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INDIVIDUAL DIFFERENCES IN OCCUPATIONAL PERCEPTIONS: A DEVELOPMENTAL STUDY

BY

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A Thesis submitted in fulfilment of the requirements for the degree of Ph.D. at the University of Aston in Birmingham.

SUMMARY

INDIVIDUAL DIFFERENCES IN OCCUPATIONAL PERCEPTIONS: A DEVELOPMENTAL STUDY

Ph.D. Thesis submitted 1978

BY CHARLES RICHARD STANLEY JACKSON

This thesis presents an investigation of the structure of people's occupational perceptions. The questionnaires used in this study collected both descriptive information about people's perceptions of occupations and also pair comparison similarities data. The data were collected both in the United States of America and England from samples of subjects who differed in terms of age and sex. This provided, therefore, both cross-cultural and developmental dimensions to the study.

A cognitive orientation to the study of vocational behaviour is developed and multidimensional scaling procedures are used to analyze the data. A prime concern of the thesis is to examine the appropriateness of this approach and these techniques to this subject area. The results of this study show that a considerable range of individual differences exist in occupational perceptions. Older subjects have a more complex structure to their perceptions and showed greater consensus as to how they perceived occupations to relate to each other. Younger subjects exhibited a greater range of individual differences in occupational perceptions but had, on average, a simpler subjective occupational structure. The multidimensional scaling procedures used in this study were able to reveal how occupational perceptions were structured, to relate these occupational perceptions to occupational preferences and other evaluative data, and to show that the groupings and structure of occupational perceptions are similar to the dimensions used in occupational classification schemes.

Implications of these results to vocational guidance theory and practice are discussed. The results reported here strongly support both the use of the cognitive approach adopted here and demonstrate the potential of multidimensional scaling techniques for further research in the field of vocational psychology.

KEYWORDS: OCCUPATIONAL PERCEPTIONS MULTIDIMENSIONAL SCALING

VOCATIONAL GUIDANCE INDIVIDUAL DIFFERENCES CROSS-CULTURAL

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1. INTRODUCTION

1.1 At the outset it may be useful to describe the developments that led up to the author's interest in this field of study. An earlier study by the author (Jackson, 1972) had been completed and submitted as a dissertation in partial fulfillment of the requirements for the degree of M.Sc in Applied Psychology. This study involved a mail questionnaire survey of a group of students who withdrew from or failed their exams at the University of Aston in the academic year 1971-72. Each student was sent a questionnaire designed to examine his or her experience of higher education in three phases; before, during and after they were at University. The questionnaire was deliberately open-ended in format, even though this might mean that the questionnaire might take longer and be more difficult to complete, because it was felt that by demanding greater participation from the students, a more positive response might be obtained from them. Although these students had 'failed' in some sense, they were still an able and intelligent group of people who needed to be treated in a mature way. A small sample of students was also interviewed in depth.

For a variety of reasons the response rate to this survey was low. Possible reasons were: the time of year (summer vacation), changes of address and, probably most importantly, the fact that these former students did not want to have anything much further to do with the university at which they had studied unsuccessfully. Although the results from this study, because of the small sample size, were in no way definitive, they did highlight two related problems. First, in almost all cases the students reported that their decisions to come to university were not based on deliberate

career plans or intentions, or on some purposive developmental scheme, but rather on continued movement along the educational 'conveyor belt' which stretches from primary school through to higher education. The second related issue is that few, if any, of these students reported receiving any careers guidance while at school. These two points are well illustrated in the excerpts from an interview given in Table 1.1.

TABLE 1.1

Excerpts from an Interview.

Student: I have always had a feeling for mechanics, but this is the downfall of the whole thing, that my Grandad has been a Motor Mechanic all his life, and of course, I have been used to dabbling with bits of cars and bits of odd machinery (he's got a lathe), and in general sort of messing about really..... and I think I made the wrong assumption of engineering as a university course. I didn't realise the amount of Maths., for one thing, or the amount of Physics. I thought there would be much more practical work involved in it, which I would have liked.

(later in the interview)

You'd think there would be a lot of attention given to each pupil, but as far as careers were concerned there wasn't. I went into the course mainly because I found that all the sixth formers were hoping to go to university, and I think, more or less, I wanted to be in with the crowd, like a lot of people must feel.... and my parents are the type that expect it of you to go to university. You know what I mean, it's something to get a university degree: and I just took it for granted that I'd better go to university, and this seemed to me the course I was most suited to - looking ahead from the sixth form days.

(from Jackson, 1972)

While these results should not be taken as conclusive, both because of the sample size and the post hoc nature of the data collection, which lends itself to rationalization and dissonance reducing explanations, they are suggestive of a key problem in

the process of vocational development. The decision whether or not to go to university, the decision of what subject to study are occupational decisions in the sense that they have occupational consequences. This is not to deny that they do not have implications for other areas of a person's life, such as leisure activities and social life. The fact that people may not even feel they are making decisions at all, or at least not perceive that they are making occupational decisions, is a challenge to those responsible for the development of careers education programmes. There is, however, another point to be stressed here and that is that cognitive and perceptual processes are involved in vocational choice. This emphasis is not new and the point would be appreciated by any layperson taking a common sense view of the choice process. Further implications of this view and a review of the research literature in this field are presented in later sections. At this stage the intention is only to indicate how the results of this study influenced the orientation to be taken subsequently.

1.2 A second major influence on the writer's thinking occurred while he was working on a survey project at the University of Durham North-East Area Study. The title of the study was "Sense of Place and Local Identity in North-East England." At this time it was the writer's intention to carry out a comparative study of the perception of the region in order to contrast the responses of professional groups, such as social workers, planners, teachers, etc., with the replies from the main survey of a sample drawn from the general population. The North-East is a region exhibiting all the indications of economic decline and backwardness on standard social indicators. It was supposed that the account given by the professionals would be moderated by their education, professional back-ground and training, and would, therefore, be different from

that of the general population, which is characterised by lack of occupational and social mobility, and a traditional community-based lifestyle. It was felt that one factor contributing to the continued failure of regional policy to make significant headway in tackling the region's problems might be the divergent perceptions, values and desires of 'planner' and 'planned'.

In contrast to many psychological accounts of people at work that are focussed, either on a fine technical analysis of the skills and tasks that make up a particular job, or on such topics as job satisfaction and the motivation of people at work, the study that would have been carried out would have looked at the social context within which these professional groups were working and how the person perceived and structured their work environment. As well as using a questionnaire, the study might have employed Repertory Grid Technique (Kelly, 1955), or the Cognitive World Structure Game (Tivendell, 1975) to investigate these relationships. Unfortunately, technical faults in the way the main survey was carried out, which would have had consequences for any analysis and interpretation of the data (see Cornish, Jackson, Ursell and Walker, 1977), and external constraints beyond the writer's control made it impossible for this research to be carried out.

1.3 A second approach to this topic was made when the author returned to Aston to continue as a research student. Working within a very similar framework to the one outlined above, this study aimed to look at people involved in counselling work in a range of different settings. A number of pilot interviews were in fact carried out with a variety of people involved in a wide range of activities, all of which had a counselling component. These included: a University Appointments Officer, a Marriage Guidance

Counsellor, a Samaritan, a Social Worker, a Counsellor Trainer, a School Counsellor and so on. The intention of the pilot interviews was to see whether sufficient common elements could be identified in the way these people perceived their counselling work to allow a more detailed inquiry to be developed. However this work was discontinued when the author got the opportunity to spend a year at the University of Minnesota.

1.4 The main reasons for seeking to go to the United States were the opportunity to participate in the more formal American Graduate Programmes, which might be expected to be especially beneficial to someone who did not have a first degree in Psychology, and the research milieu in which the writer would be working. In the United Kingdom the vocational subject area has not recently been an area in which the majority of occupational psychologists have shown much interest and the great mass of the research literature in the English language is American in origin. For research workers in this country, there is the difficulty of deciding whether the results of American work are applicable here.

These new circumstances in which the writer found himself had a profound effect on the development of this research. Being based in a department which has an international reputation for work in this field dating from the 1920's, where there were a large number of other people also working in this field, it would, perhaps, have been more surprising if the writer's interests and plans had not been modified. There are several reasons for the change of focus from a study oriented towards a particular occupational group or groups to one concerned with a rather different aspect of vocational behaviour and development. In part this reflects a change of emphasis from the study of vocational adjustment of people at work to the study

of an aspect of vocational development of people in the process of vocational choice. This change of interest on the part of the author was back to a subject area more in line with earlier work for an M.Sc dissertation, which has already been described.

1.5 The choice of topic and subsequent formulation of the research problem on which a piece of research is to be based can be crucial to its successful completion, as the writer was aware from his previous experience. It was decided early that this year to be spent in the United States would provide a great opportunity to carry out a piece of comparative research, which could subsequently be replicated when the author returned to England. This research might have some general relevance to the wider question of whether the results of American work are applicable in England. The limited time available for the research meant also that the study, at least in the United States, would have to be cross-sectional in design. These two factors, therefore, acted as parameters within which the research plan was developed. The particular orientation and the process of the development of the research are outlined in the following sections.

It was felt also that while there is a great amount of American research work within this field, which could most usefully be replicated in this country, such a study would not meet the requirement that the research work represents an original contribution to knowledge. It might be suggested that such considerations are not purely the concern of the candidate, but also should involve the research supervisor and this is readily admitted and happened in this case. To question the role of Ph.D. degree is not at all the purpose of this introduction, but it is

well known that there has been considerable debate as to its proper form, content and purpose. It seems to the author that to make a useful and original contribution to knowledge must be the preeminent purpose of a Ph.D. dissertation but that the component of research training is also of importance. In this dissertation it is hoped to demonstrate that not only is the first requirement met, but also that the experience of carrying out and reporting research has made the author more competent and qualified to undertake research in the future. In the presentation that follows, there is, therefore, a considerable emphasis on describing both the development of the research and learning process in which the author was necessarily involved in carrying out this study.

1.6 For the evaluation of theories in any area of psychology, it is important to remember, as Merton (1968) has noted elsewhere, that data taken for granted in one discipline may well be problematic to another. Several recent reviews have evaluated theories concerned with the process of vocational choice and development (see Crites, 1969, Osipow, 1973) and have contrasted the heuristic value of theories in stimulating research through giving it focus and direction (Kuhn, 1962, considers this essential for the emergence of science), against the logical and systematic requirements of theory construction that allow the development of hypotheses testable by experimentation. However, although it is quite legitimate to consider the field of vocational psychology as a suitable topic for pure scientific enquiry, the fact is, as Lohnes (1974) elaborates, that historically this is an applied discipline. As a consequence the models used for explanation have become the models of practice. One feature of this applied approach has been that psychologists working in this field have developed ideas in isolation from other related areas of psychology. At the same time

concepts have also been borrowed from these areas and it appears that sometimes those responsible have not recognised the problematic quality of these concepts. One example is the use of the trait and factor model of personality, which implies the existence of stable underlying dispositions within the individual. This approach is certainly controversial among personality psychologists. Initially, therefore, a few points will be raised to clarify the author's perspective on the field, particularly as they effect the use of terminology within this study.

1.7 Murphy and Kovach (1972) have estimated that, "at least 90% of the world's professional psychology is today American" (p.484). Although this could lead to undesirable consequences for American psychologists, it poses real problems for research workers in other countries because of the lack of certainty about the crosscultural validity of much psychological research. Research in the applied fields of psychology is especially prone to the effect of cultural variables. There are potentially serious outcomes if either research results from another culture, which will usually be the United States, are borrowed when their validity in the new culture has not been demonstrated, or if our dependence on one particular source of knowledge excludes consideration of work done elsewhere.

Although the American research literature is easily accessible to British psychologists, there are linguistic differences and these frequently affect the definition of technical terms. For example, in this country the field of 'Occupational Psychology' is usually defined to cover a wide variety of activities related to work and may well derive from the past editorial policy of the journal 'Occupational Psychology'. As an applied field it is juxtaposed to the fields of clinical and educational work. However in the United

States the term Occupational Psychology is rarely used. Industrial/Organizational Psychology is distinguished from Vocational Psychology and, although there may be some overlap between the two fields, the latter is seen as a speciality in its own right.

1.8 The definition of fields of study is not easy, but the issue can be clarified, as Singleton (1967) notes when discussing the relationship of ergonomics to other areas,

> "Much of the controversy about definitions in our general area of interest derives from the naive and invalid assumption that sets must not overlap and thus that the boundary of one discipline must also be the complementary boundary of another."

Borow (1964) has also pointed out that the labelling of a group of research activities in a field of study does not form a scientific classification because the classes of events under study overlap.

Crites (1969) has argued that vocational psychology is a specialty and some credence has been given to this view with the publication since 1971 of the Journal of Vocational Behaviour. Just as Super (1955) saw the publication of the Journal of Counseling Psychology in 1954 as a sign that the field of counseling psychology had come of age, so the publication of a journal in the vocational field as an outlet for research is a sign that vocational psychology has a significant body of knowledge and expertise. The publication of a specialist journal also acts as a stimulus for further research work.

1.9 In this dissertation the term 'Vocational Psychology' will be used to refer to the study of vocational behaviour and development thus making a somewhat finer distinction between

fields than is usual in this country. Vocational Guidance will be used as the generic term for the provision of counselling and guidance in this field. A set of distinctions suggested by Brown (1968) regarding the terms 'job', 'occupation' and 'career' will be followed. He provides a simple example that will serve in place of formal definitions.

> "When a graduate leaves university and goes to work he or she is taking up a 'job' or 'employment'; this job may be in a general field such as electrical engineering, in which case the 'occupation' could be electrical engineer. The word 'occupation' is therefore more closely connected with 'career' which is a person's course of employment throughout life; whereas a person may have several jobs or even more than one occupation during that career."

The term 'career' will also be used in a broader sense, which is given in the following definition by Hansen and Gysbers (1975), "Career is viewed broadly to stress life roles and lifestyles, occupation being considered only one part of career....."

To further assist in the clarification of culturally loaded terms, which might be confusing to the reader, and where an Americanism has been used as the most appropriate and correct description, (this is frequently the case in the description of the fieldwork carried out at the University of Minnesota), the nearest equivalent English term has been placed afterwards in brackets. It is hoped that in this way the meaning will be as clear as possible to the reader.

1.10 To conclude, this introduction has aimed to outline the background to the development of the research and to identify some of the more problematic aspects of the underlying assumptions with which researchers in this field must come to terms. It has also presented a perspective on some of the contrasting definitions used in this field and in particular has attempted to clarify some differences between American and British usage of special terms. As the dissertation includes data collected both in the United States and this country and as it is hoped that it will be of interest to people in both countries, the writer feels it necessary to point out possible areas of confusion.

2. A COGNITIVE APPROACH

2.1 Much contemporary work in psychology has been concerned with 'cognition' - a term used to describe both the process by which a person experiences and understands the world and the end result of that process. The cognitive approach emphasizes that,

> ".....we have no direct, immediate access to the world, nor to any of its properties... Whatever we know about reality has been mediated, not only by the organs of sense but by complex systems which interpret and reinterpret sensory information."
>
> (Neisser, 1967, p.3)

This emphasis has its antecedents in the work of Bartlett and Piaget and their concept of 'schemata'. Bartlett (1958) also argued that cognitive activity is a constructive act and might be viewed as an advanced form of skilled behaviour. This perspective on human behaviour can also be traced to books, such as Miller, Galanter and Pribram's 'Plans and the Structure of Behaviour' (1960) and to work on problem-solving that has stressed certain analogies between human cognitive processes and computer programmes (Newell, Shaw and Simon, 1958). More recently cybernetic analogies have identified the role of information as the feedback guiding human behaviour (Annett, 1969).

Although much of the research in the cognitive tradition is being carried out in areas of psychology which bear only indirectly on the subject areas of personality and social psychology, Mischel (1975) points out that the cognitive orientation has major implications for the study of persons. In the following pages, the potential contribution of this approach to the understanding of vocational behaviour is discussed, but first some of the

cognitively oriented work in the field of personality psychology will be reviewed.

2.2 There are two broad approaches to the study of personality that can be described as having a cognitive orientation. The first, which will be called the 'phenomenological' approach, includes the work of such well-known psychologists as Lewin, Rogers and Kelly, while the second is found in contemporary work subsumed under the heading of 'social behaviour theory' and in particular the work of Mischel (1973). A brief review of these approaches will highlight some similarities and differences between them; it will also demonstrate that although cognitive psychology is concerned with much of human activity, it does not provide a complete account of behaviour on its own.

There are numerous antecedents in psychology and philosophy to the phenomenological approach, which deals with the 'self' and the person's subjective, internal experiences and personal concepts. The first theory mentioned here will be the Field Theory developed by Lewin (1936) which introduced the notion of the life space and emphasized the importance of the psychological environment. Lewin's theory identified the difficulty of predicting a person's behaviour and consequently focussed on the description of the psychological situation and the identification of the dynamic factors that cause change in the way a particular situation is structured. The renewed interest and recognition of the importance of the psychological environment has made Lewin's work topical once more.

In the development of psychotherapeuatic methods, primarily client-centred therapy, Carl Rogers (1942, 1951) has developed a

theory of personality and behaviour usually referred to as 'self' or 'self-concept' theory. Summarizing the theory, Roger writes,

> "This theory is basically phenomenological in character, and relies heavily upon the concept of the self as an explanatory construct. It pictures an end-point of personality development as being a basic congruence between the phenomenal field of experience and the conceptual structure of the self - a situation which, if achieved, would represent freedom from internal strain and anxiety, and freedom from potential strain; which would represent the maximum in realistically oriented adaptation; which would mean the establishment of an individualized value system having considerable identity with the value system of any other well-adjusted member of the human race."
>
> (Rogers, 1951, p.532)

In reviewing this theory and noting how it highlights many of the major points of both a phenomenological and humanistic approach to psychology, Mischel (1975) notes that the theory,

> ".....emphasizes the person's perceived reality, his subjective experiences, his organismic striving for actualization, his potential for growth and freedom. It rejects or deemphasizes specific biological drives, and focusses on the experienced self rather than on historical causes or stable trait structures. A unique feature of Rogers' position is his emphasis on unconditional acceptance as a requisite for self-regard."

The third theory to be mentioned in this section is Kelly's

(1955) Personal Construct Theory, that puts forward a model of "Man the Scientist" always trying to understand the world he lives in. Bannister and Mair (1968) write,

> "Construct theory explicitly argues for construing as a fundamental process and for construct systems as changing strategies for dealing with the person's world...."

The phenomenological approaches of Rogers and Kelly are characterized by their emphasis on the person's experience as he perceives it. Both have been concerned to collect empirical data to anchor their theories in objective and scientific methods. Rogers has worked from the transcripts of face to face interviews to collect self-reports, while Kelly has developed Repertory Grid Technique as a method appropriate for the study of personal constructs. Both these methods have been widely used in clinical and research settings as methods for describing the subject's phenomenal world and have demonstrated that useful information about the subject can be obtained directly, simply by asking him. Mischel (1968) has noted that the predictions made on the basis of this type of data have not been bettered by those obtained by indirect psychometric methods or by expert judges.

This approach to the study of people has much in common with that taken by existentialist philosophers in that both reject many of the preconceptions of other approaches. Sartre writes:

> "For us, man is defined first of all as being 'in a situation'. That means that he forms a synthetic whole with his situation - biological, economic, political, cultural, etc. He cannot be distinguished from his situation for it forms him

> and decides his possibilities; but, inversely, it is he who gives it meaning by making his choices within it and by it."
>
> (Sartre, 1946, p.59)

2.3 Before examining some of the implications these approaches hold for the study of personality and the relevance of these approaches to the field of vocational psychology, some work in the tradition of social behaviour theory by Mischel will be briefly presented. This representation is based on a recent review article (Mischel, 1973) that summarises recent work in the field and presents a reconceptualization with a distinct cognitive orientation.

Although early behaviouristic learning theory approaches to the study of personality did not emphasize the role of cognition in learning, more recent formulations have been concerned with the effect social variables have on learning (e.g. Bandura and Walters, 1963). As a consequence, and in contrast to, trait theories of personality, which hypothesize cross-situational consistency and broad dispositions as the basic units of personality, social learning theories stress that similar behaviour can only be expected in a range of situations to the extent that it is likely to lead to similar consequences. Even though in certain areas, particularly those related to cognitive and intellective styles, consistency is marked, results generally tend to indicate that the idiosyncratic organization of behaviour within the individual and the complexity of the person/situation interaction are such that the number of moderator variables required for the explication of the interaction is very large. Mischel suggests that man's very subtle 'discriminative facility' is accurately reflected in the

inconsistent results obtained in much research, but that, in spite of all this, continuity in people is recognised.

In the light of concepts drawn from the study of cognition and social learning, Mischel proposes the use of five sets of variables for the study of individuals as an alternative and more adequate theoretical approach to the study of personality. These are:

1. Cognitive and Behavioural Construction Competencies.

The ability to construct (generate) particular cognitions and behaviours which is related to measures of IQ, social and cognitive maturity and competence, ego development, social-intellectual achievements and skills. This refers to what the subject knows and can do. Cognitive skills and behaviour-generating capacities tend to be enduring and may be important in the creation of the impression of the consistency of personality.

2. Encoding Strategies and Personal Constructs.

These are units for categorizing events and for self-descriptions. Clearly different persons may group and encode the same events and behaviours in different ways.

3. Behaviour-outcome and Stimulus-outcome Expectancies in Particular Situations.

Adaptive performance is the recognition and appreciation of new contingencies depending on the individual and cultural meaning of the stimulus and the perceived intentions of motivating behaviour.

4. Subjective Stimulus Values of Outcomes to Individuals.
Motivating and arousing stimuli, incentives and aversions may mean that even when people have similar expectancies they put different values on the possible outcomes.

5. Self-regulatory Systems and Plans.
Self-imposed goals and self-produced consequencies regulate behaviour. That is, subjects adopt their own contingency rules to guide behaviour in the absence of, or in spite of, immediate situational pressures.

Mischel suggests that people will differ in all these areas and that variables in the psychological environment of the individual will influence the person variables, affecting cognitive and behavioural activities. These five sets of variables, concerned as they are with how an individual structures his behaviour, how he structures new information, how he evaluates that information and how a strategy is decided upon for behaviour, are essentially cognitive in orientation.

2.4 There are certain similarities, perhaps unexpected, between the 'Cognitive Social Learning' approach and the phenomenological approaches of Rogers and Kelly, and these have been commented on by Mischel (1975). Both approaches stress the importance of subjective and cognitive variables in the explanation of behaviour, but it must be made clear that in behaviourally oriented accounts, cognitions and self-concepts are not seen as the pervasive determinants of personality. The relations between cognitions and behaviour are often quite indirect. Evidence from work on Cognitive Dissonance (Festinger, 1957) or Self-Perception Theory (Bem, 1972) has suggested that cognitions may change to be brought

into line with behaviour. Neisser (1967) makes clear that he realises that a cognitive account on its own is incomplete, especially for an understanding of higher mental processes, but it will be taken for granted here that any account which does not consider cognitive variables must also be incomplete.

2.5 The study of personality is closely related to the vocational area in the range of topics that it covers and in its concern with the whole person rather than some particular aspect of the individual. Cognitive approaches to the study of personality are, therefore, particularly relevant to accounts of vocational behaviour.

The domain of vocational psychology, vocational behaviour and development, is also a prime example of a field of psychology where cognitive approaches are appropriate. From Parsons' true reasoning on the relation between data about the self and data about occupations to Super's argument that work is one specific activity through which the total personality can manifest itself (Super, 1957), the outlines of a cognitive approach in vocational psychology can be discerned. Learning about the world of work, thinking about occupations, engaging in occupational decision-making are but three examples that demonstrate the importance of cognition to vocational behaviour and development.

It is accepted that one of the essential characteristics of being human is the continuous interaction with the environment, which is selectively perceived, structured and acted upon. It has also been long recognised that:

"The conceptions which men form of themselves seem to depend upon their vocations, and in general upon

> the role which they seek to play in the communities and social groups in which they live, as well as upon the recognition and status which society accords them in these roles."
>
> (Park, 1931)

It is suggested, therefore, that not only are cognitions important to an account of vocational behaviour, but also that a person's cognitions will be influenced by the position in which he finds himself in the occupational world.

It would, however, be misleading to imply that vocational psychologists have ignored cognitive approaches because such an orientation is often implicit in their ideas. Super (1976) has frequently described vocational or career psychology as drawing upon life-span developmental psychology and cognitive psychology. Rogers work, in particular, has been influential in vocational psychology. Using the concept of self, Super (1951) has suggested that in making vocational choices an individual is actually attempting to develop and implement a certain self-image. This approach has provided both an orientation for counselling and guidance practice and introduced for evaluation a new outcome to the choice process.

2.6 One study has attempted to do this using Repertory Grid Technique (Oppenheimer, 1966). This technique was considered by Crites (1969) to be, "The best measure of self-concept and the one which most closely fits the model for translating 'psychtalk' to 'occtalk'..."('Psychtalk' is the term used by Starishevsky and Matlin (1963) to refer to the individual's subjective language for talking about the world, which has to be translated to 'occtalk', the language used to talk about occupations.) Oppenheimer,

investigating the relationship between occupational preferences and self-constructs, found that people prefer occupations perceived as congruent with their self-constructs. He also studied the relationship between ideal and actual self-concepts and used a measure of the discrepancy between the two as a measure of self-esteem. Self-esteem was found to be positively correlated (r=.33) to the degree of agreement between self-concepts and occupational preferences. Further analysis indicated that people with low self-esteem preferred occupations congruent with their ideal self-concepts rather than occupations perceived as congruent with their actual self-concepts.

Oppenheimer also considered whether cognitive complexity, expressed as the number of independent construct dimensions generated by the subject on the modified Repertory Test, was related to the similarity between self and occupational preferences. It was hypothesised that

> "cognitive complexity would be associated with more accurate and thoughtful judgements in formulating occupational preferences, which should be reflected in a higher level of agreement between self-concepts and concepts of occupational preferences for cognitively complex people."

Although no significant relationship was found between the variables, the cognitively complex person was found to be using more dimensions with their self-concept in formulating occupational preferences and Oppenheimer suggests that the more cognitively complex person might perhaps be more satisfied with their occupational choice.

2.7 The studies by Korman (1966, 1967) support the prediction that self-esteem acts as a moderator variable in the vocational choice process. Those who were high in self-esteem were found to use their self-perceived needs differently from those who think relatively little of themselves. It is not that people high in self-esteem perceive occupations differently from those low in self-esteem, but that they attach greater weight to information which confirms their self-rating. This suggests two questions, first, how do people's self-perceptions both of occupational and other information differ and, secondly, what factors both in the person and in the environment affect the way people use data from their self-perceptions in making choices?

Studies in this second category have investigated both the effect of structural variables in cognition, such as cognitive complexity and its effect on vocational choice (as well as the paper by Oppenheimer already cited, see also Bodden, 1970, Bodden and Klein, 1972 and Bodden and James, 1976), and also style variables, such as self-esteem (see Osipow, 1970). There is a distinction between variables to do with the representation of information, which will differ both across persons and situations, and variables that can be considered, perhaps, as more general personality variables. Both sets of variables are cognitive in orientation, but there does seem to be a danger that these variables are seen as causing or affecting behaviour rather than being affected themselves by the actual behaviour of the person or the situation in which the person finds himself.

2.8 This approach to the study of vocational behaviour and development, drawing largely on concepts introduced by Rogers and

Kelly, can be contrasted with the analysis developed by Jones (1973) which draws an analogy between the study of attitudes and occupational choice behaviour. Jones noted that 'interests' are one of the core concepts of vocational psychology and that there are certain similarities between the concept of interest and the concept of attitude in social psychology.

Both concepts are difficult to define, but the classical viewpoint of Katz and Stotland (1959) is probably the most widely accepted definition of attitude. An attitude is defined as an individual's tendency or predisposition to evaluate an object or symbol in a certain way. Three components of an attitude are distinguished;

(1) the cognitive component, consisting of beliefs or knowledge about the qualities of the object;

(2) the affective component, consisting of feelings and physiological reactions triggered off by the presence of the object;

(3) the behavioural component, consisting of action tendencies or behavioural intentions.

Katz and Stotland make further distinctions and identify five types of attitude that vary according to the function they serve and also according to which of the above three components dominate.

2.9 Vocational psychologists have not reached a consensus on the definition of the concept of interest or the relationship between interests and related concepts such as values or needs. There have been various studies which have attempted to classify the different components of interests, needs and values and which have noted the similarity of these conceptions. Super (1949) provided some useful clarification of possible definitions of interest, by relating the

method of assessment to the definition. In this way four kinds of interest can be defined:

(1) Expressed interests - expression of a specific interest or preference.

(2) Manifest interests - shown by actions and participation in activities.

(3) Inventoried interests - estimated from replies to interest inventories.

(4) Tested interests - shown in 'objective' tests of information or knowledge.

2.10 Jones notes the similarity of this four-fold typology to the three component view of attitude. The cognitive component is similar to Super's tested interests, the affective component is equivalent to inventoried interest, while expressed interest might represent a self-rating (possibly inaccurate). Finally Jones suggests that the behavioural component is clearly similar to manifest interests.

In making this juxtaposition Jones is deliberately attempting to draw attention to some of the implications the social psychologists' concept of attitude have for any conceptualization of vocational behaviour and development. These implications are:

1. The de-emphasis of the importance of correct information and the suggestion that incorrect information and stereotypes could be equally important in the formation of the cognitive component of an occupational attitude.

2. That change and stability in interests or occupational preferences should be seen as involving attitudinal mechanisms of learning and consistency, and the interaction of different motivations.

3. To question the idea of 'occupational choice' as involving only one or two occupations, but rather to consider that a person's attitude exists to some degree towards a number of occupations.

The first two points are particularly relevant to this study. This analogy suggests that the perception of occupations is an important part of any cognitive component of attitude. Data on the development and formation of attitudes might influence ideas about how vocational development occurs. Equally, social psychologists' ideas on the development of attitudes in naturalistic settings might benefit from consideration of information on the development of vocational choices.

2.11 The suggestion that the perception of occupations, or as it is sometimes referred to 'occupational cognition', is relevant to the study of vocational behaviour and development is not new. Zytowski (1968, p.86) notes;

> "If, indeed, vocational behaviour is structured and actualized on the basis of some portion of perception, as opposed to real experience, considerably more study of the perception of occupations is appropriate, and some terms which account for it must be woven into our conceptualizations of the activity of pursuing a career."

Reeb (1959) was one of the earliest to suggest;

> "Vocational choice, however unreliable or uninformed, is the result of a motivational scheme operating on some mental configuration." (p.3)

More recently he has commented on the neglect of the study of the way people perceive the world of work (Reeb, 1974). He notes that in Crites' (1969) 'Vocational Psychology' the few studies concerned with, "the ways in which persons perceive occupations and the attributes they ascribe..... to their members" are relegated

to a footnote (p.54). Research work in this area is reviewed in a following section, but at this stage it is worth noting that much of the research is concerned with the traits people ascribe to occupations and the accuracy of these descriptions, rather than the role of such perceptions in the understanding of vocational behaviour and development. This topic has also been neglected by social psychologists. One might have expected people interested in interpersonal perception to have used occupational stimuli, as occupation is generally considered to give much evidence about social status, role and social behaviour.

While Crites (1969) has distinguished vocational behaviour from other kinds of behaviour in that the stimulus that evokes it is occupational, it seems only more surprising that the study of how people perceive occupations has not been related to vocational theory earlier. It is necessary to make clear that occupations are not perceived directly in the same way as physical objects, but have a certain similarity to the perception of persons which as Cook (1971) commented; "....can cover a variety of judgements, decisions or reactions, on a number of different levels." Jones (1973) in his review has also noted that the perception of occupations involves complex cognitive processes, through which a person transforms a variety of data into an organized set of attitudes and perceptions, and that the perception of occupations might have something in common with work on 'impression formation' and the study of 'attitude development' in social psychology. In elaborating this idea further, Jones writes;

> "The term, 'perception' as applied to occupations does not refer solely to perceptual processes that occur when an individual is confronted with occupationally relevant

> stimuli. Rather it refers to the complex of beliefs and assumptions which exist in the individual's memory. The term incorporates the processes by which this complex came to be organized as it is, and how it is likely to incorporate new information. Thus studies of the 'perception' of occupations might be more accurately described as studies of how people form concepts about the occupational world, how they interrelate these concepts, and how they manipulate and evaluate them when making vocationally relevant decisions." (p.34)

In this quotation it is hard not to notice a certain similarity between the 'cognitive social learning' variables proposed by Mischel and the type of variable and process described by Jones. However, this use of the term 'perception' covers both what Mischel would call 'Encoding strategies and Personal Constructs' - basically the cognitive component of attitude - and also in part all the other four sets of variables that Mischel identifies, which include behavioural and affective components as well as cognitive elements. This seems to suggest that the whole study of vocational behaviour is only the study of the perception of occupations, rather than that the perception of occupations is one component or set of variables that must be considered in any complete account of vocational behaviour.

By suggesting that the term 'perception of occupations' should have a more circumscribed use, it is not denied that these other components or sets of variables are not also relevant to the study of vocational behaviour. Although the empirical work to be reported here focuses almost exclusively on this one component of

vocational behaviour, this is seen as involving much more than the definition of the stimulus and to have wide relevance to the fields of vocational psychology and vocational guidance.

In the field of psychophysics Stevens has argued that the problem of the definition of the stimulus is central. However, as Gregson (1975) points out, in many judgment situations the role of stimuli that are not present must also be considered. He adds that until comparatively recently the judgment of relations between stimuli - the judgment of similarity - has been another topic in which only a few workers have shown interest. For the vocational psychologist interested in vocational choice it is the relationships between many occupational stimuli that is most likely to provide evidence of the types of concept that individuals hold about the occupational world. Unfortunately in many studies, as Jones noted, the emphasis has been on the attitudes towards only one or two occupations. To understand how individuals use these concepts in vocational decision-making it is necessary to consider the other sets of variables that Mischel identifies and how they are used and combined to make choices. Concepts may be refined or elaborated in particular situations, but this is seen initially by the author as a secondary consideration, while the primary focus is on the structural variables of occupational cognition and developmental and individual differences between people.

2.12 In elucidating these terms it is useful to consider the distinction made by Vroom (1964) between occupational preferences, occupational choices and occupational attainment. In his conception people are considered to have preferences among occupations, but these preferences may be differently evaluated

when the individual comes to make choices among occupations. The expectancies an individual has of his ability to enter a particular occupation may result in the chosen occupation being different from the preferred occupation. Occupational attainment is, of course, denoted by entry into a particular job and the selection process is governed by social and economic factors as well as individual variables. These three terms can also be related to the three component view of attitude. Both occupational choice and occupational attainment have behavioural components, in the former case at the level of behavioural intentions, in the latter case in the form of overt behaviour. The affective component may be considered to be primarily involved in the formation of occupational preferences, although there is also a significant affective component in the formation of occupational choices. Just as attitudes are seen to have cognitive foundations in the beliefs of the individual, so antecedent to the formation of preferences it is possible to identify the ideas and perceptions individuals hold about occupations and work. The view of occupational decision-making elaborated by Vroom using Expectancy Theory seems also to suggest that a cognitive model is appropriate to the study of vocational behaviour.

2.13 Although it is not the intention of this review to consider research on interest measurement except where it is relevant to the matter in hand, it is useful to note that Cooley (1966) has suggested that interest inventories may frequently be measuring two distinct but related concepts. In reporting the results of the Project Talent follow-up studies (Flanagan et al., 1966), Cooley notes after examining the relationships between Interests, Abilities and Career Plans that the results he reports,

> "are consistent with the proposition that vocational interests reflect aspects of self-concept while at the same

time seem to be measuring dimensions of motivation. Interests appear to be measuring self-concept because interests change as the student matures and gains a more realistic picture of his own abilities and motives and those needed for various occupations. Interests appear to be measuring basic motives because they seem to affect the development of abilities and the career planning of the individual to some extent."

He suggests that this may be because of the type of content included in the interest inventory used in the Project Talent follow-up. He continues:

"Future research may show that interest measures which are based on student activities and specialized knowledge have a larger motivational content, while those based primarily upon occupational titles come closer to measuring self-concept and student perceptions of occupations. As long as interest inventories continue to be mixtures of different kinds of items, they will exhibit this confounded behaviour of simultaneously seeming to anticipate changes in abilities and plans and yet change themselves to become more consistent with previous abilities or new plans."

Cooley seems to be suggesting that, in practice, the distinction made by Super between types of interest will not always work out. In suggesting that interest inventories also measure perceptions of occupations, it would seem that Cooley means that students make their judgements in stereotypical terms and that their judgements therefore reflect the stereotypes students hold of occupations.

2.14 The following sections review work on the perception of occupations. Two broad approaches to the study of people's perceptions of the world of work are identified. The first focuses on the content of occupational stereotypes, while the second is concerned with the underlying structural dimensions of the world of work and the cognitive models that individuals hold of the occupational structure. As this study is mainly concerned with the structure of occupational cognitions, research on the content of occupational stereotypes is reviewed in less detail than studies that have been concerned with the structure of occupational perceptions. A major part of the review is concerned with examining in detail five sets of studies that have used multidimensional scaling methods to study occupational perceptions.

Although the two approaches to the study of people's perceptions of the world of work are treated separately in the review that follows, the two areas of research do have a certain amount in common. As well as having broad relevance to vocational psychology and to sociology, both research traditions have implications for aspects of vocational guidance theory and practice. Some of these are mentioned in the review that follows. Two areas of practical application will be mentioned here, because they will not be considered in detail in the review. These applications will be expanded in a later section of the thesis where they will be related to the evaluation of the data from this study. The first of these is occupational classification, how occupations might be most usefully grouped together, and what underlying dimensions of the world of work can be identified. Research on interest measurement and job analysis is also pertinent to this area and

will be referred to in that section. The second topic that will be considered then is the relation of these cognitive variables to the occupational choice process. These variables are concerned with aspects of cognitive structure and are therefore different from the cognitive style variables that Osipow (1970) considers. The role of the perception of occupations to theories of career development and the implications of this cognitive approach to studies of occupational decision-making will also be discussed at that point.

3. THE CONTENT OF OCCUPATIONAL STEREOTYPES.

3.1 Much of the work subsumed under this heading has concentrated on describing the content of work and the attributes people ascribe to particular occupational groups. Traditionally the research has emphasized the pervasive existence of occupational stereotypes and has been concerned with the accuracy of the stereotypes people hold of either particular jobs or occupational groups. However, more recently there has been a trend away from this type of study to look at such aspects as the sexual stereotypes of occupations (Shinar, 1975), and the stereotypes women hold of occupations (Pratt, 1975).

Reviewing the traditional area of research, Marks and Webb (1969) reported that:

(1) College students have reliable stereotypes of a wide variety of high level occupations.

(2) These stereotypes differentiate between occupations.

(3) Differences in occupational stereotype even between first year students (freshmen) and postgraduates working in the occupations are very slight.

(4) There is a high correlation between self image and description of chosen occupation.

The results of this and similar studies (O'Dowd and Beardslee, 1960) suggest that students have accurate images of the typical job incumbent. It is immediately obvious that Marks and Webb are referring to results at a general aggregate level obtained from groups of students. Individuals (see for example Table 1.1) may have quite incorrect ideas as to what a particular occupation involves. However, even if the results are to be applied only at

the group level, there are a number of qualifications that must be made to this statement.

3.2 One of these relates to the range of job titles for which people might be expected to have reasonably accurate stereotypes. Osipow (1962) found that students differed in their attitudes when presented with a pair of alternative job titles (Building Superintendent and Janitor) for the same occupation, but that these differences disappeared when a short job description was included with the job title. From this study it is not possible to make any inferences about the accuracy of the students ratings, but only to suggest that a specific job title, itself, may give certain cues to the subjects that can affect the rating procedure, and that these cues can be counterbalanced by a job description.

The fact that the students ratings were affected by the job title chosen, suggests a limitation to the number of different jobs about which people might be expected to have some information and, hence, accurate stereotypes. The personal experience of college and university students is likely to have given them contact with members of higher level occupational groups and, conversely, the experience of 16 year old school leavers is likely to mean that they have information at their disposal about a somewhat different set of occupations. This suggestion is partially confirmed in a study by Banducci (1970), who found that with American Senior High School boys, high academic development correlates with having an accurate stereotype of high level jobs and low academic development correlates with an accurate stereotype of low level jobs. Students with crystallized vocational plans and those categorized as Realistic, Investigative or Enterprising from their scores on the

Holland Vocational Preference Inventory (Holland, 1965) were found to have the most accurate stereotypes.

At a more practical level, Kelso's (1975) study indicated that students who expected to leave school before completing twelfth grade (18 years old) showed higher levels of realism in their vocational choice. The measure of realism developed for the study compared students' self-assessment on abilities, interests, etc., with those known to be associated with their preferred occupation. This indication that these students made accurate self-assessments congruent with their occupational choice is some indirect evidence that they have accurate stereotypes both of themselves and their preferred occupation and that they can use this information in decision-making.

These two studies, therefore, suggest that it is important to consider the situation of the subject, whether he/she is at school or university, whether male or female, of what social class, to give only a few examples. Walker (1958) in his early study has noted that some occupational groups are more stereotyped than others. Among the university students who were his subjects, there was least variability in the characteristics ascribed to doctors and factory owners, and greatest variability in the adjectives used to describe trade union leaders and factory workers. The number and range of occupations about which an individual is likely to have accurate information will be limited and will be affected by this large range of factors. Of particular relevance to this study will be the extent of cross-cultural differences in occupational stereotype.

3.3 A second major area of concern with studies in this category relates to certain methodological limitations of the studies. Most research studies concerned with the nature and accuracy of occupational stereotypes, as well as studies in related areas such as sex-role stereotyping, have requested their subjects to rate the stimulus object, in this case an occupational title, on a number of specific attributes or bipolar rating scales. Even when these lists have been compiled from sets of constructs elicited from the subjects, as in the study by Triandis (1959b), Frieze (1974) has correctly criticized such a research situation because it constrains the subjects to generate stereotypes although they might not normally think in stereotypic terms.

There is another related issue also concerned with the methodological aspects of these studies, and that is whether the subjects can actually rate the stimulus material using the constructs supplied by the experimenter, and whether what the subjects understand by the construct is the same as the experimenter originally intended. This is a problem inherent in all questionnaire based research, and is well illustrated in a paper by Speak (1967). In this study a questionnaire survey was followed up by long in-depth interviews with the respondents to elaborate what they meant by their replies to the original survey. Although some of the questions included in the study contained deliberate ambiguities in order to investigate the nature of communication errors, the extent of error was shattering to the researcher. Of the seven questions followed up with each respondent, not a single question was found to be correctly understood as intended by everybody who answered it, and not one person understood all the questions as intended.

Effects such as these can introduce systematic errors into research results. For an example in the vocational field, a paper by Hakel et al. (1971) reports the results of a study using a forced-choice test constructed to determine how well students could discriminate between occupations on the basis of the average intelligence of the members of the various occupational groups. Accuracy at identifying the occupation in the pair with the higher average intelligence was significantly worse than chance, because subjects appeared to rely exclusively on prestige to make their choices, selecting the occupational group of higher status as the group with the higher average intelligence.

A further question raised by Triandis (1959a) is, "to what extent does the man determine the perception of a job, and the job the perception of the man?" Although in his research Triandis elicited constructs separately for the people and the jobs, there was some overlap of constructs, and he found that when he compared the rating of Mr. T., the Personnel Director, and the Personnel Director's job on equivalent bipolar scales, the ratings were very similar. These results suggest that it makes little difference whether the job incumbent is being rated or the characteristics of the job itself.

3.4 In spite of these methodological problems, this kind of research has proved valuable in highlighting the importance of occupational stereotypes and their effect on vocational behaviour, although the finding by Brown (1961), that secondary modern school leavers tend to wish certain characteristics into jobs, makes it difficult to know which comes first, the occupational preference or the occupational stereotype. This suggests that this is no simple

chicken and egg problem, but a subtle interaction effect. In the applied vocational guidance context, however, the counsellor should be aware of these halo effects and have the skills to cope with them.

One example of a problem which must occur frequently is when counsellors use interest inventories which use job titles as items. The counsellor cannot assume that the client will understand the job titles as representing particular interest categories and must decide whether clients' stereotypes of the job titles are accurate or not. This can in some situations provide the counsellor with a good opportunity in a subsequent interview for discussion of the world of work and the client's perceptions of himself in relation to the world of work. This also relates to the point made by Cooley(1966) that the type of item used in interest inventories affects what they can be considered to be measuring (see Section 2.13).

