in the pilot study. In addition, it was thought that, even though the overall suitability of triading had been established (see 5.4.8b), it would be informative to examine construct elicitation method as a possible factor influencing the outcome of the experiment. The reason for this is to investigate the goodness of fit of the triads as used in the experiment. In the application of the repertory grid analysis to psychotherapy situations the triads generally consist of elements that are intuitive (*e.g.* things, persons, etc.). In the present study, the same degree of intuitiveness of the elements and consequently that of the triads cannot be assumed. It is hoped that, through contrasting the two modes of elicitation, another aspect of the application of repertory grid analysis to linguistic/applied linguistic problems can be examined.

The new mode of construct elicitation introduced can be grouped under *laddering.* (See 5.2.1.b.) Instead of using triads as the construct elicitation tool, this method focuses subjects' attention through the experimenter's verbal directions on those dimensions of the construct field where the constructs are to be elicited. Typically, the experimenter asks the subject to identify important dimensions for the subject himself/herself in the construct field and to label them.[2] A sample of the construct definition table and the grid for the laddering mode is found in *Appendix 7*. Laddering appears to be a rather intuitive method of construct elicitation and enjoys a high degree of face validity, and, as argued in 5.4.8b, may not need the kind of validity investigation thought necessary for triading.

In the laddering mode, one additional construct (*i.e.* **Preview**) is supplied. This was done to make the construct field for laddering focused on the three vocabularies which constitute the signalling devices in the Winter & Hoey model. In the experimental sessions, half of the subjects were assigned to the laddering mode.

There are, therefore, two modes for construct elicitation used in the experiment. The mode using triads for elicitation is referred to as the *standard* mode while the additional mode is referred to as the *laddering* mode.

6.2.3 The analysis design

6.2.3.a *The overall approach :* The main emphasis of the analysis design is on the repertory grid technique as a quantitative method, where the data will be analysed statistically to uncover meaningful patterns of results. This will be supplemented by a qualitative analysis of a limited scale consisting of triangulating three different aspects of the subjects' perception of the structure of the text read. These include the repertory grid analysis results, the definitions given by the subjects for the elicited constructs and the recalled summaries written by the subjects immediately after the experimental sessions. It may be argued that triangulating the three

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2 See Easterby-Smith 1981 for more details.

different sources of data assumes that they adequately reflect the subjects' perception of text structure. This may not be equally clear in all the three sources of data concerned, particularly regarding the recalled summaries. However, it is a fair assumption to regard the recalled summaries as reflecting how the subjects perceive the structure of the texts read because they have to rely on their memory of salient points in the texts to write the summaries. Indeed, there is a well established research practice in using recalled summary as a record of the text structure that is understood by experimental subjects (*e.g.* Dawes 1966, Kintsch & Keenan 1972, Frederiksen 1973, Meyer 1975).

It may be necessary to repeat here that the reason for using both a quantitative and a qualitative approach is that, while the former can provide valuable results in terms of the overall pattern of the subjects' individual perception and the possible agreement / disagreement among them, the latter can supplement quantitative findings with details concerning individual differences that are equally important and valuable. Such an approach to data analysis is at the same time necessary and conceptually compatible, and is made possible because of the use of repertory grid analysis as the central method of investigation.

In the sections that follow, details of both the quantitative and the qualitative analysis used will be described.

6.2.3.b *Quantitative analysis :* The overall design of the study as described in 6.2.2 above consists of *two* samples of experimental subjects with *three* levels of English language proficiency. There are *two* texts used and *two* modes for construct elicitation. The overall research design is, therefore, a 2x3x2x2 ANOVA with two subjects in each cell.

It should be pointed out that the apparently very small number of subjects per cell need not be considered over-restricted. Given the large number of cells (twenty-four) in the design, to have a number of subjects per cell exceeding two as presently assigned would lead to a considerable increase in the overall sample size, which would be quite unmanageable when individual grids are examined. Such a design is not particularly worrying, because in the actual analysis rarely will there be contrasts between only two subjects. Indeed, the only occasion when the contrast of only two subjects is necessary is in a four-way interaction analysis. This will certainly not be made, because an interaction of such a high order would not be very meaningful. Three-way interaction analysis will also be rare; in such cases the number of subjects per cell is already four. It is expected that, as a rule, the number of subjects per cell in the present design would be in the region of eight or more. This is certainly acceptable in an ANOVA study, where main effects and lower-order interactions are the main areas of interest.

6.2.3.c *Qualitative analysis :* As described in 6.2.3a above, the qualitative analysis consists of the triangulation of the repertory grid analysis results, the definitions given by the subjects for the elicited constructs and the recalled summaries. The analysis consists of comparing (*i.e.* triangulating) the three sources of data available. Any aspect in the investigation is considered substantiated, if it is confirmed by, at least, two out of the three sources of data examined. It must be stressed, however, that the point of qualitative analysis is not so much the extent, but rather the kind of substantiating evidence gathered. What is shown to be valid is of the greatest relevance and is not predefined as in a null hypothesis.

In the process of both identifying and classifying the agreement needed for substantiation, there is always a problem of the experimenter's subjective interpretation of the data. This is, more or less, inherent in qualitative analysis. It should be recalled, however, that the point of qualitative analysis is the informativeness rather than the logical cogency of the argument; furthermore, it is precisely the taking of all such shortcomings and problems (from a quantitative paradigm point of view) as part and parcel of an actual research situation that qualitative analysis is advocated as an alternative to quantitative analysis.

6.2.4 The experimental sessions

The forty-eight subjects were invited to attend the experimental sessions in groups, the maximum size of which is six. To ensure uniformity in administering the experimental sessions, two sets of instructions to the experimenter were written, one for each mode of construct elicitation: *standard* or *laddering* . (See *Appendix 8* for details.) The instructions to the experimenter would be read in the subjects' native language (*Cantonese*) at each stage of the experiment. Four sets of grid elicitation materials were also prepared, one for each of the two texts used in both the *standard* and the *laddering* mode. Each set consists of the text (*i.e.* the *Helicopter* or the *Computer* text), a set of four triads consisting of sets of three clauses for the standard mode, a table for construct elicitation and, finally, the grid itself. (See *Appendices 2* , *3* and *7* for specimens.) A subject code was randomly assigned to the subjects in each of the three English language proficiency strata and according to the two modes of construct elicitation. These subject codes were then printed on each set of the grid elicitation materials. This was to ensure a truly random assignment of the instrument, even though the time chosen for the sessions has to suit subject availability and to allow for rescheduling in cases of failure to attend the specified sessions. This way, the research design could be maintained.

In the actual experimental sessions, after a brief introduction to the overall aim of the experiment was read to the subjects from the instructions to the experimenter sheet, each subject received the set of grid elicitation materials according to his/her subject code. Time was then given for the reading of the text, at the end of which the subjects were asked if they thought they fully understood the text. (None of the subjects indicated any difficulty in understanding.) Two different procedures for construct elicitation were then used. In the standard mode, the subjects had to identify from the triads, the clause that seemed to them different from the other two. They then circled the number of the clause in question and labelled the construct in whatever way they thought appropriate. In the laddering mode, on the other hand, the subjects were told that the three elicited constructs to be elicited refered to *signalling devices* for the text pattern of Problem-Solution. Furthermore, a brief definition of text signalling devices was given them as expressions in the text that signal a particular function (*e.g.* Situation, etc.). The subjects then had to label the type of expression thus identified and to include examples. Subjects were given the freedom to identify less than three constructs if they thought that they were unable to identify all three types of signalling devices. In both modes, then, the subjects filled in the grids by rating all the elements along all the constructs using a dichotomous scale (*i.e.* a scale consisting of only two values **1**s and **0**s). The raw grids can be found in *Appendix 10* .

At the end of the grid elicitation, the subjects were asked to write a brief summary of whatever they could remember from the text without the help of the actual text. They were made to understand that they were not expected to reproduce the text but rather to write down whatever they were able to recall, which was the only thing that mattered.

6.3 *The Analysis*

6.3.1 Introduction

There are three types of data analysis involved in the study. First of all, analyses using *INGRID* are performed; then, a number of quantitative analysis techniques are used to examine aspects of the data relating to the results from *INGRID* ; finally, the triangulation based on the repertory grid analysis results, the construct definitions given by the subjects as well as the recalled summaries aims to provide details which are not captured by or which may indicate contrary evidence to the results of the quantitative analyses, thus performing a useful and much needed supplementary and critical function to the quantitative analyses.

6.3.2 Repertory Grid Analysis

6.3.2.a **INGRID** is used to analyse the forty-eight invidual grids and the theoretical grid first individually; it will also be used for grid comparison by joining each individual grid with the theoretical grid to form a combined grid. The decision to join the grids to be analysed by **INGRID** for grid comparison rather than to use the grid comparison programs outlined in 5.2.2 is based on two principal reasons. Firstly, the individual grids are only partially aligned in terms of constructs. The four supplied constructs of Situation, Problem, Solution and Evaluation are certainly aligned while the four elicited constructs have to be considered not aligned. Such an alignment of constructs is not analysable by any of the methods of grid comparison available in *INGRID.* In addition, it should also be remembered that, as described in 5.2.4, all the grid comparison methods within *INGRID* have an **INGRID** type analysis as their basic method. One reason for the inclusion of the grid comparison programs in *INGRID* is the programming restriction of the maximum size of 40x40 for the data matrix in **INGRID**. The various grid comparison methods are in effect ways to expand the data matrix to be analysed to over several hundreds on both dimensions of the data matrix. In the present study, the combined grid of a theoretical grid and a subject grid has twelve or fifteen elements and sixteen constructs, which is still analysable by **INGRID**.

It is certainly possible to adopt a weaker initial assumption and consider the eight constructs in the grids as not aligned; and then to use **PREFAN** to compare them with the theoretical grid.[3] Such a solution is not adopted because the statistics generated by **PREFAN** are not as usable as those generated by **INGRID** to form the basis for further quantitative analyses as envisioned in the study. The main purpose of the combined grid analysis is to provide statistical data for the **ANOVA** study planned. Specifically, the correlations between corresponding constructs between the theoretical grid and the subject grids will be required. These are not generated by **PREFAN** but are among the standard output of **INGRID**. For these reasons **INGRID** rather **PREFAN** is used for grid comparison.

6.3.2.b A separate grid comparison analysis is done focusing on the four supplied constructs. This is because the four text patterning constructs of Situation, Problem, Solution and Evaluation are taken directly from the Winter-Hoey model and are central to the study. Additional analyses would certainly be useful and necessary, particularly because the four

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3 This is, in fact, done in the pilot study. (See 5..4.6.c)

constructs are aligned in all the grids and, are, thus, amenable to further comparison by the programs in *INGRID* .

A set of grids consisting of the four supplied constructs from each grid will then be derived resulting in a series of grids that are aligned in both elements and constructs. These will be analysed firstly by **SERIES** the results from which will then be used to generate two *consensus* grids one for each of the two texts. A *consensus* grid is derived from grids that are aligned along both elements and constructs. The ratings in the consensus grid are the arithmetic means of the ratings in the original grids. Being measures of central tendency, the arithmetic means of the grid ratings can be taken as the average view among the grids. Thus the term *consensus* grid. Comparison analysis will then be performed between the consensus grids and the corresponding theoretical grid using **DELTA**. The aim is to investigate the possible text type effect on the perception of text structure in the subject groups as a whole.

6.3.3 Quantitative Analysis

The quantitative analysis to be performed consists of a series of analyses of variance (**ANOVA**). It includes the four treatment variables of *a* - experimental subject sub-sample, *b* - English language proficiency level, *c* - text type and *d* - construct elicitation mode. The dependent variables include the correlations between the constructs in the theoretical grid and the individual grids expressed as cosines. The correlations should indicate the relative agreement or otherwise between the theoretical grid and the individual grids. The aim of the **ANOVA** study is to determine whether any of the independent variables would constitute factors influencing the agreement between the theroretical and the individual grids.

6.3.4 Qualitative Analysis

The main aim of the integration of quantitative and qualitative analysis is for meaningful insight to be gained in terms of the understanding of the research problem being investigated. In particular, the comparison between the repertory grid analysis results and the construct labels serves to throw light on the subjects' perception of the constructs, while the analysis of the recalled summary may be able to provide further insight into the structure of those constructs within the subject's consciousness. There is certainly no absolute guarantee, nor is it assumed that the recalled summary is the best method to get at the construct system of the subjects in regards to text structure internalization. The initial mediation of the researcher in all these investigations remains unresolved. However, it is precisely the purpose of the qualitative analysis to make explicit the actual situation in the field of inquiry so that the reader can formulate a personal point of view vis-a-vis the evidence presented. The aim of any qualitative analysis is not elegance of the solution but rather the comprehensiveness of the field description. It is indeed a paradigm of research orientation different from quantitative analysis. To put it very succinctly, in qualitative analysis, validity is of prime importance while in quantitative analysis it is reliability. By merging and integrating the two paradigms in the present research it is hoped that both reliability and validity of the study will be safeguarded and enhanced.

As described in 6.2.4.c, the qualitative analysis consists of the triangulation of three different sources of data on the subjects' perception of text stsructure. The first source of data is the INGRID results of the subject grids. In particular, the statistics from the principal component analysis are used as the quantification of the pattern of perception of text structure. The second source is the labelling the subjects provide in the table of construct definition for the four elicited constructs. The third source is the recalled summaries written by the subjects. From the definition of *triangulation* given in 4.4 it can be seen that there is considerable flexibility in qualitative analysis procedures. The components of a triangulation, for example, can be a variety of data sources and types, analytic methods and procedure, and diverse theoretical perspectives and assumptions. The measurements included in a triangulation need not be perfect. In this regard it is instructive to consider the following argument by Denzin (1971):

> "Triangulation forces the observer to combine multiple data sources, research methods, and theoretical schemes in the inspection and analysis of behavioural specimens. It forces him to situationally check the validity of his causal propositions. ... It forces him to temporarily specify the character of his hypothesis. ... It directs the observer to compare his subject's theories of behaviour with his emerging theoretical scheme." (p.177)

In addition, Webb et. al. (1966) observes:

> "Once a proposition has been confirmed by two or more measurement processes, the uncertainty of its interpretation is greatly reduced. The most persuasive evidence comes through a triangulation of measurement processes. If a proposition can survive the onslaught of a series of imperfect measures, with all their irrelevant error, confidence should be placed in it." (p.3)

As regards the qualitative analysis on hand, the repertory grid analysis results constitute a dimension of subjective perception which can be described as non-explicit. This refers to a perspective which the subjects themselves may not be able to adequately and explicitly verbalize. The construct labels given by the subjects can be taken to represent the explicit verbalization by the subjects on text structure, while the recalled summaries can be viewed as an expression of the subjects' internalization of text structure. It must be pointed out that the interpretation of the three sources of data may not be uncontroversial. In the first place, none of the three types of data can be directly described as manifestation of perceptions of text structure. They are labelled as such after a process of interpretation via a statistical process, as in the case of repertory grid analysis, or by the researcher's own subjective understanding and perception, as in the cases of the interpretation of the construct labels and the recalled summaries. Furthermore, the grids and the construct labels refer to possible constructs perceived as relevant to the understanding of a piece of text. However, in the whole experimental procedure, there is no absolute guarantee that these constructs are in fact patterned and organized in the actual process of text comprehension in a way identical to the analysis results. To assume the contrary would be to neglect and negate the importance of the text as a unified whole which is more than its constituent parts, constructs notwithstanding. A third observation can be made regarding the recalled summaries. In themselves, the summaries can be considered as manifestations of the salient points the subjects perceive after reading the text. It remains an open question whether the salient points reflect the text structure as perceived by the subjects.

The point of the present discussion is to make clear that the researcher is painfully aware of the complexity in all the aspects of the study and that, precisely because of the points raised, the necessity of a qualitative analysis for the present research is all the more apparent. Quantitative analyses almost always tend to present themselves as elegant solutions to research problems because of the assumed precision of a mathematical formulation. However, more often than not, the appearence of elegance is more apparent than realbecause of the often hidden assumptions in any statistico-methematical models; and the whole question of goodness of fit between the abstract mathematical model and the data on hand. This is particularly true in this study.

CHAPTER SEVEN

RESULTS 1 - Individual Perception

7.1 *Introduction*

7.1.1 Scope of the presentation

As the amount and the variety of results generated from the statistical analyses is exceedingly large, particularly regarding those from repertory grid analysis, there is certainly no room in the thesis to examine every piece of information produced. For this reason, the presentation of results will focus on those aspects relevant to the research questions being addressed, while other statistics are included in the Appendices for reference. Furthermore, even with a selective presentation and discussion, the amount of information is still large. Consequently, two chapters are devoted to the presentation of results. The present chapter examines results relating to the subjects' individual perception as revealed by the **INGRID** results. After some introductory remarks on repertory grid analysis and the *INGRID* package, the chapter presents the analysis in the following areas:

a **INGRID** results for the theoretical grids of the Helicopter and the Computer text (7.3);

b a series of case studies with comparisons made between individual grids and the theoretical grids (7.4) ; and

c qualitative analysis on the case studies in b.

Chapter Eight deals with the agreement between the theoretical grids and the subject grids. Agreement between all subjects in the sample and the theoretical grids will be analysed based on the **INGRID** results; subjects' consensus will, then, be compared with the theoretical grids and, finally, factors affecting the agreement will be identified and analysed.

7.1.2 Repertory grid analysis

The reason for the inclusion of numerous statistics in **INGRID** is that they are relevant to different research and/or clinical (in the case of psychotherapy) situations. Indeed, it is, as pointed by Slater 1977 (p.85), not necessary to consider all the statistics generated. At times it is the relationships among constructs, or among elements, or between constructs and elements that matters. In other times it is the overall pattern of relationship among all constructs and elements that is to be focused upon. The latter is the case for the present study.

7.2 *The* **INGRID** *output*

In describing the **INGRID** results, three relevant sets of statistics from the output will be examined:

a descriptive statistics for the constructs;

b those for the elements; and

c results of the principal component analysis.

These are most relevant to the analysis of overall relationship among constructs and elements. A discussion of the two theoretical grids will first be carried out, followed a similar analysis on five subject grids chosen as examples. Full listings of the results of all the statistics from INGRID for the two theoretical grids and the four sets of statistics discussed in this chapter for all the subjects are given in Appendiix 11.

7.3 *The Theoretical Grids*

7.3.1 The Helicopter text

7.3.1.a *Overview of the statistics* : Statistics presented for the theoretical grid of the Helicopter text include basic descriptive statistics for the constructs (Table 7.1a); descriptive statistics for the elements (Table 7.1b) and the results of the principal component analysis (Tables 7.1c&d).

The descriptive statistics in both Tables 7.1a&b have as their focal point the arithmetic means of the constructs around which all other descriptive statistics are centred. In Table 7.1a, the actual construct means are reported (the Mean column). Dispersion about the construct means (the SS column) are, then, expressed by the sums of squares for each construct across all elements. Thus, the construct of Situation has a sum of squares of .9333, which is the sum total of the squared differences between the ratings across all elements in the grid and the construct mean of Situation (.067). The sums of squares are then expressed as percentages (the As % column) in terms of the total sums of squares in the grid for easy comparison.

In Table 7.1b, the total deviations from construct means across all constructs for each element are reported first (the **Total deviation** coloumn). These statistics show how far the ratings in an element across all constructs are above or below the construct means, and can be useful as initial indicators of the spread of the elements ratings within the grid. The

Construct	Mean	SS	As %
Situation	.067	.9333	4.46
Problem	.333	3.3333	15.92
Solution	.333	3.3333	15.92
Evaluation	.267	2.9333	14.01
Preview	.067	.9333	4.46
Voc. 1	.267	2.9333	14.01
Voc. 2	.267	2.9333	14.01
Voc. 3	.600	3.6000	17.20

Table 7.1a: Construct mean and var. (Helicopter text).

Element	Total Deviation	SS	As %
1	-.200	1.471	7.03
2	.800	1.404	6.71
3	-.200	1.604	7.66
4	-.200	1.604	7.66
5	-.200	1.604	7.66
6	-.200	1.604	7.66
7	-.200	.938	4.48
8	-.200	.938	4.48
9	.800	1.404	6.71
10	.800	1.804	8.62
11	-.200	1.604	7.66
12	-.200	1.071	5.12
13	-.200	1.071	5.12
14	-.200	1.738	8.30
15	-.200	1.071	5.12

Table 7.1b: Element total and SS (Helicopter text).

dispersions about construct means for the elements are, then, reported, as is the case of the constructs, in the form of sums of squares (the **SS** column), which are again expressed as percentages (the **As %** column). These percentages are very important statistics in the discussions of the **INGRID** results. They are indices of the relative variation of the elements and the constructs in the grid and can be used as the basis for a general discussion on the structure of the text as evidenced by the grid. For instance, a construct like Problem in the theoretical grid for the Helicopter text has in the grid itself (see Appendix 4a) five ratings of **1**s and ten **0**s, which is a considerable variation of ratings. It has, as a consequence, a high percentage of sums of squares (15.92%).

Finally, the principal component analysis, which constitutes the central statistical calculation, has ultimately the function to make explicit a data structure already contained in the pattern of percentage distribution for the sums of squares. It attempts to uncover underlying dimensions in the grid and to align groups of constructs and elements along these dimensions. The pattern thus emerging would reveal the way a text is perceived by an individual.

7.3.1.b *Sums of squares* : It may not be immediately apparent why dispersion about construct means (or variation) is not expressed by more conventional forms like standard deviation or variance. It is, therefore, necessary to discuss the choice of sums of squares before going into detailed analysis of Tables 7.1a&b. Sums of squares represent the total dispersion rather than the mean dispersion, as is the case of variance (and by extension standard deviation). There are two reasons for the use of sums of squares in **INGRID**. In the first place, the principal component analysis in **INGRID** is based on the matrix of deviations from construct means. To use the sums of squares to represent dispersion is, therefore, more in line with such an approach. Secondly, the dispersion about the constructs means for the elements refer to different constructs. It is, therefore, not very reasonable to derive a mean value for the dispersion as is the case of variance, but to use the sums of squares instead. As a consequence, sums of squares should also be used for the dispersion about construct means for constructs to facilitate comparison.

7.3.1.c *Descriptive statistics* : In discussing Tables 7.1a&b, both the first column (**Mean** in Table 7.1a and **Total deviation** in Table 7.1b) and the sums of squares (the SS column) will be referred to. The latter will be discussed mainly in reference to their percentage presentations (the **As %** column). This is a very useful statistic to indicate the salience of constructs and elements that have high degrees of dispersion, which make them prominent in the grid. For example, the two constructs of *Problem* and *Solution* in Table 7.1a have 15.92% of the total covariance each and will be expected to feature prominently in the principal component analysis.

The construct means in Table 7.1a contain three distinct groups in terms of mean ratings. *Voc.3* is most prominent with a mean of .60, indicating a 60% of elements (clauses) having a rating of 1 on this construct. *Problem* and *Solution* with a mean of .333, and *Evalaution* and *Voc.1 & 2* with a mean of .267 form the second highest group, and, finally, *Situation* and *Preview* with a mean of .067 form the lowest group. If the mid-point mean rating of .50 in a dichotomous scale is taken into consideration, only *Voc.3* is considerably above the mean; all the other constructs are below, *i.e.* having less than 50% with a rating of 1. The sums of squares also have *Voc.3* at the top with 17.20% of the total dispersion in the grid, followed by *Problem* and *Solution* with 15.92%, *Evaluation*, and *Voc.1 & 2* with 14.01%, and, finally, *Situation* and *Preview* with 4.46%. These percentages can be viewed in terms of the expected average percentage for the constructs. If the assumption is made that the eight constructs are equally prominent, the mid-point mean percentage for the construct dispersion would be 12.5%. From such a perspective, it can be seen that only *Situation* and *Preview* fall below the mid-point value by a rather large margin; the other constructs are all above the mid-point mean percentage. The overall pattern ratings for the theoretical grid of the *Helicopter* text is, therefore, one that has a very prominent *Voc.3*, followed by a series of rather even spread of ratings across the constructs of *Problem*, *Solution*, *Evaluation*, and *Voc.1* & *2*. *Situation* and *Preview* would be relatively insignificant.

The Total deviations in Table 7.1b can be used to indicate the tendency of the ratings of elements (or clauses) to be above or below the construct means. In Table 7.1b *Clauses 2*, *9* and *10* have ratings above the construct means at .80; all the other clauses stand at the same point of deviation of -.20. More interestingly, however, the sums of squares present a very evenly spread pattern between the range of 4.48% to 8.62%. In this they contrast with the variations of the percentage of covariance accounted for by the different constructs. In other words, there is little difference between the importance of the different elements (or clauses) in the grid, whilst there are large differences for the constructs.

7.3.1.d *Principal component analysis* : Tables 7.1c&d report on the results of the principal component analysis of the theoretical grid for the *Helicopter* text. Table 7.1c provides an overview of components, giving, in particular, the percentages of covariance extracted in each. These would indicate the relative prominence of each component. Table 7.1d presents a detailed pattern of loadings of the elements and the constructs in the components that are found significant.

Component	Root	As %
1	8.0981	38.69
2	5.6879	27.17
3	2.9858	14.26
4	1.9314	9.23
5	1.0590	5.06
6	.7936	3.79
7	.3775	1.80

Table 7.1c: PCA for the Helicopter text.

Element	Component 1 Loading	Component 2 Loading
1	-.4297	-.2587
2	.6180	-.3916
3	**.8623**	.6642
4	**1.1606**	-.1825
5	**.8623**	.6642
6	**1.1606**	-.1825
7	**-.7664**	.2784
8	**-.7664**	.2784
9	-.6460	**.8462**
10	**-.8744**	.3378
11	-.1034	**1.0552**
12	-.5097	**-.7598**
13	-.5097	**-.7598**
14	.4516	**-.8297**
15	-.5097	**-.7598**
Construct		
Situation	-.1510	-.1085
Problem	**1.6388**	.2397
Solution	**-1.1093**	**1.1723**
Evaluation	-.3786	**-1.3036**
Preview	-.3073	.1416
Voc. 1	.3427	**1.3543**
Voc. 2	**1.1915**	-.6651
Voc. 3	**-1.5440**	-.4985

Table 7.1d: PCA loading matrix for the Helicopter text.

7.3.1.e *Issues relating to principal component analysis*: Before analysing Tables 7.1c&d, it is necessary to examine a number of issues relating to the principal component analysis in INGRID, which are most conveniently discussed here. The principal component analysis is based on the matrix of deviations from construct means, which is also used to compute the sums of squares used in Table 71.a&b. A covariance matrix is then derived from the matrix of deviations and becomes the matrix for the computation of the principal component analysis. It is clear, then, that the principal component analysis focuses on the construct means. However, in doing so, the computations relate not only to the deviations of the constructs from construct means (the R-technique) but also to the deviations of elements from the construct means (the Q-technique). There are several rather important implications in such an approach and noticeable differences between the method used here and the commonly used method of using the correlation matrix and the R-technique alone - a method which is more typically found in, for example, language testing research.

In the first place, since the starting point of the principal component analysis is the covariance matrix, there is no upper limit to the size of the loadings (which would have 1 as their maximum value in principal component analysis based on the correlation matrix). Consequently, there is no possibility of deciding on a single cut-off level for significant loadings. Each component has to be examined within the context of the same principal component analysis according to its overall pattern. Prominent loadings are identified on the basis of the internal contrasts of loadings within the same principal component analysis.

Second, there are no communalities reported because, when one uses the covariance matrix (as opposed to the correlation matrix) one is using unstandardized values and the squared loadings do not sum to a value of 1. Furthermore, because of the use of the Q-technique, the decision rule for the specification of the number of components to be extracted is quite different from those commonly used in principal component analyses using the R-technique. It may be beyond the scope of the present thesis to go into the mathematical and the statistical reasons for this. It may, however, be instructive to consider a non-technical aspect of the Q-technique. In the Q-technique, the principal component analysis is based on the covariances not only of the constructs but also of the elements in relation to the construct means. This has important implications for the percentage of covariance extracted in each component. Assuming equal weight for both elements and constructs in a grid as an ideal case, the percentage of covariance extracted in any component that is due to the covariance in the constructs is, in the case of the *Helicopter* text, eight (constructs) out of twenty-three variables (constructs and elements combined), which is about 35%. Since we are mainly interested in the covariance associated with the constructs, it is inappropriate to use normal decision criteria as to when to stop extracting components. This is so because only a proportion of the total covariance in each component is associated with the constructs. (The rest will be associated with the elements.) As a result, the proportion of the covariance shown to be associated with each component in Table 7.1c is an inflated estimate of the covariance due to the constructs alone. Thus, decision criteria such as rejecting components with **eigenvalues** below 1, or with proportions of the covariance below 10%, or even the **Scree** test, are inappropriate. The foregoing, by no means, represents accurately the decision rule for the specification of the number of significant components used in **INGRID**. However, it should suffice to show why a specific decision rule has to be adopted in the place of more commonly used rules.

7.3.1.f *The Bartlett test*: The method for significant component specification in INGRID is the Bartlett test (Bartlett 1950, 1951a, 1951b). This method, developed initially for the R-techinique, was found to be highly generalizable. (See Slater 1977, pp.101-103.) It consists of a chi-square test on the assumption that the residual covariance after each component is randomly distributed. As a general perspective on all decision rules for component specification, Slater (1977) thinks that the Bartlett test is not the only possible method available nor prescriptive in nature. There is certainly room for exploratory analyses on a grid. In fact, this was done in the pre-pilot (see Table 4.5) where four components were extracted to examine specifically whether the components would align according to text patterning lines. The results there do not seem to indicate such a pattern. Consequently, in the main study it was decided that the Bartlett test should be used. This is so for the following reasons.

Since the Bartlett test is applicable to the Q-technique, it may not be fully justified to use other methods without an indepth examination of their suitability for the Q-technique situation. It is certainly beyond the present thesis to examine that aspect of principal component analysis. The Bartlett test, in addition, seems rigorous enough; and its adoption should not be considered as blind component extraction, which is strongly discouraged in principal component and factor analysis. There is also a strong reason for not adopting an exploratory approach in the experiment proper. The main aim of the analyses centres on the agreement between the theoretical grids and the subject grids. To use an exploratory approach for the analyses of the grids would make the experimenter open to criticisms and the real danger of subjectivity and bias. An objective and statistically based method like the Bartlett test is certainly more acceptable than an exploratory approach in the present context. This is particularly so in view of the unfamiliarity of the Q-technique and the pioneering nature of the application of **INGRID** to linguistic analysis in the present study.

7.3.1.g *Principal component analysis for the Helicopter text* : Following the discussion of various issues related to the use of principal component analysis, we can now return to the data presented on the *Helicopter* text. Table 7.1c presents statistics, called *latent roots* (the **Root** column in Table 7.1c) showing the relative prominence of components. Percentage representations are also given for the latent roots to help analysis. Two components are identified through the Bartlett test as significant with 38.69% of the total covariance going to Component 1 and 27.17% to Component 2. These two components are described in detail in Table 7.1d.

The pattern of loadings in Table 7.1d reveals the following results in the principal component analysis.[1] Component 1 contains a contrast between *Problem* and *Solution* with *Voc. 2* signalling associated with the former and *Voc. 3* with the latter. In terms of the elements, Clauses 3 "*because the landing impact has to be cushioned to give a soft landing* ", 4 "*Unfortunately most normal spring systems bounce the load* ", 5 "*as it lands* ", 6 "*sometimes turning it over*" are associated with the **Problem-Voc.2** pole while Clauses 7 "*To avoid this* ", 8 "*Bertin, developer of the aero-train, has come up with an air-cushion system* " and 10 "*It comprises a platform* " with the **Solution-Voc.3** pole. The groupings of the elements fall more or less in line with the grid ratings (see Appendix 4a) except in the case of Clause 5, which does not have a Voc.2 signal but is grouped under the Problem-Voc.2. The reason is apparently Clause 5's falling within the Problem section of the

1 The loadings that are prominent in each component are bold-faced.

text. A more interesting case would be that of Clause 2 "*but this system has its problems*". It has the same sign in its loading in Component 1 and should belong to the Problem-Voc.2 pole. However, the size of its loading is not very high (.6180). The reason is that, since Component 1 contains the contrast between Voc.2 and Voc.3 and Clause 2 has both signals in it, Clause 2 would be placed in between the two poles regarding the Voc.2 and 3 contrast but is pulled towards the Problem pole of the component. Clause 2 exemplifies one very important point regarding the handling of principal component analysis results. The meaningful interpretation of principal component analysis results depends, in many instances, on the judgment of the researcher as well as the actual results themselves.

Component 2 contains a contrast between *Solution* and *Evaluation* with the former having strong *Voc. 1* signalling. Clauses 9 "*which assures a safe and soft landing*" and 11 "*on which the freight is loaded with, underneath, a series of 'balloons' supported by air cushions*" are relevant to the **Solution-Voc.1** pole and Clauses 12 "*Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second*", 13 "*The charge weighed about one-and-a-half tons*", 14 "*but the system can handle up to eight tons*", and 15 "*At low altitudes freight can be dropped without a parachute*" to the **Evaluation** pole. Again the groupings of results in Component 2 go along the ratings of the grid and does not present any unexpected outcome.

7.3.1.h *Observations:* To sum up, the overall pattern in the principal component analysis indicates a more prominent Component 1 with 38.69% as compared with Component 2 with 27.17%. The contrast between Problem-Voc.2 and Solution-Voc.3 in Component 1 is, thus, more important than that between Solution-Voc.1 and Evaluation in Component 2. In text analysis terms, the principal component analysis reveals in the

Helicopter text a structure which has as its main focus a dimension with a Problem-Solution contrast with a parallel contrast between Voc.2 and Voc.3. There is a less prominent dimension consisting of a Solution-Evaluation contrast with a parallel contrast of the presence or the absence of Voc.1 signalling.

It can be observed that there are four aspects in the above text analysis which show rather clearly the contribution principal component analysis can have vis-a-vis text analysis in general. Firstly, the overall text pattern is now given differential weighting (*i.e.* components with different percentages of covariance) and not merely an unweighted categorization of a certain number of text pattern components and signalling devices present. From the relative prominence of the components, an overall picture of the text structure can be obtained; and any disproportionately significant dimension can be quite precisely identified. Secondly, detailed internal relationships among the text pattern components (*e.g.* the Problem-Solution pair on the one hand, and the Solution-Evaluation pair on the other) and among the signalling devices (*e.g* the Voc.2 and Voc.3 pair) can now be identified, which may be rather difficult to discover in discursive type analysis. Such detailed configuration of the relationships among text structure features would open up the possibility of highly refined text analysis, which could not easily be achieved otherwise. Thirdly, there is now an objective index which can be the basis for comparison with subjects' perceptions of the same text. As a result, actual occuring text phenomena can now be analysed both in depth and in breadth, which has so far been quite impossible. Finally, the particular relationships between text patterning components and signalling devices (*e.g.* that between Problem and Voc.2) identified in the principal component analysis may not be revealed in discursive analysis. The identification of such relationships goes a long way towards better understanding of the text signalling approach to text analysis and of text phenomena in general. There is, however, one point of caution of a general nature which needs to be kept in mind. It is striking that the components generated by the analysis are characterized by patterns of strong positive and negative loadings. This may be a reflection of text structure (*i.e.* constructs emerging because of their opposition with one another) or an artifact of the analytic procedure used. This issue will be returned to later after the results of other analyses have been reported.

7.3.2 The Computer text

Exactly the same stages will be followed in presenting and discussing the results for the *Computer* text. Table 7.2a contains the construct means, the construct sums of squares and their representation in percentages. The construct means for this text, shown in Table 7.2a, present three rather distinct groups. *Voc.3* is at the top with a value of .846 considerably above the mid-point construct mean of .50. Next comes a group consisting of *Situation* and *Voc.1* with a mean of .462 and *Solution* with a mean of .385, which falls just below the mid-point mean. Finally we have a group consisting of *Preview* (mean: .154), and *Problem*, *Evaluation* and *Voc.2* (mean: .077), all with very low construct means. The sums of squares of the construct ratings reveal also three groups, which are, however, aligned slightly differently from the construct mean alignment. The highest group consists of *Situation* and *Voc.1* with 20.59% and *Solution* with 19.61%, followed by a group comprising *Preview* and *Voc.3* with 10.78%. The lowest group includes *Problem*, *Evaluation* and *Voc.2* with 5.88%. Taking again the mid-point construct mean of 12.5% as was the case for the *Helicopter* text, *Situation* , *Solution* and *Voc.1* are above the mid-point value by a large margin; *Preview* is marginally below; and *Problem* , *Evaluation* and *Voc.2*

Construct	Mean	SS	As %
Situation	.462	3.2308	21.21
Problem	.077	.9231	6.06
Solution	.385	3.0769	20.20
Evaluation	.077	.9231	6.06
Preview	.154	1.6923	11.11
Voc. 1	.308	2.7692	18.18
Voc. 2	.077	.9231	6.06
Voc. 3	.846	1.6923	11.11

Table 7.2a: Construct mean and var. (Computer text).

Element	Total Deviation	SS	As %
1	1.615	2.136	14.02
2	-.385	.598	3.92
3	-.385	.598	3.92
4	-1.385	1.290	8.47
5	-.385	2.136	14.02
6	-.385	.598	3.92
7	.615	1.444	9.48
8	.615	1.136	7.46
9	.615	1.136	7.46
10	.615	1.136	7.46
11	.615	1.136	7.46
12	-.385	1.367	8.97
13	-1.385	.521	3.42

Table 7.2b: Element total and SS (Computer text).

are very much below the mid-point mean. These results suggest that the *Computer* text has a text structure which exhibits prominence in *Situation* and *Solution* with strong *Voc.1* signalling. There should also be a moderate prominence for *Preview* and certain degree of *Voc.3* signalling. *Problem* and *Evaluation*, and *Voc.2* signalling seem to be rather insignificant.

Interesting comparisons can be made between the two theoretical grids with regard to the relative prominence of the constructs in the grids. The statistic that is most suitable for this purpose is the percentage representation of the construct sums of squares. Comparing the two grids, it can be seen that they manifest rather different text structures. The *Helicopter* text is patterned with prominent *Problem, Solution* and *Evaluation* and the *Computer* text focuses on *Situation* and *Solution*. *Preview* is more prominent in the *Computer* than in the *Helicopter* text. In terms of signalling devices, the *Helicopter* text has signals in all three vocabularies with a slightly higher importance of *Voc.3* signals. The *Computer* text, on the other hand, has very prominent *Voc.1* (*i.e.* subordinator) signals, a fairly low prominence for Voc.3 (*i.e.* lexical signal) and rather insignificant *Voc.2* (*i.e.* conjunct) signals. Such differences in the configuration of both text pattern and text signalling constructs not only reveal the textual differences that are there; but above all would lead to posing questions as to whether and in what way they would influence the way people perceive text structure or the extent the text will be understood. Some of these problems will be considered later in Chapter Eight particularly.

The Total Deviation column in Table 7.2b, which presents four distinct groups of elements. *Clause 1* has the highest positive deviation (1.462), showing that it is mostly rated above the construct means. The second group has a total sums of squares slightly above the construct means (.462) and includes *Clauses 6* to *11* . The third group has ratings just below the construct means (-.538) and includes *Clauses 2* to *5* and *Clause 12*. Finally, *Clause 13* has the lowest ratings with a sum of deviations of -1.538. In terms of the sums of squares for the elements, *Clauses 1* and *5* form the highest group with 14.37%, indicating a rather wide spread in the ratings across constructs, and *Clauses 4, 7* and *12* next highest group with 9.46%. The other clauses form a group with rather low percentages ranging from 6.03 to 4.07. Taking the ideal mean percentage sum of squares for elements of 7.7% in the *Computer* grid into consideration, it can be seen that the *Clauses 2, 3* (4.56%), *6* (5.05%) and *13* (4.07%) are very low in spread. The distribution of element sums of squares contrasts rather clearly with that found in the *Helicopter* text where the distribution of sums of squares was fairly evenly spread and did not present any clear contrasts. Such results indicate that the perception of text structure of the *Helicopter* text is not dependent on a few key clauses with particularly high or particularly low spread; the perception of text structure of the *Computer* text, on the other hand, would depend on whether the key clauses are picked up by the reader, thus rendering agreement with the theoretical grid more problematic.

The principal component analysis reported in Table 7.2c reveals a very large Component 1 with 52.29% of overall covariance. Component 2 is relative small in comparison with 17.63%. The structure of the *Computer* text would, therefore, be expected to depend very heavily on Component 1. (This dependence on a very prominent first component contrasts with the principal component results for the *Helicopter* text.) Component 1 in Table 7.2d (the component loading matrix) shows a contrast between *Situation* and *Solution* with *Voc. 1* signalling associated with the latter. In terms of elements, Clauses 8 to 11 "*How interaction between design, production engineering and production control can be promoted* ", "*What planning and control of material requirements have to be satisfied* ", "*How*

Component	Root	As %
1	7.9643	52.29
2	2.6848	17.63
3	1.9859	13.04
4	1.2950	8.50
5	.6535	4.29
6	.3686	2.42
7	.2788	1.83

Table 7.2c: PCA for the Computer text.

Element	Component 1 Loading	Component 2 Loading
1	-.7566	**-1.0621**
2	-.6269	.0163
3	-.6269	.0163
4	**-.8577**	.4796
5	**-.9809**	**.7643**
6	-.6269	.0163
7	.4798	**-.7711**
8	**1.0338**	.1802
9	**1.0338**	.1802
10	**1.0338**	.1802
11	**1.0338**	.1802
12	-.0742	-.1110
13	-.0649	-.0696
Construct		
Situation	**-1.5860**	.1408
Problem	-.2681	-.6482
Solution	**1.6353**	-.0306
Evaluation	-.0263	-.0677
Preview	-.0981	**-1.1188**
Voc. 1	**1.4653**	.4400
Voc. 2	-.3476	.4664
Voc. 3	.6515	**-.7592**

Table 7.2d: PCA matrix of loading for the Computer text.

capacity can be optimised through planning of manufacturing resources ", "*How capacity can be optimised through control of manufacturing resources* " are related to the **Solution-Voc.1** pole and Clauses 4 "*who will be drawn from companies of widely varying size and products* " and 5 "*Furthermore, time will be made available for delegates to see the associated exhibition* " with *Situation*. Component 2 has *Preview* and *Voc. 3* loading high on the same pole. This is associated with Clauses 1 "*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group* " and 7 "*Discussions will centre on four concurrent streams* ". Clause 5 "*Furthermore, time will be made available for delegates to see the associated exhibition* ", however, loads on the opposite pole.

7.3.2.a *Observations* : The overall structure of the *Computer* text as shown in the principal component analysis is one with a very prominent Component 1 (52.29% of total covariance) which consists mainly of a contrast between Situation and Solution and a noticeably less prominent Component 2 (17.63 % of total covariance) which consists of Preview. In terms of signalling devices, there is strong Voc.1 signalling in Component 1 associated with Solution and a less strong Voc.3 in Component 2 associated with Preview. Such a text structure is very different from that in the *Helicopter* text just reported. Such a difference would certainly be noted by any text analyst. The contribution of principal component analysis to such an understanding is again the increase in the precision with which the differences are identified and the detailed configuration of the underlying dimensions in a text structure.

There is one aspect in the component loading pattern in the *Computer* text that needs further elaboration. The component loading pattern in Component 1 suggests that the contrast observed between

Situation and Solution is associated with the presence of Voc.1 signal in Solution and its absence in Situation. This seems quite true in respect of the ratings in the raw grid (Appendix 4b). However, as is also evident from the raw grid, Situation is strongly signalled by Voc.3, which is not loaded high in Component 1. This seems rather counter-intuitive to discursive text analysis. The answer to this question lies in the function of the various statistics generated from *INGRID*.

The strength of the Voc.3 signal is well captured by its very high construct mean in Table 7.2c. With the aid of the raw grid, there should not be any problem in identifying the strength of the constructs within a grid. The function of the principal component analysis is, by virtue of its focus on the covariance matrix (this is also true with the variance matrix), to capture the maximal distinctiveness in the covariance matrix. In other words, principal component analysis has as its main function that of telling one construct apart from another, as far as text structure is concerned. It is, therefore, imperative in using *INGRID* that the relevant statistics be referred to for specific pieces of information and is why several statistics are reported in the study. The strength of the Voc.3 in Situation is not lost in the analysis with *INGRID*. It is not captured by the principal component analysis simply because Voc.3 signal, by being employed rather over abundantly (very high construct mean), is not distinctive enough within the context of the whole grid to be prominent within the context of the principal component analysis. Such a pattern makes very interesting comparison with the prominence of Voc.3 in Component 2 where it is associated with Preview. Here Voc.3 constitutes the feature that distinguishes Preview (Clause 7) and Detail (Clauses 8 to 11) within Solution. This confirms the point on distinctiveness under discussion. The question is indeed a very general issue about the principal component analysis in *INGRID* but has not been raised ealier because it would not appear relevant without data to exemplify and to bring the issue into focus. The point just discussed is certainly of very general importance and should be taken into account in subsequent analyses.

The problem being discussed also relates to the question of the possible artifactual nature of some of the principal component analysis results raised in 7.3.1.h. It is true that principal component analysis is calculated on the basis of the degree of distinctiveness of its variables (*i.e.* the covariance). In this sense, then, the results now under discussion is artifactual. However, from the psychotherapy point of view (which is the basic application of repertory grid analysis), it is the dimensions of distinctiveness in the client's construing that is the psychological reality that the psychotherapist is trying to uncover, and in that sense repertory grid analysis does reflects psychological reality within the context of psychotherapy. Within the field of linguistics too distinctiveness of linguistic signals rather than the amount of them should be regarded as the carrier of linguistic messages. It may be too early to identify the present discussion as a case in point; however, it is not an impossibility and remains an open question. Further research is needed, perhaps most fruitfully using repertory grid analysis.

The immediate question on the possible artifactual effects in the principal component analysis is whether it would make the whole linguistic model validation effort in the present study artifactual too. The answer is in the negative. The fundamental methodology of the validation procedure being attempted is the degree of match between theory and subject perception of text structure when measured by the same instrument. Even if the instrument chosen is sensitive only to distinctiveness dimensions within the text structure, it is still a valid instrument on condition that it consistently identifies the distinctiveness dimensions in the theory and in the subjects' construing. Principal component analysis is able to do that. The point of fundamental importance to be kept in mind is, therefore, that it is not the intention of this study to identify the perfect method for linguistic model validation but rather a method which can make consistent and reliable comparison between a theoretical linguistic model and actual language behaviour.

Coming back to the component loading matrix in Table 7.2d. The pattern of element loadings in Component 1 indicates high loadings (1.0338) in *Clauses 8* to *11* , which constitute the elements in Component 1 in the **Solution-Voc.1** pole. These are four out of the five elements constituting the Solution section. As a section of text, the four clauses form a set of four parallel wh-clauses. Their high loadings in Component 1 are certainly the result of high ratings in both constructs of Solution and Voc.1; however, textually speaking they also stand out as rather special. It will be interesting how the clause set would be perceived by the experimental subjects.

7.4 *Case studies of subject grids*

7.4.1 Introduction

The **INGRID** results of five subjects in the experiment are discussed below with the aim of providing samples of repertory grid analysis in the subject grids. By examining such results, insight would be gained regarding the perspectives different individuals have on a text. If the focus of a study was the individual, the **INGRID** results may well be the most important part of the analysis, as is the case of psychotherapy. In the present study, it serves as illustration of individual perception of text structure.

The presentation of the case studies is structured as follows

a relevant background information on the subject will be presented;

b the construct mean and sums of squares, the sums of squares of the elements and the principal component analysis results will be presented as has been in the case of the theoretical grids;

c observations will be made on features that emerge from the analyses regarding the subject.

At the end of the five case studies, an attempt will be made to comment on common issues which are relevant to all five subjects concerned.

7.4.2 Case 1

7.4.2.a Case 1 (*Bus Comp Mod S Lb*) is a *Business* student who read the *Computer* text and was given the *Standard* mode for construct elicitation, *i.e.* the elicitation through triads. He belongs to the *Low* reading ability band according to his test results. The triads were chosen with one or two of the clauses in it bearing the construct to be elicited. Thus, in the triad for Preview (Construct 5) below, Clause 7 signals Preview; in the triad for Voc.1 (Construct 6) Clauses 6 and 11 both have Voc.1. signal. This was necessary because in drawing up the triads as many clauses as possible should be included. The odd-one-out in a triad, however, is referred to in the study as the *target* clause.

The triads for the Computer text are

C5 (Preview) - Target clause 7

7	*Discussions will centre on four concurrent streams:*
10	*How capacity can be optimised through planning of manufacturing resources;*
8	*How interaction between design, production engineering and production control can be promoted;*

C6 (Voc.1) Target clause 2

6	*which will include demonstrations of equipment.*
2	*The seminar, ... will follow the Institution's policy of featuring speakers with practical experience ...*
11	*How capacity can be optimised through control of manufacturing resources.*

C7 (Voc.2) Target clause 5

1	*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group.*
13	*Further details are now available from the Conference Secretary, Rochester House.*
5	*Furthermore, time will be made available for delegates to see the associated exhibition, ...*

C8 (Voc.3) Target clause 12

12	*The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry.*
9	*What planning and control of material requirements have to be satisfied;*
4	*who will be drawn from companies of widely varying size and products.*

The four elicited constructs are labelled as follows:

C5 (Preview)	*more boardened (sic) and no specification. (Target clause: 7)*
C6 (Voc.1)	*It suggests the method. (Target clause: 11)*
C7 (Voc.2)	*For all the general enquiries. (Target clause: 13)*
C8 (Voc.3)	*Tell you the aim of the seminar. (Target clause: 12)*

The student identifies the correct target clauses 7 for Construct 5 and 12 for Construct 8. He also gives a definition to Construct 5 which can be regarded as relating to Preview. The same is not true for Constructs 6 and 7 where the target clauses were not correctly identified, and the construct definitions do not suggest Voc.1 or 2.

7.4.2.b The raw grid for this subject is found in Appendix 10. The layout of series "*a*" tables in the case studies is slightly different from Tables 7.1&2a by having an extra column of the percentages of the sums of squares for constructs from the theoretical grid included. This is done to enable easy comparison between the theoretical grid and the subject grid. The distribution of construct means in Table 7.3a shows two distinct groups of constructs with *Situation* (.462), and *Problem* and *Construct 5* (.308) forming a higher group; and *Solution* with a mean of .154, and *Evaluation* and *Voc.1, 2, 3* with a mean of .077 forming a lower group. It is immediately apparent that the students tended to give many zero ratings with the result that all the construct means are below the mid-point mean of .50 with the possible exception of Situation, which falls just below the mid-point value. The sums of squares see a split into three groups of constructs. *Situation* (22.83%), and *Problem* and *Construct 5* (19.57%) form the highest group; *Solution* (11.96%) is the next group; and *Evaluation* and *Constructs 6* to *8* (6.52%) form the lowest group. In terms of constructs, then, it is quite apparent that the subject focuses on discourse/text patterning constructs; does not seem to be sensitive to text signalling devices, to the extent that it is evidenced by his failure to pick up the signalling devices through the triads; and failed to make use of Constructs 6 to 8 in construing the text structure. A comparison with the percentages of the construct sums of squares reveals clear differences between the subject grid and the theoretical grid in Problem and Constructs 5, 6 and 8. A certain degree of difference is also noticeable in Solution as well.

Similar to the "*a*" series of tables, the "*b*" series of tables in the case studies also has an extra column on the percentages of sums of squares for

Construct	Mean	SS	As %	Theory
Situation	.462	3.2308	22.83	20.69
Problem	.308	2.7692	19.57	5.33
Solution	.154	1.6923	11.96	19.61
Evaluation	.077	.9231	6.52	5.88
5	.308	2.7692	19.57	10.78
6	.077	.9231	6.52	20.59
7	.077	.9231	6.52	5.88
8	.077	.9231	6.52	10.78

Table 7.3a: Construct mean and var. (Case Study 1).

Element	Total Deviation	SS	As %	Theory
1	.462	.911	6.44	14.37
2	-.538	.527	3.72	4.56
3	-.538	.527	3.72	4.56
4	.462	.911	6.44	9.46
5	.462	1.527	10.7	14.38
6	-.538	.527	3.72	5.05
7	.462	.911	6.44	9.95
8	-.538	.834	5.89	6.03
9	-.538	.834	5.89	6.03
10	-.538	.834	5.89	6.03
11	.462	1.680	11.87	6.03
12	.462	2.142	15.13	9.46
13	.462	1.988	14.05	4.07

Table 7.3b: Element total and SS (Case Study 1).

elements in the theoretical grid included. The total deviations from construct means in Table 7.3b (Element deviation from construct means and SS) show two groups of elements. *Clauses 1, 4, 5, 7* and *11* to *13* have a total deviation of .462. *Clauses 2, 3, 6* and *8* to *10* have a total deviation of -.538. In terms of percentages of sums of squares, it is very clear that there are only a few elements which are particularly prominent suggesting the possibility that this reader does not rate all of the propositions contained in the text but instead operates quite selectively on a few sections. These are *Clauses 5* (10.79%), *11* (11.87%), *12* (15.13%) and *13* (14.05%). Such a pattern of results reflects the particular way the subject construes the text, which is quite close to the theoretical grid except for Clauses 1 and 11 to 13.

7.4.2.c The layout of the "*c* " and "*d* " series of tables for the case studies has also the relevant statistics from the theoretical grid included for comparison. In the "*c* " series the actual percentages of covariance in the components are included. In the "*d* " series, the loadings that are high in both grids will be marked by an asterisk (*).

Table 7.3c (Principal component analysis) reveals a very important Component 1 with 42.27% of total covariance while Component 2 takes up another 22.14%. Such a pattern shows that the subject has a major dimension in his construing and rather similar to the theoretical grid (see Table 7.3c) even though the imbalance in prominence between the two components is reduced in the subject grid.

