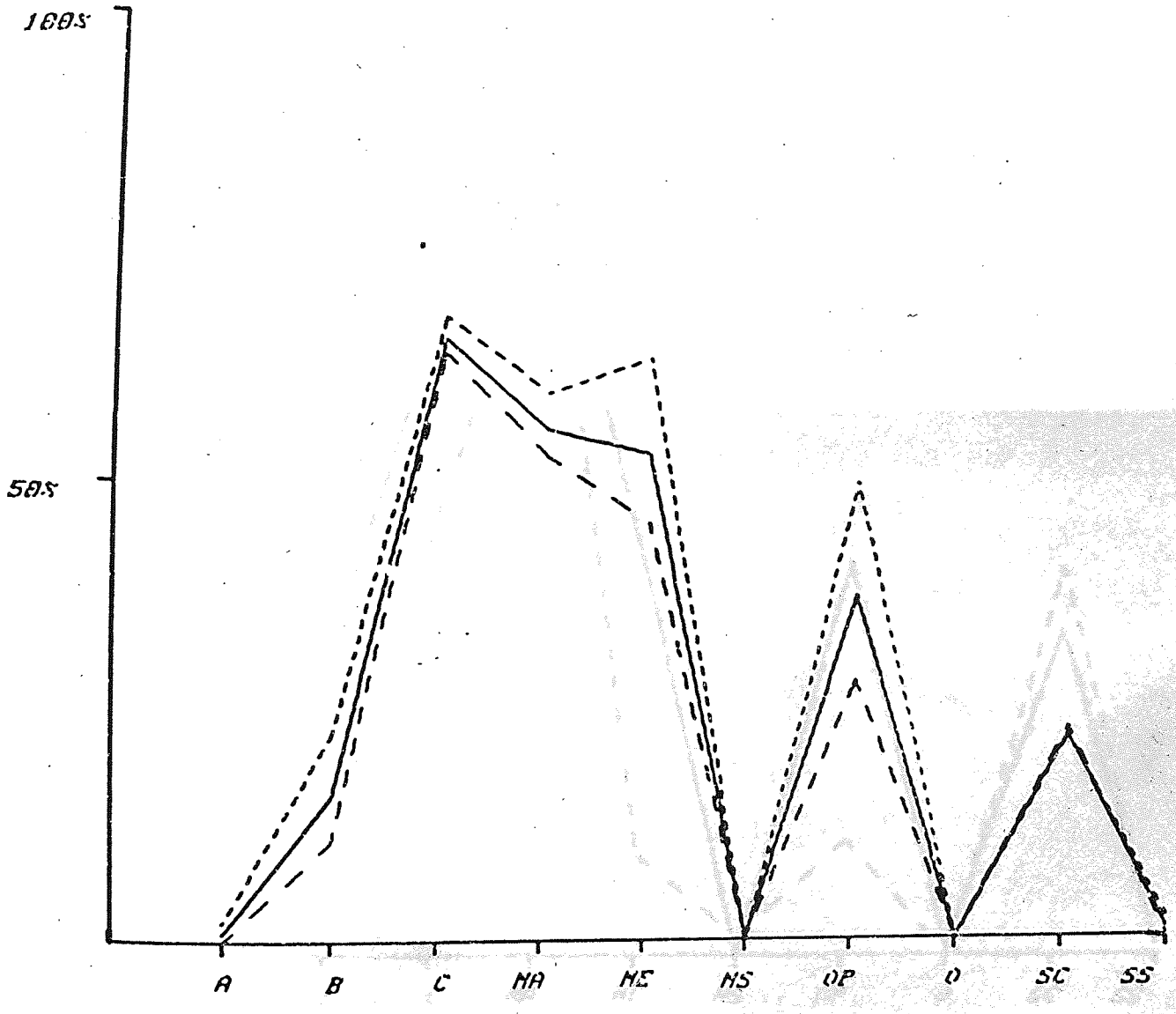
FIGURE 8.8

Interest profile Computer Operator: University of Minnesota students.



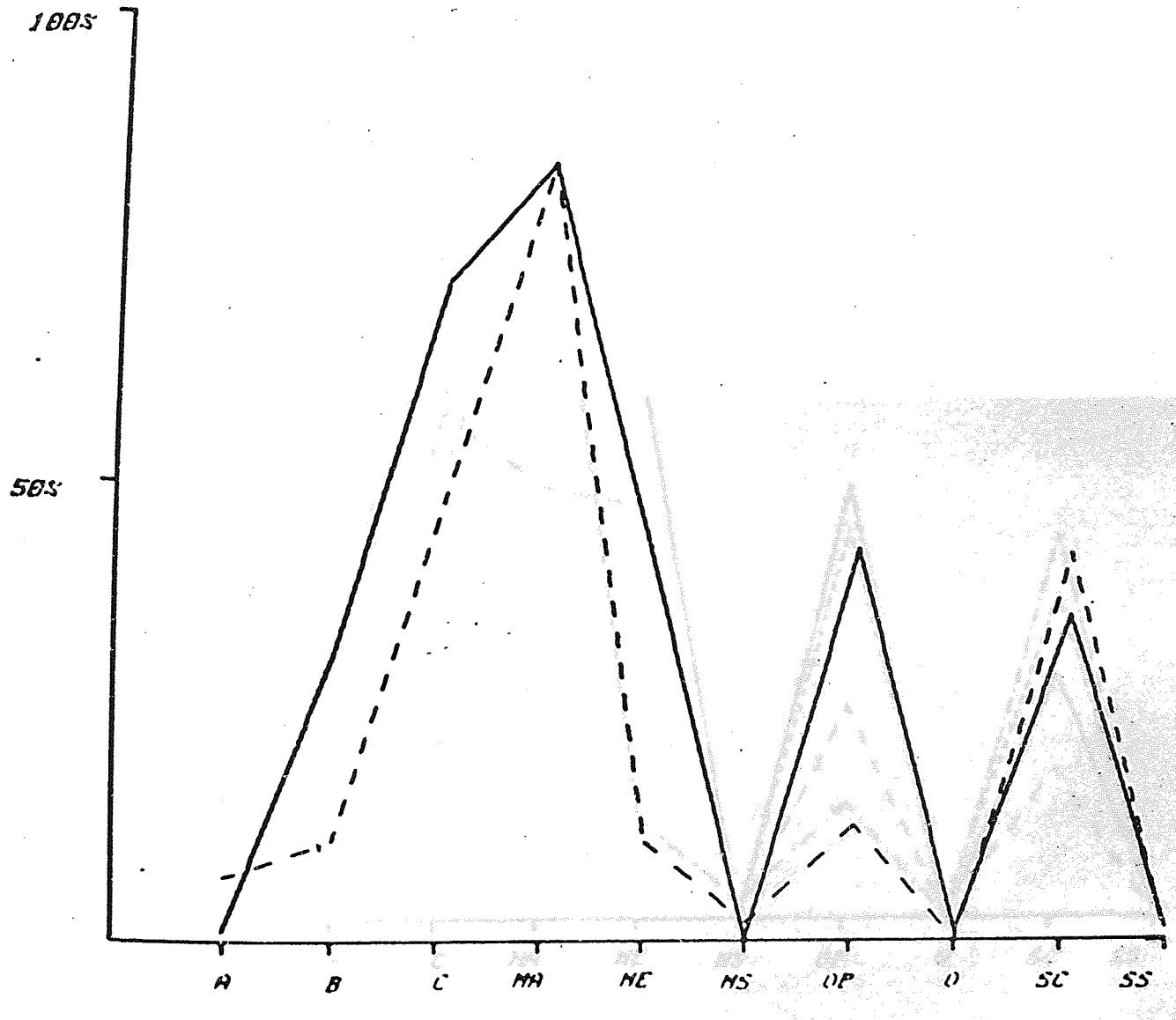
——— University of Minnesota students

– – – University of Minnesota students - men

----- University of Minnesota students - women

FIGURE 8.9

Interest profile Computer Programmer: University of Minnesota students.



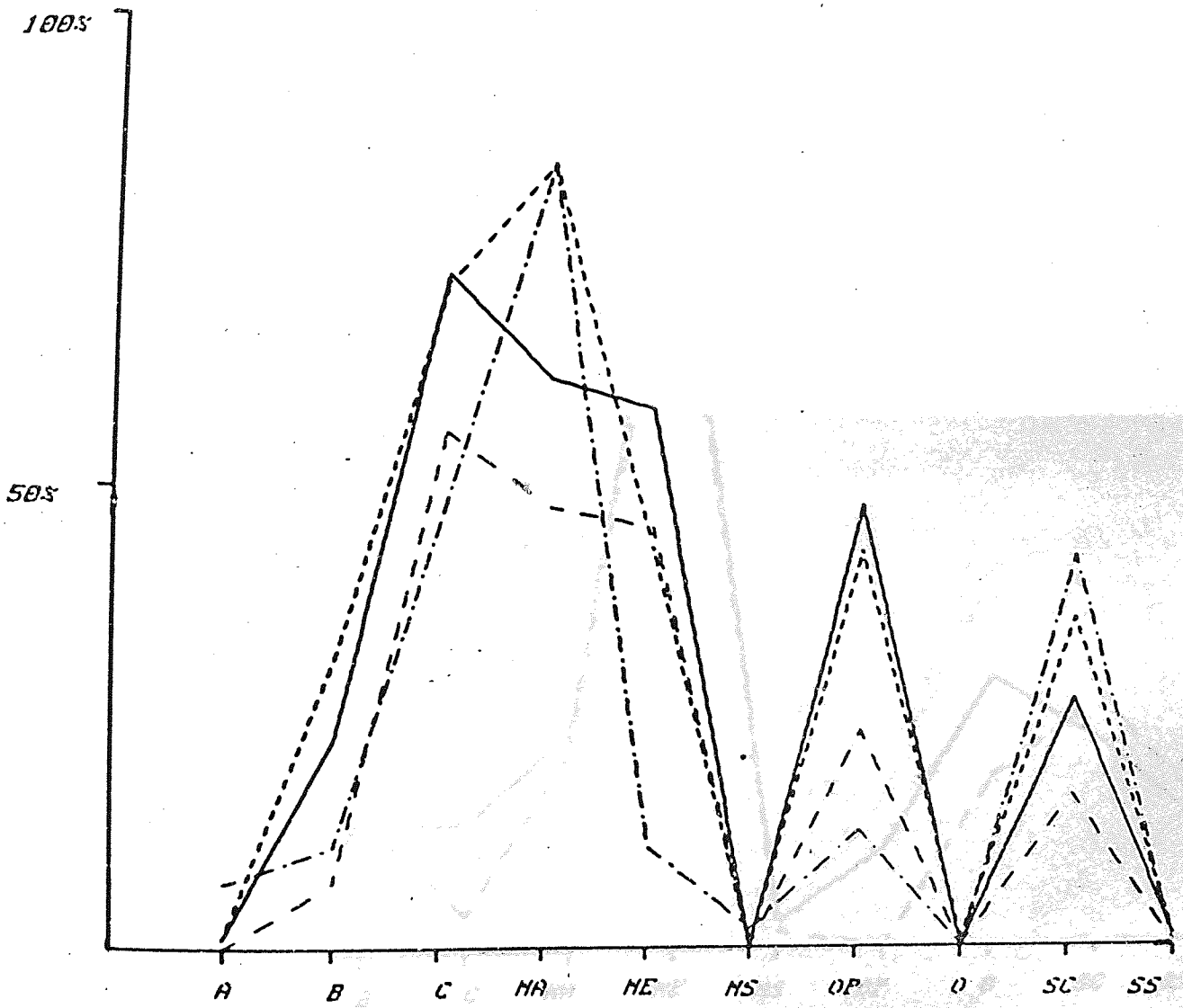
——— University of Minnesota Liberal Arts students

– – – University of Minnesota Institute of Technology students

FIGURE 8.10

Interest profiles Computer Operator and Computer Programmer:

University of Minnesota students.



——— University of Minnesota Liberal Arts students: Computer Operator

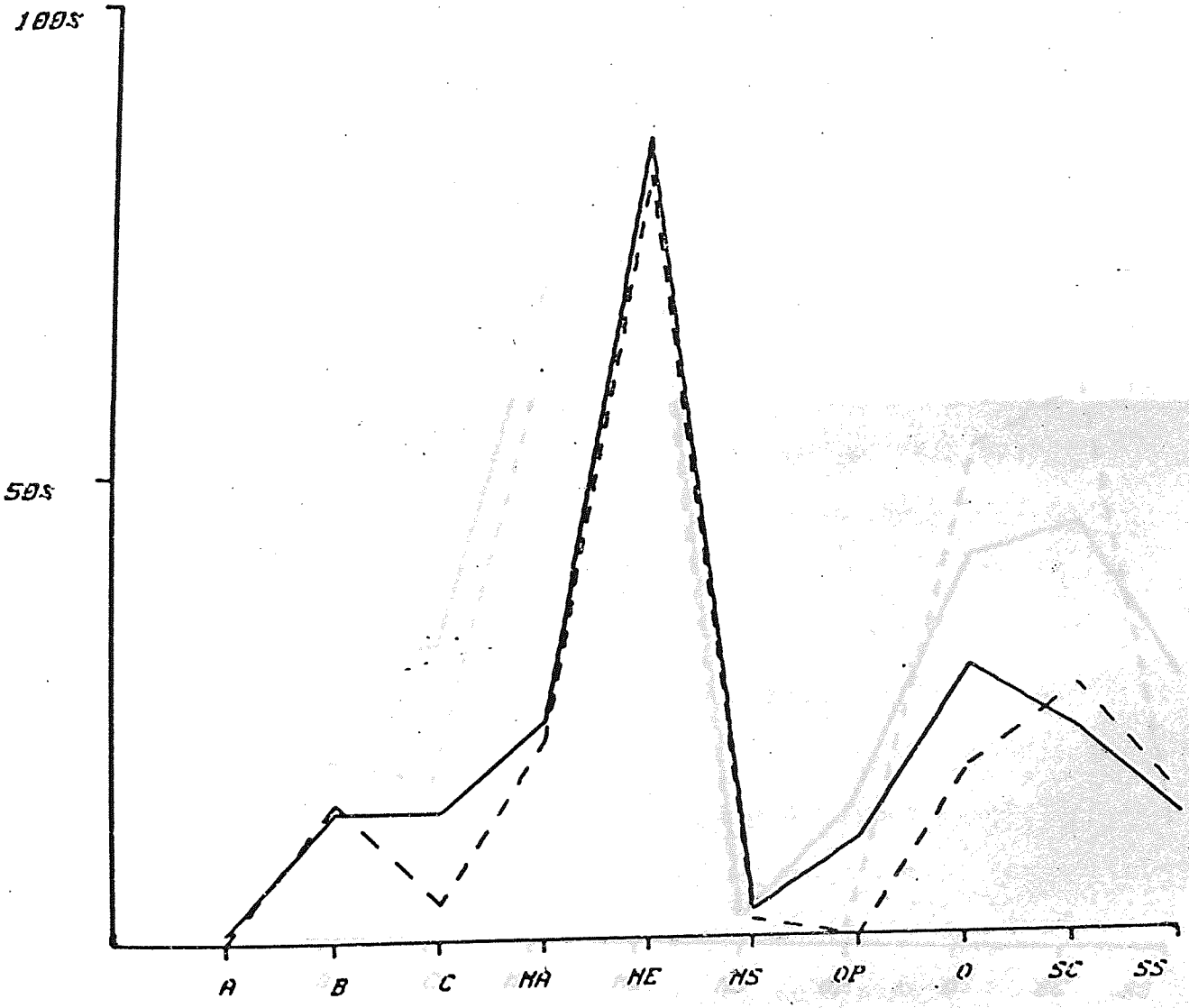
– – – University of Minnesota Institute of Technology students: Computer Operator

----- University of Minnesota Liberal Arts students: Computer Programmer

—·—· University of Minnesota Institute of Technology students: Computer Programmer

FIGURE 8.11

Interest profile Maintenance Engineer: University of Minnesota students.

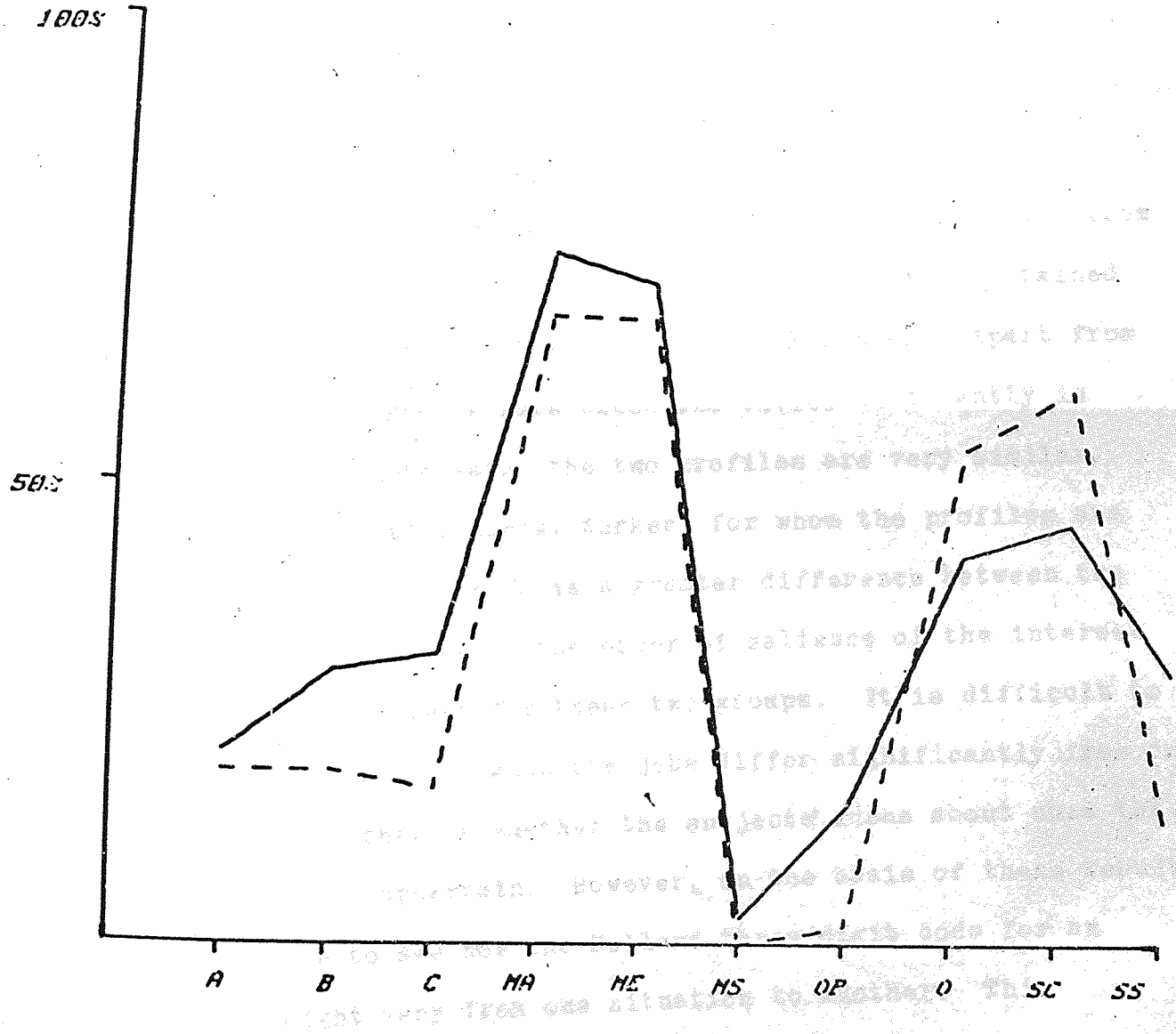


——— University of Minnesota Liberal Arts students

– – – University of Minnesota Institute of Technology students

FIGURE 8.12

Interest profile Civil Engineer: University of Minnesota students.