3.5 A second applied use of results of the research on occupational stereotypes is concerned with the accuracy of the material, which is comparatively easy to collect, and consequently the possible uses of the data in place of more costly objective data collection procedures. For instance, Desmond and Weiss (1975) reported data collected from workers and supervisors in eleven different jobs, who were asked to estimate the ability requirements of their jobs on the dimensions of the General Aptitude Test Battery (GATB, US Department of Labour, 1967). The results obtained compared favourably with Occupational Aptitude Patterns obtained from GATB (US Department of Labour, 1966) and suggest that workers can estimate the ability requirements for their jobs and that workers might also be able to make more complex judgments

regarding aspects of their jobs than they have previously been given the opportunity to make.

3.6 The third area where it can be expected for research on occupational stereotyping to have a major impact is on the position of women and other 'disadvantaged' groups, both in the United States and United Kingdom. In documenting the nature and scope of these prejudices, questionnaire based survey research can provide valuable information about the barriers to employment facing members of these groups in contemporary societies. The criticism made of Psychologists and other Social Scientists that they have neglected to include women in their subject populations and have frequently ignored the special problems of women and minority groups, is well known. This is an especial weakness of much so-called applied research in occupational and vocational psychology. Yet it is acknowledged that the position of women in the workplace is quite different from that of men in several ways. The demographic data on the distribution of women in the labour force are probably the most obvious example of this, but equally important, perhaps, is the quite different career structure in which women find themselves.

Psychologists (Zytowski, 1969, Wolfson, 1972) and Sociologists (Sobel, 1965, Psathas, 1968) concerned with the career development and career patterns of women have noted that they cannot be described in the same terms as those of men. This should not be ascribed to prejudice as Zytowski's comment on his own scheme makes clear,

> ".....the author would like to reiterate the hope that altered social expectations and technological innovation

will ultimately result in the obsolescence of this entire scheme."

Wolfson identifies five factors which might distinguish the vocational development of women. All of them are related either directly or indirectly to marriage. They are:

(1) the focus on marriage

(2) the unpredictability of future roles

(3) a lack of work orientation

(4) a lack of vocational identity

(5) the absence of realistic occupational-vocational planning.

For man, work is an integral part of the adult life, but for women there is an initial choice, however circumscribed, whether or not to work. This choice may have ramifications, a woman must decide how much of her life is to be devoted to work and this affects other choices and decisions about marriage and children, whether to work full or part-time, etc.

The position of blacks, immigrants and other minority groups is analagous in many respects to the position of women and can usefully be highlighted by research on the content of occupational stereotypes. Although knowledge alone will not remove discrimination, without research it is not possible to form action plans to eliminate the effects of these long established prejudices.

3.7 Although research on the nature and content of occupational stereotypes is useful to occupational psychologists in the ways outlined above, there are certain problems where this type of research is of only limited use. By their very nature research data of this kind are subjective and idiosyncratic and, therefore, cannot provide the basis for the construction of objective taxonomies of work, or

be used to identify objective dimensions for the classification of occupations, although both of these activities can be influenced by the results of such research. These topics, which are fundamental to a psychology of occupations, must be considered on the basis of more objective data, such as the factor analysis of interest inventories, task analysis of particular work situations and so on.

Data on occupational stereotypes are also important guides to the attitudes of people towards work and as such are a significant component of studies concerned with the development of attitudes towards work and the gradual change that takes place in these attitudes over time. The introduction of Careers Education in schools is aimed in part to inform school children about the world of work and may be expected to alter the stereotypes children hold about occupations. The renewed interest in research into the transition from school to work may be expected to provide in the long term valuable evidence both on the development ofand change in attitudes towards work over the transitional period, and also data that will enable the partial evaluation of different types of Careers programmes in the schools. This work may also fruitfully extend understanding of the stages of vocational development and relate this research to concepts in social psychology about the development of attitudes.

4. THE STRUCTURE OF OCCUPATIONAL PERCEPTIONS.

4.1 An alternative approach to the study of the subjective aspects of the perception of occupations has focussed on the structural components of these perceptions, recognizing, as Jones (1973) suggests, that the notion that occupations are perceived as aggregates of simple qualities ignores any kind of 'gestalt' properties that occupations may possess. Research work in this field has been carried out for a wide variety of purposes, but before considering these in detail, this review will present a descriptive account of the variety of tasks and investigations that are being considered under this heading.

4.2 One of the earliest direct studies of how occupations might be grouped together was reported by Vernon (1949). He was concerned with the classification of high-grade occupational interests, that is how occupations typically entered by university graduates might be grouped together. The main purpose of the study seems to have been to explain the occupational interests of graduates by identifying a set of underlying factors among a set of 58 occupational titles chosen to represent the variety of high level occupations open to university graduates. This study can be distinguished from earlier factor analytic studies of interests, because instead of being based on the factor analysis of an interest inventory, the subjects were asked to rate directly on a seven point scale the similarity of pairs of occupational titles. Although with 58 titles there are 1653 possible pairs of titles, individual subjects were only asked to rate a small subset of the pairs, but because the subjects were asked to rate different sets of titles, each of the 1653 pairs was rated

several times by different subjects. Inter-columnar correlations were calculated to show the resemblance of the total pattern of interests in each pair of occupations by a method Vernon called the 'double tetrachoric'. Although he identified four factors which after rotation were labelled as: 1. - Gregarious vs. Isolated, 2. - Social Welfare vs. Administrative, 3. - Scientific vs. Display, and 4. - Verbal vs. Active, he admits that the rotation was somewhat subjective. The groupings proposed on the basis of this factor analysis appear quite reasonable and are similar to the groups produced by Strong (1943) on the basis of factor analysis of empirical data from interest inventories.

4.3 Another early study is by Grunes (1957), who gave high school students a list of 51 varied occupations chosen from the Dictionary of Occupational Titles (DOT) and asked them to group the occupations in as many ways as possible, giving each grouping a name. The students were told that a higher score would be given for producing more groups and using more job titles, presumably to motivate performance in the task. The groups were content analyzed and for each job title the percentage of times each of the other job titles appeared in the same group as it was calculated. A second test studied the jobs associated with certain stereotypical descriptions of people. From these studies she generated several clusters of job titles, which have a certain face validity, in that the groups appear to be of meaningfully related jobs. However, these groups can be criticized because they do not provide any basis for generalization to a wider range of job titles. Unfortunately this study did not suggest factors or dimensions which could be used for rating new occupational titles, which is at least theoretically possible from the results of Vernon's factor analysis. Differences

were recorded in the replies from high school students of different socio-economic class, in particular students from a higher socio-economic background made finer distinctions between business and professional occupations than those from a lower socio-economic background. This result is as expected and seems to parallel results from studies into the content of occupational stereotypes reviewed earlier.

4.4 An interesting hypothesis was proposed in a paper by Gonyea (1961), that individuals choosing occupations structure their perceptions of the world of work in accordance with their needs. A two-way inter-action was proposed such that,

> "people tend to prefer occupations which they perceive as capable of meeting their needs, and to perceive need satisfaction potential in occupations which they prefer,"
>
> (Gonyea, 1963 p.25).

This suggests a consistency based hypothesis as to the way people handle occupational information, in order that the discrepancy between perceptions and preferences might be minimised. Unfortunately the procedure chosen for the data collection to test this hypothesis resulted in only 118 of the 193 subjects producing usable data. Although the data obtained were factor analyzed, producing a complicated primary and second order factor structure, it is difficult to estimate the effect of the missing 73 cases or to allow for the biasses that may have remained unnoticed in the remainder of the data set.

4.5 Each of these three studies may be criticized further because the methods of analysis that they employed did not do sufficient justice to their data. Vernon's study, although it used a standard

psychophysical procedure for the collection of the data - the method of pair comparisons, (usage here follows Guildford (1954), who pointed out that it is the stimuli and not the comparisons that are paired), involved the use of approximate methods of analysis, admittedly for entirely practical reasons, while in the study by Grunes the analysis might be considered somewhat superficial. In contrast the last study may be criticized for imposing a particularly elaborate method of analysis on rather dubious data. It might be argued that these studies suffer in that when they were designed the originators do not seem to have thought them through from data collection to data analysis in sufficient detail.

4.6 Five sets of studies (Reeb, 1959, 1971, 1974; Burton, 1972; Coxon and Jones, 1974a; Siess and Rogers, 1974; and Shubsachs and Davison, in press), have used the technique of multidimensional scaling to examine the structure of occupational perceptions. The advantage of multidimensional scaling as a method is that it does not impose a preconceived set of ideas regarding the particular set of dimensions appropriate for the stimulus material. It is also possible to ask questions in some situations about individual differences in the way people structure the stimuli. Before elaborating on the technique in greater detail (See Section 4.10), these five studies will be reviewed as a group to outline, not only their similarities and differences, but also some of the potential of multidimensional scaling methods. The basic experimental parameters of these studies are given in the accompanying Table 4.1

With the exception of Burton, all the studies have used the same experimental task, based on the method of pair comparisons, asking the subjects to rate directly the similarity of pairs of

TABLE 4.1

Experimental Parameters of the Research Studies

Research Study Author and Country	Number of Job Titles	Subjects Number and Description	Number of Points on Rating Scale	Number of Dimensions	MDS Programme
Reeb, (1959a) United Kingdom	15	25 Youth Employment Officers	7	2	Metric
Reeb, (1971)	15	37 Youth Employment Officers	7	2	Metric
United Kingdom	10	42 14-15 year old boys	5	2	Metric
Reeb, (1974) Israel	12	125 8th Grade boys (average age 14.2 years)	5	2	MDSCAL
Burton, (1972) United States	60	54 Respondents to advert in student newspaper	Not applicable	3	MDSCAL
Coxon and Jones, (1974a) United Kingdom	16	162 Adults (various occupations) and Students (various disciplines)	9	2 and 3	INDSCAL
Siess and Rogers, (1974) Canada	20	189 Students taking Introductory Psychology Class (90 men, 99 women)	7	4	Metric
Shubsachs and Davison, (in press) United States	18	54 Vocational Counsellors (11) and Students taking Introductory Psychology Class (43)	Not specified	4	INDSCAL

job titles. Although the exact form of the question and the length of the scale (5, 7 or 9 point scales have been used) have varied in the different studies, these differences seem to have a negligible effect on the results of the studies. A more important consequence of using the method of pair comparisons is that as the number of stimuli is increased, the number of pairs increases very much more rapidly. This is illustrated in Table 4.2.

TABLE 4.2

To illustrate how the number of possible pairs increases as the number of stimuli increases

Number of stimuli	Number of pairs
10	45
11	55
12	66
13	78
14	91
15	105
16	120
17	136
18	153
19	171
20	190

The general Formula for the Number of Pairs (N) is:

$$N = n(n-1)/2$$

where (n) is the number of stimuli

If 10 stimuli are included, for example, there are 45 pairs, but for 20 stimuli there are 190 pairs, over four times as many. If subjects are required by the experimental design to rate all

possible pairs and not just a sub-set of the total number, once the stimulus set exceeds about 20 objects, the number of pairs to be rated in a complete design will become too excessive for an individual subject, making it probable that boredom and tiredness will affect the concentration of the subject and the reliability of the results.

4.7 Looking at the accompanying Table 4.3, which lists the job titles selected for these different studies, it is at once obvious, even when allowances are made for the fact that these studies have been conducted in several different countries, that the range of job titles used is very wide. While the number of titles that could be studied has been limited for the operational reason outlined above, it is also clear that the job titles differ in other ways too. For example, in the level of specificity of the occupational title. Burton uses Salesman, perhaps a generic title for a family of specific jobs, while Reeb in his earlier study has Clothing Salesman, Coxon and Jones have Commercial Traveller, Siess and Rogers include both Car Salesman and Insurance Salesman, and finally Shubsachs and Davison include Auto Salesperson and Securities Salesperson de-sexed but equivalent, perhaps, to the previous pair.

The jobs have also been selected in a variety of different ways. In his first study Reeb aimed initially at selecting the jobs which were numerically the most common for 15 - 19 year old males in London and about which, therefore, he might expect the schoolboys and counsellors, who were his subjects, to have some knowledge. However, such detail could not be obtained from the Census material that was available, and the list was finally chosen by more subjective methods. For his second study in Israel, Reeb

TABLE 4.3

Lists of Job Titles

1. Reeb, (1959, 1971)

3. Coxon and Jones, (1974a)

Aston University

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Aston University

Content has been removed for copyright reasons

TABLE 4.3 (Contd.)

Lists of Job Titles

4. Burton, (1972)

Aston University

Content has been removed for copyright reasons

Aston University

Content has been removed for copyright reasons

TABLE 4.3 (Contd.)

Lists of Job Titles.

5. Siess and Rogers, (1974)

6. Shubsachs and Davison, (in press)

Aston University

Content has been removed for copyright reasons

Aston University

Content has been removed for copyright reasons

first asked 300 eighth graders (14 year olds), 'In what jobs do people most commonly work?' An extremely wide and variable range of jobs were given in the responses to this question and the lists obtained bore no relation to numerical data in Israel. As these results did not provide a basis for the selection of job titles, the final criterion chosen was that the job titles should be well-known to the children, cover a wide range of realistic job choices, and include job titles of different occupational level, which his earlier study had suggested was an important dimension along which job titles differed.

Burton also started out by having subjects generate occupations by free recall, but found that subjects tended only to list prestigeful and creative occupations, and omit such occupations as Machinist, Farmer, Mechanic, etc., which make up the bulk of things people actually do. Finally the titles were chosen to represent the nine major categories of the Dictionary of Occupational Titles (US Dept of Labour, 1965).

Coxon and Jones chose eight titles from the 30 included in the Hall and Jones (1950) list, which was itself chosen in a fairly idiosyncratic manner, and added eight more titles to represent the occupational groups from which they were drawing their subjects, as they were interested in the effect of differential familiarity on the judgements about occupations.

Both of the remaining studies selected occupational titles to represent different interest and personality types; Siess and Rogers on the classification proposed by Anne Roe (1956) and Shubsachs and Davison from the Minnesota Occupational Classification

System (MOCS, Dawis and Lofquist, 1974) to represent the different Holland Personality Types. As the subjects for both these studies were to be University Students the selections are, perhaps, relatively homogeneous in terms of occupational level.

4.8 Coxon and Jones (1974b) in a paper discussing the problem of the selection of occupational titles for sociological research suggest that there are three main problems that confront researchers when they make their choices:

(1) The problem of comparability with other investigations

(2) The problem of operational feasibility

(3) The problem of representativeness

The five studies being reviewed here have not been designed to have any comparability one with another and, although some attention has been given to relating the selection of occupational titles to external criterion, given the number of titles that were selected for these studies, it was practically impossible for the selection not to be somewhat subjective and arbitrary. A more serious problem is the extent to which the process of selection is explicit so that comparisons can be made, or equivalent sets of titles can be constructed for replication of these studies. Unfortunately the typologies and classifications upon which the selection of titles might be based are themselves potentially controversial and, because the world of work is ever changing and developing, always a little out of date.

For all these studies the selection of titles has inevitably been constrained for operational reasons, but the most worrying aspect of the design of these studies has been the failure to consider ways of checking to see that their data could be called in any way representative. This assumption of representativeness

is compounded by the further implicit assumption in all these studies that the content domain that they are trying to sample is in fact homogeneous, and that individuals do have sets of constructs which they will use over the whole set of occupational titles. Although this might be true for certain constructs, it seems most likely that subsets can be identified for which people use their own individual sets of constructs. Not only will the size and range of these groupings vary from person to person, but also the number and type of constructs that are used will also change. Kelly (1955) would have called this an example of his notion of "Range of Convenience" and some examples might make the concept clearer.

For example, consider the situation where people are asked to generate a list of occupations for which they might consider themselves suitable for employment, or to list the different occupations in what appears to be a well defined occupational field, such as medicine or engineering. In the first case it would be anticipated that individuals would produce quite different lists for obvious reasons related to their different interests and skills. In the second instance different lists would also be given, not only because of knowledge or memory effects, but also because there would be genuine disagreement over just what occupations come within these spheres. Even if, perchance, the same titles were included in two lists the subjects are likely to use different constructs to categorise and compare the occupations. The converse may also be expected to hold true, if subjects use the same constructs and just happen to encounter the same pair of occupational titles they will probably rate them differently just because of the difference in the context in which the ratings took place.

This neglect of situational variables is, perhaps, surprising given the recent emphasis on the development of a psychology of people-in-environments (Warr, 1970) and studies, such as that by Bem and Allen, (1974), that have looked for moderator variables to allow, at an individual level, the specification of equivalence classes of situations. As Scott (1963) noted, when discussing the structural properties associated with cognitive processes:

> ".....it is quite likely that these modes of organization, and the cognitive structures associated with them, have been built up through specific experience with the object domains - the way a person is introduced to an area, the amount of time he spends thinking about it, the way in which he uses his knowledge, etc. It would seem altogether possible to maintain a conceptual framework concerning professional activities that is structurally quite different from that relating to family or social life - mainly because the situations in which they are developed and expressed pose quite different demands."

4.9 An equally important and related issue is concerned with the range and selection of subjects for these research studies. The research populations have been selected for a variety of purposes, sometimes to make specific comparisons between groups and other times for more general reasons. In his earlier study Reeb was interested to compare the perceptions of school-leavers and Youth Employment Officers who give vocational guidance, while his second study aimed to see if the dimensions found in the earlier study could be shown to have a crosscultural validity. Coxon and Jones only included men in their sample, but from different occupational groups to see if differences in familiarity affected perceptions.

Burton gives no information about his subjects except their number and how they were recruited, although he was interested in the semantic dimensions of occupation names. Siess and Rogers included both male and female university students in their study and were interested both in looking for evidence in support of Roe's occupational classification and in sex differences in the perception of occupations. Shubsachs and Davison in their study aimed to compare the perceptions of students in different disciplines with the perceptions of Vocational Counsellors.

Without at this stage considering the results of these studies, it is possible to note certain features of the subject populations which indicate that a number of important variables have not been explored in any great detail. Coxon and Jones comment on the importance of occupational background to the perception of occupations, but the process of the development of occupational perceptions has not been explored in any of the studies which have all been cross-sectional in design. Nor has this problem been tackled by using the same experimental task with different age groups, which would at least give some information about age effects even though such a design is a poor second to a proper longitudinal design. This is surprising given the developmental nature of many of the theories of occupational choice.

The choice of subjects has also precluded the study of sex differences in occupational perceptions in any detail. These might also be expected to show strong developmental effects as sex roles become elaborated through childhood and adolescence. Research results have demonstrated a strong sex-typing of occupations (Shinar, 1975) and it seems probable that this should be an

important component of occupational perceptions. Evidence illustrating the very different occupational opportunity structure for women and the position of women in the labour force has already been discussed (see Section 3.6), and indicates that women consider a more circumscribed set of possible occupations than men (Rauta and Hunt, 1975).

4.10 Before presenting findings from these studies, aspects of multidimensional scaling will be briefly outlined. Shepherd (1972) suggests that the two major purposes for employing multidimensional scaling techniques are:

1. Somehow to get hold of whatever pattern of structure may lie hidden in the data set.
2. To represent that structure in a form more accessible to the human eye - namely as a geometrical model or picture.

In contrast to factor analysis which is based on a vector model derived from the analysis of correlation coefficients, multidimensional scaling techniques interpret proximity data as relations on distances. The objects under study - in this case either people or job titles - are represented by points in space, such that the significant features of the model are revealed in the geometrical relations among the points. In these examples the model aims to represent the perceived similarity among the job titles, so that the distance between two job titles perceived as more similar is less than that for two job titles perceived as less similar.

One of the major problems with such a data analysis procedure is to decide on the criteria for an acceptable solution. As in factor analysis, where the decision has to be made how many factors are necessary to explain the observed variation in the data, with

multidimensional scaling it is necessary to decide in what dimensionality it is reasonable to accept a solution. The most parsimonious solution to a scaling problem will usually be the representation of the lowest possible dimensionality consistent with the data. In this way not only are fewer parameters estimated from the same data, but also a solution in one, two or three dimensions is probably optimal for either graphic or pictorial representation, although such a solution may not be subtle enough to accommodate the full complexity of real data.

A second problem is to decide on the interpretation of the solution. Representation is not an end in itself. The traditional approach aims at identifying dimensions in the solution that can be meaningfully interpreted, but this is only one of a number of types of pattern that can be found in a spatial representation. Other configurations are, to give an example that can be extended from two to three dimensions and to spaces of higher dimensionality, the way points cluster together or the ordering of points along the perimeter of a circle or sphere.

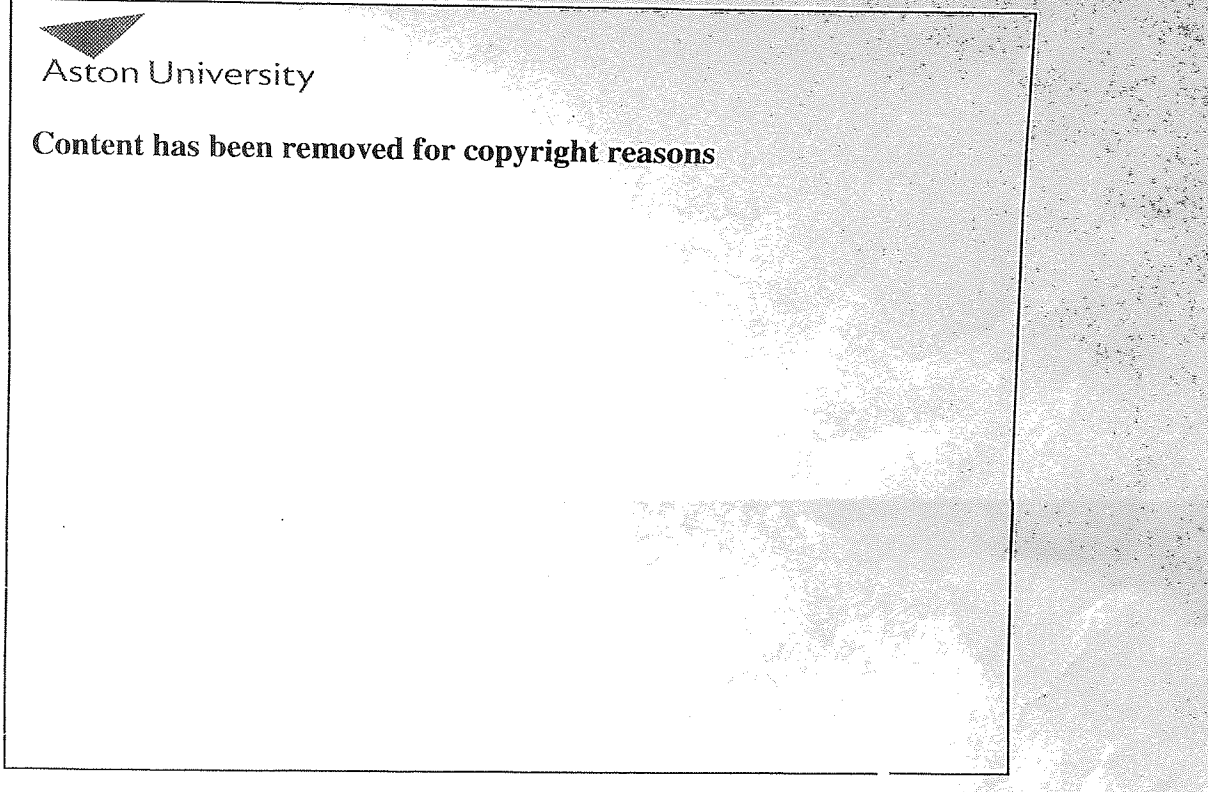
The criteria for a solution are, therefore, both mathematical, being based on various objective measures that can be used to describe a solution (the relative merits of these measures will be discussed in a subsequent section), and subjective in that they are supported by the interpretation given to them by the researcher, which might be psychologically or sociologically grounded.

4.11 As one of the main advantages of multidimensional scaling is to allow graphical representation of the research results, in presenting the results of these studies diagrams will be included whenever possible. The results of Reeb's earlier study in London

with Youth Employment Officers and Schoolboys are shown in Figures 4.1 and 4.2. Each figure shows the result for two groups. Notice first the close agreement between the two adult groups which suggests the existence of a consensual image of the job titles included in the study and also the similarity of this figure, even though it included 5 extra job titles, with the results from the two schoolboy groups shown in the second figure. Both the solutions presented here are in two dimensions only, although for the adult groups the analysis produced three factors explaining 97% and 98% of the variance respectively. The third factor was subsequently ignored because it explained only 3-4% of the variance. The correlations of the remaining factor scores to the similarity ratings were .921 and .935. The adults were also asked to rate the jobs on 'level' and these ratings correlated highly (r=.899, .941) with the second factor. The first factor seems to distinguish fields of work, perhaps in this case representing a blue-collar versus white-collar distinction. These results were essentially replicated with the schoolboys, as can be seen from the diagram, but in this case the boys were asked to do two extra ratings, the first on the prestige of the jobs, the second on their desirability. Although both groups agreed on the direction of the prestige rating, the desirability dimension is nearly at right angles for the two groups (See Figure 4.2). For the boys from the comprehensive school in the middle class suburb (Group K) the desirability of the occupations is very close to the prestige dimension and approximately lines up with the higher level jobs. While for the secondary modern schoolboys (Group M) from the working class neighbourhood the desirability axis is slanted towards the blue-collar and skilled trades group of jobs.

FIGURE 4.1

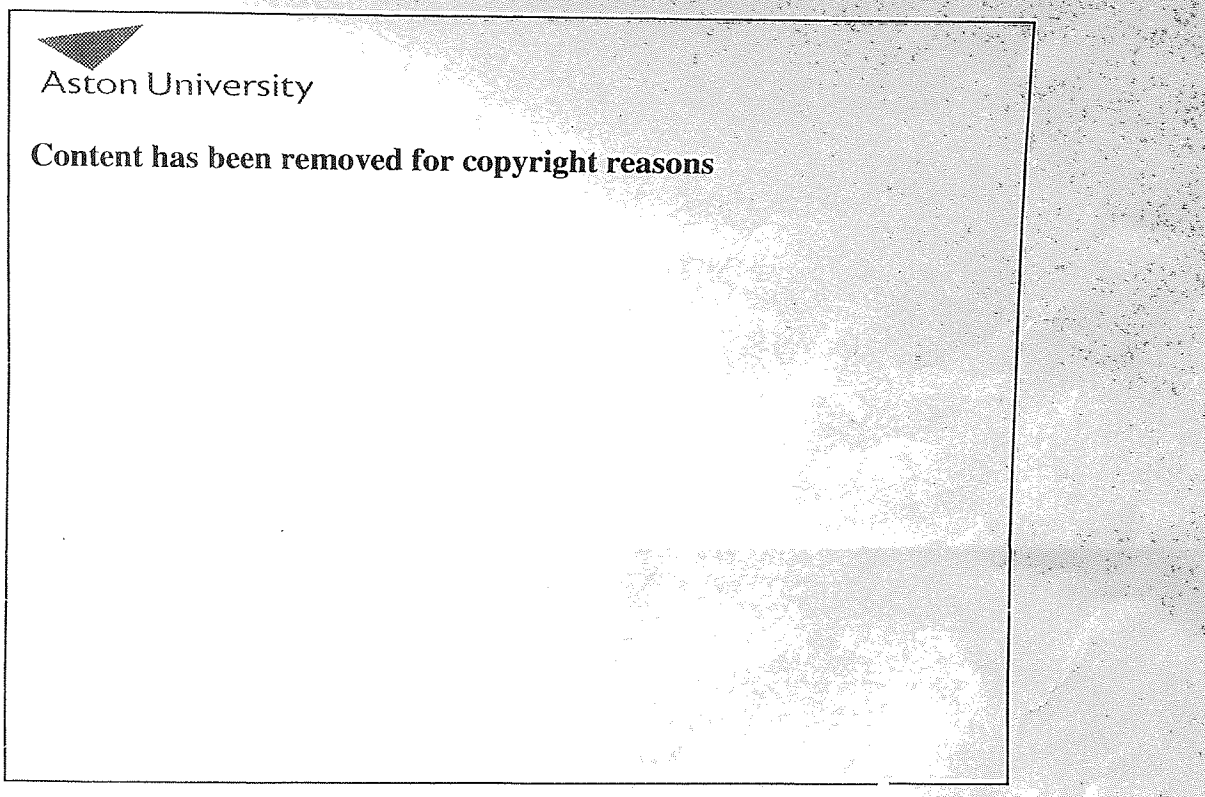
Rotated factor loadings of judged similarities between jobs.
(First two components - adult groups.)



(from Reeb, 1971)

FIGURE 4.2

Rotated factor loadings of judged similarities between jobs.
(First two components - school groups.)



(from Reeb, 1971)

Although for technical reasons these results are only at the group and not the individual level they have a number of implications. In a purely descriptive sense the difference in perceived desirability between the two groups might be expected from the known difference in socio-economic background, but these results also have a theoretical interest. There has been considerable debate over the position of cognitive models and their relationship to the evaluative judgements people make. Alexander (1972) writes,

> "We may find that people respond to the perception of different status worlds, rather than respond differently.....to similar perceptions of a consensually defined status structure."

These results provide evidence of consensually defined perceptions of the world of work that are evaluated differently by different groups. It might seem intuitively obvious that people will make cognitive and evaluative distinctions, for example, agreeing how two occupations differ, but disagreeing on the meaning of these differences. Much of the research evidence on this topic has been somewhat problematic, as Coxon and Jones (1974a) point out, failing to distinguish between cognitive and evaluative judgements.

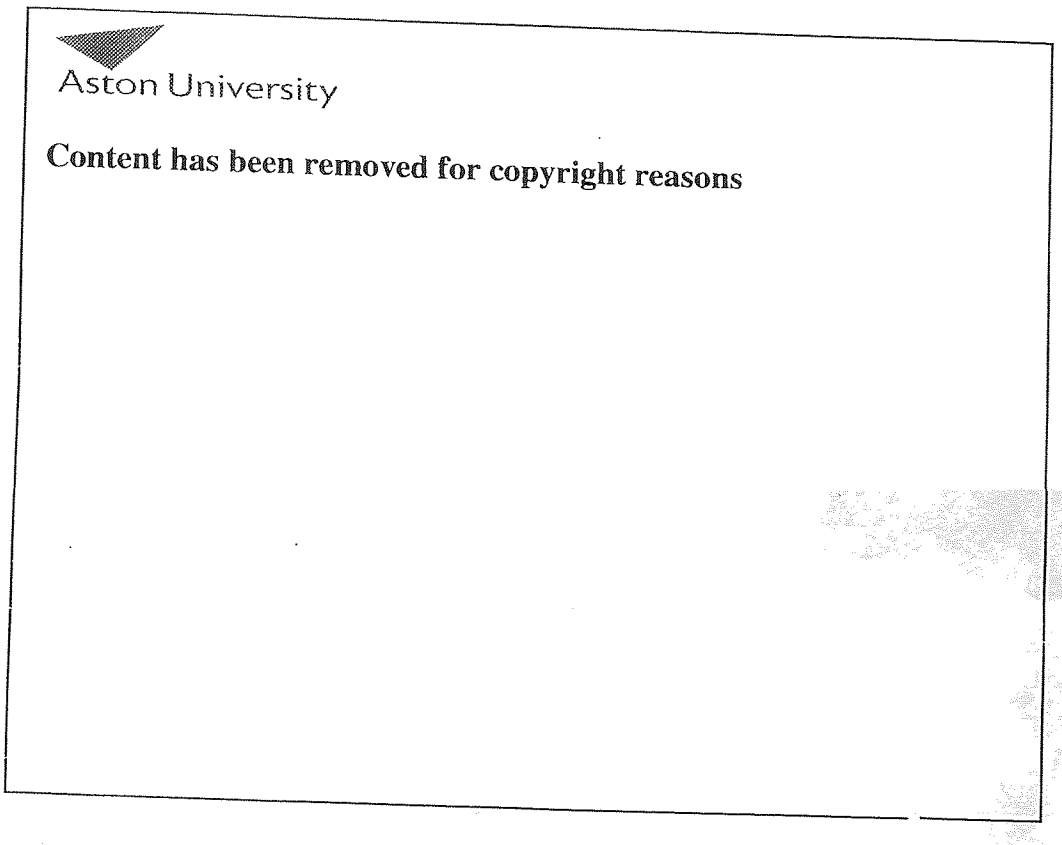
4.12 The results of Reeb's second study carried out in Israel are shown in Figure 4.3. Although the selection of occupational titles was slightly different in this study the two dimensions Reeb identified are the same as previously, one being a prestige dimension, the other a field dimension that distinguishes blue-collar from white-collar jobs. Other data also collected in this study included intelligence scores, age, socio-economic background data on the school and job preference. No difference that might be judged to be significant could be shown on these variables for

FIGURE 4.3

Two-dimensional representation of perceived occupational structure.

Doctor ● ($1\frac{1}{2}$)

X_2
T



(from Reeb, 1974)

the observed perceptual structure, but in contrasting the two schools judged to be at the two socio-economic extremes, differences in the position of the 'ideal points' were observed. The ideal point represented by 'A' and 'D' on the diagrams for the two schools, indicate points on the two dimensional plot such that the distances from that point to the job titles represent the order of job preferences for that particular group. The remarkable consistency in the perceptual structures observed by Reeb for all his different groups in both sets of studies are certainly provocative. Unfortunately at the time these studies were carried out it was only possible to analyse groups of subjects and so it is probable that significant individual variation has been lost as a result of this. Further consideration of this interesting result will be left until the discussion of the results of the author's study.

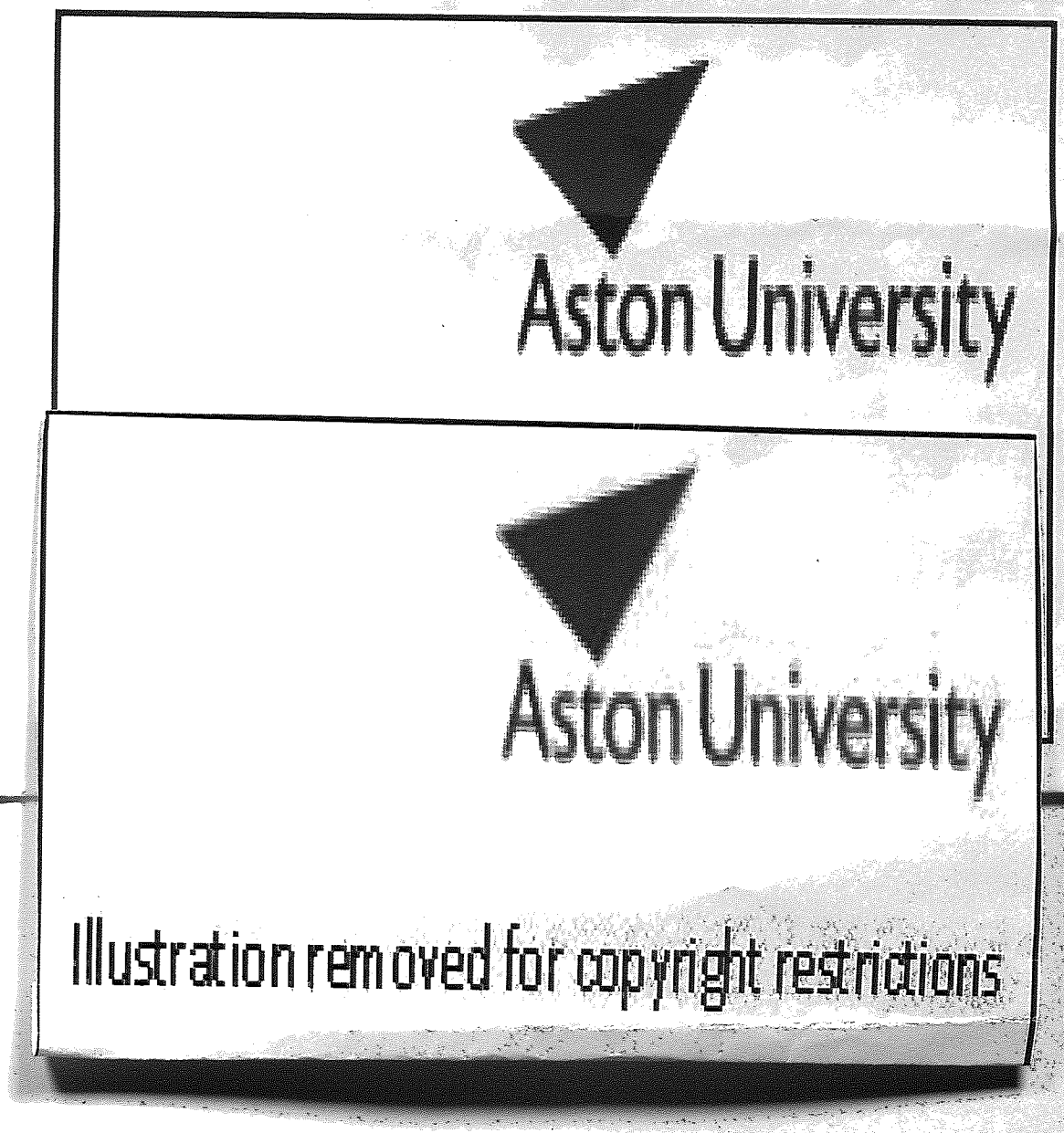
4.13 Keeping to a strictly chronological order of presentation, the next study to be reported was by Burton. This study differs from the others in two ways. First instead of asking the subjects to rate pairs of job titles for similarity in a direct manner, Burton merely asked the subjects to group the job titles into sets that went together. From these free groupings Burton was able to derive a similarity measure based on the observed co-occurence of job titles in the different groups that the subjects produced. By the use of this method of calculating the similarity of the various pairs of jobs, Burton was able to include a much greater number of job titles than could ever be included in a direct pair comparison design. This probably has the advantage of producing a much more representative set of occupational titles than those produced by the other studies and this was essential, for the purpose of this

study was to examine occupation names as a subset of English role terms. Three dimensions were required for a satisfactory solution to the scaling problem. The first labelled as a 'dependency' dimension, roughly signified how independent or autonomous a member of that occupational group was likely to be; the second dimension was labelled a prestige dimension and seemed to be most strongly related to the amount of education required for the particular job; while the third dimension was called a skill dimension and reflected the amount of specific training required to do the job. These results are shown diagramatically in figures 4.4 and 4.5. A second experimental task for the subjects was to perform a pair comparison task. Half the subjects rated the titles on 'prestige' and 'income' while the other half rated the titles on 'income' and 'social status'. Only 90 of the possible 1770 pairs were included in this balanced incomplete pair comparison design. The results indicated that the criterion of prestige and social status were effectively interchangeable (Spearman rho=.91) and that this dimension is effectively the same as the second dimension of the multidimensional scaling solution. It is also clear from the diagrams that this is the dimension which has the greatest spread of values suggesting that it is the most important of the three dimensions in the solution.

Hierarchial clustering of the original similarities data was also carried out by the diameter method (Jonnson 1967). The results of this clustering are shown in Tables 4.4 and 4.5 and Figure 4.6. The hierarchical result corresponds closely with the result of the multidimensional scaling. Occupations that are close together in the multidimensional space also tending to be in closely related clusters. It is also possible to describe the region of space in

FIGURE 4.4

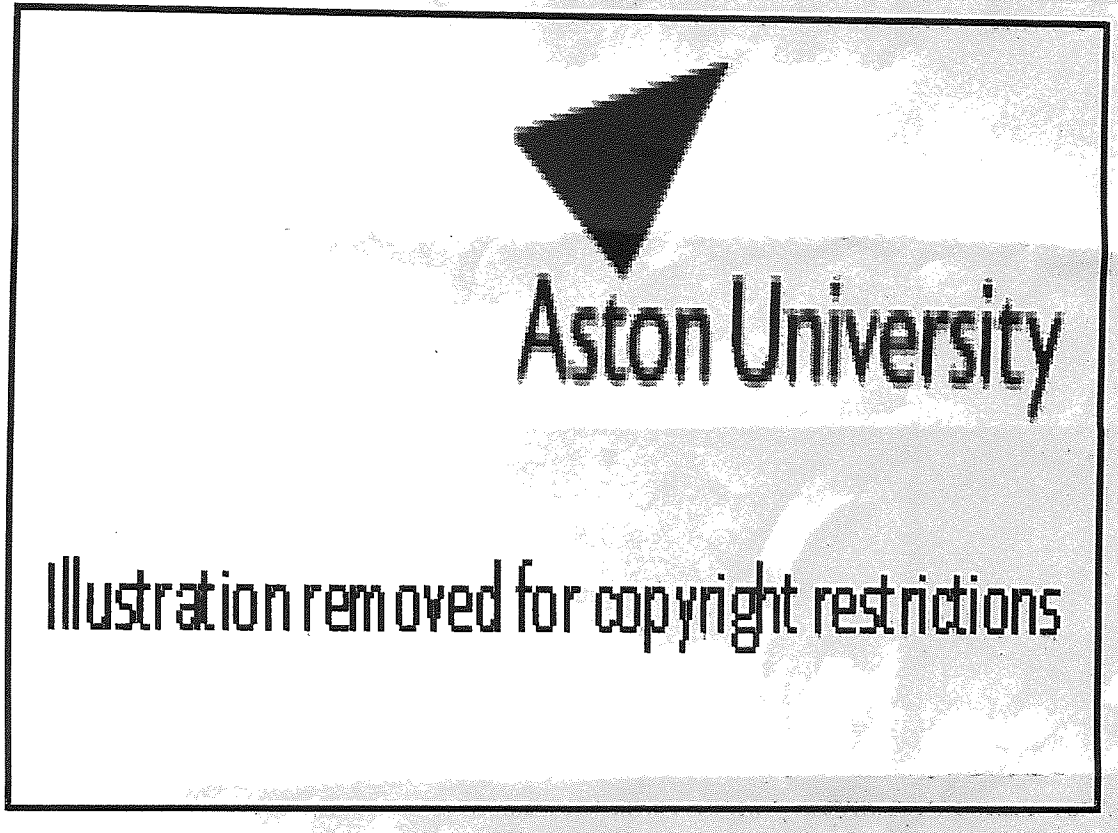
Three dimensional configuration: plot of dimensions one and two.



(from Burton, 1972)

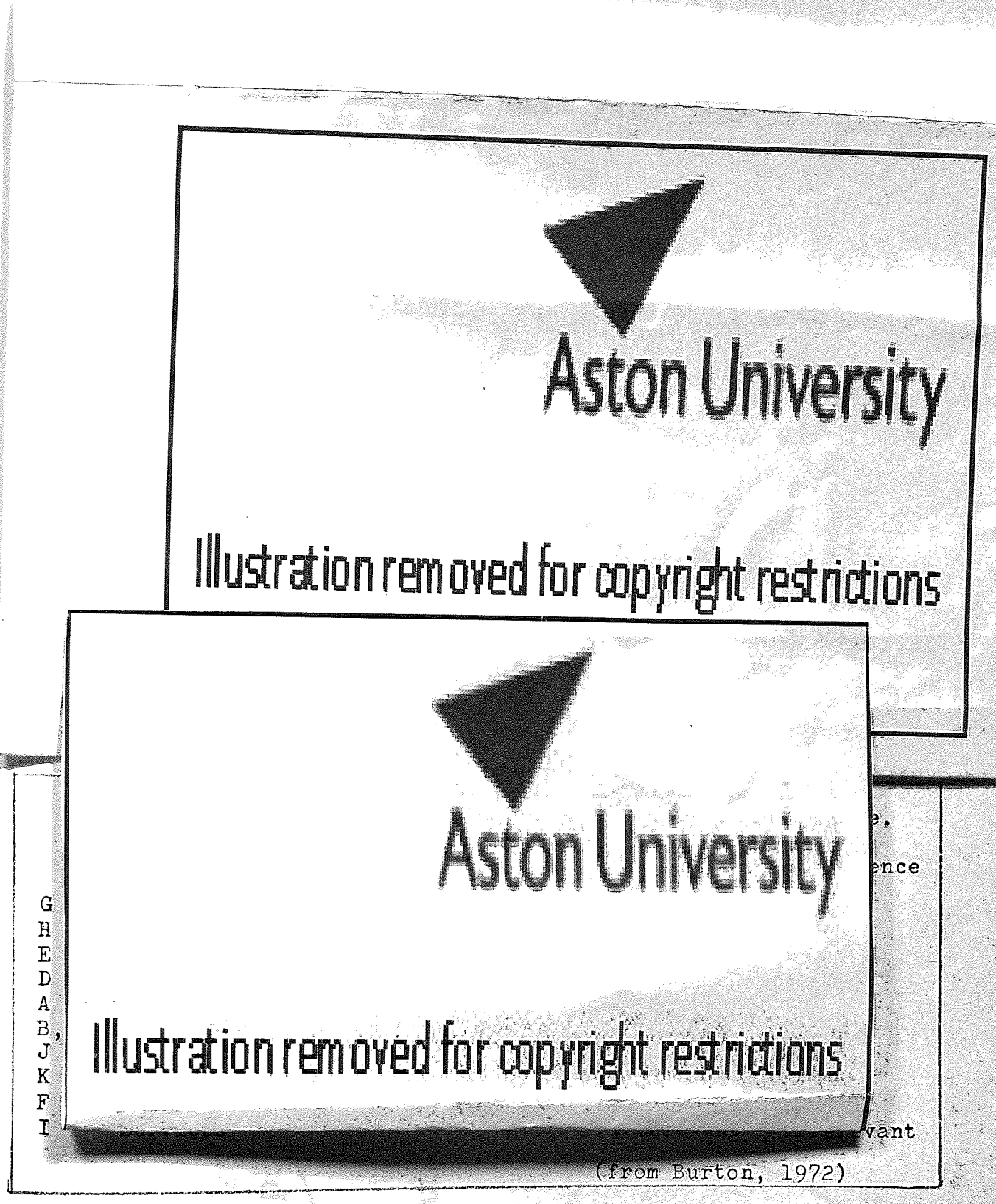
FIGURE 4.5

Three-dimensional configuration: plot of dimensions one and three.