In the matrix of component loadings (Table 7.3d - Component loadings), Component 1 contains the contrast between *Situation* and *Problem* with *Preview* being on the same pole of Situation. The elements are grouped into two chunks in this component with *Clauses 1* to *7* in the **Situation-Preview** pole and the rest of the clauses in the **Problem** pole.

Component	Root	As %	Theory
1	5.9832	42.27	52.29
2	3.1338	22.14	17.63
3	2.3655	16.71	13.04
4	1.6855	11.91	8.50
5	.7131	5.04	4.29
6	.2727	1.93	2.42

Table 7.3c: PCA for Case Study 1.

Element	Component 1 Loading		Component 2 Loading
1	**-.8795**		-.1255
2	-.4011		-.3231
3	-.4011		-.3231
4	**-.8795**	*	-.1255
5	-.2236		**.9957**
6	-.4011		-.3231
7	**-.8795**		-.1255
8	**.8088**	*	-.2497
9	**.8088**	*	-.2497
10	**.8088**	*	-.2497
11	**.9711**	*	-.3668
12	.3620		.2940
13	.3058		**1.1722**
Construct			
Situation	**-1.5706**	*	**-.7602**
Problem	**1.3890**		**-.6304**
Solution	.0336		**1.2246**
Evaluation	.1480		.1661
5	**-1.1700**		.3497
6	.3970		-.2072
7	.1250		**.6621**
8	.1480		.1661

Table 7.3d: PCA matrix of loading for Case Study 1.

Clauses 1 "*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group*", 4 "*who will be drawn from companies of widely varying size and products* ", 7 "*Discussions will centre on four concurrent streams* " are the most prominent elements in the **Situaion-Preview** pole while *Clauses 8* to *11* (*i.e.* the four wh-clauses in the *Computer* text) in the **Problem** pole.

A comparison with the theoretical grid (see Table 7.3d) shows that, in terms of construct loadings, only *Situation* loads high in both the theoretical and the subject grid. Loadings on the elements are rather similar in the two grids as clear from Table 7.4d. This indicates that the subject may have associated some of the elements with constructs different from the theoretical grid. It is clear from Component 1 that the element loadings are split into two sequential segments with *Clauses 1* to *7* on the **Situation-Preview** pole and *Clauses 8* to *13* on the **Problem** pole.

The subject, therefore, perceives the text as largely composed of a pattern consisting of Situation and Problem. The clauses most prominent in the Situation-Preview pole are Clauses 1, 4 and 7. Clauses 1 and 7 seem to be understandably related to Situation and Preview. However, the inclusion of Clause 4 under Situation-Preview seems rather unexplainable. The four prominent clauses on the Problem pole are Clauses 8 to 11. Here the prominence of the four wh-clauses in the Computer text again emerge as has already been noticed in principal component analysis of the theoretical grid for the Computer text. An additional feature in the present case is the contrast (*i.e.* opposite signs in the loadings) between the set of wh-clauses and Clause 6 which is the Preview to the four clauses in question.

The pattern loadings in Component 2 has *Solution* as the most important construct. This is associated with Construct 7 (*For all the general enquiries*). (See 7.4.2a above.) This pole is contrasted with a

Situation-Problem pole. Clauses 13 "*Further details are now available from the Conference Secretary, Rochester House* " and 5 "*Furthermore, time will be made available for delegates to see the associated exhibition* " are associated with the **Solution-Construct 7** pole. A close examination of the two clauses may reveal that the subject was, in fact, responding to the two expressions *Furthermore* in Clause 5 and *Further details* in Clause 13 as signals for his linking Solution and *For all the general enquiries*. From this it can be deduced that what the subject defines as *For all the general enquiries* is, perhaps, what he understood as Solution. This may throw some light on the perception of the subject regarding the construct Solution, which should be considered quite different from that in the theoretical grid. In fact, the match in high loadings between the subject and the theoretical grid is found only in Clause 5.

7.4.2.d The **INGRID** results described above, therefore, have helped to describe the ways Case 1 construes the text read and to reveal the advantages of repertory grid analysis for the study of individual characteristics in text perception. With such a method of analysis, it is now possible to study phenomena like the reading behaviour which is at once quantitative and objective, and which approaches the subject on the terms of the reader rather on a predefined theory of reading. This is certainly one of the greatest contribution of repertory grid analysis.

To recapitulate on the case study in question, through the principal component analysis in Table 7.3c an individual's general approach to text can be identified. The subject concerned tends to concentrate on one predominant dimension in his construing. This may indeed be specific to the text read, *i.e.* the *Computer* text. However, if the strategy emerges in repeated analyses, it would be possible then to identify individual traits in general reading strategies.

The pattern of loadings in Table 7.3d uncover a profile of the subject in a way which is quite refined. We see, for example, that the subject has a rather complex view on the constructs of Situation and Problem. These are contrasted with each other in Component 1, but are grouped together in Component 2 to contrast with Solution. It should also be noted that Evaluation is not distinctive (but neither is it so in the theoretical grid). From the description above it can be seen that a profile of the subject's construing is emerging. Whether such a profile is text specific or general, as has already been argued, is a question that can easily be investigated. The possibility of drawing up a reader profile is certainly very conducive to the study of the reading behaviour and seems to be achievable using repertory grid analysis.

7.4.3 Case 2

7.4.3.a Case 2 (*BUS Heli Mod L Hb*) is a *Business* student who read the *Helicopter* text and was given the *Laddering* mode of construct elicitation. She is rated *High* on the reading test.

Since the Laddering mode was adminstered to this subjects, triads were not used for construct elicitation. The constructs were defined by the subject herself based on what she thought as constituting signalling devices. The constructs elicited from this subject are

C6 (Voc.1)	*Verbs eg. bounce, turning over, come up with, to avoid.*
C7 (Voc.2)	*Nouns eg. problems, Trials, the system can.*
C8 (Voc.3)	*for, has to be, can .*

The word *for* chosen as an example in Construct 8 appears to be rather problematic. The co-text of *'for'* is the phrase *'for dropping freight by parachute'* in the clause *'Helicopters are very convenient for dropping freight by parachute'* (Clause 1).[2] It can be described as a pre-verb modifier or marker. Such a label would also be applicable to the other two examples in the same construct.

From the labelling of Constructs 6 and 7 it would appear that the subject has in mind principally *parts of speech* as the classification criterion. However, it looks rather peculiar that the expression *'the system can'* is considered as an example of nouns in Construct 7. A close examination of the examples included above reveals that, while it is true that the classification given is put in parts of speech terms, the examples all relate to Problem or Solution. This is true even with the Construct 8 examples. The subject, therefore, classified on the basis of parts of speech, focusing on Problem and Solution.

The way the elicited constructs are labelled shows clearly the problems that may arise with laddering because the intended constructs of the three vocabularies have not been identified except Voc.3. It must be stressed, though, that the failure to elicit the desired constructs is a problem because of the existence of targetted constructs. In an open-ended construct elicitation through laddering, the constructs elicited should be accepted as valid since they reflect the subject's perspective, which is what an open-ended repertory grid analysis tries to uncover.

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2 The subjects are asked to circle in the text where the examples are found.

7.4.3.b The construct means in Table 7.4a (Construct means and SS) have two distinct groups with *Situation* (mean .667), *Construct 6* (mean .600) and *7* (mean .533) forming a group with means higher than the mid-point mean of .50; the group with constructs means lower than the expected value includes *Evaluation* and *Construct 8* with a mean of .333, and *Problem* and *Solution* with a mean of .267, and finally *Preview* with a mean of .200. The sums of squares for the constructs show a gradual spread over the range between 9.38% to 14.58%. Such a spread should not be considered too wide; and the differences in construct percentage sums of squares are, therefore, not very different. This means that the subject has a wide perspective on the text structure of the Helicopter text. The percentages of construct sums of squares compare very closely with the theoretical grid (see Table 7.4a)

Percentages of sums of squares for the elements in Table 7.4b (Element deviation from construct means and SS) fall between the range from 3.75% to 10%. The spread is, however, quite gradual. Here too the subject agrees to a large extent with the theoretical grid. From the results in Tables 7.4a&b, it is expected that the subject would have a rather diffused view on both the elements and the constructs.

7.4.3.c Table 7.4c (Principal Component Analysis) reveals a fairly large Component 1 with 37.09% and Components 2 and 3 comparable in importance with 20.51% and 18.61% respectively. Such a pattern confirms the observation made above regarding Tables 7.4a&b. The distribution of percentages of covariance in the components is again very close to the theoretical grid with a third dimension becoming significant as well.

In Table 7.4d (component loading matrix) Component 1 contains principally the contrast between *Situation*, *Problem* and *Preview* with Construct 8 (*pre-verb modifier*) signalling, and *Solution* and *Evaluation* with

Construct	Mean	SS	As %	Theory
Situation	.667	3.3333	13.02	4.46
Problem	.267	2.9333	11.46	15.92
Solution	.267	2.9333	11.46	15.92
Evaluation	.333	3.3333	13.02	14.01
Preview	.200	2.4000	9.38	4.46
6	.600	3.6000	14.06	14.01
7	.533	3.7333	14.58	14.01
8	.333	3.3333	13.02	17.20

Table 7.4a: Construct mean and var. (Case Study 2).

Element	Total Deviation	SS	As %	Theory
1	-.200	2.093	8.18	7.03
2	-.200	2.493	9.74	6.71
3	.800	2.560	10.00	7.66
4	-.200	1.427	5.57	7.66
5	-1.200	.960	3.75	7.66
6	-.200	1.427	5.57	7.66
7	-.200	2.093	8.18	4.48
8	-.200	1.693	6.61	4.48
9	-.200	2.227	8.70	6.71
10	-.200	1.427	5.57	8.62
11	.800	2.027	7.92	7.66
12	.800	1.227	4.79	5.12
13	.800	1.227	4.79	5.12
14	-.200	1.293	5.05	8.30
15	-.200	1.427	5.57	5.12

Table 7.4b: Element total and SS (Case Study 2).

Component	Root	As %	Theory
1	9.4952	37.09	38.69
2	5.2510	20.51	27.17
3	4.7645	18.61	14.26
4	3.5761	13.97	9.23
5	1.0452	4.08	5.86
6	.7333	2.86	3.79
7	.5976	2.33	1.80
8	.1371	.54	

Table 7.4c: PCA for Case Study 2.

Element	Component 1 Loading		Component 2 Loading		Component 3 Loading	
1	**-1.0896**		-.5860		.1074	
2	-.1923		**-1.1141**		.0762	
3	**-1.3824**	*	-.6582		.0693	
4	-.6026		**.6966**	*	-.1637	
5	-.3098		**.7688**	*	-.1255	
6	-.6026		**.6966**	*	-.1637	
7	.0309		.3480		**1.3337**	*
8	**.8799**	*	.1352		.7595	
9	**1.1912**	*	**-.7024**	*	.2332	
10	.4888		-.4283		**-.9131**	*
11	**1.3288**	*	.0566		.3663	
12	.6264		.3307		**-.7801**	*
13	.6264		.3307		**-.7801**	*
14	-.6715		.6221		.1874	
15	-.3217		-.4964		-.2069	
Construct						
Situation	**-1.0510**		.5571		**-1.2686**	
Problem	**-.9021**	*	-.1654		-.0833	
Solution	**1.1134**	*	-.0709		**1.2337**	*
Evaluation	**1.3830**		-.1801		**-.8584**	*
Preview	**-.8646**		**-1.0292**		.1159	
6	.4238		**1.7392**		.2904	
7	**1.5018**		**-.8239**		-.5703	
8	**-1.1145**		-.3363		.6830	

Table 7.4d: PCA matrix of loading for Case Study 2.

Construct 7 signalling (*noun*). Clauses 1 "*Helicopters are very convenient for dropping freight by parachute* " and 3 "*because the landing impact has to be cushioned to give a soft landing* " are the two elements aligned with the first pole, and Clauses 9 "*which assures a safe and soft landing* ", 11 "*on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions* " and, to a certain extent, 8 "*Bertin, developer of the aero-train, has come up with an air-cushion system* " are elements aligned with second pole.

The pattern of loadings in Component 1 captures again the overall view the subject has on the text. This is evidenced by the number of prominent constructs in the component. In fact, all constructs with the exception of Construct 6 have prominent loadings in Component 1, which should be viewed as a component representing the subject's general view on the text. There is also a near sequential split into two groups among the elements. This, it should be recalled, was found also in Case 1.

Component 1 agrees with the theoretical grid in its high loadings on the contrast between Problem and Solution (* in Component 1). The difference lies in the subject's perception of the contrast also in relation to other constructs and the theoretical grid has the Problem-Solution contrast as distinct. High loadings on the elements agree also with the theoretical grids to a very large extent with the exceptions of Clauses 1, 2 14 and 15. However, the alignment of the elements in the subject's loading matrix is different from the theoretical grid.

Component 2 contains a local contrast between Construct 6 (*Verb*) signalling and *Preview* which is associated with Construct 7 (*Noun*) signalling. The elements associated with the **Construct 6** pole are Clauses 4 to 6 "*Unfortunately most normal spring systems bounce the load* ", "*as it lands*" and "*sometimes turning it over* ", and those with the **Preview-Construct 7** pole are Clauses 2 "*but this system has its problems* " and 9 "*which assures a safe and soft landing* ".

Component 2 has a rather peculiar structure. Judging from the clauses with prominent loadings on the Preview-Construct 7 pole (*i.e.* Clauses 2 and 9), it appears that the perception of the construct Preview is quite different from that in the theoretical grid, because these two clauses do not belong to the Preview section in the theoretical grid. The contrast beween Constructs 6 and 7 found in Component 2 has Clauses 4 to 6 grouped under Construct 6, and Clauses 3 and 9 under Construct 7. The expressions in the text circled by the subject for Construct 6 are '*bounce* ' (Clause 4), '*lands* ' (Clause 5) and '*turning it over* ' (Clause 6), while those for Construct 7 are '*problems* ' (Clause 2), '*safe and soft landing*' (Clause 9). It seems that Component 2 has to do with a dimension which includes a contrast between *Nouns* and *Verbs*. However, it is difficult to tell whether the subject perceives the contrast in syntactic or semantic terms. In any case, this component reveals a dimension in the subject's perception which shows the highly individualized way of construing on the part of the subject.

Component 3 is mainly the contrast of *Situation* and *Evaluation* with *Solution* . Clause 7 "*To avoid this* " is associated with the **Solution** pole while Clauses 10 "*It comprises a platform* " , 12 "*Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second*" and 13 "*The charge weighed about one-and-a-half tons* " with the **Situation-Evaluation** pole. This agrees with Component 2 in the theoretical grid (loadings marked with *). Like the patterning in Component 1, an additional construct, in this case Situation, is brought under the Evaluation pole. This is a further confirmation of the subject's diffuse approach to text structure perception.

7.4.3.d The overall profile of perception of Case 2 is one that consists of one general dimension which tends to split the text into two consecutive halves of elements and to have the constructs placed into two contrasting groups. There are two other dimensions consisting of constrasts of a more or less local nature. Such a profile bears some similarity with that found in Case 1, *e.g.* the spliting of the elements in Component 1. The pattern of loadings in Component 2, on the other hand, indicates a very individualized dimension in this subject's construing.

Two other observations need to be made particularly regarding Component 2. The first regards repertory grid analysis as a statistical tool. Even though principal component analysis is mainly a data reduction technique, it is evident from the discussion on Component 2 that new dimensions quite unforeseen at the stage of experiment planning may emerge if there is a strong enough basis for such new dimensions to appear. It is well known that principal component analysis is an excellent tool for exploratory investigation.

The second observation relates to the experiment itself. As described in 5.3 and 5.4, there is a problem of the extent of experimenter intervention, direction and, worst of all, intrusion in the present study. The balance that has to be struck is to establish how much experimenter intervention is needed to focus the subjects' attention on the textual aspect of reading without influencing and distorting the results. The loading pattern in Component 2 provides evidence indicating that the subject is not unduly directed and is able to approach the text as she perceives it, because of its highly individualized pattern and its obvious disagreement with the theoretical grid.

7.4.4 Case 3

7.4.4.a Case 3 (*Sci Comp Mod L Hb2*) is a *Science* student who read the *Computer* text and was given the *Laddering* mode for construct elicitation. She is rated *High* in the reading test.

The elicited constructs are as follows:

C6 (Voc.1)	*Action, i.e. to be held on*
C7 (Voc.2)	*How, What*
C8 (Voc.3)	*Connective e.g. Furthermore*

Of these, construct 7 is clearly Voc.1 signalling and Construct 8 is Voc.2 signalling, while Construct 6 is not easily labelled and has to be examined using the principal component analysis results.

7.4.4.b Construct means in Table 7.5a (Construct means and SS) can be divided into three groups. The first comprises *Situation* (mean .538) and *Evaluation* (mean .615) both of which are above the .50 mid-point mean. The second group includes *Problem* and *Construct 6* (mean .385) and *Construct 7* (mean .308), whose means fall clearly below the .50 value. The third group includes *Solution* (mean .077), *Preview* (mean .154) and *Construct 8* (mean .154) and represents a set of construct means falling far below the mid-point value.

The distribution of the construct sums of squares percentages indicates two distinct groups. The first comprises *Situation* (16.54%), *Problem* , *Evaluation* and *Construct 6* (15.75%), and *Construct 7* (14.17%), all of which are above the ideal mean percentage of 12.5%. The other constructs, *i.e.* *Solution* (4.72%), *Preview* and *Construct 8* (8.66%), are all far below the expected value. It may be interesting to notice that there is a rather wide gap separating the two groups of construct sums of squares, indicating the subject's tendency to peceive some of the constructs with a much more distinct view (the high percentage constructs) than others (the

Construct	Mean	SS	As %	Theory
Situation	.538	3.2308	16.54	20.59
Problem	.385	3.0769	15.75	5.33
Solution	.077	.9231	4.72	19.61
Evaluation	.615	3.0769	15.75	5.88
Preview	.154	1.6923	8.66	10.78
6	.385	3.0769	15.75	20.59
7	.308	2.7692	14.17	5.88
8	.154	1.6923	8.66	10.78

Table 7.5a: Construct mean and var. (Case Study 3).

Element	Total Deviation	SS	As %	Theory
1	1.385	2.189	11.21	14.37
2	-.615	.805	4.12	4.56
3	.385	1.036	5.30	4.56
4	-.615	1.728	8.84	9.46
5	.385	1.497	7.66	14.37
6	-.615	1.112	5.69	5.05
7	.385	1.959	10.02	9.95
8	.385	1.497	7.66	6.03
9	.385	1.497	7.66	6.03
10	.385	1.497	7.66	6.03
11	.385	1.497	7.66	6.03
12	-.615	2.189	11.2	9.461
13	-1.615	1.036	5.30	4.07

Table 7.5b: Element total and SS (Case Study 3).

low percentage ones). A comparison with the construct sums of squares reveals the subject grid has similar percentage distribution as the theoretical grid in Situation, Preview and Constructs 6 and 8. Considerable difference is observed in Problem, Solution, Evaluation and Construct 7 in terms of construct sums of squares.

Sums of squares percentage distribution for the elements in Table 7.5b (Element deviation from construct means and SS) has *Clauses 1* and *12* (11.21%), and *Clause 7* (10.02%) forming the highest group; *Clause 4* (8.84%), *Clauses 5, 8* to *11* (7.66%) forming the next highest group, *Clause 2* (4.12%), *Clauses 3* and *13* (5.30%) and *Clause 6* (5.69%) forming the lowest group. Here too there is a very similar distribution in percentages of the element sums of squares. The only element that is rather different from the theoretical grid is Clause 5.

7.4.4.c There is a large Component 1 with 44.46% of the total covariance and a considerably less prominent Component 2 with 21.43% found in Table 7.5c (Principal component analysis). Even though Component 1 is more prominent than Component 2, the latter has also a considerable percentage of covariance included. The overall principal component analysis is also quite similar to the results in the theoretical grid.

Component 1 (Table 7.5d - Component loadings) contains the contrast between *Situation* on the one hand, and *Problem* and *Evaluation* on the other. *Construct 6* signalling is associated with Situation while *Construct 7* (Voc.1) with Problem-Evaluation. Clause 7 "*Discussions will centre on four concurrent streams* " is related to the **Situation-Construct 6** pole, while Clauses 8 to 11 (*i.e.* the wh-clause set in the Computer text) are related to the **Problem-Evaluation** pole.

Here, as has been in the previous cases, Component 1 is a dimension of overall perception. The element loadings are split basically into two

Component	Root	As %	Theory
1	9.2725	47.46	52.29
2	4.1878	21.43	17.63
3	2.7493	14.07	13.04
4	1.8814	9.63	8.50
5	.8274	4.23	4.29
6	.2994	1.53	2.42
7	.1911	.98	1.83
8	.1294	.66	

Table 7.5c: PCA for Case Study 3.

Element	Component 1 Loading		Component 2 Loading	
1	-.6791		**-.8836**	*
2	-.2174		.6197	
3	-.5365		.0083	
4	-.7296		**.8199**	
5	-.3319		**1.0713**	*
6	-.0794		-.3278	
7	**-1.1293**		-.5964	
8	**1.2133**	*	-.0797	
9	**1.2133**	*	-.0797	
10	**1.2133**	*	-.0797	
11	**1.2133**	*	-.0797	
12	-.5348		**-.7608**	
13	-.6151		.3683	
Construct				
Situation	**-1.3920**	*	.6878	
Problem	**1.3707**		-.5876	
Solution	-.1756		-.3718	
Evaluation	**1.2111**		.5143	
Preview	-.5939		-.7232	
6	**-.9717**		**-1.2511**	
7	**1.5937**	*	-.1559	
8	-.3486		**.9242**	

Table 7.5d: PCA matrix of loading for Case Study 3.

sequential segments with the first seven and the last two going to the Situation pole, and the remaining to the Problem-Evaluation pole. It is worthwhile to point out that there is a clear contrast between Clause 7 and the following four clauses (8 to 11). They have the highest loading among the elements. The subject's construing, therefore, is very much conditioned by her perception of this group of clauses, which are structured as one Preview clause (7) followed by four parallel wh-clauses forming the details. This is, indeed, not the first occasion when the four parallel wh-clauses are perceived as a single group by the subjects.

The pattern of construct and element loadings also reveals a possible subjective understanding of Problem and Evaluation by the subject. Clauses 8 to 11 are the only elements associated with these two constructs; and it can be deduced that the subject considers the two constructs rather indistinguishable, at least in the present text. This marks a rather striking difference between the subject grid and theoretical grid, which has the four wh-clause set included in Solution.

Table 7.5d reveals the agreement in high loadings between the subject grid and the theoretical grid in Situaion and Construct 7 which should correspond to Voc.1 in the theoretical grid.

Component 2 includes the contrast between *Construct 6* and *Construct 8* with Clauses 1 "*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group* " and 12 "*The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry* " associated with the former, and Clauses 4 "*who will be drawn from companies of widely varying size and products* " and 5 "*Furthermore, time will be made available for delegates to see the associated exhibition* " with the latter.

7.4.4.d The overall pattern of loadings in Component 2 helps to clarify the meaning of Construct 6 which is still not completely clear from the labelling given in 7.4.4a. The clauses associated with the Construct 6 pole are principally Clauses 1 and 12 while those associated with the Construct 8 pole are Clauses 4 and 5. Considering such a local contrast within the text itself it can be seen that Clauses 1 and 12 can be labelled as describing general features of the seminar while Clauses 4 and 5 refer to particulars. It may, therefore, be the case of an implied discourse pattern of General-Particular which attracted the attention of the subject. If so, what has been said about the exploratory function of principal component analysis in 7.4.3d is also true in this case.

From the pattern of loading in Component 1, the two characteristics found present in the previous two cases are also found in Case 3. The split of elements in Component 1 is nearly sequential, with the exceptions of Clauses 12 and 13. Like the previous two cases, Component 1 is also a general view of the subject on the text structure. This is particularly pronounced in the present case where Component 2 is highly localized on a Construct 6 and 8 contrast.

The lack of prominence of Solution has already been indicated as the result of the subject's understanding of Problem. From the sign of loading of Preview in Component 1, it can further deduced that the subject perceives Preview as subsumed under Situation. These two cases show clearly the generalized perspective the subject may have on construing the text.

7.4.5 Case 4

7.4.5.a Case 4 (*Sci Heli Mod 1 Ma*) is a *Science* student who read the *Helicopter* text and was given the *Standard* mode of construct elicitation. His rating in the reading test is *Middle* .

The triads for construct elicitation are as follows:

C5 (Preview) Target clause 10

12 *Trials have been carried out with freight- dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second.*

8 *Bertin, developer of the aero-train, has come up with an air-cushion system ...*

10 *It comprises a platform ...*

C6 (Voc.1) Target clause 3

3 *...because the landing impact has to be cushioned to give a soft landing.*

1 *Helicopters are very convenient for dropping freight by*

13 *The charge weighed about one-and-a-half tons, ...*

C7 (Voc.2) Target clause 6

4 *Unfortunately most normal spring systems bounce the load ...*

2 *but this system has its problems.*

6 *sometimes turning it over.*

C8 (Voc.3) Target clause 7

11 *on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions.*

5 *as it lands, ...*

7 *To avoid this, ...*

The four elicited constructs are labelled as follows:

C5 *The information which given by the sentence has no supportive meanings (Target clause: 10);*

C6 *No description to the new invention (Target clause: 1);*

C7 *The sentence is the main idea of them (Target clause: 2);*

C8 *The sentence has no information of lending process (Target clause: 7).*

Though the target sentences for Construct 5 and 8 were correctly identified, the construct definitions do not bear any relation to Preview for Construct 5 and to text signalling for the other three constructs. This is certainly peculiar in that, while correctly identifying two of the target clauses, the subject was unable to identify the targetted feature of text signalling devices. This is certainly an interesting phenomenon, and it would be of interest to find out whether the mislabelling has any effects on the principal component analysis results.

7.4.5.b As can be seen in Table 7.6a (Construct means and SS), Construct means present a gradual spread within the range from .267 to .533. The same pattern of distribution is found for percentages of sums of squares for the constructs, which spread over a narrow range between 10.43% to 13.27%.

The distribution of percentages of sums of squares for the elements in Table 7.6b (Element deviations from construct means and SS) follows the same pattern with a range of values between 5.42% to 8.50%. The percentages of sums of squares for constructs and elements show remarkable similarity with the theoretical grid except for Situation and Preview, both of which have sums of squares comparable to other constructs in the subject grid but are noticeably lower in the theoretical grid.

7.4.5.c Table 7.6c (Principal component analysis) also reveals a very balanced pattern of components with Component 1 taking up 29.41% and Component 2 23.19% of covariance. This pattern is also very similar to the theoretical grid.

Component 1 (Table 7.6d - Component loadings) contains the contrast between *Situation* and *Solution* with *Construct 6* grouped with the former and *Construct 7* with the latter. The elements associated with the **Situation-Construct 6** pole are Clauses 1 "*Helicopters are very convenient for dropping freight by parachute* ", 2 "*but this system has its problems* " and 10 "*It comprises a platform* ". Those associated with the **Solution-Construct 7** pole are Clauses 7 "*To avoid this* ", 8 "*Bertin, developer of the aero-train, has come up with an air-cushion system* " and 11 "*on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions* ".

Component 2 contains the contrast between *Problem* and *Evaluation* with *Constructs 5* and *7* associated with Problem. As far as elements are concerned, Clause 2 "*but this system has its problems* " is related

Construct	Mean	SS	As %	Theory
Situation	.467	3.7333	13.27	4.46
Problem	.267	2.9333	10.43	15.92
Solution	.333	3.3333	11.85	15.92
Evaluation	.467	3.7333	13.27	14.01
5	.333	3.3333	11.85	4.46
6	.533	3.7333	13.27	14.01
7	.533	3.7333	13.27	14.01
8	.400	3.6000	12.80	17.20

Table 7.6a: Construct mean and var. (Case Study 4).

Element	Total Deviation	SS	As %	Theory
1	.667	1.724	6.13	7.03
2	2.667	2.391	8.50	6.71
3	-1.333	1.858	6.60	7.66
4	.667	1.858	6.60	7.66
5	-.333	2.058	7.31	7.66
6	-1.333	1.858	6.60	7.66
7	-.333	1.924	6.84	4.48
8	-.333	2.058	7.31	4.48
9	.667	1.724	6.13	6.71
10	.667	1.991	7.08	8.62
11	.667	1.991	7.08	7.66
12	-.333	1.791	6.37	5.12
13	-.333	1.524	5.42	5.12
14	-2.333	1.524	5.42	8.30
15	.667	1.858	6.60	5.12

Table 7.6b: Element total and SS (Case Study 4).

Component	Root	As %	Theory
1	8.2727	29.41	38.69
2	6.5234	23.19	27.17
3	5.2025	18.49	14.26
4	3.2045	11.39	9.23
5	2.1868	7.77	5.06
6	1.6385	5.82	3.79
7	.8245	2.93	1.80
8	.2805	1.00	

Table 7.6c: PCA for Case Study 4.

Element	Component 1 Loading		Component 2 Loading	
1	**.8799**		.7012	
2	**.7906**		**-1.0992**	
3	.3621		-.1283	
4	.5203		-.4513	
5	.6145		-.5931	
6	-.5465		-.6954	
7	**-.9159**	*	-.3865	
8	**-.9914**	*	-.5797	
9	-.7261		.7147	
10	**1.0888**	*	-.3806	
11	**-1.0274**		.2748	
12	-.6968		-.0907	
13	.7070		**.9286**	*
14	-.3598		.6845	
15	.3008		**1.1010**	*
Construct				
Situation	**1.7043**		.0809	
Problem	.3917		**-.9296**	
Solution	**-1.1682**	*	.4402	
Evaluation	-.3207		**1.6891**	*
5	.2801		**-1.0741**	
6	**1.3641**		.5427	
7	**-1.2493**		**-.9057**	
8	.4973		-.5808	

Table 7.6d: PCA matrix of loading for Case Study 4.

to the **Problem-Construct 5** pole while Clauses 13 "*The charge weighed about one-and-a-half tons* " and 15 "*At low altitudes freight can be dropped without a parachute* " are associated with the **Evaluation-Construct 7** pole.

Agreement with the component loadings in the theoretical grid in Table 7.6d is rather scattered and does not indicate an extent of agreement that may be of great relevance.

7.4.5.d Case 4 appears to be rather different from the previous three in that his perception of the text is not particularly focused on any specific constructs or elements. This is apparent from the three descriptive statistics reported in (Table 7.6a&b), the overall principal component pattern (Table 7.6c) and the element and construct loading matrix (Table 7.6d). Unlike the other three cases, the two components are very balanced in prominence.

Construct 7 has a rather interesting status. It is labelled '*The sentence* (*i.e.* the target sentence) *is the main idea of them* ' and is loaded high in both components, exhibiting, however, different patterns of relationship in each. It is contrasted with Construct 6 in Component 1 in terms of signalling in the text and is on the Solution pole, while it is contrasted with Construct 5 in Component 2 where it is grouped under the Problem pole. The pattern of relationship is more intriguing because Problem also loads high in both components but is related to Construct 7 differently in both. It is on the opposite pole to Construct 7 in Component 1, but is on the same pole in Component 2. The possible explanations of such a pattern of relationship are complex and may not be discoverable using only **INGRID** results. What **INGRID** is able to do is to pinpoint an area in the subject's construct system worthy of more in-depth investigation. In such a case, a face-to-face interview may be in order to find out possible explanations. In general terms, two possible explanations can be conjectured. The subject may have difficulty in formulating the precise meaning of the construct; or his perception of it is indeed complex. The subject's label for Construct 7 *'main idea'* is very general and can be applicable in a number of semantic as well as textual environments.

From the pattern of loading of Preview and Voc.3 in both components in the theoretical grid and that of Construct 5 and 8 in the subject grid, it can be seen that there is little agreement between the two grids. Consequently, it can be deduced that the perception of the two constructs concerned is rather different from that in the theoretical grid.

7.4.6 Case 5

7.4.6.a Case 5 (*Sci Comp Mod S Lb*) is a *Science* student reading the *Computer* text with the *Standard* mode of construct elicitation. She is rated *Low* on the reading test.

Her construct definitions are as follows

C 5 *Senetnces 10 & 8 are question, but sentence 7 is not. (Target clause: 7)*
C 6 *Sentence 6 is not a complete sentence. (Target clause: 6)*
C 7 *Sentence 13 & 5 give us more information. (Target clause: 1)*
C 8 *Sentences 9 & 4 are asking for further information. (Target clause: 12)*

Of the four clauses picked, those for Constructs 5 and 8 are on target. From the labelling of the constructs it can be seen that Preview can be considered correctly identified; Constructs 6 and 7 are grammar oriented; and Construct 8 discourse pattern oriented.

7.4.6.b In Table 7.7a (Construct means and SS), the distribution of construct means shows a most prominent *Situation* with a mean of .615 followed by *Problem* with a mean of .308. The other constructs have very low means with *Construct 7* having a mean of .154 and the rest having .077.

Construct	Mean	SS	As %	Theory
Situation	.615	3.0769	25.32	20.59
Problem	.308	2.7692	22.78	5.88
Solution	.077	.9231	7.59	19.61
Evaluation	.077	.9231	7.59	5.88
5	.077	.9231	7.59	10.78
6	.077	.9231	7.59	20.59
7	.154	1.6923	13.92	5.88
8	.077	.9231	7.59	10.78

Table 7.7a: Construct mean and var. (Case Study 5).

Element	Total Deviation	SS	As %	Theory
1	.538	.988	8.13	14.37
2	.538	.988	8.13	4.56
3	-.462	.296	2.43	4.56
4	-.462	.296	2.43	9.46
5	-.462	.296	2.43	14.37
6	.538	1.142	9.40	5.05
7	.538	1.142	9.40	9.95
8	-.462	.911	7.50	6.03
9	-.462	.911	7.50	6.03
10	-.462	.911	7.50	6.03
11	.538	1.757	14.46	6.03
12	.538	2.219	18.26	9.46
13	-.462	.296	2.43	4.07

Table 7.7b: Element total and SS (Case Study 5).

Distribution of sums of squares follows the same line with *Situation* on top with 25.32%, followed by *Problem* with 22.78%. *Construct 7* is some distance below with 13.92%. The lowest group comprises *Solution*, *Evaluation* , *Constructs 5, 6* and *8* with 7.59% for all. Such a distribution shows considerable difference to that in the theoretical grid. The constructs of Problem, Solution, Construct 6 and 7 have very different construct sums of squares from the theoretical grid.

The distribution of sums of squares in Table 7.7b (Element deviations from construct means and SS) has three distinct groups. The highest group in terms of percentage of overall sums of squares consists of Clause 11 "*How capacity can be optimised through control of manufacturing resources* " (14.46%) and 12 "*The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry* " (18.26%). The next highest group includes Clauses 1 "*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group* " and 2 "*The seminar ... will follow the Institution's policy of featuring speakers with practical experience* " (8.13%), 6 "*which will include demonstrations of equipment* " and 7 "*Discussions will centre on four concurrent streams* " (9.40%). Clauses 8 to 10 - the wh-clause set has a mean of 7.50%. The lowest group includes Clauses 3 "*to be held on 26/27 June at the Birmingham Metropole Hotel, National Exhibition Centre* " to 5 "*Furthernore, time will be made available for delegates to see the associated exhibition* " and 13 "*Further details are now available from the Conference Secretary, Rochester House* " (2.43%). The pattern of distribution just described suggests that the subject has a rather blinkered view on text structure. A comparison with the distribution of element sums of squares in the theoretical grid shows different values between the two in Clauses 1, 5, 11 and 12.

7.4.6.c Results in Table 7.7c (Principal component analysis) reveal a prominent Component 1 with 48.76% of total covariance and a moderate Component 2 with 19.13%. The pattern is very close to the one in the theoretical grid.

Component 1 in Table 7.7d (Component loadings) contains the contrast between *Situation* and *Problem* with *Clauses 8* to *11* (the, by now, familiar wh-clause set) associated with Problem pole. Clauses associated with Situation pole are very evenly and moderately spread across *Clauses 1* to *7* .

In terms of agreement with the theoretical grid, there is only one construct, *i.e.* Situation, loading high in both. The elements are again split into two near consecutive sets with the exception of Clause 13.

Component 2 includes a link between *Evaluation* and *Voc. 3* signalling. The element associated with this component is Clause 12 "*The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry* ". An agreement in high loading between this subject and the theoretical grid is found in Construct 8 (Voc.3) in this component.

7.4.6.d Case 5 shows an individual with highly focused perception. Her construing is directed to a small number of constructs and elements. This is clear from the loading pattern in both components in the matrix. There is, however, a common feature between Case 5 and other cases just examined. Like other subjects studied, Case 5 also splits the clauses into two consecutive groups in Component 1 with Clauses 1 to 7 associated with Situation and Clauses 8 to 12 with Problem. Clause 13 is associated with Situation, which can be taken as an indication that the subject genuinely rates the clauses as she perceives them and does not just follow a response

Component	Root	As %	Theory
1	5.9261	48.76	52.29
2	2.3251	19.13	17.63
3	1.6019	13.18	13.04
4	1.0000	8.23	8.50
5	.7194	5.92	4.29
6	.5813	4.78	2.42

Table 7.7c: PCA for Case Study 5.

Element	Component 1 Loading		Component 2 Loading	
1	-.6645		-.1704	
2	-.6645		-.1704	
3	-.4402		-.0238	
4	-.4402		-.0238	
5	-.4402		-.0238	
6	-.5296		-.0418	
7	-.5296		-.0418	
8	**.8938**	*	-.1911	
9	**.8938**	*	-.1911	
10	**.8938**	*	-.1911	
11	**1.0753**	*	-.3353	
12	.3923		**1.4281**	
13	-.4402		-.0238	
Construct				
Situation	**-1.7044**	*	-.3408	
Problem	**1.5432**		-.5958	
Solution	.4417		-.2199	
Evaluation	.1611		**.9365**	
5	-.2175		-.0274	
6	-.2175		-.0274	
7	-.5459		-.2235	
8	.1611		**.9365**	*

Table 7.7d: PCA matrix of loading for Case Study 5.

set. It can also be observed yet again that the set of the four wh-clauses in the Computer text are singled out as a distinct group of clauses.

Component 2 is a very interesting example. The subject focuses on Evaluation and relates Clause 12 to it. This is in complete agreement with the theoretical grid.

Case 5 is interesting in that it reveals an approach of perception through focusing on just a few constructs and elements. This is all the more interesting because she was able to pick up the Evaluation section found in the Computer text only in Clause 12.

7.4.7 Observations

The amount of statistics and information presented in the case studies are extremely large and complex. Consequently, there is a need to provide comments of a general nature regarding the five cases sampled. From the five cases examined a number of interesting features emerge. Firstly, as has been noted, there is a tendency, in all subjects but Case 4, to split the element loadings in Component 1 in the principal component matrix into two groups with opposite signs, which are sequentially arranged. The subjects studied tend, therefore, to split the text initially into two consecutive groups of elements. The main point of interest is in the consecutive nature of the split because it indicates a tendency of the subjects to construe text structure in terms of a binary opposition as its most distinctive feature. If such a tendency is highly general, it would be an aspect of reading behaviour that can be further investigated. This is also an example of how repertory grid analysis can be applied in the research of reading behaviour.

Another clear pattern of results from the principal component analysis is certainly the set of the four wh-clauses in the Computer text (Clauses 8 to 11). This set was identified as a chunk by all the subjects reading the Computer text (Cases 1, 3 and 5). In all cases too, Clause 7 is contrasted with the four wh-clauses of which it is the Preview. The results seem to confirm the function of *Repetition* (lexical or grammatical), which is one of the major signalling devices in the Winter-Hoey model (Hoey 1983, p.24). In addition, the possibility of capturing the impact of particular text signalling devices on readers suggests that the way is now open to investigate experimentally and statistically the ways signalling devices function within the text. This would certainly mean considerable advances for text analysis and is particularly important because it is language behaviour based rather than purely abstract theory based.

The major conclusion is then that, through principal component analysis in **INGRID** particular dimensions in the subjects' construct system are identified, which would enable a refined understanding of the subjects' construing. Furthermore, unexpected patterns of relationship within the data can also be uncovered. This would be invaluable for exploratory research in individual perception. The use of repertory grid analysis for the study of individual perception of text structure seems, therefore, based on rather solid grounds. It can, thus, be employed with some confidence for the linguistic validation planned. Furthermore, the results from the case studies suggest that reader style information can now be captured with the use of repertory grid analysis and become methodologically studiable. The potential seems now unlocked for future research into text organization and reading behaviour, which would be firmly based on genuine reading behaviour and which can be made to vary through careful experimental planning and choice of texts, which is not an insignificant advance for applied lingusitic research.

7.5 *Qualitative Analysis*

7.5.1 Introduction

The relevance of qualitative analysis to the study of human perception and the amenability of repertory grid analysis to qualitative analysis have been alluded to in 4.4. However, it may be beyond the scope of the present study and may not do qualitative research justice to aim at performing a full fledged qualitative analysis with the data on hand, which alone would constitute a piece of research in its own right. The qualitative analysis presented, therefore, is rather informal and tentative; it serves principally as an illustration of the potential of repertory grid anlaysis for such analysis. Here too, it is the methodological implications rather than the actual findings that are important.

For the reasons suggested above, the scope of the analysis is primarily focused on the five cases just investigated.

The qualitative analysis to be used consists of the triangulation of three sources of data: *a* - the results from **INGRID** and principally the construct means and sums of squares; *b* - the construct definitions given by the subjects; and *c* - the recalled summary of the subjects. Of the three sources of data, the first two are directly from the elicited grids while the recalled summary is that part in the experimental procedure which does not form part of the standard procedure for grid elicitation. The three sources of data can be triangulated because they all relate to the same aspect of the data - perception of text structure by the subjects. The **INGRID** results represent what is statistically identifiable; the construct definitions represent what the subjects are able to verbalize regarding constructs for text structure patterning; the recalled summary can be taken to represent the internalization of text structure by a subject, since it is derived from the constructs perceived by the subjects as salient. This is certainly a rather generalized assumption with only a prima facie basis. However, recalled summary is a fairly commonly used source of data for the study of the reading behaviour and the structure of texts. The psycholinguistic basis of its use has been upheld by some scholars (*e.g.* Gomulicki 1956, Kintsch *et al.* 1974, Meyer 1971, 1975, Dawes 1966, Frederiksen 1972, Crothers 1972, 1973). There is, it must be admitted, no unquestionable guarantee that the recalled summary is derived only from salient constructs. There may well be other factors, *e.g.* rote memory, which may influence, to a certain extent, the kind of recalled summary generated. There is also a possible factor of how the subjects perceive the task of the summary writing that would influence the outcome. Thus taking the recalled summary as a record of the salient constructs perceived by the subjects has to be interpreted with the cautions just mentioned.

The triangulation in this analysis consists of comparing and contrasting the three sources of data to fill in details on aspects of subject perception not obtainable from the **INGRID** results and to identify discrepancies in the data so that a less biased view can be obtained.

From the results obtained so far there are a number of questions which, it is hoped, the qualitative analysis will be able to throw light on. The first is to examine whether prominence of some of the text pattern constructs in the grids is observable also in the recalled summaries. Second, the question of whether the relative explicitness of text structure in the two texts would correspond to relative explicitness of text structure in the recalled summaries. Finally, an investigation would be made on whether prominence of text signalling constructs in the grid and the ability to explictly verbalize the text signalling devices in the construct definitions have any bearing on the recalled summaries.

7.5.2 Case 1

The construct means and variations in Table 7.3a reveal the prominence of the constructs *Situation*, *Problem* and *Construct 5* which can be labelled as relating to *Preview* . This can be deduced from the target clause (Clause 7 "*Discussions will centre on four concurrent streams* ") picked up by the subject. This is also the intended target clause. The construct definition given for this construct is " *more boardened (sic) and no specification* ", which can be interpreted as indicating Preview.

On the other hand *Construct 6* to *8* are all expressed in discourse pattern oriented terms (See 7.4.2.1.), even though Construct 8 has the target clauses correctly identified.

An analysis of the recalled summary (see end of section) reveals that *Sentences 1* and *2* in the summary are related to the Situation section in the original, the first constituent clause in *Sentence 3* is related to **Evaluation** and *Sentence 2* to **Preview.** The latter was re-interpreted by the subject and expressed as a subordinate clause: "*... as it concentrates on four concurrent streams* ". The four wh-clauses in the Computer text, which constitute the **Details** signalled by the **Preview**, are summarized by *Sentence 4* . This could be interpreted as an implicit **Problem** section the expression "*... to optimise your capacity..*". in Sentence 4 is taken to signal Problem. This is plausible if the loadings of the four wh-clauses in Component 1 in the principal component matrix are taken into consideration (see Table 7.3b). The last sentence is also the last sentence in the original text.

From the above analysis, it can be observed that Situation and Preview, which are prominent in the grid, are also found in the recalled summary, with the possible inclusion of Problem as well. Evaluation, which is not prominent in the grid, was recalled. From such results it can be stated that the constructs that are prominent in the quantitative analysis, also appear in the recalled summary, indicating thus a rather close correspondence. As far as text signalling devices are concerned, there are two instances of *Voc.3* signals present in the summary. The first is the signal for Evaluation: "*It will have a great help...*" Sentence 3; and the second is the signal for Problem already alluded to in Sentence 4.

> *A two-day's seminar will be held by a company about the computerisation on the manufacturing management. It will be held on 26/27 June. It will have a great help in the promotion of computerisation in the manufacturing management as it concentrates on four concurrent streams. All of them tell you how to use your present materials with the computer to optimise your capacity. For further information, you can go to a specific place.*

Recalled summary of Subject No.1

7.5.3 Case 2

The construct means and variations in Table 7.4a show a rather balanced pattern for all the constructs except, perhaps, that of *Preview*, which is not prominent in the theoretical grid anyway. Since the subject was given the Laddering mode for construct elicitation, the definitions of the constructs were not elicited through the triads, but reflected the subject's own view. The subject gave three constructs. Construct 6 was labelled Verbs and Construct 7 Nouns. These are then parts of speech oriented constructs. Construct 8 was not defined but given examples from expressions in the text: "*for, has to be, can* ". It may not be possible to classify this construct.

In the recalled summary, *Sentence 1* relates to the **Situation** in the original Helicopter text. *Sentence 2* is the **Problem** section signalled by the expression "*However* ". *Sentence 3* is the **Solution** section, which is signalled with the expression "*To avoid these problems* ", which is very close to the original text. *Sentences 4 & 5* constitute the **Evaluation** section.

The structure of the recalled summary and the signalling devices employed are certainly very interesting data, and, like Case 1, a close match is found between the prominence of constructs as indicated by the quantitative analysis and the qualitative data.

> *Helicopter is very convenient for dropping the freight from above. However, it has its problems of lending because sometimes the freight are bounced or may be turned over. To avoid these problems, a person has invented a platform of baloons which can provide a soft landing surface. Trials have been carried out to see that this method can be use for dropping the freight of lower weight from above. If it is not too high above the ground a parachute and not be need.*

Recalled summary of subject No.2.

7.5.4 Case 3

The construct means and SS in Table 7.5a indicate the prominence of *Situation, Problem, Evaluation* and *Construct 6 & 7*. This subject was also given the Laddering mode. The construct definitions extracted are "*Action* " for Construct 6. A clear Voc.2 examples were given for Construct 7 and a Voc.3 label "*Connective e.g. Furthermore* " was given for Construct 8. The subject produced a very brief (four sentence) summary. The *first three* belong to the **Situation** section and the *last* sentence relates to **Preview** in the original Computer text. The implicit **Problem** section is found in *Sentence 1* (*i.e.* "*Effective use* ") but is difficult to tell whether this is merely reproduced from memory.

Overall, therefore, Case 3 shows rather clear perception of the constructs but fails to record them in the recalled summary. This may be due, perhaps, to poor memory.

> *A seminar of the effective computer on management is held. the speakers come from company of different size and product. An associated exhibition is held which include demonstration of equipment. The seminar centre on four areas.*

Recalled summary of subject No.3

7.5.5 Case 4

Results in Table 7.6a present a very balanced distribution of construct means and SS, showing the subject's ability to distinguish among the constructs. The four elicited constructs are divided into two groups with Constructs 5 and 7 being discourse oriented while Constructs 6 and 8 content oriented. Constructs 5 and 8 have also the target clause correctly identified. The recalled summary of this subject shows several very interesting features. It has a good number of points from the original text included, although, the way the points are sequenced is quite unlike the original. The structure of the summary, however, still keeps the Problem-Solution Pattern with *Sentences 1* to *3* expressing **Situation**; *Sentences 4* to *6* **Problem**; *Sentence 7* **Solution** and *Sentences 8* & *9* **Evaluation.**

The four text pattern constructs again appear in the recalled summary. This subject is particularly interesting because there is little chance that the recalled summary could have been written from rote memory. The text pattern constructs must have some psychological reality for the subject. Another interesting feature in the recalled summary is the appearance of a number of *Voc.2* (*e.g.* "*However* " in Sentence 5) and *Voc.3* (*e.g.* "*In order to prevent damage* " in Sentence 4) in the summary, even though there is no text signalling construct identified as such among the construct definitions.

> *Air-freight is a method of transporting to long distance away. Helicopter is the medium for transportation. At the desired location, freight is dropped to the load surface. In order to prevent damage, parachute is used and landing systems are prepared. However, the spring loading system will also turn the load over. It is one of the problems. scientists are invented a new method for landing, a platform, underneath placed is a lot of ballons which filled with air, can act as a air-cushioning effect to prevent the brokege of load. At a suitable height and wind speed, the load can drop to the surface without damage, even if no parachute is used. The method is under testing process. It is the solution to the landing problem.*

Recalled summary of subject No.4.

7.5.6 Case 5

From the construct means and sums of squares in Table 7.7a it can be observed that the subject focuses on three constructs: *Situation* , *Problem* and *Construct 7* . As far as construct definitions are concerned (See 7.4.6.a.), Preview can be considered as identified; Construct 6 and 7 are labelled in grammar oriented terms while Construct 8 in discourse oriented terms. Constructs with target clause correctly picked are Constructs 5 and 8. The elicited constructs, then, are not labelled as text signalling constructs.

The recalled summary has *Sentences 1* to *3* as the Situation section. Then, *Sentence 4* expresses **Preview**. *Sentences 5* to *8* form the **Detail** section. *Sentence 9* is the **Evaluation** section. The last sentence is a paraphrase of the last sentence of the original text. There is, however, no Problem section and, consequently, the Solution section in the original is not expressed as such in the summary, which focuses rather on the Preview-Detail pattern.

It is interesting to note the way the Preview-Detail section is structured in the recalled summary. Like in the original text, the Details are in the form of four parallel structures. However, instead of keeping the Voc.1 signals in the original, the subject uses Voc.2 signals (*i.e.* "*Firstly* ", "*Secondly* "). Another example of the subject's use of her own signal rather than using what is in the original text is in the Evaluation section (Sentence 9) where the Voc.3 signal "*...will lead to interest of ...* " instead of the original Voc.3 signal "*... will certainly be of of great help...* ". This may be regarded as an interesting individual characteristic of the subject concerned.

> *There will be a seminar about the promotion of computerisation in industry at Metropole Hotel. There will be also an exhibition for the people who are selected from companies of varying sizes and products. Demonstrations will be held for these people. The seminar includes four major streams: Firstly, it will discuss the interaction between design and production. Secondly, it will discuss the planning of the production resources. Thirdly, it will discussed the control of the production resources. Finally, it discusses the promotion of computerisation in industry. The seminar and exhibition will lead to interest of computerisation in this field. Further details are available.*

Recalled summary of subject No.5.

7.5.7 Observations

7.5.7.a Several salient points emerge from the analysis so far. In the first place, of the two types of constructs (*i.e.* discourse pattern constructs and text signalling constructs) discourse patterning, especially the four Problem-Solution discourse pattern constructs feature most prominently in the subjects' construct system. In the recalled summaries, only one out of the five cases examined (*i.e.* Case 3) does not include all the four Problem-Solution pattern constructs. The absence of Solution in Case 1, as already been pointed out, may be due to its low profile in the original text. Construct definitions are by and large put in discourse pattern oriented terms even though there are also definitions in text content oriented and grammar oriented terms. In contrast, text signalling constructs do not have the same degree of prominence in either recalled summaries or construct definitions. The two cases (Cases 2 and 3) where the three vocabularies are featured, involve cases which belong to the Laddering mode of construct elicitation. It needs to be recalled that, during the experimental sessions in the Laddering mode, the subjects were told that the three constructs to be elicited have to do with signalling devices, even though the instructions were given in very general terms.

7.5.7.b A related problem is that of the status of the text signalling constructs. These do not feature too prominently in the construct definitions and the recalled summaries. However, this cannot be taken to mean that the three text signalling constructs lack psychological reality, for, while prominence may indicate psychological reality, the reverse is not necessarily true, particularly in the case of the recalled summary. The failure of the three text signalling constructs to appear in the summaries could be due to many reasons, since the summaries are to a large extent free writing on the part of the subjects with no control or direction from the experimenter. It should be understood that, while the four discourse pattern constructs cannot be easily altered in the comprehension and the recall phase, the three text signalling constructs, being signals of discourse pattern, are, by definition, interchangeable and there is no guarantee that the subjects need to produce the same signalling devices as the original texts.

7.5.7.c There is also a text structure explicitness dimension. Of the five recalled summaries, the two relating to the *Helicopter* text have all the four text pattern constructs included; the text structure of the recalled summaries relating to the *Computer* text is not as clear and exhibit more variation. This may be taken to show that an explicit text structure facilitates recall possibly by virtue of its clarity in text structure, which would in turn make the semantic structuring of the text so much more easily to construct than a text with less explicit text structure.