——— University of Minnesota Liberal Arts students

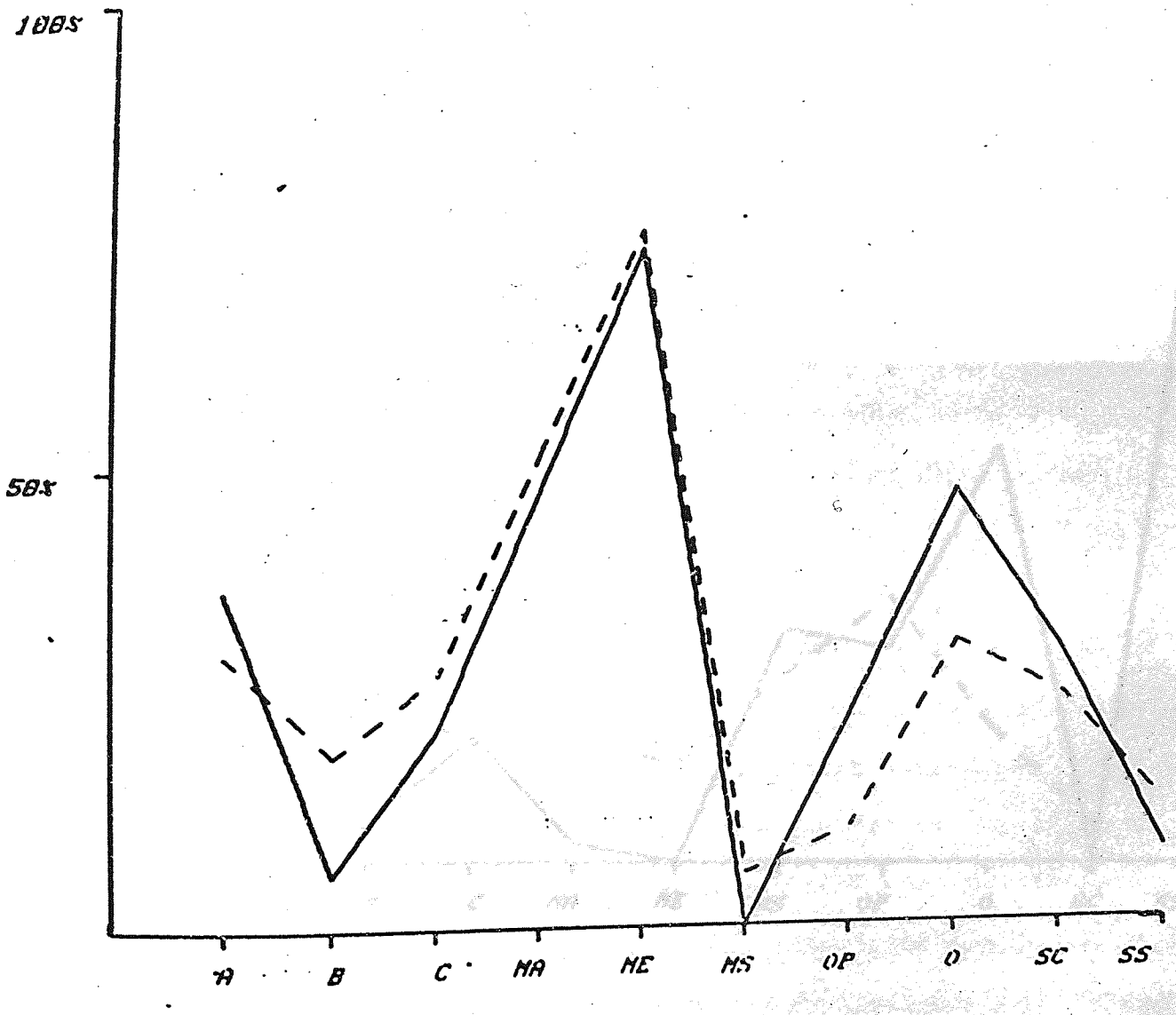
– – – University of Minnesota Institute of Technology students

Arts students do not rate Civil Engineer highly on Outdoor or Scientific interests but appear to associate the interest categories Business Management/Clerical Computational/Office Practices and Social Service with this title. In this case there is an emphasis, perhaps, on the 'Civil' component of the title in contrast to the identification as an Engineer. It can be seen that the professional engineer is not distinguished clearly by either group from the skilled operative in terms of interest.

8.13 The final two figures contrast results from the American High School students with the one group of U.K. School Boys to provide some cross-cultural comparisons. Only the boys are included from the High School group. Figure 8.13 shows the profiles obtained from these two groups for the title, Civil Engineer. Apart from the fact that the groups rate these two titles differently in terms of Outdoor interests, the two profiles are very similar. However for the title, Social Worker, for whom the profiles are shown in Figure 8.14, there is a greater difference between the two groups. In particular the order of salience of the interest categories is different for these two groups. It is difficult to know whether this is because the jobs differ significantly from one country to the other or whether the subjects' ideas about what the jobs involve are uncertain. However, on the basis of these results it is possible to see how the Holland three digit code for an occupation might vary from one situation to another. This variation might be due to different measurement techniques, because in different locations the pattern of interests associated with a particular occupation genuinely are different, or differences in the actual job content.

FIGURE 8.13

Interest profile Civil Engineer: US High School boys and UK Schoolboys.

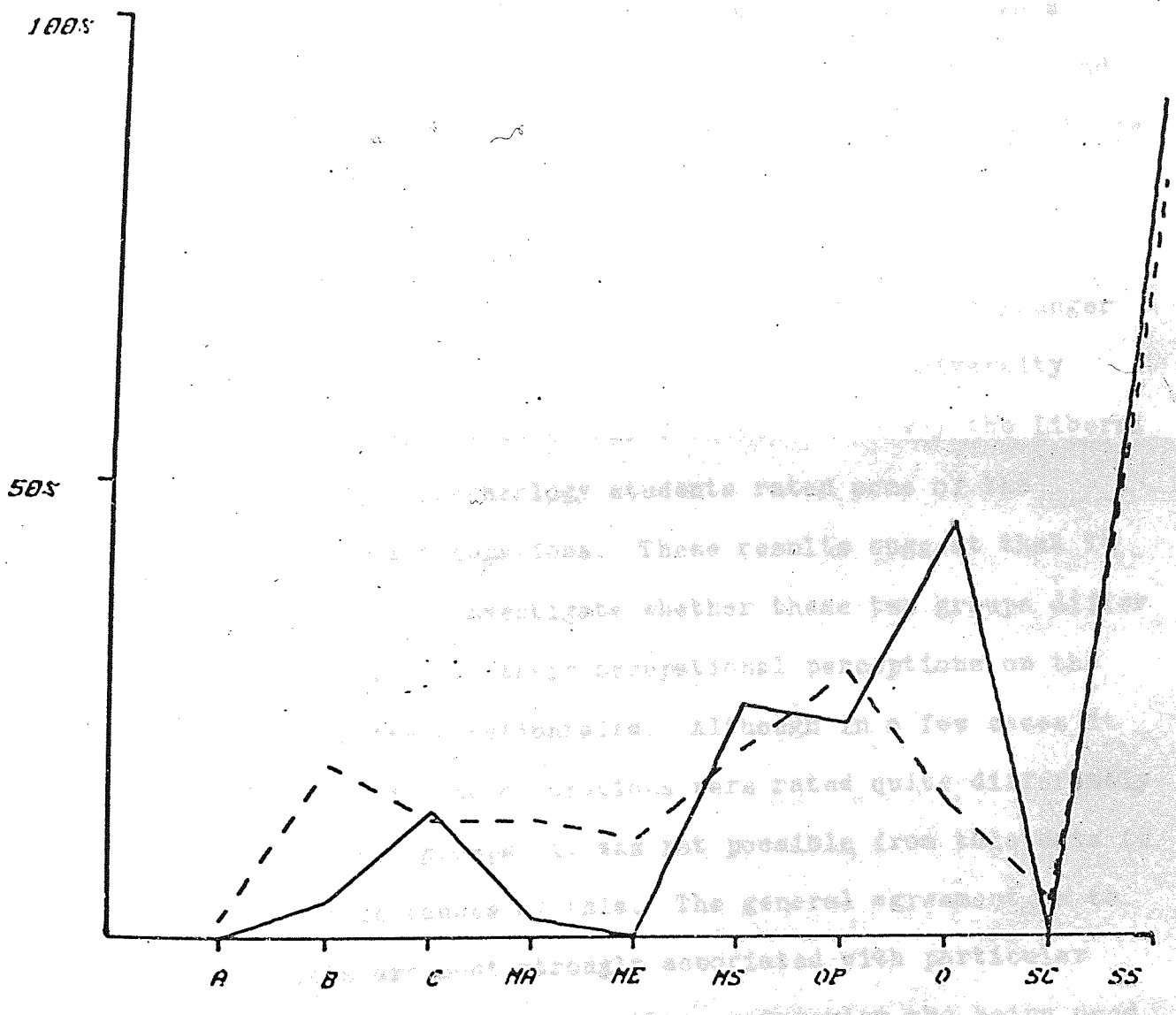


——— Senior High School boys

– – – UK Schoolboys

FIGURE 8.14

Interest profile Social Worker: US High School boys and UK Schoolboys.



——— Senior High School boys

– – – UK Schoolboys

8.14 While the results of this analysis need to be interpreted cautiously, both because of the inevitable selectivity in the choice of profiles for presentation, and also because of the relatively small size of some of the subject groups, certain trends do emerge in this data. First of all there seems to be a general consensus as to which interest categories are most strongly associated with particular occupational titles. The differences that are reported between the subject groups rarely involve a difference as to which is the most salient interest category and many of the differences that do exist are small and unlikely to be significant.

This consensus appears to be less apparent for the younger groups than for the older groups. However for the University students there did appear to be differences in the way the Liberal Arts and Institute of Technology students rated some of the technically oriented occupations. These results suggest that it will be appropriate to investigate whether these two groups differ in the way they structure their occupational perceptions on the yellow version of the questionnaire. Although in a few cases it was noted that particular occupations were rated quite differently by different subject groups, it was not possible from this data to elicit the possible causes of this. The general agreement as to which occupations are most strongly associated with particular interest categories suggests that these categories are being used in the same way by the different subject groups. Thus differences in the way particular occupations are rated should be associated with the possibility that, on aggregate, different subject groups have differing stereotypes of these occupations. On the other hand, some of this variability may be caused by lack of familiarity with certain of the occupational titles that were included in this

question.

If there is a general consensus as to the occupational stereotypes held by subjects of these occupations it would be expected that the solutions that will be obtained for the pair comparison data will also be similar for the different subject groups. Differences obtained in terms of prestige rating may appear more marked because that rating involved the subjects more directly in personally evaluating the prestige of the occupations. Thus, while subjects might on the whole agree on the description they would give of occupations in terms of interests, they might differ in how they would evaluate the occupations in terms of prestige.

8.15 The next question to be analyzed is the question on the difficulty or challenge of the different jobs. Although the amount of missing data for this question was greater than for the others in this section of the questionnaire, it was decided that analysis of this data was still appropriate. It had initially been intended to analyze the British and American data separately, both because the list of occupations included for the groups differred slightly and also because the researcher was interested in age and sex differences in the replies. Unfortunately, as has been noted earlier, it was decided that data from only one group of the British schoolboys was worth analyzing.

This meant that the original intention to factor analyze the two sets of data for the British and American subject groups had to be abandoned. The UK schoolboys represented a single homogeneous subject group so that any grouping of the occupations by factor analysis would be likely to be specific to this subject group. The American data, however, could be factor analyzed because the sample

of subjects represented by this data is heterogeneous on several criteria. It is, therefore, more likely that any grouping of the occupations by factor analysis of this data would be generalizable to other situations.

A first step in this procedure was therefore to examine the distribution of responses to this question. This was done both for individual occupational titles and for the replies on the seven point scale from all the questions. There is a considerable debate in the literature as to when data is appropriate for factor analysis. The assignment of integers to rating scale data produces rank order data, but it is frequently assumed that a continuous normal distribution underlines the observed distribution of response choices and that such data could be treated as interval level data. The distribution of replies by response category for this question is given in Table 8.5 and, apart from the one pair of results that deviate from the curve, probably can be considered to represent an underlying normal distribution. It was decided from this data that it was worthwhile proceeding with the analysis and that Pearson Product-Moment correlations coefficients could be calculated for this data set.

TABLE 8.5
Distribution of replies by response category.

Response Category	1	2	3	4	5	6	7
Number of Responses	169	350	831	850	700	789	592

The second step is to consider whether the correlation matrix is actually worth analyzing. Weiss (1970) suggests that it should be demonstrated that the correlation matrix departs significantly from an identity matrix (a matrix with 1's in the diagonals and 0's

in all the off-diagonal elements). Bartlett's test, a modification of the chi^2 procedure, is appropriate to calculate this. This test has been shown to discriminate between random and non-random correlation matrices, and is very useful as studies have also shown that when random correlation matrices are factor analyzed, solutions are produced that can be given 'meaningful' interpretations.

In this case, therefore, the chi^2 value was calculated and indicated that the probability was less than 1% that the Pearson product moment correlation matrix was an Identity Matrix. It was decided, given this result, to proceed with the Factor Analysis of the American data. 198 out of the 218 subjects had complete data for this question which is over 90% of the subject group. Examination of the earlier Table 7.4 indicates that these subjects are evenly spread across each of the individual groups.

Once the decision has been taken to factor analyze the correlation matrix, a major problem is the determination of the number of factors to extract. In reviewing this problem, Weiss (1971) notes the danger of underfactoring, that is extracting too few factors from a set of data, as being more serious than over-factoring. Various criteria are suggested for determining the appropriate number of factors, one of the most common being the Kaiser criterion, which determines the number of factors to extract by their eigenvalues. Using this criterion for an initial factor analysis, a solution was obtained with six factors and this was then rotated to simple structure using the Varimax criteria which seeks to identify simple factors with individual variables having factor loadings that are as near the extremes of 0 and 1 as possible.

The results of the factor analysis appear to be quite satisfactory on a number of criteria. 16 of the 20 occupations load highly on only one factor, indicating their simple nature. Four of the occupations, Librarian, Pharmacist, Photographer and Police Officer are shown by their low communality values to have little variance in common with the other occupations, and this is confirmed by inspection of the correlation matrix. (For convenience of exposition, full technical details of the Factor Analysis are listed in Appendix I and are not presented here). It is interesting to note how the occupations are grouped together in the Factor Analysis and the occupations loading on each of the six factors are listed in Table 8.6.

TABLE 8.6
Occupations loading on factors.

FACTOR 1	FACTOR 2
Certified Public Accountant	Computer Operator
Civil Engineer	Computer Programmer
Electrical Engineer*	
Electronics Technician	
Statistician	

FACTOR 3	FACTOR 4
Police Officer	Librarian
Primary School Teacher	Pharmacist
Social Worker	Secretary
	Staff Nurse*

FACTOR 5	FACTOR 6
Aircraft Mechanic	Architect
Electronics Technician	Draftsman*
Maintenance Engineer	Photographer
Television Repairman	

These groupings seem to be readily interpretable in terms of content. Only one occupational title, Electronics Technician, is listed as loading on two factors, although the occupations asterisked have smaller loadings on a second factor. The author decided that the factor structure produced by this analysis seemed to fit the observed data satisfactorily and therefore that no further factor analysis was required. No substantive interpretation is being given to the six factors that have been identified. It is obviously possible to interpret the groupings in a variety of ways. Interests, abilities and sex stereotypes are three obvious categories that could be used for some or all of these groupings. However labelling is, perhaps, the most subjective part of the interpretation of factor analytic data and in this case there would seem to be little data to justify one explanation against another. One thing that is apparent from these groupings is that there is no obvious ordering of these groups in terms of challenge or difficulty. It is obviously possible to go back to the simple frequency distributions and to generate from the scores an order of the degree of difficulty for the list of occupational titles. This was done and is presented in Table 8.7 where the occupations are grouped in order of their median scores. It is immediately apparent that there is little similarity between this grouping and the grouping generated by the Factor Analysis and this is an argument against the notion of challenge or difficulty as an explanatory variable for the factor structure. There is some similarity between this grouping and the rankings in terms of prestige, especially for the extreme groupings, which contain occupations that were consistently judged to be of high and low prestige respectively.

It seems that, with this question, what was anticipated

TABLE 8.7
Occupations Grouped by Median Score from Question on Challenge of Occupation

Score 3	Architect
	Electrical Engineer
Score 4	Aircraft Mechanic
	Civil Engineer
	Computer Programmer
	Draftsman
	Electronic Technician
	Pharmacist
	Photographer
	Police Officer
	Social Worker
	Staff Nurse
Score 5	Certified Public Accountant
	Computer Operator
	Primary School Teacher
	Statistician
	TV Repairman
Score 6	Maintenance Engineer
	Secretary
Score 7	Librarian

earlier has in fact come about (see Section 6.11). It is not possible to say from this data that the dimension of occupational difficulty is not present or salient for this subject group. The obtained results most probably are due to the question format and the groupings from the Factor Analysis appear to be groups of occupations that might naturally go together. The ordering in terms of difficulty appears most closely related to the prestige hierarchy identified earlier. There is some similarity here, perhaps, with the data reported by Hakel et al (1971), which was reviewed earlier (see Section 3.3), which indicated that his subjects failed to distinguish prestige rankings of occupations from ability rankings. Hakel demonstrated that subjects rated occupations exclusively in terms of prestige and not in terms of ability. The data from this question provide further evidence for the powerful effect of the prestige dimensions in our evaluations of occupations.

There are several important lessons to be learnt from this question. In particular, the researcher should have taken greater care in operationalizing the concept of difficulty. Although this question was only intended to act as an indicator, it has not worked well in this context. In some respects the results reported here are a fine example of the old adage, 'more haste less speed'. Concepts such as prestige or interests, because of their common-sense meaning and widespread use, are easier to operationalize in novel and experimental ways. However, it seems that in using a concept that is not already well grounded, greater care should have been used.

8.16 The final set of data to be presented here concerns the background of the subjects. One criticism of earlier research (see Section 4.9) was that comparatively little information was

Jones (1974a) suggested that occupational history might be the most significant variable in influencing individual's perceptions of the occupational structure. Obviously, for most of the subjects included in this study, this is an inappropriate criteria as very few have any work experience. However, various data were collected from the subjects to help in the assessment of their background. The particular data to be considered here concerns subjects' educational aspirations and where they had been brought up.

It had been attempted to get a measure of occupational knowledge by asking subjects to complete a sentence describing various occupations. However examination of a sample of the replies revealed them to be superficial and they did not appear to the author to provide any basis for discriminating among the subjects in terms of job knowledge. In retrospect this failure creates an unfortunate omission in the data to be presented. A simple self-rating task where subjects were asked to rate their knowledge of a set of occupations on a set of 5 point rating scales might have been a suitable alternative, although this would only have provided a subjective rather than objective measure of occupational knowledge.

One group of subjects, however, was asked to indicate if they were unfamiliar with any of the occupational titles included in the pair comparison section of the questionnaire. This group was the Liberal Arts students who were given either the White or Yellow form of the questionnaire to complete. These subjects were asked, once they had completed the questionnaire, to indicate which of the occupational titles listed on the first page of the questionnaire they knew little about. This data will be reported in the following chapter concerned with the multidimensional scaling analysis of the

data, as it relates directly to the interpretation of that data.

In considering the replies from these two questions on the subjects' background, it is easiest to treat the data from the American and British subjects separately, because the questions asked of the subjects necessarily differed since the educational structure and social structure of the countries are different.

The American subject groups were asked to rate their educational aspirations in terms of qualifications they expected to achieve and were asked to state where they had been brought up. This latter question was to obtain some measure of mobility from the sample. If a sufficiently large group of geographically mobile subjects could be identified, it would be worth looking to see if their perceptions were different from the rest of the subjects. The results by subject group are presented in Table 8.8 for the American subjects.

TABLE 8.8
Educational Aspirations by Subject Group.