(from Burton, 1972)

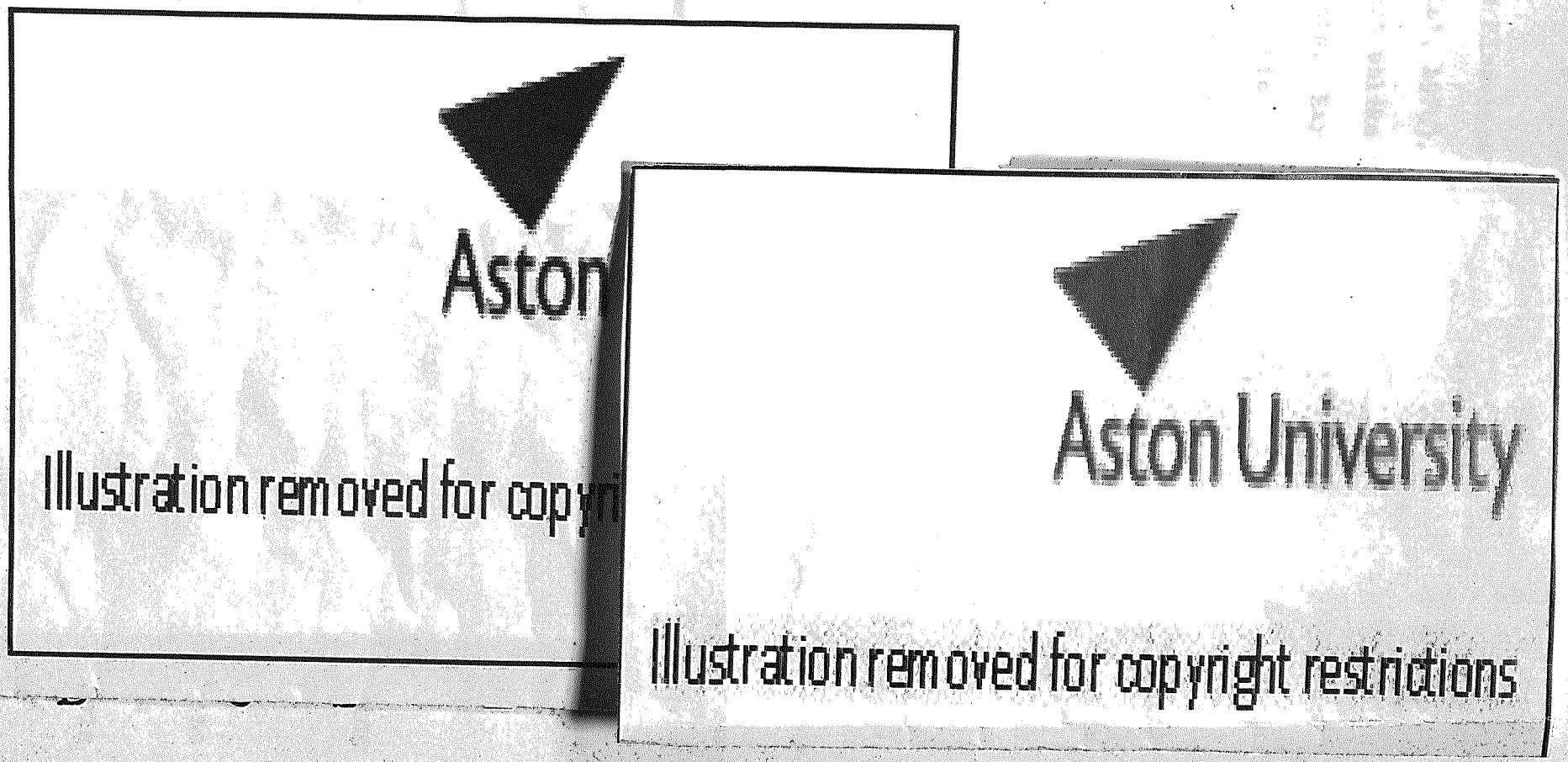
which most of the higher level clusters reside.



(from Burton, 1972)

Although the orientation of this paper is not strictly in the field of vocational psychology, it is interesting to note how the clustering and scaling solutions group the occupational titles into categories. These are not unlike those based on a priori classifications, such as Roe's (1956) taxonomy, or on empirical

FIGURE 4.6 Hierarchical clustering of occupational groups.



(from Burton, 1972)

work, such as the Minnesota Occupational Classification System (Dawis and Lofquist, 1974). The terms used to describe the occupations are not unlike those commonly used to describe vocational interests. Earlier research by Burton (1968) had already suggested that Artistic occupations formed a separate group that could be distinguished from other occupations. However, the selection of occupational titles used in this study, by being so broad and representative, is likely only to suggest the most obvious dimensions to the vocational psychologist. In a typical vocational counselling situation, the counsellor not only has to assist the client who has no idea what occupation might interest him, (for which it is useful to know what are likely to be the salient dimensions people use to categorise the world of work), but also to help the client who knows his field of interest is, for example, engineering but wishes to find out how jobs in this field might be distinguished. This suggests a need for analagous studies to this one, where all the occupational titles are chosen to represent some one occupational field, perhaps, even one of those identified in the hierarchical clustering analysis performed in Burton's study.

An alternative approach would be to work in reverse, starting out with a large number of occupational titles (200+), initially partitioned into small subsets, and then selecting from each partition those titles which best represented particular dimensions in that partition for inclusion at a higher level. Such a design has been used by Bush (1973) in a multidimensional scaling analysis of adjectives denoting feelings to identify salient dimensions in that field. This design would allow both the isolation of dimensions that seemed to be related to one particular occupational field and the identification of dimensions that appeared to be

superordinate and used at the most general level in the description of occupations. By including different groups of subjects in the design it would be possible to see if at particular levels of the partition these groups structured their perceptions in different ways. The main problem with the design is the large number of subjects and therefore time required for its completion. 762 college students were included in the study by Bush and even here at the lowest level sometimes as few as seven subjects rated a single partition. If the partitions at the lowest level were of substantive interest in their own right many more subjects would have to be included in the study making it of doubtful practicality unless carried out as part of a major research study.

4.14 The study by Siess and Rogers "was designed to assess the degree to which Roe's (1956) classification of occupations corresponds with the perceived similarity of occupations in college students." In contrast to the relatively simple solutions proposed in the preceding studies the results of this study suggested a solution in eight dimensions although only the first four dimensions are considered in detail in the report. The dimensions are taken to identify fields of interest, although there is a suggestion that one of them represents an enterprise dimension of the type suggested by Super (1957). This solution is, obviously, too complex to be represented easily by a diagram. The absence of a level dimension from the solution is not surprising given the selection of occupational titles for this study, for which one of the criteria was that the titles were to be familiar to the subject population of college students (see Table 4.3 for the list of occupational titles).

Separate multidimensional scaling solutions were also obtained for the men and women in the study and these indicated that the structure of the occupational perceptions of the men was more complex than that of the women. Ten factors were obtained for the men, while five dimensions were sufficient to scale the women's data. While differences in the perception of occupational titles are expected for a variety of reasons that have already been discussed, because the analysis in this study was carried out only at the group level more fine grain distinctions cannot be made. For example it is not known whether particular groups of men and women have different perceptual structures or whether the solutions obtained here might be caused by a relative minority in each of the groups who have a particularly complex or simple structure respectively.

A second question raised by this study relates to the adequacy of Roe's suggested occupational classification and, in particular, whether the circumplex structure of occupational fields finds support. The factor analysis of occupational preferences by Jones (1965) does provide support for this hypothesis as a two dimensional solution was reckoned to be satisfactory and this solution did order the occupational groups in a circle. However another study by Meir (1970) did not support this finding and certainly the results of this study, where solutions have been proposed in more than four dimensions, suggest a more complex ordering of the occupational fields. How much this can be attributed to factors in the design of the study, such as the actual choice of job titles, remains an open question. None of the studies reviewed to date have been replicated, although it might be considered that the results of Reeb's later study in Israel can be considered as a

partial replication of his earlier work. It is also surprising that both of these studies (Burton's and the one by Siess and Rogers) seem to have been carried out in total ignorance of the earlier work by Reeb. In the research reported here a major emphasis will be on the comparison of British and American data.

4.15 The two remaining studies used an individual differences multidimensional scaling technique, INDSCAL, that was developed by Carroll and Chang (1970). As Coxon and Jones point out the model conventionally used to analyze data on the perception of occupations generates a multidimensional scaling solution from the aggregated judgements. They continue,

> "....if subjects' similarity judgements refer to different subjective occupational structures, it is hard to see how their data can be compared, and it is equally difficult to see how the notion of some consensual occupational structure can be maintained." (p.145).

In their analysis Coxon and Jones identified two problems involved in understanding what status to give to models of the occupational structure. These are how individual models relate to each other, and how they might relate to any 'objective' occupational structure, if that concept can be given some unambiguous meaning. They question the notion that there might be some external occupational structure and that individual cognitions can only be seen as distortions of that structure. This is not to deny that occupations can be objectively distinguished on many criteria, for example, in the abilities or skills required to carry out particular jobs. As sociologists they are interested in how individual conceptions of the social structure are used to explain and understand the world. For them the occupational structure is a

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constructed entity and the individual's cognitions have a crucial role in this process, so that although the description or conception of the structure used by the social scientist might be more descriptively accurate, it will not differ in form from the model used by the individual.

The difficulty with the analysis of aggregated data is that it imposes a collective representation, while if individual data is analysed on its own, any notion of a common basis for the model is abandoned. Multidimensional scaling in its use of a distance model presents almost literally a map to represent the domain under consideration. The ways in which individuals can differ in their occupational structures has already been discussed in relation to the problems in the actual selection of occupational titles. Three possible distinctions can be made:

(1) individuals use different constructs

(2) individuals have different configurations of points that cannot be related to each other

(3) individuals use different rules to combine information to make judgements.

There have been several attempts to develop methods to accommodate these individual differences. The model proposed by Carroll and Chang, perhaps because of its similarity to other models which attempt to study differences in individuals' perception, like the work on cognitive complexity and judgement (Bieri et al. 1966), has proved the most useful to many social scientists interested in individual differences in perception. Carroll (1972) describes the model:

"It assumes that different individuals perceive the

stimuli in terms of a common set of dimensions, but that these dimensions are differentially important or salient in the perception of different individuals. (Of course, the 'importance' can be zero, in which case the corresponding dimension does not affect the subject's perception or his perceptual judgements, at all.)" (p.106-107).

This model is able to accommodate the first two distinctions mentioned in the previous paragraph. In using this model, individuals can be depicted as points in a 'subject space' that has the same dimensions as the occupational space. These points representing the weights each subject has been given on the different dimensions. INDSCAL involves a generalization of the more simple distance model. The only formal difference between the two models is that in the INDSCAL model the subject's similarity judgement is represented as a weighted distance. The similarity between stimuli 'j' and stimuli 'k' for the 'i'th individual is assumed to be a function of the distance between the stimuli in the individual's private space:

$$s_{jk}^{(i)} = F(d_{jk}^{(i)}) \qquad (1)$$

where $s_{jk}^{(i)}$ is the similarity, $d_{jk}^{(i)}$ the distance and in the metric version of the model F is a linear function. The distance formula for an individual's private space is:

$$d_{jk}^{(i)} = \left[\sum_a (y_{ja} - y_{jk})^2\right]^{\frac{1}{2}} \qquad (2)$$

These 'private' distances can also be defined as modified, weighted distances in the group space:

$$d_{jk}^{(i)} = \left[\sum_a w_{ia}(x_{ja} - x_{jk})^2\right]^{\frac{1}{2}} \qquad (3)$$

where the w_{ia} are the weightings of dimension 'a' for the 'i'th

subject and the x_{ja} the coordinates of the stimuli in the Group Space.

There are two important consequences of using the INDSCAL model:

(1) it gives a unique set of axes and although the space is assumed to be Euclidean, it makes a difference which set of dimensions are differentially weighted by the subjects. The solutions cannot be rotated and nothing in the model constrains the axes to be uncorrelated.

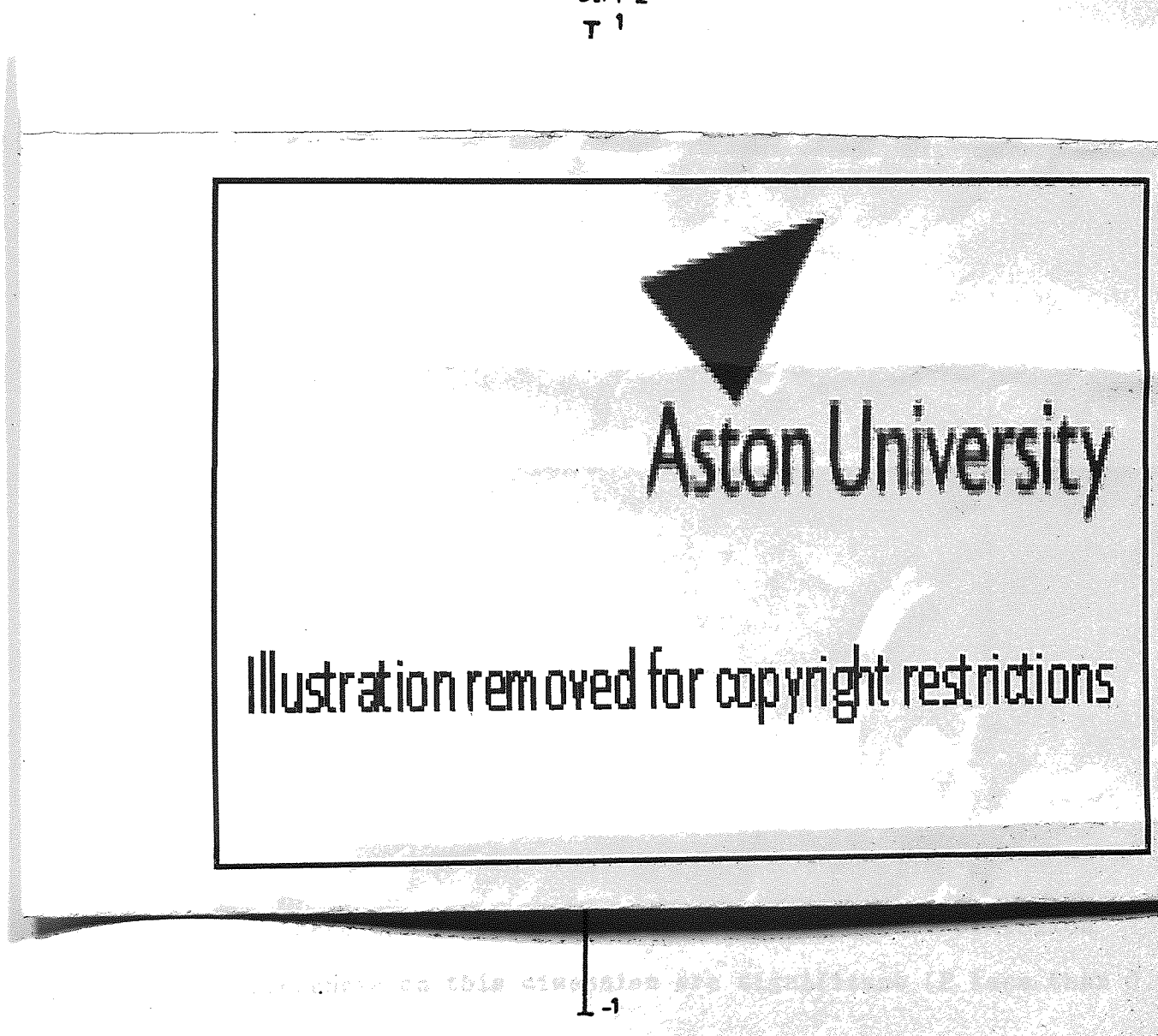
(2) When a subject is represented by a point in the subject space, the length of the line from the origin to the point is a measure of the amount of variation in the subject's similarity judgements explained by the INDSCAL solution.

4.16 Coxon and Jones in their study were interested in individual differences in the perception of occupations and used the INDSCAL model so that they could look at the variation in the dimensional weights between subjects from different occupational groups, which should be greater between groups than within groups.

The solution Coxon and Jones obtained for the occupational titles is shown in Figure 4.7. This solution is for a representative group of 70 of their subjects. The configuration seems readily interpretable with 'Level of Education' running from top left to bottom right with a 'People Orientation' approximately orthogonal to it. In contrast to the previous studies the emphasis in the analysis is not to explain the configuration of occupational titles, but rather to examine how well the INDSCAL model fits the individual data and also to see how well the model resolves the

FIGURE 4.7

Two-dimensional solution.



(from Coxon and Jones, 1974a)

problem of allowing the representation of an individual case in relation to a defined consensual group solution. The subject space for the two-dimensional solution shown in Figure 4.8 shows two types of individual variation:

(1) the extent to which a subject's similarities data are explained by the model, indicated by the distance of a subject point from the origin;

(2) the relative salience of the dimensions in the subject's data, shown by the ratio of the weights for each subject.

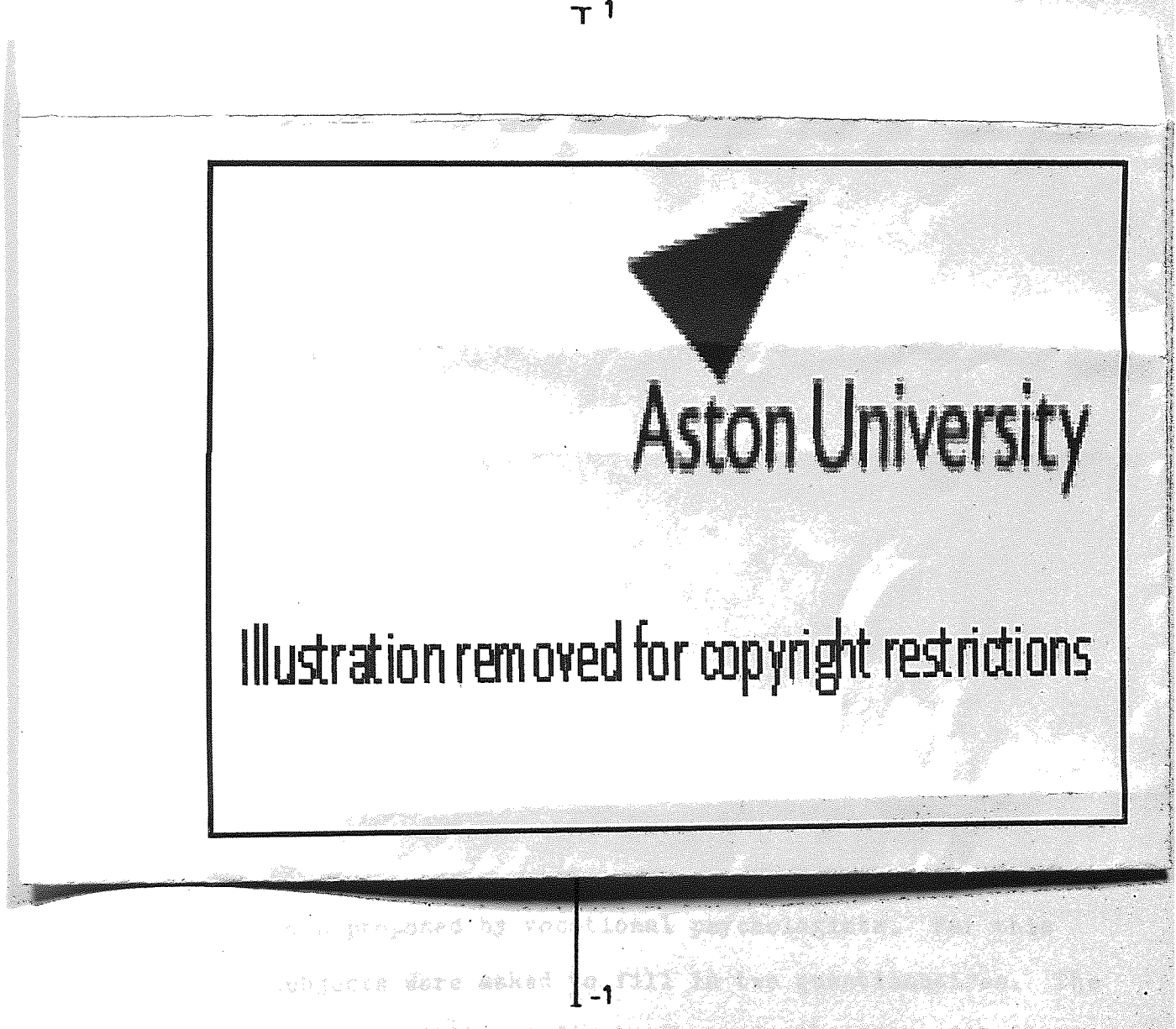
For most of the subjects the three-dimensional solution fitted the data rather satisfactorily. The correlation between subjects' similarities data and the similarity values predicted was greater than .70 in three quarters of the cases. Although for a small minority of the subjects their data was discrepant with the group data, the solution can be fairly regarded as providing the common basis for the occupational cognitions.

The multivariate analysis of variance also demonstrated that: "There is less than one chance in a hundred that the observed pattern of variation in subjects' weights within and between occupational groups could have come about by chance". More weight was given on average to the first dimension by the occupational groups, but there was a greater spread along the second dimension and the differences on this dimension are significant (P less than 0.01).

Coxon and Jones' data can be taken as offering some considerable support to their argument that individual variation is a significant variable in the perception of occupational titles and cannot be ignored, or treated as idiosyncratic. Although their data also show some differences between the perceptions of different

FIGURE 4.8

Two-dimensional subject space.



(from Coxon and Jones, 1974a)

occupational groups, they have not been able to offer any explanation for these differences in terms of occupational membership and suggest two possible alternative reasons. First that people with similar occupational histories may be more similar than those with the same current occupational membership and, secondly, that the way people actually make their judgements may also be important. These two points will be considered further in a later section (4.19) of this review.

4.17 The final study to be reviewed is the most recent one and was in fact completed subsequently to the work reported here. Shubsachs and Davison's study had three aims, (1) to compare the perceptions of a group of vocational counsellors, the sophisticated group, with a group of college students, the naive group; (2) to study the relationship between occupational perceptions and the Occupational Reinforcer Patterns (ORPs) of the Theory of Work Adjustment (Dawis, England and Lofquist,(1964); (3) to examine the relationship between occupational perceptions and the occupational classification system proposed by Holland (1973). This study also used INDSCAL because of the interest in individual differences in the perception of occupations. The study was also specifically concerned with the relationship between the subjects' occupational structure and classifications proposed by vocational psychologists. For this reason the subjects were asked to fill in two questionnaires. The first asked subjects (1) to indicate their familiarity with the occupations (see Table 4.3), (2) to rate all possible pairs of occupations on similarity, and (3) to rank the occupations in terms of prestige and difficulty. The second asked the subjects to rate each occupation on the chosen dimensions from the Occupational Reinforcer Patterns (Borgen, Weiss, Tinsley, Dawis and Lofquist,

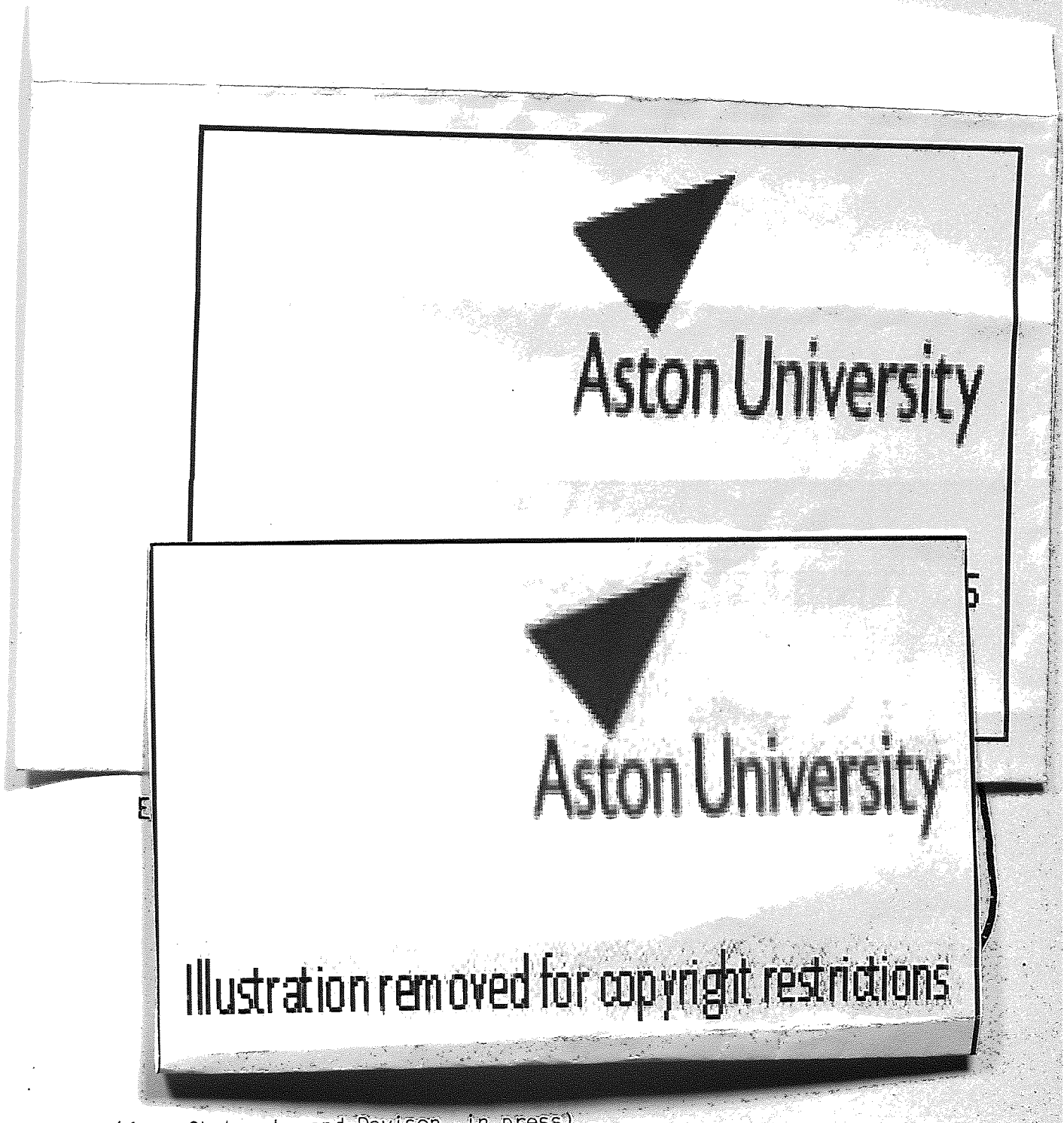
1972; Rosen, Hendel, Weiss, Dawis and Lofquist, 1972). The four-dimensional INDSCAL solution is shown in Figures 4.9 and 4.10. This solution was chosen in preference to the three-dimensional solution because the subjects' rankings were found to be much more highly correlated with that solution than the solution in the lower dimensionality.

The four dimensions in the solution were labelled; (1) Production - Sales, (2) Scientific - Artistic, (3) Blue-collar - White-collar and (4) High Compensation - Low Compensation. These labels include the notion of occupational level as well as reflecting differences in the field of the occupations and are similar to the type of dimension reported by the other studies. Although the occupations were chosen primarily to represent different fields of interest, it is quite clear from the list that different levels of occupation were chosen, including some that are rather inappropriate for college students, so that the general form of the result is not surprising.

The authors indicate that their results do give some limited support for Holland's (1973) occupational category system in that separate clusters of occupations can be seen to fill different areas of the four-dimensional hyperspace, but they argue that their result provides little support for the hexagonal arrangement of the categories suggested by Holland, which should produce a circumplex arrangement of the occupational titles analagous to the model proposed by Roe. However it seems open to question whether this hypothesis can be tested by this data. Although different studies have tended to agree on the Holland codes that should apply to various occupations, there has been some variation in particular cases in the three letter code given to occupations and Holland has not suggested

FIGURE 4.9

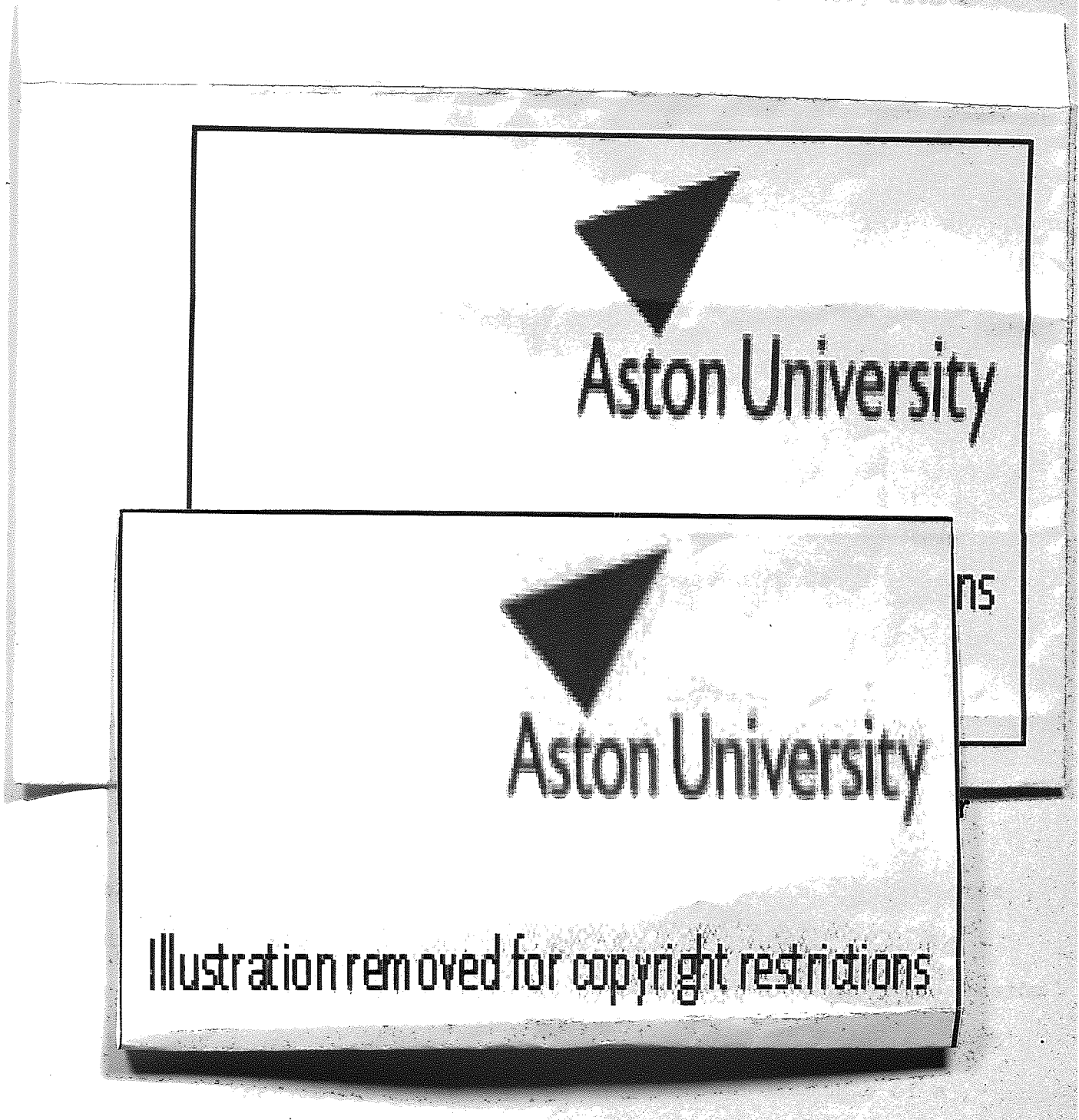
Four-dimensional solution: plots of dimensions one and two.



(from Shubsachs and Davison, in press)

FIGURE 4.10

Four-dimensional solution: plot of dimensions three and four.



(from Shubsachs and Davison, in press)

that the six categories are sufficient on their own. In this study, for instance, Computer Operator has been listed as an occupation falling into the 'Conventional' category, although Holland (1973) lists it in the 'Investigative' category with a code ICR, rather than the code CIS given in Minnesota Occupational Classification System. Most occupational titles can probably be classified by the Holland system, but it is not easy to pick titles that are good representatives of the six categories. In this case eleven of the eighteen occupational titles have Investigative given as the first or second letter of their 'Three point' code under the Holland system.

More importantly, both Holland (1973) and Roe (1956) suggest that a two-dimensional model of occupational fields provides adequate and meaningful representation at a general level of the differences between occupations. They also both suggest that occupational level be considered as a third dimension, while Super (1957) suggests that type of enterprise should also be considered. It would certainly be possible to argue that in this case the four dimensions labelled by Shubsachs and Davison can be fitted into this model, although in part their labels might be taken to be associated with both field and level. The Scientific vs. Artistic dimension and the Blue-collar vs. White-collar dimension are certainly field dimensions, while the Production vs. Sales dimension includes perhaps, both enterprise and field components. Although the compensation dimension may not be a perfect analogue of a prestige or social status dimension, it is meant perhaps to reflect intrinsic compensation rather than financial compensation. Shubsachs and Davison were able to show a high correlation between their solution and external (separate) ratings on a prestige

dimension. Of course an interpretation in terms of dimensions is not the only one that can be given to a Multidimensional Scaling solution and scaling is not the only technique for handling this type of data. Hierarchical clustering (Johnson 1967) as performed by Burton can help in providing an interpretation as well as suggesting a model for the data itself.

4.18 These two interpretations suggested for this data, although they are not incompatible, call into doubt the fact that studies of this type can usefully help to elucidate the dimensions along which occupations can most constructively be differentiated. The very limited number of occupations that can be included in a design of this sort can never be representative and, consequently, it is not possible to test hypotheses of this kind in this way. The INDSCAL model does provide, however, a very powerful model for looking at individual differences and it is on this aspect of the study that attention will now be focussed.

Three groups of subjects were included in the study, liberal arts and engineering students all male, as well as a group of vocational experts, who were either vocational counsellors or researchers. Analysis indicated that there was little, if any, difference in the four-dimensional solutions obtained for any of these three groups. From regression onto this solution of the rankings on compensation and independence, that were obtained separately, it appeared that the vocational counsellors used the dimension of independence in making their judgements somewhat more and the dimension of compensation somewhat less than the students. There was no difference between the two student groups. These results are very similar to those reported by Reeb and reviewed

earlier. It seems reasonable to suggest that at the general level the range and type of construct used vary little from person to person. Individual differences might be more pronounced in particular sub-domains, with individuals tending to use more personal criteria for making judgements at this level.

A third aspect of this study was a comparison of subjects' ratings of the kinds of occupational reinforcement found in the occupations with data obtained from the published Occupational Reinforcer Patterns and also relating both these sets of data with the four-dimensional INDSCAL solution. As the reinforcers were perceived by the subjects, estimated from their ratings, most of the dimensions were found to be highly (r significant at .01) or fairly highly (r significant at .05) associated with the subjects' INDSCAL solution. However, the published Occupational Reinforcer Patterns (ORPs) were not greatly correlated with the INDSCAL solution suggesting that the subjects perceptions were different from the measured ORPs. This could indicate either that the subjects understood the ORP constructs but, in general, were unable to accurately rate the occupational titles on the constructs, or that they did not understand the constructs at all. As the subjects' ratings correspond closely with the INDSCAL solution, there is some evidence for consistency in both tasks and this suggests that the subjects were able to discriminate using the constructs but consistently made attributions about the occupations that were mistaken.

There is one relatively minor piece of information that is not mentioned by Shubsachs and Davison but which could affect the choice of solution for displaying the results. They do not report for either the 3-dimensional or 4-dimensional solutions the extent to

which their axes are correlated. It has been pointed out earlier that nothing constrains the axes in an INDSCAL solution to be uncorrelated and, obviously, the higher the dimensionality of the solution, the more likely it is that two of the axes might be significantly correlated. Without this information it is not possible to make objective criticism of the choice of dimensionality they have chosen to represent their data, but only to question subjectively their judgement and interpretation of the results. Some comments on these have already been made and nothing further will be added at this stage.

4.19 It is appropriate at this point to make some more general comments on these studies as a group and also to question one or two underlying assumptions of the model of data analysis which have not yet been raised. The first point to be made here is about the difficulty of making comparisons between the studies that have been reviewed. In part this follows from the choice of occupational titles and some comments on this have been made in an earlier section. Although all the studies have suggested labels for the dimensions of their solutions and these have generally included a level dimension and various field dimensions, it seems doubtful whether studies of this sort can do more than offer some confirmatory evidence as to the type of dimensions that are appropriate for the classification of occupations in a vocational guidance context. The study by Burton is perhaps an exception to this and could, if extended in the manner suggested, provide a basis for a subjective classification of the world of work.

The INDSCAL model used both by Coxon and Jones and Shubsachs and Davison does provide a most powerful model for the study of individual and group differences. In particular it would seem most useful for a study aiming to look at developmental differences as well as more general group differences. One concept that might be used to elaborate these differences would be 'cognitive complexity' which is defined by Bieri et al. (1966) as "intended to reflect the relative differentiation of a person's system of dimensions for construing behaviour." The focus of such a study would be on the structural variables affecting the perception of occupations as opposed to the style variables that might influence vocational behaviour. This point will be elaborated in a later section.

Another question that was raised in the paper by Coxon and Jones was whether the occupational history and background of the subjects, as well as the context in which the actual judgements were being made, would affect the subject's perception of occupations. This highlights the importance of knowing what the subject thought was involved in the experimental situation. The studies that have been reviewed here might be criticised for presenting so little information about their subjects that it is not possible to attempt to elucidate aspects of the subjects' backgrounds which might have affected their perceptions.

One topic that has not been mentioned in any of these studies is the appropriateness of the spatial model for the representation of this kind of data. There are two points that need to be considered:

(1) Whether a Euclidean distance model is suitable for this type of judgement situation? Using a Euclidean model means that all

the dimensions are weighted equally and contribute to an equivalent extent to the difference between occupations and that the Theorem of Pythagoras holds. Alternative models, either the 'city block metric' proposed by Attneave (1950) or other Minkowski r-metrics (see Coombs et al., 1970) make different assumptions. These will be discussed in a later section.

(2) Whether a continuous spatial model is appropriate for this type of data, or whether a discreet typological model based on cluster analysis might not be more suitable and generate more parsimonious solutions?

In many ways these are empirical problems and it is open to debate whether a solution based on one model is easier to understand and subsequently more useful than another. It is important to remember, as Beals, Krantz and Tversky (1968) noted, that the analysis of this type of data is based on both dimensional and metric assumptions. As the intention in using Multidimensional Scaling mthods is to understand complex behaviour, it is necessary to be aware of the theoretical assumptions of the measurement and scaling theory and how a real world theory can correspond to the particular measurement model.

4.20 The purpose of this review of the literature has been to introduce an approach to the study of vocational behaviour and development which is distinctly cognitive in orientation. This view places considerable emphasis on the role of people's perceptions of occupations as a mediating process in vocational behaviour. It is also argued that the study of people's occupational perceptions has been a comparatively neglected topic in most accounts of vocational psychology (see Section 2.11).

A distinction has also been made between two approaches to the study of occupational perceptions. The first, which is of less relevance to this study, is concerned mainly with the content of occupational stereotypes and has been briefly reviewed in Section 3. The second approach, which has received less attention in the literature, is described here as focusing on the structural aspects of occupational perceptions. Studies that have adopted this approach or can be interpreted within this framework have been reviewed in Section 4. In particular five studies which have used multidimensional scaling techniques have been discussed in detail because this method is seen to be particularly appropriate to a study concerned with the role of occupational perceptions in vocational behaviour.

4.21 The pilot study which is to be reported in the next section developed directly out of the work of Reeb, which is one of the studies that was described in detail in this section. The initial concern was to develop a method of studying perceptions of occupations. The pilot study, therefore, was intended to attempt to replicate in a new setting the technique used by Reeb. Before the role of the structural aspects of the perception of occupations in vocational behaviour is considered further, it is necessary to attempt to demonstrate that there is a research method that appears to generate valid information about occupational perceptions. The pilot study is, therefore, exploratory in that it attempts to test the feasibility of a particular research method, while the main study will be exploratory, in a different sense, in that it will be using the research method to examine and describe the structural qualities of occupational perceptions.

4.22 Another reason why this study must also be considered exploratory is in its development and use of measurement procedures to study the structural aspects of occupational perceptions. One measure that was always central to the author's thinking on this topic was cognitive complexity. This concept was used by Oppenheimer (1966) and his study has been reviewed earlier (see Section 2.6). Cognitive complexity is one of the dimensions of cognitive structure that is expected to distinguish between individuals in specific situations. The originators of the concept discussed it at length:

> "In its most general meaning, cognitive complexity is a construct which is intended to indicate something about the person's structuring of his social world. More specifically, we consider cognitive complexity to be an information processing variable which helps us predict how an individual transforms specified behavioural information into social or clinical judgements.
>
> We can begin to identify the nature of this structural variable by noting that cognitive complexity is intended to reflect the relative differentiation of a person's systems of dimensions for construing behaviour. It should be noted that although cognitive complexity is closely related to the notion of differentiation, we consider a more complex structure to be a more differentiated structure in a particular sense. That is, we are concerned with the differentiation of dimensions of judgment, rather than with categories, concepts or regions. Cognitive complexity may be defined as the capacity to construe social behaviour in a multidimensional way. A more cognitively complex person has available a more differentiated system of dimensions for perceiving others' behaviour than does a less cognitively

complex individual. As we have noted, an advantage of this approach is that it brings the analysis of the cognitive structural variable into closer systematic relation to the stimulus conditions within which judgement occurs. If we wish to predict differences on a task between judges who differ in cognitive complexity, we believe it is of value to analyse the stimulus in terms of its relative dimensionality."

Bieri et al. (1966)

Cognitive complexity as introduced by Bieri (1955) was used in particular for the analysis of data from repertory grids and it is apparent that much of the work on cognitive structure has developed from Personal Construct Theory (Kelly, 1955), or can be considered within that framework, although it has not concentrated on the use of the Rep Test as a method. This convergence between different research methods for measuring theoretically similar variables is strong evidence for the validity of the theory (Campbell, 1960) and suggests that the notions of Personal Construct Theory are relevant to the study of structural variables. Rosenberg (1977) also makes clear that Personal Construct Theory is a structural theory that is meant to be universal in conception.

The notion of cognitive complexity, as has alreay been pointed out (see Section 4.19), would appear to be most appropriate to the interpretation of data from individual differences scaling performed using the multidimensional scaling programmes INDSCAL (Carroll and Chang, 1970). Although Landfield (1971, 1977) has argued that cognitive complexity emphasizes only differentiation, but not the other aspects of the organization of the person's system of constructs, it would still appear an appropriate measure for the

interpretation of data from multidimensional scaling. The other alternative measures proposed by Landfield are only appropriate to a modified Rep Test situation and, therefore, are not discussed here.