7.5.7.d From the correspondence between explicitness of text structure and the structure of the recalled summaries discussed above, an answer can be given in the affirmative to the question whether the recalled summaries include the salient points of the subjects' understanding of the texts. Two further pieces of evidence are also found in the present qualitative analysis. Firstly, in the recalled summaries relating to the *Computer* text, the section that is present in all recalled summaries is Preview with or without the accompanying Details section. This is very significant to the present discussion because the Preview-Details section with the very prominent set of four wh-clauses is prominent in all principal component loading matrices and in the element sums of squares tables. This is, therefore, an undeniably salient feature of the text and is found in all recalled summaries albeit with some variations. Secondly, the rather individualized structure of the recalled summaries for Cases 4 and 5 show that the subjects did rely on internalized semantic structure of the text rather than rote memory in writing the summaries.

Such results suggest, then, that repertory grid analysis can be used in investigating the question of recall of prose in a way which is quite unlike those being used in the past and which appears to be very fruitful and interesting.

Indeed, there seem to be very wide ways of application of repertory grid analysis in applied linguistic research. In particular, language use data, once so elusive, can now be quantified and studied in their genuine forms with little or no artificial experimental controls. Furthermore, a combination of quantitative and qualitative approach to the analysis of the data as has been done in the present study proves to be beneficial and mutually enhancing for both methods of behavioural research.

CHAPTER EIGHT

RESULTS 2 - Theoretical & Subject Grid Agreement

8.1 *Introduction*

The main aim of Chapter Eight is to investigate the extent of agreement between the theoretical grids and the subject grids. The establishment of such an agreement constitutes the most important investigation in the quantitative validation of the text analysis approach being examined, and is, therefore, central to the thesis. The following aspects will be examined:

a the agreement between the theoretical grids and the subject grids;

b the agreement between the theoretical grids and the consensus grids derived from the subject grids; and

c factors affecting such agreement.

8.2 *Theoretical grid and subject grid agreement*

8.2.1 Matching the constructs

Before reporting the results of the analyses, there is a need to establish how the constructs are matched between the theoretical grids and their corresponding subject grids. For the supplied constructs, there is certainly no problem. For example, the first construct in the theoretical grid and in any subject grid should both be Situation. Matching can also be assumed for the elicited constructs in the Standard mode since the triads for elicitation are so chosen that the subjects are directed to the identification of the constructs concerned. Thus, Voc.1, which is the sixth construct in the theoretical grid should also correspond to the sixth construct in the subject grids in the Standard mode, since the three clauses for elicitation were chosen to focus on Voc.1 signalling.

Construct matching is not so straighforward for the elicited constructs in the Laddering mode. The difficulty is due particularly to the fact that the subjects had complete freedom in labelling the constructs in terms of both number and order, giving rise to *a* - gaps in the elicited segment of the grid and *b* - dissimilar ordering of the constructs. Some of the definitions given to Construct 6 for the Helicopter text in the Laddering mode are "*Verb* ", "*but, as, by* " and "*Noun* ". (See Appendix 12 for a complete list of construct definitions by the subjects.) In cases where subjects gave fewer than three definitions, it was not necessary that they refered to Voc.1 when they fill in the slot in the *Construct Definition Table* for Construct 6. For example, the subject *Sci Comp Mod L Hb* gave the following two construct definitions: "*noun e.g. two day seminar* " for Construct 6 and "*a kind of action, e.g. in being organised* " for Construct 7. (See Appendix 12.) The solution adopted for matching these constructs is to examine the labelling and the sample expression(s) of the elicited constructs, which the subjects included along with the construct labels, to determine the existence of a match with one of the vocabularies. If found, the construct was linked to the correspondent construct in the theoretical grid. For example, the subject *Bus Heli Mod L La* had as label for Construct 8 the following "*Adverb: Unfortunately, sometimes*". This construct is then linked to Voc.2 (Construct 7) in the theoretical grid. Whatever constructs that are either not labelled or unmatched are considered missing.

8.2.2 Indices of agreement between constructs: Correlation and Angular distances

Once the constructs are matched, the next issue is to decide how indices of agreement can be calculated. The basic index is the corrrelation coefficient which is computed between the matched constructs in the paired grid consisting of the theoretical grid and a subject grid. The forty-eight paired grids were analysed using **INGRID** and the correlations between matched constructs can be obtained from the table *Correlations and Angular Distances between Constructs*[1] which is part of the **INGRID** output.

The correlation, therefore, is an indication of the agreement between a construct in the theoretical grid (say Problem) and the matched construct in the subject grid. It provides one of the major units for comparison of the grids. A second index which is used is the angular distance. This is the angle the cosine of which corresponds to the value of a correlation coefficient, and can, in effect, be considered as a

1 See Appendix 11 Table 11.Hc, for a specimen.

transformation of exactly the same information contained in the correlation coefficient. A correlation of **1**, for example, can, by consulting the table of Trigonometric Functions (found in nearly all statistics books), be converted to an angular distance of *0* (*i.e.* the angle whose cosine gives the value of 1). Similarly, a correlation of **.50** would have an angular distance of *60* and a correlation of **0** would give an angular distance of *90* . Negative correlations would give even larger angular distances. It may first appear rather artificial and far-fetched to refer to the angular distances instead of the most commonly used correlation coefficients, particularly because, in some ways, the angular distance is simply a transformed version of the correlation coefficient. However, there are justifications for such a form of representation especially where repertory grid analysis is concerned. First, it is used extensively as part of the standard output of **INGRID**, and this fact alone, given the way in which this study is basically investigating the use of repertory grid techniques for applied linguistic research, is very important. A second and more specific reason for using the angular distance measure is that it has been argued (*e.g.* Ferguson 1976, p.134 and Slater 1977, Ch.8) that where large numbers of correlations are concerned, and where it is necessary to obtained some measure of the typical correlation, the mean angular distance is a more dependable measure than a mean of a series of correlations, because of the mathematical properties of angular distances.

8.2.3 Statistics on construct correlations & angular distances: Introductory remarks

The *Correlations and Angular Distances between Constructs* for the matched constructs in the forty-eight paired grids are reported in Table 8.1 below. The labels for the columns in Table 8.1 are as follows. Column 1 (SS Code) stands for the subject code assigned to each subject. It is

SS Code	C1-R	C1-Ang	C2-R	C2-Ang	C3-R	C3-Ang	C4-R	C4-Ang	C5-R	C5-Ang	C6-R	C6-Ang	C7-R	C7-Ang	C8-R	C8-Ang	Ang Mean
B H S H	0.25	75.5	0.71	45.0	0.56	56.3	0.08	85.7	0.68	47.0	0.44	63.7	0.21	78.1	-0.08	94.6	68.24
B H S H	-0.33	109.1	0.56	56.3	0.35	69.3	-0.24	103.7	0.44	63.7	-0.11	96.1	0.66	48.8	0.29	73.2	77.53
B H S M	0.11	84.0	0.85	31.5	0.56	56.3	-0.30	107.6	0.33	70.9	0.44	63.7	-0.11	96.1	-0.12	97.1	75.90
B H S M	0.25	75.5	0.85	31.5	0.71	45.0					-0.16	99.3	0.44	63.7	0.22	77.4	65.40
B H S L	-0.13	97.7	0.71	45.0	0.85	31.5	1.00	0.0	0.68	47.0	0.08	85.7	0.83	34.0	-0.12	97.1	54.75
B H S L	0.54	57.7	0.85	31.5	0.85	31.5	0.85	21.5	-0.19	100.9	-0.21	102.3	0.45	63.1	0.17	80.4	61.11
S H S H	-0.16	99.3	0.71	45.0	0.53	57.8	0.32	71.4	-0.16	99.3	-0.30	107.6	0.08	85.7	0.07	86.1	81.53
S H S H	1.00	0.0	0.56	56.3	0.38	67.8	0.56	55.7	-0.17	99.3	0.44	63.7	-0.26	105.2	-0.08	94.6	67.83
S H S M	0.29	73.4	0.85	31.5	0.70	45.6	0.64	49.9	0.38	67.8	-0.04	92.3	0.26	74.8	0.11	83.6	64.86
S H S M	0.29	73.4	0.85	31.5	0.53	57.8	0.43	64.5	0.33	70.9	0.08	85.7	0.45	63.1	-0.06	93.1	67.50
S H S L	0.16	80.7	0.56	56.3	0.38	67.8	-0.16.	99.3	-0.13	97.7	-0.04	92.3	0.08	85.7	-0.08	94.6	84.30
S H S L	0.22	77.4	0.71	45.0	0.71	45.0	0.64	49.9	-0.16	99.3	0.21	77.7	-0.04	92.3	-0.33	109.1	74.46
B H L H	0.38	67.8	0.85	31.5	0.35	69.3	0.44	63.7	-0.13	97.7			0.12	82.9	0.33	70.9	69.11
B H L H	0.19	79.1	0.85	31.5	0.85	31.5	0.21	77.7	-0.13	97.7					0.60	53.1	61.77
B H L M	0.25	75.5	0.56	56.3	0.56	56.3	0.21	78.1	0.54	57.7			0.21	77.7	0.07	86.1	69.67
B H L M	0.33	70.9	0.71	45.0	0.53	57.8	0.66	48.8	0.54	57.7							56.04
B H L L	0.19	79.1	0.85	31.5	0.56	56.3	0.43	64.8	-0.13	97.7			0.65	49.4	0.00	90.0	66.97
B H L L	1.00	0.0	1.00	0.0	0.71	45.0	0.74	42.4									21.85
S H L H	0.16	80.7	0.85	31.5	0.70	45.6	0.56	55.7	-0.19	100.9					0.43	64.5	63.15
S H L H	0.44	63.7	0.71	45.0	0.38	67.8	0.34	70.0	-0.07	94.1			0.08	85.7	0.58	54.7	68.71
S H L M	0.25	75.5	0.85	31.5	0.14	82.0			0.38	67.8	0.43	64.5			0.00	90.0	68.55
S H L M	0.13	82.3	0.71	45.0	0.56	56.3	0.21	77.7	-0.13	97.7			0.08	85.7			74.12
S H L L	0.29	73.4	0.85	31.5	0.85	31.5	0.65	49.4	-0.07	94.1							55.98
S H L L	0.54	57.7	0.71	45.0	0.87	30.0	1.00	0.0	-0.07	94.1			0.11	83.9			51.78
B C S H	0.69	46.3	0.31	71.8	0.68	47.6	0.68	47.4	0.68	47.4	1.00	0.0	-0.12	97.1	0.12	82.9	55.06
B C S H	-0.14	98.1	0.36	68.6	-0.53	121.8	1.00	0.0	0.18	79.8	0.54	57.5	0.23	76.8	0.40	66.8	71.18
B C S M	0.55	56.8	-0.19	101.1	-0.62	128.7	1.00	0.0	0.68	47.4	0.72	43.9	0.23	76.8	0.12	82.9	67.20
B C S M	0.27	74.5	-0.23	103.2	0.10	84.4	0.68	47.4	0.46	62.6	0.22	77.0	-0.23	103.2	0.12	82.9	79.40
B C S L	0.69	46.3	-0.19	101.1	-0.34	109.7	1.00	0.0	0.64	50.2	0.31	71.8	-0.08	94.8	0.12	82.9	69.60
B C S L	0.72	43.9	-0.23	103.2	-0.23	103.2	-0.16	99.1	0.27	74.2	0.85	31.4	-0.19	101.1	0.12	82.9	79.88
S C S H	0.59	53.7	-0.08	94.8	0.68	47.6	0.53	58.2	0.46	62.6	0.54	57.5	-0.12	97.1	0.18	79.5	68.88
S C S H	0.55	56.8	-0.23	103.2	-0.62	128.7	0.27	74.5	0.03	88.1	0.72	43.9	0.53	58.2	0.34	70.3	77.96
S C S M	0.86	31.0	-0.19	101.1	-0.23	103.2	1.00	0.0	0.40	66.8	0.72	43.9	-0.08	94.8	0.12	82.9	65.46
S C S M	0.24	76.2	-0.19	101.1	-0.34	109.7	0.43	64.3	-0.28	106.5	0.86	31.0	0.53	58.2	-0.03	91.9	79.86
S C S L	0.59	53.7	-0.08	94.8	0.42	65.5	0.68	47.4	0.68	47.4	0.72	43.9	-0.23	103.2	-0.68	132.6	73.56
S C S L	0.73	43.0	-0.19	101.1	0.36	68.6	1.00	0.0	0.68	47.4	0.31	71.8	-0.12	97.1	0.12	82.9	63.99
B C L H	0.86	31.0	-0.19	101.1	-0.43	115.7	0.43	64.3	0.78	38.9	0.72	43.9					65.82
B C L H	0.03	88.1	-0.27	105.5	-0.34	109.7	1.00	0.0	0.72	43.9			0.12	82.9			71.68
B C L M	0.54	57.5	-0.19	101.1	-0.23	103.2	1.00	0.0	0.18	79.8	0.72	43.9					64.25
B C L M	0.86	31.0	-0.19	101.1	-0.22	102.7	1.00	0.0	0.78	38.9	0.72	43.9					52.93
B C L L	0.85	31.4	-0.19	101.1	-0.42	114.5	1.00	0.0	-0.23	103.5	0.72	43.9			-0.27	105.8	71.46
B C L L	0.38	67.6	-0.12	97.1	0.54	57.4	1.00	0.0	0.41	65.8	0.72	43.9			-0.40	113.2	63.57
S C L H	0.54	57.5	1.00	0.0	0.54	57.5	0.68	47.4	0.18	79.8							48.44
S C L H	0.55	56.8	0.36	68.6	-0.23	103.2	-0.36	111.4	1.00	0.0	0.72	43.9			-1.00	180.0	80.56
S C L M	1.00	0.0	0.31	71.8	-0.34	109.7	0.36	68.6	-0.12	97.1	0.72	43.9					65.18
S C L M	-0.22	102.7	-0.08	94.8	0.30	72.5	0.68	47.4	0.54	57.4	0.72	43.9					69.78
S C L L	-0.10	95.6	-0.23	103.2	-0.43	115.7	-0.27	105.5	0.27	74.2							98.84
S C L L	0.22	77.3	-0.08	94.8	-0.30	107.5	-0.16	99.1	0.27	74.2	0.38	67.6					86.75
Mean		64.30		64.94		73.94		50.42		72.93		61.38		80.55		88.55	67.97
r(circa)		.43		.42		.28		.63		.29		.48		.16		.025	.37
SD		25.48		32.03		29.85		35.83		23.66		24.39		18.17		22.56	11.69
Minimum		0		0		30		0		0		0		34		53.1	21.85
Maximum		109.1		105.5		128.7		111.4		106.5		107.6		105.2		180	98.84

Table 8.1: Construct Correlations & Angular Distances

abbreviated in Table 8.1 to four letters. The first refers to subjects' major academic discipline (B: Business, S: Science); the second refers to the text read (H: Helicopter, C: Computer); the third refers to the mode of construct elicitation (S: Standard, L: Laddering) and the fourth refers to level of reading proficiency (H: High, M: Mid, L: Low). Column 1 is followed by eight pairs of columns (C_n-R and C_n-Ang, *e.g.* C_1-R, C_1-Ang) with the former referring to the correlation and the latter to angular distance of a pair of matched constructs (*e.g.* C_1-R: the correlation for Situation and C_1-Ang: its angular distance). Unmatched constructs are left blank. The right most column is labelled Ang Mean and is the mean angular distance for each subject. Summary descriptive statistics of the angular distances are reported at the bottom of the table. **Mean** refers to the mean angular distance for a construct; **r(circa)** refers to the correlation coefficient corresponding to the mean angular distance; **SD** the standard deviation. **Minimum** is the minimum angular distance for a construct and **Maximum** the maximum value. The last two statistics indicate the range of the angular distances for the constructs and will be used quite extensively in the discussion that follows.

8.2.4 Descriptive statistics

The construct mean angular distances for each construct (*i.e.* the row labelled *Mean*) show considerable variation. The highest is in *Evaluation* (Construct 4) with a mean of 50.42 degree or an *r* of about .63. and the lowest in *Voc. 3* (Construct 8) with a mean of 88.55 degree or an *r* of about .025. The ordering of the eight constructs in terms of angular distance and mean correlations is as follows in Table 8.2 below. The mean correlations of the constructs in the sample range from a high (.63) in *Evaluation* (Construct 4) to moderate in *Situation* (Constructs 1), *Problem* (Construct 2) and *Voc.1* (Construct 6) - *r* between .42 and .48, to low in *Solution*

Construct	Mean Angular distance	Mean Correlation
Evaluation	50.42	.63
Voc.1	61.38	.48
Situation	64.30	.43
Problem	64.94	.42
Preview	72.93	.29
Solution	73.94	.28
Voc.2	80.55	.16
Voc.3	88.55	.025

Table 8.2: Mean construct angular distances.

(Constructs 3), *Preview* (Construct 5) and *Voc.2* (Construct 7) - *r* between .16 and .29. *Voc.3* (Construct 8) has a near zero *r* of .025. We can also calculate the average of the mean correlations to obtain an overall mean correlation, *i.e.* a mean of means. This value is .37. We can then see that *Situation, Problem, Evaluation* and *Voc.1* are all above the mean of means and the other four constructs are all well below, with the possible exceptions of *Solution* and *Preview*. From the results just described, it can be seen that four out of the eight constructs in the grid have mean correlations that can be considered as good. If the mean correlations of Solution and Preview are taken as marginal, six constructs can be considered to show a clear trend of agreement between the theoretical grids and the subject grids. In other words, the way the theorist analyses the texts is similar to the way the subjects perceive the structure of the text. The results do not seem to be an artifact of the constructs being supplied or elicited. On the whole the supplied text pattern constructs of Situation, Problem, Solution and Evaluation tend to have higher correlations than the text signalling constructs. The major exception to this are Voc.1, which has a higher correlation than the other two text signalling constructs, and Preview, which, at .29, is somewhat lower than the other text pattern constructs.

The spread or range of the mean angular distances of the constructs is ordered from widest to narrowest as follows in Table 8.3 below.

Construct	**Range**
Voc.3	126.9
Evaluation	111.4
Situation	109.1
Voc.1	107.6
Preview	106.5
Problem	105.5
Solution	98.7
Voc.2	71.2

Table 8.3: Range of mean angular distances.

The pattern of distribution is rather interesting. Except for the two extreme values (Voc.3 highest and Voc.2 Lowest), the other six constructs show a rather gradual decrease within a relatively narrow range in terms of spread. However, Voc.3 is noticeably high and Voc.2 noticeably low in value.

It is also worth relating the mean angular distance and the range statistics. The lowest mean angular distance 88.55 (*r* about .025) and the widest spread in angular distance of 126.9 in Voc.3 indicates that, while there is generally no agreement between the theoretical grids and the subject grids in this construct, there are a few subjects who did agree with the theoretical grid to a rather high degree. The picture is very different with Voc.2, where both the mean angular distance (80.55, *r* about .16) and the range of angular distances (71.2) are low, indicating that there is little agreement between the theoretical grids and the subject grids among most of the stubjects.

8.2.5 The extent of theory-subject agreement

To examine further the agreement found in Table 8.1, the frequency distribution of the correlations of the constructs across all subjects was tabulated and the results are in Table 8.4 below. The frequency distribution in Table 8.4 was computed according to five bands of correlations. The cut-off level for each band is chosen using the critical values of *r* at the 99% (r = .37, p = .01 for 48 subjects), for the *High* bands and at the 95% (*r* = .29, *p* = .05) for the *Low* bands. The third band represents random *r* and is, thus, labelled the *Non-systematic* band. The five bands of *r* are 1 to .37 (the **High positive** band), .369 to .29 (the **Low positive** band), .289 to -.289 (the **Non-systematic** band), and -.29 to -.369 (the **Low negative** band) and -.37 to -1 (the **High negative** band).

	Range of r					
Construct	1 to .37	.369 to .29	.289 to -.289	-.29 to -.369	-.37 to -1	Missing
Situation	23	4	20	1		
	47.92%	8.33%	41.67%	2.08%		
Problem	25	4	19			
	52.08%	8.33%	39.58%			
Solution	26	4	7	5	6	
	54.17%	8.33%	14.58%	10.42%	12.50%	
Evaluation	31	3	10	2		2
	64.58%	6.25%	20.83%	4.17%		4.17%
Preview	21	2	23			2
	43.75%	4.17%	47.92%			4.17%
Voc. 1	22	2	9	1		14
	45.83%	4.17%	18.75%	2.08%		29.17%
Voc. 2	8		23			17
	16.67%		47.92%			35.42%
Voc. 3	4	4	22	1	3	14
	8.33%	8.33%	45.83%	2.08%	6.25%	29.17%

Table 8.4: Theory-subject mean construct correlations.

From the results in Table 8.4 it is clear that the percentage of significant High-positive (99% level) correlations is very high and includes six of the eight constructs. There is also a small percentage of Low-positve (95% level) correlations. The cumulative percentages of the two positive correlation bands (*i.e.* 99% and 95% levels) are as follows in Table 8.5 below.

Construct	**Range**
Situation	56.25%
Problem	60.42%
Solution	62.50%
Evaluation	70.83%
Preview	47.92%
Voc.1	50.00%
Voc.2	16.67%
Voc.3	16.67%

Table 8.5: Cumulative % of high mean agreement.

On the other hand, Low-negative and High-negative correlations tend to have noticeably lower percentages and are rather scattered. It is quite clear then that, while there is a substantial portion of the ratings of the subjects across six constructs that has a significant to high correlations with the theoretical grid ratings, there are little significant or high negative correlations. In other words, agreement with the theoretical grids is very high and disagreement with the theoretical grids is small.

The mean value of all subject mean angular distances in Table 8.1 is 67.97 - r (circa) .37. The spread (in terms of angular distances) covers an extremely wide range: minimum 21.85 (r about .93), maximum 98.84 (r about -.98). This indicates that there are very large differences among the subjects. This can be examined with the frequency distributions of the overall subject mean correlations. These are tabulated below in Table 8.6, using the same banding levels as in Table 8.4.

r range	1 to .37	.369 to .29	.289 to -.289
	23	11	14
	48%	*23%*	*29%*

Table 8.6: Overall mean theory-subject conrrelations.

Results in Table 8.6 show that *48%* of the subjects have a overall mean correlation with the theoretical grid highly significant at the 99% level, and *23%* have a moderately high correlation at the 95% level. There is *29%* of the subjects who do not show any systematic overall mean correlations with the theoretical grid. The cumulative percentage of all significant correlations in Table 8.6 stands at a high *71%* . Judging from the results just obtained it can be stated that, as far as mean correlations are concerned, there is a rather high correlation between the subject and the theoretical grids.

There is, therefore, unmistakable evidence that the model of text structure proposed in the text signalling approach does hold some reality within the construct systems of the subjects analysed, and consequently validated by the quantitative method used. To further validate the linguistic model and to examine a different aspect of the data, a grid representing the consensus among the subjects was derived using **SERIES** and the comparison was made using **DELTA** to examine the extent of agreement between the theoretical grids and the subjects' consensus grids. This will be investigated in 8.3 below after some of the characteristics relating to the results just analysed have been presented.

8.3 *Subject consensus*

8.3.1 Introduction

Text structures like the Problem-Solution pattern, according to Hoey (1983c) can be viewed as culturally popular patterns of expectations associated with certain groups of language users or certain types of texts. It is, therefore, quite pertinent to investigate the extent of agreement between the theoretical grids and the consensus among the experimental subjects. As described in 6.3.2.b, consensus grids can be generated by **SERIES** and are derived from the mean ratings across all subject grids. Repertory grid analysis, therefore, can also be an excellent tool in the investigation of the agreement between the theory and subject consensus.

In deriving the consensus grids for the data on hand, however, there are a number of problems which need to be resolved before the analysis can proceed. As there are gaps in the text signalling constructs in the Laddering mode (see Table 8.1), it may not be possible to have mean ratings which represent all the subjects. In order to include as many subjects as possible in the computation, it was decided that one pair of consensus grids would be derived covering the five discourse pattern constructs, where there are nearly no gaps, on all the subjects in both the Standard and the Laddering mode, labelled the *Combined mode* data, and another pair covering all the eight constructs only in the Standard mode, labelled *Standard mode* data.

The results of the agreement between the theoretical grids and the consensus grids were computed using **DELTA**, as recommended by Slater (1977), and are reported in Tables 8.8a&b to 8.11a&b below (see pp. 197-199 for specimens). Correlations between the theoretical grids and the consensus grids, reported in the "*a* " series of tables (*e.g.* p.197), are taken to indicate agreement. (Four sets of statistics are included in the tables:

construct mean ratings and sums of squares (the **SS** columns) for the Theoretical grid (**Grid A**), the same for the consensus grid (**Grid B**), construct mean differences between the theoretical grid and the consensus grid and their sums of squares (**Changes, B-A**), and the correlation between the theoretical grid and the consensus grid. The table also includes a statistic labelled "*General Degree of Correlation* ". This is a correlation generated by **DELTA**, which is computed on the basis of the total covariance for all the constructs on the theoretical grid and the consensus grid, and the sums of squares of the two grids in question. It may not be necessary here to examine the mathematical details of the computation. Slater (1977, pp.149-153) has an indepth description of the computation procedures.

The principal component analyses, reported in the "*b* " series of tables (*e.g.* p.198), are calculated on a grid of differences between pairs of grids. High loadings of both constructs and elements can then be used to identify those that are most responsible for the differences found between the theoretical grid and the consensus grid. The analyses in this section will concentrate on the extent of agreement between the theoretical grids and the consensus grids.

8.3.2 Overall results

The overall correlation between the theoretical grids and the consensus grids for the four sets of results, reported in the "*a* " series of tables are as follows in Table 8.7.

	Combined mode data	*Standard mode data*
the Helicopter text - *r*	.8001	.5324
the Computer text - *r*	.4184	.4681

Table 8.7: Overall theory-consensus correlations.

It can be seen that the correlations are all rather high, showing good overall agreement between the theoretical grid and the consensus grids. In particular, the correlation for the *Helicopter* text in the *Combined* mode data is very impressive.

Figure 8.1 below presents the results graphically.

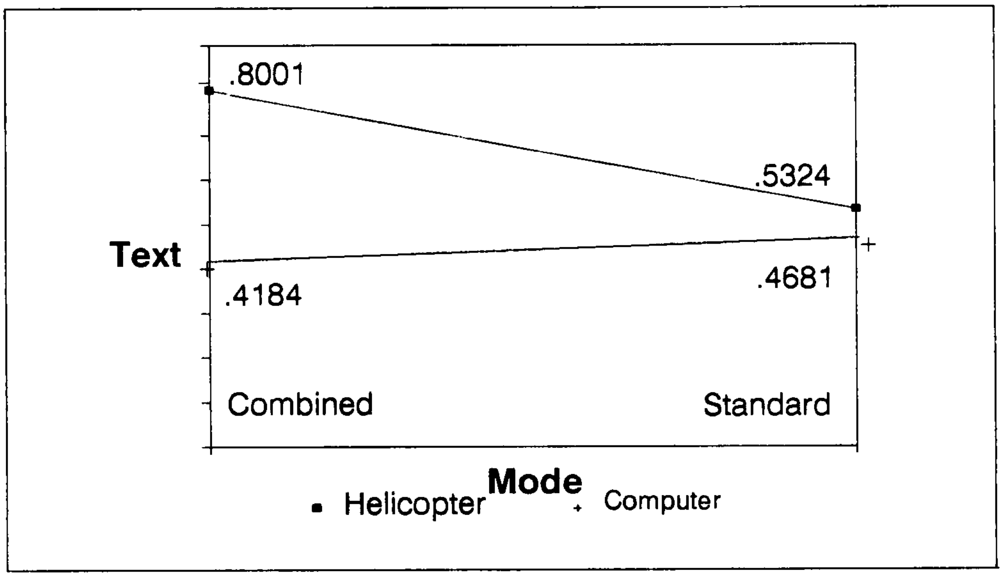

Figure 8.1: Overall theory-consensus agreement.

As can be noticed in Fig.8.1, there is a stronger agreement with the theoretical grid in the *Helicopter* text than in the *Computer* text. In fact, the agreement is very noticeably higher in the *Combined mode* data. At the same time, though, the difference between the two texts in terms of agreement with the theoretical grid is much reduced in the *Standard mode* data. A very interesting feature here is found in the direction of the change. There is a very steep drop in agreement in the Helicopter text between the Combined mode and the Standard mode data, whilst a small increase in agreement is noticeable in the Computer text. Such a pattern of results raises some very interesting points.

Since the Combined mode data comprise the five text pattern constructs, it is clear then that the large difference observed in the two texts is due to the explicitness of the text pattern in the Helicopter text and the relatively inexplicit structure in the Computer text. Indeed, from the very large difference it can be deduced that explicitness in text pattern is a very important factor affecting perception of text structure.

The Standard mode data include all the eight constructs in the grid. The decrease in difference in agreement between the two text found in the Standard mode data seems, therefore, to be due to the text signalling constructs, which help to increase the agreement in the Computer text while bring the agreement in the Helicopter text drastically lower than in the Combined mode. From this, it can be deduced that text signalling is clearer in the *Computer* text than in the *Helicopter* text.

All the above are rather interesting results and will be investigated in details in the rest of the chapter.

8.3.3 The Helicopter text

The data on the Helicopter text are presented in Tables 8.8a&b, and 8.9a&b. The correlations of the constructs in the Combined mode (Table 8.8a) and Standard mode (Table 8.9a) show very strong agreement between the theoretical grid and the consensus grid in the constructs of *Solution* (r = .9251 in Combined mode and .8906 in Standard mode) and *Problem* (r = .9053 and .8773). This implies that these two constructs were most clearly perceived by the subjects and, consequently, influneced the way they looked at the text. There is also considerable agreement in *Evaluation* (r = .7666 and .6845), *Situation* (r = .5468 and .3308) and *Preview* (r = .4822 and .4044). The results of the Standard mode further reveal good agreement in the constructs of *Voc.2* (r = .59). There are only two constructs showing no agreement - *Voc.1* (r = .0784) and *Voc.3* (r = -.0122).

Construct	Grid A Mean	Grid A SS	Grid B Mean	Grid B SS	Changes B-A Mean	Changes B-A SS	r
Situation	.067	.933	.468	.608	.401	.718	.547
Problem	.333	3.333	.225	1.859	-.108	.685	.905
Solution	.333	3.333	.205	.993	-.128	.960	.925
Evaluation	.267	2.933	.273	.688	.006	1.443	.767
Preview	.067	.933	.229	.167	.163	.719	.482
	Total	11.467	*Total*	4.316	*Total*	4.526	

General Degree Of Correlation .8001

Gird A - Theoretical Grid; Grid B - Consensus Grid

Table 8.8a: Combined mode DELTA results (Helicopter).

Construct	Grid A Mean	Grid A SS	Grid B Mean	Grid B SS	Changes B-A Mean	Changes B-A SS	r
Situation	.067	.933	.461	.816	.395	1.172	.331
Problem	.333	3.333	.211	1.730	-.123	.850	.877
Solution	.333	3.333	.201	1.063	-.133	1.043	.891
Evaluation	.267	2.933	.277	.803	.011	1.635	.684
Preview	.067	.933	.251	.407	.184	.842	.404
Voc. 1	.267	2.933	.271	.397	.005	3.161	.078
Voc. 2	.267	2.933	.278	.399	.011	2.056	.590
Voc. 3	.600	3.600	.289	.607	-.311	4.243	-.012
	Total	20.933	*Total*	6.223	*Total*	15.003	

General Degree Of Correlation .5324

Gird A - Theoretical Grid; Grid B - Consensus Grid

Table 8.9a: Standard mode DELTA results (Helicopter).

Principal Component Analysis

Component	Root	As %
1	2.1148	46.73
2	1.1808	26.09
3	.8661	19.14
4	.2460	5.44
5	.1178	2.60

Specifications of First 2 Components

Construct	Component 1 Loading	Component 2 Loading
Situation	.5090	-.4723
Problem	-.1562	-.2034
Solution	.7563	.5208
Evaluation	**-1.1092**	.2825
Preview	.1704	.7519

Element	Loading	Loading
1	-.2677	.5856
2	-.0010	.2250
3	.0343	.1619
4	.0608	.0276
5	.2504	.1142
6	.0296	.1389
7	-.3878	-.0393
8	-.1754	.1908
9	-.6602	.0233
10	-.4755	-.7598
11	-.3536	-.1640
12	.3933	-.0025
13	.5405	-.1744
14	.3526	-.1393
15	.6598	-.1883

Table 8.8b: PCA of combined mode data (Helicopter text).

Principal Component Analysis

Component	Root	As %
1	6.7061	44.70
2	3.6775	24.51
3	1.8296	12.20
4	1.1994	7.99
5	.7462	4.97
6	.4835	3.22
7	.2715	1.81
8	.0887	.59

Specifications of First 2 Components

Construct	Component 1 Loading	Component 2 Loading
Situaion	-.3167	.5952
Problem	.4811	-.2171
Solution	.3622	.6192
Evaluation	-.4907	-.8226
Preview	-.1324	.0489
Voc. 1	**1.6119**	.4912
Voc. 2	-.2177	**-1.1848**
Voc. 3	**-1.8273**	.7542

Element	Loading	Loading
1	.5399	-.5860
2	.5481	.1533
3	-.6187	.0398
4	.0031	.6488
5	**-1.3654**	.1896
6	-.0974	.4177
7	.0815	-.4742
8	.3539	-.3236
9	-.4932	-.9262
10	.4047	-.3780
11	**-1.3525**	-.1765
12	.4621	.0021
13	.7579	.0977
14	-.0595	**1.1275**
15	.8355	.1880

Table 8.9b: PCA of Standard mode data (Helicopter text).

From the correlations found in the three vocabularies it can be deduced that Voc.2 signalling is the only signalling device that has some bearing on the subjects' perception of text structure on the Helicopter text.

It may be recalled that the principal component analyses in DELTA, reported in Tables 8.8b & 8.9b, focus on the differences between the theoretical grids and the consensus grids. An examination of the principal component loading matrix for the Combined data (Table 8.8b) is due principally to *Evaluation* (highest loading in Component 1). This means that the subjects had a perception of the construct of Evaluation somewhat different from the theoretical grid.

The Standard mode data results in Table 8.9b show most clearly that *Voc.1* and *3* (highest loadings in Component 1) account for most of the differences observed, and *Voc.2* (highest loading in Component 2) also accounts for some of the differences. The construct of *Evaluation* (second highest loading in Component 2) also shows some effect on the difference between the theoretical grid and the consensus grid as is the case ofthe Combined mode results.

Differences in perception in Voc.3 signalling are related to the different interpretation between the subjects and the theoretical grid of Clauses 5 "*as it lands* " and 11 "*on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions* " (highest element loadings in Component 1) and Clause 14 "*but the system can handle up to eight tons* " (highest element loading in Component 2 and having the same sign as Evaluation in Component 2.) Because of the main focus in the study on linguistic model validation, details in the results above cannot be further investigated. They provide, however, the starting point for follow-up investigations on the specific ways signalling devices are perceived particularly useful for qualitative type investigation through, for example, indepth interviews to uncover individual perception characteristics regarding text signalling devices.

From the description of results above, the usefulness of using **SERIES** and **DELTA** for the study of consensus is clearly demonstrated. Besides providing overall indices of agreement in the form of correlation coefficients, the principal component analyses indicate key areas where the differences between the theoretical grid and the consensus grid can be zeroed in. It may be possible, with the identification of constructs responsible for differences in perception and their associated elements, to uncover characteristics of both the text in question or more general features in the text signalling approach to text analysis particularly if a number of texts are analysed. Such information is certainly very important for indepth investigations which lie beyond the scope of the present study but should be pursued.

8.3.4 The Computer text

The data on the Computer text are presented in Tables 8.10a & b, and 8.11a & b. Correlations in Table 8.10a (Combined mode data) and 8.11a (Standard mode data) have *Evaluation* (r = .9355 in Combined mode and .8791 in Standard mode) with the highest agreement, followed by *Situation* (r = .7665 and .7610) and *Preview* (r = .7534 and .7111). *Problem* and *Solution* both show no significant correlations. In the Standard mode data, *Voc.1* shows a very strong agreement (r = .8821) while *Voc.2* and *3* have rather low correlations. Of particular importance is the lack of agreement in *Problem* and *Solution* in both the Combined and the Standard mode data. The lack of agreement for Problem is expected as it is only implicit in the text. Solution appears to be a rather special case and will be examined further using the principal component analysis results.

Construct	Grid A Mean	Grid A SS	Grid B Mean	Grid B SS	Changes B-A Mean	Changes B-A SS	*r*
Situation	.462	3.231	.450	1.249	-.012	1.400	.766
Problem	.077	.923	.291	1.449	.214	2.534	-.070
Solution	.385	3.077	.292	.214	-.092	3.714	-.261
Evaluation	.077	.923	.203	.486	.126	.156	.936
Preview	.154	1.692	.254	.574	.100	.781	.753
	Total	9.846	*Total*	3.973	*Total*	8.585	

General Degree Of Correlation .4184

Gird A - Theoretical Grid; Grid B - Consensus Grid

Table 8.10a: Combined mode DELTA results (Computer).

Construct	Grid A Mean	Grid A SS	Grid B Mean	Grid B SS	Changes B-A Mean	Changes B-A SS	*r*
Situation	.462	3.231	.467	1.400	.005	1.394	.761
Problem	.077	.923	.307	1.698	.230	2.895	-.109
Solution	.385	3.077	.288	.317	-.097	3.610	-.110
Evaluation	.077	.923	.178	.772	.101	.211	.879
Preview	.154	1.692	.282	.551	.128	.870	.711
Voc. 1	.462	3.231	.314	1.372	-.148	.888	.882
Voc. 2	.077	.923	.281	.345	.204	1.170	.087
Voc. 3	.846	1.692	.172	.481	-.674	1.824	.194
	Total	15.692	*Total*	6.936	*Total*	12.862	

General Degree Of Correlation .4681

Gird A - Theoretical Grid; Grid B - Consensus Grid

Table 8.11a: Standard mode DELTA results (Computer).

Principal Component Analysis

Component	**Root**	**As %**
1	5.7262	66.70
2	1.7044	19.85
3	.9546	11.12
4	.1145	1.33
5	.0853	.99

Specifications of First 3 Components

Construct	**Component 1 Loading**	**Component 2 Loading**	**Component 3 Loading**
Situation	-.6296	-.6066	.7944
Problem	**-1.3285**	.8553	.1166
Solution	**1.8725**	.3200	.2885
Evaluation	-.0451	.1803	-.1322
Preview	.2381	.6855	.4575
Element	**Loading**	**Loading**	**Loading**
1	.6899	-.9032	-.4334
2	.3593	.1472	.0644
3	.3817	.0711	-.0281
4	.5730	.3434	-.1985
5	.5785	.3597	-.1090
6	.6325	.2236	-.1849
7	**-.8443**	-.6727	.1378
8	**-.9181**	.1591	-.0866
9	**-.8654**	.1482	-.0850
10	**-.7806**	.1417	-.0662
11	**-.7415**	.1539	-.0514
12	.5433	-.0304	.3035
13	.3918	-.1418	.7373

Table 8.10b: PCA of combined mode data (Computer text).

Principal Component Analysis

Component	Root	As %
1	6.2124	48.30
2	3.4317	26.68
3	1.1953	9.29
4	1.0236	7.96
5	.5706	4.44
6	.2580	2.01
7	.1319	1.03
8	.0386	.30

Specifications of First 2 Components

Construct	Component 1 Loading	Component 2 Loading
Situation	-.6549	-.6704
Problem	-1.4166	.8336
Solution	1.8435	.0472
Evaluation	.0826	.1818
Preview	.2233	.5347
Voc. 1	-.0756	-.5058
Voc. 2	.1414	-.7399
Voc. 3	.5441	1.0784
Element	**Loading**	**Loading**
1	.7168	-.9475
2	.2891	-.2629
3	.2206	-.3618
4	.6575	.8777
5	.8617	.8510
6	.5786	-.0458
7	-.9503	-.5676
8	-.8692	.2436
9	-.8692	.2436
10	-.8100	.2456
11	-.7458	.2261
12	.5199	.0309
13	.4002	-.5329

Table 8.11b: PCA of Standard mode data (Computer text).

The principal component analysis results in Table 8.10b (Principal component analysis for the Combined mode data) reveal that the constructs contributing most to the disagreement are *Problem* and *Solution* . This becomes clear when the element loadings are taken into consideration. As far as elements are concerned, it is the segment of the text between Clauses 7 "*Discussions will centre on four concurrent streams* " and 11 "*How capacity can be optimised through control of manufacturing resources* " that is most responsible for the differences found. This is the segment in the Computer text comprising Preview and the four parallel wh-clauses. From the sign of the loadings on this segment of the text it is clear that the disagreement is principally due to the subjects' assigning it to Problem whereas the theoretical grid has it under Solution (see Appendix 4b).

Results of the principal component analysis for the Standard mode data in Table 8.11b has results in Component 1 very similar to the Combined mode data. This renders confirmation to the observations just made regarding the pattern of loadings in the Combined mode data. Component 2 in Table 8.11b reveals a considerable influence of Voc.3 as a factor of disagreement. This may be due to the subjects failing to detect the Voc.3 signal "*ineffect use* " in Clause 1 "*A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group* ", and identifying Voc.3 signals in Clause 4 "*who will be drawn from companies of widely varying size and products*" and 5 "*Furthermore, time will be made available for delegates to see the associated exhibition* ".

8.3.5 <u>Observations</u>

The results from the analyses of the consensus grid again show very substantial agreement between the theoretical grids and the view of the subjects as a group. The overall correlations between the theoretical grid and the consensus grid are good; individual construct correlations are also good. There are also notable and informative disagreement between the theoretical grids and the subject consensus. In the first place, the subjects have apparently low sensitivity in Voc.3 signals as evidenced by this being a construct that is responsible for disagreement in both the Helicopter and the Computer text. The reverse assignment by the subjects of the Solution segment to Problem in the Computer text may indicate the strength of Problem as a psychological construct. This is quite reasonable in that in the absence of identifiable problems there is little sense to talk about solutions. This may have implications for the different degrees of importance of the four component of the Problem-Solution text pattern and needs to be further investigated in studies designed to examine this particular aspect. The overall conclusion, however, is that the agreement between the theoretical grids and the consensus grids has clearly been established from the quantitative point of view. In the following section (8.4), the question of whether and to what extent the agreement observed may be due to external factors present in the experimental situation as a whole will be examined.

8.4 *ANOVA*

8.4.1 Introduction

The purpose of the analysis of variance (ANOVA) is to examine some of the factors that may have influenced the relative agreement between the theoretical grids and the subject grids. Some of these factors (*e.g.* the text structure) have already been seen to be of relevance in the analyses so far. Specific investigations of these factors are, therefore, important for the present study. The different factors to be considered (*Independent variables*) include students' major academic discipline (DEPT), reading test score (LEVEL), text read (TEXT) and mode of construct elicitation used (MODE). The angular distances between matched constructs in Table 8.1 are used as the *Dependent variables.* The basic approach in ANOVA is to divide the sample into sub-groups according to combinations of one or more of the factors (or independent variables). The differences in mean subject grid / theoretical grid agreement (expressed as angular distances) in the sub-groups will be examined and tested for significance. The aim is to identify which of the four factors (labelled *main* effects) or their combinations (labelled n-way *interaction* effects) would yield signifcantly different mean correlations. Those that do would be taken as factors influencing degree of agreement between subject and theoretical grids. As there are four factors, there should, in theory, be interaction effects among all four factors (4-way interactions). In computing the ANOVA, the main effects as well as all interaction effects are calculated for the sake of completeness. However, in analysing the results, the decision was made to focus on *main* and *two-way* interaction effects. No analysis is given to higher order interaction effects. This is so for two reasons. Firstly, interpretation would be quite difficult for any significant interaction among all four independent variables. Secondly, cases per cell for a four-way interaction in the present ANOVA are exceedingly small (two cases per cell) to make any meaningful deduction. Such effects would certainly be rather difficult to interpret. For the purpose of the present study two-way interactions are the most meaningful and manageable, and so will be reported along with main effects.

Because of the complexity of the results generated, detailed results of the ANOVA are placed in Appendix 14a to h. Relevant aspects of the results will be tabulated in integrated forms within the text for ease of presentation. The basic test of the significance of mean differences in

ANOVA is the F statistic. Because of the sample size, the higher 99% level (p =.01) of significance rather than the 95% (p =.05) level will be taken as the decision level. However, significance between 99 to about 95% will also be tabulated to indicate trends in the results.

8.4.2 The Results

8.4.2.a *Overall results* : Table 8.12 below includes the significance levels of all the main and two-way interaction effects of all the factors with significance level between 99% to about 95% (p. = < 01 is indicated with ** and p. = < 05 with *); blanks would represent non-significant effects.

Main effects	Construct 1	2	3	4	5	6	7	8
DEPT				*				
TEXT		**	**	*	**	**	.061	*
MODE		*				**	**	**
LEVEL								
Interaction effects								
DEPT TEXT		*		*				
DEPT MODE		*						
DEPT LEVEL								.053
TEXT MODE						**	.081	*
TEXT LEVEL		**			.075			*
MODE LEVEL								

Table 8.12: Summary of ANOVA results.

The overall impression of Table 8.12 is the large number of significant effects with very clear concentrations in TEXT and MODE as the two most infleuntial factors. These are in line with the results that have been examined so far. In fact, many of the results here have been quite noticeable previously; they are given rigorous and statistically tested presentation by the ANOVA.

Among all the constructs, *Situation* (Construct 1) shows no significant main or interaction effects, indicating that agreement in the construct of Situation is not influenced by any of the factors in the analysis. This may be due to two reasons: its lack of prominence in the Helicopter text; it is also low in the subjects' construing as evidenced in 8.3 above. The construct that is most susceptible to the four factors is *Voc.3* (Construct 8) which has two significant main effects associated with TEXT and MODE, and three significant interaction effects associated with DEPT-LEVEL, TEXT-MODE and TEXT-LEVEL. Voc.3 is, therefore, the most volatile of the constructs and is so because of its low theory-subject agreement as has been indicated in 8.3. Among the factors, TEXT has a significant main effect in all constructs except Situation. The main effects of MODE, however, tend to concentrate on the text signalling constructs (Constructs 6 to 8). DEPT has only one significant main effect at the 95% level in Evaluation (Construct 4) and LEVEL has no significant main effects. It can be stated that the major academic discipline and the ESL reading proficiency of the subjects alone do not constitute factors that would influence their agreement with the theoretical grids. However, there are interesting interaction effects which are examined below. The examination of the effect of subjects' major academic discipline should be of considerable interest for applied linguistic investigations. In the area of language testing, for example, Alderson & Urquhart (1983) investigate the effect of student background knowledge and reading comprehension. The results of the ANOVA regarding the effects of DEPT whether main or interactive should be of relevance to such studies.

There are interesting interactions between subjects' major academic disciplines and text structure, mode or subjects' ESL reading ability. There is also rather clear relevance of interactions between text structure and mode of construct elicitation or subjects' ESL reading ability.

8.4.2.b *Detailed results for main effects* : In this section the main effects reported in Table 8.12 above which have a significance level at or above the 99% level will be examined in detail.

Significant mean agreement differences in terms of angular distances ($p = < .01$) which are associated with TEXT are as follows in Table 8.13.

Construct	Helicopter Text	Computer Text
Problem	38.82	91.05
Solution	52.55	95.33
Preview	82.77	63.91
Voc. 1	84.20	47.26

Table 8.13: Main effects in TEXT.

The results in Table 8.13 again confirm patterns of results clearly identifiable previously. The significantly higher means in agreement (lower angular distances) associated with *Problem* and *Solution* in the Helicopter text are clearly the result of the relatively greater explicitness of its text pattern than that in the Computer text. Conversely, the significantly higher means in agreement in the Computer text associated with *Preview* and *Voc.1* are due to the Preview-Detail pattern very markedly signalled by the four wh-clauses in the Detail section.

Significant mean differences associated with MODE ($p = < .01$) are in Table 8.14 below.

Construct	Standard Mode	Laddering Mode
Voc.1	66.82	48.33
Voc. 2	81.21	78.31
Voc. 3	87.60	90.83

Table 8.14: Main effects in TEXT.

As an overall picture, *Voc.1* and *2* , therefore, show higher agreement in the Laddering than in the Standard mode, whilst the reverse is true in *Voc.3*. It should be noted that the difference is most pronounced in Voc.1. It can be deduced that, in terms of construct elicitation for the signalling devices the Laddering mode seems preferable to the Standard mode. Moreover, the subjects appear to be rather sensitive to Voc.1 signalling rather than Voc.2 or 3. This may, in fact, be an ESL feature of Hong Kong students. Native / non-native speaker contrasts in this respect would certainly be a worthwhile follow-up study.

8.4.2.c *Interaction effects* : Two-way interactions self-evidently involve the interaction of two dimensions. They are, thus, best represented by two-dimensional line graphs. The results that follows will, therefore, be presented using line graphs.

The first two-way interaction effect at the 99% level to be examined is that between DEPT and TEXT associated with Evaluation (Construct 4). The means in agreement in terms of angular distances are tabulated below in Table 8.15 and are shown graphically in Figure 8.2 below.

	DEPT Business	Science
TEXT		
Helicopter	63.09	58.5
Computer	21.52	60.32

Table 8.15: TEXT-DEPT interaction for Evaluation.

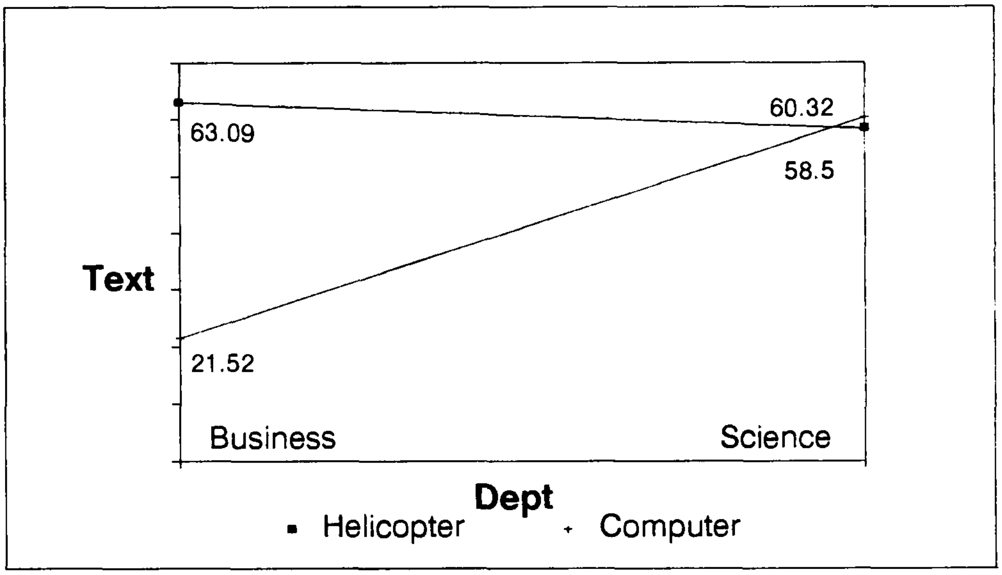

Figure 8.2: TEXT-DEPT interaction for Evaluation.

It is clear from the results that the two texts used have very different effects with the Business students and show near negligeable difference with the Science students. Specifically, the Business students agree much more highly with the theoretical grid of the Computer text than that of the Helicopter text. This seems, at first, rather unexplainable. The answer lies in the fact that the subject matter in the Helicopter text is a straight Science reporting from a science magazine of a popular nature - The New Scientists, whilst the Computer text is on the application of the computer to management. It is maintained (*e.g.* Alderson & Urquhart 1983, Lee 1982, 1985) that subject-matter is a factor that generally affects understanding in reading. This is certainly another area of application of repertory grid analysis for further research which needs to be examined in future.

The second two-way interaction effect to be given detailed examination is that between TEXT and MODE associated with Voc.1 (Construct 6). The mean differences are reported in Table 8.16 below and represented by Figure 8.3.

	MODE Standard	Laddering
TEXT		
Helicopter	85.84	64.50
Computer	47.80	46.53

Table 8.16: TEXT-MODE interaction for Voc.1.

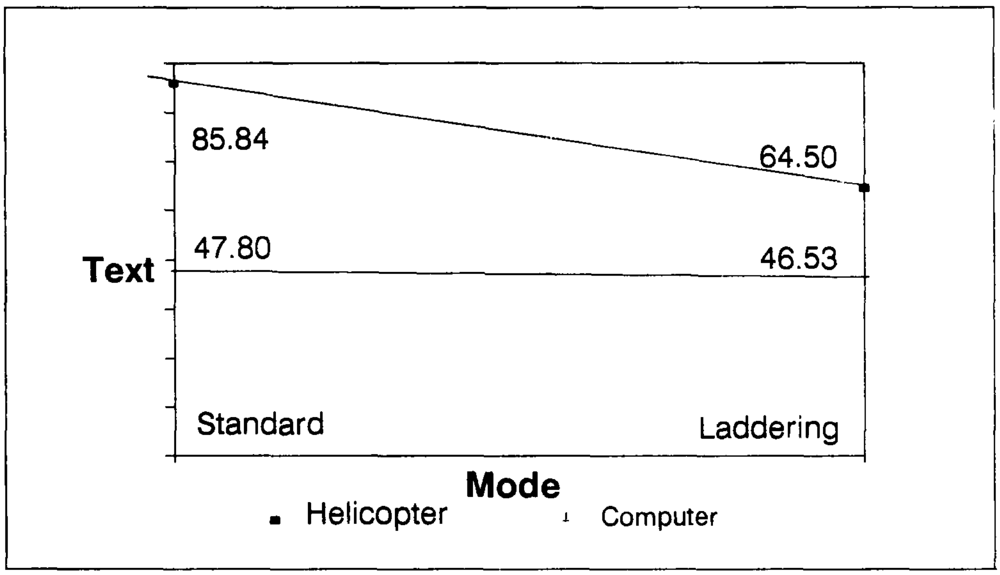

Figure 8.3: TEXT-MODE interaction for Voc.1.