	Subject Group		
	Junior High School % ages	Senior High School % ages	University Students % ages
High School Graduation	22.2	0	n.a.
Vocational Technical Certificate	22.2	4.3	n.a.
Two Year Degree	24.4	6.4	2.4
Four Year Degree	17.8	53.2	41.6
Master's Degree	6.7	17.0	33.6
Doctorate/Professional Degree	6.7	19.1	22.4

n.a. = not applicable

For all these subjects sex differences in aspirations were slight, although it did appear that, among the University students, fewer women than men were aspiring for professional degrees (29% versus 13.2%) and consequently more were only aspiring for 4 year degrees (Bachelors) (36.1% vs 49.1%). Evidence that the Senior High School students were probably a group of above average ability is shown by the fact their aspirations are considerably higher than those of the Junior High School students. Nearly 90% of the former group expect to achieve at least a first degree while only about 30% of the latter group expect to achieve this level.

It is interesting also to compare these figures with those from the Minnesota Statewide Testing Service for 1974 from over 50,000 High School Students in the State of Minnesota. Their figures are presented in Table 8.9 and appear more similar to the Junior High School students than to the Senior High School or University students. This also provides evidence as to how the subject groups included in this study differ from the population in general. In particular they suggest that the subjects for this study have higher aspirations and are, therefore, probably of higher ability than the general population, especially in the two older age groups.

TABLE 8.9
Educational Aspirations of Minnesota High School Students.

	% Males (N=24,924)	% Females (N=25,541)	Total (N=50,465)
High School Graduation	17.1	17.2	17.1
Vocational Technical Certificate	36.8	33.9	35.3
Two Year Degree AA	7.5	12.2	9.9
Four Year Degree BA/BS	24.4	26.3	25.4
Master's Degree MA/MS	5.2	3.7	4.5
Professional Degree	6.6	4.2	5.4
NR	2.5	2.5	2.5

from Questionnaire Summaries of 1974 Minnesota Statewide Testing Programme

The data on where the subjects were brought up are summarized in Table 8.10. Only six of the subjects had been brought up in more than one location and so there is no point in separating this group for analysis.

TABLE 8.10
Where brought up.

	Twin Cities	Minnesota	Out of State
School Students	81	6 + 3*	6
University Students	69	32 + 2	24 + 1

* indicates subjects who ticked Twin Cities and other locations.

The data from the American samples can be compared with the data from two of the British samples - the schoolboys from one of the King Edward's schools and the girls from the Comprehensive school. Their results on the question on level of educational aspiration are presented in Table 8.11 and although the categories are not quite equivalent, some comparisons can still be made.

TABLE 8.11
Educational Aspirations - British Subjects.

	Boys (N=51)		Girls (N=59)	
	N	% age	N	% age
CSE	-		-	
GCE (O level)	1	2.0	4	6.7
GCE (A level)	11	21.6	7	11.9
Secretarial etc.	4	9.8	30	50.8
HNC/HND/ONC/OND	1	2.0	5	8.5
First Degree	17	33.3	9	15.3
Higher Degree/ Professional Qualification	14	27.5	-	
Missing	2	3.9	4	6.7

It would appear that the British subjects have lower educational aspirations than the American Senior High School and

University Students, although both the boys and the girls are above average ability. These differences could be due to a large number of factors, including perceived differences in educational opportunity, genuine structural differences in the education systems and labour markets of the two countries. Most noticeable is the difference between the sexes within the British sample. Far more of the boys than the girls are aspiring to University Education rather than Further Education or vocational training. This may, in fact, be a function of their different occupational ambitions, as traditional female careers such as nursing, teaching and secretarial work could come into these latter categories. It may also be that the Grammar School has more able and ambitious pupils than the comprehensive school.

Given the lack of evidence for geographical mobility in the American sample, the equivalent question was not asked of the British sample. Occupational background and mobility were, therefore, not measured for this sample.

8.17 In concluding this section it should be pointed out that inevitably the data presented hereare selective and that the topics covered in these questions have been mentioned only fleetingly. There are two problems here. First that it was very difficult to anticipate just which questions would be most revealing about the structure of the subject populations on other grounds beside age and sex. This was partly because the choice of subject populations was largely determined by availability and this meant that the questions had to be general in form. Secondly, the questions might be criticized for their superficial nature and again the researcher has the choice of carrying out a study to reveal, for example, the nature of people's ambitions or alternatively attempting to construct

questions which the researcher hopes, on rational grounds only, will be appropriate as global indicators, with the inevitable possibility that the questions may not work out well in practice. If more time or resources had been available the researcher would have pre-tested in greater depth the whole of the second part of the questionnaire.

There would still be difficulties in this case caused by the problems of attempting to ask equivalent questions in two different countries. After having completed the pilot study in the United States and having decided that a second content oriented section was required, the researcher had the difficulty of constructing a questionnaire to fit into a predetermined schedule of data collection. By using questions that had been used elsewhere, an attempt was made to minimize the risk of problems in the use of the questionnaire, but such factors cannot always be anticipated. Ultimately, however, the choice was whether to include questions that had not been tested for appropriateness or not to include any questions at all. The former option was chosen with the results indicated.

The author feels that this risk was justified. Although some of the questions were not appropriate, others, for example the question on prestige, revealed interesting differences between the subject groups. This data, although far from perfect on many grounds, met a major purpose of this study in providing information that can be used to complement the data from the pair comparison task which will be reported in the following section.

The fact that some of the data the author collectedhave only

been analyzed superficially and are not being presented might be another criticism of the study. The author would argue, however, that in an exploratory study that has experimented with question formats, some failures are inevitable. Data on aspects of occupational background are difficult to collect because researchers know very little about the range and type of occupational mobility currently existing. Keil (1978) has highlighted the fact that many of the traditional findings on occupational and social mobility are being challenged by recent research and that at present little is known about individuals' own evaluation of their occupational history. The small amount of data that are available suggest that changes, that to the researcher appear purposeless, are often seen by the individual concerned to be made in a purposive manner based on a logical and rational evaluation of the options open to them.

In relation to evaluating individuals' knowledge about the world of work, occupational psychologists have also failed to collect much objective data. Although some careers education materials are designed to assist in learning about the world of work, evaluation of people's knowledge is an intrinsically difficult problem because the world of work is continually changing. The nature of the labour market can change rapidly and technological change means that there are also major structural changes taking place in the range and type of opportunities that are available. These effects combine to make the determination of suitable criterion for measuring occupational knowledge difficult, as many of the criteria will be transitory. Reeb (1959b) reports that he asked subjects to complete pen pictures on the occupations that he included in his study with the intention of using these as a measure of job knowledge. However, this data proved impossible

to analyze satisfactorily. This author experienced the same difficulty.

This discussion has exposed some of the difficulties of operationalizing concepts, especially in applied research settings, where the researcher is concerned to collect information about the very many variables which are serving as indicators of underlying concepts. In the construction of measuring instruments for this kind of research, the researcher essentially proceeds by a trial and error process in an attempt to find and develop appropriate measuring techniques. This viewpoint is in line with the idea that science is craftsman work (Ravetz, 1971) and that "scientific knowledge emerges from a complex and lengthy social endeavour," (ibid p407).

A second problem that has been exposed in this chapter is the difficulty of developing an approach to data analysis before the data have been collected. Earlier the author had suggested that some of the studies reviewed (see Section 4.5) suffered because the researchers did not "seem to have thought them through from data collection to data analysis in sufficient detail." In his own research, the author has found out just how difficult this could be to achieve in practice. The difficulty of proceeding directly as initially planned has been shown by the fallibility of the data collection process. It proved impossible to collect all the data as originally intended and, therefore, the strategy of data analysis had to be reconsidered and modified to use the data that were available.

9. MULTIDIMENSIONAL SCALING ANALYSIS.

9.1 This chapter is concerned with the analysis of the results from the first section of the questionnaire, which asked subjects to rate pairs of occupational titles for their similarity. The preliminary analysis of this data to identify subjects with extensive amounts of missing data and subjects who were particularly inconsistent in their responses has already been reported (see Section 7). A small number of subjects were eliminated from the analysis at that point.

The analysis falls into two parts. This first chapter is concerned with the analysis of the group data from the subjects and the second chapter with the analysis of the data for individual differences. All the computation to be reported here was carried out in Cardiff, once the author had moved there, using the MDS(X) suite of multidimensional scaling programmes (Coxon et al, 1975) which had been made available locally. Some analysis of the American data had been carried out while the author was at the University of Minnesota, but it was decided to recompute all this data, so that all the data to be reported here was analysed using the same programmes. The fact that some of the data had been analysed by two different but equivalent programmes also allows some check on the consistency of the solutions offered by these programmes.

It was also decided to reanalyze the pilot data at this stage. This data had already been given the same preliminary analysis as the other data from the main study. The pilot data was used both to compare the results from the reanalysis of this data with the

data from the main study and for separate individual differences scaling. As 15 of the 20 occupational titles used in this study were also used in the main study questionnaire (white form) and 8 of the 20 occupational titles used in the main study questionnaire (yellow form) it is interesting to compare how these common titles are rated in the different settings.

9.2 To complement the multidimensional scaling analysis, which provides a geometrical representation of the data, it was also decided to carry out a cluster analysis using the hierarchical clustering programme, HICLUS (Johnson, 1967). In contrast to the spatial model of multidimensional scaling, which attempts to represent the structural aspects of the similarity matrix in a geometric configuration of points, the clustering model attempts to place the occupational titles in mutually exclusive groups in such a way as to best represent measures of similarity between them. The hierarchical method of clustering used here makes the same nonmetric assumptions about the quality of the data as the multidimensional scaling programmes but produces clusterings in a series of stages from the 'weak' clustering, in which each occupational title is a separate cluster, to the 'strong' clustering, in which all of the titles are grouped into one single cluster. Each step in the hierarchical clustering corresponds to the merging of two of the existing clusters. This means that, as the analysis proceeds, once two titles appear together in the same cluster, they cannot appear in different clusters in subsequent steps.

Johnson's hierarchical method uses two methods of clustering to produce two solutions. These methods would be equivalent if the original data perfectly satisfies the ultrametric inequality, but

with real, fallible data produce different solutions. These methods are called the 'minimum' or 'connectedness' method and the 'maximum' or 'diameter' method. Normally the 'diameter' method is used in preference to the 'connectedness' method as the latter tends in practice to produce clusters by adding single points to existing clusters, rather than generating new clusters from single points. Solutions from this method can also be difficult to interpret. In the analysis to be presented here the diameter method will be used throughout.

9.3 An advantage of using both hierarchical clustering and multidimensional scaling is that it is frequently possible to represent the clustering solution as a set of contours in a two dimensional space, obtained from the scaling analysis, and this can assist in the interpretation of the results from both forms of analysis. It is important that the original data is submitted to both forms of analysis and not the recovered distances from the scaling analysis, as the scaling solution is globally stable but locally unstable. That is, the overall pattern of the scaling solution is robust, but individual distances are likely to vary from one solution to the next. These individual distances are crucial in the initial stages of the clustering procedure.

This combination of a dimensional and a typological approach to the analysis of similarities data acts as a useful multimethod aid, particularly to the interpretation of the data. The types of structure, as has already been pointed out (see Section 5.18), that can be represented in a spatial arrangement are complex and any aid to interpretation is useful. It is also possible to see that, at a common-sense level, people use both categories and dimensions

in their natural groupings and in making sense of their perceptions and cognitions. The combination of methods has the advantage of being more naturalistic and allowing for the possibility of both a categorical and dimensional explanation existing in parallel with each other.

9.4 The multidimensional scaling methods that will be used for the bulk of the analysis will be MINISSA (Roskam and Lingoes, 1970) and INDSCAL (Carroll and Chang, 1970). MINISSA is a programme equivalent to the TORSCA programme that was used for the analysis of the pilot data and which was described earlier (see Section 5.13). INDSCAL, the programme used by Coxon and Jones (1974a) and Shubsachs and Davison (in press), has also been described earlier (see Section 4.15).

9.5 A major problem with the analysis of the data from this study was the determination of a strategy. This study is more complex in design than any of the previous studies that have been reviewed (see Section 4) in that it includes a large number of individual subjects, who are grouped together by various criteria, as well as parallel forms of the questionnaire. This makes the organization of the presentation of the information quite complex.

There are also considerable practical problems in the handling of comparatively large data sets which are structured in quite complex ways for computer analysis. For example, as can be seen from the code books for the questionnaires (see Appendix G) there are about 400 variables for most of the subject groups. This approached the maximum number it was possible to analyze with some of the versions of SPSS which were used for the simple descriptive

analysis. Since the number of variables was too large for certain statistical procedures, some of the analyses had to be carried out in parallel.

The original raw data files also had to be transformed for some of the analyses. The pair comparison data, for instance, were collected in the structured order suggested by Ross (1934) and were also coded in that order. However, for the INDSCAL analysis, the data for each individual had to be transformed into a data matrix in a systematic order. A special computer programme was written to do this. Although each stage in this process is comparatively simple to carry out, the whole process in practice is very time consuming - as anyone who has carried out a computer based analysis of this kind will be aware. The researcher also runs up against physical constraints, such as lack of filespace in the computer which is being shared with other users, as well as technical and hardware faults in the computer system. The author knows of very few researchers who, when carrying out a reasonably large scale analysis with a computer, manage to keep to their projected time scale.

For the analysis of the data from the main study, the raw data, as well as being stored on IBM cards, were also stored on disk on the computer as a series of data files for each subject group. These data files were then copied for use in particular statistical analyses. The individual files could also be combined into larger units for certain analyses as well as being edited into smaller files for other analyses. The transformed data matrices for the INDSCAL analyses were also stored and used in the same way. As the number of individual files held soon runs into

double figures, the researcher has to develop his own 'housekeeping' system, making sure that individual files are carefully labelled. The volume of paper output obtained is also very voluminous and must be carefully catalogued.

This area of data management is not well covered in the literature, partly because individual computer systems vary considerably from place to place in their operating procedures, so that what is best in one location would be inappropriate in another. The analysis to be reported here was carried out on a linked network of computers, where individual machines are used for particular types of programme. This means that the researcher has to be familiar with more than one operating system as computers which are produced by different manufacturers, or which are of a different technological 'generation', usually have non-compatible operating systems. The author still finds it surprising that, in spite of these difficulties, general common-sense principles for file management are infrequently discussed. It seems to be assumed that this process is intellectually trivial and within the realm of common sense, and yet, in practice, people regularly make costly errors or very inefficient use of their time through lack of guidance. There is some similarity here with the use of libraries, where the author suspects that most social scientists are unaware of many of the facilities that are actually available to them.

To return to the problem of determining a strategy for the analysis of this data. The author has already noted (see Section 8.17) the difficulty of fully determining a strategy for data analysis before the data have been collected. In an exploratory study such as this, the analysis is evolved as the study progresses. Thus, the preliminary

analysis reported in Section 7 acted to rule out the possibility of making certain types of analysis it had initially been planned to make. The results in Section 8 served to focus the analysis in particular ways. The data on the differences in prestige ranking and, in particular the multidimensional scaling analysis, indicated considerable differences at the younger level. This suggests that it would be appropriate to analyze the data for each group of subjects, first of all using a group multidimensional scaling programme to generate a group space and then subsequently to use the output of this analysis as the starting configuration for a separate individual differences scaling analysis. If the results from this analysis were similar to the results of the multidimensional scaling on the prestige data, it would suggest that considerable sex differences might be expected, particularly within the US High School group.

9.6 The first stage of the multidimensional scaling analysis was, therefore, the group analysis of the data from the individual subject groups. The first analysis of the American data, which was carried out while the Author was at the University of Minnesota, used the multidimensional scaling programme TORSCA (Torgerson and Young 1967). Subsequently when the author returned to England and when all the data for this study had been collected and the preliminary analysis was complete, the data was analyzed using the programme MINISSA (Roskam and Lingoes, 1970). Most recently a version of this programme has become available which incorporates the programme MSPACE (Spence and Graef, 1974). This programme attempts to find, for a given input pattern of five empirically determined stress values, the best fitting match to Monte Carlo data in one, two, three and four dimensions using a least squares procedure. It therefore makes objective, rather than subjective, the choice of a dimensionality

for a multidimensional scaling solution. The Monte Carlo data used for determining an appropriate dimensionality for the empirical data is structured with various degrees of error, so that output from MSPACE not only suggests the degree of fit of the data in different dimensions but also the amount of error in the solution in a particular dimensionality.

This programme, which only became available to the author at a late stage in the analysis of this data, has considerable advantages over existing, more subjective, methods for determining the appropriate dimensionality of scaling solutions. Of particular concern to the analysis to be presented here is whether or not the data from the different subject groups who have completed the same version of the questionnaire can be interpreted in the same dimensionality. The data for different subject groups might also differ in the amount of error it contains. Even if a space of the same dimensionality appears appropriate for the different subject groups, it still does not necessarily follow that the arrangement of the occupations in that space will be equivalent. It was decided, therefore, even at this late stage, that the data would be submitted to the MSPACE analysis.

9.7 The pattern of stress values obtained in five dimensions through to one dimension is shown in Table 9.1. Examination of the Tables suggests (1) that the pattern of stress values for the yellow form of the questionnaire, which dealt with the applied science and technical jobs, is markedly different from that for the other forms of the questionnaire; (2) that the pattern of stress values from all the subject groups for the white form of the questionnaire is remarkably similar with the one exception of the

University of Minnesota students; and (3) that the pattern of stress values obtained from the pilot form of the questionnaire is also quite similar to the pattern of stress values obtained from the white form of the questionnaire.

TABLE 9.1
Group Multidimensional Scaling Solutions.
MINISSA Solutions - Stress Values.

Group	Dim.*	SV.**	Group	Dim.	SV.
Pilot Data	1	363	Junior High School	1	359
	2	207		2	197
	3	113		3	109
	4	080		4	063
	5	058		5	050
Student - White	1	376	Aston	1	306
	2	192		2	177
	3	102		3	097
	4	045		4	055
	5	027		5	038
Student - Yellow	1	313	Five Ways	1	336
	2	139		2	197
	3	072		3	111
	4	046		4	063
	5	032		5	044
Senior High School	1	348	Sharmons Cross	1	306
	2	209		2	190
	3	104		3	098
	4	057		4	060
	5	042		5	043

* Dimensionality
** Stress Values - Decimal points omitted.

To determine the appropriate dimensionality for these solutions, these stress values were fed into the MSPACE programme and the pattern of results obtained is listed in Table 9.2. For each group the fit in one, two, three and four dimensions is listed and the degree of error in each case is also reported. The best fitting solution for each subject group is asterisked in the Table.

TABLE 9.2

MINISSA Solutions. Results of MSPACE Analysis.

		Error % age	Least Squares Value
Pilot Data			
	1	65	39.4
	2	43	21.3
	3	34	11.1*
	4	25	17.7
Student - White			
	1	72	44.2
	2	45	27.6
	3	39	20.7
	4	26	14.0*
Student - Yellow			
	1	56	42.6
	2	26	19.5
	3	21	10.3*
	4	9	17.4
Senior High School			
	1	70	31.7
	2	48	25.1
	3	41	18.1*
	4	28	21.5
Junior High School			
	1	72	29.6
	2	48	17.0
	3	42	10.0*
	4	30	14.5
Aston			
	1	60	27.9
	2	36	27.7
	3	29	21.0*
	4	17	29.6
Five Ways			
	1	68	26.0
	2	46	21.7
	3	39	16.2*
	4	27	23.5
Sharmons Cross			
	1	62	25.2
	2	39	29.8
	3	32	23.6*
	4	20	32.1

Spence and Graef point out that there are benefits, besides considerations involved in the interpretation of the data, in having correct estimates of the dimensionality of the data. If the dimensionality of data is underestimated, there is a marked deterioration in the quality of the metric recovery. If the dimensionality is overestimated, metric recovery may be slightly degraded. These results suggest that it is better to err on the side of overestimation in interpretation, although this may not be the most parsimonious approach (see Section 4.10).