The notion of cognitive complexity used as a measure on the results of multidimensional scaling analysis is a second order measure of structure. The outcome of the multidimensional scaling analysis is itself a structural measure, which suggests how the content domain can best be represented in a spatial arrangement. An alternative structural model is obtained by cluster analysis, which attempts to group the content domain into categories. In the analysis of the data from the main study this technique will also be used as a method to locate structure in the data and will serve to complement the use of multidimensional scaling.

Although both these methods have psychometric rationales, it is still necessary to relate these models to the psychological models of vocational psychology. This issue will be discussed in a later section concerned with the interpretation of the results of the main study and their implications. Other measures that will be used in the analysis of the data will be presented during the description of the results of the study. The next section, however, describes the development of the pilot study.

5. THE PILOT STUDY.

5.1 The purpose of the pilot study was essentially to try to replicate Reeb's (1959a, b, 1971) research with a student population. In contrast to other research methods, the multidimensional scaling procedure used by Reeb to analyse the pair comparison data yielded a discreet and finite number of dimensions to explain the observed similarity scores. In a parallel measurement procedure Reeb was also able to anchor the dimensions externally and to show that they were unidimensional. At the time, this research procedure seemed to be the most promising for further research on the way people subjectively structure the world of work.

The method has the very important advantage of not structuring the dimension on which comparisons are to be made - which is a criticism of techniques such as the Semantic Differential or Repertory Grid Technique (if it is used in a standard format for a group of subjects). As Reeb (1971) notes the multidimensional scaling procedure allows the perceptual dimensions to emerge and "therefore does not assume that the constructs useful in studying vocational perception and choice are necessarily those of personality theories."

5.2 A crucial issue in the design of a questionnaire that uses a pair comparison format is that the number of pairs to be rated increases very much more rapidly than the number of stimuli. If a complete design is going to be used, where every item is compared to every other one, a questionnaire that includes more than 20 items is likely to prove overlong and the subjects are likely to complain

of fatigue affecting their performance. Some of the consequences of this are illustrated with the development of the Minnesota Importance Questionnaire (Weiss, Dawis, England and Lofquist, 1964; Gray, Weiss, Hendel, Dawis and Lofquist, 1971). This originally started out as 100 item Likert format questionnaire where 20 scales were represented by 5 items each. Because the questionnaire in this form had some undesirable psychometric characteristics, it was decided to construct a pair comparison format version of the MIQ. For this version one statement was chosen to represent each of the twenty scales of the Likert form of the MIQ. Each of the twenty statements was paired with all the others to give 190 pair comparison items. These 190 items were then repeated so that the consistency of the ratings could be measured to give 380 pair comparison items. One problem with this format was the amount of time it took to administer the questionnaire and subjects frequently reported that the instrument seemed unduly repetitive. In 1967 it was decided to revise the instrument yet again and to use a different method of measuring consistency. The revised instrument consists of 190 pair comparison items plus an absolute judgement section of 20 items. Although the instrument in this format has been used as the standard form of the MIQ for over 10 years, recently an alternative version of the questionnaire was developed using a multiple rank order format which should be equivalent to the 190 pair comparison items but with only 105 items plus 21 items in an absolute judgement section. The main reason for developing this new version of the questionnaire, which can be used in parallel with the 1967 version, is that it should be quicker to complete, because some subjects still complained about the length and repetitiveness of the 210 item version of the MIQ.

In a research situation subjects' motivation to complete lengthy questionnaires is even more limited. For the pilot study therefore it was decided that no more than twenty items would be used so that the questionnaire would include 190 pair comparisons. Ten pairs would also be repeated to give a rough measure of the consistency of response. It was felt at this stage that this would be the longest questionnaire that could be given in practice.

An alternative approach might have been to adopt an incomplete pair comparison format, where not all possible pairs are included in the design. There is, however, comparatively little data available about the effect of missing out some of the comparisons. One 'Monte Carlo' study by Spence and Domoney (1974) attempted to assess the effect of missing data and of different incomplete pair comparison designs on the types of solutions obtained by nonmetric multidimensional scaling procedures. There are a number of alternative ways that incomplete designs can be constructed and this research indicated that some types of incomplete design for single subjects tended to yield more consistent approximations to the complete data set than others.

In spite of the attraction of using an incomplete design that would allow the inclusion of a larger number of job titles, it was decided that, for the pilot study at least, a complete pair comparison design would be used for two further reasons. First, some of the nonmetric multidimensional scaling programmes which would be used to analyze the data could not be used with incomplete data sets and, secondly, at this stage the prime objective was to assess the feasibility of the questionnaire method and to check on the quality of the data that could be obtained in this

way. Therefore, it was felt best to play safe at first and to adopt the most conservative approach to the questionnaire design. If the pilot study was successful and demonstrated that the data could be collected successfully and could be meaningfully interpreted, then, when it came to extending the research to other groups of subjects and other sets of job titles, it would perhaps be worth considering the possibility of using an incomplete pair comparison design.

5.3 The second problem in the design of the questionnaire was the selection of the job titles. Some of the difficulties in the selection of job titles have already been discussed in an earlier section (4.8). The main concern in the selection of job titles for the pilot study was that the titles chosen should be familiar to the students who were to act as subjects and be of an appropriate occupational level such that US college students would be likely to consider them of a suitable standard for college graduates. A second criterion was to be able to relate the occupational titles chosen to other data bases generated by vocational psychologists which attempt to classify or scale jobs. It was decided that the most useful data base currently available and suitable for this was the newly published Minnesota Occupational Classification System (MOCS) (Dawis and Lofquist, 1974). MOCS was developed as part of on-going work of the Work Adjustment Project at the Department of Psychology at the University of Minnesota. It classifies occupations along the two dimensions identified by the Theory of Work Adjustment (Dawis, Lofquist and Weiss, 1968) that are used to relate individuals and the world of work. These

dimensions are:

(1) abilities - which are defined in terms of Occupational Aptitude Patterns (OAP's) identified by the US Department of Labour (1970) and

(2) needs - which are defined in terms of the Occupational Reinforcer Patterns (Borgen, Weiss, Tinsley, Dawis and Lofquist, 1972; Rosen, Handel, Weiss, Dawis and Lofquist, 1972) that describe the contribution of 20 occupational needs. Occupational Reinforcer Patterns have been developed for 148 occupations and have been grouped into 12 Occupational Reinforcer Clusters (ORC's).

Basically, MOCS cross-classified occupation along these two axes. So far, with 114 occupations included in the classification, 77 taxons (clusters of occupations defined by unique OAP - ORC combinations) have been identified. One of the main advantages of the Minnesota Occupational Classification System is that it includes information from other classifications. In particular, it includes the Holland three digit codes for each of the occupations in the system and lists which interest inventories have occupational scales for the occupations. A number of the dimensions used in the Dictionary of Occupational Titles (US Department of Labour, 1965) are also given. These include the ratings of the extent to which each of the occupations involves working with people, working with data and working with things; information on occupational groupings and the rankings of interests, temperaments and physical demands of the different occupations. A fuller description of the development and use of MOCS is given elsewhere (see Dawis and Lofquist, 1975).

To meet the first criterion it seemed reasonable to try to find out what occupations college graduates typically go into. An approach was made to the University of Minnesota placement services to try to find this out. Unfortunately their records did not prove to be of use because so many students either did not notify the placement service of their employment or went on to further training. It was therefore decided to try a different criterion. All the occupations included in MOCS where the average score of the OAP was greater than or equal to 100 were listed. Inspection of this list suggested that a few occupations in MOCS which might be appropriate for college students were omitted. It was also noted that probably this list included more occupations appropriate for men only. By changing the criterion to an OAP score greater than or equal to 95, 4 more occupations were identified bringing the total to 36 occupations. The complete list of 36 occupations with an OAP score greater than or equal to 95 is given in Table 5.1. From this list 20 occupations were chosen for the Pilot Study to try to meet two criteria. First to represent the different Holland categories, although unfortunately no jobs in Holland's 'Enterprising' category met the OAP criteria, and secondly to include occupations that might generally be considered appropriate for both men and women as well as occupations more usually carried out by men or by women. These are listed in Table 5.2. There are two difficulties here. First it is well known that the mass of women workers are concentrated in relatively few occupations and, second, that by the research worker's own rating, there were few occupations in the list chosen from MOCS that were most commonly performed by women. Although in both the United States and the United Kingdom sex discrimination in employment practices is now illegal, it is still true that there are many occupations in which

TABLE 5.1

Occupations selected from the Minnesota Occupational Classification System.

Criterion - Average OAP score greater than 95

List of Job Titles (including alternative titles)	MOCS TAXON	HOLLAND CODE
1. Embalmer/Embalmer's Apprentice	1 2	SEC
2. Secretary, General Office/Girl Friday/ Secretarial Stenographer Legal Secretary/Medical Secretary	1 9	CSE
3. Radiologic Technologist/X Ray Technologist	1 10	ISR
4. Medical Technologist	1 13	ISR
5. Stenographer/Clerk Stenographer	1 13	CIE
6. Typist	1 13	CIE
7. Patrolman/Accident Prevention Squad/ Homicide Squad/Vice Squad	1 13	RES
8. Police Lieutenant Precinct/District/ Field/Precinct/Uniform Force	1 13	RES
9. Digital Computer Operator/Computer Operator/Console Operator	1V 2	CIS
10. Counselor - Private Employment Agency	1X 2	SEC
11. Claims Adjuster/Field Claims Representative/Insurance Adjuster/ Investigator	1X 9	SER
12. Electrical Engineer	X 1	IRE
13. Highway Engineer	X 1	RIE
14. Civil Engineer/Structural Engineer	X 1	RIE
15. Mechanical Engineer	X 1	RIE
16. Programmer Business/Digital Computer Programmer/Programmer Engineering and Scientific/Programmer Technical	X 1	IRA
17. Statistician Applied/Demographer/ Biostatistician/Statistician, Business and Economics/Statistician Physical Science and Engineering/Statistician Social Science/Statistician Vital	X 1	IRA
18. Dietician	X 2	RIE

TABLE 5.1 (Contd.)

19.	Writer, Technical Publications/ Handbook Writer/Service Publication Writer/Technical Editor/Technical Writer/Writer Publications	X 3	AIS
20.	Pharmacist/Druggist/Registered Pharmacist	X 4	IES
21.	Librarian	X 4	SAI
22.	Accountant, Cost	X 4	CIS
23.	Commercial Artist, Illustrating/ Graphic Artist/Title Artist/Fashion Artist	X 6	AIS
24.	Nurse, General Duty/Nurse Staff	X 8	SIA
25.	Claims Examiner/Claims Analyst/ Claims Reviewer/Loss Examiner	X 9	SIE
26.	Physical Therapist/Physiotherapist	X 10	SIR
27.	Counselor, School/Guidance Counselor/ Vocational Adviser/Vocational Counselor	X1 2	SEC
28.	Counselor, Vocational Rehabilitation	X1 2	SEC
29.	Teacher, Elementary School/Teacher, Primary	X1 2	SAE
30.	Teacher, Secondary School/Teacher, High School	X1 2	SIC
31.	Caseworker	X1 2	SIC
32.	Photographer, Commercial/Still Cameraman	X1 7	AIR
33.	Architect	X11 1	AIR
34.	Accountant, Certified Public/ Certified Public Accountant/CPA	X11 4	CIS
35.	Interior Designer and Decorator/ Consulting Decorator/Interior Decorator	X11 7	AIS
36.	Occupational Therapist	X11 S 352R	SIR

TABLE 5.2

SELECTED SAMPLE OF JOB TITLES

TITLE	MOCS TAXON	HOLLAND CODE	DOT CODE
1. Secretary	1 9	CSE	201.368
2. X Ray Technologist	1 10	ISR	078.368
3. Computer Operator	1V 2	CIS	213.382
4. Electrical Engineer	X 1	IRE	003.081
5. Civil Engineer	X 1	RIE	005.081
6. Mechanical Engineer	X 1	RIE	007.081
7. Computer Programmer	X 1	IRA	020.188
8. Statistician	X 1	IRA	020.188
9. Technical Writer	X 3	AIS	139.288
10. Pharmacist	X 4	IES	074.181
11. Librarian	X 4	SAI	100.168
12. Commercial Artist	X 6	AIS	141.081
13. Staff Nurse	X 8	SIA	075.378
14. Physical Therapist	X 10	SIR	079.378
15. Vocational Counselor	X1 2	SEC	045.108
16. Primary School Teacher	X1 2	SAE	092.228
17. Social Worker	X1 2	SIC	195.108
18. Photographer	X1 7	AIR	143.062
19. Architect	X11 1	AIR	001.081
20. Accountant - CPA	X11 4	CIS	160.188

at present the vast majority of members are of one sex only. In choosing a list of occupations it is extremely difficult to strike an appropriate balance between saying all occupations are now in theory open to anyone who is appropriately qualified and saying the list ought to reflect the 'status quo' distribution.

The difficulty of selecting a list of 20 job titles that might be representative has already been discussed but perhaps it is not until one tries to choose a selection to meet particular criteria that the nature of the compromises inherent in any such selection procedure becomes apparent. In the list finally chosen for the pilot study, it will be noticed that 17 out of the 20 include 'Investigative' as one of the three components of their Holland code and the sample may be somewhat biased in this respect. However, it was hoped that this list, subjective though it was, would meet the most important criterion of being appropriate for the subject population.

Holland (1973) points out that the distribution of a representative sample of occupations in the United States is very skewed (see Table 5.3), but that

TABLE 5.3

Distribution of occupations in a National (US) representative sample.

Holland Type	%
Realistic	82
Investigative	5
Artistic	2
Social	2
Enterprising	6
Conventional	4
Total	101*

* Caused by rounding errors

the distribution for college students will usually contain few 'Realistic' occupations, but many 'Social' and 'Investigative' ones. Holland's Occupations Finder (1973) lists 456 occupations including all the most common occupations in the United States, and it is quite instructive to look at the distribution of the occupations in terms of Holland's six categories and by educational level (see Table 5.4).

TABLE 5.4

Distribution of jobs in Holland's Occupation Finder.

CATEGORY	N of jobs		N of jobs - college training necessary		%age of jobs in category requiring college traini
	N	%	N	%	%
Realistic	151	33	12	6.3	8
Investigative	69	15	55	28.9	80
Artistic	36	8	29	15.3	81
Social	86	19	56	29.5	65
Enterprising	67	15	32	16.8	48
Conventional	47	10	6	3.2	13
TOTAL	456	100	190	100	-

The breakdown by educational level quickly suggests that this classification does not include jobs with minimal educational requirements and suggests that the classification is aimed at students of above average ability. (See Table 5.5).

TABLE 5.5

Classification by Holland type and educational level.

Educational Level	Holland Type REAL	INV	ART	SOC	ENT	CON	TOTAL
College training necessary	12	55	29	56	32	6	190
High school and some college, technical or business training necessary	118	14	7	28	35	41	243
Elementary school or no special training	21	0	0	1	0	0	22
Other*	0	0	0	1	0	0	1
TOTAL	151	69	36	86	67	47	456

* Housewife

This classification would, perhaps, have provided an alternative sample pool for occupational titles for the investigation but/rich detail of information about alternative classifications available for MOCS was not presented with this list and MOCS was, therefore, more suitable for the study. However, the distribution of occupations that require college training is instructive as to what would be an appropriate distribution of occupations for this pilot study. The 'Investigative' and 'Social' categories contain the majority of occupations at this level. At this point it is worth reiterating that the division of occupations into six categories is somewhat arbitrary and that some occupations would easily fit into more than one category. Evidence for this comes from the fact that occupations have been classified into different categories by different people using the same approach. The two or three point code is probably a much better guide to the categorization of the occupations as it suggests which two or three

areas are most commonly associated with the occupation. From the counsellor's point of view it would also be interesting to know which of the six categories are very rarely associated with an occupation. "Dislikes" can be an equally important source of information for vocational guidance.

It is also reasonable to question at this stage how adequate any categorisation system for describing occupations can be. This is an issue which will be discussed again in a later section, but some of the difficulties and constraints that are involved in the use of categories, at least for research purposes, have been illustrated in the above discussion. In particular that, although there may be a theoretical framework within which the occupational titles might be chosen, all too often in practice the relevant occupational data does not exist so that the actual selection process involves numerous compromises.

5.4 At this stage the two basic parameters affecting the questionnaire design had been fixed. The next stage was to decide on the response form and instructions for the questionnaire, as well as the ordering of items. Reeb (1959a, 1971) had used two forms of instruction in his research. In his earlier paper he reported asking subjects to rate directly the similarity of pairs of job titles on a 7 point scale. In his second study he changed the form of the task, even though the results from the first study appeared quite satisfactory and no problems with the original format were reported. In the second study, people were asked to consider how suitable a person would be for job X given that they were suitable for job Y. Although in practice the two forms of the rating procedure did produce similar results for the groups he

studied, there is a conceptual distinction between the methods of obtaining ratings. Intuitively it would seem that the 'suitability' relationship need not be symmetrical. Consider a pair of jobs, A and B. A person most suitable for Job A might be quite suitable for Job B. However, it would not necessarily follow that a person most suitable for Job B would be also quite suitable for Job A. Yet this is an implicit assumption made in this form of the rating task. Similarity obviously is a symmetrical mathematical relationship as well as seeming intuitively to be a slightly simpler concept than suitability. Against this can be argued that the suitability rating might be more realistic in some sense than the rating in terms of similarity.

For this Pilot Study it was decided that the possible conceptual difficulty was more important than an uncertain element of realism and, therefore, that the rating should be in terms of similarity using a 7 point rating scale ranging from (1) Almost identical to (7) Completely different, shown below:-

1. Almost identical
2. Very similar
3. Mostly similar
4. About as similar as different
5. Mostly different
6. Very different
7. Completely different

In using the method of pair comparisons, it is important to consider how the pairs can best be ordered. Intuitively a random order of pairs might seem the most appropriate. However, as Ross (1934) points out it is desirable that the experimental series

should:

1. Eliminate space and time errors
2. Avoid regular repetitions which might influence judgement,
3. Maintain the greatest possible spacing between pairs involving any given member of the stimulus group.

Ross goes on to develop and explain a general method for finding optimal orders for stimulus sets of any number of members. The structured ordering that Ross suggests was used for this study and it has the advantages of achieving optimal spacing between the occurrence of a single stimulus, as well as balancing the order in which items appear in pairs and spreading individual stimuli throughout the sequences.

In the pilot study the stimuli were arranged alphabetically, as such an ordering did not appear to be structured. One drawback of this arrangement was that the two titles 'Computer Operator' and 'Computer Programmer' were adjacent in the list and so appeared frequently in adjacent pairs on the questionnaire. Whether this subsequently affected the results is difficult to determine but any list in whatever order can contain elements of structure whether intended or not. However, this is, perhaps, one element that is not controlled by the method of ordering Ross advocates, but that could possibly affect subjects performance of the task.

The instructions for this part of the questionnaire were closely modelled on the report Reeb (1959b) gave of his experimental procedure and are shown in Appendix A. The emphasis in the instructions was the same as Reeb reported, stressing the individuality of the judgements and their synoptic nature. To answer any

specific queries, information about the jobs had been prepared from the current editional of the Occupational Outlook Handbook (US Dept. of Labor, 1974). This information is shown in Appendix B. The use of the rating scale was also explained in the instructions. It was stressed that "the position (4) on the scale is not meant to be the average of your ratings, but try not to see all the pairs as either (7) completely different, or (6) very different". The remainder of the instructions were intended to parallel those used by Reeb, telling subjects the order was random and to try to consider each pair afresh. They were encouraged to work rapidly and were told that it would take about 45 minutes to complete the first section of the questionnaire. After completing this section, subjects were instructed to continue straight on to the second and third sections. The second section asked subjects to rate their preferences for the 20 job titles using a 9 point rating scale which was anchored at both ends and in the middle - as indicated below:

(1) means that you would like the job very much - (like very mu

(5) that you are indifferent to it - (indifferent)

(9) that you think you would dislike it strongly (dislike stron

The job titles were arranged in random order for this. The purpose of the section was to obtain a preference ranking for each individual A pair comparison format would obviously have produced a more exact preference ordering, but it was felt that such a procedure would not be practical because of the time it would take for subjects to complete. It was also felt that the alternative of asking subjects to rank 20 occupations would not be practical.

It was also possible that the rating of preference using a 9 point scale might in some sense be more realistic than a method

that yielded a finer ordering. Although using the rating scale meant that for most subjects there would be many tied ranks, it seemed intuitively reasonable to suggest that the natural orderings people make towards a group of occupations, which would not necessarily include occupations to which they were either particularly attracted or particularly unattracted were categorical rather than dimensional in form. Accepting Jones' argument (See Section 2.10) that people do have attitudes towards a number of occupations rather than just a few, it seemed reasonable at this pilot stage to see whether preference data collected in this way could be meaningfully interpreted. If this were the case, it implies that an easier method of collecting this data is perhaps adequate for many research situations instead of having to use more refined methods such as pair comparisons (its equivalents) or direct ranking.

The final section of the questionnaire contained ten biographical questions of a standard format used in questionnaires put out by Student Life Studies at the University of Minnesota. (Student Life Studies is a research unit within the Office for Student Affairs in the University which, over the years, has carried out a number of questionnaire studies with University students and was the department at the University within which the author was based). The purpose of these questions was to enable some comparisons to be made between this sample and other data collected in the future. This information would also allow some comparisons to be made within the pilot sample, for instance contrasting the replies of men and women. The questions covered age, sex, education and home background.

5.5 At this stage, when the questionnaire design had been

completed, the author had to submit the research outline and research instrument for approval to the University Committee on the use of Human Subjects in Research before any arrangements for data collection could be made. The committee had only recently been set up (July, 1974), which meant that the procedures were not well known among academic staff, but it reviewed all research carried out by people associated with the University of Minnesota, regardless of intended subject populations, prior to the initiation of the research. Although the author wholeheartedly approved of such a policy, in practice for the research worker under close time constraints, as the author necessarily was during his year at the University of Minnesota, this involved some administrative delay before contact could be made with possible subject populations. Separate permission had to be obtained from University departments to use their students as subjects and approval from the Committee was a prerequisite for this. Further, when the author wished to collect data within the School system in the Twin Cities, separate approaches had to be made to the School systems in both Minneapolis and St. Paul.

An important lesson that the novice researcher learns in this situation relates to the detailed administrative requirements that are frequently encountered in applied research situations. Although in the United Kingdom such vigorous monitoring of research except in clinical settings, is rare, it is likely to become more widespread and the research worker is increasingly likely to have to justify his research, not only to academic colleagues, but also to the representatives of the community in general. This applies not only to applications for funding but even for permission to car out research. This monitoring, aimed primarily at assessing the

ethical implications of the research, may help to make research workers, especially those in the social and behavioural sciences, more aware of their social responsibilities.

5.6 Once the project had received approval from the Committee on the Use of Human Subjects in Research it was possible to approach departments for subjects. It had originally been intended to approach the Psychology Department subject pool because the questionnaire had been designed with Liberal Arts Students in mind. However, due to the delay caused by the requirement to get prior approval for the research, the deadline for applications to this subject pool for that term (Winter Quarter 1975) had already passed. Fortunately, it proved possible to gain access to another Introductory Psychology Class in the General College of the University, so that data collection was able to go ahead before the end of that term. (General College programmes are similar in orientation to Liberal Arts courses but tend to attract more mature students because individual students have somewhat greater freedom of choice in the selection of courses). Arrangements were made to test students from this class in four sessions with up to 10 students at a time. The reason for limiting the number was purely because of the size of the room that was available for testing. There was no reason why the questionnaire could not be administered to a considerably larger group of subjects. Prior to running a group testing session, several individuals, mainly undergraduate research assistants, working in Student Life Studies, filled in the questionnaire. This was to check that there were no obvious procedural difficulties with the questionnaire and to check on the estimate of time it would take to complete. A total of 41 completed pilot questionnaires were obtained, 36 from the

Introductory Psychology Class and 5 others from individuals. As there was no obvious reason not to include the individuals who had completed the questionnaire along with the other group, it was decided to analyze all the data together. A breakdown of the pilot study sample by college (faculty), class (year), sex and age is given in the accompanying table 5.6. As can be seen from the tables the distribution of men and women in this sample by age, class and college is very similar.

5.7 Data collection of the pilot data was completed in the last two teaching weeks of the Winter Quarter. The subjects seemed to have little difficulty in completing the questionnaire. Individuals were encouraged to work at their own pace and took from 40 minutes to an hour to complete the questionnaire. Although subjects were asked before filling in the questionnaire whether they were unsure about what the jobs listed involved, only one or two actually asked any questions about particular jobs. This was, perhaps, not particularly surprising as it might be expected that social psychological factors in the experimental situation would be such as to minimise the admission of ignorance before one's colleagues. The 36 students from the Introductory Psychology Class were getting academic credit for participating in the research and, therefore, their motives as subjects were not altruistic. However, the regulations of the Committee on the Use of Human Subjects in Research were such that the students had to give their informed consent to participate and were free to withdraw at any time without loss of credit should they feel this consent had been breached in any way.

TABLE 5.6

Pilot subjects - Distribution by year, sex and college.

SEX	Men (N=20) College		Women (N=21) College		TOTAL
YEAR	GC	Other	GC	Other	
Freshman	7	1	9	1	18
Sophomore	7	0	6	1	14
Other	1	4	0	4	9
TOTAL	15	5	15	6	41

Pilot subjects - Distribution by year, sex and age.

SEX	Men (N=20) Age		Women (N=21) Age		TOTAL
YEAR	20 or less	over 20	20 or less	over 20	
Freshman	5	3	7	3	18
Sophomore	4	3	3	4	14
Other	1	4	0	4	9
TOTAL	10	10	10	11	41

Pilot subjects - Distribution by year, age and college.

AGE	20 or less (N=20) College		over 20 (N=21) College		TOTAL
YEAR	GC	Other	GC	Other	
Freshman	12	0	4	2	18
Sophomore	7	0	6	1	14
Other	0	1	1	7	9
TOTAL	19	1	11	10	41

Pilot Subjects - Distribution by age, sex and college

SEX	Men (N=20) College		Women (N=21) College		TOTAL
AGE	GC	Other	GC	Other	
20-	9	1	10	0	20
20+	6	4	5	6	21
TOTAL	15	5	15	6	41

*GC = General College.

5.8 The participation of subjects in experiments for academic credit is rare in the United Kingdom, although it is very common in the United States. In both countries college students are frequently used as subjects in psychological research for reasons of convenience, and it is well known that this has certain consequences for the generalizability of the results of much of this research. The main question to be raised here, however, is whether participation for credit is likely to distort the results of the study. It seems reasonable to the author to assume that participation in an experiment for academic credit is unlikely to distort the experimental results any more than participation for a financial reward, which is another common way of paying subjects for their time. Under the procedure adopted at the University of Minnesota the least motivated subjects might also self-select out as they would still gain academic credit if they withdrew at any stage of the proceedings, while subjects would not normally be paid if they did not complete the experiment. This withdrawing might, of course, have the consequence of reducing the representativeness of the samples, but as the samples are not strictly probability samples from a specified population but rather what Warwick and Lininger (1975) call a 'Haphazard collection', this effect is probably unimportant. For a pilot study such effects as these are of little importance and in fact no-one did withdraw their consent to participate in this study.

5.9 One point where the procedure followed by the author differed from that pursued by Reeb(1959a) concerns the provision of information about jobs. Reeb reports that, 'a few questions about the specification of the job were evaded", whereas in the research reported here information was available and subjects were asked to

say if they were uncertain what any of the jobs involved. This difference may seem unimportant in practice since only a few subjects availed themselves of this opportunity. However, in principle, it raises the question of whether it is reasonable to allow subjects to perform the task when they have little or no information about particular jobs. Provision of information of a standard kind may, on the other hand, be said to be biasing the results in such a way that they are more likely to appear meaningful. The author decided, however, that judgments made in ignorance were likely to produce systematic rather than random errors and that subjects who asked questions and received no information might not take the research seriously and therefore produce meaningless data. One strategy that would have been more conservative, would have been to exclude altogether subjects who said that they had no idea what any particular occupation involved. However, it was felt that such a research strategy might reduce the sample size dramatically and consequently limit the feasibility of the study.

5.10 The possible consequences of this one example of the decision making involved in the design of the research illustrates that in practice the research worker frequently has to strive intuitively to make optimal decisions in the design of research procedures on the basis of very little evidence. All the options will have costs and benefits associated with them and the research worker has to attempt to balance out the costs against possible benefits. In extremely few situations, the consequences of decisions may perhaps be quantified and directly costed, although more typically the judgements will involve qualitative costs which cannot be directly estimated. The constraints that usually exist in terms of time, manpower, money and other resources also preclude the empirical

determination of the possible consequences of minor design changes in a research procedure. Replication of research will probably provide a robust test of any procedure, as many minor changes, frequently unintentional, will be introduced. If similar results are obtained the research worker can probably conclude that the research procedure has proved robust in practice and that the effects causing the results are not ephemeral. In many situations the fact that an attempt at replication yields unexpected results allows the researcher to refine his or her definitions and understanding of the process under study. Both outcomes are valuable and suggest that replication is important to science and, perhaps, its value is frequently underestimated by research workers seeking novel topics and new research problems.

5.11 Once the pilot data had been collected, it had to be coded and transferred to punch cards for data analysis using the computer. At this stage the only biographical information coded was the subjects' age and sex and, as all the data in the other sections of the questionnaire was numerical already, it was relatively simple to prepare a codebook for the data (see Appendix C) and to punch the data onto IBM cards. All the data was punched by the author as data preparation services had to be paid for. At the University of Minnesota computing facilities are not provided free of charge to students. Although the author was given $ 100 of computer time by Student Life Studies, ancilliary materials such as IBM cards had to be purchased separately. Initially punching the cards was very time consuming but by the time the author was punching the main survey results he had become quite proficient.

Card punching is merely a clerical task but the limiting

factor is the number of errors that are made, as correcting errors can only be done by duplicating the card automatically and substituting the correct digit for the error. If the person punching cards is tired, the number of errors increases significantly and consequently the rate of punching correct cards is rapidly reduced. In such situations the lesson to be learnt is that now is the time to stop. It often seemed an attractive idea to spend an evening punching cards, but after a long day the efficiency of the process was low.

5.12 Once the data had been punched onto cards, preliminary analysis of the data could begin. This was carried out using the Statistical Package for the Social Sciences (SPSS, Nie, Hull, Jenkins, Steinbrenner and Bent, 1975). All the data reported in this section were recomputed once the author returned to England, as the original output was too bulky to transport. The first task was to compute simple frequency distributions for each individual item and to calculate the mean score on individual items. This data would be needed for subsequent multidimensional scaling analysis of the group data. However, the author was first concerned to look at the distribution of responses in the data overall. These results are presented in Table 5.7 and compared with the earlier results of Reeb (1959a) and Coxon and Jones (1974a).

TABLE 5.7

Distribution of pairwise similarity ratings

	Reeb (1959)		Coxon and Jones (1974)			Jackson	
N of subjects x N of Pairs	25 x 105		162 x 120			41 x 200	
Rating	N	%	Rating	N	%	Rating	N	%
1	39	1.49	1	406	2.09	1	192	2.34
2	198	7.54	2	879	4.52	2	519	6.33
3	285	10.86	3	1401	7.21	3	950	11.59
4	385	14.67	4	1465	7.54	4	1269	15.48
5	506	19.28	5	1680	8.64	5	1635	19.94
6	697	26.55	6	2058	10.56	6	1648	20.10
7	515	19.62	7	2899	14.91	7	1984	24.20
			8	3353	17.25			
			9	5262	27.07			
Missing	0	0		42	0.22		3	0.04
Total	2625	100.01		19440	100.01		8200	100.02

Comparison of the author's and Reeb's results indicate a broad similarity, with the author having more extreme ratings. Coxon and Jones' results, although not strictly comparable as they used a 9 point rating scale, are somewhat more skewed towards dissimilarity than the other two studies and this effect may have been caused by differences in the instructions given for the rating procedure. Jackson followed Reeb in urging his subjects to "try not to see all pairs as either (7) Completely Different, or (6) Very Different", whereas Coxon and Jones instructed subjects to use their own definition of similarity.

The nonmetric multidimensional scaling procedures used in the two more recent studies only use rank order information from the

pair comparisons, but Reeb in his early study had to assume that the data were of interval level and approximately normally distributed. It is perhaps debatable whether Reeb's data meet this requirement.

The author also formed the subjective impression from punching the data onto cards that subjects tended to become more extreme in their ratings as they progressed through the questionnaire. To test this hypothesis, separate counts were prepared for the first 100 and second 100 items. These are shown in Table 5.8.

TABLE 5.8

Districation of scores by section of questionnaire and response category.

	Pairs 1 - 100		Pairs 101 - 200		Pairs 1 - 200	
Rating	N	%	N	%	N	%
1	110	2.68	82	2.00	192	2.34
2	307	7.49	212	5.17	519	6.33
3	525	12.80	425	10.37	950	11.59
4	711	17.34	558	13.61	1269	15.48
5	813	19.83	822	20.05	1635	19.94
6	803	19.59	845	20.61	1648	20.10
7	829	20.22	1155	28.17	1984	24.20
missing	2	0.05	1	0.02	3	0.04
Total	4100	100.00	4100	100.00	8200	100.02*
	Σ X 19829		Σ X 21278		Σ X 41107	
	Mean 4.84		Mean 5.19		Mean 5.015	

* caused by rounding error

Visual inspection of this table suggests that subjects on the whole

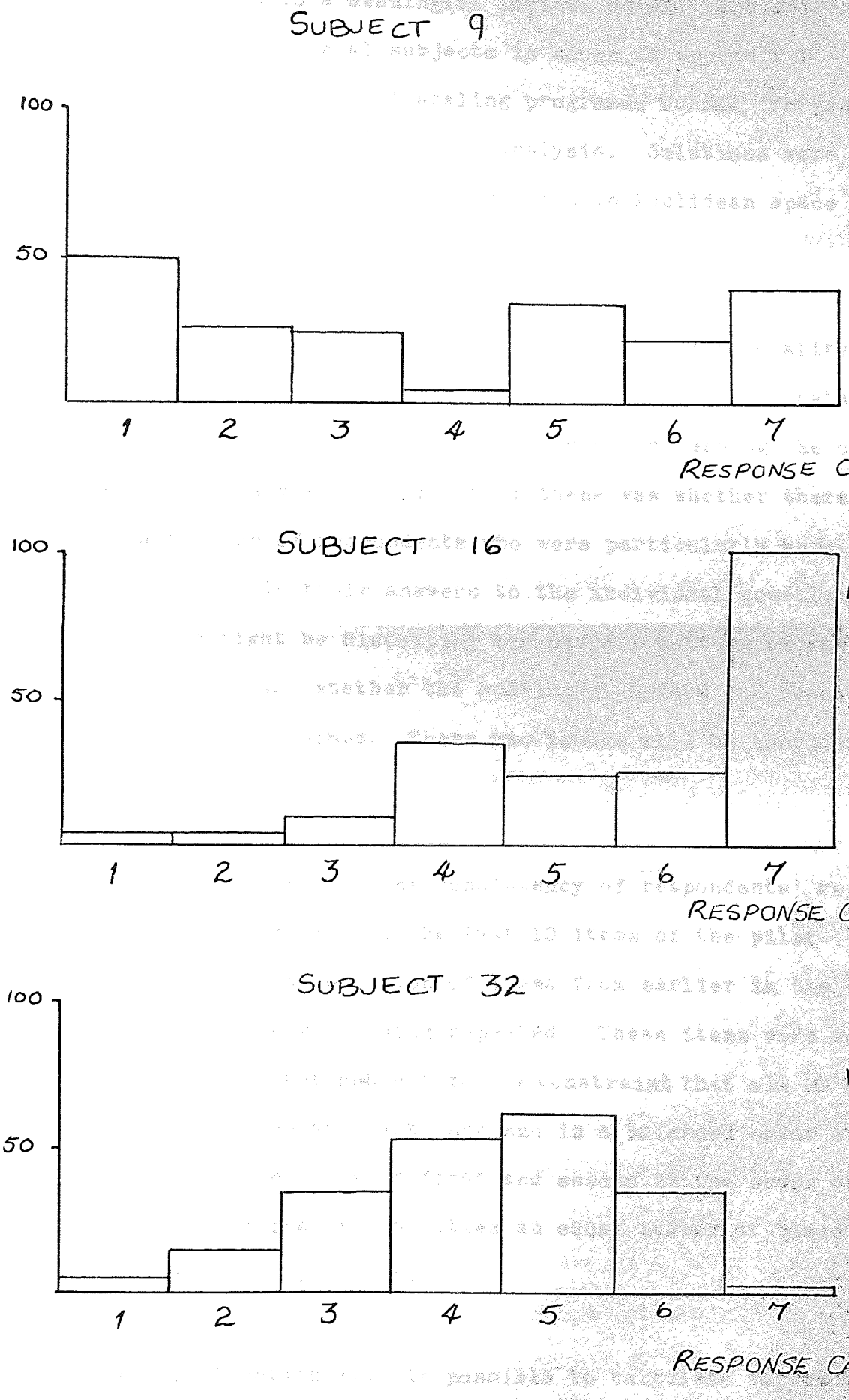
did tend to use points (6) and (7) on the rating scale more frequently in the second half of the questionnaire. There are a number of possible explanations for this. In the author's opinion this is most likely to be a fatigue or boredom effect caused by the length of the questionnaire, but it may also be that the instructions become less salient in the individuals' minds as they worked through the questionnaire. It could also be a reflection on the content of the items in the different halves of the questionnaire. If either of the first two reasons applies, it suggests there is a good reason for making the questionnaire for the main study considerably shorter.

Although the general pattern of responses obtained from the whole group is of the form indicated, there is considerable variation in response pattern. Many are highly skewed, but some are nearly normal in form, others bimodal or even skewed in the opposite direction. Some examples of individual distributions are shown in Figure 5.1. These results suggest that there is a considerable amount of individual variation in subjects' responses to the questionnaire. This individual variation will be explored in subsequent analysis, but at this stage the only multidimensional scaling analysis that could be performed was of the aggregate data, because no programme for individual differences scaling was available at that time at the University of Minnesota although one was in the process of being made available.

5.13 For the multidimensional scaling analysis of the group data the first task was to prepare a matrix of the mean scores from the scores for each item in the questionnaire. These mean scores were available from the frequency counts carried out using SPSS,

FIGURE 5.1

Individual response patterns.



but had to be transformed from the structured random order used in the questionnaire to a meaningful logical order. The matrix for the pilot data for the 41 subjects is shown in Appendix D. The non-metric multidimensional scaling programme TORSCA (Torgerson and Young 1967) was used for this analysis. Solutions were obtained from 5 dimensions through to 1 dimension in Euclidean space in this way.

The next problem was to determine which dimensionality offered the most parsimonious scaling solution for this data. There were, however, some preliminary issues concerning the operation of the programmes. The first of these was whether there was a significant group of respondents who were particularly unreliable and inconsistent in their answers to the individual questionnaire items and who might be distorting the overall pattern of responses. The second issue was whether the scaling algorithm had reached a global or a local minimum. These two issues will be considered in turn.

5.14 In order to measure the consistency of respondents' replies to the questionnaire items, the last 10 items of the pilot questionnaire were a selection of items from earlier in the questionnaire which were being repeated. These items were selected on a random basis, but subject to the constraint that all 20 job titles were included at least once and in a balanced order such that each job title appeared first and second in the order of presentation of pairs of job titles an equal number of times overall in the questionnaire.

This replication made it possible to calculate for each

individual in the pilot sample a test-retest correlation on the ratings given for these ten items. Individuals for whom the correlations indicated that less than 10% of the variance on these items appeared reliable were excluded from the subsequent analysis (see Table 5.9). This eliminated 5 men and 5 women from the samples for further analysis. One other woman was also excluded from the analysis as she rated 187 out of the 200 pairs as completely different on the 7 point rating scale.

This reduction of the sample size from 41 to 30 for subsequent analysis might appear to indicate that too great a proportion of the pilot sample was being excluded from the analysis. However this was a deliberate attempt to be conservative in the analysis. By selecting the more consistent individuals for separate analysis, it was hoped that the comparison of the TORSCA scaling solutions for this smaller sample with that obtained for the whole group, some measure of the effect of excluding apparently more inconsistent individuals could be estimated.

5.15 The second issue concerned whether a local or global minimum point had been reached in the iterative procedure used in the analysis. This concept can be conveniently illustrated graphically (see Figure 5.2). The iterative procedure used by the multidimensional scaling algorithm approaches the solution by a series of approximations. This iterative estimation procedure uses a least squares comparison of the calculated distances which are compared with the original estimates. There is, therefore, always a possibility that the algorithm might approach a local minimum (point A in the figure) rather than the global minimum (point B). A separate analysis was therefore performed with 40 iterations

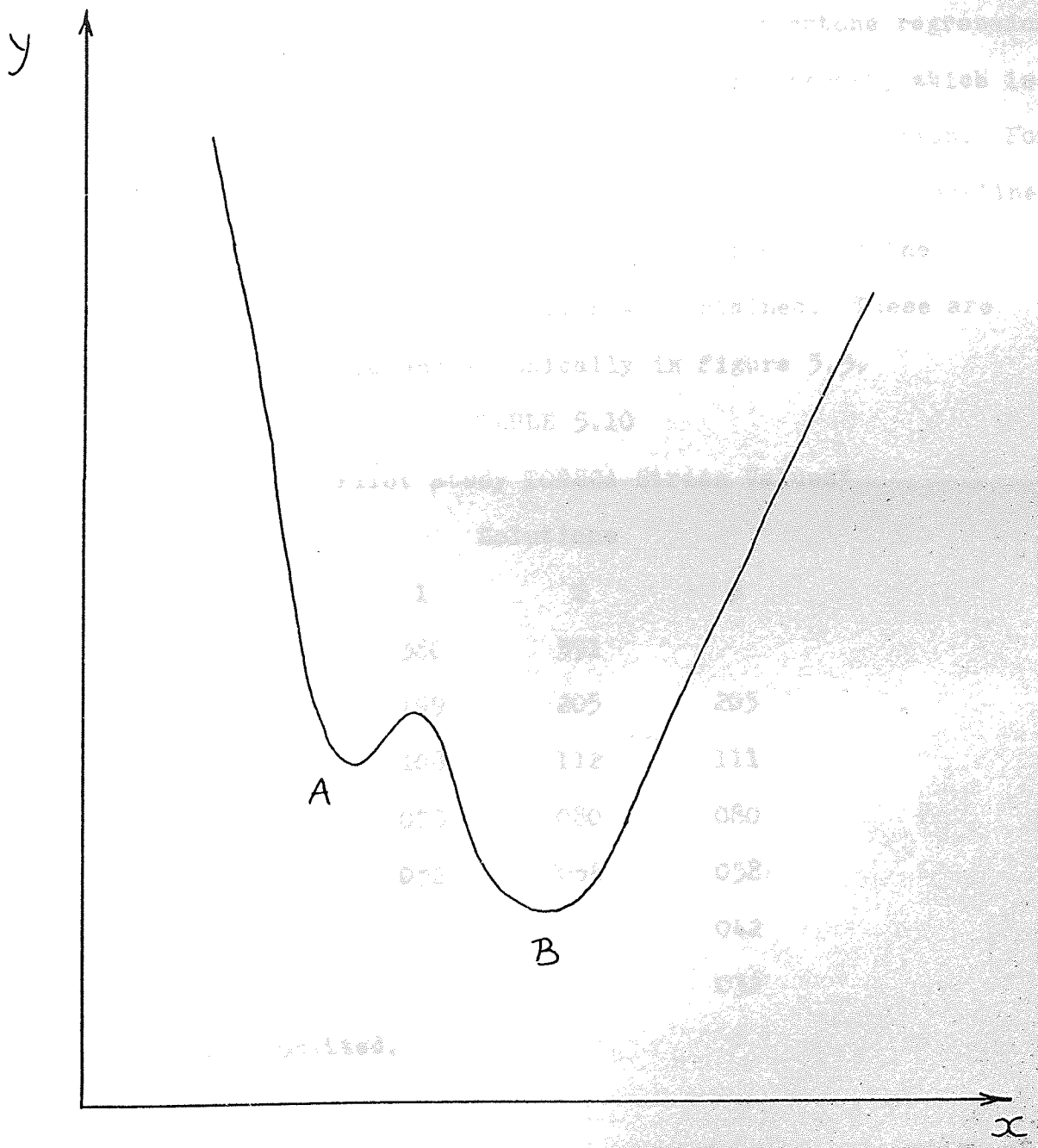
TABLE 5.9

Subject	Correlation	Subject	Correlation
1	.0625*	21	.507
2	.373	22	.520
3	.795	23	.717
4	.344	24	.679
5	.966	25	.311*
6	.593	26	.523
7	.58	27	.258*
8	.076*	28	.836
9	.926	29	.714
10	.166*	30	.404
11	.847	31	.601
12	.829	32	.232*
13	.238*	33	.102*
14	.38	34	1.0
15	.589	35	.598
16	.573	36	.578
17	.617	37	.870
18	.289*	38	.883
19	.351	39	.143*
20	.78	40	.722
		41	.542

* Subjects with less than 10% variance accounted for.