The Computer text shows generally higher agreement than the Helicopter text. The difference, however, is much more pronounced in the Standard than in the Laddering mode. The Voc.1 signal, therefore, is much more clearly identifiable in the Computer text for the subjects to pick up than in the Helicopter text. This is yet another example of the strength in signalling of the four wh-clause set. Such a difference would be reduced if subjects' own tacit knowledge of text signals, which was called into play in the Laddering mode, rather than the focusing through the use of triads as a means for construct elicitation became the basis for construct elicitation. This may be a case in favour of *laddering* rather than *triading* as a preferred method of construct elicitation.

The last two-way interaction to be examined is that between TEXT and LEVEL found in Problem (Construct 2). The mean differences are reported in Table 8.17 and represented by Figure 8.4 below.

LEVEL		High	Mid	Low
TEXT	Helicopter	42.76	37.97	35.72
	Computer	76.70	96.91	99.55

Table 8.17: TEXT & LEVEL interaction for Problem.

The results show an overall higher agreement in the Helicopter text than in the Computer text. There is an interesting phenomenon in the LEVEL dimension. The Helicopter text has means all lower (*i.e.* higher correlation) than the means in the Computer text, showing a generally higher agreement with the theoretical grid. However, Figure 8.5 shows a

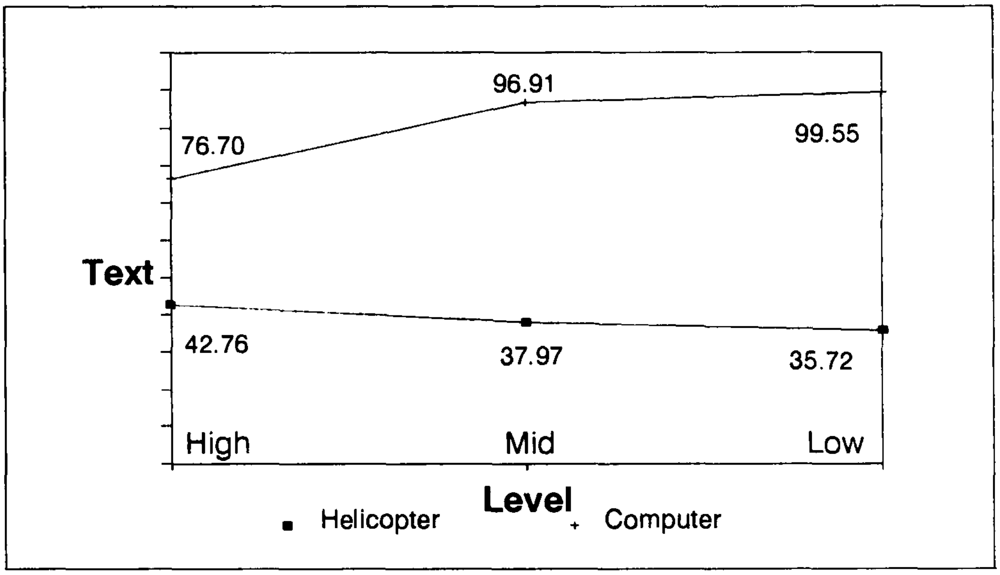

Figure 8.4: TEXT-LEVEL interaction for Problem.

slight tendency of a reverse trend between the two texts. There is a clear correspondence between ESL reading proficiency and agreement with the theoretical grid in the Computer text. Such a correspondence is not evident in the Helicopter text, and indeed there is a very slight reverse relationship between ESL reading proficiency and agreement with the theoretical grid. This, as indicated by the ANOVA results, has to do with the different text structure in the two texts. The construct of Problem is explicit in the Helicopter text but implicit in the Computer text. This is, therefore, the construct where the two texts are maximally different in terms of text structure. The results show, therefore, that a text with explicit text pattern (the Helicopter text) is easier to process and less discriminating in terms of reading ability, whilst a text with less explicit text pattern (the Computer text) is more difficult to process but also more discriminating. Text patterning, then, is a construct that has relevance for reading ability and can be one of the construct that can be included in a reading ability test.

8.4.3 Observations

The results from the ANOVA, therefore, have identified two major factors: text structure and mode of construct elicitation, that, by themselves, influence the agreement between subject grids and theoretical grids. Text structure has a rather pervasive relevance in most of the constructs; and text structure is particularly relevant regarding text signalling constructs.

8.5 *Observations on theory-subject agreement*

To sum up, there are two dimensions of investigation in Chapter Eight. The first dimension relates to the methodological perspective of the thesis on how a linguistic model can be validated using repertory grid analysis. This was done by examining the extent of agreement between the theoretical grids and the subject grids based on the INGRID results obtained. The agreement between the theoretical grids and the consensus of the subjects was then investigated using two grid comparison programmes: SERIES and DELTA. The former provided the necessary data for the derivation of a consensus grid which was then analysed with the latter programme. Aspects in the data and the experimental situation were then further analysed with an ANOVA design to examine possible factors that may have influenced the results observed. The results from the analyses above can be taken as validating evidence for the Winter-Hoey approach to text analysis. This is the second dimension of investigation in Chapter Eight. Strictly speaking, the present study is neutral towards the goodness of fit of the linguistic model concerned. The methodology should stand irrespective of the validity of the linguistic model studied. The only important question in this regard would be the rigour of the application of repertory grid analysis.

The way to tackle this last question was to follow as closely as possible the procedure of repertory grid analysis most commonly used, making small modifications only when there were strong enough justifications for them. This was done to establish the necessary basis for the application of repertory grid analysis to linguistic research. Already, several aspects of repertory grid analysis appeared to be problematic. These will be discussed in details in Chapter Nine. Judging from the results of both Chapter Seven and Eight, it should be stated with some confidence that repertory grid analysis can certainly be used as a method for lingusitic model validation as first hypothesized in the study.

As far as the Winter-Hoey model of text structure is concerned, the extent of agreement between the theoretical grids and subject grids, as analysed in Chapter Eight, has yielded very positive results. In the first place, mean construct correlations between the two (8.2) show a fairly high degree of agreement. In terms of the correlations between individual grids and the theoretical grid (8.2), there is a very high degree of agreement. Similar results have been obtained between the consensus view of the subjects and the theoretical grids (8.3). There seems, therefore, to be strong enough grounds to view the text signalling approach also as an explanatory model of text structure besides being a descriptive model.

It is, therefore, justified to claim that, in so far as the text signalling approach to text analysis can be validated through agreement between naive language users and the theory, the model proposed by Winter and Hoey should be considered, to some extent, validated and the method of repertory grid analysis should be considered a valid method for a quantitative approach to linguistic model validation.

CHAPTER NINE

Conclusions & Implications for Future Research

9.1 *Introduction*

With Chapter Eight the argument in the study has come to a close. It is now possible and necessary to give an overall review on the major issues examined so far. In developing the arguments relating to specific areas in the study throughout the thesis a considerable amount of detail had to be included. The line of the overall argument as well as the central areas of study may have been blurred. The aim of the review in Chapter Nine, therefore, is to recapitulate, to summarize and to spell out

a the major steps of the procedure which establishes a methodology for a quantitative approach to linguistic model validation;

b the principal findings, both confirmatory and problematic, in the study; and

c the most notable implications for future research.

9.2 *The methodological investigation*

9.2.1 Introduction

As a methodological study the contribution of the present research to the field of linguistic investigation is in the rigour with which the method of analysis was implemented and the care in its execution. It is, therefore, vital for the appreciation of the research endeavour put into this study to retrace the steps in the procedure used for the establishment of that methodology. It should be emphasized again that it is the validity of the basic method rather than the generalizability of the actual findings that is the focal point of the whole study, even though interesting insight and at times rather important findings did emerge from the application of the method of inquiry.

The main stages of the methodological investigation are as follows

1. a brief review of some recent approaches to text analysis and a choice of an approach for the present study was presented (*Chapter Two & Three*);
2. a brief examination of the requirements for the analytic tool to be used and the discussion on the actual technique to be used was discussed (*Chapter Four*);
3. an analysis of the details of repertory grid analysis applications, *i.e.* the analytic procedure chosen, was examined (*Chapter Five*);
4. a pre-pilot and a pilot study were carried out to examine both the broad features and the details of repertory grid analysis application to the proposed linguisitic investigation (*Chapter Five*);
5. the main study was described to provide a detailed record of the implementation of the method of investigation (*Chapter Six*);

6 the results from the experimental data were reported regarding firstly individual subjects (*Chapter Seven*) and then the sample as a whole (*Chapter Eight*).

These will be discussed in detail in the sections that follow.

9.2.2 Review of the field of text analysis and the choice of the linguistic model

The study began by examining some of the most recent and the most notable approaches to text analysis, which is the area of linguistic research chosen for the study. It is necessary to reiterate that the choice of text analysis to begin with had very much to do with the researcher's own personal interest in this area of linguistics and that the method for linguistic model validation being proposed should be of very wide range of application.

The actual review of literature was rather succinct, concentrating on the central tenets of each approach examined. This was done in order not to become too involved in details with the danger that the focus of the thesis would be blurred. Four approaches were covered. They were

a the Tagmemic approach (2.2);

b the Schema theory (2.3);

c text linguistics (2.4); and

d the signalling apporach (2.5).

In choosing from among the four models above for the study, two criteria were used : that the approach should be text-based and that the data should be codable *(Chapter Three*). These two criteria were used so that the study could clearly focus on textual phenomena and so that quantification of the data would be possible. The text signalling (or the Winter-Hoey model for short) was deemed most suitable based on the two criteria, and was chosen for the study.

9.2.3 Discussion and choice of on analytic technique

The choice of an analytic technique was discussed against the background of broader issues relating to research methodology. Specifically, the distinction and the relationship between the quantitative and the qualitative research paradigm were carefully examined (4.2.2). The conclusion reached was that the two approaches to research method can and need to be complementary to one another in order to illuminate different aspects in the data even if emphasis may be placed on one of the two approaches. The search was, therefore, for a quantitative analytic method for the investigation of human language perception which is amenable to qualitative analysis as well. The choice fell on repertory grid analysis (4.4).

A general introduction to the theoretical and the applicational aspects of repertory grid analysis to text analysis was then given (4.5 & 4.6).

Comparisons were then made, using a specimen text (4.8 to 4.11), between the two most popular computer programme packages for repertory grid analysis : the *FOCUS* and the *INGRID* packages (4.7). The comparisons centred on the suitability of the statistical techniques employed in each programme in respect to the aim of the study. The conclusion was that *FOCUS* may be suitable for clinical and counselling situations because of the accessibility of its results, while *INGRID* is more suitable for research situations because of the kinds of statistical results generated. The latter package was, therefore, chosen for the present study.

9.2.4 The pilot studies

9.2.4.a *The pre-pilot study*: Detailed aspects of the application of repertory grid analysis were then examined in a series of pilot studies. Firstly, a pre-pilot study was mounted (5.3). This was a study of an informal nature. Its main aim was to examine broad features of the application of *INGRID* to linguistic data. From the results of the pre-pilot study the following conclusions were drawn.

a As a text can be read and viewed from a number of perspectives, *e.g.* meaning, grammar, etc., there is little guarantee that the text structure dimension would be focused upon spontaneously by the subjects. There is need to focus the subjects' attention on the text structure dimension through the method of experimental planning.

b The specification of the triads (*i.e.* the sets of three elements) for construct elicitation cannot be fruitfully achieved on the basis of statistical information from the repertory grid analysis of the theoretical grid. Judgmental criteria on the part of the researcher based on the raw grid of the theoretical grid may yield usable triads. Thus, rather than choosing a triad on the basis of contrasting high loadings of elements in the principal component analysis of the theoretical grid, the elements in the triad were identified by examining the ratings in the theoretical grid and identifying the required contrasts therefrom.

c The size of grid in the pre-pilot (fifteen constructs and twenty-three elements) was found to be too demanding in terms of both time and attention, and had to be reduced in the main study.

9.2.4.b *The pilot study* : A formal pilot study was then carried out (5.4) based on a small sample (twenty-four) of the target population for the main study (*i.e.* undergraduate students in Hong Kong). Modifications were made on the basis of the results in the pre-pilot study. These included firstly, the reduction in the size of the grid to be used. The constructs were kept to eight which include the four text pattern constructs of Situation, Problem, Solution and Evaluation, and the three text signalling constructs of Voc.1, 2 and 3. To these was added Preview which was found to be an embedded text pattern. The number of elements (clauses in the text) was also reduced to fifteen for the text used in the pre-pilot (*i.e.* the *Helicopter* text) by deleting eight clauses which did not affect the text pattern. Second, to focus the subjects' attention on the text structure dimension of the text the four text pattern constructs were made 'supplied' constructs which were presented to the subjects as just one possible opinion on text structure; furthermore, a brief introduction was given to the subjects on the principal aim of the research. Thirdly, a number of external factors were introduced via an ANOVA design to investigate their possible influence on the results. These included

a subjects' ESL reading proficiency; and

b relative text pattern explicitness.

To enable the latter factor to be investigated a second text pattern had to be chosen. It was hypothesized that, if a second text with an implicit Problem-Solution pattern was used, the results in the two texts in terms of relative agreement between the theoretical grid and the subject grids would be very informative. A text (the *Computer* text) with an implicit Problem section was then chosen to be the alternative text.

The data obtained were then analysed using *INGRID* and the results were analysed focusing on the broad agreement between the theoretical grids and subject grids and the relevance of the factors. There was enough agreement between the theoretical grids and the subject grids to indicate that repertory grid analysis would probably be usable as a technique for a quantitative approach to lingusitic model validation. Furthermore, relative explicitness in text structure was found to be significantly influential. This indicated that agreement between theoretical and subject grids was influenced by certain external factors like text structure explicitness. As a consequence, an investigation of some of these external factors needed to be carefully considered in the main study.

9.2.5 The main study

The design of the main study (*Chapter Six*) is basically that of the pilot study with a few dimensions added to expand and make more rigorous the investigation on external factors which had been proved important in the pilot. Besides the two factors of ESL reading proficiency and relative explicitness of text structure which were in the pilot, two new factors were introduced. Firstly, there was the question of whether experimental subjects' major academic discipline would be a relevant factor. To examine this, the target population was expanded to encompass two sub-populations from two different academic disciplines. These were *Science* and *Business* undergraduate students in Hong Kong. Furthermore, there was also the question of whether the method of construct elicitation using the triads, which is a near standard in repertory grid analysis, suited the present study well. To investigate this problem, an additional mode of construct elicitation was used in addition to the method of elicitation through triads. It was hoped that by comparing the two construct elicitation methods, insight could be gained to answer the question just posed. The alternative construct elicitation method chosen was the *Laddering* mode of construct eclicitation. This mode has a straightforward specification and, unlike the mode using triads, did not need further piloting. The aim of the additional factors in the design was to enable refined results to be calculated particularly regarding sub-population characteristics and the effect of modes of elicitation.

The principal analyses in the main study (*Chapter Seven & Eight*) were in the following areas

- **a** the investigation of *individual* perception of text structure (7.3 & 7.4);
- **b** the *qualitative* analysis of individual perception as a possible and logical extension of repertory grid analysis (7.5);
- **c** the establishment of *agreement* between individual perception and the theoretical linguistic model on text structure via grid comparison capabilities within *INGRID* (8.2);
- **d** the establishment of agreement between the consensus among subjects (the consensus grids) and the theoretical grids (8.3); and
- **e** the analysis of experimentally manipulated factors likely to influence the agreement between the subjects' perception of text structure and the theoretical model of text structure (8.4).

The basic line of argument in Chapter Eight is that, if the subjects' perception of text structure as individuals and as a group agree, to a reasonable extent, with the theoretical grids, the Winter-Hoey model of text structure should be considered as having a certain degree of perceptual and psychological reality; and to that extent it is validated.

The results from the analyses in Chapter Eight seem to suggest that the Winter-Hoey model does have the reasonable basis for perceptual reality just described. More importantly, though, repertory grid analysis has shown to be a usable technique for the kind of linguistic model validation procedure planned. As a methodological study, therefore, it can be said that the research has yielded positive results in terms of (*a*) demonstrating the validity of using repertory grids for linguistic model validation, and (*b*) indicating various research design issues which would be very important in future studies.

The study has, however, opened up several points that need some further comment and examination and has implications going beyond the particular aspect of linguistic research analysed. To these issues the rest of the chapter will now turn.

9.3 *Principal findings*

9.3.1 Introduction

The following section aims to provide an assessment of and comments on some of the issues which are best discussed from an overall perspective. The discussion that follows will focus on the three key areas in the thesis :

- **a** repertory grid analysis, as a methodology for linguistic investigation;
- **b** the text signalling approach to text analysis as the linguistic model being validated; and
- **c** conditions of adequacy for linguistic model validation.

9.3.2 Repertory grid analsysis

As a candidate for a quantitative approach to linguistic model validation, repertory grid analysis seems to have been demonstrated to be suitable. The extent of its suitability and additional details of similar applications in linguistic research naturally have to be further investigated.

This will be examined in 9.4.3 and 9.4.4 below. There are, however, a number of issues arising from the analyses so far that can be examined here. These include

- **a** the choice of elements and constructs;
- **b** the construct elicitation techniques; and
- **c** some characteristics of the principal component analysis.

9.3.2.a *The choice of elements and constructs* : The choice of clauses in a text as elements and text pattern features as constructs may need some additional clarification besides those already offered. (See 4.6.) There is, in the first place, a fundamental question concerning the selection of the unit of linguistic analysis. This is always problematic because the type of unit chosen is relative to a host of considerations and assumptions specific to the theoretical linguistic approach adopted. Furthermore, as is always the case in linguistic investigation, segmenting linguistic units from the language stream always involves a certain degree of artificiality. The severity of such problems associated with artificiality is dependent on how related to language use (in the Widdowsonian sense) the investigation is. In the present study, the choice of the clause as the unit of analysis is based on the text analysis approach adopted (see *Chapter Three*) and the intuitive status of the clause being a unit in language for nearly all naive language users. From the actual reaction of the subjects during the experimental sessions, it can be stated with some confidence that the choice of the clause as the unit of analysis has not been unwarranted. The actual results from the study, which were also satisfactory, confirm the suitability of clauses as elements. There is, however, one point of caution. The status of the clause as a distinct unit within the perceptual world of an individual is a very relative one. The subjects in the experiment had no problem construing the clauses being linguistic units of some kind because they had all gone through instruction in the English language. As a consequence, their ability to consider clauses as distinct is very much an acquired one. From this it can be stated that the choice of elements in an application of repertory grid analysis always needs careful consideration. With a sample of subjects from a different population clauses may not be the right choice for the same type of analysis. In some situations, chunks of a text representing each section of the text structure can be used; in other situations, short texts exemplifying minimal contrasts in text structure can also be possible and desirable.

The constructs used in the study are also of a rather special nature. On the one hand, they constitute the given from the text analysis model being validated; and yet, they cannot all be supplied. If they had been, the subjects' attention would have been so clearly directed towards what to focus on that there would have been no point in investigating it. The decision to use a mixture of supplied constructs for the text patterning features and elicited constructs for the three signalling devices suited the study well.

9.3.2.b *The construct elicitation technique* : It should be pointed out that the triading used in the study has one characteristic not generally found in that they have a targeted construct to be elicited. As general practice, in most repertory grid applications the triads are quite open ended. The particular way of configuring the triads was specifcally planned for the present study and is not meant to be a general recomendation. However, this should not be viewed as violating, in any basic way, the procedure and the rationale of repertory grid analysis. The triads used in the study had a targeted construct only from the experimenter's point of view. As far as the experimental subjects were concerned, the triads were in no way different from open ended triads. It was for this reason too that laddering was introduced as an alternative construct elicitation method for comparison with triading.

9.3.2.c *Principal component analysis* : It was quite consistently the case in the principal component analysis in Chapter Seven that the configuration of the constructs and the elements in a component depends on the construct mean (*i.e.* the number of 1s) and the patterning of the ratings of other constructs and elements. This may seem rather artifactual and not always representing the actual text pattern. There is, among linguists it seems, a rather intuitive suspicion that, if language phenomena are found to be too mathematically patterned, this may be due more to the artificiality of the mathematics and statistics concerned rather than any genuine regular pattern that is in the language phenomena themselves. It may be argued that there are instances (*e.g.* Clause 2 "*but this system has its problems* " in the Helicopter text and Clause 12 in the Computer text "*The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry* ") where a text element may not be salient according to the two statistical criteria but is prominent for any person actually reading the text. This is entirely possible, and indeed may be a frequent occurrence.

The discussion on this issue in 7.4.7 (*i.e.* the qualitative analysis) showed that there is some indication in the data of such a psychological, reader-based prominence and of the need for critical and judicial use of the results from **INGRID** rather than slavish adherence to statistical results. Cases like these confirm rather than refute the validity of text structure as uncovered by statistical procedure. The principal component analysis in **INGRID** is derived from the grid which is a record of the text pattern as perceived by the person filling the grid. The distinctness and the relative prominence of groups of constructs or elements are in the grid as records of text phenomena. Whether some non-prominent constructs in terms of text pattern would have a strong impact on the understanding of the text belongs, the author would tend to think, to the realm of cognitive psychology. Such constructs still remain non-prominent within the text qua text. The lack of prominence in text elements like Clause 2 of the Helicopter text is a real textual phenomenon. The prominence that emerges during the reading of the text should be considered a discoursal phenomenon, in which the interpretation of the reader through his/her schematic knowledge renders a textually unprominent element prominent within a particular discoursal context. This shows then the importance and the function of the type of text analysis being proposed. With a method like repertory grid analysis, there is the possibility to identify rather clearly the textual characteristics in a text and, consequently, disentangling them from discoursal characteristics. Such a demarcation is sometimes extremely difficult in discursive text analysis. In other words, studies like the present one may be useful preliminaries to establish the characteristics of texts prior to being used in discourse studies.

There is another feature of the principal component analysis which requires some examination. It is nearly always the case that the components are patterned in the form of a contrast between two groups of constructs and elements. This is inherent in the nature of the grid and the method of computation. The contrasts in the components, therefore, should be understood as belonging to the grid and do not necessarily refer directly to any semantic and/or perceptual reality in the present study. The contrast within any component is the result of the number of **1**s and **0**s in the constructs (*Construct Means*) and the distinctness of the constructs from one another (*Sums of Squares*). Whether the constrast is to be interpreted in terms of psychological opposites seems not to depend on the computation but rather the psychological or linguistic theory being studied. In standard Kellyan repertory grid analysis applications the contrasts within components suit personal construct psychology well, because Kelly (1955) claims that people perceive the world in terms of contrasting constructs. The interpretation to be given in a linguistic oriented analysis like the present one, contrasting poles in the components in Table 7.1d should more appropriately be taken as distinct rather than opposite.

9.3.3 The Winter-Hoey model

The Winter-Hoey model of text structure has been shown to agree with the way language users perceive the structure of the text. It can, therefore, be taken as a model that explains language behaviour besides being a descriptive model of text structure. There are several aspects that should be considered here. They are

- **a** those aspects in the model that have been validated albeit provisionally;
- **b** problems with the Winter-Hoey model;
- **c** issues that have not been addressed by the Winter-Hoey model; and
- **d** some special features.

9.3.3.a *What has been validated*: There is, in the first place, the establishment of agreement between individual and group perception of text structure and the theoretical analysis of text structure based on the Winter-Hoey model (8.2 and 8.3). This issue was investigated by examining the agreements reflected in the correlations between the subject grids and the consensus grids with the theoretical grids. However, such agreements exhibit a number of characteristics.

Firstly, there was differential degree of validation associated with the text pattern constructs of Situation, Problem, Solution, Evaluation and Preview on the one hand and the text signalling constructs of the three vocabularies on the other (8.2). In general, the text pattern constructs showed higher agreement with the theoretical analysis than the text signalling constructs. This may indicate that the text pattern constructs may have a higher degree of psychological reality. It is, however, too early to make any definite claim to that effect at the present stage of research.

Secondly, the relative explicitness of the text structure, *i.e.* explicit vs implicit, has considerable influence on the perception of text structure (8.4.2 and 8.4.3). This was deduced from the large number of main and interaction effects associated with TEXT in the ANOVA. The level of ESL reading proficiency had also some influence on agreement when relative explicitness of text structure was also considered. This was apparent from the significant interaction effect associated with LEVEL and TEXT (8.4.4). These aspects associated with the agreement beween the subjects' and the theory's model of text structure certainly provide rather interesting comparisons.

The implications of the effects due to TEXT go far beyond what was observable in the present study. The results from this study have succeeded in bringing out one aspect in the study of perception of text structure which is of particular importance. Text structure differences both internal in any particular text pattern and across diverse patterns within the same approach, *e.g.* the Winter-Hoey model, should be investigated in detail. Furthermore, the general issues relating to the analysis of text types should be seriously considered. These issues will be returned to in 9.4 (*Implications for future research*).

9.3.3.b *Problems with the Winter-Hoey model*: There is also a problem with the Winter-Hoey model as evidenced from the present results. In the case studies (7.4), there are instances of subjects making the correct identification of the clauses as salient but associating them with a construct different from that in the theoretical grid. Specifically, the four wh-clauses in the Computer text were correctly identified by all the three subjects reading the text. However, they associated them with Problem rather than Solution as is the case of the theoretical grid. This may raise the question of the meaningfulness of the labels for the constructs.

The rather special prominence of the set of four wh-clauses in the Computer text (Clauses 8 to 11) certainly deserves some comment. It is something a reader would notice when reading the Computer text. In this sense, it is not at all surprising or interesting to see the same prominence emerging in the principal component analyses. What is interesting, however, is the detailed effects the section of the text exhibits within the text and within the perception of the subjects. All three subjects in the case studies who read the Computer text (Cases 1, 3 and 5) have the four wh-clauses loaded high on the same component with the same sign but with an opposite sign to and higher loadings than Clause 7 which is the Preview to the section. This indicates then that the four wh-clauses probably form a more prominent segment in the Preview-Detail contrast. This leads to Preview having very high correlations with the theoretical grid in the Computer text, and much higher than the correlations in the Helicopter text. In the recalled summaries, all three subjects included Preview. Such results are captured with the aid of repertory grid analysis and its extension to its related qualitative analysis, without which it would be very difficult to uncover such details in the data. As it happens, the prominence of the wh-clause segment renders confirmation of Repetition, which constitutes one of the basic signalling devices in Hoey (1983b).

9.3.3.c *To what extent is the Winter-Hoey model not validated?* : It may be relevant to ask then to what extent the Winter-Hoey model is not validated. The first issue relates to the bipolar nature of the loadings in a component already described in 9.3.2.c above. The issue now is whether the opposition is merely an artifact of principal component analysis or does it relate to real underlying psychological opposition. If the latter interpretation is adopted, there may be problems with the adequacy of repertory grid analysis representing the text structure in the Winter-Hoey model. Text structure is not usually conceived in terms of opposing contrasts. The best answer to this difficulty is that there is no inherent requirement to interprete the opposite in signs of the loadings in terms of psychological oppositions. In fact, the opposition in component loadings is derived from the pattern of distinctiveness within the covariance matrix, which does not have an inherently contrastive meaning. Differences in signs can be viewed as merely differences and not contrasts. This should lead to caution when interpreting the loading pattern in a component.

The second issue also relates to principal component analysis. The basis for the identification of salient groups of constructs or elements is the degree of their distinctness in terms of the number of similarly distinct constructs and/or elements. This raises the question of the status of a section of a text or a clause with very marked textual function but low frequency of occurrence. The results of the principal component analysis would not reveal such a construct or element. A possible answer to this point is to propose that, as far as text structure is concerned, the construct or clause in question should be rated low in prominence qua text structure.

The fact that it is marked in textual function is due to the reader's subjective understanding which is not purely textual in nature.

Text pattern, by its very definition, concerns itself with the patterning of textual units. Patterning in such a case should refer to the number of units of the same kind (*e.g.* the Problem section) and their relative positioning within the text. Such patterning gives rise to textual prominence. There is another type of prominence which depends on the perceiver's own point of view. This is psychological or discoursal prominence. By being able to identify and to single out textual prominence as distinct from discoursal prominence, principal component analysis is able to make an important contribution towards distinquishing textual from discoursal phenomena so necessary for text and discourse analysis.

9.3.3.d *Conditions for adequacy of linguistic model validation* : It may be necessary at this point to make explicit one particular problem regarding validation in general. It is legitimate to ask what constitute the conditions for adequacy in linguistic model validation. This is a pertinent question, because what has been done in the study regarding the validation of the Winter-Hoey model can only be described as a provisional validation. Not only was the sample small; the segment within the Winter-Hoey model that was examined in the study was a very small segment indeed. It was felt that this was legitimate because of the methodological nature of the study. However, a comprehensive validation for a linguistic model needs to go far beyond what has been done in the study. First, there is a pressing need to increase the sample size. In addition, the number of texts to be analysed within the same text pattern needs to be quite large to establish stable results. It is also vital that other text patterns are examined and the results obtained are compared to those reported here in order to discover any common trend among the various patterns. Only after a exhaustive investigation both in depth and in breadth can the validation of a linguistic model be called complete making the results truly representative of the model.

9.3.4 Some special issues

There are still a few points that need some additonal consideration. They are

a the distinction between text patterning and text signalling constructs;

b the text structure as analysed by quantitative methods.

9.3.4.a *Text patterning and text signalling constructs* : The consistent pattern of results that emerges from the present analyses regarding the clear difference between the five text pattern constructs and the three signalling constructs already alluded to in 9.3.3.a above needs further comment. This is apparent in the correlations between matched constructs (Table 8.1), where text pattern constructs have generally a higher mean correlation, *i.e.* higher degree of theoretical and consensus agreement, than the signalling constructs. The difference is also observed in the ANOVA study, where TEXT is a significant factor for the text pattern constructs and MODE for the signalling constructs. The differences observed may be the manifestation of the differences which some linguistic theories claim to exist between coherence and cohesion (Widdowson 1979 p.145, de Beaugrande 1984). The former would refer to the text pattern constructs while the latter refer to the signalling constructs. As de Beaugrande (1984) points out:

> "COHESION subsumes the procedures whereby the SURFACE TEXT is organized as a sequentially related configuration of language items. ...

> COHERENCE subsumes the procedures whereby a configuration of concepts is assembled into a TEXTUAL WORLD: the total knowledge activated while processing the text." (p.38)

From a systemic perspective (*e.g.* Bernhardt 1985), text pattern constructs belong to the ideational function and signalling constructs have a textual function. The two belong to different systems and can exhibit different behaviour in terms of the perception of an individual, even though they must function together to produce and to decode a text. The distinctness and the relationship between these two systems within the same text is certainly a very important aspect of research and can be very fruitlfully investigated using repertory grid analysis as has been evidenced by the results in the present study.

9.3.4.b *The text structure as analysed by a quantitative method*: The repertory grid analysis on the theoretical grid associated with the Helicopter and the Computer texts certainly presents a very finely tuned analysis of the text structure, which, even though not unattainable by the common means of discursive text analysis, is much more easily accessible and probably more precise. The principal component analysis of the two theoretical grids in 7.3 bear ample evidence to the extent of refinement that can be obtained through text analysis. The components represent underlying dimensions of the ways a text is perceived. Within each component the relationships among the text pattern constructs and the text signalling constructs, and also between them, are uncovered. In addition, the alignment of the clauses within a component could throw further light on the text structure itself, as is evident from the analyses of the theoretical grids as well as the subject grids in 7.3 & 7.4. The implications for the text signalling approach to text analysis are numerous. In the first place, with the help of repertory grid analysis different texts analysed by the same individual (*e.g.* the theorist) can now be analysed by *INGRID* and its associated programs. Such a consistent method of analysis would certainly yield interesting insight into the model and, in all probability, indicate modifications to the basic formulation. Furthermore, with the same technique analyses by different individuals (*e.g.* different scholars) can be examined and their views compared on an objective basis. This would be invaluable in providing an objective basis for academic discussions among scholars. Such an objective basis will certainly not be a substitute for personal ideas and insights, but would facilitate consensus and enhance speculation.

9.3.4.c *Observations* : To sum up the discussion so far, it can be said that repertory grid analysis has opened up the possibility of analysing linguistic phenomena and scrutinizing linguitic models with a method at once objective, informative and giving full recognition to human perception. The application of the analytic tool to the linguistic problem on hand should be considered worth additional research effort. However, the discussions in this chapter show that there are details which need to be addressed to make the application of repertory grid analysis to linguistic research more rigorous than has been done in this study; furthermore, there are also areas in repertory grid analysis and in text analysis which the present study is neither able nor expected to go into. It is hoped that future research efforts would shed more light on some of these issues. It is to some of these research implications that the following section of the final chapter will now turn.

9.4 *Implications for future research*

9.4.1 Introduction

It is indeed impossible and would certainly be presumptuous to try to spell out all the implications for future research that can arise as a result of the present study. However, the thinking that was gone into throughout the process of the present study does give the researcher a vantage point to view the research potential of the study, which may not be apparent to the first-time reader of this work. In the following sections, therefore, a few important implications for future research will be indicated to serve as a reminder of some of the points which the researcher kept being alerted to throughout the study. This is done also in the hope that it will initiate more thinking into those problems that could be pursued along similar lines of research endeavour. The discussions will again focus on repertory grid analysis as the research method being pioneered, and the text signalling approach as the relevant linguistic model. To those are added suggestions as to how linguistic research can benefit from the use of repertory grid analysis as a research tool.

9.4.2 Repertory grid analysis

The actual application of repertory grid analysis in the present study can be described as following orthodox lines with great care being taken to follow, as far as possible, the standard procedure of application found in a number of publications in the field (*e.g.* Slater 1977, Fransella & Bannister 1977, Shaw 1981a). This was necessary in order to do justice to *INGRID* as a standard in repertory grid analysis as applied to linguistic investigation. Once the goodness of fit for *INGRID* has been established, refinements can then be progressively introduced with justification and insight. In the following discussion a few suggestions will be made regarding the three major areas within *INGRID* : element and construct specification, construct elicitation techniques and principal component analysis.

9.4.2.a *Element and construct specification* : Because the aim of the present study was to validate the *signalling approach* in text analysis, the specification of elements and constructs in the study is based directly on the linguistic model. In an open ended investigation the use of other types of elements and constructs can be made with great benefit. For example, chunks of a text representing the components of text pattern (*e.g.* Situation, Problem, etc.) could be used instead of clauses. In such cases, the text pattern constructs may be more clearly highlighted than when clauses are used as elements. In other words, varying the elements to be used within the same field of investigation, could provide valuable insights into what exactly constitute the truly transparent elements for the language user. In the text signalling approach, such further research might be revealing as to the status of the clause as a linguistic unit derived from the model. More ambitiously, it might be revealing as to the status of the sentence, an issue which is still notoriously problematic.

Another problem relates to the size of the grid. The texts that were analysed in the present study were relatively short texts. It would certainly be necessary to explore ways of analysing longer texts and/or texts with more complex structure, *e.g.* texts with embedded structures where a negative Evaluation of a Solution would open up a fresh Problem and the whole structure is recycled. In both cases, the resulting grid would tend to be much larger than those used in the study.

However, there are two problems associated with the analysis of such texts. There is, first of all, the problem associated with the size of grid analysable by **INGRID**. Here, the particular programme limitation in **INGRID** , *i.e.* a 40x40 maximum data matrix, may look restrictive. Even so, this problem is not unsurmountable. One way to extend the data matrix for INGRID would be to divide the intended grid into smaller component grids and to administer them to the same individual in different sessions.

The second problem has to do with limitations in human information processing. It has been shown in the pre-pilot study that it is quite impossible for any individual to handle a grid of a size of 40x40 or even smaller. (See 5.3.) In order to elicit grids of a large size, careful thought needs to be given particularly regarding experimental situation manipulation so that longer and complex texts can be used for *INGRID* analysis without overburdening the individuals. For example, a long text can be analysed first with a grid on the overall text pattern; then, grids on each segment of the text can be used for the study of details in the text pattern. Naturally, there is always the question of how large a single grid can be for any one experimental session or how many sessions there can be for a long text to be scheduled.

9.4.2.b *Construct elicitation technique* : The use of both Standard and Laddering modes of construct elicitation succeeded in bringing out the relevance of the mode of construct elicitation in the context of application of repertory grid analysis to lingustic research. Even more methods of elicitating constructs are worth exploring. In particular, there seems to be a need for a method which would enhance a comunicative and interactive environment in the construct elicitation phase. Such an environment is partially provided by making creative use of laddering. However, there is a very interesting suggestion in Shaw's (1981) program called PEGASUS. This is essentially an interactive computer program which allows a step-by-step approach to eliciting the constructs interactively and heuristicaly. PEGASUS is usable for both eliciting through triads or laddering. Research into the precise ways of using methods of construct elicitation like **PEGASUS** would certainly help to make grid elicitation procedures ever more transparent to the individual, because the individual is given nearly full control of the ways the grid is to be elicited.

9.4.2.c *Principal component analysis* : From the discussion of the various aspects of the principal component analysis in **INGRID** in 7.3.1, it is clear that there are several important aspects of the technique that need to be explored further. There seems to be a need, in the first place, to develop descriptive statistics similar to the communalities in standard **R**-technique principal component analysis. Essentially, communalities indicate the percentages of common variance/covariance that each variable (in the case of repertory grid elements and constructs) contains. Such information is vital in examining in each variable to see what the variable may have in common with other variables and what may be specific to itself. Knowledge of both is important for an understanding of the overall picture of the grid and this is currently unavailable.

The number of components generated by **INGRID** on the basis of the Bartlett test tends to be small (in the region of two to three). This is quite understandable within the context of psychotherapy which is the most common application of repertory grid analysis. It would be quite difficult for a psychotherapist to examine too many dimensions of the patient particularly when the last components may contain small percentages of covariance. A small number of components with fairly large percentages of covaruance serves a psychotherapist's function well. This is also the position of Slater (1977). From this point of view, it is quite clear then that in situations like linguistic research a larger number of components may be more advantageous. It very often happens that a component which has a rather small overall covariance from a principal component anlaysis can open up very interesting research dimensions. Validity rather than reliability is the main concern of research. There is need, therefore, for exploratory approaches to be developed for the specification of components to be examined within **INGRID**. Slater (1977, pp.1101-103) explicitly encourages other methods other than the Bartlett test to investigate.

Furthermore, confirmatory approaches are also highly desirable particularly in research in a field like linguistics. The design of *INGRID* is quite conducive to the development of confirmatory approaches. In some ways, by trying to validate a linguistic model, the application of repertory grid analysis in the present study has a confirmatory orientation. *INGRID*, with its flexibility in the grid to be included for analysis and the ways with which grids can be compared, provides an excellent confirmatory framework. Through extensive grid comparison among a large sample of grids, a particular linguistic model can be rigourously validated and a target grid representing the ideal model can be derived. This would then be used as the basis for confirmatory analysis using again grid comparison analyses. Such an approach to confirmatory principal component analysis is highly interesting. One of the most difficult and most controversial problems in confirmatory factor analysis is the way the target factor/component matrix is derived. In commonly used confirmatory factor analysis it is almost exclusively based on theoretical mathematical models (see Nunnally 1978). What is being discussed here regarding the confirmatory application of repertory grid analysis suggests that an empirical method could be used to derive the target factor/component matrix, making the target matrix a true target matrix to be the criterion for confirmatory analysis. However, to become fully confirmatory, a host of goodness-of-fit testing statistical procedures need to be developed. If these are forthcoming in future, it would certainly represent great advances for the application of repertory grid analysis as a research rather than a clinical tool.

9.4.3 The Winter-Hoey model

One of the most important contributions of repertory grid analysis to linguistics, particularly text analysis, is the possibility of analysing textual diversity, either genuine (in the sense of Widdowson 1979 pp.163-172) or engineered. Once diversity is quantified, comparisons can then be made in a host of problems relating to the text. For example, variables can be manipulated within the text according to a plan to obtain different configurations of constructs with differential highlighting. The results from the analysis of such data should be helpful for an understanding of, for example, the relative explicitness of text pattern constructs, their differential importance within the text pattern, relationships among the text signalling constructs, or, finally, the relationships between text perception and background schematic knowledge.

Manipulated variables can also be used to study relationships among texts. In the discussion on linguistic model validation (9.3.3.d), mention was made regarding the necessity to expand the analyses of the present study both within the Problem-Solution pattern and across other text patterns in the Winter-Hoey model, *e.g.* Matching Compatability or General-Particular. Indeed, an obvious and legitimate extension of the validation of the Winter-Hoey model is the issue of the applicability of repertory grid analysis to the study of text types, which is of central importance to text analysis but is much more complex than it may first appear. This is so not because of any lack of classifications of text types in linguistics. Winterowd (1970), Grimes (1975), Crothers (1979) and de Beaugrande (1984) have all proposed classification schemes. However, Kintsch (1982) makes the following observation on existing text type classifications :

> "They have some psychological validity, derived from the intuitions of their inventors, but when it comes to experimental data and the construction of processing models, they simply do not matter." (p.93)

and further on he states :

> "What we need are not fancy linguistic classifications, but some indications on what naive readers (not linguists) are doing - in other words, a process model of comprehension." (*ibid.*)

de Beaugrande (1984) makes the same point and suggests :

> "A typology of texts should be based on processes and contexts, not just on the features of artifacts..." (p.100)

If naive language users' text processing model is indispensible for the study of text types, repertory grid analysis should be one of the best experimental and quantitative method to tap those processes.

9.4.4 Linguistics & applied linguistics

With its powerful grid comparison capabilities, *INGRID* can be a very useful tool particularly in establishing a consensus view within the field of linguistics and applied linguistics. Scholars from within the same persuasion can now have an objective method to help develop consensus views vis-a-vis any area of common linguistic interest. By the same token, competing and/or conflicting models in an identical area of linguistic research could now have differences as well as similarities compared and studied on an objective basis. Such possibilities, vital as they are, have been lacking until now, at least with any mathematical base. Repertory grid approaches allow possibilities for change.

But the potential for use of repertory grid analysis goes much further than we have seen so far. In so far as it is a technique for the analysis of human perception, repertory grid analysis can be applied to all types of research concerning human perception of language phenomena. In particular, psycholinguistics and sociolinguistics, particularly the social psychology of language, can find extensive scope for applications. Repertory grid analysis can also be applied in more standard theoretical lingustic research. To quote two possible examples, in semantics, the area of lexical fields and lexical network, and in syntax, grammatical acceptability judgment study are both directly based on perceptual judgment of individuals and are easily analysed by repertory grid analysis.

As far as applied linguistics is concerned, repertory grid analysis could be an excellent tool for the study of the psychological dimension of language behaviour. The whole area of research relating to text comprehension, reading behaviour and cognitive psychological factors influencing language use could benefit from such study. Language learner characteristics and L1-L2 langauge user differences can be examined with a method that is at once objective and individualized.

In the field of language testing the fundamental issue in applied linguistics of process *vs* product (see Widdowson 1979, p.71) is also relevant. Conventional strategy in the field tends to regard product as the prime source of data, because it is product that is most easily quantified and measured with existing statistical techniques in language testing. Thus, language tests tend to derive test content principally from the language system, albeit from a very wide sense of the term. Attempts to measure process, *e.g.* in construct validation for language tests, have been principally deductions based on experimental manipulation of product measurements as is the case of the Mutli-Trait-Multi-Method construct validation procedure (Bachman & Palmer 1981), where traits (*i.e.* processes) are examined through patterning product tests in such a way to enable deductions on processes. The application of repertory grid analysis could open a wholely new dimension regarding process versus product testing. As has been discussed in conjunction with text type study (9.4.3), repertory grid analysis renders language processes accessible quantitatively and, therefore, testable. Constructs become directly measurable during the time of their unfolding rather than via product data manipulation. The implication of such a possibility is quite significant. The fundamental question of test validity, *i.e.* what a test purports to measure, could now be given a direct rather than an indirect answer.

9.5 *Conclusion*

The limited examples of the possible areas of application of repertory grid analysis just described look very impressive indeed. It looks as though what has been achieved in the thesis is only the beginning of a beginning; and the method of repertory grid analysis is, in fact, applicable to any linguistic phenomena that have to do with the perception of language. If that is the case, the author of this thesis would feel amply rewarded for having made the first step in applying such methods to applied linguistics.

Appendices

Appendix 1a - The text used in the pre-pilot

[1]Helicopters are very convenient for dropping freight by parachute [2]but this system has its problems. [3]Somehow the landing impact has to be cushioned to give a soft landing. [4]The movement to be absorbed depends on the weight and the speed [5]at which the charge falls. [6]Unfortunately most normal spring systems bounce the load [7]as it lands, [8]sometimes turning it over. [9]To avoid this, [10]Bertin, developer of the aero-train, has come up with an air-cushion system [11]which assures a safe and soft landing. [12]It comprises a platform on [13]which the freight is loaded with, underneath, a series of "balloons" supported by air cushions. [14]These are fed from compressed air cylinders equipped with an altimeter valve [15]which opens [16]when the load is just over six feet from the ground. [17]The platform then becomes a hovercraft, [18]with the balloons reducing the deceleration [19]as it touches down. [20]Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second. [21]The charge weighed about one-and-a-half tons, [22]but the system can handle up to eight tons. [23]At low altitudes freight can be dropped without a parachute.

Appendix 1b - Triads used in the pre-pilot

Triad for Construct 2

8 sometimes turning it over.
6 Unfortunately most normal spring systems bounce the load ...
10 Bertin, developer of the aero-train, has come up with an air-cushion system ...

Triad for Construct 3

7 ... as it lands,
11 ... which assures a safe and soft landing.
10 Bertin, developer of the aero-train, has come up with an air-cushion system ...

Triad for Construct 4

23 At low altitudes freight can be dropped without a parachute.
21 The charge weighed about one-and-a-half tons,
9 To avoid this,

Triad for Construct 5

12 It comprises a platform ...
14 These are fed from compressed air cylinders equipped with an altimeter valve ...
2 ... but this system has its problems.

Triad for Construct 6

11 ... which assures a safe and soft landing.
2 ... but this system has its problems.
14 These are fed from compressed air cylinders equipped with an altimeter valve ...

Triad for Construct 7

15 ...which opens ...
16 ... when the load is just over six feet from the ground.
20 Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second.

Triad for Construct 8

8 ... sometimes turning it over.
6 Unfortunately most normal spring systems bounce the load ...
11 ... which assures a safe and soft landing.

Triad for Construct 11

13 ... on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions.
19 ... as it touches down.
4 The movement to be absorbed depends on the weight and the speed ...

Triad for Construct 12

22	... but the system can handle up to eight tons.
21	The charge weighed about one-and-a-half tons,
9	To avoid this,

Triad for Construct 14

12	It comprises a platform ...
5	... at which the charge falls.
22	... but the system can handle up to eight tons.

Triad for Construct 15

15	... which opens ...
16	... when the load is just over six feet from the ground.
4	The movement to be absorbed depends on the weight and the speed ...

Appendix 1c - Construct definition table in the pre-pilot

Triads	Constructs *Positive Pole* (Rating = 1)	 *Negative Pole* (Rating = 0)
8,6,10		
23,21,9		
12,14,2		
7,11,10		
15,16,20		
8,6,11		
13,19,4		
11,2,14		
22,21,9		
12,5,22		
15,16,4		

Appendix 1d - Raw grid in the pre-pilot

Triads	Clause 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
8,6,10																							
23,21,9																							
12,14,2																							
7,11,10																							
15,16,20																							
8,6,11																							
13,19,4																							
11,2,14																							
22,21,9																							
12,5,22																							
15,16,4																							

Appendix 1 e - Construct definitions of the pre-pilot subjects

Positive Pole	Negative Pole
Subejct 1 (linguistcally naive)	
Different constrasts in 8 & 6.	"NOT BOUNCING THE LOAD".
Incomplete.	Complete.
Plural.	Singular.
Complete Sentence.	Incomplete Sentence.
Complete Sentence.	Incomplete Sentence.
Complete Sentence.	Incomplete Sentence.
Complete Sentence.	Incomplete Sentence.
Incomplete Sentence.	Complete Sentence.
Not talking about weight.	Refers to weight.
Beginning Sentence.	Sections of sentence.
Complete sentence.	Incomplete sentence.
Subject 2 (linguistically trained)	
8 has no meaning by itself, needs context.	6/10 are main clauses, they carry information that can be understood out of context.
23 doesn't refer to something else.	21/9 both refer to something mentioned before.
	12/2 lead you to expect more related info.
14 gives extra detail and is complete.	10/11 make up a sentence.
7 - a fragment.	15/16 are part of the same clause.
20 - a complete sentence from the text.	8/11 both possible endings for 6 depending on context.
6 - beginning of sentence for either 8 or 11.	
	4/19 a possible sentence.
13 could not be matched with 4 or 19.	11/2 both give extra info about the missing subject of the sentence.
14	
	21/22 both talking about weight - "tons".
9 - no lexical connection.	12/22 clauses.
5 - "at which" - phrase.	15/16
4	
Subject 3 (linguistically naice)	
Both 6&8 are incomplete as they do not explain the meaning.	10 explaines who the developer is.
9 has no subject.	23 is a complete sentence, also 21.
12&14 assume a previous sebject.	2 is a partial explanation.
7&11 follow an explanation.	10 is an initial explanation.
15&16 follow an explanation.	20 is a conclusion of a test.
8&11 conclude a previous explanation.	6 concludes a group of tests.
11 follows a dingle subject.	14&2 follow dual subjects.
9&22 explain an alternative.	21 offers no alternative.
4 preceeds an illustration.	15&16 without subject or context.

Appendix 2a - The Helicopter text

[1]Helicopters are very convenient for dropping freight by parachute; [2]but this system has its problems, [3]because the landing impact has to be cushioned to give a soft landing. [4]Unfortunately most normal spring systems bounce the load [5]as it lands, [6]sometimes turning it over. [7]To avoid this, [8]Bertin, developer of the aero-train, has come up with an air-cushion system [9]which assures a safe and soft landing. [10]It comprises a platform [11]on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions. [12]Trials have been carried out with freight-dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second. [13]The charge weighed about one-and-a-half tons, [14]but the system can handle up to eight tons. [15]At low altitudes freight can be dropped without a parachute.

Appendix 2b - The triads for the Helicopter text

12 Trials have been carried out with freight- dropping at rates of from 19 to 42 feet per second in winds of 49 feet per second.
8 Bertin, developer of the aero-train, has come up with an air-cushion system ...
10 It comprises a platform ...

3 ...because the landing impact has to be cushioned to give a soft landing.
1 Helicopters are very convenient for dropping freight by
13 The charge weighed about one-and-a-half tons, ...

4 Unfortunately most normal spring systems bounce the load ...
2 but this system has its problems.
6 sometimes turning it over.

11 on which the freight is loaded with, underneath, a series of "balloons" supported by air cushions.
5 as it lands, ...
7 To avoid this, ...

Appendix 2c - Construct definition table for the Helicopter text

Triads	Construct Definition
12,8,10	
3,1,13	
4,2,6	
11,5,7	

Appendix 2d - Raw grid for the Helicopter text

Triads	Clause 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Situation															
Problem															
Solution															
Evaluation															
12,8,10															
3,1,13															
4,2,6															
11,5,7															

Appendix 3a - The Computer text

[1]A two day seminar on effective use of computers in manufac-turing management is being organised by the IProdE's manufactur-ing management activity group. [2]The seminar, [3]to be held on 26/27 June at the Birmingham Metropole Hotel, National Exhibition Centre, will follow the Institution's policy of featuring speakers with practical experience [4]who will be drawn from companies of widely varying size and products. [5]Furthernore, time will be made available for delegates to see the associated exhibition, [6]which will include demonstrations of equipment. [7]Discussions will centre on four concurrent streams: [8]How interaction between design, production engineering and production control can be promoted; [9]What planning and control of material requirements have to be satisfied; [10]How capacity can be optimised through planning of manufacturing resources; and [11]How capacity can be optimised through control of manufacturing resources. [12]The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry. [13]Further details are now available from the Conference Secretary, Rochester House.

Appendix 3b - Triads for the Computer text

7 Discussions will centre on four concurrent streams:
10 How capacity can be optimised through planning of manufacturing resources;
8 How interaction between design, production engineering and production control can be promoted;

6 which will include demonstrations of equipment.
2 The seminar, ... will follow the Institution's policy of featuring speakers with tical experience ...
11 How capacity can be optimised through control of manufacturing resources.

1 A two day seminar on effective use of computers in manufacturing management is being organised by the IProdE's manufacturing management activity group.
13 Further details are now available from the Conference Secretary, Rochester
5 Furthermore, time will be made available for delegates to see the associated exhibition, ...

12 The seminar will certainly be of great help to promote computerisation of management in the manufacturing industry.
9 What planning and control of material requirements have to be satisfied;
4 who will be drawn from companies of widely varying size and products.