There are, of course, certain assumptions in using this method. It is assumed, first of all, that a geometric model is appropriate for the data and, secondly, that the nature of the experimental error is essentially of the same form as that used in the Monte Carlo runs, random perturbations of the distances. In practice, real data sets may have error components that are correlated and not random, so that in using the MSPACE procedure it is necessary to be cautious not to be overdependent on a computational algorithm.

Examining the pattern of results from the MSPACE analysis, several trends emerge. First of all, as extra dimensions are added to the solution, the amount of error estimated to exist in the data decreases. Attractive as this appears, it is essentially an artifact and what is important is the dimensionality MSPACE suggests is the best fit to the data, which is determined by a least squares criteria. In certain cases, however, there appears to be a choice as to which dimensionality appears most appropriate. These cases will have to be decided on other grounds.

A second point concerns the level of error found in the

suggests error levels below 30% can be considered low, while error levels below 10% are extremely low for real data sets. Error levels in the range of 30 to 70% are considered moderate, while levels above that are high. It is seen from the results of the MSPACE analysis that the range of error levels in this data range from 21% to 42% and are generally in the low to moderate error categories on Spence's criteria.

Examining the results of the MSPACE analysis, it is reassuring to note that this analysis suggests that the three dimensional solution is optimal for the pilot data. The earlier analysis (see Section 5.15 to 5.20) had also suggested that a solution in this dimensionality was appropriate for this data, although it was noted that in fact the two dimensional solution was also interpretable. No further analysis, therefore, will be carried out of this data at this point, although an individual differences scaling will be reported subsequently.

For the rest of the data collected in the main study, the MSPACE analysis requires careful interpretation. For the American School student data the analysis indicates that a three dimensional solution is appropriate. However for the University students who were given the same version of the questionnaire, the analysis indicates a four dimensional solution as appearing the most appropriate. For the parallel yellow form of the questionnaire used with the University students, the analysis indicates that a three dimensional solution with only 21% of error is appropriate. This is somewhat surprising as it was thought that this version of the questionnaire was more difficult to fill in. It was, therefore, expected that there would be less agreement among these respondents

about how particular pairs of occupations should be rated on this form of the questionnaire and that this would result in greater error in the scaling solution.

It is surprising also because, when the Liberal Arts students, who completed one or other of these questionnaires, were asked after they had finished filling in the questionnaire to check which of the occupations they were unsure about, far more marked occupations included in the yellow form than occupations included in the white form. The actual figures are listed in Table 9.3 and, although the sample sizes were slightly different, indicate that the number of checks given was roughly three times greater for the yellow form than for the white form of the questionnaire.

TABLE 9.3
Knowledge of Occupations

Occupations in Yellow Form Number of Subjects = 40		Occupations in White Form Number of Subjects = 37	
Aircraft Mechanic	-	Architect	-
Architect	1	Certified Public Accountant	2
Automobile Mechanic	2	Civil Engineer	14
Civil Engineer	16	Commercial Artist	1
Computer Operator	2	Computer Operator	1
Computer Programmer	2	Electrical Engineer	8
Customer Engineer	24	Librarian	-
Draftsman	4	Pharmacist	-
Electrical Engineer	9	Photographer	-
Electronics Technician	2	Police Officer	-
Maintenance Engineer	14	Primary School Teacher	-
Mechanical Engineer	7	Secretary	-
Statistician	5	Social Worker	2
Structural Engineer	14	Staff Nurse	-
Technical Writer	14	Statistician	8
TV Repairman	1	X Ray Technologist	3
Total	117	Total	39

The multidimensional scaling result may, however, be explained in terms of the structure of the two lists of occupations and the nature of the dimensions the subjects were likely to use in the

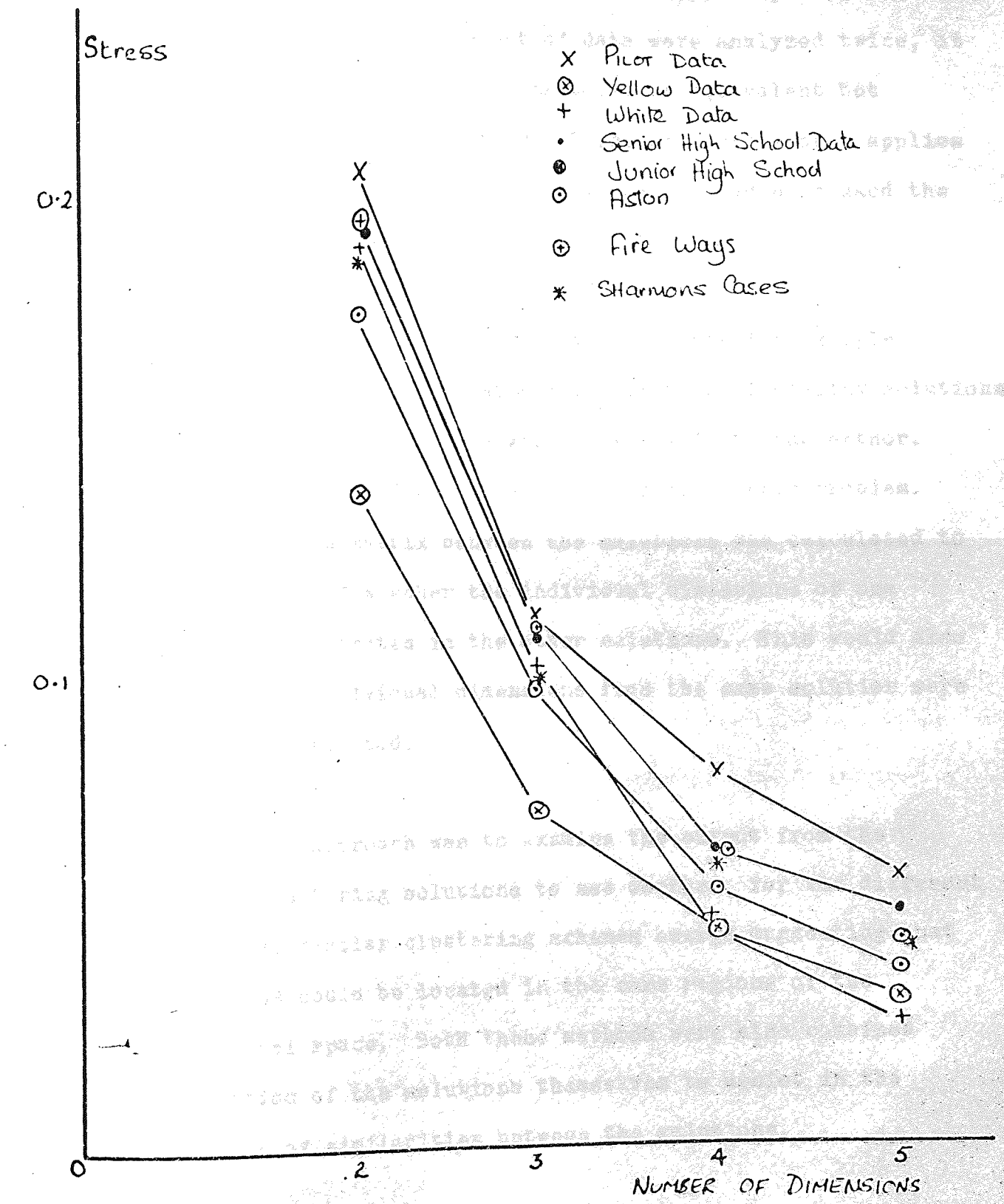
rating procedure for making their judgements of similarity. It is very likely that a prestige dimension will emerge for the yellow forms of the questionnaire as the occupations differ along this dimension, while the occupations included in the white form were chosen to be of similar occupational level.

The data from the British school groups are also shown by the MSPACE analysis to have an underlying three dimensional structure. Apart from the University students, for whom the four dimensional solution appears to be the most appropriate, the data from all the subject groups who completed the white version of the questionnaire appear to be best interpreted in three dimensions. This raises two questions, first, whether this one result is an anomaly or a genuine result? Examinations of the stress values, which are presented graphically in Figure 9.1 does suggest that there is, perhaps, a genuine difference between this result and the others, as the pattern of the graph obtained is distinctly different for this group. This evidence in itself suggests that the subjects in this group have a more complex representation of the occupational structure than the other groups. Further evidence to support this interpretation will be reported subsequently.

9.8 The second question is whether, for the remaining subject groups for whom a three dimensional solution appears appropriate, the spatial arrangement of the occupational titles from the white version of the questionnaire are similar or different? Unfortunately, this is not easy to determine, as a number of solutions might be equivalent to each other but look very dissimilar, because dimensions are inverted so that solutions are mirror images of each other, or because the solution is rotated so that, although the distances [illegible] the same, the loading on individual dimensions

FIGURE 9.1

MINISSA scaling: stress values.



are very different. Rotation and reflection are therefore two forms of transformation that would leave the distances between points unchanged but cause considerable differences to the appearance of the solution in terms of looking at two dimensional plots. It should be noted that even if the same set of data were analyzed twice, it would be possible that the solutions would be equivalent but transformed versions of each other. This, of course, only applies in a Euclidean space. If an alternative metric had been used the solutions could not be rotated at will in this way.

Although there are computer programmes (see for example Kaplan, undated) designed to match multidimensional scaling solutions in a least squares sense, these were unavailable to the author. Two approaches were used by the author to resolve this problem. First a correlation matrix between the solutions was calculated to provide a measure of whether the individual dimensions of one solution could be located in the other solutions. This would also indicate whether individual dimensions from the same solution were significantly correlated.

The second approach was to examine the output from the hierarchical clustering solutions to see whether, for the different subject groups, similar clustering schemes emerge suggesting that the occupations could be located in the same regions of the multidimensional space. Both these methods were also combined with examination of the solutions themselves to assist in the identification of similarities between the solutions.

For the analysis to be reported here solutions had to be selected to represent each of the subject groups. Different

solutions for individual groups will vary slightly. In this case the solutions from the analysis which included the MSPACE analysis were used as there was no reason to think that these solutions were not well representative of the sets of solutions that had been obtained. The pattern of stress values for these solutions was found to be almost identical to the pattern from earlier analyses. In carrying out a multidimensional scaling analysis there is always the possibility that a local rather than a global minimum has been reached for a particular solution in a particular dimensionality. If, however, several analyses give the same pattern of stress values, it is most unlikely that two identical local minimum solutions have been reached and it will, therefore, be safe to conclude that a global minimum has been reached.

9.9 The correlation matrix obtained is shown in Table 9.4. All the groups who filled in the white form of the questionnaire are included, and both the three and four dimensional solutions for the University of Minnesota students are included in the matrix. There are several points to note in this matrix. First that the first dimensions in each of the solutions are usually highly inter-correlated and in all cases this dimension is highly correlated with each of the other solutions. Note also that, within a particular solution, the dimensions are hardly correlated at all. This suggests that within all the solutions there is one common dimension. The variability among the occupational titles is also greatest on this dimension.

It is also possible to note that the second and third dimensions are not usually so highly intercorrelated. This indicates that in most cases these dimensions are more speceific to the subject groups, although in some cases there are very high

TABLE 9.4 Correlation Matrix for MINNISA Solutions by Subject Group.

		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Sharmons	1	-12	-02	97	-04	-15	99	-07	06	84	29	38	95	-15	16	94	04	11	-27	96	07	06
Cross	2		-07	-18	-72	-35	-12	-58	-52	-52	61	12	-24	-74	13	-25	-58	31	-20	-22	-57	35
	3			04	-40	76	02	61	-62	10	33	-20	05	-15	-79	14	-50	-74	22	12	-53	-71
Five	4				-00	-00	99	07	03	89	30	23	98	-10	02	98	03	08	-09	98	03	03
Ways	5					00	-06	33	93	31	-90	-19	07	93	25	-02	91	-04	17	-04	89	-08
	6						-06	91	-33	24	08	-61	05	27	-89	12	-15	-69	64	07	-27	-69
Aston	7							00	00	87	35	26	97	-15	05	97	00	10	-15	98	01	02
	8								00	39	-22	-59	13	57	-80	18	14	-71	61	12	03	-73
	9									23	-86	06	07	78	54	-04	92	15	-12	-03	95	13
Junior	10										00	00	94	29	-13	93	28	-12	11	92	25	-22
High	11											00	23	-86	-32	32	-85	19	05	33	-85	17
School	12												16	-35	62	13	-04	10	-89	20	07	24
Senior	13													00	00	98	11	05	-02	98	-10	-04
High	14														00	-06	82	-27	31	-09	78	-31
School	15															-11	42	61	-62	-05	52	63
University	16																00	00	00	100	-01	-09
of Minnesota	17																	00	00	00	96	-04
4D Solution	18																		00	02	09	94
	19																			-08	-11	-09
University	20																				-00	-07
of Minnesota	21																					06
3D Solution																						

intercorrelations between all the dimensions of two solutions indicating they are almost identical. For example the solutions from the two King Edward's school groups appear to be almost identical, and the four dimensional solution for the University of Minnesota students, not surprisingly, correlates almost perfectly with the three dimensional solution for this group.

It is interesting also to note from the correlation matrix that the correlations between the British subjects and the correlations between the American subjects appear no greater than the correlations between the two sets of subject groups. This suggests that there is little evidence from this data that British and American subjects differ at an aggregate level in their occupational perceptions. Although the individual differences scaling will be used to examine the structure of individual differences in the sample groups, the results of these group analyses indicate most clearly the very considerable common element in the occupational perceptions of all these different subject groups.

9.10 Examination of the correlation matrix in this way is not, perhaps, the ideal method of comparing solutions, but is made easier in this case, because the dimensions within each solution are almost totally uncorrelated. Shubsachs and Davison (in press), in their study referred to earlier, used canonical correlation as a technique to examine the extent to which the three different groups in their study were similar. However, they seem to have made an error in their analysis, in thinking that, because they extracted four significant canonical correlations for their four dimensional solutions, these solutions must be nearly identical. The canonical correlation is calculated from the correlation of one weighted linear composite derived from the first set of variables (in their

case one of the INDSCAL solutions) with a second weighted linear composite derived from the second set of variables (the other INDSCAL solution), where the weights used are chosen to maximise the correlation. The squared canonical correlation, as Weiss (1972) points out, gives the proportion of variance in one of these new variables that is predicted from, or in common with, the other new composite variable. Because these new variables are weighted composites, not all the variance from each set of the original variables will necessarily be included in these new composite variables, although the canonical variables are constrained to be uncorrelated with each other. It is possible, by a technique called 'Redundancy', to calculate the proportion of variance in one set of variables predicted in the other set, but this requires more information to calculate than is reported by Shubsachs and Davison. In particular, as it is likely that the dimensions in the INDSCAL solutions may be correlated, it is necessary to know whether or not common variance is only a small proportion of the total variance.

In this study it was decided that using canonical correlation to study the interrelationship of seven different solutions, which would involve 21 separate analyses, would be extremely time consumin It would yield only slightly better information about the relationships between the solution than the correlation matrix, even if the redundancy index was calculated. As each set of variables is almost completely uncorrelated with itself, it is possible to say that the dimensions in each solution can be combined to give unit weighted linear composites that can be intercorrelated with a second set of dimensions from another solution. This also is little better than visual inspection of the correlation matrix, which indicates very

clearly the similarity of the solutions.

9.11 The second approach to be used for the study of the structure of the solutions is to examine the solutions to the hierarchical cluster analysis. Cluster analysis is, perhaps, a simpler form of representation than multidimensional scaling in that it produces categories, rather than an arrangement ordered along some dimension. It is possible to think of a clustering into categories as a first step towards ordering along dimensions. The hierarchical ordering of clusters, so that once two of the items are included in the same cluster at one level, they are also included in the same cluster at all higher levels, does impose a partial order on the arrangement. Some other clustering procedures, which are described by Sneath and Sokal (1973), permit the formation of overlapping clusters, or hierarchical arrangements in which it is possible that items included in the same cluster at one level could be in different clusters at other levels in the hierarchy. However, they point out that these methods usually are dependent on multidimensional scaling or a similar technique to provide an adequate pictorial representation of the data, and, therefore, might as well be replaced by multidimensional scaling alone. In some situations, the constraint of having non-overlapping clusters may be a disadvantage of Johnson's hierarchical clustering technique, but in this case, where the results are to be presented in conjunction with multidimensional scaling, any anomalies should be apparent.

It will be convenient to start with the hierarchical clustering from the pilot study, which is shown in Figure 9.2. Before discussin the interpretation of this data there are one or two points to note about the format of presentation used here. X's linking occupational

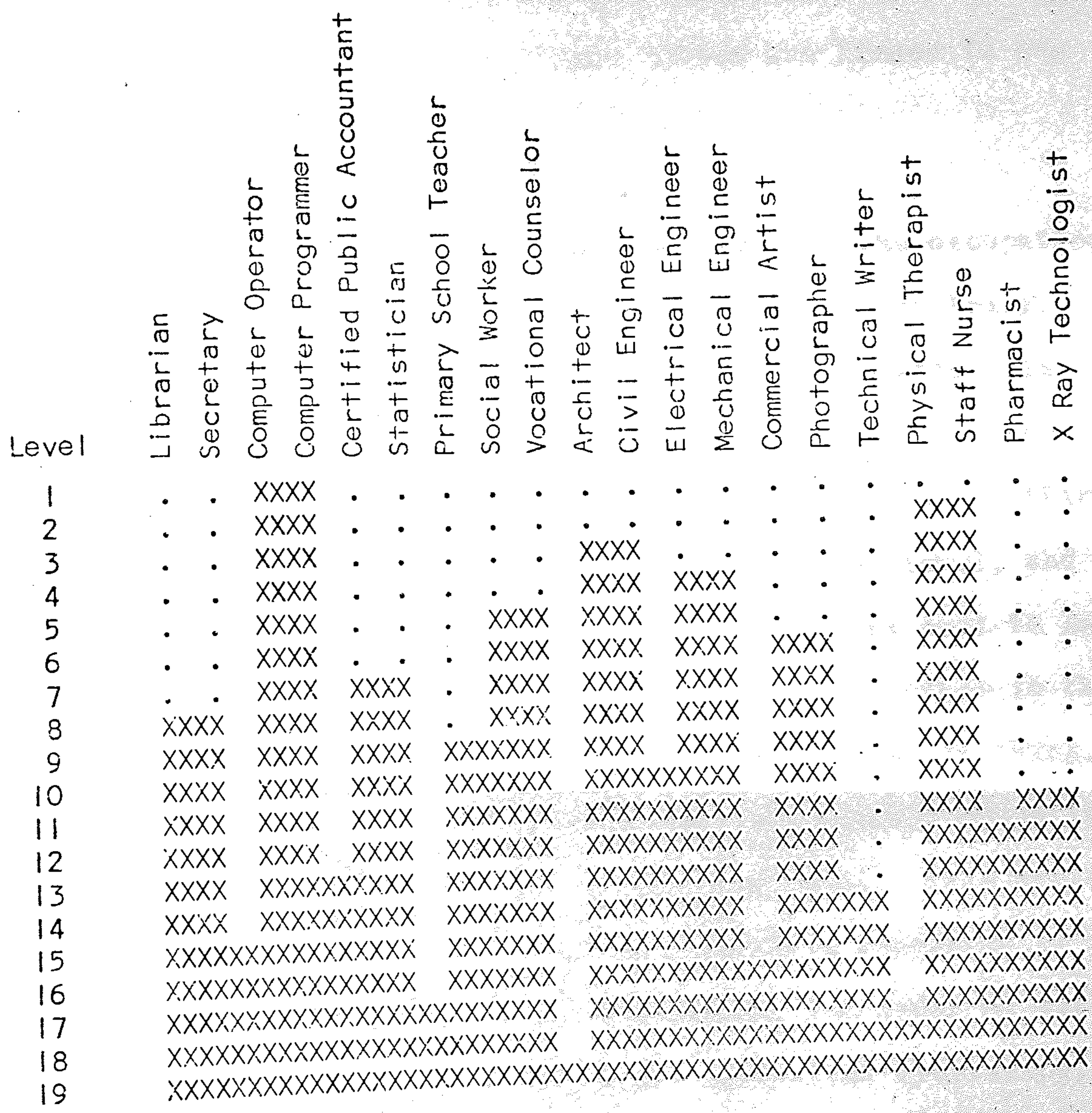


FIGURE 9.2

Hierarchical Clustering: Pilot Study Data.

titles are used to indicate that these titles should be considered to be in the same cluster. As the analysis proceeds from a lower level, the clustering progresses from a weak clustering, where the occupational titles are in separate individual clusters, to a strong clustering, where all the occupational titles are linked in one single cluster.