FIGURE 5.2

Local versus global minimum.



instead of the usually conservative estimate of 30 iterations. This enabled a comparison to be made between the solutions obtained under these two conditions.

5.16 To measure the goodness of a scaling solution in a particular dimensionality to the original data, Kruskal (1964) introduced a least squares measure that uses a procedure of monotone regression to estimate a parameter of the solution called "stress", which is a measure of the discrepancy between the data and the solution. For the three scaling solutions obtained under the conditions outlined above, there is a pattern of stress values for each of the dimensionalities for which a solution was obtained. These are presented in Table 5.10 and graphically in Figure 5.3.

TABLE 5.10

Pilot Study TORSCA Stress Values*

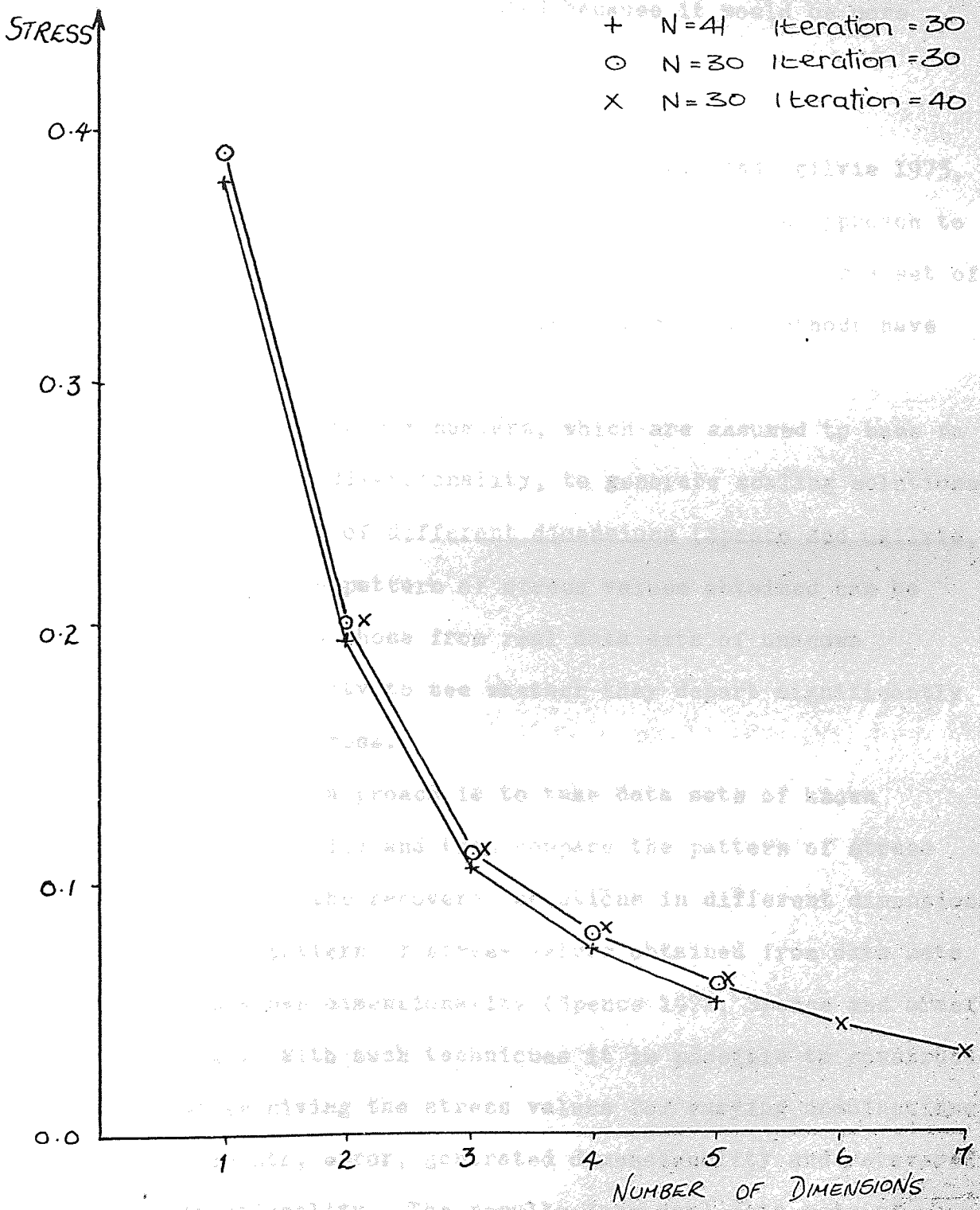
Dimensionality	Solutions 1	2	3
1	380	391	
2	199	205	205
3	108	112	111
4	073	080	080
5	052	058	058
6			042
7			032

*Decimal points omitted.

Various criteria have been suggested for the estimation of an appropriate dimensionality for the solution. Early workers usually wished to accept a solution in as few dimensions as possible for the reasons outlined earlier (See Section 4.10). It was usual to plot stress against the number of dimensions and then to look for

FIGURE 5.3

Pattern of stress of values.



a discontinuity in the gradient, such that the curve first approaches zero and then declines only slowly thereafter. For these data sets this criterion suggested that a three or four dimensional solution would seem appropriate. The three dimensional solution would therefore be accepted because it would be more parsimonious.

More recently a series of studies (Spence and Ogilvie 1973, Spence 1972, Spence and Graef 1974) have developed an approach to the estimation of the most appropriate dimensionality for a set of data on the basis of Monte Carlo experiments. Two methods have been used:

1. The use of random numbers, which are assumed to have no underlying dimensionality, to generate scaling solutions in a number of different dimensions (Spence and Ogilvie, 1973). The pattern of stress values obtained can be compared to those from real data sets of unknown dimensionality to see whether they depart significantly from randomness.
2. The second approach is to take data sets of known dimensionality and then compare the pattern of stress values of the recovered solutions in different dimensions to the pattern of stress values obtained from data sets of unknown dimensionality (Spence 1972, Spence and Graef 1974). With such techniques it is possible to construct tables giving the stress values for varying combinations of points, error, generated dimensionality and recovered dimensionality. The results from real data sets of unknown dimensionality can be compared to the tables of stress values obtained from these Monte Carlo runs and it

is possible to see which pattern of stress values most nearly approximates the values from the data set of unknown dimensionality. This provides a way of estimating not only the likely dimensionality but also the amount of error in the data set. This procedure has now been automated using a computer programme called MSPACE (Spence and Graef, 1974), which attempts to find the best fitting match to the pattern of stress value found in the real data with the results from the Monte Carlo studies using a least squares procedure.

At the time this analysis was being carried out, however, the author did not have access to this programme. Therefore the pattern of stress values obtained (see Table 5.10) had to be compared with the results given by Spence (1972) by eye. The appropriate table is reproduced in Table 5.11. The pattern of stress values actually obtained would suggest either a three dimensional solution with a relatively high degree of error (in the range 12.25 - 25%) or a four dimensional solution with error in the range 6.25 - 12.25%. This result agreed well with the estimate made previously.

5.17 The next major question that must be answered before the multidimensional scaling analysis can be considered to have been successful concerns the apparent meaningfulness of the spatial representations. Are the solutions obtained in these dimensions open to interpretation?

Only one of these solutions will be presented here, as all three solutions were broadly similar. This finding in itself

TABLE 5.11

Pattern of stress values for varying error, generated dimensionality and recovered dimensionality.*

Generated dimensionality	Error Level 0.0000	0.0625	0.1225	0.2500	Recovered dimensionality
	000	080	156	294	1
	000	066	126	202	2
1	000	054	098	153	3
	000	046	079	118	4
	000	040	065	096	5
	327	329	398	400	1
	000	066	133	219	2
2	000	055	106	156	3
	000	043	083	116	4
	000	038	067	093	5
	320	343	371	413	1
	134	148	180	243	2
3	000	050	100	160	3
	000	042	078	116	4
	000	035	063	092	5
	362	382	403	450	1
	172	172	200	265	2
4	064	082	117	180	3
	000	048	082	130	4
	000	040	064	102	5

*Decimal points omitted

(from Spence, 1972)

TABLE 5.12

Two-Dimensional Coordinates of TORSCA Solution

Occupational Title		TORSCA Coordinates 2D solution I	II
1.	Architect	0.506	-0.620
2.	Certified Public Accountant	0.441	0.654
3.	Civil Engineer	0.668	-0.359
4.	Commercial Artist	0.098	-0.855
5.	Computer Operator	0.549	0.290
6.	Computer Programmer	0.466	0.255
7.	Electrical Engineer	0.647	-0.261
8.	Librarian	-0.150	0.618
9.	Mechanical Engineer	0.686	-0.205
10.	Pharmacist	-0.418	0.410
11.	Photographer	-0.022	-0.785
12.	Physical Therapist	-0.788	-0.281
13.	Primary School Teacher	-0.839	0.068
14.	Secretary	-0.170	0.722
15.	Social Worker	-0.823	-0.050
16.	Staff Nurse	-0.620	0.255
17.	Statistician	0.254	0.385
18.	Technical Writer	0.201	0.006
19.	Vocational Counsellor	-0.648	-0.079
20.	X Ray Technologist	-0.038	-0.217

TABLE 5.13

Three-Dimensional Coordinates of TORSCA Solution

Occupational Title	TORSCA Coordinates 3D solution I	II	III
1. Architect	0.509	-0.430	-0.320
2. Ceritified Public Accountant	-0.007	0.651	-0.350
3. Civil Engineer	0.645	-0.116	-0.236
4. Commercial Artist	0.141	-0.666	-0.413
5. Computer Operator	0.305	0.539	0.009
6. Computer Programmer	0.301	0.441	-0.031
7. Electrical Engineer	0.694	0.028	-0.083
8. Librarian	-0.524	0.219	-0.368
9. Mechanical Engineer	0.664	-0.040	-0.048
10. Pharmacist	-0.061	0.246	0.721
11. Photographer	0.118	-0.734	-0.215
12. Physical Therapist	-0.275	-0.268	0.673
13. Primary School Teacher	-0.740	-0.252	-0.091
14. Secretary	-0.560	0.476	-0.077
15. Social Worker	-0.666	-0.312	0.231
16. Staff Nurse	-0.342	-0.017	0.622
17. Statistician	0.043	0.405	-0.269
18. Technical Writer	0.044	0.019	-0.416
19. Vocational Counsellor	-0.599	-0.211	0.179
20. X Ray Technologist	0.308	0.022	0.481

suggests the robustness of the multidimensional scaling procedure. The coordinates of this solution in two and three dimensions are presented in Tables 5.12 and 5.13 and the correlations between the dimensions are given in Table 5.14. The three dimensional solution is represented graphically in Figures 5.4 - 5.6.

TABLE 5.14

Correlations between Dimensions

TORSCA 3D solution

1.	1.0000		
2.	0.0117	1.0000	
3.	-0.2394	0.0135	1.0000

TORSCA 2D solution

1.	1.0000	
2.	-0.118	1.000

Considering each of these solutions in turn, the first dimensions of the three dimensional solution appears to distinguish occupations which involve working with people from those that involve technical concepts. Job titles that load highly on this dimension include all the Engineering occupations which are contrasted to the People Orientated occupations at the other extreme. The second dimension distinguishes the Artistic occupations from occupations that involve working with Data. While the third dimension distinguishes the Medical occupations from the rest. This pattern of results suggests strongly that a spherical arrangement of the occupations is appropriate. Different areas on the surface of the sphere could be considered to represent different groups of occupations.

FIGURE 5.4

Three dimensional solution: plot of dimensions one and two.

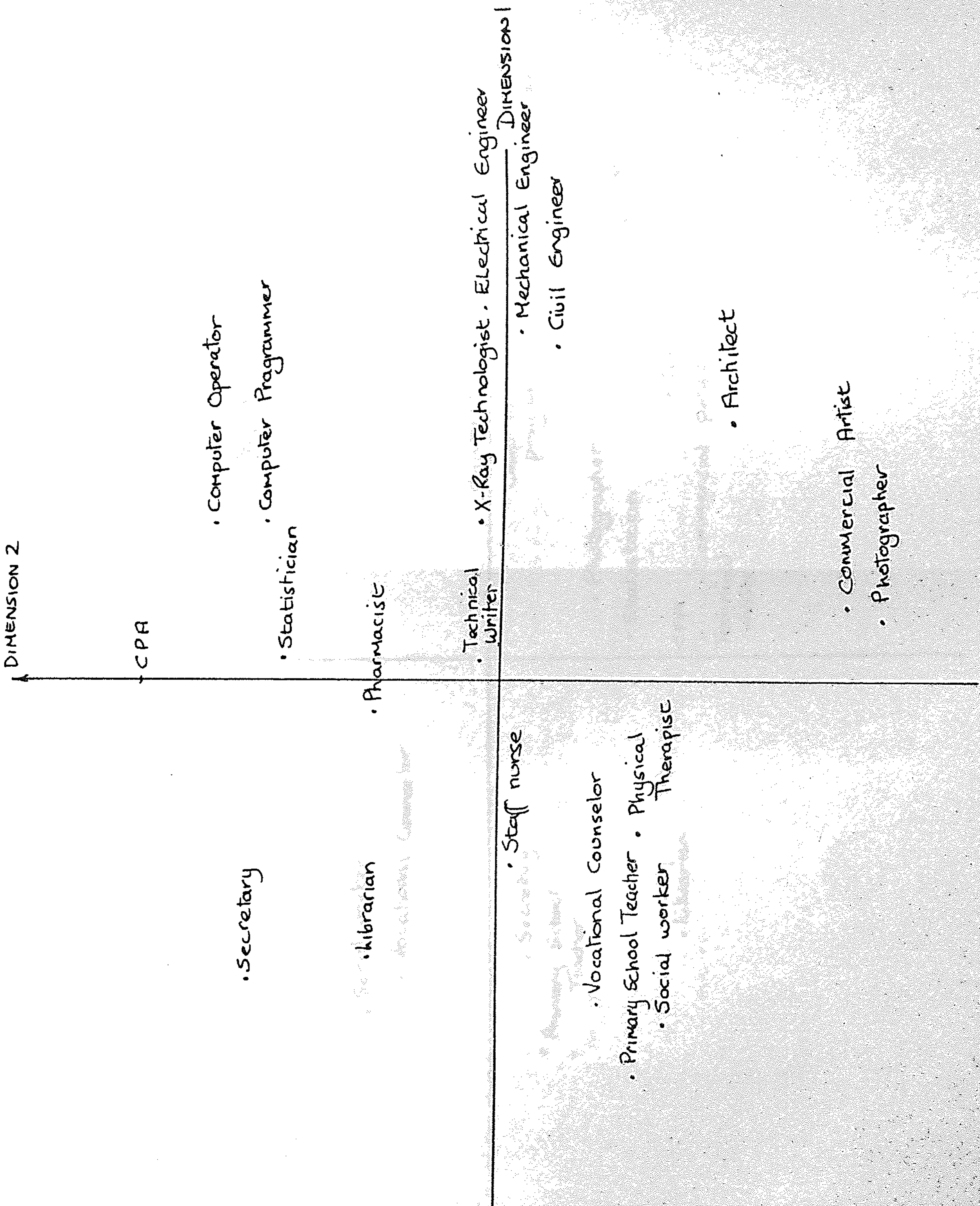


FIGURE 5.5

Three dimensional solution: plot of dimensions one and three.

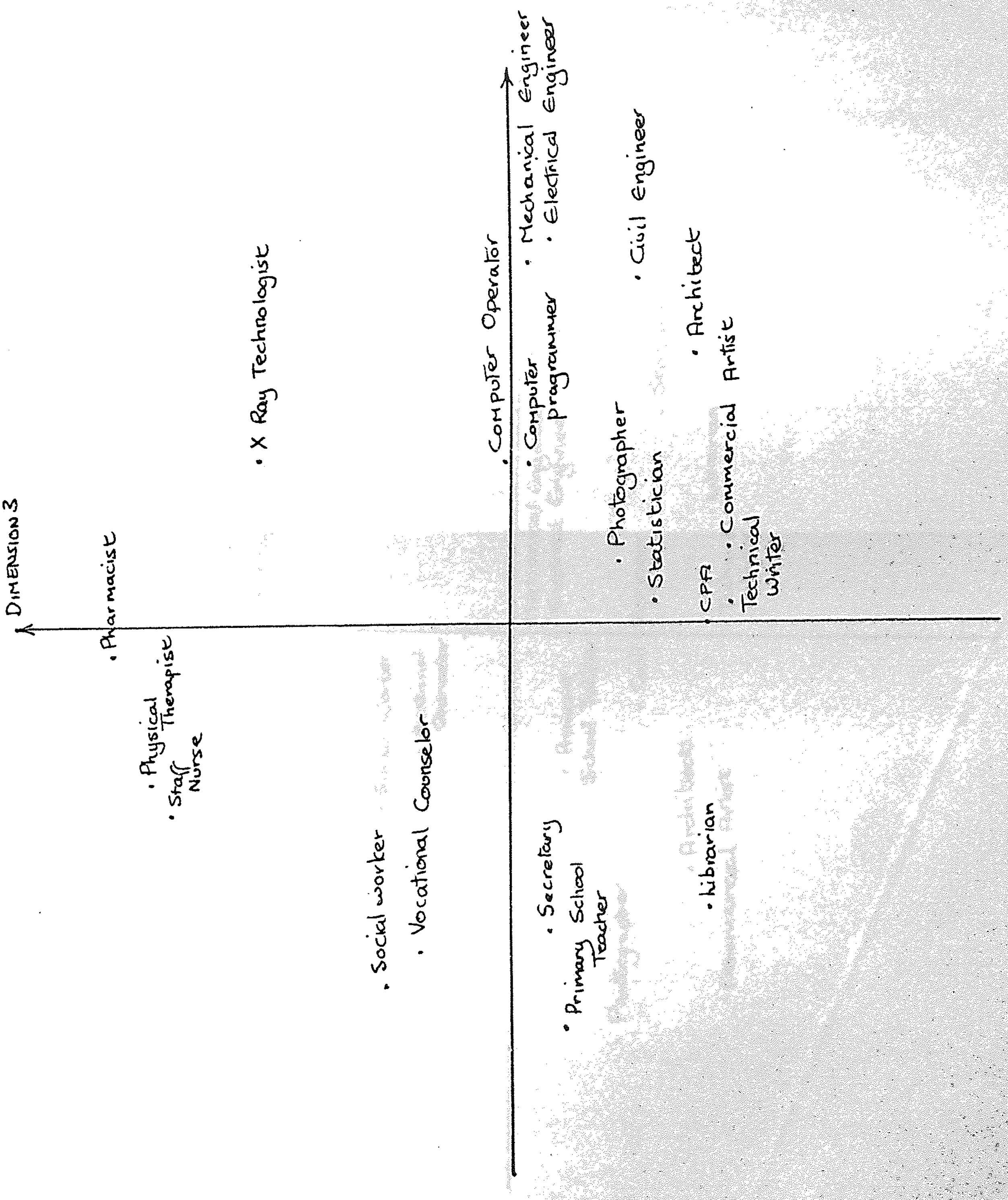
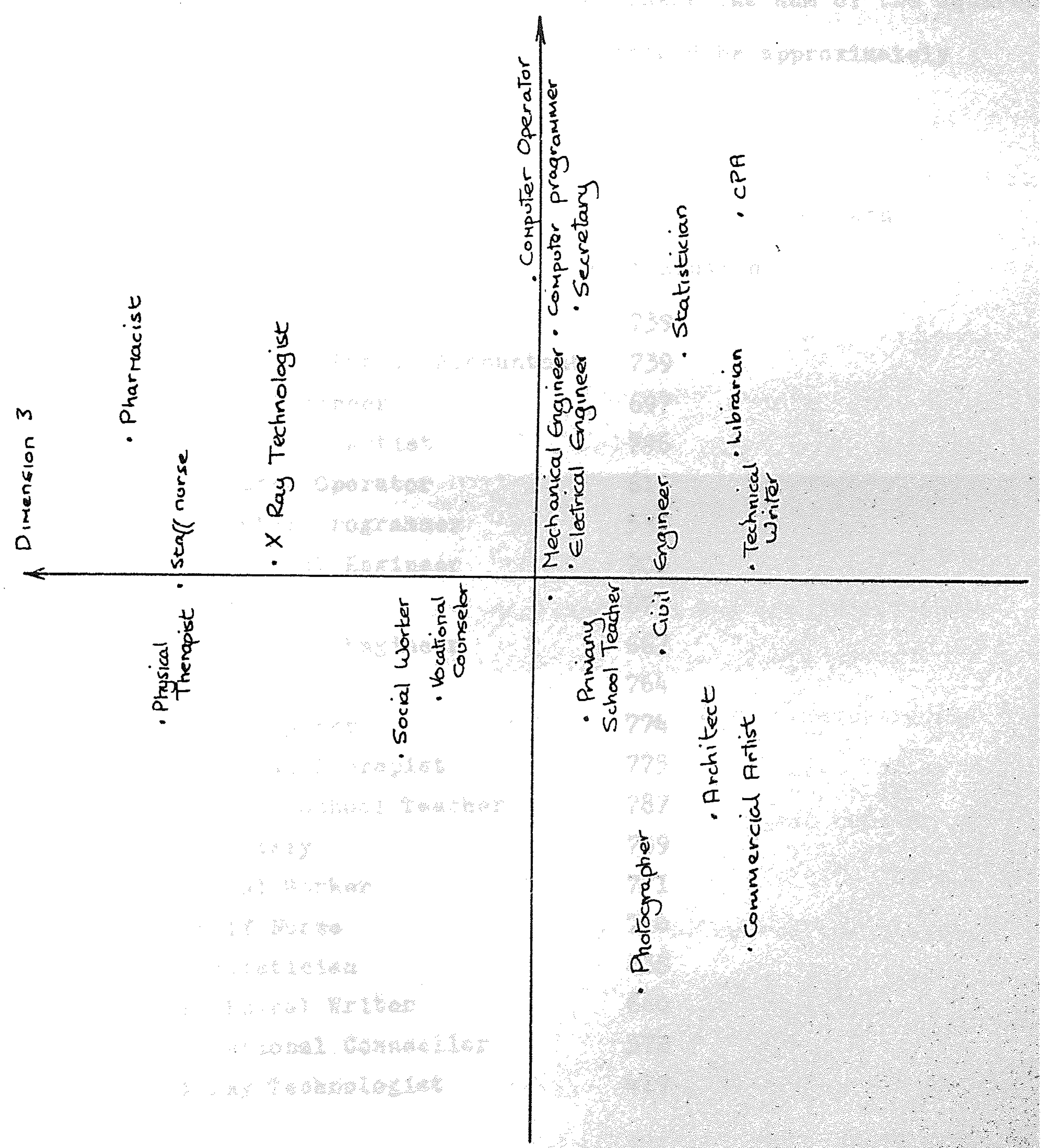


FIGURE 5.6

Three dimensional solution: plot of dimensions two and three.



The general equation of a sphere is given by the equation (1)

$$r^2 = x^2 + y^2 + z^2 \qquad (1)$$

where r is a constant, the radius of the sphere, and x, y and z are the coordinates in each dimension of points on the surface of the sphere. If the coordinates on the three dimensions for each occupation do fall on the surface of a sphere the sum of the squares of the coordinates for each occupation should be approximately constant.

TABLE 5.15

Pilot Study 3D solution Sum of Squares Data

	Occupational Title	Sum of Squares
1.	Architect	739
2.	Certified Public Accountant	739
3.	Civil Engineer	697
4.	Commercial Artist	796
5.	Computer Operator	619
6.	Computer Programmer	535
7.	Electrical Engineer	700
8.	Librarian	677
9.	Mechanical Engineer	667
10.	Pharmacist	764
11.	Photographer	774
12.	Physical Therapist	775
13.	Primary School Teacher	787
14.	Secretary	739
15.	Social Worker	771
16.	Staff Nurse	710
17.	Statistician	488
18.	Technical Writer	660
19.	Vocational Counsellor	572
20.	X Ray Technologist	419

Mean 681 Standard Deviation 106

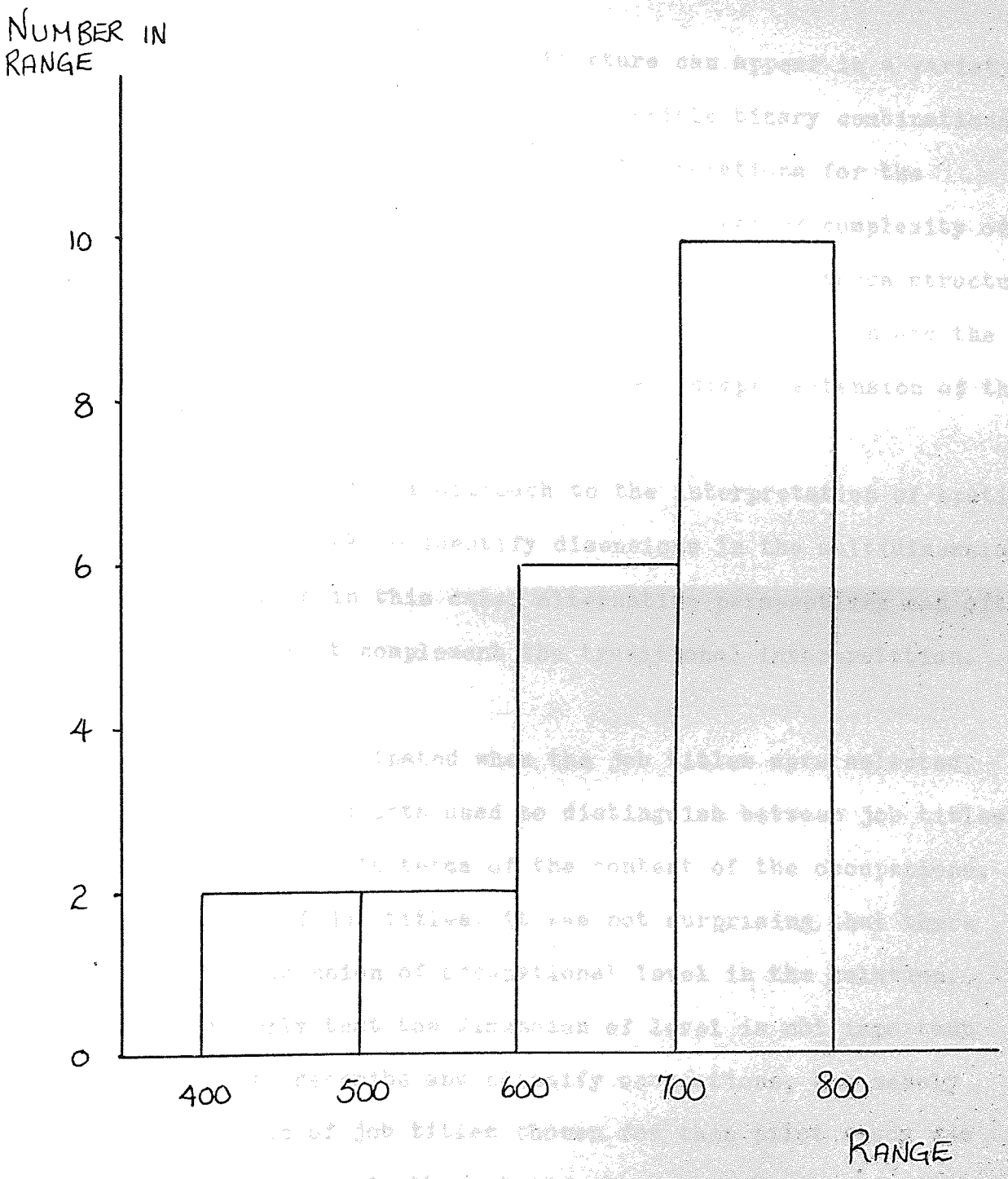
Standard Error of the Mean 24

Table 5.15 gives the value of the square root of the sum of squares for each occupation and the mean and the standard deviation of these values and the standard error of the mean based on these estimates. These results coupled with the relatively small range of values taken by the sums of squares which is shown diagramatically in Figure 5.7 indicate that the sum of squares for only one occupation is more than two standard deviations from the mean value. This suggests that the results from the three dimensional solution could well be represented by points on the surface of a sphere and, from the earlier discussions, that the three dimensions or axes of the sphere can be interpreted in concrete terms as previously indicated.

5.18 There are two points which need to be discussed in relation to the interpretation of this data. The first point, which has been alluded to earlier, is a methodological point concerned with the type of structure that can be found in a spatial representation of this sort. Degerman (1972) has reviewed the types of possible structures that can occur in Euclidean space and has identified three basic simple structures which can appear singly or in combination with each other. The three structures are based on (1) the dimension, (2) the cluster and (3) the circle. The notion of a dimension in a Euclidean space that can be given substantive interpretation is fundamental to the interpretation of multivariate analysis and need not be explained here. The search for clusters for the interpretation of spatial configurations is also well known. The third structure is the idea of a circular arrangement, what Guttman (1954) called the 'circumplex', where the variation in results appears to be continuous and to form a closed circular structure with qualitative order effects. A familiar example of such a structure is the colour circle. It is important to note

FIGURE 5.7

Range of sums of squares values.



that this type of structure need not be exactly circular, but that any closed ordered structure can be considered to belong to this general category.

These three basic types of structure can appear in a variety of combinations and Degerman lists 15 possible binary combinations of these structures based on two possible operations for the combinations of structures. Much greater degrees of complexity of structure can be envisaged by further combination of these structures. The binary structures are described in detail by Degerman and the extension to more complex combinations is a simple extension of this.

The most traditional approach to the interpretation of spatial arrangement is to seek to identify dimensions in the multidimensional space. However, as in this case, alternative perspectives can often provide insights that complement the traditional interpretation.

5.19 As had been anticipated when the job titles were selected, the dimensions the students used to distinguish between job titles have been interpreted in terms of the content of the occupations. Given the choice of job titles, it was not surprising that there was no obvious dimension of occupational level in the solution. This does not imply that the dimension of level is not important in any attempt to describe and classify occupations, but merely that the selection of job titles chosen for this pilot study was relatively homogeneous in these terms since they had been selected as appropriate for a college student population.

5.20 The solution presented above was three dimensional in form, but to the extent that the data can be interpreted as falling on

the surface of a sphere, the relative position of any one occupation can be specified in terms of only two coordinates, for example a latitude and longitude. This suggests that in fact the data might be interpreted in two dimensions only and that an essentially two dimensional structure is embedded in a three dimensional space. Should such an interpretation be possible, it would make the display of the solution much simpler. Figure 5.8 presents the two dimensional scaling solution. Although the stress value indicates that this solution is not such a good fit to the data as the solution in the higher dimensionality, the two dimensions seem open to interpretation. Dimensions 1 as before seems to contrast a People versus Things orientation where the second dimension contrasts Artistic versus Data oriented occupations.

The extent to which a particular occupation involves working with people, working with data, and working with things has been incorporated into the US Dictionary of Occupational Titles (1967). This functional occupational classification structure (Fine and Heinz, 1958) has been found to be one of the most useful typologies for distinguishing between occupations (see Robinson, Athanasiou and Head 1969). This scheme has been simplified and extended in the on-going research at the American College Testing Programme reported by Hanson (1974). They have suggested that two independent bipolar dimensions: (1) a data/ideas dimension and (2) a people/thing dimension can be used to represent the world of work. They have presented their findings as a World of Work Map (see Figure 5.9) which locates various job clusters in particular regions of their two dimensional space. This map which is used for the presentation of the results of vocational interest measurement to a student has a remarkable similarity to the two dimensional solution obtained

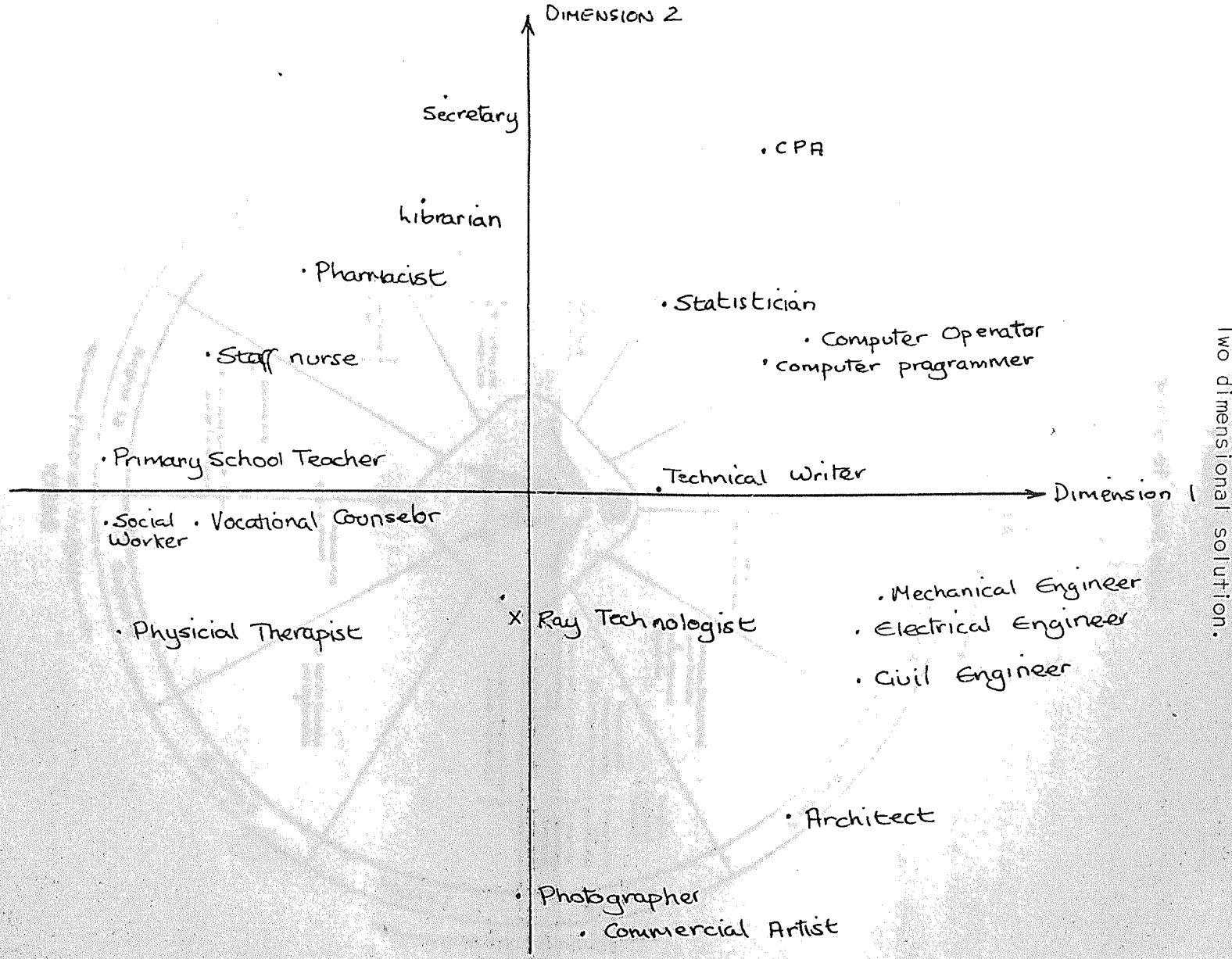
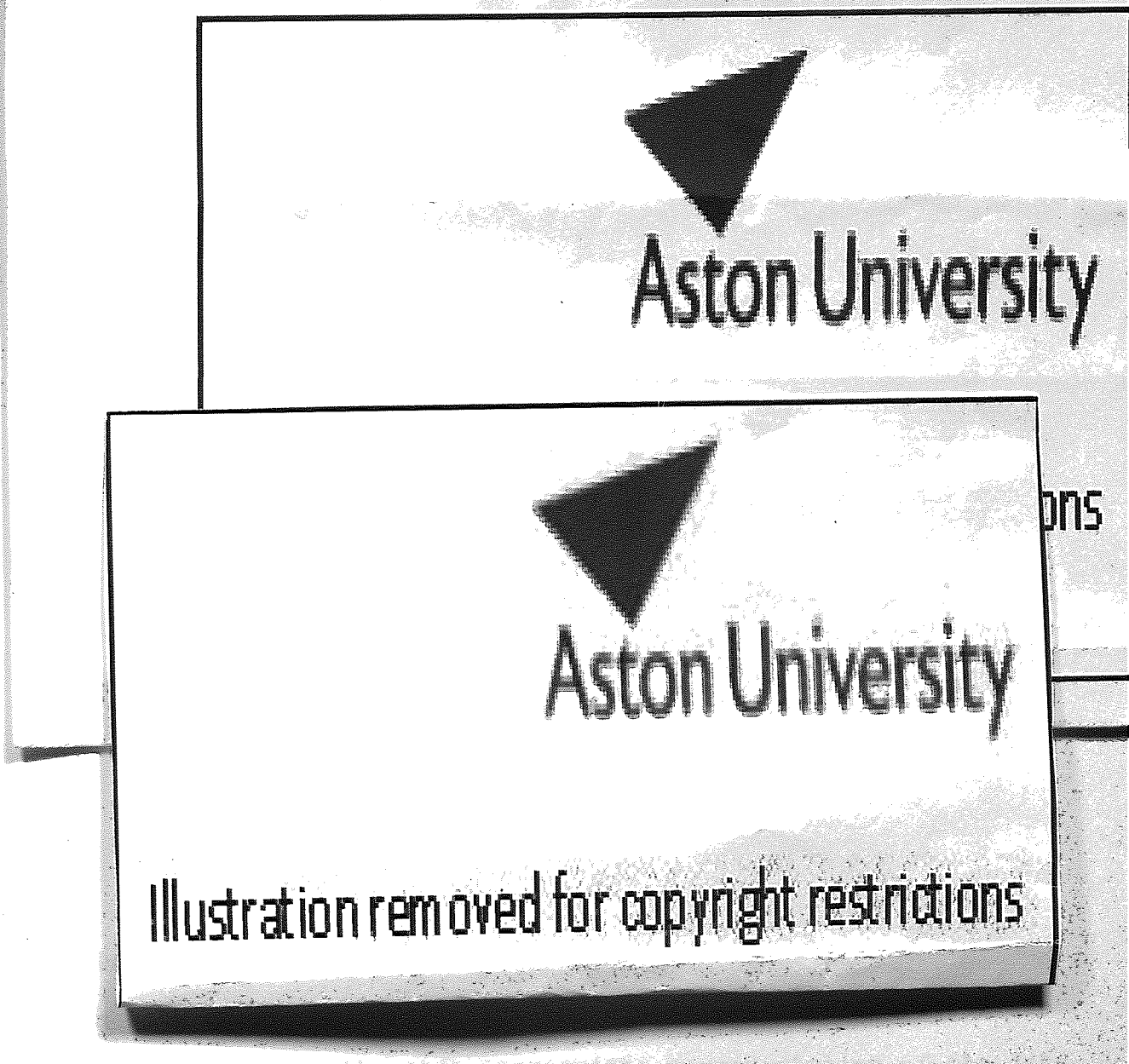


FIGURE 5.8
Two dimensional solution.

FIGURE 5.9

World of work map.



(from Hanson, 1974)

for the pilot data.

One of the main reasons for carrying out this pilot study was to establish not only the practicality of the research method, but also that the results would themselves be open to meaningful interpretation. The fact that these results appear to be easily interpreted in either 2 or 3 dimensions and that there is a considerable similarity between the two dimensional solution and the World of Work Map is powerful evidence for the validity of the research.

5.21 Although at this time it was not possible in the analysis of the pilot data to carry out individual differences scaling, it was decided to obtain separate scaling solutions for the men and women in the sample. The pattern of stress values for these two solutions are presented in Table 5.16 and are broadly similar to the values obtained earlier (see Table 5.10).

TABLE 5.16

Pilot Study TORSCA Stress Values Men's and Women's solutions*

Dimensionality	Solution Men	Women
1	382	388
2	216	198
3	127	120
4	093	091
5	069	067

*Decimal points omitted.

In both cases, therefore, the two dimensional configuration was considered to be the most appropriate representation of the data. These solutions are presented in Figures 5.10 and 5.11. It will be noted that there are considerable differences between the two solutions, in particular, the relative position of artistic and

FIGURE 5.10

Two dimensional solution: men.