Appendix 3c - Construct definition table for the Computer text

Triads	Construct Definition
7,10,8	
6,2,11	
1,13,5	
12,9,4	

Appendix 3d - Raw grid for the Computer text

Triads	Clause 1	2	3	4	5	6	7	8	9	10	11	12	13
Situation													
Problem													
Solution													
Evaluation													
7,10,8													
6,2,11													
1,13,5													
12,9,4													

Appendix 4a - Theoretical grid of the Helicopter text

Construct / **Elements** — **Clauses**

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Situation	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Problem	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Solution	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0
Evaluation	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Preview	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Voc. 1	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0
Voc. 2	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0
Voc. 3	1	1	0	0	0	0	1	1	1	1	0	1	1	0	1

Appendix 4b - Theoretical grid of the Computer text

Construct / **Elements** — **Clauses**

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
Situation	1	1	1	1	1	1	0	0	0	0	0	0	0
Problem	1	0	0	0	0	0	0	0	0	0	0	0	0
Solution	0	0	0	0	0	0	1	1	1	1	1	0	0
Evaluation	0	0	0	0	0	0	0	0	0	0	0	1	0
Preview	1	0	0	0	0	0	1	0	0	0	0	0	0
Voc. 1	0	0	0	1	0	1	0	1	1	1	1	0	0
Voc. 2	0	0	0	0	1	0	0	0	0	0	0	0	0
Voc. 3	1	1	1	0	0	1	1	1	1	1	1	1	1

Appendix 5 - A typical principal component analysis

Element	Component 1 Loading	Component 2 Loading
1	.39	-.15
2	-.68	.02
3	-.75	.28
4	-1.20	.20
5	-.75	.28
6	-1.20	.20
7	.76	.45
8	.87	.58
9	.76	.45
10	.76	.45
11	.24	.63
12	.44	-.87
13	.45	-.87
14	-.53	-.77
15	.44	-.87
Construct		
1	.14	-.07
2	-1.61	.46
3	1.20	1.21
4	.27	-1.60
5	.31	.27
6	.56	.17
7	-1.27	-.17
8	1.48	-.38
Root	8.04	4.50
%	44.66	24.99

Appendix 6 - Chi square results from the pilot study

Cross-tabulation: C2 (Problem)
By TEXT

TEXT C2	Count C	H	Row Total
0	11	1	12
1	1	11	12
Column Total	12 50.0	12 50.0	24 100.0

Chi-Square	D.F	Significance
16.66667	1	.0000

Cross-tabulation: C3 (Solution)
By TEXT

TEXT C3	Count C	H	Row Total
0	7	3	10
1	5	9	14
Column Total	12 50.0	12 50.0	24 100.0

Chi-Square	D.F.	Significance
2.74286	1	.0977

Coss-tabulation: C4 (Evaluation)
By TEXT

C4	TEXT C	Count H	Total	Row
0	8		8	
1	4	12	16	
Column Total	12 50.0	12 50.0	24 100.0	

Chi-Square	D.F.	Significance
12.00000	1	.0005

Cross-tabulation: C7 (Voc 2.)
By TEXT

TEXT C7	Count C	H	Row Total
0	10	4	14
1	2	8	10
Column Total	12 50.0	12 50.0	24 100.0

Chi-Square	D.F.	Significance
6.17143	1	.0130

Appendix 7a - Construct definition

(Laddering mode)

Construct	Construct Definition
Construct 6	
Construct 7	
Construct 8	

Appendix 7b - Raw grid for the Helicopter text

(Laddering mode)

Construct	Clause 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Situation															
Problem															
Solution															
Evaluation															
Preview															
Construct 6															
Construct 7															
Construct 8															

Appendix 7c - Raw grid for the Computer text

(Laddering mode)

Construct	Clause 1	2	3	4	5	6	7	8	9	10	11	12	13
Situation													
Problem													
Solution													
Evaluation													
Preview													
Construct 6													
Construct 7													
Construct 8													

Appendix 8 - Instructions to experimenter

(to be delivered in Cantonese)

1 Introduction to subjects

Dear students, the experiment you are participating aims to investigate how you read English texts. This is not a test of reading and there are no right or wrong answers. What is of interest is how you read and what is or is not meaningful to you. More specifically, the experimenter is interested to know what kind of mental picture (or text structure) you formulate after reading the text. Now, I am going to distribute the materials for the experiment to each one of you.

The set materials should be distributed according to the subjects' experimental code.

2 The reading stage

First of all, please read the text on the first page. Take time to read and understand it.

Give enough time for everyone to finish reading.

3 The construct definition stage

(For the Standard mode)

Now please turn to page 3 of the handout. There are 2 grids there. First examine the grid at the lower part of the page. On the left hand side, you can find a column of labels called Triads.
The first four are already labelled as Situation, Problem, Solution and Evaluation. These four labels represent the opinion of some scholars who specialise in the study of text structure. According to these scholars, it is very common, particularly in academic writings, to have a four-stage text structure of Situation-Problem-Solution-Evaluation. A Situation is presented, where a Problem (or a number of Problems) is identified. Solution(s) are then given with Evaluation of the solution(s) also given. It should be remembered that these four stages need not all be present and need not have fixed ordering. This particular way of looking at text structure is presented to you only as an opinion. its sole purpose is to focus your attention on the aspect of text the experiment aims to investigate. You are free to agree or disagree with the view of the scholars. It is vitally important to remember that it is your view and your understanding of text structure that is the only important concern in this experiment.
The other four items in the Triads column do not have any labels. You have to supply them. The way to do this is as follows. Instead of a label, each of the four unlabelled item has a set of three numbers. These refer to the corresponding clauses in the text. The three clauses are chosen in such a way that one of the three is different from the other two in one aspect. Your task is to compare the three clauses in each item within the context of the text to identify which appears to you as the odd-one-out. Circle that particular number in the grid at the upper part of the page and write down in the blank space on the right, labelled CONSTRUCT DEFINITION, the feature you consider constituting the contrast between the clause circled and the other two clauses. Do this with all the four unlabelled items. There is one very important point to keep in mind when labelling the items. You cannot repeat your CONSTRUCT DEFINITIONs. The four items should have different labels. To help you label the items, the three clauses in each set are listed on page 2 of the handout. You can also split all the pages of the handout to ease the labelling task.

(For the Laddering mode)

Now please turn to page 2 of the handout. There are 2 grids there. First examine the grid at the lower part of the page. On the left hand side, you can find a column of labels called Triads.
The first five are already labelled as Situation, Problem, Solution and Evaluation. These labels represent the opinion of some scholars who specialise in the study of text structure. According to these scholars, it is very common, particularly in academic writings, to have a four-stage text structure of Situation-Problem-Solution-Evaluation. A Situation is presented, where a Problem (or a number of Problems) is identified. Solution(s) are then given with Evaluation of the solution(s) also given. Those are then the first four labels found in the grid. It should be remembered that these four stages need not all be present and need not have fixed ordering. The 5th item is labelled Preview. It is another way a text can be structured. Preview refers to the way of text structuring where an overall view is presented before details are presented. Preview is, therefore, contrasted with Details. This particular way of looking at text structure is presented to you only as an opinion. its sole purpose is to focus your attention on the aspect of text the experiment aims to investigate. You are free to agree or disagree with the view of the scholars. It is vitally important to remember that it is your view and your understanding of text structure that is the only important concern in this experiment.
The last three items do not have specific labels. They are labelled Construct 6, 7 and 8. They refer to expressions in the text that provide signals for the text structure. Your task is to examine the text and to identify the kinds of expression you think that signal text structure. Examine the test again and circle those epxressions you think that signal text structure. Write down the name for the types of signalling expressions (e.g. noun, verb, conjunction, etc.) in the blank spaces in the grid at the upper part of the page and include at least three examples of the type of expression you identify. If you find it difficult to give a name to a type of expression, include only the examples. However, please remember always to include examples of the type of expression identified. A maximum of three items are provided; however, this does not mean that you have to identify all three types of expressions. Care should be taken that you do not repeat a type already identify. The three types of signalling expressions should all be different.

4 Grid completion stage

Now go back to the grid in the lower part of page 3 (for the Standard mode) / page 2 (for the Laddering mode). Examine each clause in the text regarding all the items in the Triads column. If you think a particular feature in the Triads column is found in a particular clause give a rating of **1** to that clause, otherwise rate that clause in regards to the feature **0**. Do this for all the clauses in the text for all the items in the Triads column.

5 Recalled summary

Now try to wirte down whatever points you can remember on the text read. This is not a test and you are not expected to reproduce the text. The aim here is to see how much you remember from the text. There is, therefore, no need to re-read or to refer to the text.

6 Conclusion

Thank you very much for your help to participate in the experiment.

Collect all experimental materials.

Appendix 9 - The Reading test scores of the sample

High group		Middle group		Low group	
BUS Comp Mod L Ha	**85**	BUS Comp Mod L Ma	**55**	BUS Comp Mod L La	**40**
BUS Comp Mod L Hb	**80**	BUS Comp Mod L Mb	**55**	BUS Comp Mod L Lb	**45**
BUS Comp Mod S Ha	**75**	BUS Comp Mod S Ma	**55**	BUS Comp Mod S La	**45**
BUS Comp Mod S Hb	**70**	BUS Comp Mod S Mb	**55**	BUS Comp Mod S Lb	**45**
BUS Heli Mod L Ha	**70**	BUS Heli Mod L Ma	**55**	BUS Heli Mod L La	**45**
BUS Heli Mod L Hb	**75**	BUS Heli Mod L Mb	**55**	BUS Heli Mod L Lb	**45**
BUS Heli Mod S Ha	**75**	BUS Heli Mod S Ma	**55**	BUS Heli Mod S La	**45**
BUS Heli Mod S Hb	**70**	BUS Heli Mod S Mb	**55**	BUS Heli Mod S Lb	**40**
SCI Comp Mod L Ha	**80**	SCI Comp Mod L Ma	**55**	SCI Comp Mod L La	**45**
SCI Comp Mod L Hb	**70**	SCI Comp Mod L Mb	**55**	SCI Comp Mod L Lb	**45**
SCI Comp Mod S Ha	**70**	SCI Comp Mod S Ma	**55**	SCI Comp Mod S La	**45**
SCI Comp Mod S Hb	**75**	SCI Comp Mod S Mb	**55**	SCI Comp Mod S Lb	**30**
SCI Heli Mod L Ha	**75**	SCI Heli Mod L Ma	**55**	SCI Heli Mod L La	**45**
SCI Heli Mod L Hb	**75**	SCI Heli Mod L Mb	**55**	SCI Heli Mod L Lb	**35**
SCI Heli Mod S Ha	**80**	SCI Heli Mod S Ma	**55**	SCI Heli Mod S La	**45**
SCI Heli Mod S Hb	**70**	SCI Heli Mod S Mb	**55**	SCI Heli Mod S Lb	**45**

Appendix 10 - Raw grids of the sample

BUS Heli Mod S Ha

101110000100111
010101000000000
000000010010000
001000100001000
100000000100000
001000000000000
100001000000000
000000001010000

BUS Heli Mod L Ha

100010000100101
011101000000000
000000001010001
000000000001000
111000000000000
111110111111111
011010001010010
000000000010001

SCI Heli Mod S Ha

001010000011000
010101000000000
000000110100001
100000001000110
000111000001000
100000000000011
010000000110000
001000100000100

BUS Heli Mod S Hb

000110001111111
011000000000000
000001110000000
110000000000000
000000111100000
011101100000000
010101100000000
000000111110000

BUS Heli Mod L Hb

101111000101111
011101000000000
000000111010000
000000001111100
111000000000000
000111110011110
010000011111101
101000100000011

SCI Heli Mod S Hb

100000000000000
001001000000000
000000010000000
000000011111111
010100110000000
001000000000000
100011000101101
000000001010000

BUS Heli Mod S Ma

110111011111111
011101000000000
000000011000000
100100001000000
010011100100100
001000000000000
000011101010000
001010101000000

BUS Heli Mod L Ma

101010001011101
010001000000000
000000110000000
010000000000010
100100000100000
110010000100010
000001110000000
001000000100101

SCI Heli Mod S Ma

110110000100101
011101000000000
000000111010001
100000001011111
010010010101000
111100001100101
010101111011000
110010100110000

BUS Heli Mod S Mb

100110010011011
011101000000000
000000101100000
000000000000000
000000000000000
000000000000100
010000000000000
000000100000000

BUS Heli Mod L Mb

100111100000100
010101000000000
001000011010000
000000001001011
100000000100001
111101110110101
000011001001011

SCI Heli Mod S Mb

101110000000111
011101000000000
000000010111000
000000011011110
000000110111100
011100000000000
011100000000000
100010010111010

BUS Heli Mod S La

001010000010000
010101000000000
000000111100000
000000000001111
000000000101000
101000000000100
010101000000000
000010110010000

BUS Heli Mod L La

110001111101110
001111000000000
000000000110000
000011011111111
110000000000001
001010101111111
100000000000001
000101000000000

SCI Heli Mod S La

110011100111111
001100000000000
000000010000000
000000001000000
000001010010000
000000011111111
000011100000000
000000000011000

BUS Heli Mod S Lb

110010000000000
001111000000000
000000110110000
000000001001111
000010001001110
111101000110111
110001000000000
110010111110010

BUS Heli Mod L Lb

100000000000000
011111000000000
000000111000000
000000000000000
000000000111111
111111111111111
111111111111111
111111111111111

SCI Heli Mod S Lb

110110000110111
001101000000000
000000011010000
110000001001111
000110110000000
000000011110100
001100011110110
001001001011110

SCI Heli Mod L Ha

100111011111101
011101000000000
100000011110000
100100001101111
100010111000000
110100011111111
001011101000001

SCI Heli Mod L Hb

100000010000011
011100000000000
000000010000000
000001001111110
100000000000000
001100000010000
010000010001101
100000001100010

SCI Heli Mod L Ma

100101000111101
011101000000000
100000001000000
000000000000000
111000001100000
011100001010010
100000000010011
000001010011100

SCI Heli Mod L Mb

110111001111111
001101000000000
000000010010000
100000101000011
001000010000100
001010000000010
110000001101000
000000100000001

SCI Heli Mod L La

110110001000101
011101000000000
000000011110000
000000000001010
100000000000000
100011101010000
010010110100000
000000000001111

SCI Heli Mod L Lb

111000000000000
001110000000000
000001111110000
000000000001111
100000000000000
111110101100110
000000000001111

BUS Comp Mod S Ha

0010001000001
1000000111100
0101110000000
0000000000010
0111001000000
0000001111100
0010110111110
0100010111100

BUS Comp Mod S Hb

1110110000001
1000001111100
1000000111100
0001000000010
0000001000000
0001010111100
1100000000000
0000000000010

BUS Comp Mod S Ma

1111111111101
0000001111100
0000111001111
0001000000010
1100101000011
0011010000000
0100011000011
0000000000010

BUS Comp Mod S Mb

1111011000001
0000000111100
0011100000011
0000000000010
0000001000000
0000000111100
1111111000001
0000000000010

BUS Comp Mod S La

1110010000000
0001000111100
0000000000010
0000101000001
0000101000001
0001000111100
1110010000000
0000000000010

BUS Comp Mod S Lb

1111011000000
0000000111100
0000100000001
0000000000010
1001101000000
0000000000100
0000000000001
0000000000010

BUS Comp Mod L Ha

1111111000000
0000000111100
0001000000011
0010110000010
1001001000000
0000000111100
0011110000000
1100001000011

BUS Comp Mod L Hb

0100000000001
0010100111100
0001010000000
0000000000010
1000001000000
0000000111100
0001010000000
0000000000010

BUS Comp Mod L Ma

1111000000001
0000000111100
0000000000010
0000000000010
0001111000000
1100111000011
0000000111100
0011000000000

BUS Comp Mod L Mb

1111110000001
0000000111100
0001110001111
0000000000010
1100001000000
0011100001101
1100010001110
0000000111100

BUS Comp Mod L La

1111010000000
0000000111100
1110111000000
0000000000010
0100000000011
1110000000001
0000000111100
0000111000000

BUS Comp Mod L Lb

0101111000001
0000000110000
0000000001100
0000000000010
1000000000001
0000000111100
1001111000011

SCI Comp Mod S Ha

1111101000001
0001000111100
0001110000011
0001010111110
1111010000001
0000000111100
0001110000000
0000000111110

SCI Comp Mod S Hb

1100100000000
0000001000000
0000010111100
0001000000011
1100101000011
0010000111100
0000000000011
0000000000011

SCI Comp Mod S Ma

1111111000000
0000000111100
0000000000001
0000000000010
1111111000000
0000000111100
0000000000001
0000000000010

SCI Comp Mod S Mb

1010111000011
0000000111100
1000100000000
1011000000010
0000000111100
0001011111100
1001100000000
1001000111100

SCI Comp Mod S La

1110000000000
0000001000000
0000110111101
0001000000010
0000001000000
0000000111100
1110000000011
0001000000000

SCI Comp Mod S Lb

1111111000001
0000000111100
0000000000100
0000000000010
0000001000000
0000010000000
1100000000000
0000000000010

SCI Comp Mod L Ha

1110101000000
1000000000000
0001010111100
0001000000010
0110001000001
1111101000001
1000010111110

SCI Comp Mod L Hb

1011111000001
0000000111100
0010000000000
0000000000010
1100001101110
1110001000011
1011110111110
0000000000000

SCI Comp Mod L Ma

1111110000000
1000100111100
0100000000001
0100111000010
0000000000010
1111111000011
0000000111100
1101000000011

SCI Comp Mod L Mb

1010101111100
0000001000000
0011010111110
0000000000011
1100111000000
1110111000001
1011111000010
0000000111100

SCI Comp Mod L La

1010001000011
0000100111100
0010000000011
0001010111100
0000001000011
1011000000010
0010111111111

SCI Comp Mod L Lb

1100011000001
0000000100000
0011100010010
0000000011100
0100001000001
1110011000000
0000000111111
0001100000000

Appendix 11 - Individual INGRID results

The listing of individual **INGRID** results include the two theoretical grids and all the subject grids. Full listing of the output from **INGRID** are included for the two theoretical grids labelled with tables whose last figures range from a to l. Thus the listing for the Helicopter text are found in Tables 11.Ha to 11.Hk. Listings for the subject grids are limited to those statistics discussed in Chapter 7. The labels for the tables of the subject grids remain identical to those in the two theoretical grids for easy cross-reference. Thus the tables from the **INGRID** output for the first subject in Appendix 11 are Tables 11.1a, 11.1d, 11.1f and 11.1g.

THEORETICAL GRID (Helicopter text)

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.067	.9333	4.46
2	.333	3.3333	15.92
3	.333	3.3333	15.92
4	.267	2.9333	14.01
5	.067	.9333	4.46
6	.267	2.9333	14.01
7	.267	2.9333	14.01
8	.600	3.6000	17.20

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.9333
BIAS .5497
VARIABILITY .8646

DEVIATIONS FROM CONSTRUCT MEANS

CONSTRUCT 1, ELEMENT
1 .9333 2 -.0667 3 -.0667 4 -.0667 5 -.0667 6 -.0667 7 -.0667 8 -.0667 9 -.0667
10 -.0667 11 -.0667 12 -.0667 13 -.0667 14 -.0667 15 -.0667
CONSTRUCT 2, ELEMENT
1 -.3333 2 .6667 3 .6667 4 .6667 5 .6667 6 .6667 7 -.3333 8 -.3333 9 -.3333
10 -.3333 11 -.3333 12 -.3333 13 -.3333 14 -.3333 15 -.3333
CONSTRUCT 3, ELEMENT
1 -.3333 2 -.3333 3 -.3333 4 -.3333 5 -.3333 6 -.3333 7 .6667 8 .6667 9 .6667
10 .6667 11 .6667 12 -.3333 13 -.3333 14 -.3333 15 -.3333
CONSTRUCT 4, ELEMENT
1 -.2667 2 -.2667 3 -.2667 4 -.2667 5 -.2667 6 -.2667 7 -.2667 8 -.2667 9 -.2667
10 -.2667 11 -.2667 12 .7333 13 .7333 14 .7333 15 .7333
CONSTRUCT 5, ELEMENT
1 -.0667 2 -.0667 3 -.0667 4 -.0667 5 -.0667 6 -.0667 7 -.0667 8 -.0667 9 -.0667
10 .9333 11 -.0667 12 -.0667 13 -.0667 14 -.0667 15 -.0667
CONSTRUCT 6, ELEMENT
1 -.2667 2 -.2667 3 .7333 4 -.2667 5 .7333 6 -.2667 7 -.2667 8 -.2667 9 .7333
10 -.2667 11 .7333 12 -.2667 13 -.2667 14 -.2667 15 -.2667
CONSTRUCT 7, ELEMENT
1 -.2667 2 .7333 3 -.2667 4 .7333 5 -.2667 6 .7333 7 -.2667 8 -.2667 9 -.2667
10 -.2667 11 -.2667 12 -.2667 13 -.2667 14 .7333 15 -.2667
CONSTRUCT 8, ELEMENT
1 .4000 2 .4000 3 -.6000 4 -.6000 5 -.6000 6 -.6000 7 .4000 8 .4000 9 .4000
10 .4000 11 -.6000 12 .4000 13 .4000 14 -.6000 15 .4000

CORRELATIONS AND ANGULAR DISTANCES BETWEEN CONSTRUCTS

CONSTRUCT 1

2	-.189	100.89	3	-.189	100.89	4	-.161	99.27	5	-.071	94.10	6	-.161	99.27
7	-.161	99.27	8	.218	77.40									

CONSTRUCT 2

3	-.500	120.00	4	-.426	115.24	5	.189	100.89	6	.213	77.69	7	.533	57.79
8	-.577	125.26												

CONSTRUCT 3

4	-.426	115.24	5	.378	67.79	6	.213	77.69	7	-.426	115.24	8	.289	73.22

CONSTRUCT 4

5	-.161	99.27	6	-.364	111.32	7	.023	91.30	8	.185	79.36

CONSTRUCT 5

6	-.161	99.27	7	-.161	99.27	8	.218	77.40

CONSTRUCT 6

7	-.364	111.32	8	-.431	115.52

CONSTRUCT 7

8	-.431	115.52

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.200	1.471	7.03
2	.800	1.404	6.71
3	-.200	1.604	7.66
4	-.200	1.604	7.66
5	-.200	1.604	7.66
6	-.200	1.604	7.66
7	-.200	.938	4.48
8	-.200	.938	4.48
9	.800	1.404	6.71
10	.800	1.804	8.62
11	-.200	1.604	7.66
12	-.200	1.071	5.12
13	-.200	1.071	5.12
14	-.200	1.738	8.30
15	-.200	1.071	5.12

UNIT OF EXPECTED DISTANCE 1.7293

DISTANCES BETWEEN ELEMENTS

```
ELEMENT 1
  2 1.002   3 1.157   4 1.157   5 1.157   6 1.157   7  .818   8  .818   9 1.002  10 1.002  11 1.157
 12  .818  13  .818  14 1.157  15  .818
ELEMENT 2
  3 1.002   4  .578   5 1.002   6  .578   7 1.002   8 1.002   9 1.157  10 1.157  11 1.293  12 1.002
 13 1.002  14 1.002  15 1.002
ELEMENT 3
  4  .818   5  .000   6  .818   7 1.157   8 1.157   9 1.002  10 1.293  11  .818  12 1.157  13 1.157
 14 1.157  15 1.157
ELEMENT 4
  5  .818   6  .000   7 1.157   8 1.157   9 1.293  10 1.293  11 1.157  12 1.157  13 1.157  14  .818
 15 1.157
ELEMENT 5
  6  .818   7 1.157   8 1.157   9 1.002  10 1.293  11  .818  12 1.157  13 1.157  14 1.157  15 1.157
ELEMENT 6
  7 1.157   8 1.157   9 1.293  10 1.293  11 1.157  12 1.157  13 1.157  14  .818  15 1.157
ELEMENT 7
  8  .000   9  .578  10  .578  11  .818  12  .818  13  .818  14 1.157  15  .818
ELEMENT 8
  9  .578  10  .578  11  .818  12  .818  13  .818  14 1.157  15  .818
ELEMENT 9
 10  .818  11  .578  12 1.002  13 1.002  14 1.293  15 1.002
ELEMENT 10
 11 1.002  12 1.002  13 1.002  14 1.293  15 1.002
ELEMENT 11
 12 1.157  13 1.157  14 1.157  15 1.157
ELEMENT 12
 13  .000  14  .818  15  .000
ELEMENT 13
 14  .818  15  .000
ELEMENT 14
 15  .818
```

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.4522	40.21
2	6.0876	32.85
3	2.3322	12.58
4	1.9868	10.72
5	.5312	2.87
6	.1433	.77

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1533	.4185	1.7893	.3200	.7895	1.1660
2	.1327	.3623	.9665	.2674	.6598	.5312
3	.1933	.5276	1.4194	.4200	1.0364	.3453
4	.1290	.3520	.9738	.2546	.6281	.5794
5	.1290	.3520	.9738	.2546	.6281	.5794
6	.1229	.3354	.9186	-.3664	-.9040	.1014
7	.1973	.5386	.4077	-.1550	-.3825	.2613
8	.1229	.3354	.9186	-.3664	-.9040	.1014
9	.1973	.5386	.4077	-.1550	-.3825	.2613
10	.1973	.5386	.4077	-.1550	-.3825	.2613
11	.1229	.3354	.9186	-.3664	-.9040	.1014
12	-.4617	-1.2603	.1761	-.0937	-.2313	.1226
13	-.3872	-1.0571	.3137	.1176	.2902	.2294
14	-.3872	-1.0571	.3137	.1176	.2902	.2294
15	-.4617	-1.2603	.1761	-.0937	-.2313	.1226
CONSTRUCT						
1	.1756	.4793	2.1703	.4083	1.0074	1.1554
2	.1653	.4512	2.1964	.3766	.9291	1.3331
3	.3519	.9606	2.6773	-.6340	-1.5643	.2303
4	-.6219	-1.6978	.0508	.0194	.0478	.0485
5	.0562	.1533	.9098	.1297	.3200	.8074
6	.2032	.5547	3.0256	.5215	1.2866	1.3702
7	-.6219	-1.6978	.0508	.0194	.0478	.0485

```
RELATIONS BETWEEN CONSTRUCTS AND ELEMENTS EXPRESSED AS COSINES

    CONSTRUCT  1 WITH ELEMENT
 1  .960  2 -.042  3 -.131  4 -.137  5 -.131  6 -.137  7  .014  8  .014  9 -.078 10 -.026
11 -.170 12  .027 13  .027 14 -.158 15  .027
    CONSTRUCT  2 WITH ELEMENT
 1 -.317  2  .663  3  .714  4  .824  5  .714  6  .824  7 -.613  8 -.613  9 -.413 10 -.470
11 -.183 12 -.545 13 -.545 14 -.047 15 -.545
    CONSTRUCT  3 WITH ELEMENT
 1 -.137  2 -.434  3 -.292  4 -.507  5 -.292  6 -.507  7  .848  8  .848  9  .783 10  .700
11  .631 12 -.316 13 -.316 14 -.471 15 -.316
    CONSTRUCT  4 WITH ELEMENT
 1 -.057  2 -.220  3 -.375  4 -.260  5 -.375  6 -.260  7 -.258  8 -.258  9 -.351 10 -.231
11 -.382 12  .903 13  .903 14  .642 15  .903
    CONSTRUCT  5 WITH ELEMENT
 1 -.029  2 -.120  3 -.228  4 -.187  5 -.228  6 -.187  7  .248  8  .248  9  .087 10  .883
11  .006 12 -.089 13 -.089 14 -.207 15 -.089
    CONSTRUCT  6 WITH ELEMENT
 1 -.297  2 -.370  3  .768  4 -.138  5  .768  6 -.138  7 -.192  8 -.192  9  .600 10 -.196
11  .770 12 -.450 13 -.450 14 -.343 15 -.450
    CONSTRUCT  7 WITH ELEMENT
 1 -.281  2  .730  3 -.026  4  .867  5 -.026  6  .867  7 -.468  8 -.468  9 -.594 10 -.373
11 -.371 12 -.287 13 -.287 14  .620 15 -.287
    CONSTRUCT  8 WITH ELEMENT
 1  .462  2  .033  3 -.702  4 -.681  5 -.702  6 -.681  7  .642  8  .642  9  .323 10  .499
11 -.409 12  .541 13  .541 14 -.419 15  .541
```

INTER-ELEMENT RELATIONS EXPRESSED AS COSINES

```
        ELEMENT  1 WITH ELEMENT
 2 -.043  3 -.301  4 -.301  5 -.301  6 -.301  7  .174  8  .174  9 -.043 10  .085 11 -.301
12  .216 13  .216 14 -.247 15  .216
        ELEMENT  2 WITH ELEMENT
 3  .003  4  .669  5  .003  6  .669  7 -.287  8 -.287  9 -.424 10 -.248 11 -.663 12 -.214
13 -.214 14  .046 15 -.214
        ELEMENT  3 WITH ELEMENT
 4  .377  5 1.000  6  .377  7 -.594  8  .594  9  .003 10 -.468 11  .377 12 -.505 13 -.505
14 -.197 15 -.505
        ELEMENT  4 WITH ELEMENT
 5  .377  6 1.000  7 -.594  8 -.594  9  .663 10 -.468 11 -.247 12 -.505 13 -.505 14  .402
15 -.505
        ELEMENT  5 WITH ELEMENT
 6  .377  7 -.594  8 -.594  9  .003 10 -.468 11  .377 12 -.505 13 -.505 14 -.197 15 -.505
        ELEMENT  6 WITH ELEMENT
 7 -.594  8 -.594  9 -.663 10 -.468 11 -.247 12 -.505 13 -.505 14  .402 15 -.505
        ELEMENT  7 WITH ELEMENT
 8 1.000  9  .585 10  .670 11  .221 12  .004 13  .004 14 -.519 15  .004
        ELEMENT  8 WITH ELEMENT
 9  .585 10  .670 11  .221 12  .004 13  .004 14 -.519 15  .004
        ELEMENT  9 WITH ELEMENT
10  .380 11  .669 12 -.214 13 -.214 14 -.595 15 -.214
        ELEMENT 10 WITH ELEMENT
11  .120 12 -.045 13 -.045 14 -.412 15 -.045
        ELEMENT 11 WITH ELEMENT
12 -.505 13 -.505 14 -.197 15 -.505
        ELEMENT 12 WITH ELEMENT
13 1.000 14  .296 15 1.000
        ELEMENT 13 WITH ELEMENT
14  .296 15 1.000
        ELEMENT 14 WITH ELEMENT
15  .296
```

```
RELATIONS BETWEEN CONSTRUCTS AND ELEMENTS EXPRESSED IN DEGREES

CONSTRUCT  1 WITH ELEMENT
  1   16.2   2   92.4   3   97.5   4   97.9   5   97.5   6   97.9   7   89.2   8   89.2   9   94.5  10   91.5
 11   99.8  12   88.4  13   88.4  14   99.1  15   88.4
    CONSTRUCT  2 WITH ELEMENT
  1  108.5   2   48.5   3   44.5   4   34.5   5   44.5   6   34.5   7  127.8   8  127.8   9  114.4  10  118.0
 11  100.5  12  123.0  13  123.0  14   92.7  15  123.0
    CONSTRUCT  3 WITH ELEMENT
  1   97.9   2  115.7   3  107.0   4  120.5   5  107.0   6  120.5   7   32.0   8   32.0   9   38.5  10   45.6
 11   50.9  12  108.4  13  108.4  14  118.1  15  108.4
    CONSTRUCT  4 WITH ELEMENT
  1   93.3   2  102.7   3  112.0   4  105.1   5  112.0   6  105.1   7  105.0   8  105.0   9  110.5  10  103.3
 11  112.5  12   25.4  13   25.4  14   50.1  15   25.4
    CONSTRUCT  5 WITH ELEMENT
  1   91.6   2   96.9   3  103.2   4  100.8   5  103.2   6  100.8   7   75.6   8   75.6   9   85.0  10   28.0
 11   89.6  12   95.1  13   95.1  14  101.9  15   95.1
    CONSTRUCT  6 WITH ELEMENT
  1  107.3   2  111.7   3   39.8   4   97.9   5   39.8   6   97.9   7  101.1   8  101.1   9   53.1  10  101.3
 11   39.6  12  116.8  13  116.8  14  110.1  15  116.8
    CONSTRUCT  7 WITH ELEMENT
  1  106.3   2   43.1   3   91.5   4   29.8   5   91.5   6   29.8   7  117.9   8  117.9   9  126.4  10  111.9
 11  111.8  12  106.7  13  106.7  14   51.7  15  106.7
    CONSTRUCT  8 WITH ELEMENT
  1   62.5   2   88.1   3  134.6   4  132.9   5  134.6   6  132.9   7   50.1   8   50.1   9   71.1  10   60.1
 11  114.1  12   57.3  13   57.3  14  114.8  15   57.3


INTER-ELEMENT RELATIONS EXPRESSED IN DEGREES

           ELEMENT  1 WITH ELEMENT
  2   92.5   3  107.5   4  107.5   5  107.5   6  107.5   7   80.0   8   80.0   9   92.5  10   85.1  11  107.5
 12   77.5  13   77.5  14  104.3  15   77.5
           ELEMENT  2 WITH ELEMENT
  3   89.8   4   48.0   5   89.8   6   48.0   7  106.7   8  106.7   9  115.1  10  104.4  11  131.5  12  102.3
 13  102.3  14   87.4  15  102.3
           ELEMENT  3 WITH ELEMENT
  4   67.9   5     .0   6   67.9   7  126.5   8  126.5   9   89.8  10  117.9  11   67.9  12  120.3  13  120.3
 14  101.4  15  120.3
           ELEMENT  4 WITH ELEMENT
  5   67.9   6     .0   7  126.5   8  126.5   9  131.5  10  117.9  11  104.3  12  120.3  13  120.3  14   66.3
 15  120.3
           ELEMENT  5 WITH ELEMENT
  6   67.9   7  126.5   8  126.5   9   89.8  10  117.9  11   67.9  12  120.3  13  120.3  14  101.4  15  120.3
           ELEMENT  6 WITH ELEMENT
  7  126.5   8  126.5   9  131.5  10  117.9  11  104.3  12  120.3  13  120.3  14   66.3  15  120.3
           ELEMENT  7 WITH ELEMENT
  8     .0   9   54.2  10   48.0  11   77.2  12   89.7  13   89.7  14  121.2  15   89.7
           ELEMENT  8 WITH ELEMENT
  9   54.2  10   48.0  11   77.2  12   89.7  13   89.7  14  121.2  15   89.7
           ELEMENT  9 WITH ELEMENT
 10   67.7  11   48.0  12  102.3  13  102.3  14  126.5  15  102.3
           ELEMENT 10 WITH ELEMENT
 11   83.1  12   92.6  13   92.6  14  114.3  15   92.6
           ELEMENT 11 WITH ELEMENT
 12  120.3  13  120.3  14  101.4  15  120.3
           ELEMENT 12 WITH ELEMENT
 13     .0  14   72.8  15     .0
           ELEMENT 13 WITH ELEMENT
 14   72.8  15     .0
           ELEMENT 14 WITH ELEMENT
 15   72.8
```

THEORETICAL GRID (Computer text)

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	21.21
2	.077	.9231	6.06
3	.385	3.0769	20.20
4	.077	.9231	6.06
5	.154	1.6923	11.11
6	.308	2.7692	18.18
7	.077	.9231	6.06
8	.846	1.6923	11.11

TOTAL VARIATION ABOUT CONSTRUCT MEANS 15.2308
BIAS .6436
VARIABILITY .7966

DEVIATIONS FROM CONSTRUCT MEANS

CONSTRUCT 1, ELEMENT
1 .5385 2 .5385 3 .5385 4 .5385 5 .5385 6 .5385 7 -.4615 8 -.4615 9 -.4615
10 -.4615 11 -.4615 12 -.4615 13 -.4615
CONSTRUCT 2, ELEMENT
1 .9231 2 -.0769 3 -.0769 4 -.0769 5 -.0769 6 -.0769 7 -.0769 8 -.0769 9 -.0769
10 -.0769 11 -.0769 12 -.0769 13 -.0769
CONSTRUCT 3, ELEMENT
1 -.3846 2 -.3846 3 -.3846 4 -.3846 5 -.3846 6 -.3846 7 .6154 8 .6154 9 .6154
10 .6154 11 .6154 12 -.3846 13 -.3846
CONSTRUCT 4, ELEMENT
1 -.0769 2 -.0769 3 -.0769 4 -.0769 5 -.0769 6 -.0769 7 -.0769 8 -.0769 9 -.0769
10 -.0769 11 -.0769 12 .9231 13 -.0769
CONSTRUCT 5, ELEMENT
1 .8462 2 -.1538 3 -.1538 4 -.1538 5 -.1538 6 -.1538 7 .8462 8 -.1538 9 -.1538
10 -.1538 11 -.1538 12 -.1538 13 -.1538
CONSTRUCT 6, ELEMENT
1 -.3077 2 -.3077 3 -.3077 4 -.3077 5 -.3077 6 -.3077 7 -.3077 8 .6923 9 .6923
10 .6923 11 .6923 12 -.3077 13 -.3077
CONSTRUCT 7, ELEMENT
1 -.0769 2 -.0769 3 -.0769 4 -.0769 5 .9231 6 -.0769 7 -.0769 8 -.0769 9 -.0769
10 -.0769 11 -.0769 12 -.0769 13 -.0769
CONSTRUCT 8, ELEMENT
1 .1538 2 .1538 3 .1538 4 -.8462 5 -.8462 6 .1538 7 .1538 8 .1538 9 .1538
10 .1538 11 .1538 12 .1538 13 .1538

CORRELATIONS AND ANGULAR DISTANCES BETWEEN CONSTRUCTS

CONSTRUCT 1

2 .312 71.83 3 -.732 137.05 4 -.267 105.50 5 .033 88.11 6 -.617 128.11

7 .312 71.83 8 -.461 117.42

CONSTRUCT 2

3 -.228 103.19 4 -.083 94.78 5 .677 47.39 6 -.192 101.10 7 -.083 94.78

8 .123 82.93

CONSTRUCT 3

4 -.228 103.19 5 .101 84.20 6 .843 32.51 7 -.228 103.19 8 .337 70.30

CONSTRUCT 4

5 -.123 97.07 6 -.192 101.10 7 -.083 94.78 8 .123 82.93

CONSTRUCT 5

6 -.284 106.52 7 -.123 97.07 8 .182 79.52

CONSTRUCT 6

7 -.192 101.10 8 .284 73.48

CONSTRUCT 7

8 -.677 132.61

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.615	2.136	14.02
2	-.385	.598	3.92
3	-.385	.598	3.92
4	-1.385	1.290	8.47
5	-.385	2.136	14.02
6	-.385	.598	3.92
7	.615	1.444	9.48
8	.615	1.136	7.46
9	.615	1.136	7.46
10	.615	1.136	7.46
11	.615	1.136	7.46
12	-.385	1.367	8.97
13	-1.385	.521	3.42

UNIT OF EXPECTED DISTANCE 1.5933

DISTANCES BETWEEN ELEMENTS

ELEMENT 1
2 .888 3 .888 4 1.087 5 1.255 6 .888 7 1.087 8 1.403 9 1.403 10 1.403 11 1.403
12 1.255 13 1.087
ELEMENT 2
3 .000 4 .628 5 .888 6 .000 7 1.087 8 1.087 9 1.087 10 1.087 11 1.087 12 .888
13 .628
ELEMENT 3
4 .628 5 .888 6 .000 7 1.087 8 1.087 9 1.087 10 1.087 11 1.087 12 .888 13 .628
ELEMENT 4
5 .628 6 .628 7 1.255 8 1.255 9 1.255 10 1.255 11 1.255 12 1.087 13 .888
ELEMENT 5
6 .888 7 1.403 8 1.403 9 1.403 10 1.403 11 1.403 12 1.255 13 1.087
ELEMENT 6
7 1.087 8 1.087 9 1.087 10 1.087 11 1.087 12 .888 13 .628
ELEMENT 7
8 .888 9 .888 10 .888 11 .888 12 1.087 13 .888
ELEMENT 8
9 .000 10 .000 11 .000 12 1.087 13 .888
ELEMENT 9
10 .000 11 .000 12 1.087 13 .888
ELEMENT 10
11 .000 12 1.087 13 .888
ELEMENT 11
12 1.087 13 .888
ELEMENT 12
13 .628

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.9643	52.29
2	2.6848	17.63
3	1.9859	13.04
4	1.2950	8.50
5	.6535	4.29
6	.3686	2.42
7	.2788	1.83