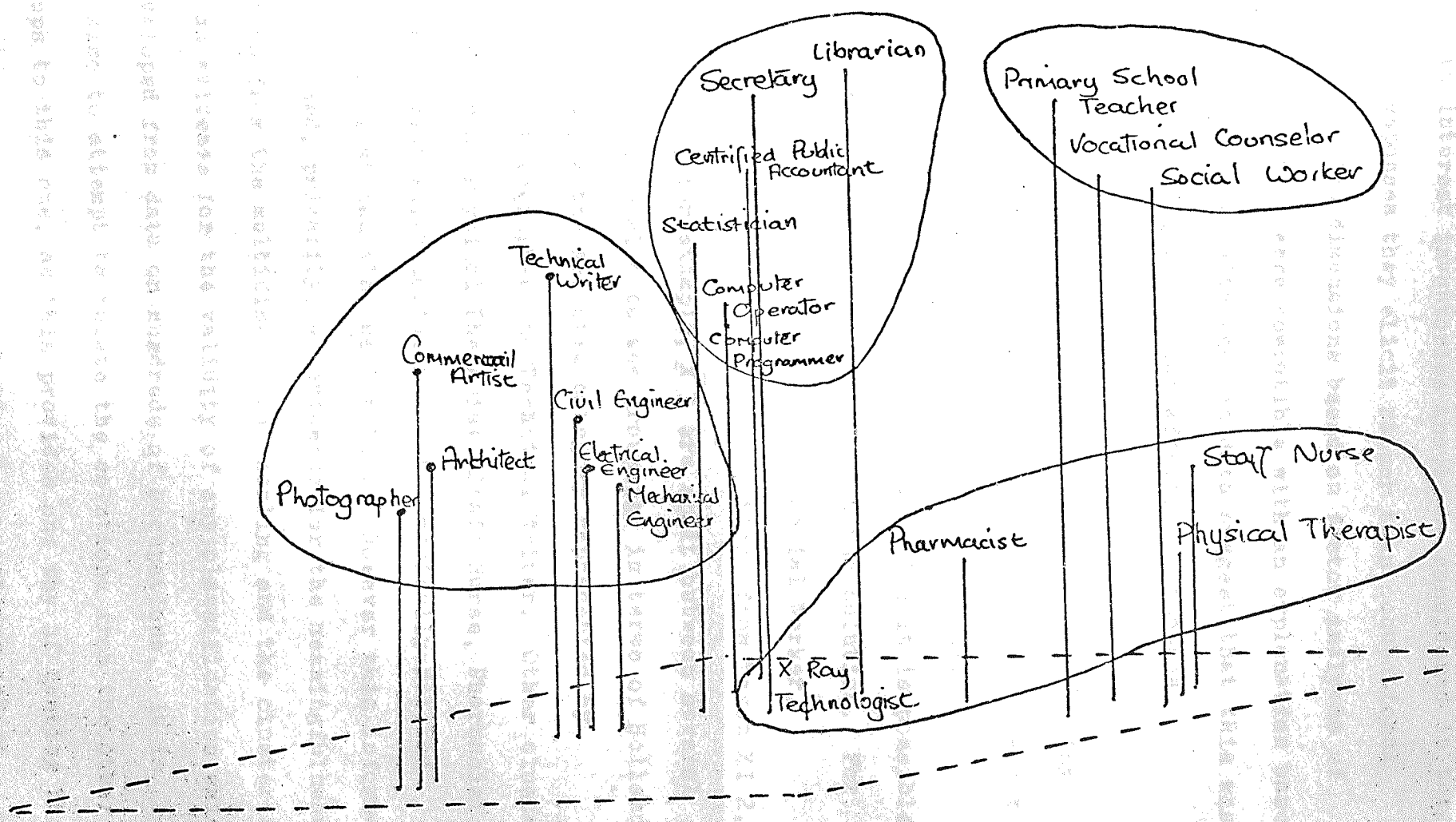
It is important to realise that the order of the occupations in the output from the cluster analysis is somewhat arbitrary. Within any particular cluster, the order of the occupations is arbitrary, although once two occupations have appeared together in a cluster, they can be considered to be more similar than a third occupation which is added to the cluster at a higher level, and so it is appropriate that particular pairs of titles are next to each other. The fact that two titles appear next to each other in the list when they are in different clusters does not mean anything, unless one of the occupations is in a singleton cluster which is to be joined to the other cluster at a higher level. This means that about any linkage between clusters, which is indicated by the lowest level at which the clusters are joined, the order of titles can be rotated to give a transformed but equivalent clustering. The clustering solution can, therefore, be considered to be like a hanging mobile, where the linkages represent the bars from which the clusters are suspended.

Examining the hierarchical clustering solution for the pilot data, bearing in mind how it might be rearranged, it is quite clear that the occupations are being grouped together in terms of content rather than in terms of prestige or level. In this sense this solution is quite compatible with the solution produced by the

multidimensional scaling, which was shown in Figures 5.4 to 5.6. Figure 9.3, which is a computer generated plot of a three dimensional solution for the pilot data, shows how the clustering solution can be overlaid onto a multidimensional scaling solution. In this case the clustering has been taken from level 16 when there are four clusters in the solution, but it would obviously be easy to plot other contours taken from different levels in the cluster analysis. These could be used to identify different numbers of clusters, or even to set out a number of contours that represent different levels in the hierarchy.

9.12 An important issue in the examination of all the data to be presented here is the extent to which the information can be related to theoretical models in the literature about how occupations might be classified and to classification systems that have been developed in practice. Some of the difficulties in relating this type of data to these classifications have already been discussed in relation to the studies that were reviewed earlier (see Sections 4.17 and 4.18). In the main part of this study, the inclusion of two parallel forms of the research questionnaire, which differed in the form of their content, was a deliberate attempt to tackle the problem of the unknown range of convenience of occupational construct and also broaden the number of occupational titles under study. The author does not think that a study of this sort provides a suitable test of two-dimensional models of occupational fields (e.g. Holland, 1973, Roe, 1956, Hanson, 1974) as compared to more complex representations in three dimensions, (e.g. Lunneborg and Lunneborg, 1977). However, it can help in relating ideas about the role of perceptions in vocational behaviour and the relationship between ideas about interests, preferences and perceptions. For instance, are cognitive models of the occupational structure

FIGURE 9.3 3D solution pilot study data with clusters overlaid.



consistent with the models proposed on the basis of the analysis of data from interest inventories? Schoon (1978) for example, argues that responses to interest inventories should be considered in terms of the affective responses they elicit rather than occupational attributes. His semantic dimensions based on factor analyses of semantic differential data were compatible with an explanation based on occupational attributes, although his data suggest that this was because the occupations elicit similar affective responses.

Examining both the clustering and multidimensional scaling solutions of the pilot data in relation to other information about the occupations available from the Minnesota Occupational Classification System (MOCS) and listed in Table 5.2 it is possible to see that certain taxons are identifiable in the solution. For example, the cluster Primary School Teacher, Social Worker, Vocational Counselor, includes all the occupations from Taxon XI 2, although other taxons, for example, X 1 are split between several clusters. It is possible also to see groupings in terms of Holland categories, for example the Artistic category represented by Commercial Artist, Photographer and Technical Writer. Other clusters for instance the group Physical Therapist, Staff Nurse, Pharmacist and X-Ray Technologist which contains all the medically related occupations in the list can also be labelled. However this information should be used, primarily, as evidence for the meaningfulness of the solution from the multidimensional scaling and the clustering rather than as evidence for the validity of any classification which has been developed from data on hundreds of occupations. It is interesting also to attempt to relate the solutions from the other subject groups to this one, as this provides one way of testing the similarity of the structure of occupational perceptions across subject groups.

9.13 The hierarchical cluster analyses for the three American subject groups who filled in the white form of the questionnaire are listed in Figures 9.4 to 9.6. There is an interesting gradation in the solutions. Look first at the solutions for the two high school groups. The order of the occupations in the top half of the solution is almost identical:

1. Primary School Teacher, Librarian, Secretary.
2. Police Officer, Social Worker.
3. Pharmacist, Staff Nurse.

After that apart from the pair, Certified Public Accountant and Statistician, the structure of the clustering is quite different. Now compare the Senior High School group solution with that for the University students. In this case it is the arrangement of the remaining occupations that is identical. Although the pairs Pharmacist and Staff Nurse, Police Officer and Social Worker, Certified Public Accountant and Statistician, and finally Librarian and Secretary are present in all the solutions, these are related to the other occupations in different ways. The main difference between the two university student groups can probably be accounted for almost entirely by the additional occupational titles included for the pilot group. However, what is most interesting in this case is the gradation from the youngest to the oldest group, with the solution for the middle group appearing to be a direct composite of these two.

9.14 However, before discussing the implications of this finding, it will be useful to look at the solutions obtained from the cluster analysis of the British data. The results for the three subject groups are shown in Figures 9.7 to 9.9. It appeared from the correlation matrix of the dimensions from the multidimensional

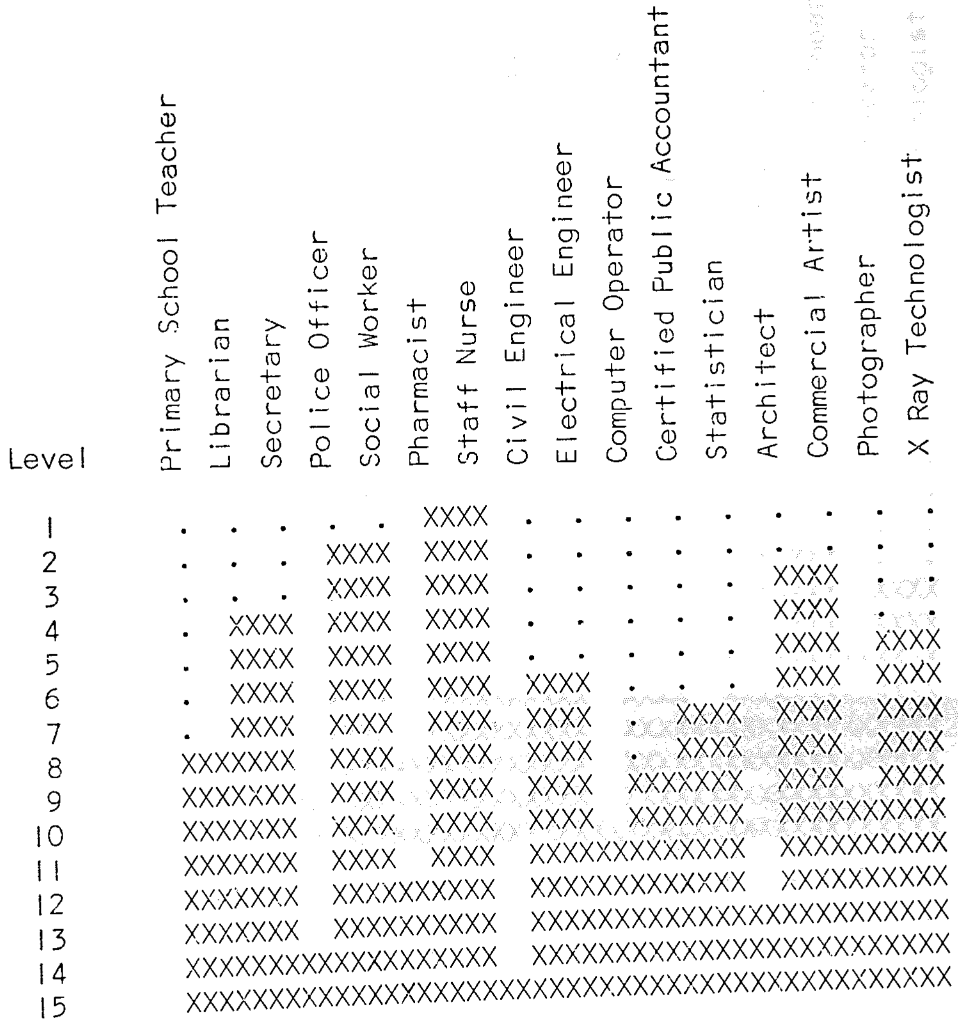


FIGURE 9.4

Hierarchical Clustering: Junior High School Students.

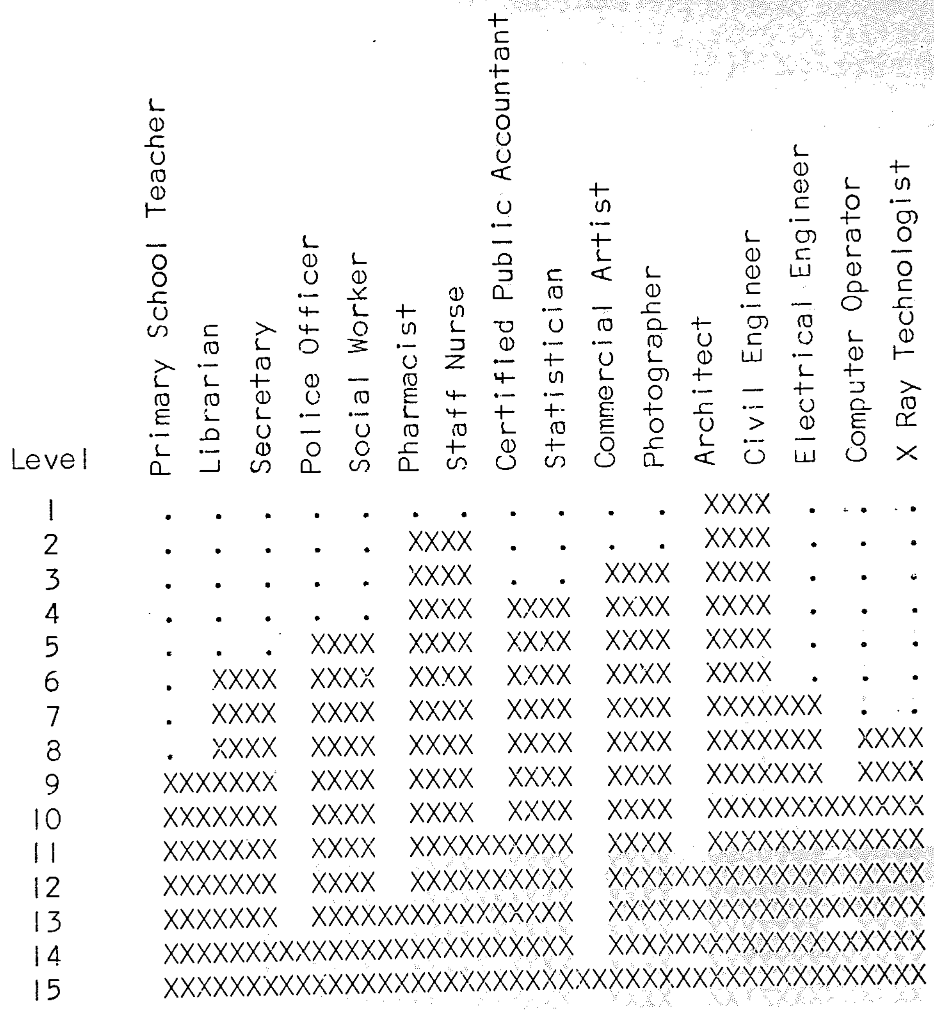


FIGURE 9.5

Hierarchical Clustering: Senior High School Students.

Columns (left to right): Primary School Teacher, Police Officer, Social Worker, Pharmacist, Staff Nurse, Librarian, Secretary, Certified Public Accountant, Statistician, Commercial Artist, Photographer, Architect, Civil Engineer, Electrical Engineer, Computer Operator, X Ray Technologist

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Level
  1    .  .  .  .  .  .  .  .  .  XXXX  .  .  .  .  .
  2    .  .  .  .  .  .  .  .  .  XXXX  XXXX  .  .  .
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 10    XXXXXXX  XXXX  XXXXXXXXXX  XXXX  XXXXXXX  XXXX
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 12    XXXXXXX  XXXXXXXXXXXXXXXX  XXXX  XXXXXXXXXXXXX
 13    XXXXXXX  XXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXX
 14    XXXXXXXXXXXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXX
 15    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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FIGURE 9.6

Hierarchical Clustering: University of Minnesota Students (white form).

scaling solutions that the two groups of boys had almost identical solutions, although dimensions two and three were interchanged for these two groups. Comparing these two solutions, it is possible to note a central group of occupations that are structured in a similar way. These form four clusters: (1) Librarian and Secretary, (2) Computer Operator, Chartered Accountant and Statistician, (3) Architect and Civil Engineer, and (4) Commercial Artist and Photographer. The other occupations are structured somewhat differently for these two groups. In particular, the relationship of the medically related occupations to the other occupations appears different. It is difficult to estimate whether this is an artifact of the method, which is constraining the form the solution can take, or reflects genuine differences in the inter-relationship between the occupations. It will be interesting to see whether the multi-dimensional scaling is able to resolve this issue. For the girls, whose solution is shown in Figure 9.9, this problem does not arise as the three occupational titles: Pharmacist, Staff Nurse and Radiographer are identified as a distinct cluster. Also, in this solution, the three Artistic occupations are clearly distinguished, all in all making this solution quite easy to interpret.

The results for this second set of data are less clear cut than for the American data. This may be partly because the subject populations are not structured in the same way, so that the relationships within this sample are being obscured. A difficulty in interpreting this type of data is how to compare the solutions. Hierarchical clustering acts as a way of structuring the description of the individual data sets, but it is not possible to infer from this anything exact about the relationship of the solutions. The only comparisons that can be made are through a description of the similarities of the solutions. It would be possible to generate a

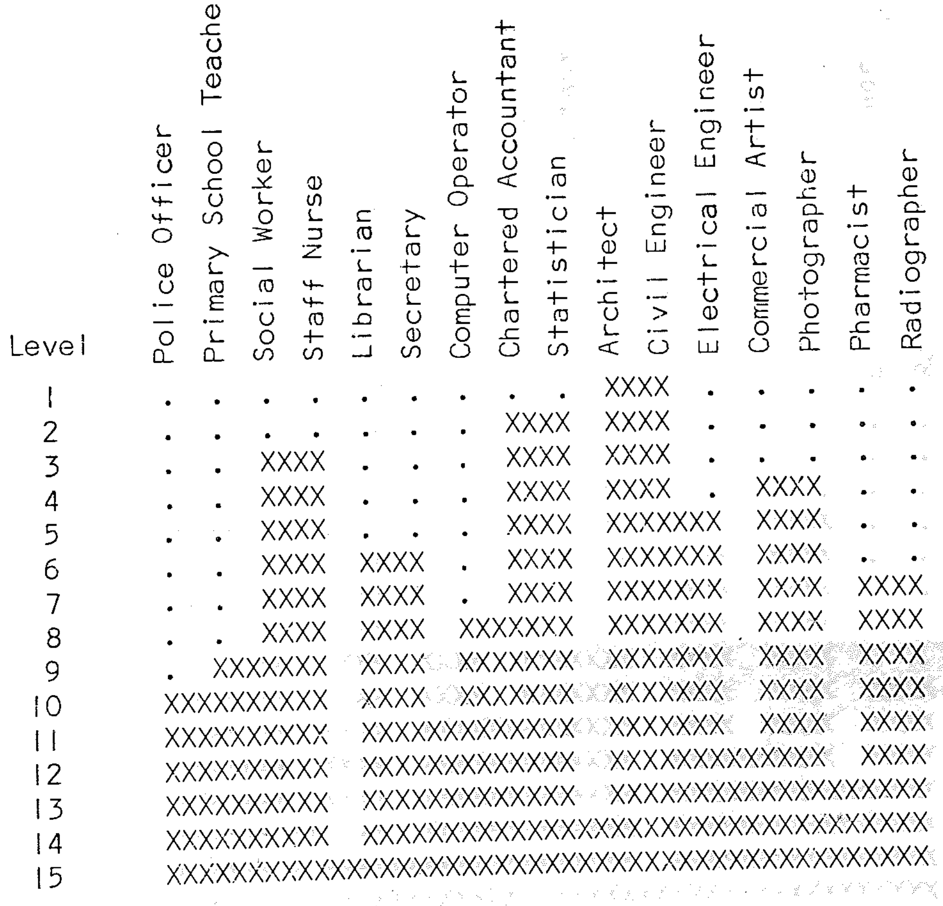

FIGURE 9.7

Hierarchical Clustering: King Edwards Aston.