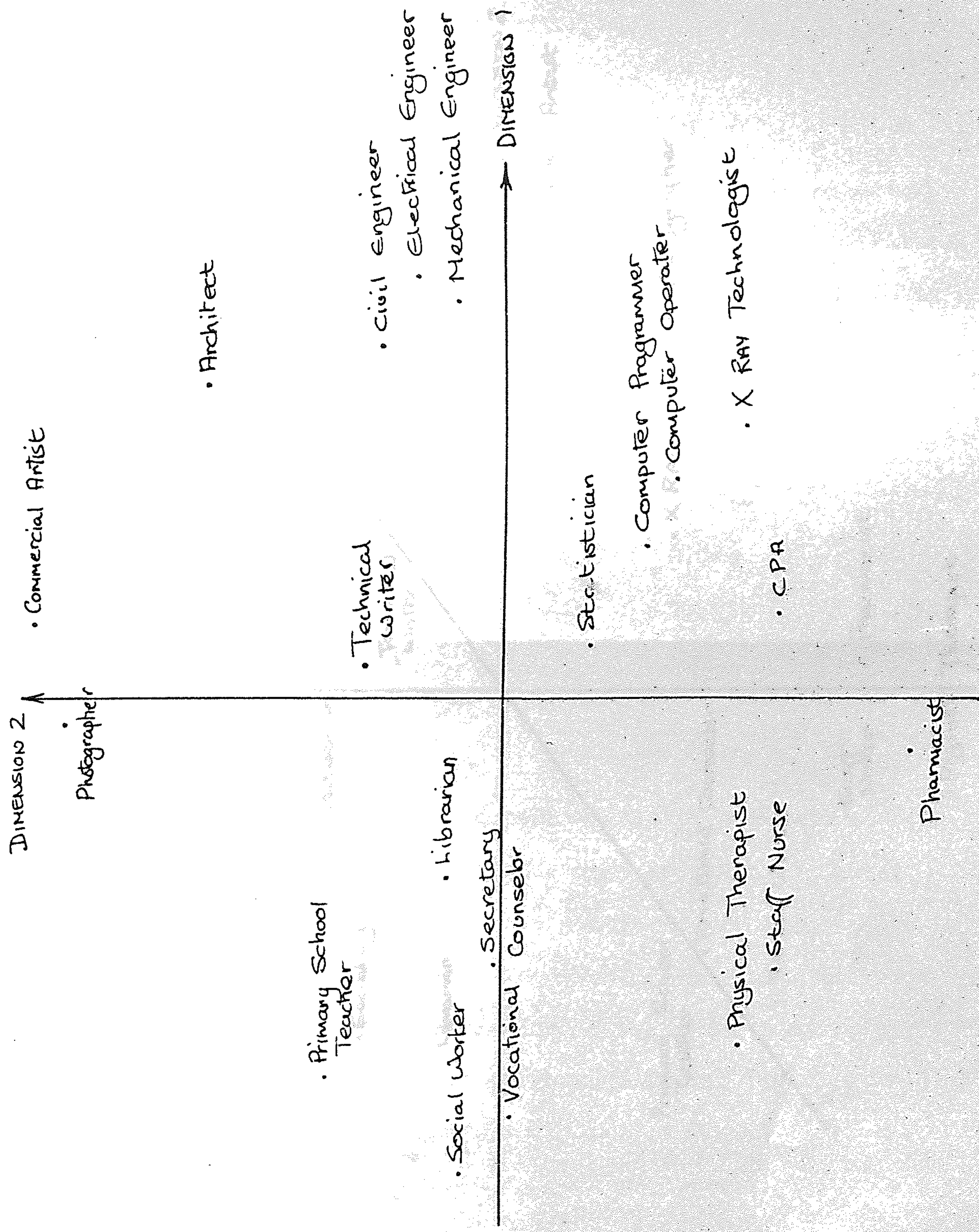
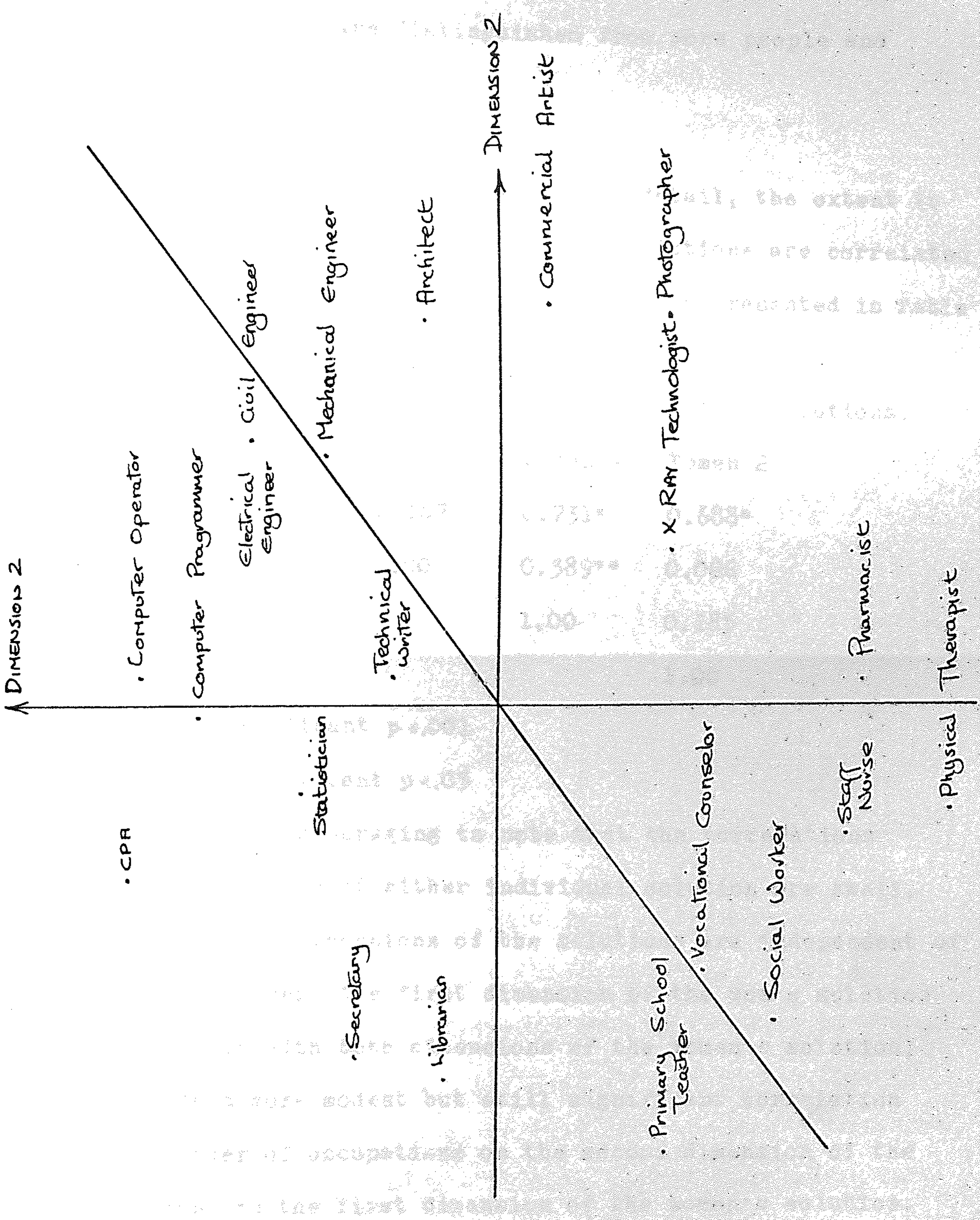


FIGURE 5.11

Two dimensional solution: women.



medical professions in the solutions is very different. There are similarities between the solutions, in that the engineering and technical occupations are distinguished from more people and service oriented occupations.

To examine these differences in more detail, the extent to which the different dimensions in the two solutions are correlated was calculated. The intercorrelation matrix is presented in Table 5.1

TABLE 5.17

Intercorrelation of two dimensional scaling solutions.

	Men 1	Men 2	Women 1	Women 2
Men 1	1.00	0.147	0.731*	0.688*
Men 2		1.00	0.389**	0.086
Women 1			1.00	0.185
Women 2				1.00

*Spearman rho significant $p < .001$

**Spearman rho significant $p < .05$

First of all it is encouraging to note that the correlations between the dimensions of either individual solution are small, indicating that the dimensions of the solutions are independent of one another. However, the first dimension of the men's solution correlates highly with both dimensions of the women's solution, while there is a more modest but still significant correlation between the order of occupations on the second dimension of the men's solution and the first dimension of the women's solution.

This information suggests that very nearly all the order information in the first dimension of the men's solution can be accommodated within the two dimensions of the women's solution, while only a small amount, approximately 15%, of the order

information of the second men's dimension can be accommodated in the women's solution. As the multidimensional scaling solutions are in a Euclidean space, the actual position of the dimensions can be rotated without altering the nature of the solution. It is, therefore, possible to attempt to locate the position of the first dimension of the men's solution in the women's solution. This dimension has been drawn on to figure 5.11.

The analysis suggests that both solutions can be considered to have one dimension in common, while the two second dimensions are relatively independent of each other. While this is only slender evidence for difference between the sexes, it will be interesting to see whether individual differences scaling will support this finding.

As regards the interpretation of these solutions, it would appear that women see more in common between the medical occupations and the artistic occupations in the sample, while the men rate the medical occupations to have a greater similarity with the data and technically oriented occupations. Although at this stage any interpretation must be tentative in its conclusions, this result suggests that different groups may associate or focus on different aspects of occupations in making their ratings of similarity. Particular groups of occupations, in this case medical occupations, may be viewed in different ways. In this instance, it might be argued that the men report a similarity between the medical occupations and people and data oriented occupations, (these being the closest groups of occupations in their scaling solution) while the women associated the medical occupations with creative and people oriented occupations. These possibly different perceptions might

have considerable impact on the reasons people would choose these occupations and their expectations of what working in one of these occupations would involve. These results, taken in conjunction with the interpretation of the group data, are supportive of the validity of the research method.

5.22 Due to time constraints, which made it imperative that the author concentrate on the design of the main study so that data collection and preliminary analysis of the data could be completed by the end of the academic year, no analysis was made, at this stage, to take account of individual differences in the pilot data and neither was any analysis made of the data relating to preferences among the occupations. The following section describes the design of the main study. Further analysis of the pilot data was carried out along with the data from the main study collected at the University of Minnesota and this is reported in the section dealing with all the results. When the author returned to England additional analyses were carried out and these are also reported in the later section.

5.23 The data reported here provide some support for the Minnesota Occupational Classification system. Occupations from certain taxons in particular, the engineering occupations, are grouped together in all the solutions. However, it is interesting to note that some occupations which would be expected to be close together, for example, Pharmacist and Librarian, which are close in the whole group solution, are widely separated when the group is split into two, although the relative position on dimension one of the men's solution is similar in both of these solutions. The closeness of the two occupations Computer Operator and Computer Programmer can,

perhaps, be attributed to misperception or lack of knowledge of the extent to which the jobs have markedly different content. Although it is also possible that this confusion may have been caused by the order of presentation of the occupations which meant that these two occupations were frequently in adjacent pairs in the questionnaire.

How occupational perceptions collected in this way relate to occupational classifications that have been developed will be a major issue in the interpretation and discussion of the main results of this study. Even at this early stage of the analysis, the possible existence of group and individual differences and of misperceptions of similarity between occupations are suggestive of the need for the careful explanation and presentation of occupational information in vocational guidance. The relationship of results obtained in this study to the various approaches to occupational classification and types of occupational classifications that are proposed for vocational guidance will be explored in detail in this later section.

6. DESIGN OF MAIN STUDY

6.1 Following the success of the pilot study, it was decided to develop and extend the research. As has been mentioned in the introduction (see section 1.5), a major emphasis of the research was to collect cross-cultural data. Furthermore, because the author would only be in the United States for a limited period of time, the research would have to be cross-sectional rather than longitudinal in design. From the outset, therefore, the design of the research was always considered within these two parameters.

The review of the literature had indicated a number of deficiencies in existing research. The two most obvious points concerned the selection of job titles for this type of research and the choice of subject populations. These two problems have been discussed at length in earlier sections and strategies for tackling these issues will be discussed in the following sections on experimental design and questionnaire development.

A third issue which had arisen concerned the orientation of research studies which have looked at occupational stereotypes and occupational perceptions. The approach adopted here is cognitive and developmental. In the pilot study the research method was chosen so as not to impose a framework on the responses that were obtained. This strategy itself was not without problems and in revising and developing the questionnaires for the main study, certain modifications were made to accommodate these limitations and the shortcomings of the approach used in the pilot study. These changes are discussed in the section 6.7 on questionnaire development.

The three following sections discuss general questions about the orientation of the research and choice of research method and this discussion then leads in to sections on the experimental design of the main study.

6.2 The orientation of this study was always exploratory. The purpose of the research was to elaborate the contribution of occupational cognitions to vocational behaviour. The first objective of the study was simply a descriptive one. A second objective was to compare the perceptions of groups of people, who were of different ages and sex, who lived in different countries and came from different socio-economic backgrounds - that is to examine some of the correlates of individuals' perceptions of the world of work. A third objective of the present research was to examine individuals' subjective occupational structures and to compare the dimensions they used to structure the world of work with the dimensions used in occupational classification systems developed by vocational psychologists. It is hoped that the findings of this study might be suggestive of ways occupational information might be structured and presented to take account of the conceptual model of the user of that information.

In a study of this type it is not appropriate to formally set out a series of hypotheses, because this is not an experimental study in that sense. The data to be presented here are essentially correlational in form and where correlations are found this does not necessarily imply the existence of causal relationships, but may suggest that further experimental research is appropriate.

6.3 The objectives for this research study raise a number of theoretical and methodological problems. Within the context of the cognitive approach adopted for this research (see Section 2), there are substantive issues as to how the perception of occupations can be studied. Any single method or approach has limitations and in the design of research, decisions have to be made about the choice of an appropriate research methodology. In this case there are special problems associated with cross-cultural research which have to be considered.

This work was carried out not only because of its substantive interest but also as a piece of research training. It is, therefore, exploratory also in the sense that it contains important learning experiences. All research contains an element of learning and, in carrying out the research, the author expects to gain further insight both into the research subject matter and into the research process itself. An important aspect of the research evaluation, therefore, is to review what has been learnt from the research in these two distinct senses.

Having decided to study the perception of occupations, the first decision that had to be made was of choice of a research method. This had important implications for the types of question that could be asked of the data generated by the research.

6.4 Crockett (1965) in reviewing the methods that had been used to measure the organization of the cognitive system in the field of impression formation, which it has already been noted might be expected to be closely related to the present research, suggested that these research methods can be considered as falling into two

broad categories.

1. Phenomenological Methods. These methods rely on subjects making relatively complex judgements. For example, "Consider this construct as a standard. Then look through all the rest of the constructs and find those that would be changed if the standard construct were changed, untrue or absent in the person. Once this is completed, take a different construct as the standard and carry out the same procedure." As a result, however, these methods make relatively much less complicated assumptions in the manipulation of the data subsequently in analysis.

2. Analytical Methods. In contrast, these methods ask subjects to make only relatively simple judgements, for example, "How similar are these two.....?" However they use procedures for analysis such as Multidimensional Scaling or Factor Analysis that make complex mathematical assumptions about the data.

Research methods in either of these categories have distinct advantages and disadvantages. The phenomenological methods have the advantage of making fewer mathematical assumptions about the data, but at the cost of making elaborate non-mathematical assumptions, in particular as to the validity of very complex subjective reports. Although any method of analysis may be rendered invalid by the data, Bannister and Mair (1968) suggest that the instructions for complex phenomenological judgement tasks are often difficult to communicate to subjects, who frequently find it hard to maintain a proper instructional set during the lengthy procedure.

An important advantage of the analytic methods is that they tend to be fairly quick to complete. In contrast phenomenological methods tend to involve individual subjects in very complex and

demanding experimental procedures. This has resulted in most studies using these techniques including relatively small numbers of subjects. In the design of a research project which has an objective of contrasting several different groups of subjects, it would be both administratively inconvenient and extremely time consuming to use a phenomenological method of data collection.

In the design of this research study, it can be argued that research methods that will generate data which can be used to identify key variables, will be more useful than methods designed to examine in detail the interrelationships between only a few variables. This approach to data analysis, which was originally set out by Tukey (1962), is more concerned with the methods of analyzing data and of interpreting the results of statistical analysis than with the process of statistical analysis itself. The adoption of this approach has important implications for the way research is structured and is most applicable in applied research settings, where the research is intended to influence decision-making. It is argued (Tukey, 1962, Mosteller and Tukey, 1968) that it is frequently more important for research to identify the predictors that most influence the decision by the use of relatively simple but robust statistical techniques rather than use the more refined methods of inferential statistics, which often require that the researcher make barely tenable assumptions about the quality of the data that is available. In many situations the use of such techniques should be seen as of only second order importance. Similarly for research designed to describe and identify the key variables, techniques to describe and summarize the data, such as the analytic methods of multidimensional scaling and factor analysis, are more appropriate than statistical methods

designed to confirm and test inferential hypotheses.

This research study has adopted an exploratory approach to the study of occupational perceptions and consequently it seemed most appropriate to use analytical methods of data analysis. This decision, therefore, determined the method of data collection to be used. The development over the last decade of much more sophisticated computer programmes for the analysis of data collected on this basis was also a factor considered in the choice of research method. A particular advantage of these programmes is that they present psychometric models that are most appropriate for the analysis of structural variables. Rosenberg (1977) has also noted the strong parallel between these models, which he has used in the study of person perception, and the structural concepts used by personal construct theory.

It would be incorrect, however, to say that there are only two alternative research strategies that can be adopted for this type of research, and that the research worker has to make a choice of one or other method, with all the implications and consequences that have been outlined above. Rather these different approaches can be used to some extent in combination to complement each other. Although in any one research situation the general orientation may be biassed towards one of these approaches, the use of a variety of methods is important in establishing the validity of any research findings (see Campbell and Fiske, 1959 and Webb, Campbell, Schwartz and Sechrest, 1966 for the classic accounts in the psychological literature on these issues).

The choice of research methodology is therefore influenced

by a range of factors, including the objectives of the research, external constraints on the design, and even the competence and experience of the research worker. The orientation chosen for this study and the constraints imposed because of this acted as a framework within which the study had to take place and formed the major parameters that influenced the choice between possible alternative research designs. The most general constraint on the research was the research worker's determination to carry out a cross-cultural study and some of the implications of that decision for this research study are outlined below.

6.5 In their textbook on Survey Research, Warwick and Lininger (1975) place considerable emphasis on discussing some of the problems associated with cross-cultural research. They suggest that there are four interlocking aspects in establishing cross-cultural equivalence in questionnaire design. These are:

1. Conceptual Equivalence.

In all comparative research a most basic question is whether the concepts to be studied have the same, similar or any meaning in the various cultures. Concepts will also differ in their salience and researchability in the different cultures, and it is important to attempt to estimate differences across the groups studied.

2. Equivalence in Measurement.

Once the concepts for the study have been chosen, the second problem is to devise comparable indicators for the different cultural groups. It is important to recognise that very different types of indicator may be necessary in different societies to measure the same concept. It cannot be assumed that questions adequate in one country will be appropriate in another.

3. Linguistic Equivalence.

This topic has received more attention than many others in cross-cultural research and while the technique of back-translation is a well known and useful technique for establishing equivalence in the exact translation of words, it does not guarantee comparability of meaning.

4. Equivalence of Response.

Non-equivalent patterns of response across different groups are found even with the best designed surveys. Particular groups may make fewer responses and exhibit different response styles, making interpretation of results difficult across cultural groups.

Although comparing British and American data may seem simple because of the close cultural and linguistic similarity, anyone who has attempted to use psychological tests developed in the United States in Britain will be aware of some considerable resistance among subjects to imported material. This is caused both by genuine cultural differences, people's misunderstandings that result when the tests are used in practice and, perhaps, slight hostility to material that feels not quite appropriate in style and content for use in this country.

One of the advantages of using multidimensional scaling as a technique to study people's perceptions is that it does not impose the constructs on the individual, but is rather a technique to elicit constructs from them. There are, however, problems in establishing the equivalence of the stimuli, in this case job titles, across the two countries where there are major differences in the structure of the education systems and in the organization of work. In themselves these are major topics beyond the scope of this

dissertation, but had to be considered in the design of the questionnaire and the interpretation of the data.

Triandis (1972) points out that in carrying out cross-cultural research one important aim can be not only to determine methods of obtaining equivalent measurement in the two cultures but also to reveal the non-equivalence when equivalence cannot be attained. In undertaking this research the author felt this to be a major problem with much research in vocational psychology. There is little research pointing out where the limits of equivalence lie and the extent to which research both in method and theory must be culture specific.

6.6 Besides the problems associated with developing questionnaires appropriate for the research in both the United States and Britain, a second major problem was to obtain samples which could be considered to be equivalent. Because the research was actually designed while the author was in the United States, this meant that in practice the research was carried out in two stages. The American subject populations were chosen and the data collected and it was not until the author returned to England that any arrangements could be made to replicate appropriate parts of the study with equivalent samples. The extent to which this issue was resolved satisfactorily will be reviewed in a later section.

In choosing subject groups for the study in the United States, the author felt strongly that subjects should differ in terms of age and sex. The idea that vocational behaviour should be seen in a developmental context is now widely accepted and non-controversial.

It is now ten years since Zytowski (1968) wrote: "Today no-one would quarrel with a concept of vocational behaviour as having important developmental qualities", (p 119), although there is still some debate about the implications this has for vocational guidance practice. (see, for example, Holland 1973 esp. p. 85-96).

A criticism of some of the earlier research (see section 4.9) is that the subject populations have tended to be relatively homogeneous in age and have usually excluded women, although there is considerable evidence of differences in career development between men and women. One consequence of this seems to be that these earlier studies have emphasized the common elements of perceptions rather than the range of differences. While the author was at the University of Minnesota all the groups included in the sample population for the data collection included men and women so that comparisons between the perceptions of the two sexes could be made at all levels.

It was decided to include three age groups in the study, junior high school students (grade 9, 14 - 15 year olds), senior high school students (grades 11 and 12, 16 and 17 year olds), and university students. These groups might be expected to be at markedly different stages in their vocational development and yet provide subjects all of whom could be expected to cope with the complexity of answering the questionnaire.

For the university students to be included in the study, a further dimension in the experimental design related to the content domain of the job titles used in the questionnaires. As has been indicated earlier (see section 4.6), the number of job titles tha

can be included in a pair comparison design is limited and it seemed possible that earlier studies had been unnecessarily constrained because of this. For this reason two parallel forms of the questionnaires were developed (as described in the subsequent section 6.8), which differed in orientation. One was a general form of questionnaire, similar to that used with the school students, while the second included applied science and technical jobs. It was intended to contrast groups of students studying liberal arts subjects with those studying technical subjects in their replies to the two forms of questionnaire.

The design of the study can now best be understood diagrammatically and is presented in the accompanying Table 6.1. Ideally there would be twelve groups of subjects, each including at least 20 people. Numerous multidimensional scaling studies have indicated that groups of about 15-20 yield stable solutions. However, it was soon realised that it would be very difficult to find 40 women studying technical subjects to answer the different forms of the questionnaire because the number of students studying in this subject area was very limited. It was decided, therefore, only to include one group of women studying technical subjects and that this group should be asked to answer the form of the questionnaire that included scientific and technical job titles. When the author returned to Britain, it was decided to replicate just the part of the study that included school students. The target population would be two age groups equivalent to the American sample and that within these two groups both sexes would be represented. Differences in the school systems would make this replication difficult to carry out. It was anticipated, in particular, that differences in the normal school leaving age between the two countries and the greater

TABLE 6.1

Research Design

United States

Yellow Form		White Form	
Men	Women	Men	Women
Liberal Arts	Liberal Arts	Liberal Arts	Liberal Arts
Technology	Technology	Technology	Technology
		Grade 11/12	Grade 11/12
		Grade 9	Grade 9

United Kingdom

White Form	
Men	Women
Sixth Form	Sixth Form
Fourth Form	Fourth Form

extent of selection still existing in British secondary education would cause difficulties in making comparisons, especially among the older group.

Although it is not the author's intention to present with this study a set of hypotheses, it is possible from Table 6.1 to detail the type of comparisons that can be made for this study. A major purpose of the study is to allow cross-cultural comparisons to be made of the structure of occupational perceptions. Equally important is the intention to make comparisons across age groups and between the sexes. The choice of subject groups for this study has, therefore, been determined so that these planned for comparisons can be made. The use of two parallel forms of the questionnaire with the University students is to permit comparison of the situational variables and also an examination of the range of convenience of the subjective occupational structures. From the results of this analysis it is hoped also to be able to critically compare the dimensions generated from this study with those used in occupational classifications developed for vocational guidance.

Details of the arrangements made for data collection, both in the United States and Britain, are discussed in subsequent sections. (6.12 and 6.14). At this stage only the conceptual framework of the experimental design has been presented. At this later stage the actual data collection procedures will be described in detail and problems encountered at this stage of the study will be reviewed. The following section describes the development of the questionnaires to be used in the main study both in the United States and Britain.

6.7 As a result of the pilot study a series of changes to the questionnaires were introduced. First of all it was felt that the pair comparison section of the questionnaire was too long and examination of the distribution of replies (see Table 5.8) suggested that, in the second half of the questionnaire, respondents were tending to drift towards using extreme ratings. It was thought that this might be caused by the apparently repetitious nature of the task and consequent loss of motivation on the part of the subjects to complete each rating with sufficient care. For the main study, therefore, it was decided to reduce the number of job titles included in this section of the questionnaire from 20 to 16, thereby reducing the total number of pairs included from 200 to 130 (10 items would still be repeated as a measure of consistency).

A second criticism of the pilot questionnaire was that rating of similarity was too open-ended an approach to the study of occupational perceptions and that the results could only be interpreted subjectively. It was, therefore, decided to expand the second section of the questionnaire. Respondents would be asked to make ratings on a number of specific dimensions and attributes associated with the occupations. In this way it is hoped to complement the data collected for analysis in a particularly abstract and mathematical way with data that could be analysed in a more direct manner. The purpose for collecting this data would be to obtain a description of the content of the occupational stereotypes held by the subjects.

The reduction in the number of job titles to be included in the main questionnaire raised yet again the problem of how to pick a selection of job titles that might be considered to be in any way

representative. This issue has been discussed at length in earlier sections (see Section 4.8). As has been mentioned in the previous section on experimental design, it was decided to resolve this issue by developing two forms of the questionnaire with distinct content domains. Some of the job titles included would be common to both forms. A particular advantage of this approach would be that it would permit direct examination of what Kelly (1955) calls the range of convenience of constructs used by the subjects in their ratings of these job titles in these different contexts.

In theory it might be possible to consider these two sets of job titles as part of one larger set and to treat them at the analysis stage as though they were part of a single incomplete pair comparison design. Although this would only allow analysis of the data at an aggregate rather than an individual level, group differences might be apparent. The data that is available on the basis of Monte Carlo studies suggests that some types of design are more efficient than others.

Using a purely random technique, Robinson and Lissitz (1977) suggest that, if subjects are presented with 50% of possible pairs, recovery of the stimulus space will be adequate in most situations. It is important to remember that in their study it was assumed that some data was available for all possible pairs, which will not be the case with the data being studied here. Spence and Domoney (1974), who studied single subject designs, found that the main factors affecting the quality of the recovery was the amount of error in the data and the proportion of pairs included, rather than the choice of design for excluding pairs. With one third of all

possible pairs deleted recovery was rated good with errors at the 15% level but only fair at the 30% level. When two thirds of the pairs were deleted, recovery was only fair on average when there was no error in the data and deteriorated rapidly so that, at 15% error levels, recovery would be unacceptable by their criteria. Most real data sets are likely to have error rates in the 15%-30% range and their research suggests that no more than one third of the pairs could be deleted without serious consequence for the quality of the data.

6.8 The first task, therefore, in revising the questionnaire was to select the two sets of job titles that would be used in the two versions of the questionnaire. As has been mentioned earlier, this inevitably involved subjective and arbitrary choices on the part of the person who did the choosing. In selecting the 16 occupations for the general form of the questionnaire, the intention was to revise the list used in the pilot study. It was felt that in this study too many engineering occupations had been included, which had always been rated similar to one another and that, as the second form of the questionnaire would contain only technical and applied science occupations, the number included could be reduced. It was also felt that the list contained too many occupations in Holland's Investigative and Social categories. Two criteria were used in the reduction of this list: (1) to remove the less familiar occupations and (2) to obtain a better balance between Holland categories. The original criteria of OAP rating was still used as an initial cut-off point.

The following occupational titles were, therefore, deleted from the list of 20 used in the pilot study: Computer Programmer,

Mechanical Engineer, Physical Therapist, Technical Writer and Vocational Counsellor. One new title, Police Officer, was added to increase the number of occupations in the 'Realistic' category and because it also was coded as involving 'Enterprising' as the second element of its typology.

The selection of jobs for the second questionnaire was more difficult as it involved starting from scratch. From discussion with a Professor of Electrical Engineering, it was decided that it would be useful to include jobs of different occupational level ranging from professional engineers to skilled workmen. It was thought that the term Engineer both in the United States and Britain is a generic occupational label which is applied to a wide range of occupations. This has the effect of lowering the prestige associated with professional engineers and could be one of the reasons why many bright young people interested in science do not choose to become applied scientists. This poor professional image of the engineering professions has been widely commented upon and, in the author's opinion, deserved investigation. It was also thought that many people not working in this field would have little idea as to what these occupations actually involved. A criticism that might be made of professionals working in this field is that they do not seek to inform the public as to the nature and range of the work they do. In retrospect it is interesting to note that the author himself felt that to ask school students to fill in this version of the questionnaire would be quite inappropriate.

As a first step in selecting titles, all the occupations the author thought to be technically oriented in MOCS were listed. This list was then discussed with the Professor of Electrical

Engineering and a number of extra titles were added to the list. It had been decided once again only to use titles that were included in MOCS. Although this meant that titles which might otherwise have been included had to be omitted, the advantage of having a considerable amount of extra information about all the occupations that would be chosen outweighed possible disadvantages. The list of all possible job titles is given in Table 6.2. Inspection of this list reveals a number of obvious categories, such as those which are medically related, construction related and so on, as well as that the jobs differ considerably in the level of professional qualification they require. To select 16 job titles once again required the use of arbitrary criteria of exclusion. By excluding two groups of (1) machine operators and (2) medically related occupations the list was considerably reduced. The final list chosen is shown in Table 6.3.

The two first parts of the questionnaires could now be completed. Only very minor modifications were made to the wording of the questionnaire instructions used in the pilot study since these had proved quite satisfactory. Copies of the actual questionnaires are shown in Appendix E.

The development of the rest of the questionnaire to be used in this stage of the study was a new task which had not initially been contemplated when the pilot study was carried out. Certain biographical and background information would be collected as in the pilot study, and additional questions about career and educational aspirations were also asked. Although small samples of subjects are quite appropriate for multidimensional scaling analysis, it was decided that if other analyses were to be

TABLE 6.2

List of possible Technical Occupations from the Minnesota Occupational Classification System

TAXON	Title/Alternate Titles	Holland Code
1 10	X Ray Technologist/Radiologic Technologist	1SR
1 13	Medical Technologist	1SR
11 17	Compositor/Typesetter/Typographer	RAI
11 29	Linotype Operator/Composing Machine Operator	RIC
11 35	Aircraft Mechanic	RIE
111 20	Key Punch Operator/Card Punch Operator	CIS
1V 2	Computer Operator	CIS
1V 34	Draftsman, Architectural	AIR
1V 35	Electronics Mechanic/Technician	RIE
V111 35	Electrician	RIE
1X 34	Electronic Technician	IRE
1X 35	Television and Radio Repairman	RIC
1X 37	Automobile/Garage Mechanic/Repairman	RIE
1X 38	Stationary/Maintenance/Operating Engineer	RIS
1X 42	Customer Engineer	RC1
X 1	Electrical Engineer	IRE
	Highway Engineer	RIE
	Civil Engineer	RIE
	Structural Engineer	RIE
	Mechanical Engineer	RIE
	Computer Programmer	IRA
	Statistician/Demographer	IRA
X 2	Dietician	RIE
X 3	Technical Writer	AIS
X 4	Pharmacist	IES
X 10	Physical Therapist/Physiotherapist	SIR
X11 1	Architect	AIR

TABLE 6.3

Technical and Engineering Jobs
Suggested List for Pair Comparison Task

	MOCS TAXON	HOLLAND CODE	DOT CODE
Aircraft Mechanic	11 35	RIE	621.281
Architect	X11 1	AIR	001.081
Automobile Mechanic/ Garage Mechanic	1X 37	RIE	620.281
Civil Engineer	X 1	RIE	005.081
Computer Operator	1V 2	CIS	213.382
Computer Programmer	X 1	IRA	020.188
Customer Engineer	1X 42	RCI	633.281
Draftsman (Architectural)	1V 34	AIR	001.281
Electrical Engineer	X 1	IRE	003.081
(Electronics Technician	1V 35	RIE	828.281
(Electronic Technician	1X 34	IRE	003.181
Maintenance Engineer	1X 38	RIS	950.782
Mechanical Engineer	X 1	RIE	007.081
Statistician	X 1	IRA	020.188
Structural Engineer	X 1	RIE	005.081
Television Service-and-Repairman/Television-and-Radio Repairman/Television Repairman	1X 35	RIC	720.281
Technical Writer	X 3	AIS	139.288

performed on the data to be collected in this section of the questionnaire, larger sample groups would be required. As far as it was possible, therefore, it was decided that the section of the questionnaire that would deal with direct ratings of aspects of jobs would be common to all groups of subjects who were to be included in the study. Certain very small changes would have to be made for particular groups, for example the school students as opposed to the university students, and it was anticipated that when the author returned to England further changes would have to be made if the questionnaire was still to be appropriate for use in a different country.

Appropriate biographical and background questions had to be developed for the school students. Basically this involved the omission of questions asked of the university students concerning class, subject, college and grade point average. The remaining questions could be carried through unaltered.

6.9 Research designed to measure the evaluative aspects of the content of occupational stereotypes has been reviewed earlier (see Section 3). In particular a number of methodological problems in this type of research were identified. The author's intention in including questions of this sort was to complement the data collected for multidimensional scaling analysis. It was hoped that, by collecting data from the first section of the questionnaire in a way that did not impose a framework on how the individuals might make their judgements, one of the main criticisms of research that has attempted to study the content of occupational stereotypes would be avoided.

It might be argued that Repertory Grid Technique (Kelly, 1955) would seem to be an appropriate research method for this type of situation. While there is some evidence that at an individual level this is a promising technique (Smith, Hartley and Stewart, 1978) for vocational guidance, the time required for collecting a large number of individual grids meant that this would not be a viable alternative for this research study. If repertory grid technique is developed into a standard test where the stimuli and sometimes even the constructs are supplied by the experimenter, it would seem that the method is no different from any other rating scale technique.

It was hoped that the design of this questionnaire would allow both an unstructured view of an individual's occupational perceptions and, from the later questions, also allow an exploration of the content of an individual's perceptions. In this way the researcher hoped to have both the advantages of the individually applied repertory grid and the comparability across a group of subjects. The relationship of an individual's ratings to the group would be explored through individual differences scaling. The questionnaire format would allow what would otherwise have been a small scale exploratory study with a very limited number of subjects to be much more wide-ranging in terms of the subject populations that could be covered in the research. The format of the questionnaire itself should, therefore, be seen as experimental and one purpose of the research as being to examine the extent to which this research approach resolves the methodological problems outlined above.

Other issues also influenced the format of the questionnaire. A major constraint was that the whole questionnaire should take less than one hour to complete. This was an external constraint

imposed by an estimate of the amount of time individual subjects would be prepared to make available for the study and the time that the researcher was likely to be allocated from the Department of Psychology's subject pool and from the local school system for the collection of data.

The design of the individual questions had to be determined within this framework. This involved decisions as to what might be considered to be the most salient and relevant dimensions in individuals' perceptions of occupations and the selection of occupation names to be used as the stimuli for these questions. Two of the content areas that were to be included were quickly determined. The first of these was interests. The centrality of interest as a concept in vocational psychology has already been discussed (see Section 2.8). The second topic area that seemed particularly well used was that of occupational prestige and it was felt that some attempt to measure prestige rating had to be made. The third topic area selected for inclusion was occupational difficulty. Zytowski (1968), in reviewing the little research work on this topic, suggests that the concept of difficulty is particularly relevant to considerations of occupational decision-making. Ideal occupational preferences will be tempered by the chance or opportunity individuals think they have of entering a particular occupation.

Considerable effort was made in the design of formats for the questions in these topic areas to make them as robust as possible. The design of each of these questions will be considered in turn. However, first there are certain underlying issues, such as the selection of job titles, which apply to all three questions.

6.10 Altogether 27 different job titles were used in the two different versions of the first part of the questionnaire and the following five job titles were included in both versions: Architect, Civil Engineer, Computer Operator, Electrical Engineer and Statistician It was decided to include these titles in all the three questions. Four titles which occurred in the list of 27 were not included in any of the questions, these were: Commercial Artist, Customer Engineer, Mechanical Engineer and Structural Engineer. All the remaining job titles included in the standard, general form of the questionnaire beside X Ray Technologist were included in all three questions and provided a standard starting set of job titles for each of the three questions to which other job titles were added so as to make the balance of job titles appropriate for the particular topic of the questions.

For the question concerning interests, the set of job titles was chosen to cover as far as possible the range of Holland codes included in the total list of 27 job titles. 18 job titles were chosen for this question, although one of these, Maintenance Engineer, was omitted from the form given to the school students, because it was thought that they would not know what it meant.

For the other two questions concerning the prestige and challenge of the jobs, it was felt important to include jobs of different occupational level and ability requirements. This necessarily meant that more titles from the second form of the questionnaire were included in the lists for these questions to provide suitable range in the question list. The sets of job titles are listed in Table 6.4.

TABLE 6.4

List of Job Titles used in the Second Section of the Questionnaire

1. Interests

- Architect
- Certified Public Accountant
- Civil Engineer
- Computer Operator
- Computer Programmer
- Draftsman
- Electrical Engineer
- Librarian
- Maintenance Engineer*
- Pharmacist
- Photographer
- Police Officer
- Primary School Teacher
- Secretary
- Social Worker
- Staff Nurse
- Statistician
- X Ray Technologist

*U of M students only

2. Prestige

- Aircraft Mechanic
- Architect
- Automobile Mechanic
- Certified Public Accountant
- Civil Engineer
- Computer Operator
- Draftsman
- Electrical Engineer
- Electronics Technician
- Librarian
- Maintenance Engineer
- Pharmacist
- Photographer
- Police Officer
- Primary School Teacher
- Secretary
- Social Worker
- Staff Nurse
- Statistician
- Technical Writer
- Television Repairman

3. Challenge

- Aircraft Mechanic
- Architect
- Certified Public Accountant
- Civil Engineer
- Computer Operator
- Computer Programmer
- Draftsman
- Electrical Engineer
- Electronics Technician
- Librarian
- Maintenance Engineer
- Pharmacist
- Photographer
- Police Officer
- Primary School Teacher
- Secretary
- Social Worker
- Staff Nurse
- Statistician
- Television Repairman

Although it might be argued that the lists should have been standardized for all three questions, it was felt by the author that the common core of job titles would provide a sufficient element of standardization and that the slight variety in the selection of the other job titles might help to lessen the monotony of rating repeatedly a similar set of titles. The occurrence of novel titles in each of the lists might serve to maintain the subjects' interest in the tasks. As any selection of job titles is inevitably arbitrary to a considerable degree, it was felt that, provided the chosen sets of job titles had the appropriate structure for the individual questions, they would adequately serve their purpose.

6.11 Having set out the rationale for the selection of job titles for these questions, the choice of the format for each individual question will now be considered. For the question concerned with interests it was decided to use a checklist approach, where subjects would be asked to check the interest category if they felt that occupation would be satisfying for somebody with that interest. The exact format of the question is shown in Appendix E. The selection of a relatively parsimonious set of interest categories was more difficult as a variety of basic sets of interest categories have been proposed. Some of the ones from the more well known interest inventories are listed in Table 6.5. The choice of appropriate categories for this question was again arbitrary. The set of ten chosen were considered to cover the main areas of occupational interest and also to be appropriate for the occupational titles chosen for this question. The format of this question is closely based on a classroom exercise (Brown, undated) used to demonstrate the range of occupational stereotypes.

TABLE 6.5

Interest Categories from well known Interest Inventories

1. Strong Basic Interest Scales

Agriculture
Nature
Adventure
Military Activities
Mechanical
Science
Mathematics
Medical Science
Medical Service
Music/Dramatics
Art
Writing
Teaching
Social Service
Athletics
Domestic Arts
Religious Activities
Public Speaking
Law/Politics
Merchandizing
Sales
Business Management
Office Practices

2. Kuder Preference Record-Form C

Outdoor
Mechanical
Computational
Scientific
Persuasive
Artistic
Literary
Musical
Social Service
Clerical

3. Edinburgh APU Guide

Scientific
Social Service
Persuasive
Literary
Artistic
Computational
Practical
Natural

For the question on the prestige of occupations, the respondents were merely asked to rate the three occupations they felt were highest and the three they felt were lowest in prestige. The argument for not asking for a complete rank ordering has been presented in an earlier section (5.4). Given the time constraints it was felt that this format of question presentation would be quick and easy to complete and yet also be a good indicator of the prestige ratings of the jobs. Ways of scoring this question are discussed in a later section.

The notion of occupational difficulty was operationalized in terms of the challenge each of the different occupations offered. The occupations were each rated on the following seven point scale:

1. Much too challenging
2. Too challenging
3. Very challenging
4. Challenging
5. Fairly challenging
6. Not too challenging
7. Not at all challenging

Respondents were asked to rate each job as to how challenging they would find it if it was their regular job. The phrasing and design of this question was experimental in several respects. The concept of occupational challenge and/or difficulty has not been defined operationally by a standard measurement procedure. The rating scale assumed that individuals would recognise for themselves positive and negative cut off points - too much and too little challenge being seen as unsatisfactory outcomes. It was felt, however, that this was a potentially important dimension of occupational perceptions and that even though the question included in the questionnaire

might only be a weak indicator of this dimension, it was important in an exploratory study to include some measure of this concept.

There are problems with this approach. Well defined differences between the different groups of respondents and in the individual ratings of occupations would suggest that the questionnaire format worked successfully. However, contrary indications could be attributable either to the lack of salience of the concept or the poorly phrased question. In practice it would be difficult to see how these possible causes of a poor response could be identified. It might be argued that the only way to test the concept of occupational difficulty would be through the development of a series of questions, each of which would be designed to measure aspects of this concept. Such a multi-method approach would allow for the elimination of possible method effects in question response. This approach, however, was quite impractical within the framework of the existing questionnaire and would demand a separate research study in its own right. Therefore a decision was made to include this question, even though it was known in advance that the information that might be gained from it was limited. It was decided that this was an acceptable risk as it did not seem likely that this question itself would disrupt or contaminate replies to other questions in the questionnaire.

One final question was included in this part of the questionnaire. This was an open-ended question which asked how it was thought that individuals working in five different occupations spent their time. The purpose of this question was to allow the subjects to present their ideas about the occupations in an open-ended format. Research work on stereotyping has been criticized (Frieze, 1974)

because it often imposes a framework on the subjects, forcing them to think in stereotypic form. The intention of this question was to allow the stereotypes to emerge. It was hoped that it would also permit a measure of the accuracy of job knowledge to be calculated. Knowlege of occupations has already been referred to in the discussion of the pilot study results as a possible moderating variable and will be discussed subsequently in the section on the results of the main study.

Once the format of the different versions of the questionnaire had been determined, the questionnaires could be printed. For convenience, the two different forms of the questionnaire were printed on different coloured paper - the general form for both school and university students on white paper and the applied science/technical form on yellow paper. Subsequently these will be referred to as the white and yellow forms respectively.

The next section reports on the data collection carried out for this part of the study at the University of Minnesota. The subsequent section will detail the changes made to the questionnaire when the author returned to England and the arrangements that were made for data collection at that stage. Copies of the three different versions of the questionnaire used in the study are included in Appendix E.

6.12 The successful organization of data collection is crucial to the success of a research project. In a project that is field based to a large extent, efficient administration of this part of a project is important not only for the control of the quality of the data but also for the maintenance of good relations between the

organization with which the research worker is identified and the external agencies which are cooperating in the study.

To carry out this project a number of agencies and individuals had to be approached. While the author was at the University of Minnesota, these included: the Department of Psychology's Subject Committee, Assistant Dean of the Institute of Technology, the Directors of the School system in Minneapolis and St. Paul, as well as many individual members of staff whose cooperation was sought to set up the project. Formal applications had to be made to the Psychology Department Subject Committee and to the two Directors of the School systems for permission to approach their students. Due to pressures from other research workers these applications were not entirely successful. The initial application to the Psychology Department subject pool asked for 100 subject hours but, due to the extent of competition, each applicant was only offered three-quarters of his request. The initial design had intended to have four groups of twenty-five students, half men and half women, and half completing one form of the questionnaire and half the second. As a result of this limitation the target number was reduced to 80 students altogether, in four groups of twenty, which it was felt would be a sufficient number, bearing in mind that it was still higher than the lowest estimate for a satisfactory group multidimensional scaling solution. The discrepancy of five student hours between the target and allowed numbers would, if necessary, be made up by paying for extra subjects.

The second setback occurred when the Minneapolis school system said that, due to pressure of work, it would not be possible for any of their schools to be used for this study. Fortunately,

the St. Paul school system was able to accommodate the research study in two St. Paul schools, one Junior High School and one Senior High School, and in each school approximately 50 students were able to participate in the study.

Arrangements were also made for questionnaires to be handed out to students in the Institute of Technology by individual course tutors together with a letter of introduction and instruction (see Appendix F) from the research worker. A second set of questionnaires were also handed out to women students in the Institute of Technology completing a seminar programme on emerging careers for women. Another set of questionnaires were handed out later to a special honours seminar of Electrical Engineering students. The details of each of these data collection arrangements will be discussed subsequently and the problems encountered at this stage will also be reviewed at that point.

1. Psychology Subject Pool Students

These students were contacted through notices informing them about the experiment and asking them to sign up for specific testing sessions. Up to twelve students were tested at any one time and they were asked to fill in one or other version of the questionnaire. As equal numbers of men and women subjects were wanted for this group and as also equal numbers were wanted to fill in each version of the questionnaire, the order of handing out the questionnaires was randomized for each sex. The students appeared to have little difficulty in completing the questionnaire. It was thought that, particularly with the yellow form of the questionnaire, students might not recognise some of the job titles, so after they had completed the questionnaire they were asked to tick on the list of job titles on the first page of the questionnaire any that they

were uncertain about. Some students did tick job titles and this data will be presented in a later section. There seemed to be few problems in this part of the data collection which proceeded as intended. Altogether 77 students, 41 women and 36 men completed questionnaires for this part of the study.

2. Institute of Technology Students.

Three separate groups of students were approached in the Institute of Technology. It was initially planned to hand out copies of both versions of the questionnaire to individual students through their course tutors. Students would be participating in the study voluntarily and in their own time. Given that there had been very few problems with getting the questionnaire completed, it was thought that it would be quite feasible to ask people to fill in the questionnaire in this way. The initial target was for fifty male students in this group, half completing each version of the questionnaire.

Unfortunately it soon became apparent that the response rate from this set of students was very low. At first it was not clear to the author whether the questionnaires were not in fact being handed out, or were not being completed by the students. It was decided to concentrate first on getting just one version of the questionnaire distributed, so that at least one set of useful data would be generated from the study. Subsequently it was also decided to send a reminder notice to all the students who had been handed out questionnaires in this way, encouraging them to complete and return the questionnaires.