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2681	-.7566	1.5636	-.6482	-1.0621	.4355
2	-.2221	-.6269	.2047	0100	.0163	.2044
3	-.2221	-.6269	.2047	0100	.0163	.2044
4	-.3039	-.8577	.5542	2927	.4796	.3242
5	-.3476	-.9809	1.1739	4664	.7643	.5898
6	-.2221	-.6269	.2047	0100	.0163	.2044
7	.1700	.4798	1.2136	4706	-.7711	.6189
8	.3663	1.0338	.0674	.1100	.1802	.0349
9	.3663	1.0338	.0674	.1100	.1802	.0349
10	.3663	1.0338	.0674	1100	.1802	.0349
11	.3663	1.0338	.0673	1100	.1802	.0349
12	-.0263	-.0742	1.3614	- 0677	-.1110	1.3490
13	-.0230	-.0649	.5165	- 0425	-.0696	.5117
CONSTRUCT						
1	-.5620	-1.5860	.7153	0859	.1408	.6955
2	-.0950	-.2681	.8512	- 3956	-.6482	.4310
3	.5795	1.6353	.4027	- 0187	-.0306	.4017
4	-.0093	-.0263	.9224	0413	-.0677	.9178
5	-.0348	-.0981	1.6827	- 6828	1.1188	.4309
6	.5192	1.4653	.6222	2685	.4400	.4285
7	-.1232	-.3476	.8023	2847	.4664	.5847
8	.2309	.6515	1.2678	4633	-.7592	.6915

```
RELATIONS BETWEEN CONSTRUCTS AND ELEMENTS EXPRESSED AS COSINES

    CONSTRUCT  1 WITH ELEMENT
 1  .519  2  .839  3  .839  4  .725  5  .617  6  .839  7 -.476  8 -.773  9 -.773 10 -.773 11 -.773
12 -.301 13 -.290
    CONSTRUCT  2 WITH ELEMENT
 1  .930  2  .074  3  .074  4 -.032  5 -.051  6  .074  7  .109  8 -.290  9 -.290 10 -.290 11 -.290
12 -.142 13 -.205
    CONSTRUCT  3 WITH ELEMENT
 1 -.414  2 -.808  3 -.808  4 -.634  5 -.524  6 -.808  7  .536  8  .924  9  .924 10  .924 11  .924
12 -.312 13 -.351
    CONSTRUCT  4 WITH ELEMENT
 1 -.114  2 -.087  3 -.087  4 -.115  5 -.109  6 -.087  7 -.070  8 -.137  9 -.137 10 -.137 11 -.137
12  .962 13  .277
    CONSTRUCT  5 WITH ELEMENT
 1  .753  2 -.163  3 -.163  4 -.188  5 -.173  6 -.163  7  .767  8 -.204  9 -.204 10 -.204 11 -.204
12 -.158 13 -.174
    CONSTRUCT  6 WITH ELEMENT
 1 -.488  2 -.682  3 -.682  4 -.540  5 -.447  6 -.682  7  .028  8  .966  9  .966 10  .966 11  .966
12 -.287 13 -.352
    CONSTRUCT  7 WITH ELEMENT
 1 -.051  2  .020  3  .020  4  .359  5  .894  6  .020  7 -.222  8 -.265  9 -.265 10 -.265 11 -.265
12 -.136 13 -.181
    CONSTRUCT  8 WITH ELEMENT
 1  .057  2 -.096  3 -.096  4 -.860  5 -.867  6 -.096  7  .319  8  .380  9  .380 10  .380 11  .380
12  .183 13  .232


INTER-ELEMENT RELATIONS EXPRESSED AS COSINES

        ELEMENT  1 WITH ELEMENT
2  .325  3  .325  4  .128  5  .064  6  .325  7  .165  8 -.555  9 -.555 10 -.555 11 -.555 12 -.145
13 -.163
        ELEMENT  2 WITH ELEMENT
3 1.000  4  .505  5  .325  6 1.000  7 -.516  8 -.768  9 -.768 10 -.768 11 -.768 12 -.020
13  .106
        ELEMENT  3 WITH ELEMENT
4  .505  5  .325  6 1.000  7 -.516  8 -.768  9 -.768  10 -.768 11 -.768 12 -.020 13  .106
        ELEMENT  4 WITH ELEMENT
5  .731  6  .505  7 -.464  8 -.650  9 -.650 10 -.650  11 -.650 12 -.129 13 -.116
        ELEMENT  5 WITH ELEMENT
6  .325  7 -.404  8 -.555  9 -.555 10 -.555 11 -.555  12 -.145 13 -.163
        ELEMENT  6 WITH ELEMENT
7 -.516  8 -.768  9 -.768 10 -.768 11 -.768 12 -.020  13  .106
        ELEMENT  7 WITH ELEMENT
8  .226  9  .226 10  .226 11  .226 12 -.057 13 -.020
        ELEMENT  8 WITH ELEMENT
9 1.000 10 1.000 11 1.000 12 -.199 13 -.223
        ELEMENT  9 WITH ELEMENT
10 1.000 11 1.000 12 -.199 13 -.223
        ELEMENT 10 WITH ELEMENT
11 1.000 12 -.199 13 -.223
        ELEMENT 11 WITH ELEMENT
12 -.199 13 -.223
        ELEMENT 12 WITH ELEMENT
13  .526
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RELATIONS BETWEEN CONSTRUCTS AND ELEMENTS EXPRESSED IN DEGREES

    CONSTRUCT  1 WITH ELEMENT
 1  58.7  2  32.9  3  32.9  4  43.5  5  51.9  6  32.9 7 118.4  8 140.7  9 140.7 10 140.7 11 140.7
12 107.5 13 106.8
    CONSTRUCT  2 WITH ELEMENT
 1  21.5  2  85.8  3  85.8  4  91.9  5  92.9  6  85.8 7  83.8  8 106.8  9 106.8 10 106.8 11 106.8
12  98.2 13 101.8
    CONSTRUCT  3 WITH ELEMENT
 1 114.4  2 143.9  3 143.9  4 129.3  5 121.6  6 143.9 7  57.6  8  22.5  9  22.5 10  22.5 11  22.5
12 108.2 13 110.6
    CONSTRUCT  4 WITH ELEMENT
 1  96.5  2  95.0  3  95.0  4  96.6  5  96.2  6  95.0 7  94.0  8  97.8  9  97.8 10  97.8 11  97.8
12  15.8 13  73.9
    CONSTRUCT  5 WITH ELEMENT
 1  41.1  2  99.4  3  99.4  4 100.8  5  99.9  6  99.4 7  39.9  8 101.8  9 101.8 10 101.8 11 101.8
12  99.1 13 100.0
    CONSTRUCT  6 WITH ELEMENT
 1 119.2  2 133.0  3 133.0  4 122.7  5 116.5  6 133.0 7  88.4  8  15.0  9  15.0 10  15.0 11  15.0
12 106.7 13 110.6
    CONSTRUCT  7 WITH ELEMENT
 1  92.9  2  88.8  3  88.8  4  68.9  5  26.6  6  88.8 7 102.8  8 105.4  9 105.4 10 105.4 11 105.4
12  97.8 13 100.4
    CONSTRUCT  8 WITH ELEMENT
 1  86.8  2  95.5  3  95.5  4 149.3  5 150.1  6  95.5 7  71.4  8  67.7  9  67.7 10  67.7 11  67.7
12  79.5 13  76.6


INTER-ELEMENT RELATIONS EXPRESSED IN DEGREES

        ELEMENT  1 WITH ELEMENT
 2  71.1  3  71.1  4  82.6  5  86.3  6  71.1  7  80.5 8 123.7  9 123.7 10 123.7 11 123.7
12  98.4 13  99.4
        ELEMENT  2 WITH ELEMENT
 3    .0  4  59.6  5  71.1  6    .0  7 121.1  8 140.2 9 140.2 10 140.2 11 140.2 12  91.1
13  83.9
        ELEMENT  3 WITH ELEMENT
 4  59.6  5  71.1  6    .0  7 121.1  8 140.2  9 140.2 10 140.2 11 140.2 12  91.1 13  83.9
        ELEMENT  4 WITH ELEMENT
 5  43.1  6  59.6  7 117.6  8 130.5  9 130.5 10 130.5 11 130.5 12  97.4 13  96.6
        ELEMENT  5 WITH ELEMENT
 6  71.1  7 113.8  8 123.7  9 123.7 10 123.7 11 123.7 12  98.4 13  99.4
        ELEMENT  6 WITH ELEMENT
 7 121.1  8 140.2  9 140.2 10 140.2 11 140.2 12  91.1 13  83.9
        ELEMENT  7 WITH ELEMENT
 8  76.9  9  76.9 10  76.9 11  76.9 12  93.9 13  91.2
       ELEMENT  8 WITH ELEMENT
 9    .0 10    .0 11    .0 12 101.5 13 102.9
        ELEMENT  9 WITH ELEMENT
10    .0 11    .0 12 101.5 13 102.9
        ELEMENT 10 WITH ELEMENT
11    .0 12 101.5 13 102.9
        ELEMENT 11 WITH ELEMENT
12 101.5 13 102.9
        ELEMENT 12 WITH ELEMENT
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BUS COMP MOD S HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.231	2.3077	10.87
2	.385	3.0769	14.49
3	.308	2.7692	13.04
4	.077	.9231	4.35
5	.308	2.7692	13.04
6	.385	3.0769	14.49
7	.615	3.0769	14.49
8	.462	3.2308	15.22

TOTAL VARIATION ABOUT CONSTRUCT MEANS 21.2308

BIAS .4283

VARIABILITY .9405

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-1.769	1.367	6.44
2	.231	1.982	9.34
3	.231	1.828	8.61
4	-.769	1.905	8.97
5	-.769	1.290	6.08
6	.231	1.367	6.44
7	.231	2.290	10.79
8	1.231	1.444	6.80
9	1.231	1.444	6.80
10	1.231	1.444	6.80
11	1.231	1.444	6.80
12	-.769	1.751	8.25
13	-1.769	1.675	7.89

UNIT OF EXPECTED DISTANCE 1.8811

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.3631	44.10
2	4.4378	20.90
3	3.1488	14.83
4	2.0465	9.64
5	.9632	4.54
6	.6927	3.26
7	.5787	2.73

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.0121	.0372	1.3655	.1293	.2723	1.2913
2	.2291	.7011	1.4907	-.3341	-.7038	.9953
3	.2544	.7784	1.2225	.2695	.5678	.9001
4	.3710	1.1352	.6168	-.1898	-.3999	.4568
5	.1378	.4216	1.1122	-.3531	-.7438	.5589
6	-.0041	-.0124	1.3667	-.1974	-1.0477	.2690
7	.2304	.7051	1.7928	.5332	1.1233	.5310
8	-.3883	-1.1881	.0322	.0478	.1007	.0220
9	-.3883	-1.1881	.0322	.0478	.1007	.0220
10	-.3883	-1.1881	.0322	.0478	.1007	.0220
11	-.3883	-1.1881	.0322	.0478	.1007	.0220
12	.0665	.2035	1.7101	-.0560	-.1180	1.6961
13	.2558	.7828	1.0617	.3071	.6470	.6431
CONSTRUCT						
1	.2420	.7406	1.7591	.5269	1.1099	.5273
2	-.5036	-1.5410	.7023	.1521	.3205	.5996
3	.2398	.7338	2.2307	-.6524	-1.3744	.3418
4	.0217	.0665	.9187	-.0266	-.0560	.9155
5	.3546	1.0849	1.5922	.1324	.2788	1.5144
6	-.4323	-1.3227	1.3274	.3439	.7245	.8026
7	-.3590	-1.0985	1.8702	-.2116	-.4457	1.6715
8	-.4340	-1.3280	1.4671	-.3039	-.6402	1.0572

BUS COMP MOD S HB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	17.95
2	.462	3.2308	17.95
3	.385	3.0769	17.09
4	.154	1.6923	9.40
5	.077	.9231	5.13
6	.462	3.2308	17.95
7	.154	1.6923	9.40
8	.077	.9231	5.13

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.0000

BIAS .5547

VARIABILITY .8660

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.769	1.923	10.68
2	-.231	1.615	8.97
3	-1.231	.923	5.13
4	-.231	1.615	8.97
5	-1.231	.923	5.13
6	-.231	1.000	5.56
7	-.231	1.769	9.83
8	.769	1.231	6.84
9	.769	1.231	6.84
10	.769	1.231	6.84
11	.769	1.231	6.84
12	-.231	2.385	13.25
13	-1.231	.923	5.13

UNIT OF EXPECTED DISTANCE 1.7321

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.5949	47.75
2	4.2709	23.73
3	2.3826	13.24
4	1.6837	9.35
5	.7426	4.13
6	.1962	1.09
7	.1291	.72

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.0244	.0716	1.9180	-.5709	-1.1799	.5258
2	-.3353	-.9830	.6490	-.2697	-.5574	.3383
3	-.2991	-.8770	.1539	-.0729	-.1506	.1313
4	-.0076	-.0224	1.6149	.5328	1.1010	.4027
5	-.2991	-.8770	.1539	-.0729	-.1506	.1313
6	-.1422	-.4170	.8261	.0421	.0871	.8186
7	.0459	.1345	1.7512	.0226	.0467	1.7490
8	.3746	1.0983	.0244	-.0209	-.0432	.0225
9	.3746	1.0983	.0244	-.0209	-.0432	.0225
10	.3746	1.0983	.0244	-.0209	-.0432	.0225
11	.3746	1.0983	.0244	-.0209	-.0432	.0225
12	-.1862	-.5460	2.0865	.5454	1.1272	.8160
13	-.2991	-.8770	.1539	-.0729	-.1506	.1313
CONSTRUCT						
1	-.4607	-1.3506	1.4068	-.4922	-1.0172	.3721
2	.5351	1.5689	.7695	-.3058	-.6319	.3702
3	.5195	1.5230	.7574	-.3167	-.6545	.3290
4	-.0661	-.1939	1.6547	.5217	1.0782	.4923
5	.0156	.0459	.9210	.0109	.0226	.9205
6	.4600	1.3487	1.4118	.2377	.4913	1.1704
7	-.1060	-.3109	1.5956	-.4068	-.8407	.8889
8	-.0635	-.1862	.8884	.2639	.5454	.5909

BUS COMP MOD S MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	16.94
2	.308	2.7692	14.52
3	.308	2.7692	14.52
4	.231	2.3077	12.10
5	.154	1.6923	8.87
6	.231	2.3077	12.10
7	.154	1.6923	8.87
8	.231	2.3077	12.10

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.0769

BIAS .5160

VARIABILITY .8916

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	2.923	2.840	14.89
2	-2.077	.609	3.19
3	.923	1.763	9.24
4	.923	1.609	8.44
5	1.923	2.302	12.07
6	-1.077	.686	3.60
7	-.077	1.840	9.65
8	-1.077	.994	5.21
9	-1.077	.994	5.21
10	-1.077	.994	5.21
11	-1.077	.994	5.21
12	-.077	1.686	8.84
13	.923	1.763	9.24

UNIT OF EXPECTED DISTANCE 1.7831

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.2838	43.42
2	4.4686	23.42
3	2.8936	15.17
4	1.3587	7.12
5	1.0000	5.24
6	.5114	2.68
7	.3451	1.81
8	.2156	1.13

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.5091	1.4652	.6935	.0203	.0428	.6917
2	-.1605	-.4619	.3961	.0142	.0299	.3953
3	.2033	.5851	1.4210	.2426	.5129	1.1579
4	.3288	.9463	.7139	.1814	.3834	.5669
5	.2547	.7331	1.7643	-.5552	-1.1737	.3867
6	.0357	.1029	.6758	.0847	.1790	.6438
7	-.1503	-.4327	1.6530	-.3224	-.6816	1.1884
8	-.3103	-.8931	.1964	.1349	.2853	.1150
9	-.3103	-.8931	.1964	.1349	.2853	.1150
10	-.3103	-.8931	.1964	.1349	.2853	.1150
11	-.3103	-.8931	.1964	.1349	.2853	.1150
12	-.0734	-.2112	1.6418	-.5466	-1.1555	.3066
13	.2938	.8457	1.0481	.3414	.7218	.5272
CONSTRUCT						
1	.5648	1.6255	.5887	.1491	.3151	.4894
2	-.4313	-1.2413	1.2285	.2553	.5398	.9371
3	.4638	1.3350	.9871	.3717	.7857	.3698
4	.0108	.0310	2.3067	-.6738	-1.4243	.2781
5	.0184	.0530	1.6895	-.0378	-.0798	1.6831
6	.3796	1.0926	1.1139	-.1673	-.3536	.9889
7	.2790	.8029	1.0477	.1711	.3617	.9169
8	.2399	.6904	1.8310	-.5117	-1.0816	.6612

BUS COMP MOD S MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	18.26
2	.308	2.7692	15.65
3	.385	3.0769	17.39
4	.077	.9231	5.22
5	.077	.9231	5.22
6	.308	2.7692	15.65
7	.615	3.0769	17.39
8	.077	.9231	5.22

TOTAL VARIATION ABOUT CONSTRUCT MEANS 17.6923

BIAS .5653

VARIABILITY .8586

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.385	.716	4.05
2	-.385	.716	4.05
3	.615	.947	5.35
4	.615	.947	5.35
5	-.385	1.024	5.79
6	-.385	.716	4.05
7	.615	1.562	8.83
8	-.385	1.793	10.13
9	-.385	1.793	10.13
10	-.385	1.793	10.13
11	-.385	1.793	10.13
12	.615	2.947	16.66
13	.615	.947	5.35

UNIT OF EXPECTED DISTANCE 1.7172

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.9468	61.87
2	4.0597	22.95
3	1.5184	8.58
4	.6951	3.93
5	.4723	2.67

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1807	.5980	.3584	.2376	.4787	.1293
2	.1807	.5980	.3584	.2376	.4787	.1293
3	.2597	.8592	.2086	-.0878	-.1769	.1773
4	.2597	.8592	.2086	-.0878	-.1769	.1773
5	.1208	.3997	.8639	-.2761	-.5563	.5544
6	.1807	.5980	.3584	.2376	.4787	.1293
7	.1989	.6581	1.1291	.3152	.6351	.7257
8	-.4013	-1.3279	.0297	.0732	.1475	.0079
9	-.4013	-1.3279	.0297	.0732	.1475	.0079
10	-.4013	-1.3279	.0297	.0732	.1475	.0079
11	-.4013	-1.3279	.0297	.0732	.1475	.0079
12	-.0356	-.1177	2.9329	-.7814	-1.5743	.4543
13	.2597	.8592	.2086	-.0878	-.1769	.1773
CONSTRUCT						
1	.4594	1.5201	.9200	.3795	.7646	.3355
2	-.4852	-1.6054	.1921	.1454	.2929	.1063
3	.2612	.8643	2.3300	-.6555	-1.3208	.5854
4	-.0108	-.0356	.9218	-.3878	-.7814	.3113
5	.0601	.1989	.8835	.1564	.3152	.7842
6	-.4852	-1.6054	.1921	.1454	.2929	.1063
7	.4960	1.6409	.3842	.2424	.4884	.1457
8	-.0108	-.0356	.9218	-.3878	-.7814	.3113

BUS COMP MOD S LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.308	2.7692	15.25
2	.385	3.0769	16.95
3	.077	.9231	5.08
4	.231	2.3077	12.71
5	.231	2.3077	12.71
6	.385	3.0769	16.95
7	.308	2.7692	15.25
8	.077	.9231	5.08

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.1538

BIAS .5493

VARIABILITY .8697

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.000	1.373	7.56
2	.000	1.373	7.56
3	.000	1.373	7.56
4	.000	1.065	5.87
5	.000	1.680	9.26
6	.000	1.373	7.56
7	.000	1.680	9.26
8	.000	1.065	5.87
9	.000	1.065	5.87
10	.000	1.065	5.87
11	.000	1.065	5.87
12	.000	2.296	12.65
13	.000	1.680	9.26

UNIT OF EXPECTED DISTANCE 1.7394

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.0152	49.66
2	6.6897	36.85
3	2.4489	13.49

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3215	-.9653	.4410	-.2525	-.6530	.0147
2	-.3215	-.9653	.4410	-.2525	-.6530	.0147
3	-.3215	-.9653	.4410	-.2525	-.6530	.0147
4	.3314	.9952	.0747	-.0999	-.2585	.0079
5	-.1082	-.3250	1.5748	.4796	1.2406	.0358
6	-.3215	-.9653	.4410	-.2525	-.6530	.0147
7	-.1082	-.3250	1.5748	.4796	1.2406	.0358
8	.3314	.9952	.0747	-.0999	-.2585	.0079
9	.3314	.9952	.0747	-.0999	-.2585	.0079
10	.3314	.9952	.0747	-.0999	-.2585	.0079
11	.3314	.9952	.0747	-.0999	-.2585	.0079
12	-.0465	-.1397	2.2763	.0705	.1824	2.2431
13	-.1082	-.3250	1.5748	.4796	1.2406	.0358
CONSTRUCT						
1	-.4283	-1.2859	1.1156	-.3904	-1.0098	.0958
2	.5519	1.6572	.3306	-.1932	-.4996	.0809
3	-.0155	-.0465	.9209	.0273	.0705	.9159
4	-.1082	-.3247	2.2022	.5563	1.4389	.1317
5	-.1082	-.3247	2.2022	.5563	1.4389	.1317
6	.5519	1.6572	.3306	-.1932	-.4996	.0809
7	-.4283	-1.2859	1.1156	-.3904	-1.0098	.0958
8	-.0155	-.0465	.9209	.0273	.0705	.9159

BUS COMP MOD S LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	22.83
2	.308	2.7692	19.57
3	.154	1.6923	11.96
4	.077	.9231	6.52
5	.308	2.7692	19.57
6	.077	.9231	6.52
7	.077	.9231	6.52
8	.077	.9231	6.52

TOTAL VARIATION ABOUT CONSTRUCT MEANS 14.1538

BIAS .6750

VARIABILITY .7679

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.462	.911	6.44
2	-.538	.527	3.72
3	-.538	.527	3.72
4	.462	.911	6.44
5	.462	1.527	10.79
6	-.538	.527	3.72
7	.462	.911	6.44
8	-.538	.834	5.89
9	-.538	.834	5.89
10	-.538	.834	5.89
11	.462	1.680	11.87
12	.462	2.142	15.13
13	.462	1.988	14.05

UNIT OF EXPECTED DISTANCE 1.5359

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.9832	42.27
2	3.1338	22.14
3	2.3655	16.71
4	1.6855	11.91
5	.7131	5.04
6	.2727	1.93

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3595	-.8795	.1378	-.0709	-.1255	.1220
2	-.1640	-.4011	.3657	-.1825	-.3231	.2614
3	-.1640	-.4011	.3657	-.1825	-.3231	.2614
4	-.3595	-.8795	.1378	-.0709	-.1255	.1220
5	-.0914	-.2236	1.4766	.5624	.9957	.4852
6	-.1640	-.4011	.3657	-.1825	-.3231	.2614
7	-.3595	-.8795	.1378	-.0709	-.1255	.1220
8	.3307	.8088	.1801	-.1411	-.2497	.1178
9	.3307	.8088	.1801	-.1411	-.2497	.1178
10	.3307	.8088	.1801	-.1411	-.2497	.1178
11	.3970	.9711	.7374	-.2072	-.3668	.6029
12	.1480	.3620	2.0110	.1661	.2940	1.9246
13	.1250	.3058	1.8946	.6621	1.1722	.5207
CONSTRUCT						
1	-.6421	-1.5706	.7641	-.4295	-.7602	.1861
2	.5679	1.3890	.8399	-.3561	-.6304	.4425
3	.0137	.0336	1.6912	.6918	1.2246	.1916
4	.0605	.1480	.9012	.0938	.1661	.8736
5	-.4783	-1.1700	1.4002	.1975	.3497	1.2779
6	.1623	.3970	.7655	-.1170	-.2072	.7225
7	.0511	.1250	.9074	.3740	.6621	.4690
8	.0605	.1480	.9012	.0938	.1661	.8736

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	13.46
2	.385	3.0769	12.82
3	.385	3.0769	12.82
4	.538	3.2308	13.46
5	.462	3.2308	13.46
6	.308	2.7692	11.54
7	.231	2.3077	9.62
8	.385	3.0769	12.82

TOTAL VARIATION ABOUT CONSTRUCT MEANS 24.0000
BIAS .2774
VARIABILITY 1.0000

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-1.231	1.385	5.77
2	-1.231	1.385	5.77
3	-1.231	1.385	5.77
4	2.769	2.308	9.62
5	-.231	2.077	8.65
6	.769	2.154	8.97
7	-2.231	1.308	5.45
8	.769	2.154	8.97
9	.769	2.154	8.97
10	.769	2.154	8.97
11	.769	2.154	8.97
12	-.231	1.769	7.37
13	-.231	1.615	6.73

UNIT OF EXPECTED DISTANCE 2.0000

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	14.0407	58.50
2	5.0348	20.98
3	2.2804	9.50
4	1.5850	6.60
5	.6818	2.84
6	.3085	1.29
7	.0687	.29
8	.0000	.00

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2491	-.9335	.5131	.2875	.6451	.0970
2	-.2491	-.9335	.5131	.2875	.6451	.0970
3	-.2491	-.9335	.5131	.2875	.6451	.0970
4	-.1252	-.4693	2.0874	-.4759	-1.0678	.9473
5	-.2377	-.8905	1.2839	-.2227	-.4996	1.0343
6	-.1153	-.4321	1.9672	-.5372	-1.2055	.5140
7	-.1578	-.5912	.9582	.3192	.7162	.4453
8	.3872	1.4508	.0491	.0776	.1742	.0187
9	.3872	1.4508	.0491	.0776	.1742	.0187
10	.3872	1.4508	.0491	.0776	.1742	.0187
11	.3872	1.4508	.0491	.0776	.1742	.0187
12	.1297	.4859	1.5332	-.2476	-.5556	1.2245
13	-.2950	-1.1053	.3937	-.0089	-.0200	.3933
CONSTRUCT						
1	-.4171	-1.5631	.7876	.2114	.4742	.5627
2	.3799	1.4235	1.0507	-.0737	-.1653	1.0234
3	-.1717	-.6435	2.6628	-.6650	-1.4923	.4360
4	.3837	1.4378	1.1635	-.4234	-.9501	.2607
5	-.3424	-1.2829	1.5848	-.0711	-.1595	1.5594
6	.4133	1.5487	.3708	.1384	.3106	.2743
7	-.1276	-.4782	2.0790	-.5507	-1.2358	.5519
8	.4479	1.6784	.2600	.0281	.0630	.2561

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.231	2.3077	12.61
2	.077	.9231	5.04
3	.385	3.0769	16.81
4	.231	2.3077	12.61
5	.462	3.2308	17.65
6	.385	3.0769	16.81
7	.154	1.6923	9.24
8	.154	1.6923	9.24

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.3077

BIAS .5439

VARIABILITY .8734

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.077	1.284	7.01
2	-.077	1.284	7.01
3	-1.077	.899	4.91
4	-1.077	1.207	6.59
5	-.077	1.284	7.01
6	-1.077	.899	4.91
7	-.077	1.592	8.69
8	-.077	1.130	6.17
9	-.077	1.130	6.17
10	-.077	1.130	6.17
11	-.077	1.130	6.17
12	1.923	2.669	14.58
13	1.923	2.669	14.58

UNIT OF EXPECTED DISTANCE 1.7468

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.6580	52.75
2	4.8039	26.24
3	1.4401	7.87
4	1.2511	6.83
5	1.0000	5.46
6	.1546	.84
7	.0000	.00

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2123	-.6596	.8489	.4034	.8841	.0674
2	-.2123	-.6596	.8489	.4034	.8841	.0674
3	.1764	.5483	.5988	-.0098	-.0216	.5983
4	-.0708	-.2201	1.1587	-.1771	-.3882	1.0080
5	-.2123	-.6596	.8489	.4034	.8841	.0674
6	.1764	.5483	.5988	-.0098	-.0216	.5983
7	-.1632	-.5073	1.3344	.1913	.4192	1.1587
8	.3323	1.0328	.0635	-.0710	-.1557	.0393
9	.3323	1.0328	.0635	-.0710	-.1557	.0393
10	.3323	1.0328	.0635	-.0710	-.1557	.0393
11	.3323	1.0328	.0635	-.0710	-.1557	.0393
12	-.4057	-1.2608	1.0791	-.4602	-1.0087	.0617
13	-.4057	-1.2608	1.0791	-.4602	-1.0087	.0617
CONSTRUCT						
1	-.2049	-.6368	1.9022	.5521	1.2101	.4380
2	-.0525	-.1632	.8964	.0873	.1913	.8598
3	.4845	1.5058	.8096	-.1341	-.2939	.7232
4	-.2839	-.8822	1.5294	-.5008	-1.0975	.3248
5	-.5185	-1.6114	.6343	.2194	.4809	.4031
6	.4845	1.5058	.8096	-.1341	-.2939	.7232
7	-.2611	-.8114	1.0340	-.4199	-.9204	.1868
8	-.2611	-.8114	1.0340	-.4199	-.9204	.1868

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	20.59
2	.308	2.7692	17.65
3	.077	.9231	5.88
4	.077	.9231	5.88
5	.538	3.2308	20.59
6	.308	2.7692	17.65
7	.077	.9231	5.88
8	.077	.9231	5.88

TOTAL VARIATION ABOUT CONSTRUCT MEANS 15.6923

BIAS .6296

VARIABILITY .8086

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.000	.639	4.07
2	.000	.639	4.07
3	.000	.639	4.07
4	.000	.639	4.07
5	.000	.639	4.07
6	.000	.639	4.07
7	.000	.639	4.07
8	.000	1.562	9.95
9	.000	1.562	9.95
10	.000	1.562	9.95
11	.000	1.562	9.95
12	.000	2.485	15.84
13	.000	2.485	15.84

UNIT OF EXPECTED DISTANCE 1.6172

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.3687	66.07
2	3.3236	21.18
3	2.0000	12.75

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2441	-.7861	.0210	.0796	.1450	.0000
2	-.2441	-.7861	.0210	.0796	.1450	.0000
3	-.2441	-.7861	.0210	.0796	.1450	.0000
4	-.2441	-.7861	.0210	.0796	.1450	.0000
5	-.2441	-.7861	.0210	.0796	.1450	.0000
6	-.2441	-.7861	.0210	.0796	.1450	.0000
7	-.2441	-.7861	.0210	.0796	.1450	.0000
8	.3743	1.2052	.1097	.1816	.3312	.0000
9	.3743	1.2052	.1097	.1816	.3312	.0000
10	.3743	1.2052	.1097	.1816	.3312	.0000
11	.3743	1.2052	.1097	.1816	.3312	.0000
12	.1059	.3411	2.3688	-.6418	-1.1700	1.0000
13	.1059	.3411	2.3688	-.6418	-1.1700	1.0000
CONSTRUCT						
1	-.5307	-1.7090	.3102	.3055	.5569	.0000
2	.4649	1.4971	.5279	.3985	.7266	.0000
3	.0329	.1059	.9119	-.3520	-.6418	.5000
4	.0329	.1059	.9119	-.3520	-.6418	.5000
5	-.5307	-1.7090	.3102	.3055	.5569	.0000
6	.4649	1.4971	.5279	.3985	.7266	.0000
7	.0329	.1059	.9119	-.3520	-.6418	.5000
8	.0329	.1059	.9119	-.3520	-.6418	.5000

SCI COMP MOD S MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	14.69
2	.308	2.7692	12.59
3	.154	1.6923	7.69
4	.308	2.7692	12.59
5	.308	2.7692	12.59
6	.538	3.2308	14.69
7	.231	2.3077	10.49
8	.462	3.2308	14.69

TOTAL VARIATION ABOUT CONSTRUCT MEANS 22.0000

BIAS .3922

VARIABILITY .9574

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	2.154	2.769	12.59
2	-2.846	1.154	5.24
3	-.846	1.462	6.64
4	1.154	2.077	9.44
5	.154	2.308	10.49
6	-.846	1.000	4.55
7	-.846	1.000	4.55
8	1.154	1.923	8.74
9	1.154	1.923	8.74
10	1.154	1.923	8.74
11	1.154	1.923	8.74
12	-.846	1.462	6.64
13	-1.846	1.077	4.90

UNIT OF EXPECTED DISTANCE 1.9149

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	12.2433	55.65
2	4.5541	20.70
3	2.1406	9.73
4	1.6558	7.53
5	1.1804	5.37
6	.1599	.73
7	.0660	.30

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.2540	.8888	1.9792	-.6253	-1.3344	.1985
2	.0890	.3113	1.0570	.2261	.4826	.8241
3	.2761	.9661	.5282	.0782	.1668	.5004
4	-.0301	-.1054	2.0658	-.4866	-1.0383	.9877
5	.3009	1.0529	1.1992	-.1667	-.3557	1.0727
6	.0976	.3417	.8833	.3147	.6715	.4323
7	.0976	.3417	.8833	.3147	.6715	.4323
8	-.3935	-1.3768	.0274	-.0053	-.0113	.0273
9	-.3935	-1.3768	.0274	-.0053	-.0113	.0273
10	-.3935	-1.3768	.0274	-.0053	-.0113	.0273
11	-.3935	-1.3768	.0274	-.0053	-.0113	.0273
12	.2761	.9661	.5282	.0782	.1668	.5004
13	.2127	.7443	.5230	.2880	.6146	.1453
CONSTRUCT						
1	.4330	1.5151	.9352	.1320	.2817	.8559
2	-.4498	-1.5740	.2919	-.0099	-.0212	.2914
3	.1586	.5549	1.3844	-.3711	-.7920	.7571
4	.2218	.7761	2.1669	-.4478	-.9556	1.2538
5	-.4498	-1.5740	.2919	-.0099	-.0212	.2914
6	-.4026	-1.4088	1.2461	.0570	.1216	1.2313
7	.1500	.5248	2.0323	-.5991	-1.2786	.3976
8	-.3858	-1.3501	1.4081	-.5310	-1.1331	.1242

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.231	2.3077	14.56
2	.077	.9231	5.83
3	.538	3.2308	20.39
4	.154	1.6923	10.68
5	.077	.9231	5.83
6	.308	2.7692	17.48
7	.385	3.0769	19.42
8	.077	.9231	5.83

TOTAL VARIATION ABOUT CONSTRUCT MEANS 15.8462

BIAS .6249

VARIABILITY .8126

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.154	1.396	8.81
2	.154	1.396	8.81
3	.154	1.396	8.81
4	.154	2.166	13.67
5	-.846	.550	3.47
6	-.846	.550	3.47
7	.154	2.320	14.64
8	.154	.935	5.90
9	.154	.935	5.90
10	.154	.935	5.90
11	.154	.935	5.90
12	.154	1.550	9.78
13	.154	.781	4.93

UNIT OF EXPECTED DISTANCE 1.6251

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.7771	49.08
2	3.3633	21.22
3	2.2981	14.50
4	1.3707	8.65
5	.8532	5.38
6	.1838	1.16

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3780	1.0543	.2850	-.2604	-.4775	.0569
2	.3780	1.0543	.2850	-.2604	-.4775	.0569
3	.3780	1.0543	.2850	-.2604	-.4775	.0569
4	.1115	.3110	2.0690	.6520	1.1956	.6394
5	-.1581	-.4410	.3558	.0200	.0368	.3545
6	-.1581	-.4410	.3558	.0200	.0368	.3545
7	.0625	.1744	2.2891	.4790	.8784	1.5176
8	-.3256	-.9080	.1104	-.1059	-.1941	.0727
9	-.3256	-.9080	.1104	-.1059	-.1941	.0727
10	-.3256	-.9080	.1104	-.1059	-.1941	.0727
11	-.3256	-.9080	.1104	-.1059	-.1941	.0727
12	.2829	.7890	.9278	.2358	.4325	.7407
13	.0276	.0770	.7751	-.2022	-.3709	.6376
CONSTRUCT						
1	.4067	1.1341	1.0215	-.4260	-.7812	.4112
2	.0224	.0625	.9192	.2612	.4790	.6898
3	-.5705	-1.5911	.6992	-.3193	-.5856	.3563
4	.1414	.3944	1.5367	.4841	.8878	.7486
5	.0224	.0625	.9192	.2612	.4790	.6898
6	-.4670	-1.3024	1.0729	-.2309	-.4234	.8936
7	.5180	1.4447	.9898	-.4076	-.7476	.4310
8	.0400	.1115	.9106	.3555	.6520	.4856

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.615	3.0769	25.32
2	.308	2.7692	22.78
3	.077	.9231	7.59
4	.077	.9231	7.59
5	.077	.9231	7.59
6	.077	.9231	7.59
7	.154	1.6923	13.92
8	.077	.9231	7.59

TOTAL VARIATION ABOUT CONSTRUCT MEANS 12.1538

BIAS .7298

VARIABILITY .7116

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.538	.988	8.13
2	.538	.988	8.13
3	-.462	.296	2.43
4	-.462	.296	2.43
5	-.462	.296	2.43
6	.538	1.142	9.40
7	.538	1.142	9.40
8	-.462	.911	7.50
9	-.462	.911	7.50
10	-.462	.911	7.50
11	.538	1.757	14.46
12	.538	2.219	18.26
13	-.462	.296	2.43

UNIT OF EXPECTED DISTANCE 1.4233

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.9261	48.76
2	2.3251	19.13
3	1.6019	13.18
4	1.0000	8.23
5	.7194	5.92
6	.5813	4.78

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2730	-.6645	.5466	-.1117	-.1704	.5176
2	-.2730	-.6645	.5466	-.1117	-.1704	.5176
3	-.1808	-.4402	.1021	-.0156	-.0238	.1015
4	-.1808	-.4402	.1021	-.0156	-.0238	.1015
5	-.1808	-.4402	.1021	-.0156	-.0238	.1015
6	-.2175	-.5296	.8615	-.0274	-.0418	.8598
7	-.2175	-.5296	.8615	-.0274	-.0418	.8598
8	.3672	.8938	.1123	-.1253	-.1911	.0758
9	.3672	.8938	.1123	-.1253	-.1911	.0758
10	.3672	.8938	.1123	-.1253	-.1911	.0758
11	.4417	1.0753	.6012	-.2199	-.3353	.4888
12	.1611	.3923	2.0650	.9365	1.4281	.0257
13	-.1808	-.4402	.1021	-.0156	-.0238	.1015
CONSTRUCT						
1	-.7001	-1.7044	.1720	-.2235	-.3408	.0559
2	.6339	1.5432	.3877	-.3907	-.5958	.0327
3	.1814	.4417	.7280	-.1442	-.2199	.6796
4	.0662	.1611	.8971	.6142	.9365	.0200
5	-.0894	-.2175	.8757	-.0180	-.0274	.8750
6	-.0894	-.2175	.8757	-.0180	-.0274	.8750
7	-.2243	-.5459	1.3943	-.1465	-.2235	1.3443
8	.0662	.1611	.8971	.6142	.9365	.0200

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.533	3.7333	22.76
2	.200	2.4000	14.63
3	.133	1.7333	10.57
4	.200	2.4000	14.63
5	.133	1.7333	10.57
6	.067	.9333	5.69
7	.133	1.7333	10.57
8	.133	1.7333	10.57

TOTAL VARIATION ABOUT CONSTRUCT MEANS 16.4000

BIAS .6733

VARIABILITY .7653

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.467	1.840	11.22
2	-.533	1.040	6.34
3	1.467	1.840	11.22
4	.467	.973	5.93
5	-.533	.373	2.28
6	.467	1.773	10.81
7	-.533	1.040	6.34
8	-.533	1.173	7.15
9	-.533	1.173	7.15
10	.467	1.107	6.75
11	.467	1.907	11.63
12	-.533	1.040	6.34
13	-.533	.373	2.28
14	-.533	.373	2.28
15	-.533	.373	2.28

UNIT OF EXPECTED DISTANCE 1.5306

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.1593	31.46
2	3.5702	21.77
3	2.9692	18.10
4	2.0000	12.20
5	1.0000	6.10
6	.9225	5.62
7	.6038	3.68
8	.1751	1.07

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3724	-.8458	1.1246	.2513	.4749	.8991
2	.1982	.4501	.8374	.3023	.5713	.5110
3	-.1903	-.4323	1.6531	-.5274	-.9965	.6601
4	-.1557	-.3538	.8482	.2572	.4860	.6120
5	-.1943	-.4412	.1786	-.0445	-.0842	.1715
6	.1563	.3550	1.6473	.5178	.9783	.6902
7	.2005	.4554	.8326	-.3345	-.6321	.4331
8	.3075	.6986	.6854	.0027	.0051	.6853
9	.3075	.6986	.6854	.0027	.0051	.6853
10	-.3305	-.7507	.5431	.0359	.0678	.5385
11	.4554	1.0345	.8366	.0048	.0090	.8365
12	.2005	.4554	.8326	-.3345	-.6321	.4331
13	-.1943	-.4412	.1786	-.0445	-.0842	.1715
14	-.1943	-.4412	.1786	-.0445	-.0842	.1715
15	-.1943	-.4412	.1786	-.0445	-.0842	.1715
CONSTRUCT						
1	-.8039	-1.8260	.3991	-.0853	-.1612	.3732
2	.0875	.1987	2.3605	.5702	1.0773	1.1999
3	.3359	.7630	1.1512	.0039	.0074	1.1512
4	.0927	.2107	2.3556	-.6332	-1.1964	.9242
5	-.3094	-.7029	1.2393	.1520	.2872	1.1568
6	-.0838	-.1903	.8971	-.2791	-.5274	.6190
7	-.0951	-.2161	1.6866	.4070	.7691	1.0952
8	.3359	.7630	1.1512	.0039	.0074	1.1512

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.600	3.6000	16.36
2	.133	1.7333	7.88
3	.200	2.4000	10.91
4	.133	1.7333	7.88
5	.267	2.9333	13.33
6	.333	3.3333	15.15
7	.267	2.9333	13.33
8	.333	3.3333	15.15

TOTAL VARIATION ABOUT CONSTRUCT MEANS 22.0000

BIAS .5164

VARIABILITY .8864

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-1.267	1.533	6.97
2	1.733	3.067	13.94
3	-.267	1.867	8.48
4	.733	1.400	6.36
5	-1.267	.600	2.73
6	.733	2.200	10.00
7	2.733	3.000	13.64
8	.733	2.200	10.00
9	.733	1.400	6.36
10	.733	1.400	6.36
11	-.267	.933	4.24
12	-1.267	.600	2.73
13	-1.267	.600	2.73
14	-1.267	.600	2.73
15	-1.267	.600	2.73

UNIT OF EXPECTED DISTANCE 1.7728

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.8144	40.07
2	6.8974	31.35
3	2.7063	12.30
4	1.7980	8.17
5	1.1967	5.44
6	.4292	1.95
7	.1580	.72
8	.0000	.00

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.0375	.1114	1.5209	.1824	.4790	1.2914
2	.4683	1.3904	1.1335	.2589	.6799	.6712
3	.2505	.7438	1.3135	.2052	.5389	1.0231
4	.1507	.4475	1.1997	.1804	.4739	.9752
5	-.1985	-.5893	.2527	.1712	.4497	.0505
6	.4222	1.2535	.6288	-.0189	-.0496	.6263
7	.3726	1.1063	1.7760	-.4913	-1.2902	.1114
8	.0234	.0695	2.1952	-.5005	-1.3144	.4675
9	-.2481	-.7365	.8576	-.3012	-.7909	.2320
10	-.2481	-.7365	.8576	-.3012	-.7909	.2320
11	-.2367	-.7028	.4394	-.0701	-.1840	.4056
12	-.1985	-.5893	.2527	.1712	.4497	.0505
13	-.1985	-.5893	.2527	.1712	.4497	.0505
14	-.1985	-.5893	.2527	.1712	.4497	.0505
15	-.1985	-.5893	.2527	.1712	.4497	.0505
CONSTRUCT						
1	-.5304	-1.5746	1.1206	.1386	.3641	.9880
2	.2421	.7188	1.2166	.1767	.4641	1.0012
3	.2756	.8183	1.7305	-.3848	-1.0106	.7091
4	.1704	.5058	1.4775	.1680	.4413	1.2827
5	-.0337	-.1001	2.9233	-.6070	-1.5941	.3823
6	.5606	1.6644	.5630	.0512	.1344	.5450
7	.4762	1.4139	.9342	-.0270	-.0708	.9292
8	-.1134	-.3368	3.2199	-.6336	-1.6641	.4507

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.867	1.7333	8.84
2	.267	2.9333	14.97
3	.133	1.7333	8.84
4	.200	2.4000	12.24
5	.400	3.6000	18.37
6	.067	.9333	4.76
7	.333	3.3333	17.01
8	.267	2.9333	14.97

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.6000

BIAS .5888

VARIABILITY .8367

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.533	1.093	5.58
2	.467	1.160	5.92
3	.467	3.027	15.44
4	.467	1.560	7.96
5	1.467	1.493	7.62
6	1.467	1.493	7.62
7	.467	2.227	11.36
8	-.533	1.227	6.26
9	2.467	2.627	13.40
10	-.533	.693	3.54
11	-.533	.827	4.22
12	-1.533	.493	2.52
13	-.533	.693	3.54
14	-1.533	.493	2.52
15	-1.533	.493	2.52

UNIT OF EXPECTED DISTANCE 1.6733

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.8511	29.85
2	4.5167	23.04
3	3.8050	19.41
4	2.4823	12.66
5	1.2704	6.48
6	1.1769	6.00
7	.3673	1.87
8	.1303	.67

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3019	.7303	.5599	-.1857	-.3947	.4042
2	.0046	.0112	1.1599	.4175	.8874	.3724
3	-.1768	-.4276	2.8438	-.1019	-.2165	2.7969
4	.2808	.6792	1.0987	-.0651	-.1383	1.0796
5	-.4370	-1.0571	.3758	-.0150	-.0318	.3748
6	-.2324	-.5622	1.1773	.2942	.6253	.7863
7	-.5636	-1.3632	.3683	-.0482	-.1024	.3578
8	.2440	.5903	.8782	-.1672	-.3553	.7519
9	-.1437	-.3477	2.5058	-.6866	-1.4592	.3764
10	.0258	.0624	.6894	.2969	.6310	.2912
11	-.0101	-.0245	.8261	-.1015	-.2157	.7795
12	.2269	.5489	.1921	.0218	.0464	.1899
13	.0258	.0624	.6894	.2969	.6310	.2912
14	.2269	.5489	.1921	.0218	.0464	.1899
15	.2269	.5489	.1921	.0218	.0464	.1899
CONSTRUCT						
1	.3061	.7404	1.1852	.0706	.1500	1.1627
2	-.0512	-.1238	2.9180	.2563	.5448	2.6212
3	.0415	.1003	1.7233	-.4018	-.8538	.9943
4	.1815	.4389	2.2073	-.4411	-.9374	1.3286
5	-.4865	-1.1768	2.2151	.5846	1.2425	.6714
6	-.0731	-.1768	.9021	-.0479	-.1019	.8917
7	-.5733	-1.3869	1.4099	-.2621	-.5570	1.0997
8	-.5462	-1.3211	1.1879	-.4007	-.8516	.4627

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.533	3.7333	31.46
2	.267	2.9333	24.72
3	.200	2.4000	20.22
4	.000	.0000	.00
5	.000	.0000	.00
6	.067	.9333	7.87
7	.067	.9333	7.87
8	.067	.9333	7.87

TOTAL VARIATION ABOUT CONSTRUCT MEANS 11.8667

BIAS .7775

VARIABILITY .6510

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.200	.342	2.88
2	.800	1.742	14.68
3	-.200	.876	7.38
4	.800	.809	6.82
5	-.200	.342	2.88
6	-.200	.876	7.38
7	.800	1.876	15.81
8	-.200	.342	2.88
9	-.200	1.009	8.50
10	-.200	1.009	8.50
11	-.200	.342	2.88
12	-.200	.342	2.88
13	-.200	1.276	10.75
14	-.200	.342	2.88
15	-.200	.342	2.88

UNIT OF EXPECTED DISTANCE 1.3020

THE COMPONENT-SPACE IS LIMITED TO 6 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.1765	43.62
2	3.8536	32.47
3	1.3801	11.63
4	.6877	5.80
5	.6061	5.11
6	.1627	1.37

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2513	-.5718	.0153	.0563	.1105	.0031
2	.2932	.6671	1.2972	-.4753	-.9330	.4266
3	.2366	.5383	.5858	-.3520	-.6909	.1085
4	-.1280	-.2912	.7241	-.3372	-.6620	.2859
5	-.2513	-.5718	.0153	.0563	.1105	.0031
6	.2366	.5383	.5858	-.3520	-.6909	.1085
7	.3751	.8535	1.1472	.4298	.8437	.4353
8	-.2513	-.5718	.0153	.0563	.1105	.0031
9	.3026	.6886	.5347	.3183	.6248	.1444
10	.3026	.6886	.5347	.3183	.6248	.1444
11	-.2513	-.5718	.0153	.0563	.1105	.0031
12	-.2513	-.5718	.0153	.0563	.1105	.0031
13	.1404	.3194	1.1736	.0561	.1102	1.1614
14	-.2513	-.5718	.0153	.0563	.1105	.0031
15	-.2513	-.5718	.0153	.0563	.1105	.0031
CONSTRUCT						
1	-.8294	-1.8872	.1720	.0289	.0568	.1688
2	.2806	.6384	2.5258	-.7725	-1.5164	.2262
3	.4309	.9804	1.4388	.5432	1.0663	.3017
4	.0617	.1404	.9136	.0286	.0561	.9105
5	.1289	.2932	.8474	-.2421	-.4753	.6215
6	.1649	.3751	.7926	.2189	.4298	.6079

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CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.200	2.4000	11.92
2	.200	2.4000	11.92
3	.267	2.9333	14.57
4	.267	2.9333	14.57
5	.133	1.7333	8.61
6	.200	2.4000	11.92
7	.200	2.4000	11.92
8	.267	2.9333	14.57

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.1333

BIAS .5735

VARIABILITY .8480

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.733	.991	4.92
2	.267	1.591	7.90
3	.267	1.591	7.90
4	.267	1.591	7.90
5	.267	1.458	7.24
6	.267	1.591	7.90
7	.267	1.324	6.58
8	.267	1.324	6.58
9	-.733	.858	4.26
10	.267	1.591	7.90
11	.267	1.458	7.24
12	.267	1.591	7.90
13	.267	1.458	7.24
14	-.733	.858	4.26
15	-.733	.858	4.26

UNIT OF EXPECTED DISTANCE 1.6959

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.2403	31.00
2	5.2458	26.06
3	4.1165	20.45
4	2.3062	11.45
5	1.5213	7.56
6	.5310	2.64
7	.1721	.85

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.0090	.0226	.9906	.1796	.4114	.8214
2	.4570	1.1417	.2877	-.2331	-.5339	.0027
3	-.0899	-.2246	1.5406	.1287	.2947	1.4538
4	.4570	1.1417	.2877	-.2331	-.5339	.0027
5	-.2639	-.6591	1.0233	-.1979	-.4534	.8178
6	.4570	1.1417	.2877	-.2331	-.5339	.0027
7	-.3055	-.7632	.7420	-.2755	-.6311	.3437
8	-.3055	-.7632	.7420	-.2755	-.6311	.3437
9	-.1230	-.3073	.7633	-.0950	-.2176	.7160
10	-.1435	-.3586	1.4625	-.0282	-.0645	1.4584
11	-.2639	-.6591	1.0233	-.1979	-.4534	.8178
12	.0155	.0388	1.5896	.3789	.8678	.8365
13	.0275	.0687	1.4531	.4581	1.0493	.3520
14	.0361	.0901	.8497	.3120	.7147	.3389
15	.0361	.0901	.8497	.3120	.7147	.3389
CONSTRUCT						
1	-.2472	-.6176	2.0185	-.1167	-.2672	1.9471
2	.5488	1.3710	.5202	- 3053	-.6993	.0313
3	-.3513	-.8776	2.1632	-.2944	-.6742	1.7086
4	.0461	.1151	2.9201	.6379	1.4611	.7853
5	-.0512	-.1280	1.7169	.1531	.3507	1.5939
6	-.0214	-.0534	2.3971	.3346	.7664	1.8098
7	.5488	1.3710	.5202	-.3053	-.6993	.0313
8	-.4558	-1.1387	1.6366	-.4134	-.9469	.7400

BUS HELI MOD S LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.200	2.4000	9.89
2	.267	2.9333	12.09
3	.267	2.9333	12.09
4	.333	3.3333	13.74
5	.333	3.3333	13.74
6	.667	3.3333	13.74
7	.200	2.4000	9.89
8	.600	3.6000	14.84

TOTAL VARIATION ABOUT CONSTRUCT MEANS 24.2667

BIAS .4372

VARIABILITY .9309

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.133	1.916	7.89
2	1.133	1.916	7.89
3	-.867	1.382	5.70
4	-.867	1.382	5.70
5	1.133	2.449	10.09
6	.133	1.982	8.17
7	-.867	1.516	6.25
8	-.867	1.516	6.25
9	.133	1.716	7.07
10	.133	1.182	4.87
11	.133	1.182	4.87
12	-.867	1.916	7.89
13	.133	1.582	6.52
14	1.133	1.382	5.70
15	-.867	1.249	5.15

UNIT OF EXPECTED DISTANCE 1.8619

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.6333	31.46
2	6.5596	27.03
3	4.4426	18.31
4	3.3822	13.94
5	1.3073	5.39
6	.5483	2.26
7	.3478	1.43
8	.0455	.19

	COMPONENT 1			COMPONENT 2			COMPONENT 3		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3080	.8511	1.1912	.0700	.1794	1.1590	-.4396	-.9266	.3005
2	.3080	.8511	1.1912	.0700	.1794	1.1590	-.4396	-.9266	.3005
3	.0731	.2019	1.3415	.3620	.9271	.4820	.2279	.4803	.2513
4	.0731	.2019	1.3415	.3620	.9271	.4820	.2279	.4803	.2513
5	-.0262	-.0725	2.4436	-.0701	-.1796	2.4114	-.4640	-.9780	1.4549
6	.1770	.4889	1.7432	.4523	1.1584	.4014	.0387	.0815	.3947
7	.1594	.4405	1.3215	-.3865	-.9900	.3415	.1916	.4039	.1783
8	.1594	.4405	1.3215	-.3865	-.9900	.3415	.1916	.4039	.1783
9	-.3636	-1.0047	.7061	-.2563	-.6563	.2753	-.1769	-.3729	.1363
10	.2285	.6314	.7836	-.2140	-.5482	.4830	.2514	.5299	.2023
11	.2285	.6314	.7836	-.2140	-.5482	.4830	.2514	.5299	.2023
12	-.4563	-1.2608	.3259	-.0320	-.0819	.3192	-.0078	-.0165	.3189
13	-.3873	-1.0699	.4374	.1405	.3598	.3079	.0519	.1095	.2960
14	-.2946	-.8138	.7199	-.0838	-.2146	.6738	-.1172	-.2469	.6129
15	-.1871	-.5169	.9817	.1865	.4776	.7536	.2126	.4482	.5527
CONSTRUCT									
1	.2135	.5899	2.0521	.0273	.0700	2.0472	-.6373	-1.3432	.2429
2	.1075	.2969	2.8452	.4319	1.1061	1.6217	.0144	.0304	1.6208
3	.2809	.7759	2.3312	-.4690	-1.2011	.8885	.4204	.8861	.1034
4	-.6113	-1.6889	.4809	-.0176	-.0451	.4789	-.0177	-.0373	.4775
5	-.5531	-1.5281	.9984	-.1178	-.3016	.9074	-.3387	-.7139	.3977
6	.1909	.5273	3.0553	.4418	1.1314	1.7752	.1259	.2654	1.7047
7	.2870	.7931	1.7711	.2313	.5923	1.4202	-.3988	-.8405	.7137
8	.2561	.7076	3.0993	-.5744	-1.4712	.9348	-.3564	-.7512	.3705

SCI HELI MOD S HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.267	2.9333	13.75
2	.200	2.4000	11.25
3	.267	2.9333	13.75
4	.267	2.9333	13.75
5	.267	2.9333	13.75
6	.200	2.4000	11.25
7	.200	2.4000	11.25
8	.200	2.4000	11.25

TOTAL VARIATION ABOUT CONSTRUCT MEANS 21.3333

BIAS .5375

VARIABILITY .8729

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.133	1.511	7.08
2	.133	1.644	7.71
3	.133	1.511	7.08
4	.133	1.511	7.08
5	.133	1.378	6.46
6	.133	1.511	7.08
7	.133	1.511	7.08
8	-.867	.911	4.27
9	-.867	.911	4.27
10	.133	1.511	7.08
11	.133	1.511	7.08
12	.133	1.378	6.46
13	.133	1.511	7.08
14	.133	1.511	7.08
15	.133	1.511	7.08

UNIT OF EXPECTED DISTANCE 1.7457

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.3196	29.62
2	4.5245	21.21
3	3.9119	18.34
4	2.7866	13.06
5	2.5477	11.94
6	.9664	4.53
7	.2766	1.30

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3531	-.8877	.7230	.3460	.7359	.1815
2	.1533	.3853	1.4960	-.1501	-.3192	1.3941
3	.0852	.2141	1.4653	-.0420	-.0893	1.4573
4	.3283	.8252	.8302	.1687	.3588	.7014
5	.3539	.8897	.5863	.1411	.3002	.4961
6	.3283	.8252	.8302	.1687	.3588	.7014
7	-.1675	-.4211	1.3338	-.3592	-.7641	.7499
8	-.1147	-.2882	.8280	-.3131	-.6659	.3846
9	-.1988	-.4998	.6613	.2385	.5073	.4040
10	-.0738	-.1854	1.4767	-.4948	-1.0526	.3688
11	.1789	.4497	1.3088	-.1776	-.3778	1.1661
12	.3539	.8897	.5863	.1411	.3002	.4961
13	-.2517	-.6326	1.1109	.1923	.4090	.9436
14	-.3531	-.8877	.7231	.3460	.7359	.1815
15	-.2690	-.6762	1.0539	-.2056	-.4372	.8627
CONSTRUCT						
1	.3866	.9719	1.9888	.0295	.0627	1.9848
2	.3221	.8098	1.7443	.0881	.1873	1.7092
3	-.2486	-.6249	2.5428	-.6453	-1.3727	.6585
4	-.4601	-1.1567	1.5953	.5278	1.1227	.3348
5	.5427	1.3643	1.0720	.2913	.6196	.6880
6	-.3879	-.9752	1.4489	.2287	.4864	1.2123
7	.1028	.2584	2.3332	-.3867	-.8225	1.6567
8	-.1329	-.3340	2.2884	-.0982	-.2089	2.2448

SCI HELI MOD S HB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.067	.9333	5.60
2	.133	1.7333	10.40
3	.067	.9333	5.60
4	.533	3.7333	22.40
5	.267	2.9333	17.60
6	.067	.9333	5.60
7	.467	3.7333	22.40
8	.133	1.7333	10.40

TOTAL VARIATION ABOUT CONSTRUCT MEANS 16.6667

BIAS .6667

VARIABILITY .7715

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.267	1.556	9.33
2	-.733	1.089	6.53
3	.267	2.222	13.33
4	-.733	1.089	6.53
5	-.733	.689	4.13
6	.267	1.422	8.53
7	-.733	1.089	6.53
8	1.267	1.889	11.33
9	.267	1.289	7.73
10	.267	.622	3.73
11	.267	1.289	7.73
12	.267	.622	3.73
13	.267	.622	3.73
14	-.733	.556	3.33
15	.267	.622	3.73

UNIT OF EXPECTED DISTANCE 1.5430

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.8197	34.92
2	4.7754	28.65
3	2.7861	16.72
4	1.5619	9.37
5	.7938	4.76
6	.5869	3.52
7	.2028	1.22
8	.1400	.84

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1416	.3416	1.4389	-.3550	-.7758	.8370
2	-.4021	-.9700	.1480	-.0507	-.1108	.1357
3	-.2004	-.4836	1.9884	-.3142	-.6866	1.5169
4	-.4021	-.9700	.1480	-.0507	-.1108	.1357
5	.1173	.2829	.6089	-.2807	-.6133	.2327
6	.1000	.2413	1.3640	-.4382	-.9577	.4469
7	-.4021	-.9700	.1480	-.0507	-.1108	.1357
8	-.2681	-.6468	1.4706	.3438	.7514	.9060
9	.0477	.1150	1.2757	.3986	.8711	.5168
10	.2973	.7172	.1078	.0419	.0915	.0994
11	.0477	.1150	1.2757	.3986	.8711	.5168
12	.2973	.7172	.1078	.0419	.0915	.0994
13	.2973	.7172	.1078	.0419	.0915	.0994
14	.0313	.0755	.5499	.2317	.5063	.2935
15	.2973	.7172	.1078	.0419	.0915	.0994
CONSTRUCT						
1	.0587	.1416	.9133	-.1625	-.3550	.7873
2	-.0416	-.1004	1.7232	-.3443	-.7524	1.1571
3	-.1111	-.2681	.8615	.1573	.3438	.7432
4	.4344	1.0478	2.6354	.7048	1.5402	.2631
5	-.6112	-1.4744	.7596	.0877	.1917	.7228
6	-.0831	-.2004	.8932	-.1438	-.3142	.7944
7	.6417	1.5481	1.3366	-.4148	-.9065	.5149
8	.0395	.0954	1.7242	.3648	.7973	1.0886

SCI HELI MOD S MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.467	3.7333	13.27
2	.267	2.9333	10.43
3	.333	3.3333	11.85
4	.467	3.7333	13.27
5	.333	3.3333	11.85
6	.533	3.7333	13.27
7	.533	3.7333	13.27
8	.400	3.6000	12.80

TOTAL VARIATION ABOUT CONSTRUCT MEANS 28.1333

BIAS .2494

VARIABILITY 1.0024

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.667	1.724	6.13
2	2.667	2.391	8.50
3	-1.333	1.858	6.60
4	.667	1.858	6.60
5	-.333	2.058	7.31
6	-1.333	1.858	6.60
7	-.333	1.924	6.84
8	-.333	2.058	7.31
9	.667	1.724	6.13
10	.667	1.991	7.08
11	.667	1.991	7.08
12	-.333	1.791	6.37
13	-.333	1.524	5.42
14	-2.333	1.524	5.42
15	.667	1.858	6.60

UNIT OF EXPECTED DISTANCE 2.0048

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.2727	29.41
2	6.5234	23.19
3	5.2025	18.49
4	3.2045	11.39
5	2.1868	7.77
6	1.6385	5.82
7	.8245	2.93
8	.2805	1.00

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3059	.8799	.9503	.2746	.7012	.4585
2	.2749	.7906	1.7661	-.4304	-1.0992	.5579
3	.1259	.3621	1.7267	-.0502	-.1283	1.7102
4	.1809	.5203	1.5871	-.1767	-.4513	1.3834
5	.2137	.6145	1.6801	-.2322	-.5931	1.3284
6	-.1900	-.5465	1.5591	-.2723	-.6954	1.0755
7	-.3184	-.9159	1.0855	-.1513	-.3865	.9361
8	-.3447	-.9914	1.0748	-.2270	-.5797	.7388
9	-.2524	-.7261	1.1973	.2798	.7147	.6865
10	.3785	1.0888	.8057	-.1490	-.3806	.6608
11	-.3572	-1.0274	.9355	.1076	.2748	.8600
12	-.2423	-.6968	1.3056	-.0355	-.0907	1.2974
13	.2458	.7070	1.0246	.3636	.9286	.1623
14	-.1251	-.3598	1.3950	.2680	.6845	.9265
15	.1046	.3008	1.7673	.4311	1.1010	.5551
CONSTRUCT						
1	.5925	1.7043	.8288	.0317	.0809	.8223
2	.1362	.3917	2.7799	-.3640	-.9296	1.9158
3	-.4062	-1.1682	1.9688	.1723	.4402	1.7748
4	-.1115	-.3207	3.6305	.6613	1.6891	.7773
5	.0974	.2801	3.2549	-.4205	-1.0741	2.1013
6	.4743	1.3641	1.8727	.2125	.5427	1.5781
7	-.4344	-1.2493	2.1726	-.3546	-.9057	1.3523
8	.1729	.4973	3.3527	-.2274	-.5808	3.0153

SCI HELI MOD S MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.467	3.7333	14.74
2	.267	2.9333	11.58
3	.267	2.9333	11.58
4	.400	3.6000	14.21
5	.400	3.6000	14.21
6	.200	2.4000	9.47
7	.200	2.4000	9.47
8	.467	3.7333	14.74

TOTAL VARIATION ABOUT CONSTRUCT MEANS 25.3333

BIAS .3944

VARIABILITY .9512

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.667	1.111	4.39
2	.333	2.644	10.44
3	1.333	2.711	10.70
4	1.333	2.711	10.70
5	-.667	1.111	4.39
6	-1.667	1.444	5.70
7	-1.667	1.178	4.65
8	1.333	1.911	7.54
9	-1.667	1.178	4.65
10	.333	1.711	6.75
11	1.333	1.911	7.54
12	1.333	1.911	7.54
13	.333	1.444	5.70
14	.333	1.311	5.18
15	-1.667	1.044	4.12

UNIT OF EXPECTED DISTANCE 1.9024

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	12.8694	50.80
2	4.9190	19.42
3	2.8618	11.30
4	2.4039	9.49
5	1.5952	6.30
6	.4169	1.65