Columns (left to right): Police Officer, Primary School Teacher, Social Worker, Pharmacist, Staff Nurse, Librarian, Secretary, Computer Operator, Chartered Accountant, Statistician, Architect, Civil Engineer, Commercial Artist, Photographer, Electrical Engineer, Radiographer

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Level
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 10   XXXXXXX  XXXX  XXXXXXXXXXXXX  XXXX  XXXX  XXXX
 11   XXXXXXX  XXXX  XXXXXXXXXXXXX  XXXXXXXXXX  XXXX
 12   XXXXXXX  XXXX  XXXXXXXXXXXXX  XXXXXXXXXXXXXXXX
 13   XXXXXXXXXXXXX  XXXXXXXXXXXXX  XXXXXXXXXXXXXXXX
 14   XXXXXXXXXXXXXXXXXXXXXXXXXXXX  XXXXXXXXXXXXXXXX
 15   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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FIGURE 9.8

Hierarchical Clustering: King Edwards Five Ways.

Columns (left to right): Civil Engineer, Electrical Engineer, Architect, Commercial Artist, Photographer, Librarian, Secretary, Chartered Accountant, Computer Operator, Statistician, Primary School Teacher, Police Officer, Social Worker, Pharmacist, Staff Nurse, Radiographer

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  5    XXXX  XXXX  .  .  .  .  XXXX  .  XXXX  XXXX  .
  6    XXXX  XXXXXXX  .  .  .  XXXX  .  XXXX  XXXX  .
  7    XXXX  XXXXXXX  .  .  XXXXXXX  .  XXXX  XXXX  .
  8    XXXX  XXXXXXX  .  .  XXXXXXX  .  XXXX  XXXXXXX
  9    XXXX  XXXXXXX  XXXX  XXXXXXX  .  XXXX  XXXXXXX
 10    XXXX  XXXXXXX  XXXX  XXXXXXX  XXXXXXX  XXXXXXX
 11    XXXX  XXXXXXX  XXXXXXXXXXXXX  XXXXXXX  XXXXXXX
 12    XXXXXXXXXXXXX  XXXXXXXXXXXXX  XXXXXXX  XXXXXXX
 13    XXXXXXXXXXXXX  XXXXXXXXXXXXX  XXXXXXXXXXXXXXXX
 14    XXXXXXXXXXXXX  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 15    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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FIGURE 9.9

Hierarchical Clustering: Sharmons Cross.

clustering solution for each individual, but this would generate an impossible amount of information to describe. An important question becomes, therefore, how much to break the subject groups down further for analysis. It is possible, for instance, to distinguish the Junior High School boys from the Junior High School girls, but at this stage in the presentation of the results, the most salient finding seems to be the effect of the age differences in the clustering of the American sample. There is a certain similarity here with the analysis from the prestige data which suggested strong effects in how the occupational titles were evaluated due to age differences. For the time being, therefore, no further analysis of this data will be carried out.

9.15 There still remains, however, the data from the group of university students who filled in the yellow form of questionnaire. The results of the hierarchical clustering of this data are presented in Figure 9.10. The groupings appear fairly meaningful with the exception of the title, Civil Engineer, which is located somewhat anomalously in comparison with its grouping in the other solutions. This may be a result of the general lack of certainty among the subjects as to what Civil Engineering involves shown by the result listed in Table 9.3.

The results of applying a hierarchical cluster analysis to the similarities data for each of these groups appears quite satisfactory. In relation to other data, these solutions suggest that the occupational titles are being grouped together in a meaningful way. For the American data, the differences in the structure of these solutions provides further evidence for the possibility of age differences in the way the occupational titles are seen to be interrelated by the subjects. This raises questions

Column order (labels printed vertically above the chart): Aircraft Mechanic, Automobile Mechanic, Television Repairman, Electronics Technician, Customer Engineer, Maintenance Engineer, Civil Engineer, Electrical Engineer, Mechanical Engineer, Architect, Structural Engineer, Draftsman, Statistician, Technical Writer, Computer Programmer, Computer Operator

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Level
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  2   XXXX  .  .  .  .  .  .  .  XXXX  .  .  .  .  .
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  5   XXXX  XXXX  .  XXXX  XXXX  XXXX  .  .  .  .  .
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  7   XXXX  XXXX  .  XXXX  XXXX  XXXXXXX  .  .  XXXX
  8   XXXX  XXXX  XXXXXXX  XXXX  XXXXXXX  .  .  XXXX
  9   XXXX  XXXX  XXXXXXX  XXXX  XXXXXXX  XXXX  XXXX
 10   XXXXXXXXXX  XXXXXXX  XXXX  XXXXXXX  XXXX  XXXX
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 15   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
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FIGURE 9.10

Hierarchical Clustering: University of Minnesota Students (yellow form)

as to whether it is meaningful to talk of a consensus when referring to the stereotypes people hold of occupations. Even if people agree about the attributes they ascribe to occupations, they might disagree about how occupations are related to one another. The possible implications of this result to theories of vocational behaviour and of the choice process will be discussed subsequently. The analysis of this data for individual differences through multidimensional scaling will be important to unravel the possible dimensions of this variation. It is appropriate first, however, to look at the results from the multidimensional scaling of the aggregate data for each of the subject groups.

9.16 Evidence from the correlation matrix and the hierarchical clustering has suggested certain similarities and differences between the data sets. The fact that the multidimensional scaling solutions are all in three or four dimensions does pose some problems for the display of the solutions. Although the author has experimented with a number of forms of representation, including three dimensional graph paper and a computer generated display on a VDU that could be rotated (as shown in Figure 9.3), none of these methods allowed the rapid preparation of a large number of figures. It was finally decided that it was easiest to represent these solutions as a series of two dimensional plots. The coordinates of the multidimensional scaling solutions for each subject group are presented in Appendix J.

It will be convenient here to start with the solutions from the King Edward's schools, as inspection of the correlation matrix suggests that these two solutions are among the most similar. Note that the correlation matrix suggests that dimension two and three in these two solutions are interchanged. It is therefore appropriate to compare the plots of dimensions one and three from one solution

with the plot for dimensions one and two from the other. These plots are presented in Figures 9.11 to 9.14. In both these cases, the first dimension appears to distinguish working with people from working with things. In both groups the occupational titles with the highest positive loading are: Primary School Teacher, Police Officer, Social Worker and Staff Nurse, and the occupations with the highest negative loadings are: Electrical Engineer, Civil Engineer and Architect. For the group of King Edward's school students who were all fourth formers, as opposed to the group who were mixed fourth formers and sixth formers, the third dimension seems to distinguish the medically related occupations from occupations that involve working with data. For the other group of King Edward's students, it is the second dimension that best distinguishes among these occupations. The remaining solution is less easy to interpret but it distinguishes the artistic occupations, Photographer and Commercial Artist, from the rest. Although there are certain similarities with the pattern of dimensions that were suggested for the pilot data, the pattern appears less clear cut in this case. This might be because a dimensional interpretation is less appropriate for this data, or might be, perhaps, one result of reducing the number of occupational titles included in the questionnaire. The cluster analyses for these groups were presented earlier and indicated that for the group of fourth formers, the two occupational titles, Electrical Engineer and Radiographer, form a cluster not found in other solutions, although in other respects there was a considerable amount of similarity in the cluster analyses It is worth noting the somewhat higher than average degree of error the MSPACE analysis suggested might exist in these data sets. It will be interesting to see whether the individual differences scaling suggests that the fit of this group of subjects' data is

FIGURE 9.11

MINISSA scaling: dimensions 1 and 2: King Edwards Aston.

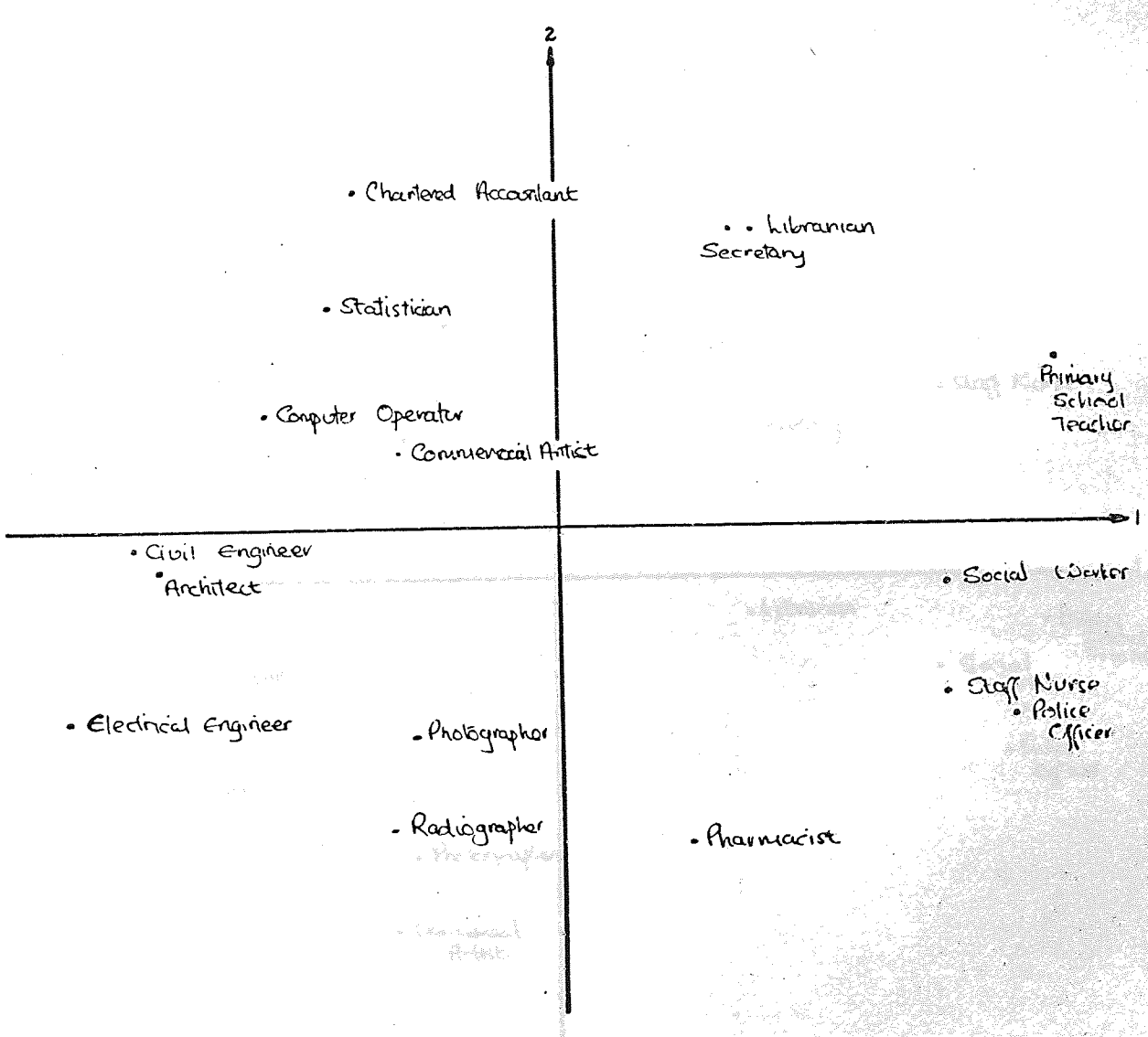


FIGURE 9.12

MINISSA scaling: dimensions 1 and 3: King Edwards Aston.

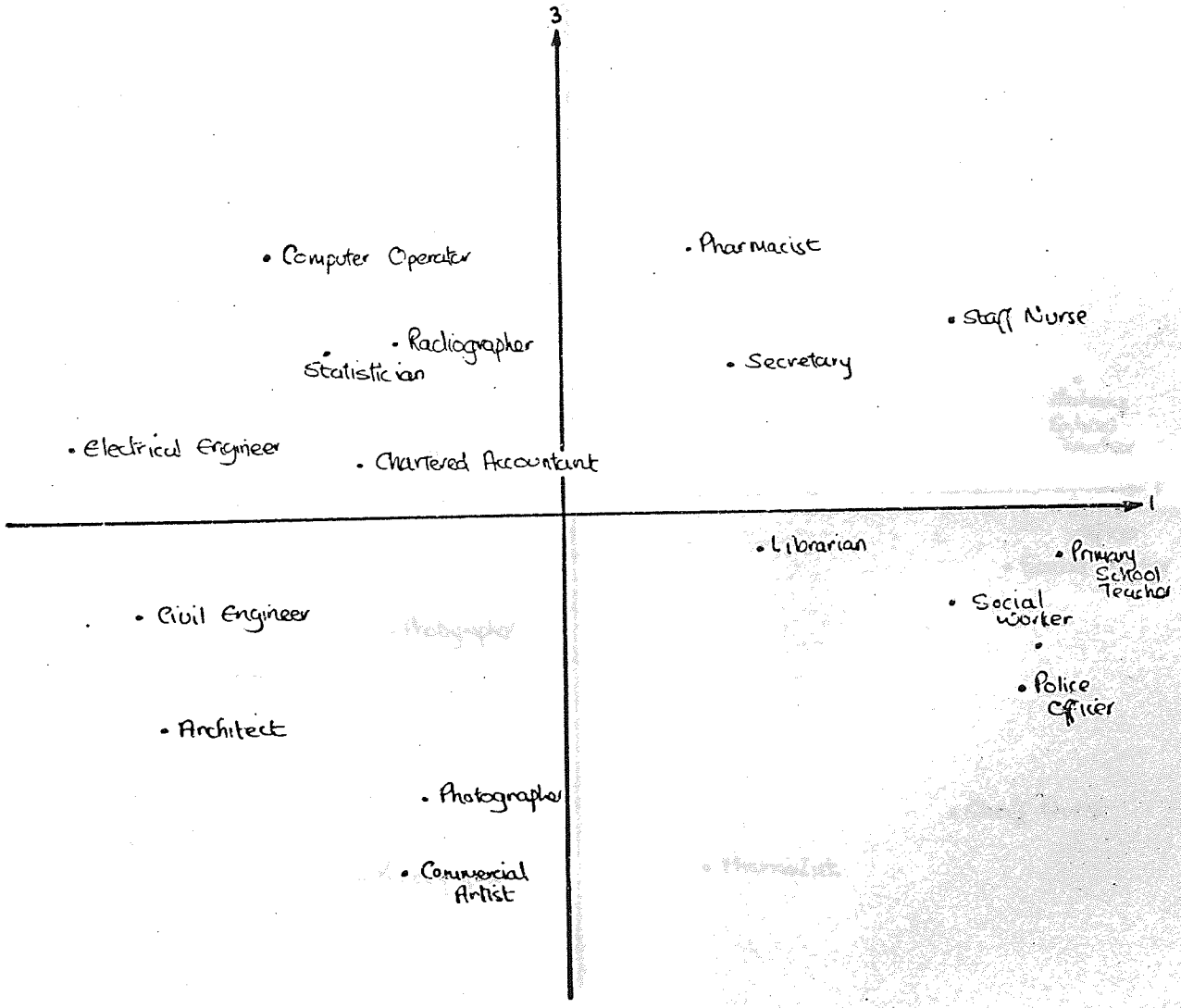


FIGURE 9.13

MINISSA scaling: dimensions 1 and 2: King Edwards Five Ways.

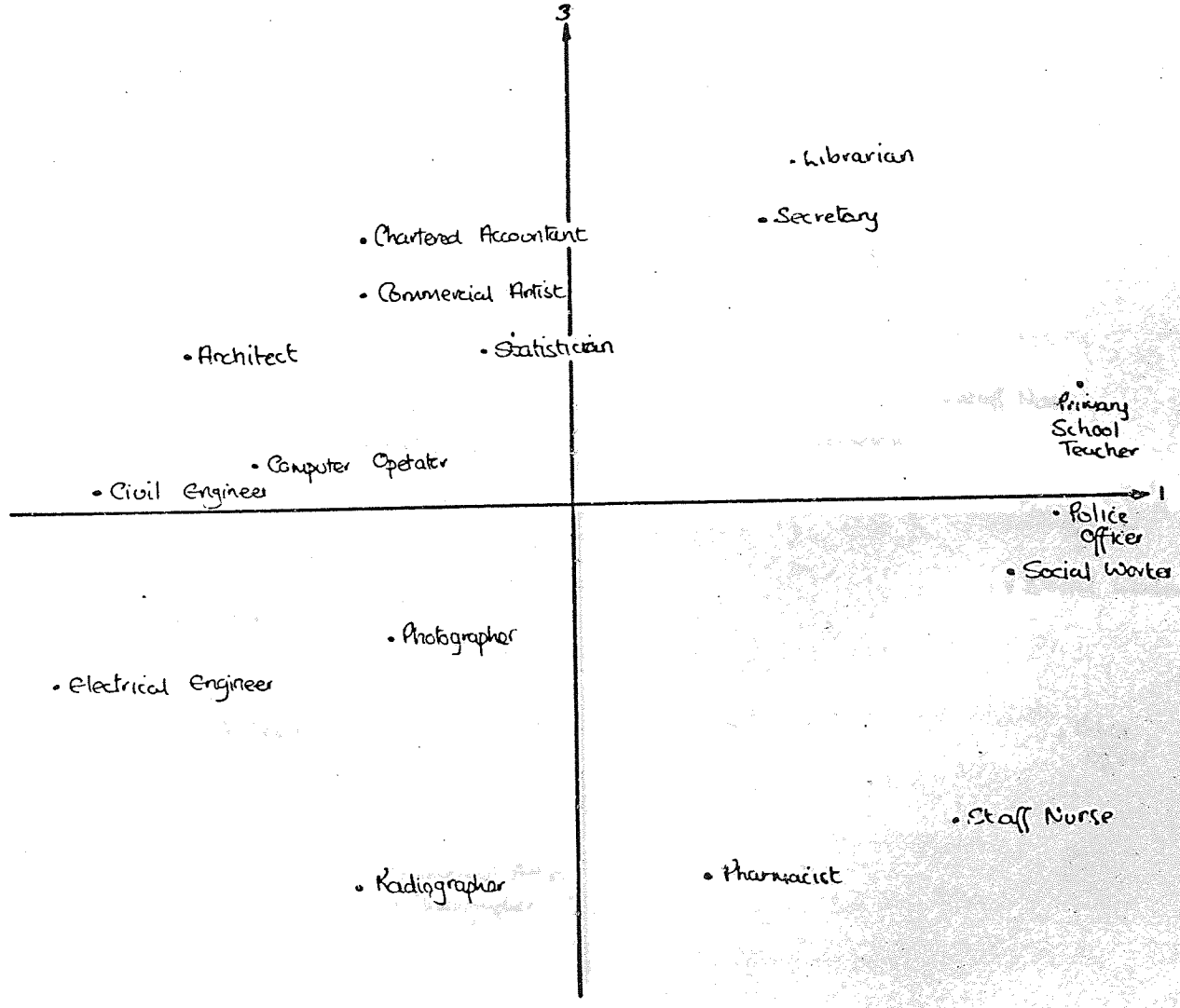
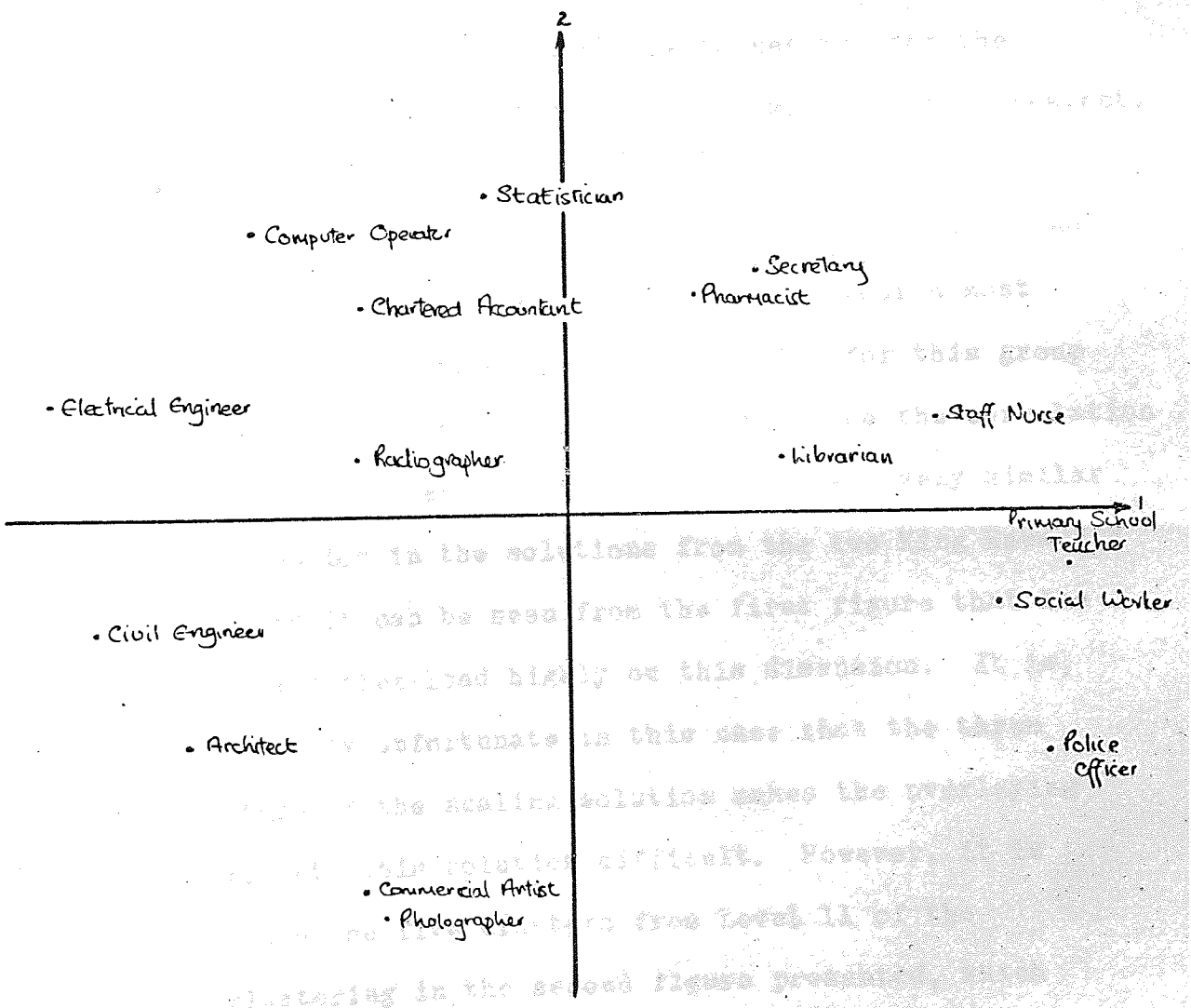