However, as it seemed possible that the overall response rate from Institute of Technology students would be small, steps were

taken to locate further groups of students. One group that had already been approached was a group of women students taking a seminar on emerging careers for women. This group was asked to complete the yellow form of the questionnaire, as the author was concerned that unless sufficient numbers of the Institute of Technology students completed this form of the questionnaire, no comparisons could be made between this group and the liberal arts students.

Finally a group of students taking a seminar course in Electrical Engineering were approached to complete the yellow form of the questionnaire. All these groups were asked to complete the questionnaire in their own time and were participating in this study voluntarily. Some of the possible consequences of this for the validity of the data generated by the research will be discussed in the subsequent section that reviews the data collection process.

3. St. Paul School Students.

Two St. Paul schools, one a Junior High School the other a Senior High School participated in the study. The author first of all visited the Junior High School with a Career Education Consultant, who was liasing between the school and research worker, to make arrangements for the data collection. In this school 50 students were selected from Grade 9 (14 years old) to participate in this study. This was, in fact, a random sample of this age group within the school selected by the School Counsellor. Approximately equal numbers of boys and girls were included in the sample.

A one-hour period was allocated for the testing session and the author arranged with the school counsellor a convenient time for this to take place. The questionnaire was administered to the

group by the author with the assistance of the school counsellor. The session went very smoothly, although some students did ask what some of the jobs involved and these questions were answered individually as they arose. One interesting comment from a student was: "How can you rate these jobs, they are all such good jobs". This is perhaps a reflection on the strategy for the selection of the job titles.

Arrangements for data collection at the Senior High School were made over the telephone, and the author went to the school with the Career Education Consultant only actually to collect the data. Here it had been arranged for two classes of students to be tested one after the other. Both were Maths classes and it was obvious that these were high ability stream students from the kinds of questions they asked, for example about the number of possible pairs in the pair comparison task. These students appeared to have little difficulty in completing the questionnaire.

The variety of ways that the data were collected for this part of the study raises certain procedural questions as to the quality of the data and also to the meaning and possible interpretations that can be put on the results of the study. These will be discussed in a later section. The next section reviews changes that were made to the questionnaire for use with school students in England and the data collection procedures used in the schools in England.

6.13 Some of the problems of carrying out cross-cultural research have already been reviewed. The major theoretical problem found here concerns the establishment of conceptual equivalence. It was

decided that, for the English students, the world of work and the perceptions of occupations would be equally salient and researchable as for the American students. This is an assumption which can only be tested empirically. The results of the study will themselves provide some evidence to test this assumption. Differences in school leaving age and the structure of the education system are likely reasons for expecting some difference in the individual's perception of the world of work.

The second conceptual issue concerns whether the procedure used for the selection of the job titles in the United States is appropriate in England. Unfortunately there is very little data comparing particular occupational groups in the two countries, as to qualifications, intelligence and so on. It was decided, therefore, to use the same set of job titles for the study, although certain modifications to some of the titles would have to be made to establish linguistic equivalence.

A major problem underlying any research work in this field in England is the serious lack of occupational information and data that is at all equivalent in standard and quality to that achieved in the United States. One of the reasons for carrying out this research was to enable more comparisons to be made between the two countries, particularly as vocational psychology in the United Kingdom could benefit a great deal from American experience in its development.

The next problem was whether the same measurement approach would be appropriate in both countries. Evidence from earlier research, which has itself been carried out in several different

countries, including England, Israel, Canada and Scotland, suggests in practice there is likely to be little or no problem here.

The major practical problem concerns linguistic equivalence. Most of the job titles used in the American study would be immediately recognizable to English people. Certain changes were made, however, these were: Chartered Accountant for Certified Public Accountant, Radiographer for X Ray Technologist, Garage Mechanic for Automobile Mechanic. A few minor changes were also introduced to the instructions to the questionnaire and to the order of questions in the second part of the questionnaire because differences in standard paper sizes meant that the layout had to be modified. Due to differences between the two countries changes also had to be made to the biographical and background questions asked. A copy of the questionnaire used is included in Appendix E. It was hoped to be able to use this equivalent questionnaire with suitable populations in Birmingham schools so that comparisons could be made between the data collected in the two countries. Most importantly it was intended to collect data from the same age groups and it was also hoped to be able to include boys and girls in the sample.

6.14 Arrangements for data collection in Birmingham did not at first proceed smoothly. At the first school to be approached the headmaster was not prepared to allow the research to be carried out in his school. The second school approached was a Sixth Form College and here the research worker was told that students would only be able to participate in the study in their own time. Arrangements were made to contact students but at the prearranged time for data collection, it was found only a handful of students

were willing to participate in the study and the session had to be abandoned. After these setbacks approaches were made to two of the King Edwards Grammar Schools in Birmingham. At both schools groups of fourth year students completed the questionnaire and at one of the schools a group of sixth formers also completed the questionnaire. Although this data collection turned out to be fairly satisfactory, at one of the schools only one classroom period of 40 minutes could be allocated to the test session and this meant that a significant proportion of the students were not able to finish completing the questionnaire.

Two other factors will also have influenced the comparability of this data. First of all, both these schools were for boys only and secondly they were also selective in their choice of pupils. This meant that no girls had been included in the sample and that the group might also have been from a higher ability range than the St. Paul samples.

In an attempt to include an equivalent group of women in the sample approaches were made to two other schools in Birmingham. Only one of these was able to accommodate the research study and at that school it was only possible to include fifth year students. The research could only be carried out in this school if all the fifth year girls were included in the study and secondly if the research worker agreed to include material that would cover three classroom sessions at the end of the Lent term. As the author was about to start work in a new city, he was keen to complete data collection before he moved and, therefore, he was prepared to accept these terms. The difficulty already experienced in finding schools to participate in the study also made the author reluctant to turn down this opportunity.

The fifth year girls at this school were streamed into six groups and it was decided first of all to ask them to complete only the first section of the questionnaire, because this was all that it was possible to guarantee they would complete in a single classroom session. For the lower streams it was also decided, in conjunction with the careers master, that even this version of the questionnaire would take too long to complete. For this group a separate shorter form of the questionnaire was prepared which will not be reported here. In the second session the girls were asked to complete an interest inventory and in the final session to complete the biographical section of the questionnaire and some questions designed to elicit aspects of their stereotypes in an open-ended manner as reported by Frieze (1974). This material should be seen as supplementary to the main study and is only reported briefly in the results section as it falls outside the scope of the initial design of the study.

6.15 In reviewing the data collection procedures both in the United States and England a number of serious questions as to the quality of the data collection procedures need to be considered. This section has concentrated on simple reportage of the proceedings. The opening sections of the following chapter will review this aspect of the research and review some of the problems which have been encountered in the data collection and to which field based studies would seem to be especially prone.

7. MAIN STUDY - PRELIMINARY ANALYSIS

7.1 A central problem with field based research is that aspects of the initial experimental design can be confounded by circumstances which are to a large extent beyond the experimenter's control. These circumstances constitute threats to the validity of the data and raise important questions as to the possible interpretation of the results of much field based research. In designing a field based research study, therefore, it becomes important to include design features which are strong enough to withstand these possible threats. It is also necessary to examine carefully the possible threats to the study when the design has been confounded.

The most thorough analysis of the problems of carrying out field based research has been presented in a series of papers by Campbell and his associates (see Campbell and Stanley, 1966, Campbell, 1969, Cook and Campbell, 1976). A major distinction made by Campbell is between internal and external validity of research findings. He considers internal validity to be "the basic minimum without which any experiment is uninterpretable." Threats to the internal validity of an experimental design will confound any possible interpretation of the data. External validity is concerned with the extent to which the results of an experiment are generalizable. In the most recent paper (Cook and Campbell, 1976) reference is also made to threats to Construct Validity and to threats to the validity of research findings due to statistical effects which they list under the heading of threats to Statistical Conclusion Validity. It is useful to evaluate the research data to be reported here by these criteria, but before doing this the types of data that have been generated in this research study are briefly reviewed.

7.2 The data to be presented here are primarily descriptive. Multidimensional scaling provides a method of summarizing and structuring this description. The description, therefore, is not only directly in terms of content, but also, through the scaling analysis, in terms of the structure of individuals' perceptions. However, it is also intended to use this data to make certain types of comparison between different groups of subjects. The outcome of the multidimensional scaling analysis serves as the basis for testing whether or not differences between groups exist.

As the research is concerned with individual differences, it can be considered to fall within the correlational tradition (Cronbach, 1957) and to be essentially multivariate in form. Recently there has been a considerable emphasis on describing the effect of situations on performance in experiments but also recognition that the person situation interaction usually accounts for more variance than the situation effect alone (Bowers, 1973).

7.3 In selecting subject groups for this research, several different criteria were used so that a series of heterogeneous groups were included in the study. Although it is not possible to consider all the groups included in the study to be strict probability samples, it is argued that the heterogeneity will provide a robust basis for making some generalizations from this data although it is not possible to make statistical generalizations on the basis of the data. Overall, the number of subjects included in the various parts of this study is quite large, over 400. (These subject populations will be described in detail subsequently).

One of the major purposes of an exploratory study is to suggest hypotheses for further study by attempting to identify major sources

of variation in the data. By including heterogeneous groups of subjects the purpose is to minimize the possibility of pursuing a sterile line of enquiry in subsequent investigations. In further defence of this approach it is worth quoting from a recent paper by Cronbach (1975),

> "Descriptions encourage us to think constructively about results from quasi-replications, whereas the dichotomy significant/nonsignificant implies only a hopeless inconsistency."

Cronbach is arguing that psychologists should place greater emphasis on interpreting their results in a context and that research findings need to be evaluated from situation to situation to discover whether in a particular setting the application of the research findings is likely to prove beneficial. Too often it would appear that social scientists set themselves unrealizable goals for their research instead of adopting a more modest but open-ended approach to their inquiries.

7.4 The data collection for the main study took place over a period of twelve months and, consequently, coding and data preparation were carried out throughout this period. The first data collected in the USA was from St. Paul High School students and students at the University of Minnesota. This data was coded and punched onto IBM cards while the author was at the University of Minnesota. Codebooks for the two forms of the questionnaire used with the University students and for the questionnaire given to the High School students are given in Appendix G.

When the author returned to England arrangements were made to collect further data in Birmingham. Two questionnaires were used, one with boys from the Kind Edward's Grammar Schools and the

other with girls from the comprehensive school. Coding and punching of the data collected from the King Edward's Schools were carried out while the author was still in Birmingham. The codebook for this adapted version of the questionnaire is also in Appendix G. The form of the questionnaire for the girls only included the first section of this questionnaire plus the short biographical questionnaire. The other information collected from this group will not be presented here. These data were coded and punched when the author had moved to Cardiff. The codebook for this version of the questionnaire is also included in Appendix G.

Inevitably during the coding process the author found questionnaires where some responses were missing. Basically these questionnaires came into one of two broad categories.

1. Individual responses missing, presumably due to oversights on the part of respondents.

2. Whole pages or sections missing. This could either have arisen from people not noticing that the questionnaire was printed on both sides of the paper, or because people accidently turned over two pages at once and this had not been noticed when the questionnaires were collected from subjects by the research worker or his assistant (eg. the school counsellor in the St. Paul Junior High School). For one group of subjects, the boys at one of the King Edward's schools, the shortage of time available also meant that some of the students had not completed the questionnaire in the class period allotted.

Decisions had to be made on how to treat these data for analysis. These are reported subsequently. At the coding and

punching stage, all the data present were coded and punched onto cards and missing data left as blank on the cards.

7.5 Once the data had been punched onto cards, preliminary analysis could begin. As for the pilot study, this analysis was done using SPSS. For the American data some of this work was carried out while the author was at the University of Minnesota, but all this computation had to be repeated when the author returned to England as the output was too bulky to transport. The only material transported was data and programme listings, original questionnaires and IBM cards, and output from some of the scaling analyses.

The analysis presented here was carried out once the author had moved to Cardiff. When all the data for the study had been collected, coded and punched, a standard approach to this stage of the analysis was adopted. The following sections detail the procedures used, which include the generation of simple frequency distributions for each data set, description of the subject populations in terms of the biographical data obtained from the questionnaires and assessment of the reliability of the data for multidimensional scaling. This is necessary both to assess the quantity of the data and, more importantly, to assess its quality. If data collected either from particular groups of subjects or particular sections of the questionnaires is inadequate in any way, certain aspects of the planned research design and analysis would be threatened. The purpose of the preliminary analysis is to determine the extent and effect of deficiencies in the data actually collected. Subsequent sections will therefore be concerned with evaluating these aspects of the research and their consequences

for the design of the study.

The first task was to obtain simple listings of the data which were stored on the computer, permanent files having been created from the IBM cards and stored on disk. These simple listings permitted the author to check whether any cards were out of order, whether any cards were accidently missing and to identify the cases for which there was missing data.

It is surprisingly easy to find errors at this stage. One card may be accidently destroyed and, if not spotted, all subsequent analysis would be meaningless. While the author was at the University of Minnesota a faulty card reading machine destroyed and damaged part of one deck of data cards, which meant that data cards had to be duplicated and some cards repunched. Decks of cards can also easily be dropped, although provided the cards have sequence numbers it is relatively easy to sort them out again either on a mechanical card sorter or with a standard computer programme for sorting and re-ordering a data set.

Once data listings had been obtained, checked and corrected, it was possible to obtain simple one-way frequency distributions for each item on the questionnaires. This is essential for checking whether there have been coding or punching errors in setting up the data file. The output is carefully checked to note where cases appear to take on impossible values or where there appears to be a substantial amount of missing data. It is possible when errors have been detected to get the computer to identify the individual cases which contain apparent errors. These can then be checked with the original listings or questionnaires, as appropriate, in order to

correct the errors, or to note a case containing missing data. This process, which is normally referred to as "data cleaning", is an essential first step to any computer based analysis. It can be quite laborious and time consuming, but in this case the procedure went relatively smoothly. Naturally this process cannot guarantee to identify all the errors in coding but it can reduce and eliminate major sources of error.

Each stage of data analysis which involves the transfer of data from one medium to another is likely to introduce some errors into the data. So the transfer of the data from questionnaire to coding sheet or direct to punch card must introduce extra error into the data set - just as a respondent's poor writing or misplaced response may introduce error. The procedures adopted here attempted to minimize the introduction of further error at this stage. It is reasonable to assume that any error introduced is very small and also random. It is to be hoped that these errors do not obscure what would otherwise have been a significant effect.

The random introduction of error seems most likely to result in Type II error, that is not rejecting the null hypothesis when it is false, the effect being similar to the introduction of 'noise' into a system which obscures the true signal. It is possible, however, that the error might cause a Type I error where the null hypothesis is falsely rejected. These are, of course, the risks in making any decision on probabilistic grounds and are inevitable in this kind of research. The role of replication in research to combat these effects has already been discussed (see Section 5.10).

7.6 The overall sizes of the different subject groups are presented in Table 7.1. For the University of Minnesota students, breakdown by form of the questionnaire and college (faculty) is given in Table 7.2. For each group a distribution by age is given in Table 7.3.

Considering these various groups in turn, it will be noted that, for the St. Paul High School students and the British School students, in absolute terms, there are sufficient numbers in each of the groups for multidimensional scaling using the criterion that there should be at least 20 subjects in each group. However, among the University students, although the overall numbers are sufficient, once these are broken down by college and grouped by subject, it is apparent that the number of women included is barely adequate for the projected analysis.

This might have presented a major problem for the analysis of the data and planned design of the study. However, the availability of INDSCAL (Carroll and Chang, 1970), a programme for the analysis of individual differences in multidimensional scaling, meant that the data from groups of subjects (up to 70 individuals altogether) could be analyzed together and individual or group differences could be identified from the output of this programme. The individual differences scaling approach has already been outlined (see section 4.15) but was not available at the University of Minnesota when this study was designed. The programme clearly has advantages for this study and it would appear foolish not to make use of it for the analysis of this data once it had become available.

TABLE 7.1

Distribution of Questionnaires by Subject Group

1. Pilot Study

Men	Women	Total
20	21	41

2. University of Minnesota Students

	Men	Women	Total
Form 1 (white)	31	20	51
Form 2 (yellow)	41	33	74

3. St. Paul High School Students

	Men	Women	Total
Junior High	22	24	46
Senior High	25	22	47

4. King Edward's Schools

	Men	Women	Total
Five Ways	51		51
Aston (4th form)	30		30
Aston (6th form)	27		27

5. Sharmons Cross Comprehensive School

	Men	Women	Total
Fifth Form		59	59

6. TOTAL

Men	Women	Total
247	179	426

TABLE 7.2

University of Minnesota Students (Main Study)

Distribution of Questionnaires by College (Faculty) and Sex

Form 1 (white)

College	men	women	total
Education	1	2	3
Institute of Technology	18	-	18
Graduate	-	1	1
Business Studies	1	-	1
Liberal Arts	11	14	25
Agriculture	-	1	1
Home Economics	-	2	2

Form 2 (yellow)

College	men	women	total
Education	2	-	2
Institute of Technology	22	9	31
Graduate	1	-	1
Business Studies	-	1	1
Liberal Arts	15	17	32
Agriculture	1	2	3
Home Economics	-	4	4

TABLE 7.3

Distribution of Questionnaires by Subject Group and Age

1. Pilot Study

Age (in years)	18	19	20	21	22	23	26-30	31-45
Number	3	7	10	3	2	5	6	5

2. University of Minnesota Students

Age (in years)	17	18	19	20	21	22	23	24	25	26-37	mis
Number	1	35	34	15	10	5	6	2	2	10	5

3. St Paul High School Students

Junior High	Age (in years)	13	14	15	16	missing	
	Number	1	27	15	1	2	
Senior High	Age (in years)	16	17	18			
	Number	26	19	2			

4. King Edwards Schools

Five Ways	Age (in years)	14	15	missing	
	Number	30	20	1	
Aston 4th Form	Age (in years)	14	15	missing	
	Number	8	15	7	
Aston 6th Form	Age (in years)	17	18	missing	
	Number	9	6	12	

5. Sharmons Cross Comprehensive School

Age (in years)	15	16	missing	absent
Number	17	33	3	6

One problem the author had to face was whether the same or equivalent programmes would be available when he returned to England. Enquiries made to the Social Science Survey Archive at the University of Essex suggested that multidimensional scaling programmes were fairly widely available in the United Kingdom althou as it turned out, they were not available at the University of Aston. Fortunately programme listings had been brought back from Minnesota. In fact before the author was able to get these programmes running successfully at Aston, he had moved to Cardiff, where a suite of multidimensional scaling programmes were available, including programmes for both group and individual differences scaling.

Because of the availability of INDSCAL for data analysis, it seemed safe to assume that in terms of absolute numbers the groups available were adequate. However this is merely the crudest criterion that the data had to meet and more detailed examination of the quality of the data was required before it could be concluded that the data was of sufficient quality to satisfy the initial criterion of the experimental design.

7.7 The next stage in the evaluation of the data was to examine the extent of missing data in the data set. It was decided that the most convenient approach to this problem would be to consider the extent of missing data in different sections of the questionnaires for each of the subject groups. As far as possible the extent of the missing data is categorised into one of the two broad categories listed earlier. This is presented in Table 7.4.

Looking at the first part of questionnaire, which was the pair comparison rating of similarity, it will be noted that only 8 people omitted major parts of this section of the questionnaire,

TABLE 7.4

Distribution of Missing Data by Section of the Questionnaire and Subject Group

Subject Group	Pair Comparisons	Interests	Prestige	Challenge	Biodata
1. Pilot	3 minor	--------not applicable--------			none
2. U of Minnesota Students					
Form 1 (white)	5 minor	none	1 major	2 minor	2 minor
Form 2 (yellow)	2 major 3 minor	none	none	5 minor	3 minor
3. St Paul High School Students					
Junior High	3 minor	none	1 minor	2 major 5 minor	2 minor
Senior High	1 major 4 minor	none	1 major	1 major 5 minor	
4. King Edwards Schools					
Five Ways	4 minor	none	1 minor	1 major 3 minor	
Aston	5 major 4 minor	6 major (minor omissions not counted)	13 major	19 major	19 major
5. Sharmons Cross	6 minor	-------not applicable--------			9 major
TOTAL	8 major 32 minor	6 major	15 major 2 minor	23 major 20 minor	28 major 8 minor

usually a whole page, and that five of these were from the King Edward's schools where inadequate time was available for many of the students to complete the questionnaire. Overall this was less than 2% of the sample, but for this one group, the percentage figure was nearly 9%. Obviously all these 8 individuals would have to be excluded from the multidimensional scaling analysis of this data due to the extent of missing data in their cases. Thirty-two individuals had minor amounts of data missing from their answers to this part of the questionnaire, usually only one or two responses to individual pair comparisons have been omitted. Although this involved about 7.5% of subjects, it should be noted that it usually involved only one omission out of 130 responses, so that the rate of omission over all possible responses was certainly less than 0.1 This rate of omission did not warrant deleting these individuals from the scaling analysis, although it did mean that for the individual differences scaling either average values had to be substituted for the blanks in the data or the cases omitted. It was decided that where this choice arose, average values for the subject group would be substituted, so that these individuals could be included in that analysis.

For the second section of the questionnaire the pattern of missing data was a little more complex. First of all, for one of the questions, it was impossible to assert that data was missing unless the individual made no responses at all. This was the question concerned with interests for which the individual was free to circle as many responses as he wished. Secondly, one of the reasons for missing data in this part of the questionnaire was lack of time for subjects to complete their answers. Although this was not a factor for some of the subject groups, when data was collecte

from institutional settings, for example schools, the amount of time available was inevitably a finite number of classroom periods, depending somewhat on the timetabling arrangements of the schools.

It will be easiest in this section to consider each of the subject groups separately, both because versions of the questionnaire differed slightly from group to group and because conditions under which the questionnaire was administered differed for each group.

There was no missing data for the pilot study group in the section on preferences or the biographical information. For the other University of Minnesota students, all of whom answered the same version of this part of the questionnaire, the missing data for these questions can be considered together. There were no detectable missing data for the interests question, although the number of responses made by different individuals varied considerably and this will be discussed when the results of this question are presented. Only one person did not provide an answer to the question on the prestige ranking of the occupations and he had written in "all the same" as a reply. The question on the different amount of challenge associated with the occupations contained the greatest amount of missing data, for this and all the other groups. Seven of the 125 students had minor omissions for this section. Nine ratings were omitted and twice, more than one rating was checked for an item. This error involved only one respondent who omitted to rate the subsequent item in each of these cases, suggesting that these answers had just been misplaced. Unfortunately, it was impossible to ascertain which response was indeed correct and which in error. There was little missing data associated with the biographical questions, although 5 individuals

omitted their age in answering the questionnaire. This may, in part, be attributable to the printed format of this section of the questionnaire, where age was one of the two questions on the right hand side of the page. For this subject group, therefore, it seems safe to assume that the extent of missing data is very minor in both parts of the questionnaire, the extent of missing data effecting only a few variables and even then to a very limited degree. The precise figures are listed in Table 7.4 presented earlier.

The next group to be considered is made up by the St. Paul High School students. No student in this group omitted the interests question, as far as it is possible to tell. One student omitted the question on prestige and on challenge because she had run out of time, otherwise there was only one respondent who failed to identify one of the job titles as lowest in prestige. It is possible that an omission of this sort should not be interpreted as missing data, but rather as a deliberate omission, reflecting perhaps genuine difficulty in making the required judgment. If possible it would have been interesting to follow up some of these individual cases to check on the meaning people gave to their replies. The questionnaire format inevitably constrains respondents to answer questions in the researcher's own terms and it is always possible that this process is biassing this section of the results. Some of the problems with forced choice questionnaires have already been reviewed (see section 3.3). The approach adopted here attempted to minimize some of these effects.

The question on challenge presented most difficulty to this group. Apart from the one senior high school student, who had insufficient time to complete this part of the questionnaire, two

junior high school students circled more than one response to most of the items in this question, suggesting they misunderstood the question instructions. It seems reasonable to suggest that the few valid responses they gave should be ignored. Five other junior high school students omitted in total 11 responses to items in this section, and five senior high school students omitted 6 responses. Altogether this totals to less than 1% of total responses, and although this is a higher rate than for the errors in the pair comparison section, it is still sufficiently small to be unlikely to distort group results to this question. It was decided therefore to include the valid replies of these 10 individuals where appropria but to ignore their incorrect or omitted responses.

For both the American subject groups it is noteworthy that the rate of missing data was higher on this question than for other questions, and there might be a number of possible explanations of this. The novelty of the question, poor instructions, difficulty with the concept or position in the questionnaire are some of the possible factors which either alone or together may account for this. It suggests that this data from this question should be interpreted with caution.

Very little of the biographical information was omitted by this group, although two junior high school students omitted to give their age. The extent of missing data for this group was slightly greater on balance than it was for the University students, but was still a small amount of the total data. This low rate of missing data can be safely ignored and is unlikely to affect the conclusions or interpretation of the results to this section of questionnaire.

The next subject group to consider is the King Edward's Schools students. It is useful here to distinguish the group who had plenty of time to complete the questionnaire from the two groups who had what turned out to be insufficient time to complete the questionnaire, as there appear to be very different rates of missing data between the two groups. For the first group, all the interest data appeared complete and only one response on the presti question had been omitted, because the respondent gave a reply that was uninterpretable, 'Social Nurse', a combination of two adjacent job titles Social Worker and Staff Nurse. One individual in this group consistently circled more than one response category for the challenge question and his data had to be deleted. Apart from this only three individuals omitted a total of four responses. None of the biographical data were omitted by this group. This group, therefore, returned data which should be comparable with that from the Junior High School sample as the rate of missing data is, once again, small.

For the remaining two classes, however, there were a large number of major omissions. These were in almost all cases caused by lack of time to complete the questionnaire. Just tabulating the major omissions it appears that 6 individuals did not complete the Interests question, 13 the Prestige question, 19 the Challenge question, 19 had some Biographical information missing and 31 omitted the question on Aspirations. Even ignoring the Biographica and Aspiration questions, 22 individuals had major omissions to questions in this section of the questionnaire. This is nearly 40% of the sample. Inevitably there were also minor omissions, although these do not appear to be of any greater extent than for the earlier groups.

Although it seems reasonable to include the pair comparison data from this sample in the subsequent analysis, as the error rate for this group is only slightly higher than for the other subject groups, it would appear unreasonable to attempt to include any of the data from the second section of the questionnaire, due to the high rate of major omissions in the replies to the questions. The high rates of missing data are likely to bias the research findings and it is possible that the group for which there is a large amount of missing data may have answered the questions differently. Although it might have been possible to retrieve some of this data by careful analysis of differences between respondents who had answered all the questions and those whose replies contained some missing data, the risk involved did not seem worthwhile, especially when the rate of missing data in the other subject groups has been so low. To avoid the high probability of introducing serious non-random errors into the data it was decided to adopt the most conservative approach to this data and omit it from the analysis. The potential consquences of this to the research design will be discussed in a subsequent section. This section will also evaluate whether the composition of the subject groups can be considered to meet the requirements of the experimental design, even though they depart from the original specifications.

7.8 It was also necessary to develop criteria to determine whether particular individuals either appeared to have a response set or to be answering the pair comparison section of the questionnaire random One measure which was used in the pilot study and by Coxon and Jones (1974a) was to exclude individuals who had rated more than two third of the items the same, as it was felt that these individuals were failing to adequately discriminate among the items. Frequency

counts were, therefore, obtained to list for each subject the number of times each response category was used. This procedure was then used to identify the handful of subjects who seemed to fail to discriminate among the response alternatives. The results of this by subject group are listed in Table 7.5.

TABLE 7.5

Distribution of Indiscriminate and Inconsistent Rating on the Pair Comparison Items by Subject Group

Subject Group	N of Subjects rating more than two thirds of pairs the same	N of Subjects with D Score greater than 2
1. Pilot	2	-
2. University of Minnesota Students		
Form 1 (white)	1	-
Form 2 (yellow)	-	-
3. St Paul School Students		
Junior High	3	5
Senior High	1	3
4. King Edwards Schools		
Five Ways	2	-
Aston	1	5*
5. Sharmons Cross	-	1

* All 5 subjects also had major amounts of missing data.

Ten subjects are excluded altogether from the analysis by this criteria and these must be added to 8 already excluded because of the major amount of missing data in their responses. 2 of these 10 individuals also had minor amounts of missing data in their replies.

7.9 In the analysis of the pilot data, correlations were calculate for each subject between the ten items that were repeated in the pair comparison section. Ten items were also repeated in the main

study for each subject group to allow a measure of consistency and reliability of response to be calculated. The range of individual differences in the use of response categories was still marked. However, because the distribution of response alternatives was demonstrated to be skewed for the pilot study and certainly also appeared skewed for the results of the main study, it was decided that the correlation coefficient was not the appropriate statistic for measuring reliability in this instance. It would also be very laborious to calculate for each individual. An alternative measure was therefore developed. This was a simple difference score for each of the ten pairs of items calculated by subtracting the response obtained for one item from the response obtained from the equivalent item. The total difference (D) score was then obtained by summing across the ten items.

Although this score was easy to compute, there are some difficulties in interpreting it. First of all, the possible range of scores depends on the initial scores. For example, if all the ratings were initially (1) Almost Identical, and the repeated ratings (7) Completely Different, the D score would be 60. However if all the initial ratings were (4) About as Similar as Different, the maximum D score possible is only 30. Assuming a completely random distribution of scores across the 7 response categories, the average D score would be 30. However, it was known in this case that the distribution of scores was heavily skewed towards one end and this has the effect of increasing the possible range of the D score and making it more likely that individuals could have D scores in the range 30-60. One alternative considered was to calculate, for each individual, the theoretical maximum D score they could obtain given their pattern of responses and then to

compare this with their actual score and use an arbitrary percentage cut off point to define 'unreliable' cases. However it was also decided that in the main study it was not necessary to adopt such a conservative approach to unreliability as had been done in the pilot study, because such an approach might be considered as loading the dice in favour of finding meaningful relationships among the data.

Examining the actual distribution of D scores obtained for the different groups, it was noted that in only a very few cases was the D score found to be greater than or equal to 20. These are listed by subject group in Table 7.5. As is apparent from this listing, this only appeared to affect the data from the school students, and further analysis indicated that 6 of the individuals identified in this way were already to be excluded from the analysis because of the large amounts of missing data in their questionnaires. Two of the individuals in the American school student group were subjects who had filled in other sections of the questionnaire incorrectly. Only two individuals, who had completed the whole questionnaire, both Junior High School students, had D scores greater than 30.

It is argued, therefore, that it is not necessary to exclude any subjects because of their D score and that the only reason to exclude subjects from the analysis should be the extent of their missing data or their failure to use the different response alternatives. The one group of subjects where the pattern of D scores is slightly different from the other groups is the American High School students but it seems that to exclude over 5% of this group for this reason would tend to make the group less representative, the greater irregularity in their data being, in fact, one

genuine result of their less sure occupational perceptions.

7.10 It is now possible to summarise the number of subjects in each of the groups who must be excluded from the multidimensional scaling analysis either because of the major extent of missing data in their questionnaires or because of failure to discriminate among the range of different response alternatives. 18 individuals are now to be excluded. This is still less than 5% of the total number of subjects.

One further possibility still to be explored is the extent to which the subjects whose questionnaires contain missing data in one section of the questionnaire also have data missing in other section It is possible that there might be a group of subjects, perhaps 5-10%, who seem to be inconsistent and careless in their responses right through their answers to the questionnaire. However, examination of the data indicates that there are only five individua who fall into this category. (This is, of course, not possible for some of the subject groups who were not asked to complete certain sections of the questionnaire, or appropriate for the group whose responses to the second section of the questionnaire are being ignored). These five individuals still account for less than 2% of the subjects, and therefore it seems reasonable to ignore the possibility of the existence of this group of inconsistent responder and to discount their effect on the results of this study.

The next section, bearing in mind the results of these analyses of the missing data and the quality of the data, reviews the extent to which the results of this study meet the original criteria. It is therefore a key section in the presentation of the results.

7.11 As the data collected can now be analysed by the Individual Differences Scaling Programme (INDSCAL), as well as the conventional Multidimensional Scaling programmes, it seems that the American data can be considered to adequately meet the initial design criterion. The actual numbers are adequate for the analysis in each of the subject groups and the rate of missing data for these groups is small and unlikely to affect the interpretation of the results. For these groups, therefore, all the planned comparisons, that is between age groups, sexes, subject groups and forms of the questionnaire, can be made.

The data from the British subjects are more equivocal. Although the data for the first section of the questionnaire are adequate for all the groups, and the planned comparisons can be made between these groups, the actual structure of the subject population is not quite as intended. The boys are from selective schools and the girls are older than their American counterparts. It will be possible to contrast the different age groups and schools among the British boys, but the girls represent an anomalous group, who, although they are meant to be of above average ability, are not strictly comparable in age to either of the groups of boys. It is, however, possible to carry out an individual differences analysis with each of these groups.

The major threat to the experimental design is in terms of the hoped for cross-cultural comparisons. Although it is probably reasonable to make comparisons between the Senior High School students and Sixth Form students, as both are groups of above average and probably similar ability, for the younger age groups the comparisons will be confounded by possible alternate explanations in terms of differences in ability, age and schooling. These form

threats to the Internal Validity of this part of the experimental design.

The exact form of the weakness in the experimental design can be pinpointed, but it is not necessarily possible to isolate all the consequences of this. These, in part, depend on the result for each of the subject groups. If these are interpreted as being broadly similar, it would seem that the sampling of heterogeneous groups of subjects in the research design would mean that it is possible to generalize from this data across experimental settings and that a 'quasi-representativeness' had been obtained, even though the design is not a random sampling one.

Within the American subject populations, comparisons can be made and interpreted on quite strong grounds, although inevitably because random probability samples were not employed, there will always be possible alternate explanations. However, in an exploratory study, this is less important because these factors can be resolved by properly controlled experiments subsequently. This is not to say that 'anything goes' in this type of research, as the intention is to identify the factors most likely to influence the data and to attempt to isolate the variables which have greatest effect on the data.

For some of the British subject groups, the omission of the second section of the questionnaire means that the number of comparisons that can be made in direct terms between the stereotypes held by the different subject groups has been a little curtailed. However, this element of the research has always been of second order importance, the greater emphasis having been

placed on identifying the structural variables in occupational perception. It is these variables that are likely to have greatest relevance to occupational classification and to relating subjective models of the world of work to the formal models developed by vocational psychologists.

The effect of missing data does seem to be limited and can be safely ignored. If more time had been available it would have been possible to attempt to collect more data to make up for some of these deficiencies, but because the author had moved yet again and because of the time in the school year, this data collection could not have taken place until six months to a year after the end of the data collection. To collect this data from a new location and so long after the earlier data could have introduced further new factors into the experimental design which could not have been easily controlled. The time constraints on the study would also have made it difficult to complete the analysis of this data.

Research always takes place in a context and certain compromises are inevitable. What is important is to try to make the best possible choice between the alternate options that are presented in the course of the research. Unfortunately the consequences of these decisions can not always be anticipated. In this case certain aspects of the research design may have been confounded by the changes that were forced upon the experimenter in practice. However, it would seem that most of the research design is not threatened by this and that the data are still of sufficient use, and contain enough information, to justify further analysis. Some of the consequences of the modifications that took place will not be unravelled until this analysis has taken place.

There are some other factors that have not yet been considered. These include the question of the possible existence of an experimental set among the subjects which could be introduced by the reward subjects received. This would only apply, of course, to the subjects recruited through the Psychology Department Subject Pool. While there is a considerable literature as to the experimen effect and the effect of subject's expectations, it is not at all clear why these should in one situation act to favour the experiment hypothesis and in another situation act against it. It may say some thing about the type of experiment for which these manipulations are often demonstrated, frequently experiments involving deception. It is worth pointing out that no deception is employed here and tha the instructions aimed to give an open and honest description of the purpose of the experiment. This may introduce bias, but it is difficult to see how this research is different from most psychological research in that respect. The fact that questionnaire were completed in a wide variety of settings, both by groups and individuals under supervision and by self-completion by subjects in their own time, should have the effect of reducing any consisten experimenter effect and making the distribution of error introduced into the replies random in nature. Ultimately, however, this is an untested assumption.

For the 48 students who were asked to complete the questionnaire in their own time, the overall rate of response was 27 (56%). Although not a very high rate of response, it must be remembered that the sample is essentially 'purposive' and not intended to be representative of this group of students. Students obviously self select themselves to participate in all psychology experiments and this is also likely to introduce bias. The strength of this study is in the fact that a heterogeneous number of subject groups

were included. From the outset this was seen as the most appropriate way to achieve a robust representativeness from which certain limited generalizations could be made.

A major question, which must also come up with the discussion of the research results from the second section of the questionnaire concerns whether the topics chosen for these questions were appropriate and, if appropriate, were operationalized in the right way. Evidence from the amount of missing data in comparison with the other questions suggests that some difficulty was experienced by subjects with the question on 'challenge', which was intended to tap the dimensions of occupational difficulty. It is possible that under the time pressure to produce a questionnaire by a certain deadline, some of the decisions made were not the best.

The analysis presented in this section has attempted to examine critically the quality of the data obtained in this study and to detail the rate and type of response obtained in each of the subject groups. This analysis has shown that, in practice, certain of the original aims of the experimental design were not realized as had been initially hoped. This was, perhaps, inevitable but does have certain consequences for the interpretation of the results of this study. These will have to be considered in the following analysis of the data.

Finally, the implementation of this research study has provided the researcher with many useful and important learning experiences. Some aspects of the research would be carried out differently again, not only because of the data obtained in this study, but also because of what has been learnt by the author in

conducting the research. In some respects the study is, perhaps, over ambitious and may leave too many knots unfastened. This is a risk with an exploratory study that is trying to map out an area, as Harré and Secord (1972) note;

> "In exploratory studies, a scientist has no very clear idea what will happen, and aims to find out. He has a feeling for the 'direction' in which to go.... but no clear expectation of what to expect. He is not confirming or refuting hypotheses".

If one knew the results in advance, of course, it would not be necessary to carry out the study, and this is, perhaps, the ultimate justification for scientific enquiry.

8. MAIN STUDY - DESCRIPTIVE ANALYSIS

8.1 The purpose of this section is to present a descriptive analysis of the data from the main study giving information about the content of the occupational stereotypes held by the subjects. This data comes primarily from the second part of the questionnaire and is, therefore, drawn from three of the subject groups: Universi of Minnesota Students, St. Paul High School Students and the one gro of King Edward's School Students. Initially each of the questions from the second part of the questionnaire will be considered in turn

8.2 The first question in this section of the questionnaire asked the subject to check each one of a list of occupations against a number of interest categories. Although the ten interest categories were the same for each group and had been chosen as being appropriat for the job titles used in the questionnaire, the three groups had been presented with slightly different versions of the questionnaire for reasons outlined earlier (see Section 6.10), so that the list of job titles for the three groups did vary in minor ways. For the University of Minnesota students the title 'Maintenance Engineer' had been included to allow comparisons to be made between the way Institute of Technology students and Liberal Arts students rated the title and also to allow comparison to be made between the ratings of this title and the others which included the generic title 'engineer'. This title had, therefore, been omitted for the St. Pau school students. For the U.K. version of the questionnaire, certain changes to the titles had to be made for language reasons and these have been listed earlier (see Section 6.13). The one title 'Commercial Artist' used in the pair comparison section, but not included for the American sample for the interests question, was

added for this group. It was not anticipated that these minor differences would, in themselves, cause differences in the replies given to this question.

8.3 An initial problem to be considered concerns the presentation of the information gathered in this question. Although the checklist format adopted for this question seemed to work well with all the groups of subjects, who had little difficulty in completing the question, it yielded a great deal of data both for an individual subject and a subject group. Even when the raw data are presented in summary form, where the responses to each item in the checklist are expressed in terms of the percentage of a subject group who endorsed a particular interest category as appropriate for a particul occupational title, the data arrays are large.

8.4 In considering the presentation and analysis of this data, it is also important to remember the purpose for which this data was collected. The main purpose of this study is to examine structural aspects of the perception of occupations. Although the data to be presented here are concerned, at a superficial level, with the content of occupational stereotypes, the reason for asking these questions was not to illuminate issues concerned with the content of stereotypes, for which there is a considerable research literature (see Section 3), but to assist in the interpretation of the data which was collected to examine the structural aspects of occupational perceptions and also to look for interrelationships between the two sets of data.

8.5 At a purely descriptive level, it seems that the data from this question could be most easily presented diagramatically, where

the group data for each occupational title is plotted for each of the ten interest categories to yield a profile. This allows a rapid assessment of whether a particular interest category is or is not associated with a particular occupational title. The profile obtained from different groups of subjects, or subsets of particular groups, can then be compared.

This comparison, however, is a far from simple issue. Compari profiles is a process beset by methodological problems. These issue will be reviewed briefly below and the strategy adopted here presented. Some of these problems also relate to more general issues related to the construction of taxonomies. These will be discussed in a later section in the context of the construction of occupational classifications for vocational guidance purposes.

8.6 Cronbach and Gleser(1953) distinguished three main ways in which profiles can differ: (1) elevation (2) shape and (3) scatte Elevation refers to the overall mean level of the profile, shape refers to the overall configuration in terms of relative elevation among the individual scales and scatter is a measure of the variability of scales within a profile from the overall mean of that profile. Cronbach (1955) examined further the components of the variance in profile scores, but the index D^2, defined as the sum of the squared differences between all variables for any two profiles, is the most commonly used measure that takes account of the three components of a profile outlined above. Some early workers attempte to use the correlation coefficient as a measure of profile similarit but this measure takes account only of the shape component and ignores the components of elevation and scatter.

In this study such a technique could have been used with the

group data, although a crucial issue to consider would have been the reliability of the data. In comparing relatively small groups of subjects, there is a likelihood of finding spurious differences caused by random error effects or systematic biases in the samples. Because the quality of the data would not justify the effort involve in computation the D^2 measure has not been employed. However, this is not an argument that the data presented here are valueless, rather that their usefulness is limited to providing a very general description of the content of stereotypes. The relatively small scale nature of this study meant that detailed evaluation of these methodological problems could not be contained within the time and resources available.

A second approach would have been to examine similarities and differences in individual replies to this question. There are, however, a number of methodological problems involved here also. The first problem concerns the range in the total number of response given by different individuals to the items in the question. Individuals had to check categories they considered appropriate and there was no minimum or maximum limit imposed on the number of alternative categories that could be checked. Although this is most satisfactory from a logical point of view, it results in a wide range of individual differences in the total number of responses checked on the question overall. This variation, shown in Table 8.1 for each of the subject groups, can be considered as a genuine response effect reflecting individual differences in the perception of occupations, but will also include response effects caused by other variables which might be associated with response style. It is not possible in this study to disentangle these two effects.

TABLE 8.1
Range of Total Number of Responses by Subject Group for Interest Data.

Number of Responses	Frequency US Student Data	US School Data	UK School Data
0-19	7	8	0
20-39	34	14	15
40-59	58	41	28
60-79	20	21	8
80-99	5	8	0
100-119	0	0	0
120-139	1	1	0
TOTAL	125	93	51

NOTE Maximum score possible is 180 for US students and UK school students but only 170 for US school students.

The second problem encountered would be the choice of a similarity measure between profiles. Sneath and Sokal (1973) detail a large number of resemblance measures that have been used in numerical taxonomy. The measure that would seem most appropriate for this type of data is one like that used by Rosenberg (1977) that ignores negative matches - the co-occurrence of any two zero values in the two profiles. This measure would attempt to minimise the variation in response effects and identify people as similar only when they checked the same items. However, it was felt that, given the unknown quality of the data, it was not worth pursuing this method of analysis. The purpose for collecting this data has already been described and it was felt by the author that this should determine the appropriate form of analysis - in this case a simple descriptive presentation. A study more concerned with the content of occupational stereotypes and the similarity of stereotypes between individuals would want to

use a variety of methods for collecting data, for which this forced choice checklist might be one appropriate method. However this method of data collection would almost certainly need to be combined with an open-ended, more naturalistic method to combat method specific effects. The groupings obtained from this method alone might be more informative of similarity in response styles between individuals, which is tangential to this thesis.