7	.2670	1.05

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.0266	.0954	1.1020	-.3999	-.8870	.3153
2	.3572	1.2816	1.0020	.4166	.9240	.1481
3	.4261	1.5286	.3746	.1250	.2773	.2977
4	.4261	1.5286	.3746	.1250	.2773	.2977
5	.0266	.0954	1.1020	-.3999	-.8870	.3153
6	.1693	.6073	1.0756	.1456	.3228	.9714
7	-.0510	-.1831	1.1443	.1286	.2852	1.0629
8	-.3559	-1.2768	.2810	.1908	.4232	.1019
9	-.0352	-.1264	1.1618	-.0248	-.0551	1.1588
10	-.2585	-.9274	.8510	.1961	.4348	.6620
11	-.3559	-1.2768	.2810	.1908	.4232	.1019
12	-.3559	-1.2768	.2810	.1908	.4232	.1019
13	-.0796	-.2855	1.3629	-.1683	-.3732	1.2236
14	-.0708	-.2540	1.2466	-.4052	-.8986	.4390
15	.1310	.4700	.8236	-.3112	-.6901	.3473
CONSTRUCT						
1	.2470	.8860	2.9484	-.6467	-1.4344	.8909
2	.3843	1.3787	1.0324	.3662	.8122	.3727
3	-.3697	-1.3262	1.1744	.3465	.7684	.5839
4	-.3494	-1.2533	2.0291	-.0117	-.0259	2.0285
5	-.4061	-1.4569	1.4776	.3286	.7288	.9465
6	.3371	1.2094	.9373	.3006	.6667	.4928
7	.3371	1.2094	.9373	.3006	.6667	.4928
8	-.3746	-1.3439	1.9273	-.1968	-.4366	1.7367

SCI HELI MOD S LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.733	2.9333	17.46
2	.133	1.7333	10.32
3	.067	.9333	5.56
4	.067	.9333	5.56
5	.200	2.4000	14.29
6	.533	3.7333	22.22
7	.200	2.4000	14.29
8	.133	1.7333	10.32

TOTAL VARIATION ABOUT CONSTRUCT MEANS 16.8000

BIAS .6633

VARIABILITY .7746

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-1.067	.480	2.86
2	-1.067	.480	2.86
3	-1.067	1.680	10.00
4	-1.067	1.680	10.00
5	-.067	1.080	6.43
6	.933	1.680	10.00
7	-.067	1.080	6.43
8	.933	2.347	13.97
9	-.067	1.747	10.40
10	-.067	.413	2.46
11	1.933	1.747	10.40
12	.933	1.147	6.83
13	-.067	.413	2.46
14	-.067	.413	2.46
15	-.067	.413	2.46

UNIT OF EXPECTED DISTANCE 1.5492

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.4309	32.33
2	4.5923	27.33
3	3.0179	17.96
4	1.7565	10.46
5	1.0772	6.41
6	.5284	3.15
7	.3969	2.36

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.1643	-.3828	.3335	.0839	.1797	.3012
2	-.1643	-.3828	.3335	.0839	.1797	.3012
3	-.2948	-.6869	1.2081	-.4760	-1.0200	.1678
4	-.2948	-.6869	1.2081	-.4760	-1.0200	.1678
5	-.3377	-.7870	.4606	.2662	.5705	.1351
6	-.2666	-.6214	1.2939	.3050	.6536	.8667
7	-.3377	-.7870	.4606	.2662	.5705	.1351
8	.2787	.6494	1.9249	-.3088	-.6617	1.4871
9	.1916	.4464	1.5474	-.3583	-.7678	.9578
10	.1783	.4154	.2408	.0723	.1549	.2168
11	.3740	.8715	.9872	.1817	.3894	.8355
12	.3029	.7059	.6484	.1430	.3064	.5546
13	.1783	.4154	.2408	.0723	.1549	.2168
14	.1783	.4154	.2408	.0723	.1549	.2168
15	.1783	.4154	.2408	.0723	.1549	.2168
CONSTRUCT						
1	.0512	.1193	2.9191	.7555	1.6190	.2980
2	-.2530	-.5895	1.3858	-.4442	-.9519	.4796
3	.1196	.2787	.8557	-.1441	-.3088	.7603
4	.0822	.1916	.8966	-.1672	-.3583	.7683
5	.1656	.3860	2.2510	.0830	.1779	2.2193
6	.7982	1.8601	.2732	-.0249	-.0533	.2704
7	-.4043	-.9421	1.5125	.3908	.8375	.8111
8	.2904	.6769	1.2752	.1515	.3247	1.1698

SCI HELI MOD S LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.600	3.6000	13.92
2	.200	2.4000	9.28
3	.200	2.4000	9.28
4	.467	3.7333	14.43
5	.267	2.9333	11.34
6	.333	3.3333	12.89
7	.533	3.7333	14.43
8	.467	3.7333	14.43

TOTAL VARIATION ABOUT CONSTRUCT MEANS 25.8667
BIAS .3712
VARIABILITY .9612

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-1.067	1.209	4.67
2	-1.067	1.209	4.67
3	-.067	1.942	7.51
4	.933	2.142	8.28
5	-1.067	1.609	6.22
6	-1.067	2.009	7.77
7	-2.067	1.809	6.99
8	.933	2.676	10.34
9	1.933	2.342	9.05
10	-.067	1.409	5.45
11	1.933	2.076	8.02
12	-1.067	1.476	5.70
13	1.933	1.542	5.96
14	.933	1.209	4.67
15	-1.067	1.209	4.67

UNIT OF EXPECTED DISTANCE 1.9223

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.9471	30.72
2	6.5398	25.28
3	5.1448	19.89
4	3.2317	12.49
5	1.1807	4.56
6	.8271	3.20
7	.6886	2.66

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2854	-.8045	.5617	.2383	.6095	.1902
2	-.2854	-.8045	.5617	.2383	.6095	.1902
3	.1294	.3647	1.8092	-.1413	-.3614	1.6786
4	-.1263	-.3560	2.0155	-.3864	-.9882	1.0390
5	-.3181	-.8969	.8045	-.2431	-.6216	.4182
6	-.0710	-.2002	1.9688	-.0928	-.2374	1.9124
7	-.2631	-.7417	1.2588	-.3313	-.8472	.5410
8	.2738	.7720	2.0796	-.4406	-1.1268	.8099
9	.4527	1.2761	.7139	.1598	.4087	.5469
10	.1292	.3641	1.2763	-.0922	-.2359	1.2206
11	.4194	1.1823	.6777	-.0190	-.0487	.6753
12	-.0843	-.2376	1.4191	.2692	.6883	.9453
13	.2534	.7144	1.0319	.2939	.7516	.4669
14	.0611	.1722	1.1792	.3089	.7900	.5551
15	-.2654	-.8045	.5617	.2383	.6095	.1902
CONSTRUCT						
1	-.1552	-.4375	3.4086	.2257	.5771	3.0755
2	-.0241	-.0679	2.3954	-.2427	-.6206	2.0103
3	.4065	1.1459	1.0869	-.1173	-.2999	.9970
4	-.0615	-.1732	3.7033	.6831	1.7468	.6518
5	-.1538	-.4337	2.7452	-.5480	-1.4014	.7813
6	.5422	1.5285	.9971	-.0384	-.0982	.9874
7	.5650	1.5927	1.1968	-.1240	-.3170	1.0963
8	.4117	1.1606	2.3863	.3045	.7786	1.7800

BUS COMP MOD L HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	14.69
2	.308	2.7692	12.59
3	.231	2.3077	10.49
4	.308	2.7692	12.59
5	.231	2.3077	10.49
6	.308	2.7692	12.59
7	.308	2.7692	12.59
8	.385	3.0769	13.99

TOTAL VARIATION ABOUT CONSTRUCT MEANS 22.0000

BIAS .3922

VARIABILITY .9574

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.385	1.615	7.34
2	-.615	1.077	4.90
3	.385	1.615	7.34
4	1.385	2.308	10.49
5	.385	1.615	7.34
6	.385	1.615	7.34
7	.385	1.615	7.34
8	-.615	1.692	7.69
9	-.615	1.692	7.69
10	-.615	1.692	7.69
11	-.615	1.692	7.69
12	.385	2.077	9.44
13	-.615	1.692	7.69

UNIT OF EXPECTED DISTANCE 1.9149

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.1111	45.96
2	5.8934	26.79
3	3.3958	15.44
4	2.0385	9.27
5	.5180	2.35
6	.0432	.20

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1885	.5993	1.2562	-.3484	-.8458	.5409
2	.1251	.3977	.9188	-.2340	-.5681	.5961
3	.2466	.7841	1.0006	.4035	.9796	.0410
4	.2643	.8403	1.6016	.0226	.0549	1.5986
5	.2466	.7841	1.0006	.4035	.9796	.0410
6	.2466	.7841	1.0006	.4035	.9796	.0410
7	.1885	.5993	1.2562	-.3484	-.8458	.5409
8	-.4037	-1.2835	.0448	.0734	.1782	.0131
9	-.4037	-1.2835	.0448	.0734	.1782	.0131
10	-.4037	-1.2835	.0448	.0734	.1782	.0131
11	-.4037	-1.2835	.0448	.0734	.1782	.0131
12	.0956	.3040	1.9845	-.2134	-.5181	1.7161
13	.0130	.0413	1.6906	-.3826	-.9288	.8279
CONSTRUCT						
1	.4736	1.5060	.9626	.1246	.3024	.8712
2	-.5078	-1.6146	.1622	.1210	.2936	.0760
3	.1173	.3729	2.1687	-.2362	-.5734	1.8399
4	.2627	.8354	2.0714	.4107	.9971	1.0771
5	.2017	.6412	1.8965	-.2777	-.6742	1.4420
6	-.5078	-1.6146	.1622	.1210	.2936	.0760
7	.3158	1.0040	1.7612	.5080	1.2332	.2404
8	.1920	.6106	2.7041	-.6289	-1.5268	.3729

BUS COMP MOD L HB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.154	1.6923	11.58
2	.462	3.2308	22.11
3	.154	1.6923	11.58
4	.077	.9231	6.32
5	.154	1.6923	11.58
6	.308	2.7692	18.95
7	.154	1.6923	11.58
8	.077	.9231	6.32

TOTAL VARIATION ABOUT CONSTRUCT MEANS 14.6154
BIAS .6617
VARIABILITY .7604

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.538	1.107	7.57
2	-.538	1.107	7.57
3	-.538	.491	3.36
4	.462	1.799	12.31
5	-.538	.491	3.36
6	.462	1.799	12.31
7	-.538	1.107	7.57
8	.462	.876	5.99
9	.462	.876	5.99
10	.462	.876	5.99
11	.462	.876	5.99
12	.462	2.107	14.41
13	-.538	1.107	7.57

UNIT OF EXPECTED DISTANCE 1.5607

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.3626	43.53
2	3.3208	22.72
3	2.0000	13.68
4	2.0000	13.68
5	.9320	6.38

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1954	.4929	.8635	-.2778	-.5063	.6072
2	.1954	.4929	.8635	-.2778	-.5063	.6072
3	-.1330	-.3355	.3786	-.0176	-.0320	.3775
4	.3609	.9102	.9703	.5403	.9846	.0009
5	-.1330	-.3355	.3786	-.0176	-.0320	.3775
6	.3609	.9102	.9703	.5403	.9846	.0009
7	.1954	.4929	.8635	-.2778	-.5063	.6072
8	-.3582	-.9035	.0594	.0859	.1566	.0348
9	-.3582	-.9035	.0594	.0859	.1566	.0348
10	-.3582	-.9035	.0594	.0859	.1566	.0348
11	-.3582	-.9035	.0594	.0859	.1566	.0348
12	.1954	.4929	1.8635	-.2778	-.5063	1.6072
13	.1954	.4929	.8635	-.2778	-.5063	.6072
CONSTRUCT						
1	.1549	.3908	1.5395	-.3049	-.5557	1.2308
2	-.6735	-1.6988	.3448	.1693	.3086	.2495
3	.2861	.7217	1.1714	.5930	1.0806	.0037
4	.0775	.1954	.8849	-.1525	-.2778	.8077
5	.1549	.3908	1.5395	-.3049	-.5557	1.2308
6	-.5680	-1.4328	.7163	.1886	.3438	.5981
7	.2861	.7217	1.1714	.5930	1.0806	.0037
8	.0775	.1954	.8849	-.1525	-.2778	.8077

BUS COMP MOD L MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.385	3.0769	16.95
2	.308	2.7692	15.25
3	.077	.9231	5.08
4	.077	.9231	5.08
5	.308	2.7692	15.25
6	.538	3.2308	17.80
7	.308	2.7692	15.25
8	.154	1.6923	9.32

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.1538

BIAS .5493

VARIABILITY .8697

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.154	.911	5.02
2	-.154	.911	5.02
3	-.154	1.680	9.26
4	.846	2.065	11.38
5	-.154	1.065	5.87
6	-.154	1.065	5.87
7	-.154	1.065	5.87
8	-.154	1.527	8.41
9	-.154	1.527	8.41
10	-.154	1.527	8.41
11	-.154	1.527	8.41
12	.846	2.373	13.07
13	-.154	.911	5.02

UNIT OF EXPECTED DISTANCE 1.7394

THE COMPONENT-SPACE IS LIMITED TO 6 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.9228	49.15
2	4.3575	24.00
3	3.0000	16.53
4	1.7369	9.57
5	.1367	.75

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.2146	.6411	.5003	-.1129	-.2356	.4448
2	.2146	.6411	.5003	-.1129	-.2356	.4448
3	.0886	.2647	1.6104	-.5688	-1.1874	.2004
4	.1754	.5239	1.7906	-.4647	-.9700	.8497
5	.1996	.5964	.7094	.3062	.6391	.3010
6	.1996	.5964	.7094	.3062	.6391	.3010
7	.1996	.5964	.7094	.3062	.6391	.3010
8	-.4131	-1.2339	.0042	.0200	.0418	.0025
9	-.4131	-1.2339	.0042	.0200	.0418	.0025
10	-.4131	-1.2339	.0042	.0200	.0418	.0025
11	-.4131	-1.2339	.0042	.0200	.0418	.0025
12	.1455	.4345	2.1840	.3734	.7795	1.5764
13	.2146	.6411	.5003	-.1129	-.2356	.4448
CONSTRUCT						
1	.3039	.9078	2.2528	-.6573	-1.3721	.3700
2	-.5531	-1.6522	.0393	.0384	.0802	.0329
3	.0487	.1455	.9019	.1789	.3734	.7625
4	.0487	.1455	.9019	.1789	.3734	.7625
5	.2592	.7743	2.1696	.2174	.4538	1.9637
6	.4647	1.3882	1.3036	.4567	.9533	.3947
7	-.5531	-1.6522	.0393	.0384	.0802	.0329
8	.0884	.2640	1.6226	-.4951	-1.0335	.5544

BUS COMP MOD L MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	14.89
2	.308	2.7692	12.77
3	.538	3.2308	14.89
4	.077	.9231	4.26
5	.231	2.3077	10.64
6	.462	3.2308	14.89
7	.462	3.2308	14.89
8	.308	2.7692	12.77

TOTAL VARIATION ABOUT CONSTRUCT MEANS 21.6923
BIAS .4070
VARIABILITY .9507

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.077	1.793	8.27
2	.077	1.793	8.27
3	-.923	1.254	5.78
4	.077	1.178	5.43
5	.077	1.178	5.43
6	.077	1.178	5.43
7	-1.923	1.793	8.27
8	-.923	2.024	9.33
9	-.923	2.024	9.33
10	2.077	2.101	9.68
11	2.077	2.101	9.68
12	.077	2.101	9.68
13	.077	1.178	5.43

UNIT OF EXPECTED DISTANCE 1.9014

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.9493	36.65
2	6.2631	28.87
3	4.0191	18.53
4	1.9365	8.93
5	.9575	4.41
6	.4846	2.23
7	.0821	.38

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.2807	.7913	1.1668	-.3635	-.9097	.3393
2	.2807	.7913	1.1668	-.3635	-.9097	.3393
3	.2004	.5651	.9351	.1150	.2878	.8523
4	.1890	.5329	.8936	.3510	.8785	.1218
5	.1890	.5329	.8936	.3510	.8785	.1218
6	.1858	.5237	.9032	.0515	.1290	.8866
7	.1023	.2884	1.7098	-.3940	-.9859	.7377
8	-.3866	-1.0900	.8356	-.2362	-.5911	.4862
9	-.3866	-1.0900	.8356	-.2362	-.5911	.4862
10	-.4191	-1.1815	.7046	.2030	.5080	.4466
11	-.4191	-1.1815	.7046	.2030	.5080	.4466
12	-.0055	-.0154	2.1004	-.0323	-.0808	2.0938
13	.1890	.5329	.8936	.3510	.8785	.1218
CONSTRUCT						
1	.5372	1.5145	.9371	.1968	.4926	.6944
2	-.5715	-1.6113	.1729	-.0265	-.0664	.1685
3	-.0322	-.0908	3.2225	.5907	1.4783	1.0371
4	-.0019	-.0055	.9230	-.0129	-.0323	.9220
5	.2354	.6636	1.8674	-.4479	-1.1209	.6109
6	-.0251	-.0707	3.2258	.6290	1.5741	.7481
7	-.0342	-.0965	3.2215	-.1206	-.3017	3.1304
8	-.5715	-1.6113	.1729	-.0265	-.0664	.1685

BUS COMP MOD L LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.385	3.0769	15.27
2	.308	2.7692	13.74
3	.462	3.2308	16.03
4	.077	.9231	4.58
5	.231	2.3077	11.45
6	.308	2.7692	13.74
7	.308	2.7692	13.74
8	.231	2.3077	11.45

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.1538

BIAS .4742

VARIABILITY .9164

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.692	1.450	7.19
2	1.692	1.988	9.86
3	.692	1.450	7.19
4	-1.308	.988	4.90
5	-.308	1.373	6.81
6	.692	1.604	7.96
7	-.308	1.373	6.81
8	-.308	1.527	7.57
9	-.308	1.527	7.57
10	-.308	1.527	7.57
11	-.308	1.527	7.57
12	-.308	2.142	10.63
13	-.308	1.680	8.34

UNIT OF EXPECTED DISTANCE 1.8328

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.8785	49.02
2	4.5875	22.76
3	3.2187	15.97
4	1.4429	7.16
5	.5651	2.80
6	.4108	2.04
7	.0504	.25

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3052	.9592	.5297	-.0836	-.1790	.4977
2	.3427	1.0771	.8280	-.3306	-.7081	.3266
3	.3052	.9592	.5297	-.0836	-.1790	.4977
4	.0544	.1711	.9589	-.0418	-.0896	.9509
5	.1252	.3935	1.2179	.4346	.9309	.3514
6	.2528	.7945	.9724	.4054	.8682	.2185
7	.1252	.3935	1.2179	.4346	.9309	.3514
8	-.3847	-1.2091	.0648	.0169	.0362	.0635
9	-.3847	-1.2091	.0648	.0169	.0362	.0635
10	-.3847	-1.2091	.0648	.0169	.0362	.0635
11	-.3847	-1.2091	.0648	.0169	.0362	.0635
12	-.0396	-.1245	2.1265	-.3320	-.7110	1.6210
13	.0677	.2128	1.6352	-.4707	-1.0081	.6188
CONSTRUCT						
1	.4010	1.2602	1.4887	.0626	.1342	1.4707
2	-.4896	-1.5387	.4015	.0316	.0676	.3969
3	.4633	1.4562	1.1102	.3627	.7769	.5066
4	-.0126	-.0396	.9215	.1550	-.3320	.8113
5	.1180	.3708	2.1702	.5291	-1.1332	.8860
6	.3248	1.0208	1.7273	-.4571	-.9684	.7894
7	-.4896	-1.5387	.4015	.0316	.0676	.3969
8	.1601	.5032	2.0545	.5951	1.2746	.4299

BUS COMP MOD L LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	21.21
2	.154	1.6923	11.11
3	.154	1.6923	11.11
4	.077	.9231	6.06
5	.154	1.6923	11.11
6	.308	2.7692	18.18
7	.538	3.2308	21.21

TOTAL VARIATION ABOUT CONSTRUCT MEANS 15.2308

BIAS .5749

VARIABILITY .8516

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.154	1.290	8.47
2	-.846	.751	4.93
3	-1.846	.675	4.43
4	.154	.675	4.43
5	.154	.675	4.43
6	.154	.675	4.43
7	.154	.675	4.43
8	.154	1.751	11.50
9	.154	1.751	11.50
10	.154	1.751	11.50
11	.154	1.751	11.50
12	.154	1.444	9.48
13	1.154	1.367	8.97

UNIT OF EXPECTED DISTANCE 1.5933

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.2480	54.15
2	2.2260	14.62
3	2.0000	13.13
4	1.5069	9.89
5	.9765	6.41
6	.2733	1.79

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.1416	-.4067	1.1246	.6249	.9323	.2554
2	-.0654	-.1879	.7162	-.4174	-.6228	.3283
3	.1050	.3015	.5837	.0546	.0815	.5770
4	-.2570	-.7381	.1298	-.1966	-.2933	.0438
5	-.2570	-.7381	.1298	-.1966	-.2933	.0438
6	-.2570	-.7381	.1298	-.1966	-.2933	.0438
7	-.2570	-.7381	.1298	-.1966	-.2933	.0438
8	.3852	1.1061	.5279	-.0322	-.0481	.5256
9	.3852	1.1061	.5279	-.0322	-.0481	.5256
10	.3852	1.1061	.5279	-.0322	-.0481	.5256
11	.3852	1.1061	.5279	-.0322	-.0481	.5256
12	-.0986	-.2830	1.3637	.5002	.7464	.8066
13	-.3120	-.8960	.5640	.1528	.2280	.5120
CONSTRUCT						
1	-.4894	-1.4054	1.2555	-.7043	-1.0509	.1512
2	.2682	.7703	1.0989	-.0432	-.0644	1.0948
3	.2682	.7703	1.0989	-.0432	-.0644	1.0948
4	-.0343	-.0986	.9134	.3353	.5002	.6631
5	-.1579	-.4536	1.4866	.5212	.7777	.8818
6	.5364	1.5406	.3957	-.0864	-.1289	.3791
7	-.5502	-1.5802	.7338	.3296	.4917	.4920

SCI COMP MOD L HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.385	3.0769	16.95
2	.077	.9231	5.08
3	.462	3.2308	17.80
4	.154	1.6923	9.32
5	.308	2.7692	15.25
6	.538	3.2308	17.80
7	.538	3.2308	17.80

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.1538

BIAS .4495

VARIABILITY .9298

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.538	1.988	10.95
2	.538	1.604	8.83
3	.538	1.604	8.83
4	.538	1.757	9.68
5	-.462	1.219	6.71
6	-.462	1.065	5.87
7	.538	1.604	8.83
8	-.462	1.065	5.87
9	-.462	1.065	5.87
10	-.462	1.065	5.87
11	-.462	1.065	5.87
12	-.462	1.680	9.26
13	-.462	1.373	7.56

UNIT OF EXPECTED DISTANCE 1.7394

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	11.3721	62.64
2	2.6059	14.35
3	2.0000	11.02
4	1.2677	6.98
5	.6022	3.32
6	.3060	1.69

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.1224	-.4126	1.8179	-.7355	-1.1873	.4081
2	-.3636	-1.2260	.1005	.0246	.0397	.0989
3	-.3636	-1.2260	.1005	.0246	.0397	.0989
4	.0334	.1127	1.7447	.5708	.9214	.8958
5	-.2470	-.8328	.5253	-.1297	-.2094	.4815
6	.2960	.9981	.0688	-.0307	-.0495	.0664
7	-.3636	-1.2260	.1005	.0246	.0397	.0989
8	.2960	.9981	.0688	-.0307	-.0495	.0664
9	.2960	.9981	.0688	-.0307	-.0495	.0664
10	.2960	.9981	.0688	-.0307	-.0495	.0664
11	.2960	.9981	.0688	-.0307	-.0495	.0664
12	.1818	.6132	1.3045	.0457	.0738	1.2990
13	-.2352	-.7931	.7438	.3283	.5300	.4630
CONSTRUCT						
1	-.4329	-1.4600	.9453	-.4903	-.7915	.3189
2	-.0363	-.1224	.9081	-.4556	-.7355	.3671
3	.4488	1.5133	.9406	.2586	.4174	.7664
4	.0638	.2153	1.6460	.3819	.6165	1.2659
5	-.3932	-1.3258	1.0114	.2491	.4021	.8497
6	-.4928	-1.6617	.4694	.0667	.1076	.4578
7	.4565	1.5394	.8611	-.5223	-.8432	.1501

SCI COMP MOD L HB2

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.538	3.2308	16.54
2	.385	3.0769	15.75
3	.077	.9231	4.72
4	.615	3.0769	15.75
5	.154	1.6923	8.66
6	.385	3.0769	15.75
7	.308	2.7692	14.17
8	.154	1.6923	8.66

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.5385
BIAS .4985
VARIABILITY .9023

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.385	2.189	11.21
2	-.615	.805	4.12
3	.385	1.036	5.30
4	-.615	1.728	8.84
5	.385	1.497	7.66
6	-.615	1.112	5.69
7	.385	1.959	10.02
8	.385	1.497	7.66
9	.385	1.497	7.66
10	.385	1.497	7.66
11	.385	1.497	7.66
12	-.615	2.189	11.21
13	-1.615	1.036	5.30

UNIT OF EXPECTED DISTANCE 1.8046

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.2725	47.46
2	4.1878	21.43
3	2.7493	14.07
4	1.8814	9.63
5	.8274	4.23
6	.2994	1.53
7	.1911	.98
8	.1294	.66

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2230	-.6791	1.7281	-.4318	-.8836	.9474
2	-.0714	-.2174	.7575	.3028	.6197	.3735
3	-.1762	-.5365	.7477	.0041	.0083	.7476
4	-.2396	-.7296	1.1955	.4007	.8199	.5232
5	-.1090	-.3319	1.3869	.5235	1.0713	.2393
6	-.0261	-.0794	1.1061	-.1602	-.3278	.9987
7	-.3708	-1.1293	.6834	-.2915	-.5964	.3276
8	.3984	1.2133	.0251	-.0390	-.0797	.0187
9	.3984	1.2133	.0251	-.0390	-.0797	.0187
10	.3984	1.2133	.0251	-.0390	-.0797	.0187
11	.3984	1.2133	.0251	-.0390	-.0797	.0187
12	-.1756	-.5348	1.9034	-.3718	-.7608	1.3246
13	-.2020	-.6151	.6571	.1800	.3683	.5215
CONSTRUCT						
1	-.4571	-1.3920	1.2930	.3361	.6878	.8199
2	.4501	1.3707	1.1981	-.2871	-.5876	.8528
3	-.0577	-.1756	.8922	-.1817	-.3718	.7540
4	.3977	1.2111	1.6102	.2513	.5143	1.3457
5	-.1950	-.5939	1.3396	-.3534	-.7232	.8166
6	-.3191	-.9717	2.1326	-.6114	-1.2511	.5674
7	.5234	1.5937	.2293	-.0762	-.1559	.2050
8	-.1145	-.3486	1.5708	.4516	.9242	.7167

SCI COMP MOD L MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.462	3.2308	15.56
2	.462	3.2308	15.56
3	.154	1.6923	8.15
4	.385	3.0769	14.81
5	.077	.9231	4.44
6	.692	2.7692	13.33
7	.308	2.7692	13.33
8	.385	3.0769	14.81

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.7692
BIAS .4485
VARIABILITY .9303

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.077	1.325	6.38
2	2.077	2.172	10.46
3	-.923	1.018	4.90
4	.077	1.249	6.01
5	1.077	1.325	6.38
6	.077	1.249	6.01
7	-.923	1.172	5.64
8	-.923	1.787	8.60
9	-.923	1.787	8.60
10	-.923	1.787	8.60
11	-.923	1.787	8.60
12	1.077	2.249	10.83
13	.077	1.864	8.97

UNIT OF EXPECTED DISTANCE 1.8605

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.9509	52.73
2	3.3795	16.27
3	2.9903	14.40
4	1.4755	7.10
5	1.2967	6.24
6	.5199	2.50
7	.1565	.75

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.0894	-.2957	1.2380	-.0679	-.1249	1.2224
2	-.3611	-1.1951	.7433	-.1432	-.2633	.6740
3	-.1225	-.4052	.8535	.1968	.3618	.7226
4	-.2206	-.7301	.7155	-.1546	-.2842	.6347
5	-.0833	-.2755	1.2495	.5167	.9499	.3473
6	-.2145	-.7099	.7445	.4301	.7906	.1195
7	-.1149	-.3801	1.0271	.1999	.3675	.8921
8	.4025	1.3320	.0126	-.0390	-.0717	.0075
9	.4025	1.3320	.0126	-.0390	-.0717	.0075
10	.4025	1.3320	.0126	-.0390	-.0717	.0075
11	.4025	1.3320	.0126	-.0390	-.0717	.0075
12	-.2344	-.7758	1.6466	-.2152	-.3955	1.4902
13	-.1694	-.5606	1.5496	-.6066	-1.1152	.3060
CONSTRUCT						
1	-.3298	-1.0914	2.0397	.4231	.7778	1.4347
2	.4344	1.4375	1.1644	.1593	.2928	1.0787
3	-.1603	-.5306	1.4108	-.4079	-.7498	.8466
4	-.3047	-1.0082	2.0604	.4288	.7883	1.4390
5	-.0708	-.2344	.8681	-.1170	-.2152	.8218
6	-.4866	-1.6101	.1768	.0848	.1559	.1525
7	.4866	1.6101	.1768	-.0848	-.1559	.1525
8	-.3248	-1.0750	1.9213	-.6460	-1.1875	.5111

SCI COMP MOD L MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.615	3.0769	14.60
2	.077	.9231	4.38
3	.615	3.0769	14.60
4	.154	1.6923	8.03
5	.385	3.0769	14.60
6	.538	3.2308	15.33
7	.538	3.2308	15.33
8	.308	2.7692	13.14

TOTAL VARIATION ABOUT CONSTRUCT MEANS 21.0769
BIAS .4351
VARIABILITY 9371

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.769	1.456	6.91
2	-1.231	1.763	8.37
3	.769	.994	4.72
4	-1.231	1.302	6.18
5	.769	1.456	6.91
6	.769	1.456	6.91
7	1.769	2.302	10.92
8	-.231	1.533	7.27
9	-.231	1.533	7.27
10	-.231	1.533	7.27
11	-.231	1.533	7.27
12	-.231	1.994	9.46
13	-1.231	2.225	10.56

UNIT OF EXPECTED DISTANCE 1.8743

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.2384	48.58
2	4.5666	21.67
3	3.0823	14.62
4	1.4347	6.81
5	.8752	4.15
6	.5232	2.48
7	.3373	1.60
8	.0193	.09

	COMPONENT 1			COMPONENT 2			COMPONENT 3		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3147	1.0070	.4417	-.2510	-.5364	.1539	-.0713	-.1251	.1383
2	.2506	.8019	1.1203	.0145	.0310	1.1193	.4913	.8625	.3754
3	.0414	.1325	.9765	-.0151	-.0323	.9755	-.3602	-.6324	.5756
4	-.0718	-.2296	1.2490	.3806	.8134	.5874	-.3277	-.5753	.2565
5	.3147	1.0070	.4417	-.2510	-.5364	.1539	-.0713	-.1251	.1363
6	.2278	.7290	.9242	.1811	.3870	.7744	-.2303	-.4044	.6109
7	.3488	1.1160	1.0564	-.3214	-.6868	.5848	-.1055	-.1852	.5504
8	-.3679	-1.1773	.1466	-.1713	-.3662	.0126	.0552	.0970	.0032
9	-.3679	-1.1773	.1466	-.1713	-.3662	.0126	.0552	.0970	.0032
10	-.3679	-1.1773	.1466	-.1713	-.3662	.0126	.0552	.0970	.0032
11	-.3679	-1.1773	.1466	-.1713	-.3662	.0126	.0552	.0970	.0032
12	-.0673	-.2154	1.9477	.5881	1.2568	.3680	-.1803	-.3166	.2678
13	.1128	.3609	2.0946	.3595	.7683	1.5044	.6344	1.1138	.2639
CONSTRUCT									
1	-.1413	-.4521	2.8725	-.7131	-1.5239	.5502	-.2206	-.3873	.4002
2	.1090	.3488	.8014	-.1504	-.3214	.6982	-.0601	-.1055	.6870
3	-.4193	-1.3416	1.2771	.2103	.4494	1.0752	-.4999	-.8776	.3050
4	.0142	.0454	1.6902	.4435	.9477	.7922	.2586	.4541	.5860
5	.4552	1.4566	.9552	-.2938	-.6278	.5611	.0073	.0129	.5610
6	.5034	1.6108	.6361	-.1326	-.2834	.5558	.1635	.2871	.4734
7	.3464	1.1083	2.0025	.1457	.3114	1.9055	-.7670	-1.3466	.0922
8	-.4599	-1.4717	.6034	-.3207	-.6854	.1336	.1258	.2209	.0848

SCI COMP MOD L LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.385	3.0769	16.13
2	.385	3.0769	16.13
3	.231	2.3077	12.10
4	.462	3.2308	16.94
5	.231	2.3077	12.10
6	.308	2.7692	14.52
7	.769	2.3077	12.10

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.0769
BIAS .4018
VARIABILITY .9531

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.769	1.917	10.05
2	-2.769	1.302	6.82
3	1.231	1.917	10.05
4	-.769	1.763	9.24
5	-.769	.994	5.21
6	-.769	.840	4.40
7	.231	1.533	8.03
8	.231	1.071	5.61
9	.231	1.071	5.61
10	.231	1.071	5.61
11	.231	1.071	5.61
12	2.231	2.456	12.87
13	1.231	2.071	10.86

UNIT OF EXPECTED DISTANCE 1.7831

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	10.1246	53.07
2	4.2153	22.10
3	2.0108	10.54
4	1.3268	6.96
5	.7179	3.76
6	.4529	2.37
7	.2285	1.20

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.2511	-.7991	1.2786	.4804	.9862	.3059
2	.0076	.0242	1.3012	.3318	.6813	.8370
3	-.3452	-1.0984	.7107	.0277	.0568	.7075
4	.0538	.1713	1.7340	.5782	1.1871	.3248
5	.1644	.5232	.7203	-.1504	-.3088	.6250
6	.1703	.5420	.5465	.0294	.0604	.5429
7	-.2367	-.7532	.9652	-.2594	-.5325	.6816
8	.3084	.9814	.1079	-.1230	-.2526	.0441
9	.3084	.9814	.1079	-.1230	-.2526	.0441
10	.3084	.9814	.1079	-.1230	-.2526	.0441
11	.3084	.9814	.1079	-.1230	-.2526	.0441
12	-.4473	-1.4232	.4301	-.1633	-.3353	.3177
13	-.3495	-1.1121	.8341	-.3822	-.7848	.2183
CONSTRUCT						
1	-.5122	-1.6299	.4204	-.1446	-.2969	.3323
2	.4394	1.3981	1.1222	-.3130	-.6425	.7094
3	-.3589	-1.1420	1.0035	-.2522	-.5179	.7353
4	.4582	1.4578	1.1055	.0562	.1155	1.0921
5	-.3248	-1.0335	1.2395	-.3920	-.8049	.5916
6	-.3111	-.9898	1.7895	.4495	.9229	.9378
7	.0596	.1897	2.2717	-.6772	-1.3904	.3385

SCI COMP MOD L LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.385	3.0769	15.63
2	.077	.9231	4.69
3	.385	3.0769	15.63
4	.231	2.3077	11.72
5	.231	2.3077	11.72
6	.385	3.0769	15.63
7	.462	3.2308	16.41
8	.154	1.6923	8.59

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.6923
BIAS .4925
VARIABILITY .9058

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.308	1.254	6.37
2	.692	1.793	9.10
3	-.308	1.254	6.37
4	-.308	1.716	8.71
5	-.308	1.716	8.71
6	-.308	1.254	6.37
7	.692	1.793	9.10
8	-.308	1.716	8.71
9	.692	1.639	8.32
10	-.308	1.408	7.15
11	-.308	1.408	7.15
12	-.308	1.101	5.59
13	.692	1.639	8.32

UNIT OF EXPECTED DISTANCE 1.8116

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.0464	45.94
2	5.2654	26.74
3	2.0246	10.28
4	1.5309	7.77
5	1.1530	5.86
6	.5283	2.68
7	.1437	.73

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3177	-.9557	.3411	.0309	.0708	.3361
2	-.4258	-1.2806	.1530	-.0590	-.1354	.1347
3	-.0380	-.1143	1.2414	.3550	.8146	.5778
4	.1676	.5042	1.4618	.4809	1.1036	.2439
5	.1676	.5042	1.4618	.4809	1.1036	.2439
6	-.3177	-.9557	.3411	.0309	.0708	.3361
7	-.4258	-1.2806	.1530	-.0590	-.1354	.1347
8	.1806	.5432	1.4210	-.2310	-.5301	1.1399
9	.3586	1.0785	.4759	-.0804	-.1845	.4419
10	.2571	.7733	.8103	-.3264	-.7490	.2493
11	.2571	.7733	.8103	-.3264	-.7490	.2493
12	.2621	.7883	.4792	.0588	.1350	.4610
13	-.1257	-.3780	1.4962	-.3551	-.8149	.8321
CONSTRUCT						
1	-.5362	-1.6127	.4761	-.1793	-.4114	.3069
2	.0600	.1806	.8905	-.1007	-.2310	.8371
3	.3052	.9179	2.2344	.5645	1.2953	.5567
4	.2902	.8728	1.5460	-.3196	-.7333	1.0083
5	-.3249	-.9772	1.3528	-.2062	-.4731	1.1289
6	-.5070	-1.5250	.7512	.1302	.2988	.6619
7	.3956	1.1898	1.8152	-.5494	-1.2606	.2261
8	.1115	.3353	1.5799	.4192	.9619	.6547

BUS HELI MOD L HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.333	3.3333	18.25
2	.267	2.9333	16.06
3	.200	2.4000	13.14
4	.067	.9333	5.11
5	.200	2.4000	13.14
6	.933	.9333	5.11
7	.400	3.6000	19.71
8	.133	1.7333	9.49

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.2667

BIAS .6254

VARIABILITY .8077

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.467	1.382	7.57
2	1.467	1.716	9.39
3	1.467	1.716	9.39
4	-.533	.916	5.01
5	.467	.982	5.38
6	-1.533	1.782	9.76
7	-1.533	.449	2.46
8	-1.533	.449	2.46
9	.467	1.249	6.84
10	-.533	.782	4.28
11	1.467	1.982	10.85
12	-.533	1.316	7.20
13	-.533	.782	4.28
14	-.533	.649	3.55
15	1.467	2.116	11.58

UNIT OF EXPECTED DISTANCE 1.6154

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.7530	31.49
2	4.6880	25.66
3	3.0838	16.88
4	2.1208	11.61
5	1.2269	6.72
6	.6027	3.30
7	.4573	2.50
8	.3342	1.83

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.1175	-.2819	1.3028	.2523	.5462	1.0044
2	.4950	1.1872	.3062	-.0746	-.1615	.2801
3	.4950	1.1872	.3062	-.0746	-.1615	.2801
4	.1923	.4612	.7029	.2086	.4517	.4988
5	-.1181	-.2833	.9019	-.0749	-.1622	.8756
6	.2327	.5582	1.4706	.2652	.5742	1.1409
7	-.0537	-.1287	.4323	.1394	.3018	.3412
8	-.0537	-.1287	.4323	.1394	.3018	.3412
9	-.0010	-.0024	1.2489	-.4331	-.9376	.3697
10	-.2692	-.6456	.3654	.2303	.4986	.1168
11	-.0992	-.2380	1.9256	-.6079	-1.3162	.1932
12	-.0650	-.1558	1.2913	.1772	.3836	1.1441
13	-.2692	-.6456	.3654	.2303	.4986	.1168
14	.0974	.2335	.5943	-.1658	-.3591	.4654
15	-.4658	-1.1171	.8676	-.2118	-.4585	.6573
CONSTRUCT						
1	-.5169	-1.2397	1.7964	.1968	.4262	1.6147
2	.5899	1.4149	.9313	.1500	.3247	.8259
3	-.2360	-.5660	2.0796	-.5786	-1.2527	.5103
4	-.0271	-.0650	.9291	.0818	.1772	.8977
5	.3637	.8724	1.6389	.0476	.1031	1.6283
6	-.0970	-.2327	.8792	-.1225	-.2652	.8088
7	.3623	.8689	2.8450	-.6609	-1.4309	.7975
8	-.2356	-.5650	1.4141	-.3786	-.8197	.7423

BUS HELI MOD L HB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.667	3.3333	13.02
2	.267	2.9333	11.46
3	.267	2.9333	11.46
4	.333	3.3333	13.02
5	.200	2.4000	9.38
6	.600	3.6000	14.06
7	.533	3.7333	14.58
8	.333	3.3333	13.02

TOTAL VARIATION ABOUT CONSTRUCT MEANS 25.6000

BIAS .3830

VARIABILITY .9562

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	-.200	2.093	8.18
2	-.200	2.493	9.74
3	.800	2.560	10.00
4	-.200	1.427	5.57
5	-1.200	.960	3.75
6	-.200	1.427	5.57
7	-.200	2.093	8.18
8	-.200	1.693	6.61
9	-.200	2.227	8.70
10	-.200	1.427	5.57
11	.800	2.027	7.92
12	.800	1.227	4.79
13	.800	1.227	4.79
14	-.200	1.293	5.05
15	-.200	1.427	5.57

UNIT OF EXPECTED DISTANCE 1.9124

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.4952	37.09
2	5.2510	20.51
3	4.7645	18.61
4	3.5761	13.97
5	1.0452	4.08
6	.7333	2.86
7	.5976	2.33
8	.1371	.54

	COMPONENT 1			COMPONENT 2			COMPONENT 3		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.3536	-1.0896	.9061	-.2557	-.5860	.5627	.0492	.1074	.5511
2	-.0624	-.1923	2.4564	-.4862	-1.1141	1.2151	.0349	.0762	1.2093
3	-.4486	-1.3824	.6490	-.2872	-.6582	.2158	.0317	.0693	.2110
4	-.1955	-.6026	1.0636	.3040	.6966	.5783	-.0750	-.1637	.5515
5	-.1005	-.3098	.8640	.3355	.7688	.2729	-.0575	-.1255	.2572
6	-.1955	-.6026	1.0636	.3040	.6966	.5783	-.0750	-.1637	.5515
7	.0100	.0309	2.0924	.1519	.3480	1.9713	.6110	1.3337	.1924
8	.2856	.8799	.9190	.0590	.1352	.9008	.3480	.7595	.3239
9	.3866	1.1912	.8077	-.3065	-.7024	.3143	.1069	.2332	.2599
10	.1586	.4888	1.1877	-.1869	-.4283	1.0043	-.4183	-.9131	.1705
11	.4312	1.3288	.2611	.0247	.0566	.2579	.1678	.3663	.1237
12	.2033	.6264	.8343	.1443	.3307	.7250	-.3574	-.7801	.1165
13	.2033	.6264	.8343	.1443	.3307	.7250	-.3574	-.7801	.1165
14	-.2179	-.6715	.8424	.2715	.6221	.4554	.0858	.1874	.4203
15	-.1044	-.3217	1.3232	-.2166	-.4964	1.0767	-.0948	-.2069	1.0339
CONSTRUCT									
1	-.3411	-1.0510	2.2287	.2431	.5571	1.9183	-.5812	-1.2686	.3090
2	-.2928	-.9021	2.1195	-.0722	-.1654	2.0922	-.0382	-.0833	2.0852
3	.3613	1.1134	1.6937	-.0310	-.0709	1.6887	.5652	1.2337	.1668
4	.4488	1.3830	1.4207	-.0786	-.1801	1.3883	-.3933	-.8584	.6514
5	-.2806	-.8646	1.6524	-.4491	-1.0292	.5933	.0531	.1159	.5799
6	.1375	.4238	3.4204	.7590	1.7392	.3956	.1330	.2904	.3113
7	.4874	1.5018	1.4781	-.3595	-.8239	.7993	-.2613	-.5703	.4740
8	-.3617	-1.1145	2.0912	-.1467	-.3363	1.9781	.3129	.6830	1.5116

BUS HELI MOD L MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.533	3.7333	18.67
2	.133	1.7333	8.67
3	.133	1.7333	8.67
4	.133	1.7333	8.67
5	.200	2.4000	12.00
6	.333	3.3333	16.67
7	.200	2.4000	12.00
8	.267	2.9333	14.67

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.0000

BIAS .5774

VARIABILITY .8452

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.067	1.467	7.33
2	1.067	2.400	12.00
3	.067	1.000	5.00
4	-.933	1.200	6.00
5	.067	.867	4.33
6	.067	1.933	9.67
7	.067	1.933	9.67
8	.067	1.933	9.67
9	-.933	.533	2.67
10	1.067	2.000	10.00
11	-.933	.533	2.67
12	-.933	.533	2.67
13	.067	1.000	5.00
14	.067	1.667	8.33
15	.067	1.000	5.00

UNIT OF EXPECTED DISTANCE 1.6903

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.5795	32.90
2	5.4767	27.38
3	2.9759	14.88
4	2.2689	11.34
5	1.4771	7.39
6	.9392	4.70
7	.1992	1.00
8	.0833	42

	COMPONENT 1			COMPONENT 2			COMPONENT 3		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.1542	-.3954	1.3103	-.3022	-.7072	.8101	-.1947	-.3359	.6973
2	.3020	.7747	1.7998	-.4433	-1.0375	.7234	.3892	.6714	.2727
3	-.3092	-.7932	.3708	.1535	.3591	.2418	-.0174	-.0301	.2409
4	.0793	.2033	1.1587	-.0699	-.1636	1.1319	-.3922	-.6765	.6742
5	-.1363	-.3496	.7445	-.1696	-.3969	.5870	.2087	.3600	.4574
6	.3777	.9688	.9947	.1721	.4028	.8325	.1220	.2105	.7882
7	.3942	1.0112	.9108	.3491	.8171	.2433	-.1517	-.2618	.1747
8	.3942	1.0112	.9108	.3491	.8171	.2433	-.1518	-.2618	.1747
9	-.1617	-.4149	.3612	.1341	.3137	.2628	.2063	.3559	.1361
10	-.0428	-.1097	1.9880	-.3542	-.8288	1.3010	-.6136	-1.0584	.1807
11	-.1617	-.4149	.3612	.1341	.3137	.2628	.2063	.3559	.1361
12	-.1617	-.4149	.3612	.1341	.3137	.2628	.2063	.3559	.1361
13	-.3092	-.7932	.3708	.1535	.3591	.2418	-.0174	-.0301	.2409
14	.1987	.5097	1.4068	-.3938	-.9216	.5575	.2174	.3751	.4168
15	-.3092	-.7932	.3708	.1535	.3591	.2418	-.0174	-.0301	.2409
CONSTRUCT									
1	-.6641	-1.7034	.8318	.1670	.3908	.6791	.3366	.5806	.3420
2	.2650	.6797	1.2713	-.1159	-.2712	1.1978	.2963	.5112	.9364
3	.3074	.7884	1.1117	.2984	.6983	.6241	-.1759	-.3035	.5320
4	.1952	.5008	1.4826	-.3577	-.8371	.7818	.3516	.6066	.4138
5	-.0459	-.1177	2.3862	-.3103	-.7263	1.8587	-.6959	-1.2004	.4177
6	.0653	.1676	3.3053	-.7106	-1.6631	.5394	.0041	.0070	.5394
7	.4546	1.1661	1.0402	.3719	.8704	.2826	-.1052	-.1815	.2497
8	-.3784	-.9705	1.9915	.0454	.1062	1.9802	-.3860	-.6659	1.5368

BUS HELI MOD L MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.400	3.6000	17.31
2	.200	2.4000	11.54
3	.267	2.9333	14.10
4	.267	2.9333	14.10
5	.200	2.4000	11.54
6	.733	2.9333	14.10
7	.400	3.6000	17.31

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.8000
BIAS .4557
VARIABILITY .9214

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.533	1.413	6.79
2	-.467	1.213	5.83
3	-.467	1.080	5.19
4	.533	1.413	6.79
5	-.467	1.480	7.12
6	1.533	1.613	7.76
7	-.467	.813	3.91
8	-.467	1.080	5.19
9	.533	2.213	10.64
10	-.467	1.213	5.83
11	-.467	1.080	5.19
12	-.467	1.747	8.40
13	-.467	.813	3.91
14	-.467	1.747	8.40
15	1.533	1.880	9.04

UNIT OF EXPECTED DISTANCE 1.7238

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	8.4371	40.56
2	5.1623	24.82
3	3.2993	15.86
4	2.1327	10.25
5	.9351	4.50
6	.5117	2.46
7	.3219	1.55

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.2439	.7083	.9116	.1248	.2835	.8312
2	.1830	.5316	.9307	-.0233	-.0529	.9279
3	.0912	.2650	1.0098	-.4227	-.9603	.0876
4	.2994	.8697	.6570	.2412	.5481	.3565
5	-.1309	-.3802	1.3355	.3561	.8091	.6808
6	.1115	.3238	1.5085	.4005	.9100	.6804
7	.2290	.6652	.3708	.1214	.2759	.2947
8	.0912	.2650	1.0098	-.4227	-.9603	.0876
9	-.4543	-1.3196	.4721	-.1753	-.3983	.3135
10	.1275	.3703	1.0762	-.1397	-.3175	.9754
11	.0912	.2650	1.0098	-.4227	-.9603	.0876
12	-.4329	-1.2574	.1657	.1043	.2370	.1095
13	.2290	.6652	.3708	.1214	.2759	.2947
14	-.4329	-1.2574	.1657	.1043	.2370	.1095
15	-.2461	-.7147	1.3692	.0322	.0731	1.3638
CONSTRUCT						
1	.3381	.9819	2.6358	.6010	1.3655	.7712
2	.2045	.5939	2.0472	.2722	.6185	1.6647
3	-.0622	-.1806	2.9007	-.6352	-1.4433	.8177
4	-.5392	-1.5661	.4806	.0288	.0655	.4763
5	.0431	.1253	2.3843	.0076	.0172	2.3840
6	.4995	1.4509	.8281	-.1714	-.3894	.6765
7	-.5459	-1.5855	1.0862	.3618	.8221	.4103

BUS HELI MOD L LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.667	3.3333	16.23
2	.267	2.9333	14.29
3	.133	1.7333	8.44
4	.667	3.3333	16.23
5	.200	2.4000	11.69
6	.667	3.3333	16.23
7	.133	1.7333	8.44
8	.133	1.7333	8.44

TOTAL VARIATION ABOUT CONSTRUCT MEANS 20.5333

BIAS .5617

VARIABILITY .8563

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.133	2.498	12.16
2	-.867	1.764	8.59
3	-.867	1.631	7.94
4	-.867	2.698	13.14
5	.133	1.298	6.32
6	1.133	2.031	9.89
7	-.867	.831	4.05
8	-.867	.831	4.05
9	.133	.498	2.42
10	1.133	1.231	6.00
11	.133	1.564	7.62
12	.133	.498	2.42
13	.133	.498	2.42
14	.133	.498	2.42
15	1.133	2.164	10.54

UNIT OF EXPECTED DISTANCE 1.7127

THE COMPONENT SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.3812	31.08
2	5.4398	26.49
3	3.7941	18.48
4	2.1376	10.41
5	1.5747	7.67
6	.5611	2.73
7	.3789	1.85
8	.2660	1.30

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3323	.8393	1.7933	.5351	1.2481	.2356
2	.2847	.7191	1.2473	.4076	.9507	.3436
3	.1954	.4935	1.3876	-.3423	-.7984	.7501
4	.5439	1.3739	.8102	-.3429	-.7997	.1708
5	-.0126	-.0319	1.2968	-.4092	-.9543	.3861
6	.2674	.6754	1.5749	-.1991	-.4644	1.3592
7	-.0289	-.0730	.8258	.1060	.2473	.7646
8	-.0155	-.0392	.8296	.1383	.3226	.7255
9	-.2369	-.5984	.1397	.0392	.0914	.1313
10	-.3294	-.8321	.5387	.0008	.0018	.5387
11	-.2609	-.6591	1.1301	-.2098	-.4894	.8906
12	-.2369	-.5984	.1397	.0392	.0914	.1313
13	-.2369	-.5984	.1397	.0392	.0914	.1313
14	-.2369	-.5984	.1397	.0392	.0914	.1313
15	-.0286	-.0723	2.1592	.1586	.3699	2.0224
CONSTRUCT						
1	-.1730	-.4371	3.1423	.4912	1.1456	1.8300
2	.3935	.9940	1.9453	-.5546	-1.2935	.2723
3	-.2337	-.5903	1.3849	-.0896	-.2090	1.3412
4	-.5254	-1.3273	1.5717	-.1559	-.3636	1.4395
5	.2329	.5883	2.0539	.4722	1.1013	.8410
6	-.5592	-1.4127	1.3377	-.2311	-.5391	1.0471
7	.1202	.3036	1.6411	.2974	.6937	1.1599
8	.3211	.8113	1.0752	-.2324	-.5420	.7815

BUS HELI MOD L LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.067	.9333	9.09
2	.333	3.3333	32.47
3	.200	2.4000	23.38
4	.000	.0000	.00
5	.400	3.6000	35.06
6	1.000	.0000	.00
7	1.000	.0000	.00
8	1.000	.0000	.00

TOTAL VARIATION ABOUT CONSTRUCT MEANS 10.2667

BIAS .8110

VARIABILITY .6055

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.000	1.182	11.52
2	.000	.649	6.32
3	.000	.649	6.32
4	.000	.649	6.32
5	.000	.649	6.32
6	.000	.649	6.32
7	.000	.916	8.92
8	.000	.916	8.92
9	.000	.916	8.92
10	.000	.516	5.02
11	.000	.516	5.02
12	.000	.516	5.02
13	.000	.516	5.02
14	.000	.516	5.02
15	.000	.516	5.02

UNIT OF EXPECTED DISTANCE 1.2111

THE COMPONENT-SPACE IS LIMITED TO 3 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	5.4870	53.44
2	3.5463	34.54
3	1.2334	12.01

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.0334	-.0783	1.1761	.1066	.2008	1.1358
2	-.3081	-.7217	.1280	-.1867	-.3516	.0044
3	-.3081	-.7217	.1280	-.1867	-.3516	.0044
4	-.3081	-.7217	.1280	-.1867	-.3516	.0044
5	-.3081	-.7217	.1280	-.1867	-.3516	.0044
6	-.3081	-.7217	.1280	-.1867	-.3516	.0044
7	-.0603	-.1413	.8956	.4969	.9358	.0198
8	-.0603	-.1413	.8956	.4969	.9358	.0198
9	-.0603	-.1413	.8956	.4969	.9358	.0198
10	.2925	.6851	.0461	-.1106	-.2083	.0027
11	.2925	.6851	.0461	-.1106	-.2083	.0027
12	.2925	.6851	.0461	-.1106	-.2083	.0027
13	.2925	.6851	.0461	-.1106	-.2083	.0027
14	.2925	.6851	.0461	-.1106	-.2083	.0027
15	.2925	.6851	.0461	- 1106	-.2083	.0027
CONSTRUCT						
1	-.0143	-.0334	.9322	0566	.1066	.9208
2	-.6577	-1.5405	.9601	-.4958	-.9337	.0884
3	-.0773	-.1810	2.3672	.7917	1.4908	.1447
4	.7492	1.7550	.5201	- 3525	-.6638	.0795

SCI HELI MOD L HA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.733	2.9333	12.87
2	.267	2.9333	12.87
3	.333	3.3333	14.62
4	.533	3.7333	16.37
5	.333	3.3333	14.62
6	.733	2.9333	12.87
7	.400	3.6000	15.79

TOTAL VARIATION ABOUT CONSTRUCT MEANS 22.8000

BIAS .3625

VARIABILITY .9647

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.667	1.480	6.49
2	-1.333	1.813	7.95
3	-1.333	2.480	10.88
4	.667	1.280	5.61
5	-.333	1.880	8.25
6	-.333	2.013	8.83
7	-1.333	2.347	10.29
8	.667	1.547	6.78
9	2.667	1.680	7.37
10	.667	1.147	5.03
11	-.333	1.213	5.32
12	-.333	.813	3.57
13	-.333	.813	3.57
14	-1.333	1.280	5.61
15	.667	1.013	4.44

UNIT OF EXPECTED DISTANCE 1.8048

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	9.0748	39.80
2	5.8589	25.70
3	3.0381	13.33
4	2.2287	9.78
5	1.1949	5.24
6	.9756	4.28
7	.4289	1.88

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3092	.9315	.6123	.2533	.6132	.2363
2	-.1716	-.5171	1.5460	-.3576	-.8655	.7969
3	-.4866	-1.4658	.3315	-.1478	-.3577	.2036
4	.0869	.2618	1.2115	-.3564	-.8626	.4674
5	-.2802	-.8441	1.1675	.3753	.9085	.3421
6	-.3810	-1.1479	.6957	-.0626	-.1516	.6727
7	-.3857	-1.1620	.9964	.2902	.7024	.5031
8	.1562	.4705	1.3253	.3373	.8164	.6587
9	.1633	.4919	1.4380	.3854	.9330	.5676
10	.3133	.9439	.2558	-.0269	-.0650	.2515
11	.1603	.4829	.9802	.0571	.1382	.9610
12	.1919	.5780	.4793	-.1986	-.4807	.2482
13	.1919	.5780	.4793	-.1986	-.4807	.2482
14	.0863	.2601	1.2124	-.2838	-.6869	.7406
15	.0459	.1383	.9942	-.0665	-.1610	.9683
CONSTRUCT						
1	.3179	.9576	2.0163	.2061	.4989	1.7674
2	-.3161	-.9524	2.0263	-.3819	-.9243	1.1720
3	.3659	1.1023	2.1182	.4157	1.0063	1.1055
4	.4610	1.3887	1.8048	-.2032	-.4919	1.5628
5	-.0124	-.0372	3.3319	.6782	1.6415	.6373
6	.5091	1.5336	.5815	-.1880	-.4551	.3744
7	-.4396	-1.3244	1.8461	.3198	.7741	1.2469

SCI HELI MOD L HB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.267	2.9333	14.97
2	.200	2.4000	12.24
3	.067	.9333	4.76
4	.467	3.7333	19.05
5	.067	.9333	4.76
6	.200	2.4000	12.24
7	.333	3.3333	17.01
8	.267	2.9333	14.97

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.6000

BIAS .5888

VARIABILITY .8367

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.133	2.360	12.04
2	.133	1.493	7.62
3	.133	1.760	8.98
4	.133	1.760	8.98
5	-1.867	.560	2.86
6	-.867	.627	3.20
7	-1.867	.560	2.86
8	1.133	2.227	11.36
9	.133	1.093	5.58
10	.133	1.093	5.58
11	.133	1.227	6.26
12	.133	.960	4.90
13	.133	.960	4.90
14	1.133	1.560	7.96
15	.133	1.360	6.94

UNIT OF EXPECTED DISTANCE 1.6733

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.1798	31.53
2	5.2828	26.95
3	4.0242	20.53
4	1.4550	7.42
5	1.3719	7.00
6	.6729	3.43
7	.4249	2.17
8	.1885	.96

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.2482	.6169	1.9794	-.2115	-.4861	1.7431
2	-.3504	-.8710	.7348	-.1503	-.3454	.6155
3	-.4266	-1.0604	.6355	.2644	.6078	.2661
4	-.4266	-1.0604	.6355	.2644	.6078	.2661
5	-.0903	-.2244	.5097	.0273	.0627	.5057
6	.1198	.2979	.5379	.1798	.4133	.3671
7	-.0903	-.2244	.5097	.0273	.0627	.5057
8	-.0884	-.2197	2.1784	-.5675	-1.3043	.4772
9	.3366	.8367	.3933	.2192	.5038	.1394
10	.3366	.8367	.3933	.2192	.5038	.1394
11	-.0217	-.0540	1.2237	.3453	.7937	.5938
12	.0545	.1354	.9417	-.0694	-.1595	.9162
13	.0545	.1354	.9417	-.0694	-.1595	.9162
14	.4181	1.0394	.4797	-.0189	-.0435	.4778
15	-.0741	-.1842	1.3261	-.4601	-1.0574	.2080
CONSTRUCT						
1	.2027	.5038	2.6795	-.5473	-1.2580	1.0971
2	-.4841	-1.2035	.9516	.1647	.3786	.8082
3	-.0356	-.0884	.9255	-.2469	-.5675	.6035
4	.5223	1.2983	2.0477	.3506	.8059	1.3983
5	.0998	.2482	.8717	-.0920	-.2115	.8270
6	-.3519	-.8749	1.6346	.3803	.8742	.8704
7	-.1625	-.4039	3.1702	-.5728	-1.3166	1.4369
8	.5388	1.3394	1.1393	.0905	.2080	1.0960

SCI HELI MOD L MA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.533	3.7333	17.28
2	.267	2.9333	13.58
3	.133	1.7333	8.02
4	.000	.0000	.00
5	.333	3.3333	15.43
6	.400	3.6000	16.67
7	.267	2.9333	13.58
8	.333	3.3333	15.43

TOTAL VARIATION ABOUT CONSTRUCT MEANS 21.6000

BIAS .5292

VARIABILITY .8783

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	1.733	2.293	10.62
2	.733	1.827	8.46
3	.733	1.827	8.46
4	.733	1.427	6.60
5	-2.267	.827	3.83
6	.733	1.560	7.22
7	-2.267	.827	3.83
8	-1.267	1.160	5.37
9	.733	2.093	9.69
10	-.267	1.093	5.06
11	1.733	1.760	8.15
12	-.267	1.093	5.06
13	-.267	1.093	5.06
14	-.267	1.493	6.91
15	-.267	1.227	5.68

UNIT OF EXPECTED DISTANCE 1.7566

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.5038	34.74
2	4.4010	20.38
3	3.4397	15.92
4	3.1210	14.45
5	1.7908	8.29
6	.7017	3.25
7	.6420	2.97

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	-.0313	-.0857	2.2860	-.6304	-1.3225	.5369
2	-.4403	-1.2061	.3721	.2390	.5015	.1206
3	-.4403	-1.2061	.3721	.2390	.5015	.1206
4	-.1030	-.2822	1.3470	.2645	.5549	1.0391
5	.0081	.0222	.8262	.0509	.1067	.8148
6	.2503	.6856	1.0900	.3597	.7547	.5204
7	.0081	.0222	.8262	.0509	.1067	.8148
8	.1864	.5105	.8994	.1988	.4171	.7255
9	-.4000	-1.0958	.8925	-.2002	-.4199	.7162
10	-.0059	-.0161	1.0931	-.1537	-.3224	.9892
11	.2050	.5617	1.4445	-.1261	-.2645	1.3746
12	.3480	.9533	.1846	.1093	.2292	.1321
13	.3480	.9533	.1846	.1093	.2292	.1321
14	-.1349	-.3694	1.3568	-.1845	-.3870	1.2071
15	.2018	.5528	.9211	-.3267	-.6853	.4514
CONSTRUCT						
1	.4428	1.2129	2.2622	-.1878	-.3940	2.1069
2	-.2677	-.7333	2.3956	.5255	1.1024	1.1804
3	-.1575	-.4313	1.5473	-.3959	-.8306	.8574
4	-.4811	-1.3177	1.5969	-.2413	-.5062	1.3407
5	-.4795	-1.3135	1.8748	.1106	.2319	1.8210
6	.0879	.2407	2.8754	-.6042	-1.2676	1.2685
7	.4883	1.3376	1.5440	.3103	.6510	1.1202

SCI HELI MOD L MB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.800	2.4000	12.16
2	.200	2.4000	12.16
3	.133	1.7333	8.78
4	.333	3.3333	16.89
5	.200	2.4000	12.16
6	.200	2.4000	12.16
7	.333	3.3333	16.89
8	.133	1.7333	8.78

TOTAL VARIATION ABOUT CONSTRUCT MEANS 19.7333
BIAS .5850
VARIABILITY .8395

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.667	1.084	5.50
2	-.333	.751	3.81
3	.667	2.818	14.28
4	-.333	1.018	5.16
5	-.333	1.018	5.16
6	-.333	1.018	5.16
7	-.333	2.084	10.56
8	-.333	2.351	11.91
9	.667	1.084	5.50
10	-.333	.751	3.81
11	-.333	1.151	5.83
12	-.333	.751	3.81
13	-.333	1.018	5.16
14	.667	1.351	6.85
15	.667	1.484	7.52

UNIT OF EXPECTED DISTANCE 1.6790

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.3716	32.29
2	4.4088	22.34
3	3.0676	15.55
4	2.1483	10.89
5	1.8837	9.55
6	.9048	4.59
7	.8355	4.23
8	.1130	.57

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.3616	.9127	.2514	-.0212	-.0446	.2494
2	.2024	.5109	.4901	.2929	.6149	.1119