FIGURE 9.14

MINISSA scaling: dimensions 1 and 3: King Edwards Five Ways.



also lower than average.

An alternative reason why the solution may be less easily interpretable is that, in reducing the number of occupational titles included in the questionnaire from 20 to 16, the sample of occupational titles was being made less representative of the world of work. Thus, previously well defined groups, such as the medically related occupations or the engineering group of occupations, were being fragmented. It will be interesting to see whether the solutions from the other subject groups are similar in this respect.

9.17 The remaining British subject group is the Sharmons Cross Fifth Form girls, for whom the cluster analysis appeared most straight forward. The three dimensional solution for this group is shown in Figures 9.15 and 9.16. It appeared from the correlation matrix that the first dimension of this solution was very similar to the first dimension in the solutions from the two King Edward's School groups, and it can be seen from the first figure that the same occupational titles load highly on this dimension. It is, perhaps, particularly unfortunate in this case that the three dimensional nature of the scaling solution makes the overlaying of the clusters onto this solution difficult. However, it is possible to locate the five clusters from Level 11 of the hierarchical clustering in the second figure presented, which is a plot of dimensions two and three from the scaling solution. If it were possible to display this solution in three dimensions, it is clear that a close fit to the cluster analysis could be presented. It again appears difficult in this case to label dimensions explicitly, although regions of the three dimensional space are clearly associated with particular types of occupational title.

FIGURE 9.15

MINISSA scaling: dimensions 1 and 2: Sharmons Cross.

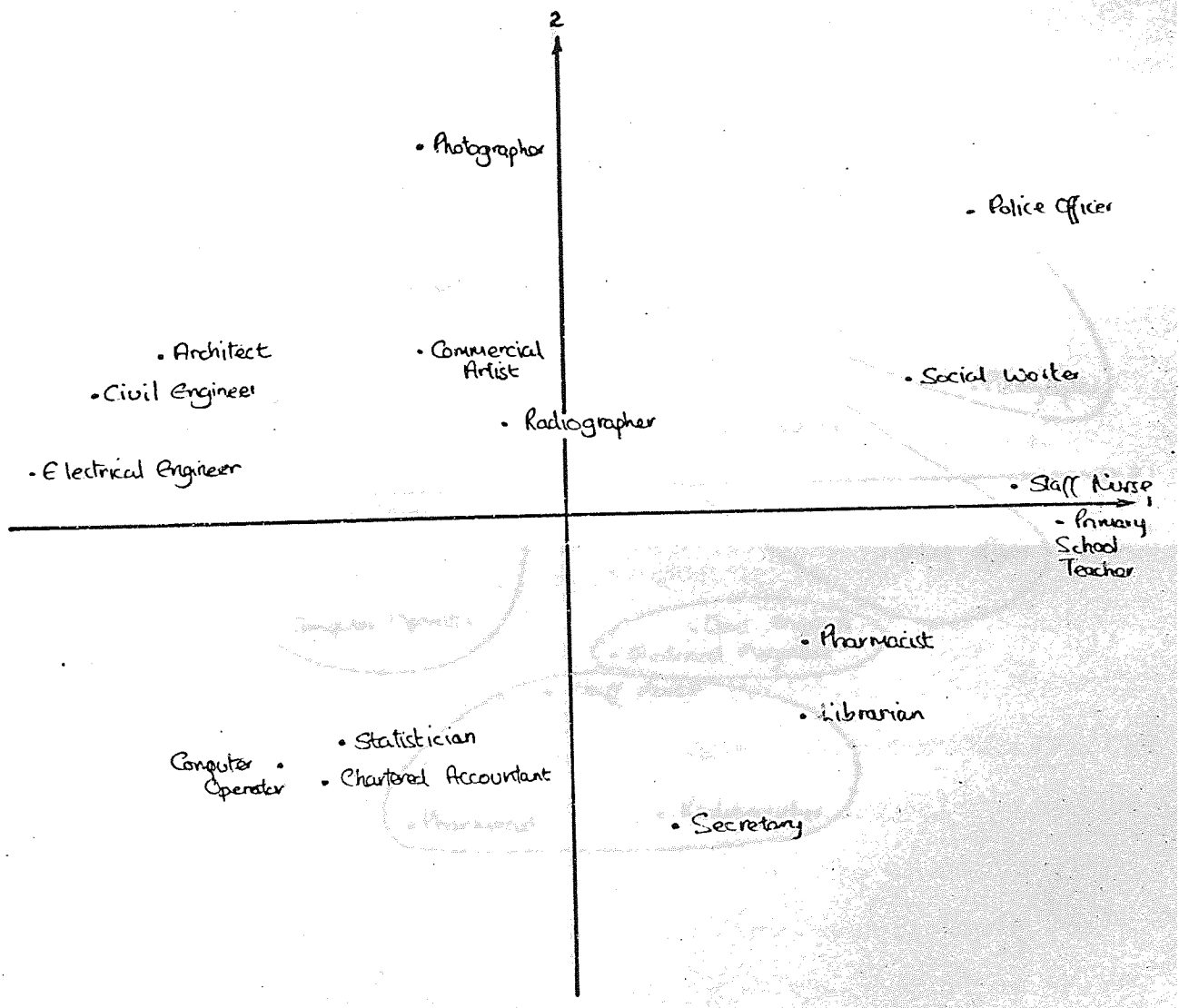
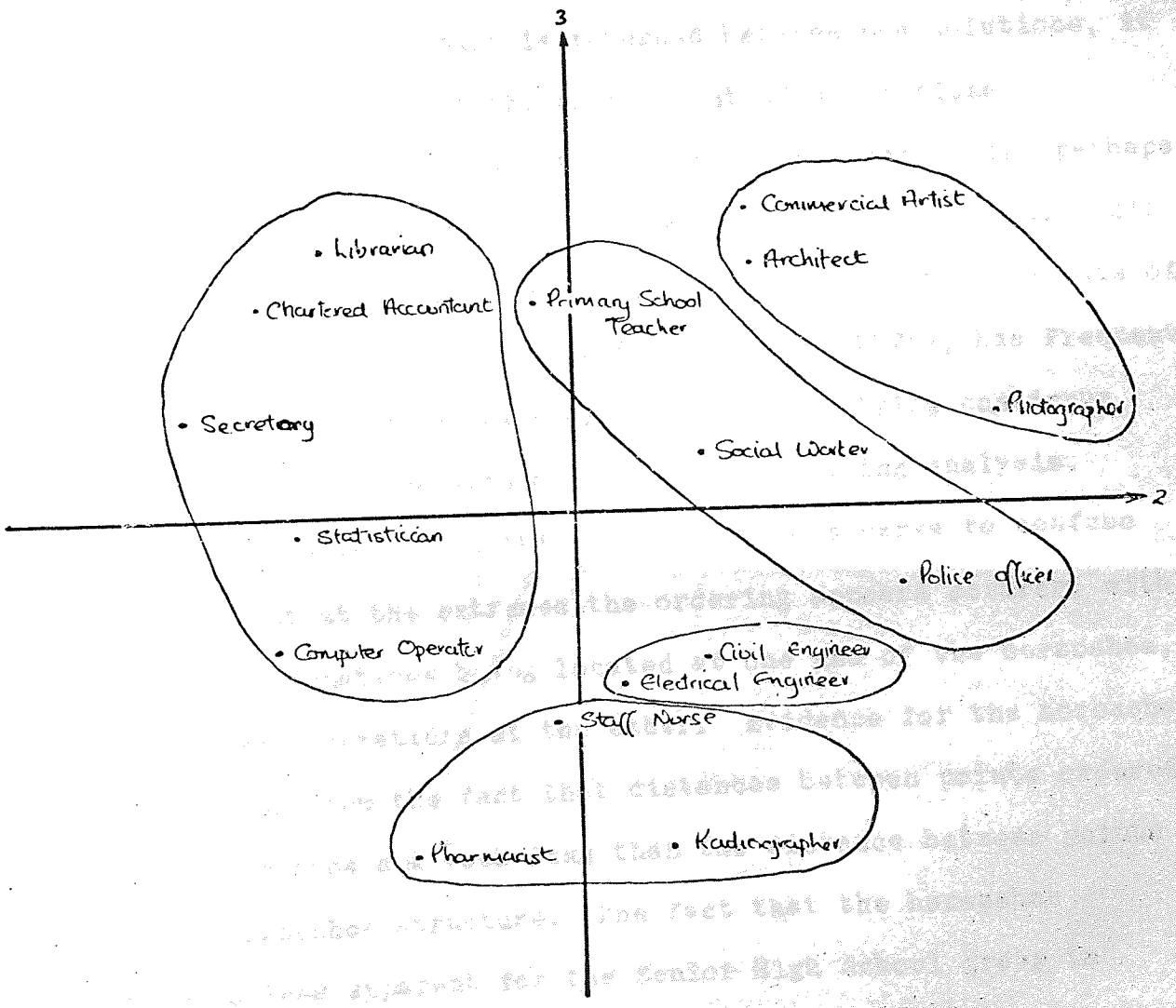


FIGURE 9.16

MINISSA scaling: dimensions 2 and 3: Sharmons Cross.



9.18 The next multidimensional scaling solutions that will be examined are from the High School Students. The solutions in three dimensions for these two groups are presented in Figures 9.17 to 9.20. Examination of the correlation matrix suggests that in this case the first dimension is again common to both solutions, but that the relationship between the third dimensions is comparatively slight. Comparing the plots for Dimensions 1 and 2 for both these solutions, although the second dimension is reversed between the solutions, it is interesting to note that the arrangement of occupations approximates the formation of a horse-shoe. This effect is, perhaps, clearest in the solution for the Junior High School Students. This type of pattern, which has quite often been found in the analysis of data from multidimensional scaling (see Kendall, 1971), has frequently been taken to indicate the existence of one underlying continuum which is being distorted into a curve in the scaling analysis. Obviously the presence of a third dimension does serve to confuse this pattern but at the extremes the ordering appears clearer, with the artistic occupations being located at one end of the horseshoe, and the social occupations at the other. Evidence for the horseshoe structure comes from the fact that distances between points ordered along the horseshoe are much less than the distance between points across the horseshoe structure. The fact that the horseshoe structure is less apparent for the Senior High School group is evidence again for the greater complexity of their solution as the presence of the horseshoe suggests that two dimensions could explain satisfactorily the Junior High School data. The first dimension in both these solutions is very similar to the first dimension of the British subject groups with the same occupations loading highly on it.

The third dimension in the Junior High School solution is

FIGURE 9.17

MINISSA scaling: Dimensions 1 and 2: Junior High School students.

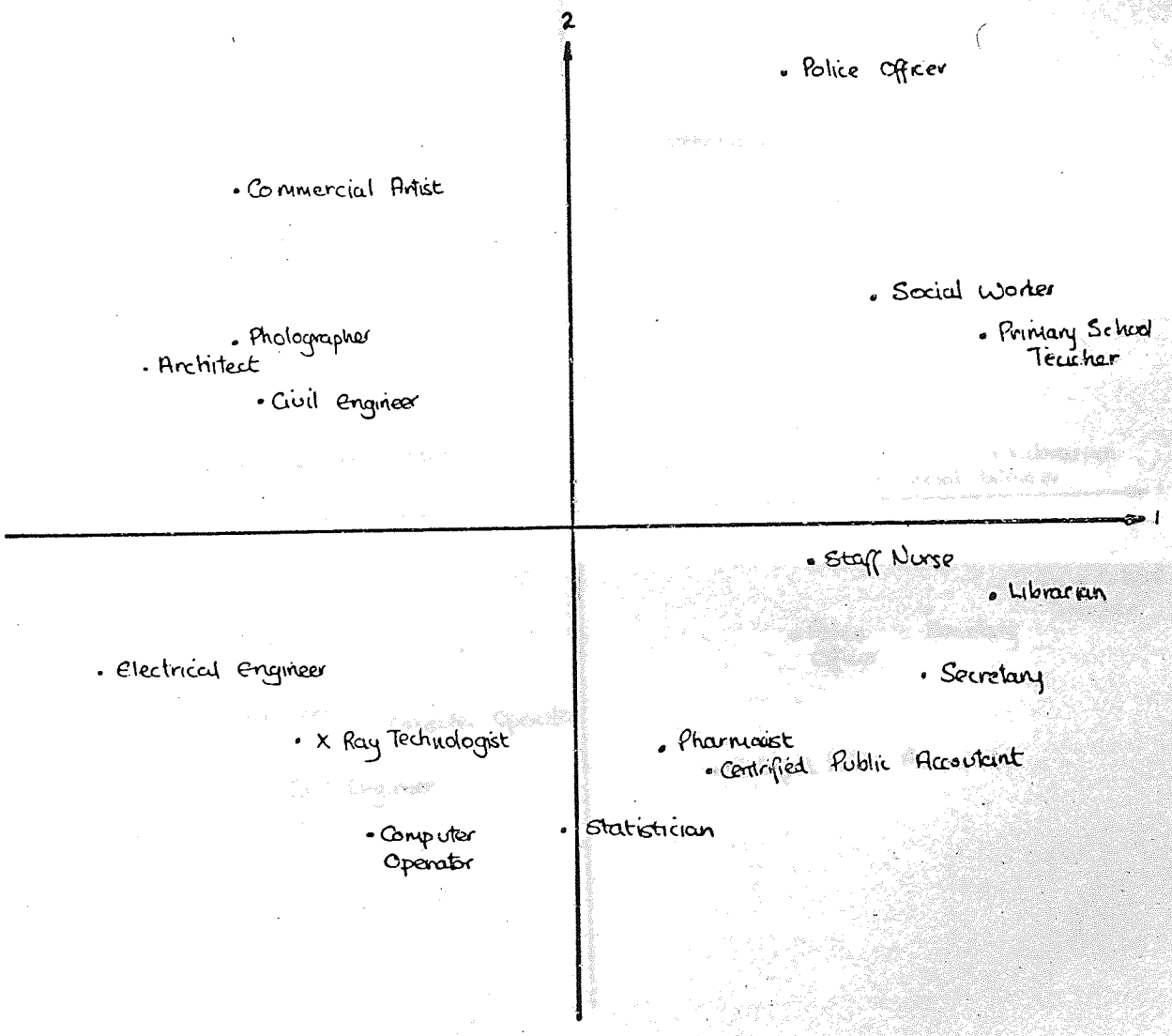


FIGURE 9.18

MINISSA scaling: dimensions 1 and 3: Junior High School students.

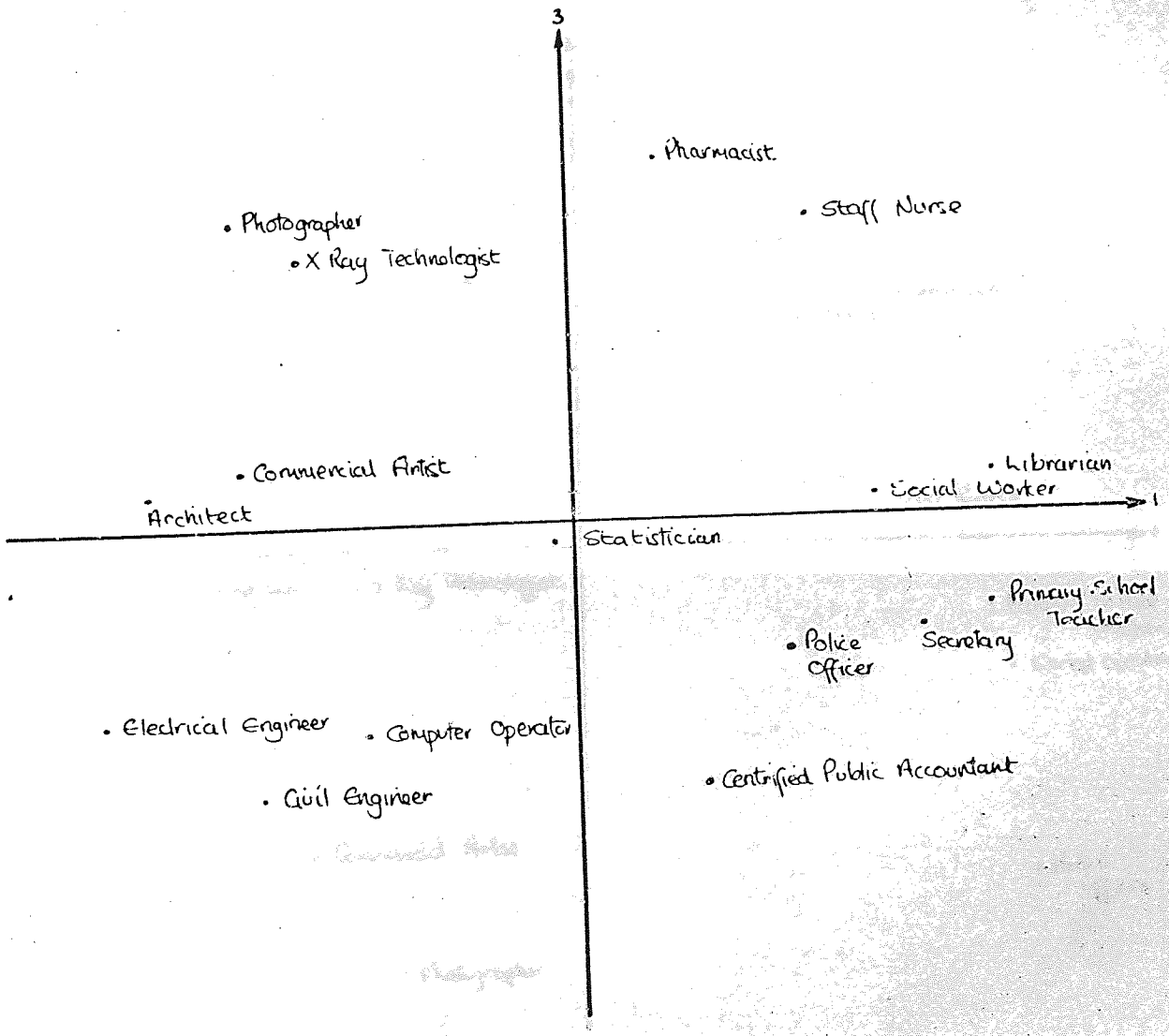


FIGURE 9.19

MINISSA scaling: dimensions 1 and 2: Senior High School students.