8.7 The descriptive analysis to be presented here focuses on a direct presentation of the profile for each subject group and for particular subsets of the groups. For each group the scores for the men and women were contrasted and, for the University students the 'Liberal Arts' students were contrasted with the 'Science and Technology' students, while for the High School students, the Junio High School students were contrasted to the Senior High School students. This process generates a very large set of profiles since there is one profile for each occupational title. To facilitate this process, therefore, the data for each of the subje groups and subsets of the subject groups was stored in a computer and a graphical applications computer programme was used to displa the profiles up to four at a time on a visual display unit (VDU). There are over 250 separate profiles altogether and this process meant that any two, three or four could be rapidly compared and the graph displayed on the VDU then stored in the computer's memory. This process saved a great deal of clerical work. It is clearly not practical to present all the graphs that were plotted either in the text or in a separate appendix. The figures that ar included in this section are therefore illustrative and presented specifically because they relate to questions raised in this study

The data arrays for each subject group and for each subset

a subject group are listed in Appendix H in the summary form outlined in Section 8.3. It is, therefore, possible for profiles to be plotted graphically by hand so that any comparison can be made besides those that are presented here.

8.8 The advent of advanced technology presents the researcher with a dilemma. It gives him the opportunity to make a far more detailed examination of the data than would have been possible by hand but it remains impractical to display all the comparisons that have been made. This raises the issue of selectivity in the presentation of research results, which the author has discussed elsewhere in the context of survey data (see Cornish, Jackson, Ursell and Walker, 1977). It is all too easy for the research worker looking for interesting or 'significant' results to present, in good faith, only the results that support his hypothesis while either not presenting results that would tend to disconfirm the hypothesis or not recognizing that his few 'significant' results can be explained by chance alone. In this situation there seems to be no alternative but to trust the integrity of the person carrying out the research to make explicit just what selection is taking place.

In this case it became rapidly apparent to the researcher that without a strategy for examining this data an almost limitless number of comparisons could be made. A naive empiricist approach to this data in the context of an exploratory study would lead nowhere. Obviously many of the possible comparisons that could be made would be trivial or uninterpretable. It was necessary, therefore, to decide on a perspective that would provide a basis for the examination of this data. The choice of subject groups and the

split into particular subsets largely determined what was appropriate for this study. The focus is on the different age groups, sex differences and relationships between different occupational titles. In particular, the author is concerned to identify whether the stereotypes seem to vary along particular dimensions or for specific occupations or whether subject groups differ in interpretation of the interest categories.

8.9 There are a number of general points that emerge from examination of the aggregate data for this question. The first point concerns the remarkable consistency in response patterns across all the subject groups. Although aggregating the responses for each of the individual groups will tend to minimize the extent of individual differences in the data, this consistency in response pattern suggests that any departures from it should be interpreted most carefully. This effect can be seen most clearly from an examination of the tables presented in the Appendix H.

A second trend in this data is that there is a greater consensus in the women's ratings than in the men's. This appears to apply across all the American subject groups and is manifest by the greater number of high and low scores in the women's data. Related to this point is the possibility that the older subject groups exhibit greater consensus in their ratings.

Finally, there is the further possibility that the different groups use the interest categories in different ways and that there are particular occupations that are evaluated in distinctly different ways by the subject groups.

These three points provide a framework for analyzing this data on interests but it is important to recognize that it may not be possible to clarify them all from the answers to this one question. Before continuing this analysis it is interesting to note some of the results from the question on prestige rating. These results are simpler to present and interpret because this question was concerned directly with the evaluation of a single attribute. The results also provide evidence on some of the same issues and help to delimit where attention should be focused in the interpretation of the interest data.

8.10 The question on prestige presented subjects with a list of twenty-one occupations from which they had to select and rank three occupations as the three highest in prestige and another three occupations as the three lowest. From this information it was possible to draw up a ranking for each of the subject groups on how they rated the prestige of the occupations. Each occupation was scored on the number of times it appeared in each of the six possibl positions, ranging from +3 for the highest to -3 for the lowest rating. The occupations could then be rank ordered in terms of the total score each obtained. Separate orderings were produced for each of the subject groups and for particular subsets of the groups. These are listed in Table 8.2.

Inspection of these lists indicates considerable variation both between the sexes within subject groups and between the subjec groups. It is easy to see that occupations that are highly rated by one group are ranked very low by other groups. One trend that is not apparent from these tables is the greater amount of consensu among the older groups, so that the spread of raw scores was much

greater for the University of Minnesota students than for the High School students.

There are a number of factors that may be influencing the form of these results and it must be remembered that, for the individual groups in some cases, the numbers are small so that the ordering of occupations may not be very reliable. A particular problem may have been that some of the job titles were not well understood by the younger age groups.

However, the fact that there appear to be some consistent trends in the orderings, for example occupations such as Police Officer, Social Worker and Primary School Teacher are always rated higher by females than by males, and the two occupations Computer Operator and Aircraft Mechanic are rated more highly by the younger groups than by the older groups, suggests that there may be different types of prestige hierarchy being used by different groups or that quite different evaluations are being made of the different occupations.

Although several research studies have suggested that the relative rankings of prestige for occupations are remarkably consistent over time (Hodge, Siegel and Rossi, 1966) and across societies (Hodge, Treiman and Rossi, 1966), more recently research has questioned whether prestige is a uni-dimensional concept (Haug and Widdison, 1975) and whether it might be useful to distinguish perception of the occupational structure from the evaluation of occupations (Coxon and Jones, 1974a). It has also been argued that the consistent results are in part attributable to method specific effects (Coxon and Jones, 1973). In this

TABLE 8.2

PRESTIGE RANK ORDERINGS

	JUNIOR HIGH SCHOOL STUDENTS	SENIOR HIGH SCHOOL STUDENTS
1	Computer Operator	Architect
2	Electronics Technician	Certified Public Accountant
3	Police Officer	Pharmacist
4=	Aircraft Mechanic	Electrical Engineer
4=	Architect	Civil Engineer
6	Electrical Engineer	Electronics Technician
7	Certified Public Accountant	Technical Writer
8	Social Worker	Computer Operator
9=	Civil Engineer	Draftsman
9=	Statistician	Police Officer
11	Primary School Teacher	Statistician
12	Draftsman	Aircraft Mechanic
13=	Pharmacist	Staff Nurse
13=	Technical Writer	Social Worker
15	Photographer	Primary School Teacher
16	Maintenance Engineer	Photographer
17	Auto Mechanic	Secretary
18	Secretary	Maintenance Engineer
19	Staff Nurse	Librarian
20	Librarian	Auto Mechanic
21	TV Repairman	TV Repairman

	U OF M STUDENTS	UK SCHOOL BOYS
1	Architect	Architect
2	Electrical Engineer	Police Officer
3	Civil Engineer	Staff Nurse
4	Certified Public Accountant	Chartered Accountant
5	Pharmacist	Pharmacist
6	Photographer	Civil Engineer
7	Statistician	Radiographer
8	Electronics Technician	Electronics Technician
9	Staff Nurse	Computer Operator
10	Technical Writer	Electrical Engineer
11	Draftsman	11= Draftsman
12	Police Officer	11= Primary School Teacher
13	Aircraft Mechanic	13= Aircraft Mechanic
14	Computer Operator	13= Statistician
15	Primary School Teacher	Commercial Artist
16	Social Worker	Photographer
17	Maintenance Engineer	Social Worker
18	Librarian	Secretary
19	Auto Mechanic	Librarian
20	Secretary	Garage Mechanic
21	TV Repairman	TV Repairman

TABLE 8.2 (Contd.)

SENIOR HIGH SCHOOL

	BOYS	GIRLS
1	Architect	Architect
2	Certified Public Accountant	Pharmacist
3	Electrical Engineer	Social Worker
4	Civil Engineer	Electronics Technician
5	Pharmacist	Certified Public Accountant
6	Statistician	Police Officer
7	Computer Operator	Technical Writer
8	Aircraft Mechanic	Civil Engineer
9=	Draftsman	Electrical Engineer
9=	Electronics Technician	Draftsman
9=	Photographer	Computer Operator
12=	Staff Nurse	Primary School Teacher
12=	Technical Writer	Staff Nurse
14=	Primary School Teacher	Aircraft Mechanic
14=	Social Worker	Statistician
16	Police Officer	Secretary
17	Secretary	Maintenance Engineer
18	Librarian	Photographer
19	Maintenance Engineer	Librarian
20	Auto Mechanic	Auto Mechanic
21	TV Repairman	TV Repairman

JUNIOR HIGH SCHOOL

	BOYS	GIRLS
1	Computer Operator	Police Officer
2	Electronics Technician	Social Worker
3	Aircraft Mechanic	Architect
4	Draftsman	Computer Operator
5	Electrical Engineer	Electronics Technician
6	Certified Public Accountant	Certified Public Accountant
7	Architect	Pharmacist
8=	Police Officer	Primary School Teacher
8=	Civil Engineer	Aircraft Mechanic
8=	Statistician	Electrical Engineer
11	Photographer	Civil Engineer
12=	Primary School Teacher	Statistician
12=	Technical Writer	Staff Nurse
14	Pharmacist	Technical Writer
15	Auto Mechanic	Secretary
16	Social Worker	Maintenance Engineer
17	Maintenance Engineer	Photographer
18	Librarian	Auto Mechanic
19	Secretary	Draftsman
20	TV Repairman	Librarian
21	Staff Nurse	TV Repairman

TABLE 8.2 (Contd.)

UNIVERSITY OF MINNESOTA

	MEN		WOMEN
1	Architect	1	Architect
2	Electrical Engineer	2	Electrical Engineer
3	Civil Engineer	3	Certified Public Accountant
4	Certified Public Accountant	4	Civil Engineer
5	Pharmacist	5	Pharmacist
6	Photographer	6	Statistician
7	Electronics Technician	7	Photographer
8	Statistician	8=	Police Officer
9	Staff Nurse	8=	Staff Nurse
10	Technical Writer	8=	Electronics Technician
11=	Computer Operator	11	Draftsman
11=	Draftsman	12	Technical Writer
11=	Aircraft Mechanic	13	Primary School Teacher
14=	Police Officer	14	Social Worker
14=	Primary School Teacher	15	Aircraft Mechanic
16	Social Worker	16	Computer Operator
17	Maintenance Engineer	17	Librarian
18	Secretary	18	Maintenance Engineer
19	Auto Mechanic	19	Auto Mechanic
20	Librarian	20	Secretary
21	TV Repairman	21	TV Repairman

analysis, therefore, it was decided to calculate correlations between the different rank orderings to produce a correlation matrix. This is shown in Table 8.3.

TABLE 8.3

Correlation Matrix of Prestige Ratings for Subject Groups

		1	2	3	4	5	6	7*
1	U of M Students (M)	1.00	0.94	0.93	0.63	0.55	0.42	0.71
2	U of M Students (F)		1.00	0.86	0.66	0.47	0.45	0.74
3	Senior High School (M)			1.00	0.63	0.68	0.49	0.65
4	Senior High School (F)				1.00	0.44	0.78	0.76
5	Junior High School (M)					1.00	0.48	0.40
6	Junior High School (F)						1.00	0.64
7	UK School Boys							1.00

* correlation coefficients calculated for the reduced set of 19 common job titles.

There are several interesting points to note here. First of all, for the younger groups, the intercorrelations are lower than for the older groups. Secondly, with two exceptions, the within sex correlations are greater than the equivalent between sex correlations. The exceptions are themselves interesting. The most obvious one is probably for the U.K. school boy group where the between sex correlations in each equivalent pair are greater than the within sex correlations. The second group where the results follow a similar pattern is for the group of female University of Minnesota students.

It is helpful here to go back to the original rank orders for each of the subject groups. The two groups of female high school students and the U.K. school boys rate similar occupations

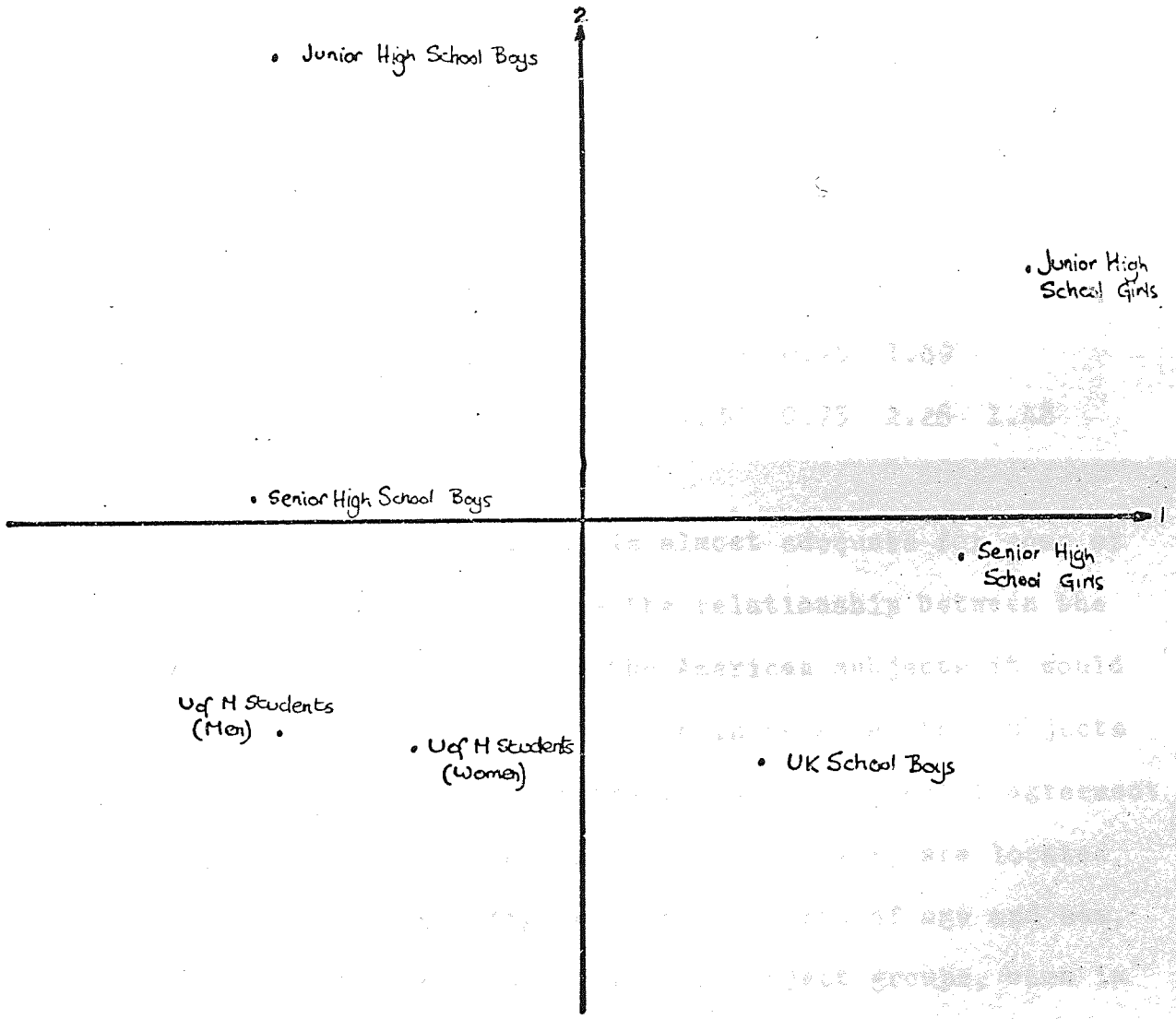
highly. For the two groups of U.S. High School Male Students, there also seems to be a tendency for male jobs, particularly at the skilled level, for instance Aircraft Mechanic, Draftsman and Computer Operator, to be positively evaluated. There are two possible explanations for this, beside the assumption that the results are essentially random or the product of method artifact. One possible explanation is that this ranking is the result of sex-stereotyping. The second is that these occupations may seem glamorous and attractive to these young people and are, in fact, being rated more in these terms than in terms of prestige, which may be a somewhat abstract concept to this group.

The analysis of this data provides some evidence as to how the different subject groups evaluate the occupations. This suggests that the analysis of the interest question should focus particularly on age and sex differences. Certain of the occupational titles which are being differently evaluated by the subject groups should also be singled out for analysis.

It was decided to examine further the interrelationships between the different subject groups on the prestige rating as it was anticipated that this analysis could be interestingly compared with that for some of the other questions. Therefore the rank order correlation matrix was used as an input to the multidimensional scaling programme MINISSA (Roskam and Lingoes, 1970), a programme for analysis of group data similar to TORSCA which was used with the pilot data and was described in section 5.13. This analysis indicated that the two dimensional solution represented the rank order of correlation coefficients almost exactly. The stress value for this solution , shown in Figure 8.1, was zero. This figure

FIGURE 8.1

MINISSA scaling: prestige data.



acts as a useful summary of the preceding discussions and the recovered distances (distances between the points in the figure) listed in Table 8.4 preserve almost exactly the ordering in the correlation matrix shown in Table 8.3.

TABLE 8.4

Distances between points in scaling solution.

		1	2	3	4	5	6
1	U of M Students (M)						
2	U of M Students (F)	0.30					
3	Senior High School (M)	0.61	0.72				
4	Senior High School (F)	1.65	1.38	1.61			
5	Junior High School (M)	1.83	1.89	1.22	2.09		
6	Junior High School (F)	2.14	1.92	1.89	0.75	1.89	
7	UK School Boys	1.15	0.85	1.38	0.75	2.28	1.48

The one dimensional solutions is almost adequate for some of the groups, but fails to accommodate the relationship between the two Junior High School groups. For the American subjects it would appear that the differences between sexes increase as the subjects get younger and that for the older groups there is greater agreement about the ratings. The British school boys, however, are located somewhat anomalously in this figure, both in terms of age and sex, being closest to the older female American subject groups, when in terms of age and sex they might be expected to be closest to the American Junior High School boys. It is unfortunate that more British subject groups equivalent to the American ones were not included in the study as it is not appropriate to conclude from this one result that there are genuine cultural differences.

Although the figure presented here represents a subject space

and not an occupational space, so that it is not appropriate to talk of dimensions of occupations in interpreting the figure, the differences between the subject groups do indicate that there are probably substantial individual differences in prestige rankings. The greater discrepancy between the two Junior High School groups perhaps indicates that information about the prestige of occupations is learned. At this age people may have only a little or vague information about the world of work and the social gradings that are made amongst occupations.

8.11 It is appropriate at this point to return to consideration of the data from the question on interests. The figures included at this point are illustrative of the points made in section 8.9. Figure 8.2 displays the profiles obtained for the four subject groups for the first occupational title, Architect. This figure shows the extent of consensus across the four subject groups. In general the high and low points are the same, although there is a considerable range of scores for some of the individual interest categories.

The second title illustrated in Figure 8.3 is Secretary. This figure also shows the extent of the consensus in the data. However, note how the High School Students rate this occupation higher on Business Management than Clerical/Computational interests, and also that the Junior High School students rate this title quite highly for Mathematical and Social Service Interests. These two figures illustrate that the different subject groups tend to agree as to which are the most salient interest categories associated with a particular occupation, but there is obviously some considerable range in the extent to which the remaining interest

FIGURE 8.2

Interest profile Architect: main study subject groups.

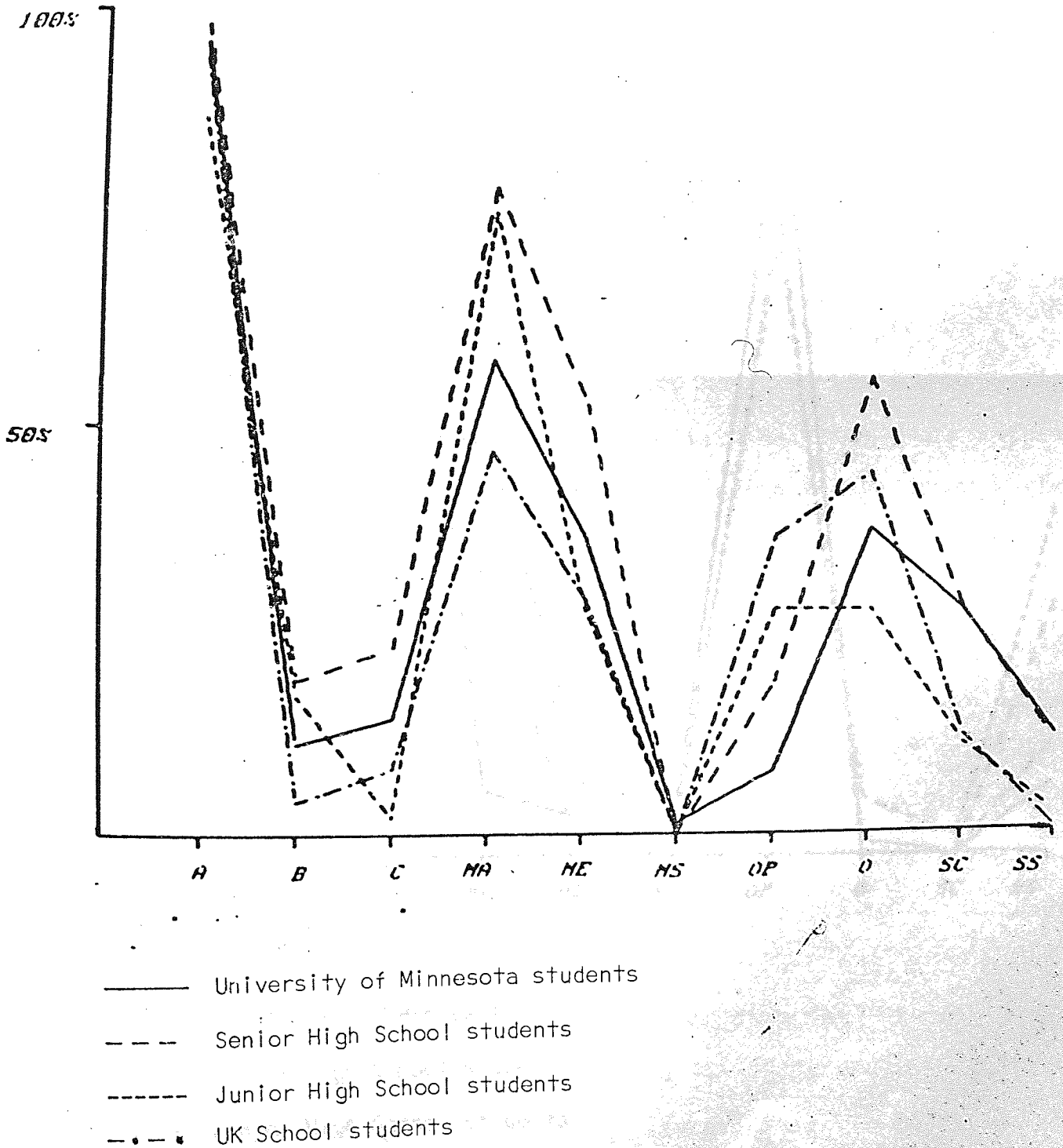
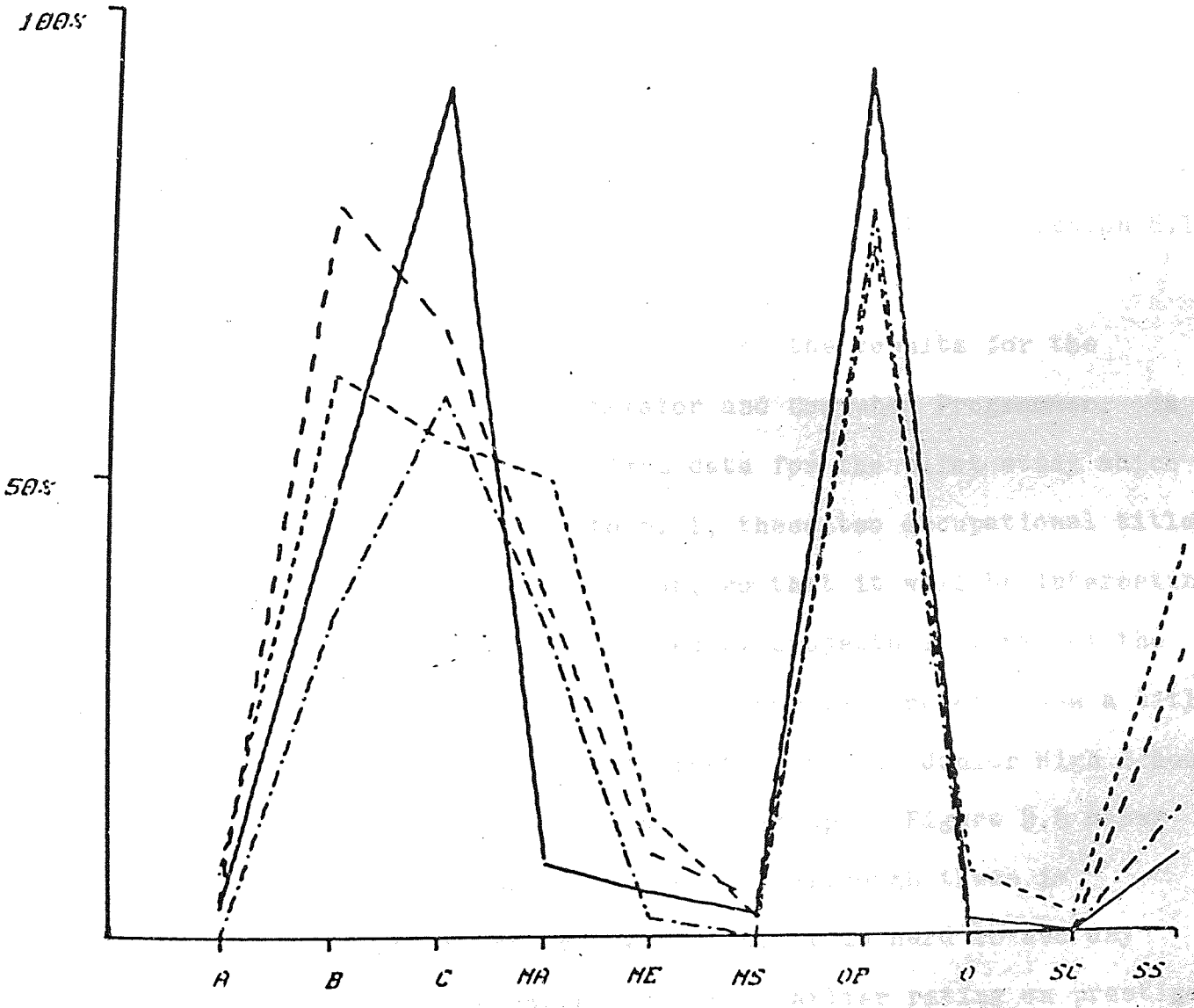


FIGURE 8.3

Interest profile Secretary: main study subject groups.



——— University of Minnesota students

– – – Senior High School students

----- Junior High School students

—·—· UK School students

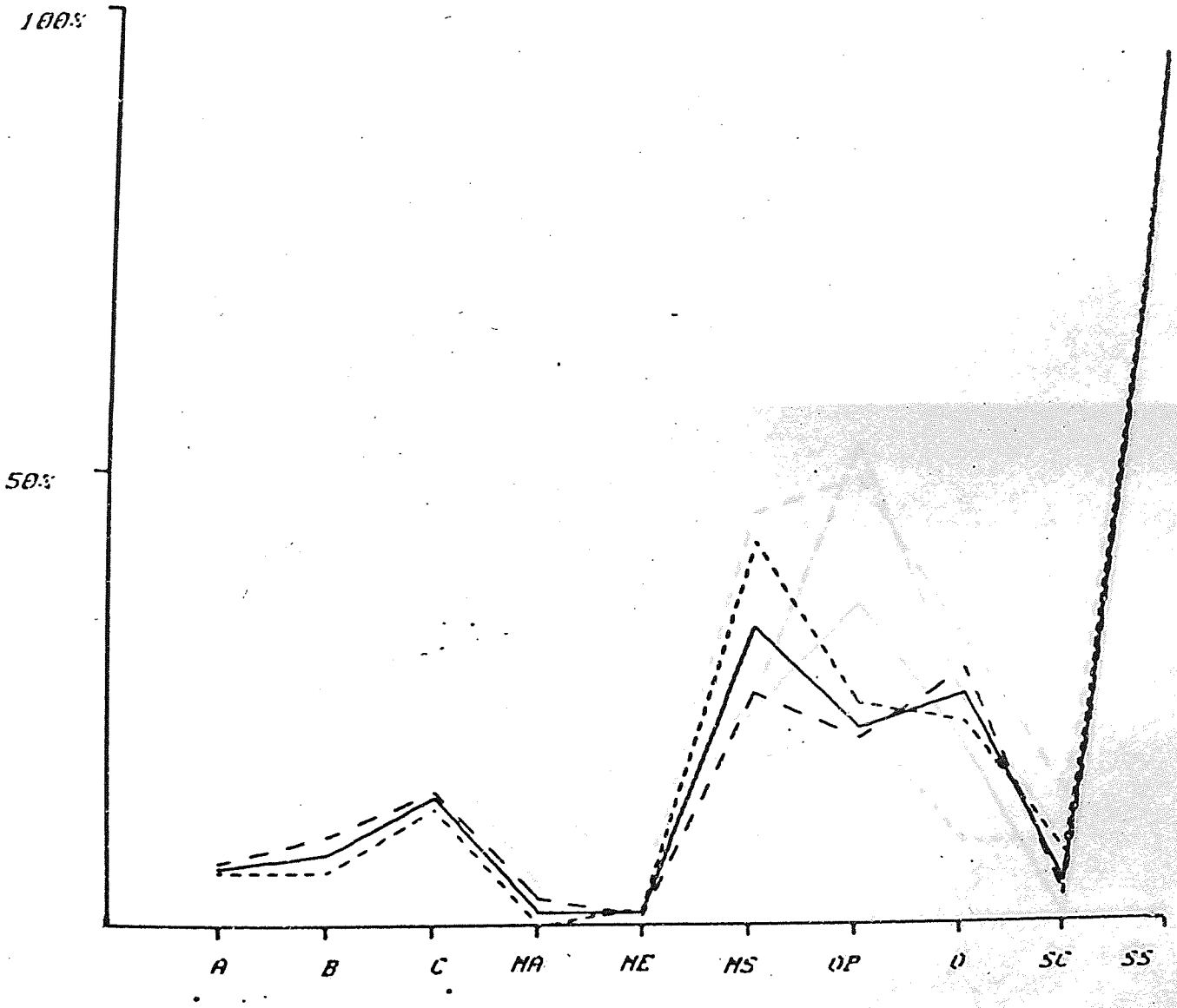
The next two Figures illustrate the greater consensus in ratings among the older university group in contrast to the rating of the High School students. Figure 8.4 shows the rating obtained from the University students for the occupational title Social Worker. Note the very great similarity of the men's and women's rating for this occupational title and contrast this result to Figure 8.5 which shows the result for the same title for the High School students. In this figure there is a much greater range in responses both between the sexes for the same age group and across the age groups. It appears that the differences for the younger Junior High School students are greatest. This result is consistent with analysis of the prestige data that was reported in Section 8.10.

8.12 The next series of figures examines the results for the occupational titles Computer Operator and Computer Programmer. In the analysis of the pair comparison data for the pilot study which was reported in Sections 5.17 to 5.21, these two occupational titles were perceived as being very similar, so that it will be interesting to see whether they are distinguished by subjects in terms of the interest categories ascribed to them. Computer Operator was a title that was rated highly in terms of prestige by the Junior High School boys but not so highly by the remaining groups. Figure 8.6 shows the result for the High School students. Although there is considerable variation across the groups, it is hard to see any connection between these ratings and the earlier rating on prestige.

Figure 8.7 shows the aggregate rating from the Liberal Arts and Institute of Technology students for the title Computer Operator. It is possible to note here a strong similarity in the shape of the two profiles, but the one from the Institute of Technology students

FIGURE 8.4

Interest profile Social Worker: University of Minnesota students.



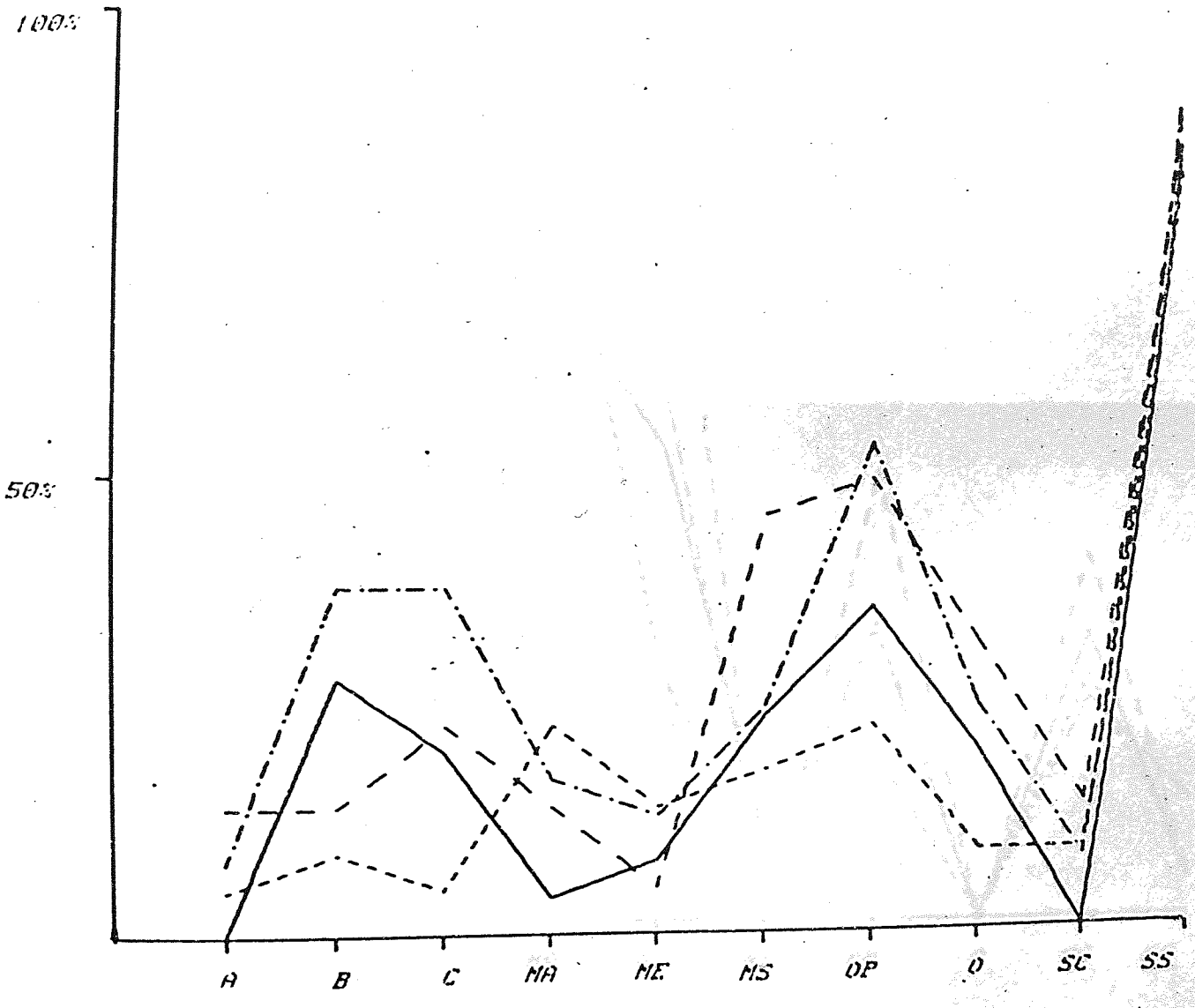
——— University of Minnesota students

– – – University of Minnesota students - men

----- University of Minnesota students - women

FIGURE 8.5

Interest profile Social Worker: US High School students.



——— Senior High School boys

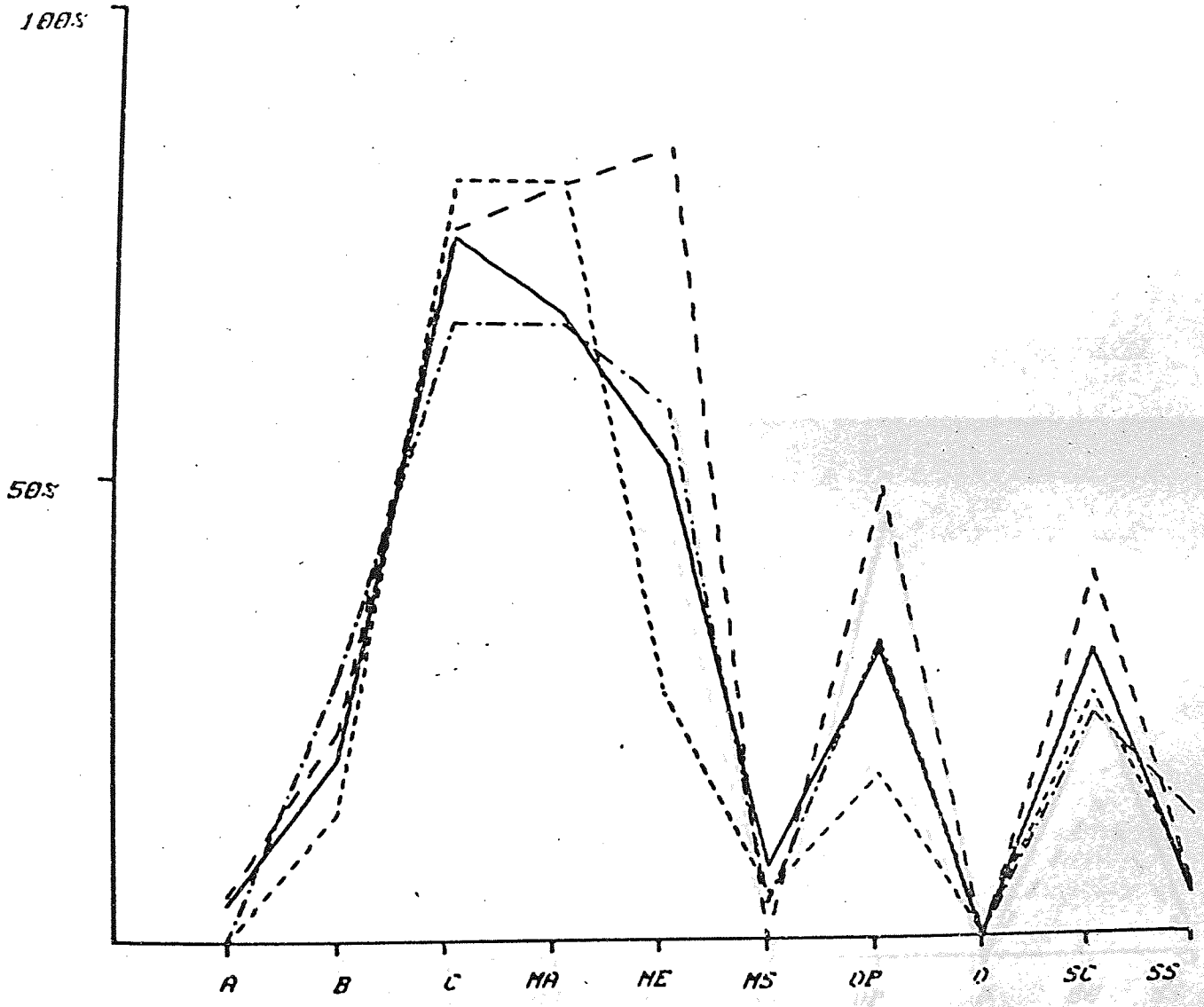
– – – Senior High School girls

----- Junior High School boys

—.—. Junior High School girls

FIGURE 8.6

Interest profile Computer Operator: US High School students.



——— Senior High School boys

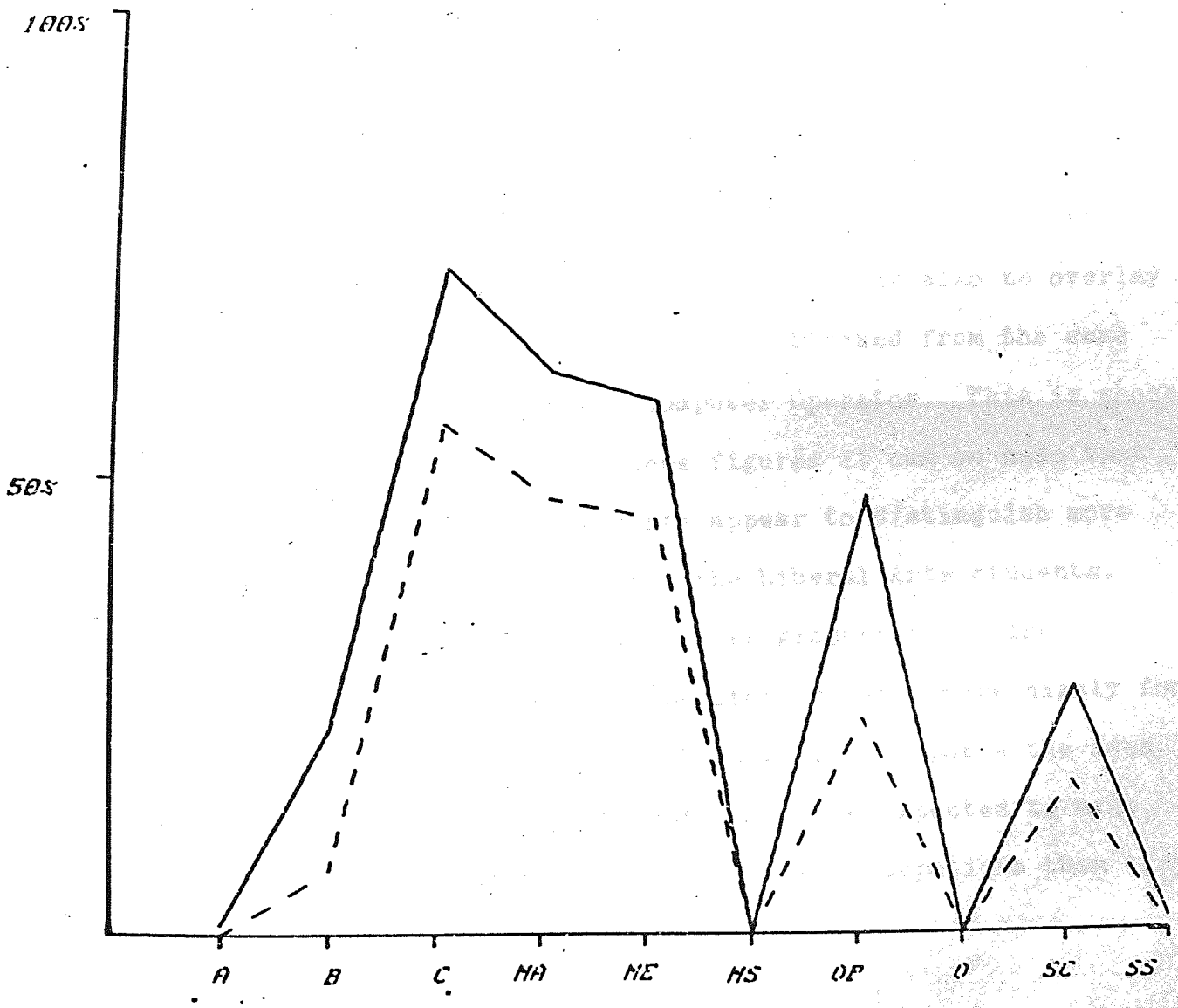
– – – Senior High School girls

----- Junior High School boys

—.—. Junior High School girls

FIGURE 8.7

Interest profile Computer Operator: University of Minnesota students.



——— University of Minnesota Liberal Arts students

– – – University of Minnesota Institute of Technology students

is of a consistently lower elevation. It is interesting to compare the result of this split with that obtained by dividing the group of university students into men and women for the same title. This is shown in Figure 8.8 and it is possible to notice that the difference between the two groups is slight and not nearly so marked as in the previous figure.

These two figures can also be compared to Figure 8.9 which is the profile for the title, Computer Programmer. Here again the profiles contrast the Liberal Arts versus the Institute of Technology students. In this figure it is possible to notice that the order of salience of the interest categories for this title is seen differently by the two groups. It is interesting also to overlay these two profiles with the two profiles obtained from the same groups of students for the title Computer Operator. This is shown in Figure 8.10. By overlaying these figures it can be seen that the Institute of Technology students appear to distinguish more sharply between the two titles than the Liberal Arts students. Although both groups see the Computer Programmer as having Mathematical interests, Computer Operator is rated more highly for Clerical/Computational interests. This result supports the idea that Institute of Technology students could be expected to make finer distinctions among technically related occupations than the Liberal Arts students.

The next result shown in Figure 8.11 contrasts the ratings of these same two groups for the occupational title, Maintenance Engineer. Surprisingly this title is rated very similarly by both groups. In contrast Figure 8.12 represents the rating of these two groups for the title, Civil Engineer. In this figure there is considerable difference between the two groups. The Liberal