3	-.5601	-1.4139	.8188	-.0593	-.1244	.8033
4	-.1374	-.3469	.8974	.1643	.3450	.7784
5	-.1010	-.2550	.9527	.0339	.0712	.9477
6	-.1374	-.3469	.8974	.1643	.3450	.7784
7	.0435	.1099	2.0724	-.6103	-1.2815	.4300
8	-.4124	-1.0410	1.2675	-.0294	-.0618	1.2637
9	.3616	.9127	.2514	-.0212	-.0446	.2494
10	.2024	.5109	.4901	.2929	.6149	.1119
11	-.0844	-.2129	1.1058	.1249	.2622	1.0370
12	.2024	.5109	.4901	.2929	.6149	.1119
13	-.1886	-.4761	.7911	.1075	.2257	.7401
14	.0581	.1468	1.3296	-.2802	-.5883	.9835
15	.1893	.4779	1.2561	-.4518	-.9486	.3562
CONSTRUCT						
1	.3680	.9290	1.5370	.3329	.6990	1.0484
2	-.3308	-.8350	1.7028	.1283	.2694	1.6302
3	-.1968	-.4967	1.4866	.0455	.0955	1.4775
4	.4018	1.0141	2.3048	-.6595	-1.3848	.3871
5	-.4600	-1.1611	1.0518	.0090	.0188	1.0514
6	-.2389	-.6030	2.0364	-.1455	-.3055	1.9430
7	.5271	1.3304	1.5633	.3982	.8361	.8643
8	.0922	.2328	1.6791	-.5058	-1.0621	.5510

SCI HELI MOD L LA

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.467	3.7333	16.87
2	.267	2.9333	13.25
3	.267	2.9333	13.25
4	.133	1.7333	7.83
5	.067	.9333	4.22
6	.400	3.6000	16.27
7	.333	3.3333	15.06
8	.267	2.9333	13.25

TOTAL VARIATION ABOUT CONSTRUCT MEANS 22.1333

BIAS .5121

VARIABILITY .8891

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.800	1.858	8.39
2	.800	1.591	7.19
3	-1.200	1.191	5.38
4	-.200	1.258	5.68
5	.800	1.324	5.98
6	-.200	1.391	6.29
7	-.200	1.258	5.68
8	-.200	1.524	6.89
9	.800	1.458	6.59
10	-.200	1.524	6.89
11	-.200	1.391	6.29
12	-.200	1.924	8.69
13	-.200	1.258	5.68
14	-.200	1.924	8.69
15	-.200	1.258	5.68

UNIT OF EXPECTED DISTANCE 1.7782

THE COMPONENT-SPACE IS LIMITED TO 8 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	6.5686	29.68
2	4.9338	22.29
3	3.9546	17.87
4	3.1680	14.31
5	2.1211	9.58
6	.7726	3.49
7	.5335	2.41
8	.0811	.37

	COMPONENT 1			COMPONENT 2			COMPONENT 3		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1154	.2956	1.7704	-.3545	-.7875	1.1503	-.3990	-.7934	.5208
2	.0682	.1747	1.5606	-.2664	-.5917	1.2105	.4574	.9096	.3831
3	-.0755	-.1935	1.1537	-.0540	-.1201	1.1393	.4190	.8332	.4450
4	-.0850	-.2179	1.2103	-.3689	-.8193	.5390	.2990	.5947	.1853
5	.2510	.6432	.9107	-.1802	-.4002	.7505	-.1397	-.2778	.6734
6	.1100	.2820	1.3116	-.1349	-.2996	1.2218	.1594	.3170	1.1213
7	.2605	.6677	.8120	.1347	.2991	.7225	-.0197	-.0393	.7210
8	.2133	.5466	1.2257	.4088	.9080	.4012	.1642	.3265	.2946
9	.2361	.6050	1.0918	-.0894	-.1985	1.0524	-.3737	-.7432	.5000
10	.2133	.5466	1.2257	.4088	.9080	.4012	.1642	.3265	.2946
11	.2456	.6294	.9949	.2255	.5008	.7441	-.2538	-.5047	.4895
12	-.4523	-1.1591	.5809	.2823	.6270	.1878	-.0795	-.1580	.1628
13	-.3241	-.8306	.5678	-.1470	-.3265	.4612	-.1592	-.3166	.3610
14	-.4523	-1.1591	.5809	.2823	.6270	.1878	-.0795	-.1580	.1628
15	-.3241	-.8306	.5678	-.1470	-.3265	.4612	-.1592	-.3166	.3610
CONSTRUCT									
1	-.0245	-.0627	3.7294	-.6993	-1.5533	1.3167	-.2385	-.4743	1.0917
2	.0069	.0177	2.9330	-.3711	-.8242	2.2537	.6713	1.3349	.4718
3	.3544	.9082	2.1085	.4293	.9536	1.1991	-.1504	-.2991	1.1096
4	-.3529	-.9045	.9152	.2542	.5645	.5965	-.0799	-.1589	.5712
5	.0450	.1154	.9200	-.1596	-.3545	.7943	-.2006	-.3990	.6352
6	.4754	1.2185	2.1152	-.1796	-.3988	1.9561	-.5162	-1.0265	.9025
7	.3926	1.0062	2.3209	.2277	.5057	2.0652	.3150	.6263	1.6729
8	-.6058	-1.5527	.5224	.1218	.2706	.4492	-.2400	-.4773	.2213

SCI HELI MOD L LB

CONSTRUCT	MEAN	VARIATION	AS PER CENT
1	.200	2.4000	12.95
2	.200	2.4000	12.95
3	.400	3.6000	19.42
4	.267	2.9333	15.83
5	.067	.9333	5.04
6	.667	3.3333	17.99
7	.267	2.9333	15.83

TOTAL VARIATION ABOUT CONSTRUCT MEANS 18.5333

BIAS .5422

VARIABILITY .8697

ELEMENT	TOTAL	SUMS OF SQUARES	AS PER CENT
1	.933	1.964	10.60
2	-.067	1.098	5.92
3	.933	1.698	9.16
4	-.067	1.098	5.92
5	-.067	1.098	5.92
6	-1.067	1.031	5.56
7	-.067	.698	3.76
8	-1.067	1.031	5.56
9	-.067	.698	3.76
10	-.067	.698	3.76
11	-1.067	1.031	5.56
12	-.067	1.764	9.52
13	.933	1.431	7.72
14	.933	1.431	7.72
15	-.067	1.764	9.52

UNIT OF EXPECTED DISTANCE 1.6272

THE COMPONENT-SPACE IS LIMITED TO 7 DIMENSIONS

COMPONENT	ROOT	AS PER CENT
1	7.4522	40.21
2	6.0876	32.85
3	2.3322	12.58
4	1.9868	10.72
5	.5312	2.87
6	.1433	.77

BARTLETT TEST NOT APPLIED

	COMPONENT 1			COMPONENT 2		
ELEMENT	VECTOR	LOADING	RESIDUAL	VECTOR	LOADING	RESIDUAL
1	.1533	.4185	1.7893	.3200	.7895	1.1660
2	.1327	.3623	.9665	2674	.6598	.5312
3	.1933	.5276	1.4194	.4200	1.0364	.3453
4	.1290	.3520	.9738	.2546	.6281	.5794
5	.1290	.3520	.9738	.2546	.6281	.5794
6	.1229	.3354	.9186	3664	-.9040	.1014
7	.1973	.5386	.4077	-.1550	-.3825	.2613
8	.1229	.3354	.9186	-.3664	-.9040	.1014
9	.1973	.5386	.4077	-.1550	-.3825	.2613
10	.1973	.5386	4077	.1550	-.3825	.2613
11	.1229	.3354	.9186	-.3664	-.9040	.1014
12	-.4617	-1.2603	.1761	-.0937	-.2313	.1226
13	-.3872	-1.0571	.3137	.1176	.2902	.2294
14	-.3872	-1.0571	.3137	.1176	.2902	.2294
15	-.4617	-1.2603	.1761	-.0937	-.2313	.1226
CONSTRUCT						
1	.1756	.4793	2.1703	.4083	1.0074	1.1554
2	.1653	.4512	2.1964	.3766	.9291	1.3331
3	.3519	.9606	2.6773	-.6340	-1.5643	.2303
4	-.6219	-1.6978	.0508	.0194	.0478	.0485
5	.0562	.1533	.9098	.1297	.3200	.8074
6	.2032	.5547	3.0256	.5215	1.2866	1.3702
7	-.6219	-1.6978	.0508	.0194	.0478	.0485

Appendix 12 - Construct definitions

BUS Comp Mod S Ha

C5 This is an introductory statement for the contents.
C6 this statement wants to show the solution of the problem.
C7 The information is more directly stated about the associated exhibition.
C8 The statement tells us the exact content of the programme.

BUS Comp Mod S La

C5 only the first sentence has described the procedure of evaluation.
C6 only this sentence has been identified the problem.
C7 only this sentence is defined the situation.
C8 only this sentence has made the solution.

BUS Comp Mod S Lb

C5 more boardened and no specification.
C6 It suggests the method.
C7 For all the general enquiries.
C8 Tell you the aim of the seminar.

BUS Comp Mod S Ma

C5 7 a normal sentence. 10, 8 How (question word) as the beginning of the sentence.
C6 2 a complete sentence. 6, 11 a phrase with noun and verb.
C7 13 with an additional phrase (Rochester House) to describe.
C8 12 a complete sentence without any further explanation/description.

BUS Comp Mod S Mb

C5 This clause is a general statement which aims at introducing items followed.
C6 The other two clauses aim at explanation and try to give some additional information.
C7 The other two clauses inform the readers something important and essential.
C8 This clause is a trying to persuade the readers to comply or to think that the seminar is of great help.

BUS Comp Mod S Hb

C5 Sentence 7 is a topic sentence for introducing the following points.
C6 Sentence 11 is one of concurrent streams. Others are the situation of the seminar.
C7 Sentence 1 is the theme of the whole context.
C8 Sentence 12 is a conclusion of the seminar.

BUS Comp Mod S Ma

C5 Starting with noun while others starting with a question subject "How".
C6 it is only a clause.
C7 The two others are passive voice while it is an active voice sentence.
C8 A noun followed by the "be" while others two are not. A past participle follow by the "be".

BUS Comp Mod L Ha

C6 How, What, and How.
C7 will be made, which will include, who will be drawn
C8 A, The

BUS Comp Mod L Hb

C6 How, What (for questions)
C7 Who, Which
C8 certainly - evaluation

BUS Comp Mod L La

C6 Reference: seminar, Birmingham Metropole Hotel; 26/27
C7 Question word: How, What
C8 Ways of suggestion: Discussions, demonstrations

BUS Comp Mod L Lb

C6 Questions e.g. How, what
C7 Noun e.g. computerisation

BUS Comp Mod L Ma

C6 nouns and nouns phrase, siminar, discussions
C7 questions, How, what
C8 Adjective phrase

BUS Comp Mod L Mb

C6 Prepositions: from, through, on
C7 Nouns: demonstrations, planning, seminar
C8 What, How

BUS Heli Mod S Hb

C5 This statement is connected with the other statement but the others are independent.
C6 This statement gives the reason buth the others are giving fact.
C7 The other statements are representing different situation which deffer from the preceding situation but this statment concerns a thing hapenning sometimes.
C8 This statement is a clause which describes a thing further.

BUS Heli Mod S La

C5 8 & 10 describe the solution for the problem while 12 describe the method of evaluation to the solution.
C6 3 is not saying the function of helicopters.
C7 4 & 6 are secribing the problem of the spring system while 2 is describing helicopters.
C8 11 is not saying the spring system.

BUS Heli Mod S Lb

C5 It shows the positive result of that aero-train.
C6 This statement is talking about the new system, not the helicopters.
C7 It is just telling a fact but the others give a more detail description on that problem.
C8 It's a descriptive phrase but the others are talking about the action taken.

BUS Heli Mod S Ha

C5 Clause 10 does not give an experiment materials.
C6 Clause 1 & 13 only give a situation & they do not account for any facts.
C7 Clause 4 & 2 both give a negative signal to the idea just mentioned bfore the 2 clauses.
C8 Clause 11 is an extension or supplement to the previous clause.

BUS Heli Mod S Mb

C5 provide information about developer and not system itself.
C6 provide the negative meaning.
C7 not provide definite problem.
C8 bring out the new idea.

BUS Heli Mod L Ha

C6 Verb
C7 Conjuction
C8 Definition of location

BUS Heli Mod L Hb

C6 Verbs eg. bounce, turning over, come up with, to avoid
C7 Nouns eg. problems, Trials, the system can ...
C8 for, has to be, can, to

BUS Heli Mod L La

C6 Verb: e.g. cushioned, handle, avoid
C7 Adjective: convenient, low
C8 Adverb: Unfortunately, sometimes

BUS Heli Mod L Lb

C6 Words e.g. avoid, problems
C7 phrases and clauses e.g. very convenient for dropping freight by parachute
C8 sentences e.g. the landing impact has to be cushioned. the charge weighted about one-and-a-half tons.

BUS Heli Mod L Ma

C6 but, as, by
C7 avoid, come up, comprises
C8 landing impact, charge weighted, low altitudes

BUS Heli Mod L Mb

C6 (physical terms) explicit meaning: problems, air-cushion system.
C7 implicit meaning: carried out (with success), dropped without a parachute (its value)

SCI Comp Mod S Hb

C5 The first statement states that how many topics will be discussed.
C6 Sentence 6 and 2 is a clause of a sentence which gives more information to the sentence.
C7 Sentence 13 is the conclusion of the passage.
C8 Sentence 12 states that the benefit of the seminar.

SCI Comp Mod S Lb

C5 Sentences 10 & 8 are question, but sentences is not.
C6 Sentence 6 is not a complete sentence.
C7 Sentences 13 & 5 give us more information.
C8 Sentences 9 & 4 are asking for further information.

SCI Comp Mod S Ma

C5 7 states the situation while 8 & 10 state the problems.
C6 11: present tense, 6 & 2: simple future tense.
C7 13: using active voice, 1 & 5: using passive voice.
C8 12: states evaluation.

SCI Comp Mod S Ha

C5 Sentence 7 is an introduction, while 8, 10 are the main themes.
C6 11 is one of the concurrent stream.
C7 5 relates to the exhibition itself.
C8 12 tells the importance of the seminar.

SCI Comp Mod S La

C5 7 is a introduction of 4 concurrent streams.
C6 11 is one of the four concurrent streams.
C7 5 and 13 are concerned about further details of the exhibition.
C8 4 is about the background of the speakers.

SCI Comp Mod S Mb

C5 10 and 8 are both questions (question).
C6 6, 2 are the content of the exhibition (content).
C7 1, 13 are the situation of the exhibition (reason).
C8 12, 9 are the purpose of the exhibition (purpose).

SCI Comp Mod L Hb2

C6 Action, i.e. to be held on
C7 How, what, ...
C8 Connective e.g. Furthermore

SCI Comp Mod L Hb

C6 noun e.g. two day seminar
C7 a kind of actions, e.g. in being organised

SCI Comp Mod L La

C6 action
C7 detail

SCI Comp Mod L Lb

C6 Description
C7 Questions
C8 Suggestion

SCI Comp Mod L Ma

C6 held, organised, will follow, draw from, will be made, see, include, centre on, to promote
C7 How, what,
C8 on ..., with ..., in ...

SCI Comp Mod L Mb

C6 noun: seminar, exhibition, streams
C7 verb: follow, held
C8 What, How

SCI Heli Mod S La

C5 It gives out two kind of information in one sentence.
C6 (i) line 13 is written in past tense and is just a fact. (ii) The others two contain an explanation or description.
C7 (i) The first two give out reasons, (ii) line 6 is not a complete sentence.
C8 The last two are opening sentences. It gives out a series of illustrations.

SCI Heli Mod S Lb

C5 "8" is an introduction of the system while the others are explanations.
C6 It is not describing the method under consideration.
C7 The other two are the problems to be tackled.
C8 "5", "7" are describing the same problem.

SCI Heli Mod S Ma

C5 The information which given by the sentence have no supportive meanings.
C6 No description to the new invention.
C7 The sentence is the main idea of them.
C8 The sentence has no information of landing process.

SCI Heli Mod S Ha

C5 12 only describes the action and not about the air-cushion system.
C6 13 describes the advantage of using parachute.
C7 2 does not describe the exact problem.
C8 5 does not relate the air-cushion system.

SCI Heli Mod S Hb

C5 the new development of the passage after stating the problem. C6 This sentence gives reason.
C7 This sentence is only a description.
C8 This sentence is a defining clause.

SCI Heli Mod S Mb

C5 The sentence 10 is just to say about solution of the system.
C6 The sentence 3 point out the problems.
C7 The sentence 2 just say the presence of problems but the rest actually mention which problem occurs.
C8 The circled sentence is a clause while the rest is one sentence of complex sentence and the phrase.

SCI Heli Mod L Ha

C6 Noun: (Helicopters, Problems, Trials)
C7 Verb: (cushioned, lands, assures)

SCI Heli Mod L Hb

C6 connectives (because, unfortunately, on which)
C7 some specific nouns (problems)
C8 some specific verbs (assures)

SCI Heli Mod L La

C6 explanation
C7 requirement
C8 data

SCI Heli Mod L Lb

C6 Connective: because, unfortunately, to avoid, for
C7 Words used to indicate some scalar: weighed, rates, altitudes.

SCI Heli Mod L Ma

C6 conjunction: eg. which, on which
C7 preposition eg. by, at
C8 phrasal verb eg. turning it over

SCI Heli Mod L Mb

C6 because, as but
C7 subject - helicopters, this system
C8 pause - at low altitudes

Appendix 13 - Recalled summaries

BUS Comp Mod S Ha

An exhibition about the computerisation on industry is held in a hotel for 2 days by a management group. The exhibition will be presented in 4 concurrent streams. Any further information can be obtained from the XXX.

BUS Comp Mod S La

There is a seminar about the computerisation on manufacturing industry hold by one institution. This seminar has been discussed the problems of how to minumise the costs through cokputerisation, how to maximise the production capacity and so on. Through computerisation these problems can be solved to a certain extent. Besides. We can contact the institution for further details.

BUS Comp Mod S Lb

A two-day's seminar will be held by a company about the computerisation on the manufacturing management. It will be held on 26/27 June. It will have a great help in the promotion of computerisation in the manufacturing management as it concentrates on four concurrent streams. All of them tell you how to use your present materials with the computer to optimise your capacity. For further information, you can go to a specific place.

BUS Comp Mod S Ma

A seminar which aims to show the effective use of computers will be held on 26/27 June at a hotel. Four areas will be included in the seminar: How to minimise the cost, who will be the potential users, how great the capacity of the computer and so. Such areas will be further explained in deep details. Further information is available if reqest.

BUS Comp Mod S Mb

A two day seminar of the effective use of computer in manufacturing management is to be organised. speakers are with practical experience in various production size and products. The seminar mainly focuses on e streams: How the effective utilisation of resources cna achieved, what planning and management requirement, ... Time is available for delegates to see the associated seminar. The seminar is certainly of great help in the computerisation of manufacturing management. Further detail is available from the conference secretary, Rochester House.

BUS Comp Mod S Hb

A seminar for the effective use on computer in manufacturing industry will be held on 26/27 this month. The speakers are widely drawn from the variety of manufacturing industries in products and sizes. During the siminar, four concurrent aspects for computerisation in this industry are discussed. they include how to use computer to plan the production and to control the production inputs. And also an exhibition about the equipments of computation is held at the same place. Both seminar and exhibition are helpful to promote the computerisation in the manufacturing industry.

BUS Comp Mod S Ma

A two day seminar will be held. A speaker who is from widely companies will give a speech. Time is available for delegates. There will also have demonstration of equipment. there are four things which will be discussed.
i) How the interaction among the production engineering, production control hve to be promoted.
ii) How is capacity of
The seminar is of great help on the computerisation of canufacturing. Further details is available at secretary.

BUS Comp Mod L Ha

A seminar will be held in June, in discussing the use of computers in business manufacturing. It will feature on speech by experienced operators. The seminar will be of great help for the computerisation of manufacturing, which will discuss 4 main problems faced by the business.

BUS Comp Mod L Hb

A two day exhibition of computer will be held 26/27 June in the Birmingham University. There will be a talk given by experts and a show of computer will be followed. The discussion will concentrate on the newly development of computer such as computer design, computer engineering and computer production. Besides, time will be given to raise questions about computers. Therefore, it is a good chance to acquire more knowledge on computer. Detailed information can be obtain from the secretary of this exhibition.

BUS Comp Mod L La

A two day seminar of effective use of computer in manufacturing management will be held on 26/27 June. The speakers talking in this topic well be selected from various companies with practical experience. Time will be available for delegate te material, including demonstrations of equipment. Discussions will be fallen on four current streams. Indeed, the purpose to having the seminar is hoping to help to promote the manufacturing companies. Further details can be found in Conference Secretary.

BUS Comp Mod L Lb

A seminar about computerisation of management will be held in a hotel. In the seminar, speakers from different kinds of companies will be presented their speech to the public and all these speakers have practical experience. Nevertheless, discussions will be done in the seminar and this is open to delegates as well. Also, during the seminar, several questions will be discussed. For example, How the management capacity can be optimised through the usej of computers and what can be done to facilitate the management capacity. Moreover, an exhibition will be held at the same time. Any information about this seminar or exhibition is made available now.

BUS Comp Mod L Ma

A two day siminar which concern the effective use of computer on manufacturing management will be held on 26/27 June. The speaker of the siminar come from the companies which vary from sezes and products. There are demonstration of equipment and discussion associated with the seminar. The discussion will centre on the problems we faced on manufacturing management. The seminar will give a great help for whom want to computerise the manyfacturing management. The further details are available later.

BUS Comp Mod L Mb

There will be a seminar held on 26/27 June at a Hotel's bational exhibition centre. The seminar is about computer uses in manufacturing management. The speakers will be drawn from may large firms. After the seminar, the time will be available for the delegates to see the exhibition. From, the seminar, we can learn how the manyfacturing process is planned and controlled by the related management. The seminar will be of great help to promote the computer uses in manufacturing management. Further information is now available from the Conference Secretary.

BUS Heli Mod S Hb

Helicopter is very convenient for dropping freight. However, it faces a problem oflanding since it has to be cushioned to give a soft landing. A developer then discovers a system in order to give a good landing. Trials have been carried out on this system. It has been proved that such system is very good in helping landing.

BUS Heli Mod S La

Helicopters are convenient for dropping freight by parachute. However, the landing system has some problems. the spring system will bounce the land and turnover as it lands. So, a more advanced landing sustem was developed. This landing system is composed of ballon which is used as air-cushion in order to reduce the problem arise by the spring system. This new system can handle up to 8 tons of weight. many experiments have been done to test for this new landing system and it is proved that no parachute is needed if the object is dropped below a certain height.

BUS Heli Mod S Lb

There are some problems in the convenient machine - Helicopter. Because with the normal spring system, it cannot load a very heavy freight and sometimes, the loader will trunover. Therefore, Belion, a developer of a new loading system air cushioned ballons to support the charge. Many trials give a positive result to this system. it is because it can load the heavy freight more safety and convenient.

BUS Heli Mod S Ha

Helicopter are convenient for dropping freights with parachute. However, there are problems associated with landing as the landing impact may sometimes turn over. Besides, the cushion system is not perfect for landing. Bertin, the developer of aero-train, has developed a better landing system with several balloons under the object to be loaded. Trials have been done to test such system & the result is satisfactory.

BUS Heli Mod S Mb

Helicopter is very convenient for landing but it has a problem. In order to avoid this problem, a man developed a new system that improve this problem. The ability of the new system is more better.

BUS Heli Mod L Ha

Helicopter are convenient for freight as they can make use of the parachute. However, there is a problem because parachute lending must be cushioned by a soft place. Unfortunately, the cushion often bounds the parachute back or even turning it over. To cope with this problem. Bertin, the developer of a new cushion system made use of the ballons and put them onto the cushion's surface so as to avoid the back bounce. Several experiment have been made under the same height and constant wind speed. It shows that the new system can hold far more tons than what it actually holds in the experiment.

BUS Heli Mod L Hb

Helicopter is very convenient for dropping the freight from above. However, it has its problems of lending because sometimes the freight are bounced or may be turned over. To avoid these problems, a person has invented a platform of baloons which can provide a soft landing surface. Trials have been carried out to see that this method can be use for dropping the freight of lower weight from above. If it is not too high above the ground a parachute and not be need.

BUS Heli Mod L La

Helicopter can be landed easily with some equipment, but there are also some problems which make it unsuccessfully, such as the climate. To avoid this, one expert has developed one system. Helicopter can be landed safety with some ballons supporting it because the ballons can reduce the rate, hence theycushion the impact between helicopter cna the load.

BUS Heli Mod L Lb

Helicopters are convenient in loading freight by parachute but sometimes the freight will be turned over when landing because the landing place is not cushioned. Mr. Bertin, is developing a cushion system to avoid this. This system consists a platform which is supported by cushion and balloons. Trials on charges weighted one and a half tone are carried out with steadyspeed and wind speed. This system can handle about 8 tons charges. No parachute is needed when dropping from low level.

BUS Heli Mod L Ma

Helicopter is very convenient for landingwith paraches. But the problem is that as it lands, it reaches the ground with post landing. Later, a man developed a betta method with improved facilities. He carried out the experiment on a platform with a given height. The experiment is supposed to be a success. At low latitude, landing can take place without parachues with a good and save landing.

BUS Heli Mod L Mb

Helicopters are convenient for parachuting. But there will be some problems. One is that the platform must be soft enough for people to land. The other is the landing will cause a bounce and make the parachute turns over. But Begg has found a solution to deal with this problem. The platform has some air-cushion to reduce the bounce and are soft enough. Experiments are carried out with success. Later or sooner, people can be landed from airplane without a parachute.

SCI Comp Mod S Hb

A two day seminar about the effective use of computers on the management of manufacturing industry will be held on 26/27 June. The speakers will give speech about their practical experience. Experiment demonstration will be included in the exhibition. Four current streams will be discussed during the seminar. The seminar will be have great help to the computerization of management of manufacturing industry. Future detail are available from the Conference Secretary.

SCI Comp Mod S Lb

There will be a seminar about the promotion of computerisation in industry at Metropole Hotel. There will be also an exhibition for the people who are selected from companies of varying sizes and products. Demonstrations will be held for these people. The seminar includes four major streams: Firstly, it will discuss the interaction between design and production. Secondly, it will discuss the planning of the production resources. Thirdly, it will discussed the control of theproduction resources. Finally, it discusses the promotion of computerisation in industry. The seminar and exhibition will leads to interest of computerisation in this field. Further details are available.

SCI Comp Mod S Ma

There is a seminar which is about the computerisation of management of manufacturing. in this seminar there are four concurrent stream and used to promote the using of computer in management. And many experienced people from companies which produce different products and of different size will come and take part in this seminar. Also an associated seminar with some demonstration. An further information about the seminar is available.

SCI Comp Mod S Ha

There is an seminar which is about the computerization of management of manufacturing. In this seminar there are four concurrent streams and used to promote the using of computer in management. And many experienced people from companies which produce defferent products and of different size will come and take part in this seminar. Also there is an associated seminar with some demonstration. An further information about the seminar is ab\vailable.

SCI Comp Mod S La

The passage is about an exhibition shich was held in Engliand. The objective of this exhibition is to introduce new information on technology of using computer in manufacturing industries. For example, how computer can increase the production rate, reduce production cost and etc. Finally, firther details of the exhibition is also available in requested.

SCI Comp Mod S Mb

A computer seminar will be hold on June. This seminar will talk about the development of computer and include a seires of exhibition. The development of computer and include a series of exhibition. The exhibition has four main streams including how computer can maximise the output through planning and production. It may have some discussions during the seminar. Further details can obtain from the organisation.

SCI Comp Mod L Hb2

A seminar of the effective computer on management is held. The speakers come from company of different size and product. An associated exhibition is held which include demonstration of equipment. The seminar centre on four areas.

SCI Comp Mod L Hb

A seminar will be held. The seminar will be directed by a person with lot of practical experience. In the seminar, demonstration will be included also. The seminar mainly focused on four main points. Further details are now available.

SCI Comp Mod L La

A computer seminar will be hold on June. This seminar will talk about the development of computer and include a series of exhibition. The exhibition has four main streams including how computer can maximize the output through planning and production. It may have some discussions during the seminar. Furhter details can obtain from the organization.

SCI Comp Mod L Lb

A seminar about computerization on manufacturing companies is being organized. Speakers have practical experience an are drawn from companies of different kind. Discussion will concentrate on four streams, about capacity, production, design, control and planning of material and so forth. Also, further details are now available.

SCI Comp Mod L Ma

A seminar on effective use of computer is held. Four streams will be discussed.

SCI Comp Mod L Mb

A seminar on the effectiveness of computer on manufacturing is held. The talker of the seminar is who have practical experience and from different company of defferent size which follow the policy of the concour. Besides, there will be exhibition that focus on four aspects, How companies can put on working, How to optimize the resources ...

SCI Heli Mod S La

Helicopters are convenient in freight of parachute but it also has its problems. The problems are that it is difficult to land on the ground softly. Sometimes, it may be bounced and turned over. Bolin, an aero-trainer, come up with a design that can give a soft impact when the helicopter lands on the ground. It contains a platform and a series of bolloon on the bottom of the helicopter to absorb impact.

SCI Heli Mod S Lb

Helicopters are used to drop freights. By using an air-cushion system, we may prevent the feights from being bounced too high or even turned over. With this method, feights up to 8 tons can be dropped without difficulties.

SCI Heli Mod S Ma

Air-freight is a method of tranporting to long distance away. Helicopter is the medium for transportion. At the disire location, freight is dropped to the load surface. In order to prevent damage, parachute is used and landing systems are prepared. However, the spring loading system will also turn the load over, it is one of the problems. Scientists are invented a new method for landing. a platform, underneath placed is a lot of ballons which filled with air, can act as a air-cushioning effect to prevent the brokage of load. At a suitable height and wind speed, the load can drop to the surface without damage, even if no parachute is used. The method is under testing process. it is the solution to the landing problem.

SCI Heli Mod S Ha

Although helicopters are convenient for dropping freight to land by using parachute it always face many problems. Firstly, the land impact is large. Secondly, the load are easily turned over. Fortunately, a person develop the air-cushion system which is good for dropping the load from a higher place. The load is supported by cluster of ballon, so it provide the soft landing. Moreover, the weight carried by the air-cushion system is much greater than that carried by a parachute.

SCI Heli Mod S Hb

Helicopter can drop freight by parachute. However, the problem is that the platform on which the load should be soft, otherwise, the load will turn over as it lands. Developer of aero-technology solves this problem by designing an air-cushion platform on which the load is landed safely. Various artificial environment has been created to test the effectiveness of this air-cushion platform design. It is found that the result is satisfactory and at low altitude, the load can be dropped without a platform.

SCI Heli Mod S Mb

Helicopter is very convenient for the dropping freight by the parachute. However, some problems still exist. For example, the helicopter has to be cushioned when landing softly. Unfortunately, the present spring system is not good enough to give the soft landing. Bertins, the developer of the aero-train, suggest a solution for this landing problems. It is that the helicopter helicopter comprise of the platforms which can give safe landing and preent turning over during landing.

SCI Heli Mod L Ha

Helicopters are a convenient means of freight dropping but it has the problem of landing. Since the freight may be bounced or even turned over at the impact with the land. Then, a person called Bertin developed a safe landing system by air-cushion matter which can handle 8-tons of freight dropping from about 40m height.

SCI Heli Mod L Hb

Helicopters has some problems on the freight. However, someone develops a air track to solve this problem. The air track is very powerful and useful. At the lower altitude, the freight will drop without parachute.

SCI Heli Mod L La

Helicopter is convenient for dropping freights by parachete. But it has a problem, the landing impact will damage the freight. So a inventor develops a system of aero-train, which loading the freight with a series of balloons to give a air cushion system. The air cushion system provide a upward force to the freight. As a result, the freight fall down. Hence, the damage to freight causing by landing impact reduce to minimum.

SCI Heli Mod L Lb

Landing of helicopter can be improved by an air cushion system, then the chances for turning over will be decreased. Moreover, it can help the helicopter to carry more things and land in a lower altitude.

SCI Heli Mod L Ma

Berter has invented a method for the landing of dropping freight. He used the concept of air-cushion to develop a 'ballon' platform which was beneath the dropping freight. By using this, the turning over of the load could be avoid and can be minimised the loss. Berter has tested this method with several tracks for the dropping of load at different freight. And they were proved to be all right.

SCI Heli Mod L Mb

Helicopter dropped a freight by a parachute; unfortunately, a freight always turns over as it lands but the new air cushion system can avoid this. This new system also carried out its function from different heights; at the end, it concludes that a freight at low attitude without new system also can land properly.

Appendix 14 - ANOVA results

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Situation (C1COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	2661.540	5	532.308	.623	.683
DEPT	.141	1	.141	.000	.990
TEXT	2304.641	1	2304.641	2.699	.113
MODE	139.401	1	139.401	.163	.690
LEVEL	217.358	2	108.679	.127	.881
2-way Interactions	4795.883	9	532.876	.624	.765
DEPT TEXT	91.301	1	91.301	.107	.747
DEPT MODE	1764.188	1	1764.188	2.066	.164
DEPT LEVEL	2148.590	2	1074.295	1.258	.302
TEXT MODE	271.701	1	271.701	.318	.578
TEXT LEVEL	473.625	2	236.813	.277	.760
MODE LEVEL	46.478	2	23.239	.027	.973
3-way Interactions	2352.018	7	336.003	.394	.897
DEPT TEXT MODE	9.541	1	9.541	.011	.917
DEPT TEXT LEVEL	105.278	2	52.639	.062	.940
DEPT MODE LEVEL	112.954	2	56.477	.066	.936
TEXT MODE LEVEL	2124.245	2	1062.123	1.244	.306
4-way Interactions	203.768	2	101.884	.119	.888
DEPT TEXT MODE LEVEL	203.768	2	101.884	.119	.888
Explained	10013.209	23	435.357	.510	.944
Residual	20492.590	24	853.858		
Total	30505.799	47	649.060		

Appendix 14a: ANOVA with Situation as independent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Problem (C2COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	34208.325	5	6841.665	42.637	.000
DEPT	96.901	1	96.901	.604	.445
TEXT	32739.853	1	32739.853	204.034	.000
MODE	720.750	1	720.750	4.492	.045
LEVEL	650.821	2	325.411	2.028	.154
2-way Interactions	5009.012	9	556.557	3.468	.007
DEPT TEXT	714.563	1	714.563	4.453	.045
DEPT MODE	936.333	1	936.333	5.835	.024
DEPT LEVEL	661.055	2	330.528	2.060	.149
TEXT MODE	11.801	1	11.801	.074	.789
TEXT LEVEL	2056.200	2	1028.100	6.407	.006
MODE LEVEL	629.059	2	314.529	1.960	.163
3-way Interactions	3489.716	7	498.531	3.107	.018
DEPT TEXT MODE	1100.168	1	1100.168	6.856	.015
DEPT TEXT LEVEL	231.073	2	115.536	.720	.497
DEPT MODE LEVEL	1399.033	2	699.516	4.359	.024
TEXT MODE LEVEL	759.443	2	379.721	2.366	.115
4-way Interactions	1646.239	2	823.119	5.130	.014
DEPT TEXT MODE LEVEL	1646.239	2	823.119	5.130	.014
Explained	44353.293	23	1928.404	12.018	0.0
Residual	3851.100	24	160.462		
Total	48204.392	47	1025.625		

Appendix 14b: ANOVA with Problem as independent variable.

****A N A L Y S I S O F V A R I A N C E****

Solution (C3COS) by Dept, Text, Mode, Level

Source of Variation	Sum of Squares	Mean DF	Sig. Square	F	of F
Main Effects	23246.481	5	4649.296	9.015	.000
DEPT	75.752	1	75.752	.147	.705
TEXT	21969.242	1	21969.242	42.598	.000
MODE	48.602	1	48.602	.094	.762
LEVEL	1152.885	2	576.443	1.118	.343
2-way Interactions	1301.501	9	144.611	.280	.974
DEPT TEXT	520.742	1	520.742	1.010	.325
DEPT MODE	8.250	1	8.250	.016	.900
DEPT LEVEL	71.439	2	35.719	.069	.933
TEXT MODE	58.300	1	58.300	.113	.740
TEXT LEVEL	607.646	2	303.823	.589	.563
MODE LEVEL	35.124	2	17.562	.034	.967
3-way Interactions	1522.145	7	217.449	.422	.879
DEPT TEXT MODE	168.375	1	168.375	.326	.573
DEPT TEXT LEVEL	34.411	2	17.206	.033	.967
DEPT MODE LEVEL	311.950	2	155.975	.302	.742
TEXT MODE LEVEL	1007.408	2	503.704	.977	.391
4-way Interactions	3421.443	2	1710.721	3.317	.053
DEPT TEXT MODE LEVEL	3421.443	2	1710.721	3.317	.053
Explained	29491.570	23	1282.242	2.486	.015
Residual	12377.705	24	515.738		
Total	41869.275	47	890.836		

Appendix 14c: ANOVA with Solution as independent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Evaluation (C4COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	11440.678	5	2288.136	2.680	.049
DEPT	3772.207	1	3772.207	4.418	.047
TEXT	4409.461	1	4409.461	5.164	.033
MODE	39.429	1	39.429	.046	.832
LEVEL	3119.601	2	1559.801	1.827	.185
2-way Interactions	13210.078	9	1467.786	1.719	.144
DEPT TEXT	5834.443	1	5834.443	6.833	.016
DEPT MODE	2145.918	1	2145.918	2.513	.127
DEPT LEVEL	836.750	2	418.375	.490	.619
TEXT MODE	912.178	1	912.178	1.068	.313
TEXT LEVEL	4249.855	2	2124.927	2.489	.106
MODE LEVEL	218.497	2	109.248	.128	.881
3-way Interactions	5221.707	7	745.958	.874	.542
DEPT TEXT MODE	3227.287	1	3227.287	3.780	.065
DEPT TEXT LEVEL	998.096	2	499.048	.584	.566
DEPT MODE LEVEL	641.319	2	320.660	.376	.691
TEXT MODE LEVEL	46.412	2	23.206	.027	.973
4-way Interactions	9104.940	2	4552.470	5.332	.013
DEPT TEXT MODE LEVEL	9104.940	2	4552.470	5.332	.013
Explained	38977.404	23	1694.670	1.985	.056
Residual	18784.760	22	853.853		
Total	57762.164	45	1283.604		

Appendix 14d: ANOVA with Evaluation as independent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Preview (C5COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	6120.699	5	1224.140	2.793	.042
DEPT	1324.751	1	1324.751	3.023	.096
TEXT	3897.584	1	3897.584	8.894	.007
MODE	121.160	1	121.160	.276	.604
LEVEL	593.293	2	296.646	.677	.518
2-way Interactions	5466.009	9	607.334	1.386	.253
DEPT TEXT	298.532	1	298.532	.681	.418
DEPT MODE	580.247	1	580.247	1.324	.262
DEPT LEVEL	1071.384	2	535.692	1.222	.314
TEXT MODE	652.527	1	652.527	1.489	.235
TEXT LEVEL	2562.943	2	1281.472	2.924	.075
MODE LEVEL	1033.027	2	516.513	1.179	.326
3-way Interactions	3172.483	7	453.212	1.034	.436
DEPT TEXT MODE	51.505	1	51.505	.118	.735
DEPT TEXT LEVEL	598.880	2	299.440	.683	.515
DEPT MODE LEVEL	500.947	2	250.473	.572	.573
TEXT MODE LEVEL	2119.005	2	1059.502	2.418	.112
4-way Interactions	783.725	2	391.863	.894	.423
DEPT TEXT MODE LEVEL	783.725	2	391.863	.894	.423
Explained	15542.916	23	675.779	1.542	.157
Residual	9641.445	22	438.248		
Total	25184.361	45	559.652		

Appendix 14e: ANOVA with Preview as independent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Voc. 1 (C6COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	4974558.655	5	994911.731	13.607	.000
DEPT	83.213	1	83.213	.001	.973
TEXT	1340743.601	1	1340743.601	18.337	.000
MODE	3381196.003	1	3381196.003	46.245	.000
LEVEL	252535.838	2	126267.919	1.727	.199
2-way Interactions	1542135.325	9	171348.369	2.344	.046
DEPT TEXT	74986.830	1	74986.830	1.026	.321
DEPT MODE	13.441	1	13.441	.000	.989
DEPT LEVEL	115406.530	2	57703.265	.789	.466
TEXT MODE	1052931.763	1	1052931.763	14.401	.001
TEXT LEVEL	34925.640	2	17462.820	.239	.789
MODE LEVEL	263871.120	2	131935.560	1.804	.186
3-way Interactions	258272.678	7	36896.097	.505	.822
DEPT TEXT MODE	74686.741	1	74686.741	1.021	.322
DEPT TEXT LEVEL	34326.301	2	17163.151	.235	.793
DEPT MODE LEVEL	109637.153	2	54818.576	.750	.483
TEXT MODE LEVEL	39622.483	2	19811.241	.271	.765
4-way Interactions	41345.540	2	20672.770	.283	.756
DEPT TEXT MODE LEVEL	41345.540	2	20672.770	.283	.756
Explained	6816312.199	23	296361.400	4.053	.001
Residual	1754761.420	24	73115.059		
Total	8571073.619	47	182363.268		

Appendix 14f: ANOVA with Voc. 1 as independent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Voc. 2 (C7COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	5482108.089	5	1096421.618	9.032	.000
DEPT	22282.701	1	22282.701	.184	.672
TEXT	467166.941	1	467166.941	3.849	.061
MODE	4959587.763	1	4959587.763	40.858	.000
LEVEL	33070.684	2	16535.342	.136	.873
2-way Interactions	539214.437	9	59912.715	.494	.864
DEPT TEXT	10138.453	1	10138.453	.084	.775
DEPT MODE	15790.508	1	15790.508	.130	.721
DEPT LEVEL	35756.233	2	17878.116	.147	.864
TEXT MODE	403296.668	1	403296.668	3.322	.081
TEXT LEVEL	41600.368	2	20800.184	.171	.844
MODE LEVEL	32632.208	2	16316.104	.134	.875
3-way Interactions	117008.713	7	16715.530	.138	.994
DEPT TEXT MODE	21930.750	1	21930.750	.181	.675
DEPT TEXT LEVEL	32841.765	2	16420.883	.135	.874
DEPT MODE LEVEL	31283.149	2	15641.574	.129	.880
TEXT MODE LEVEL	30953.049	2	15476.524	.127	.881
4-way Interactions	39053.251	2	19526.626	.161	.852
DEPT TEXT MODE LEVEL	39053.251	2	19526.626	.161	.852
Explained	6177384.490	23	268581.934	2.213	.029
Residual	2913284.570	24	121386.857		
Total	9090669.060	7	193418.491		

Appendix 14g: ANOVA with Voc. 2 as indepenedent variable.

* * * *A N A L Y S I S O F V A R I A N C E* * * *

Voc. 3 (C8COS) by Dept, Text, Mode, Level

Source of Variation	*Sum of Squares*	*DF*	*Mean Square*	*F*	*Sig. of F*
Main Effects	3974814.459	5	794962.892	12.317	.000
DEPT	79235.001	1	79235.001	1.228	.279
TEXT	299283.668	1	299283.668	4.637	.042
MODE	3342240.750	1	3342240.750	51.784	.000
LEVEL	254055.040	2	127027.520	1.968	.162
2-way Interactions	1501233.093	9	166803.677	2.584	.031
DEPT TEXT	100.341	1	100.341	.002	.969
DEPT MODE	63802.083	1	63802.083	.989	.330
DEPT LEVEL	429123.303	2	214561.651	3.324	.053
TEXT MODE	318371.763	1	318371.763	4.933	.036
TEXT LEVEL	458472.241	2	229236.121	3.552	.045
MODE LEVEL	231363.361	2	115681.681	1.792	.188
3-way Interactions	967136.585	7	138162.369	2.141	.078
DEPT TEXT MODE	24.653	1	24.653	.000	.985
DEPT TEXT LEVEL	90616.700	2	45308.350	.702	.505
DEPT MODE LEVEL	396700.925	2	198350.463	3.073	.065
TEXT MODE LEVEL	479794.305	2	239897.153	3.717	.039
4-way Interactions	83064.003	2	41532.001	.643	.534
DEPT TEXT MODE LEVEL	83064.003	2	41532.001	.643	.534
Explained	6526248.139	23	283749.919	4.396	.000
Residual	1548997.740	24	64541.572		
Total	8075245.879	47	171813.742		

Appendix 14h: ANOVA with Voc. 3 as independent variable.

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