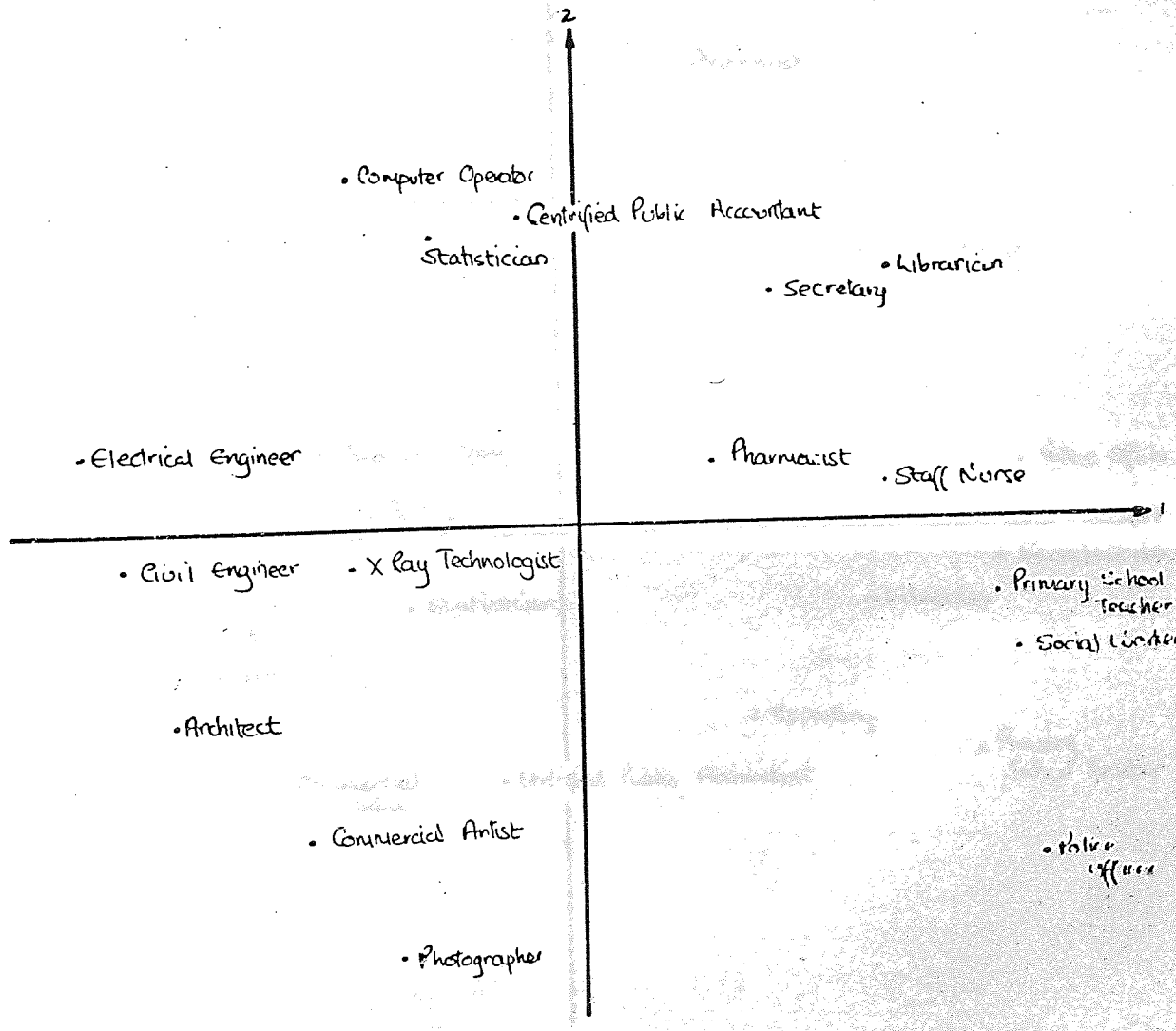
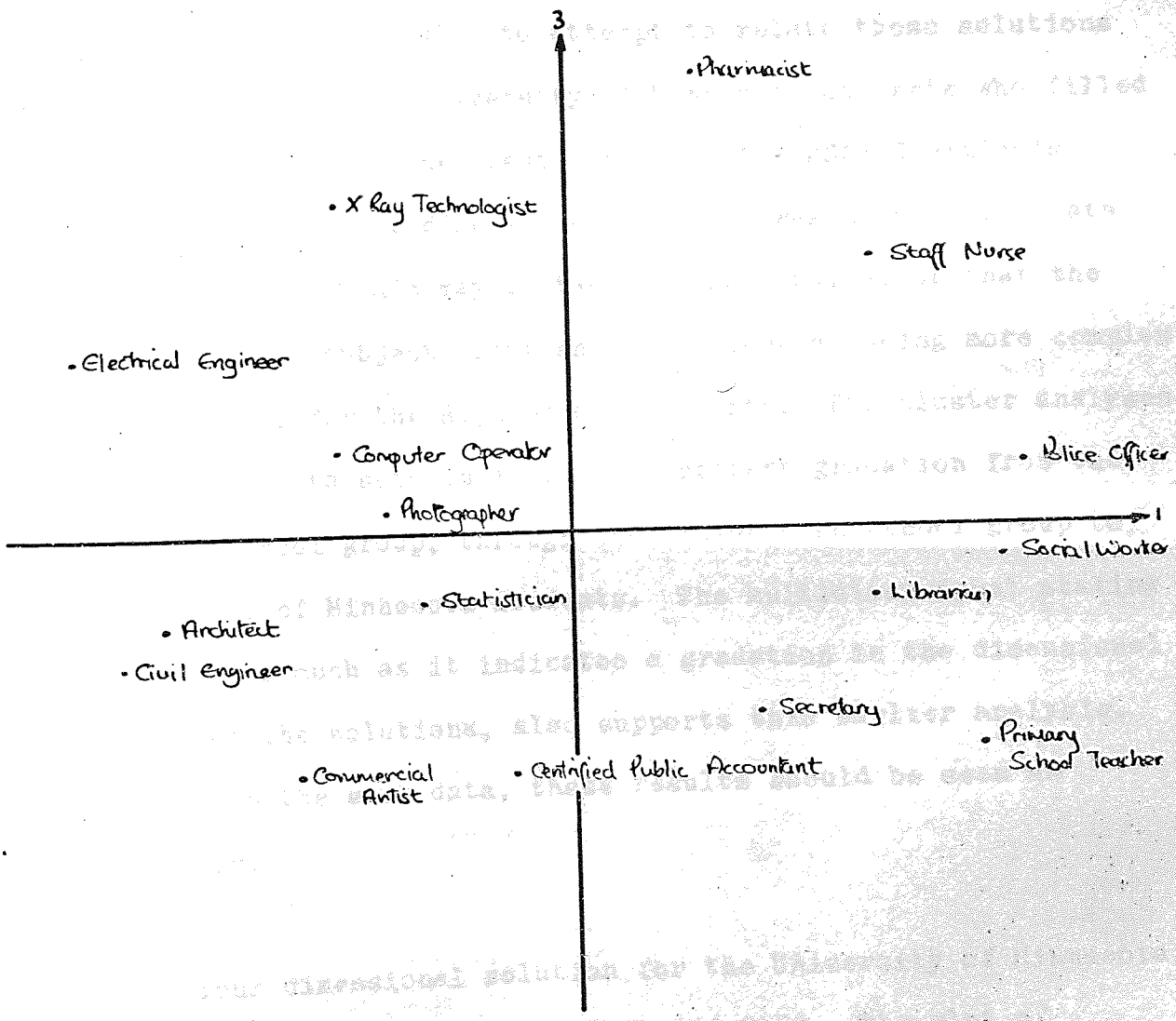


FIGURE 9.20

MINISSA scaling: dimensions 1 and 3: Senior High School students.



not amenable to interpretation alone, but serves to explicate the similarity relationship among the occupations that fall in the middle of the horseshoe in the first two dimensions. For the Senior High School students, the third dimension more clearly distinguishes the three medically related occupations from the remainder of the occupations.

9.19 It is interesting also to attempt to relate these solutions to the results from the University of Minnesota students who filled in the same version of the questionnaire. The MSPACE analysis indicated that the four dimensional solution was more appropriate for this data set. This may be taken as one indication that the results from this subject group should be seen as being more complex than the results for the High School students. The cluster analyses of these three data sets indicated an apparent gradation from the Junior High School group, through the Senior High School group to the University of Minnesota students. The multidimensional scaling analysis, in so much as it indicates a gradation in the dimensional complexity of the solutions, also supports this earlier analysis. Being based on the same data, these results should be seen as complementary.

The four dimensional solution for the University of Minnesota students is presented in Figures 9.21 and 9.22. The plot of dimensions one and two presents a horseshoe shaped distribution of the occupations once again, which is suggestive of a unidimensional continuum underlying this two dimensional plot. The additional two dimensions can be seen to serve to refine this ordering and to make the relationship between different occupations more explicit. This solution also makes clear some interrelationships between

FIGURE 9.21

MINISSA scaling: dimensions 1 and 2: University of Minnesota students (white form)

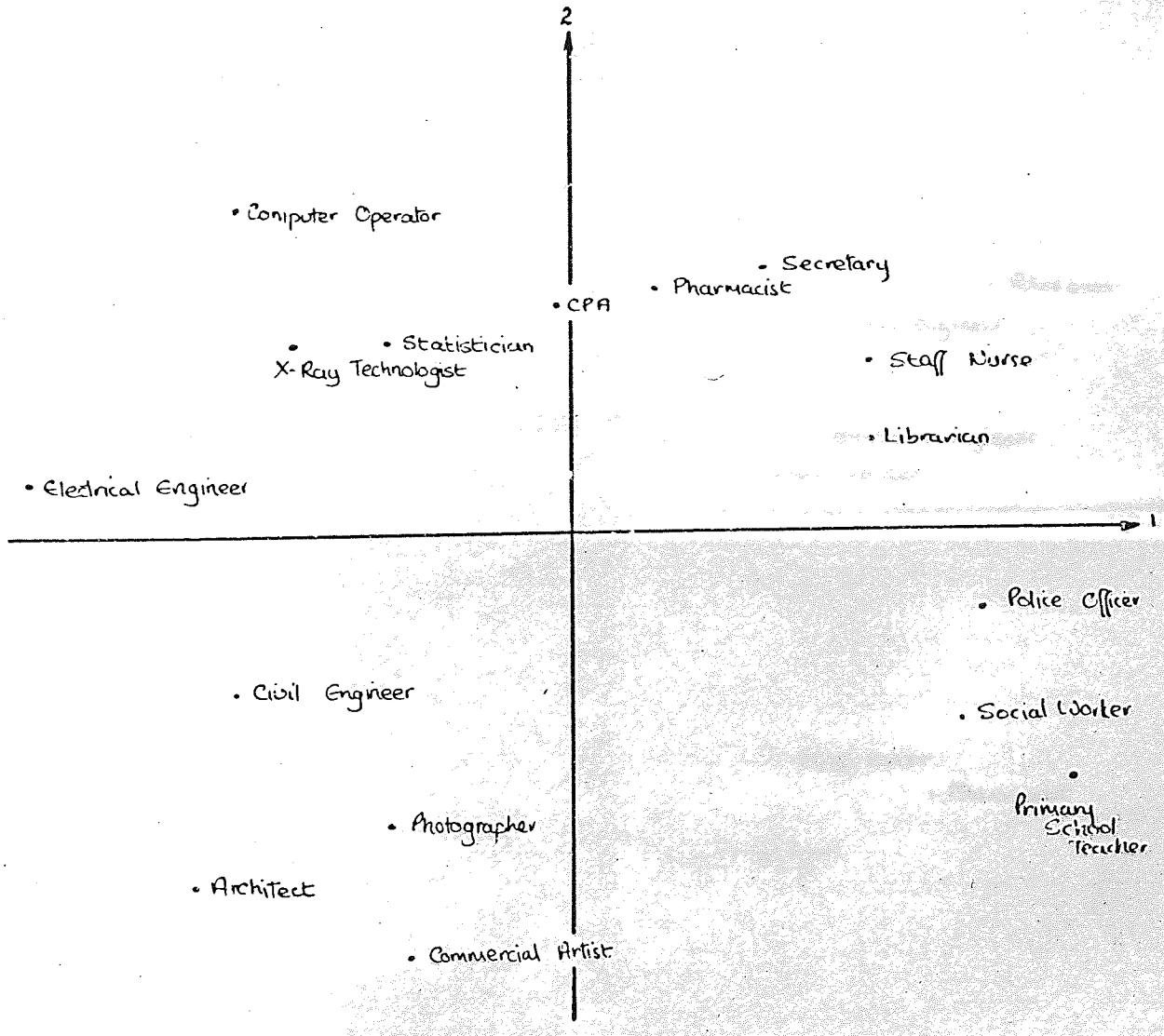
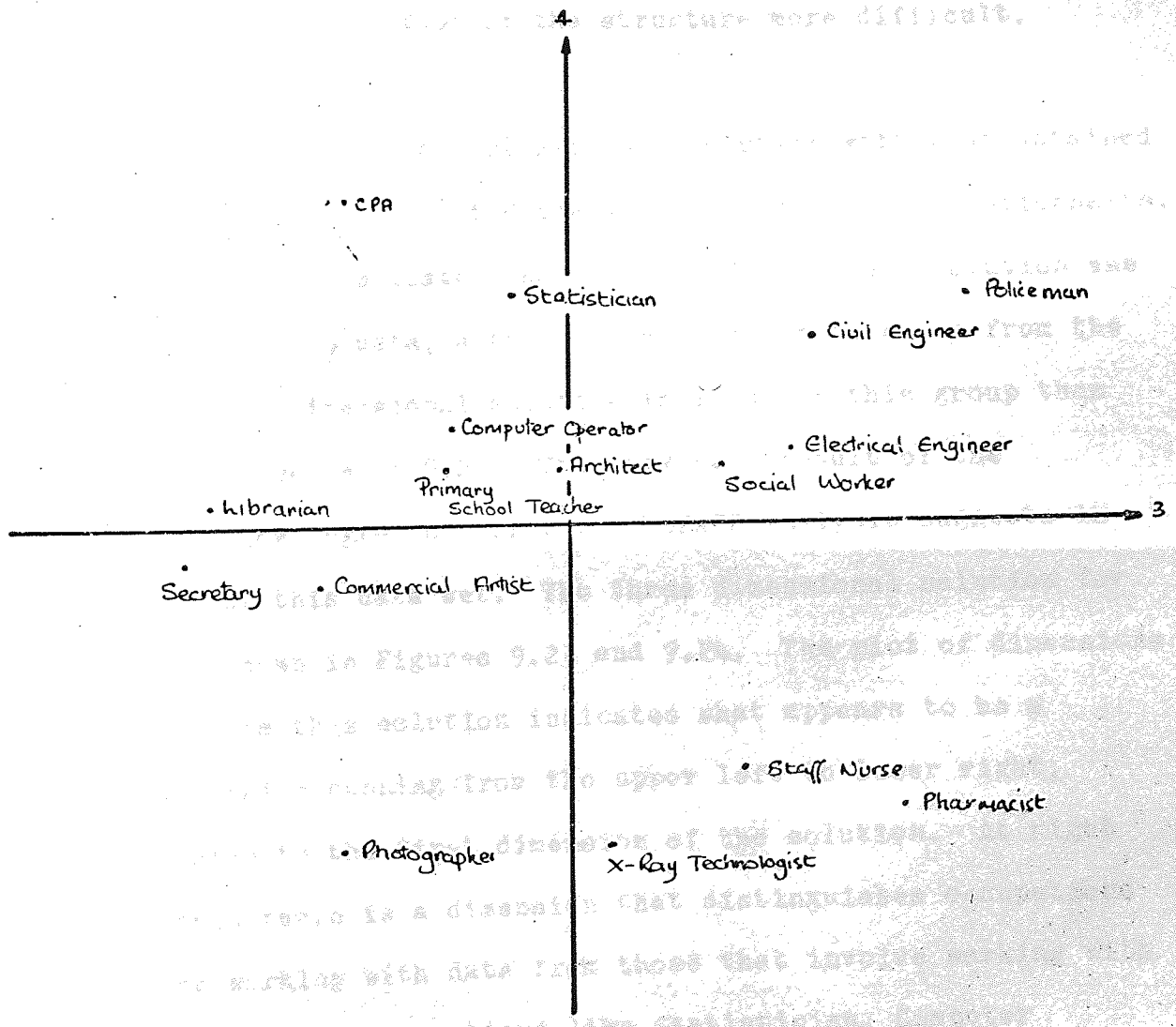


FIGURE 9.22

MINISSA scaling: dimensions 3 and 4: University of Minnesota students (white form)



occupations which are not clear in the cluster analysis, for example, that the pair of occupations, Computer Operator and Statistician, are seen as being closely related. In this example, it is possible to see how the multidimensional scaling, by offering a more complex representation of the data set than the hierarchical clustering, is able to reflect better some of the subtleties of the relationships between the occupational titles, although this can serve to make interpretation of the structure more difficult.

9.20 It is also useful to contrast this solution with that obtained from the students who completed the yellow form of the questionnaire. The MSPACE analysis indicated that a three dimensional solution was appropriate for this data, although the increase in error from the three to the two dimensional solution is less for this group than for any other (see Table 9.2). This may be a result of the comparatively low degree of error the MSPACE analysis suggests is appropriate for this data set. The three dimensional solution for this data is shown in Figures 9.23 and 9.24. The plot of dimensions one and two from this solution indicates what appears to be a prestige dimension running from the upper left to lower right, closely related to the first dimension of the solution. At right angles to this there is a dimension that distinguishes occupations that involve working with data from those that involve working with things - that is the occupations like Statistician, Computer Programmer and Technical Writer from occupations like Maintenance Engineer, Aircraft Mechanic and Automobile Mechanic. This might represent an almost triangular structure within the solution, with occupations that involve working with ideas and concepts, such as Architect, Draftsman, Structural and Civil Engineer, further distinguished within the solution. This suggested structure is

FIGURE 9.23

MINISSA scaling: dimensions 1 and 2: University of Minnesota students

(yellow form)

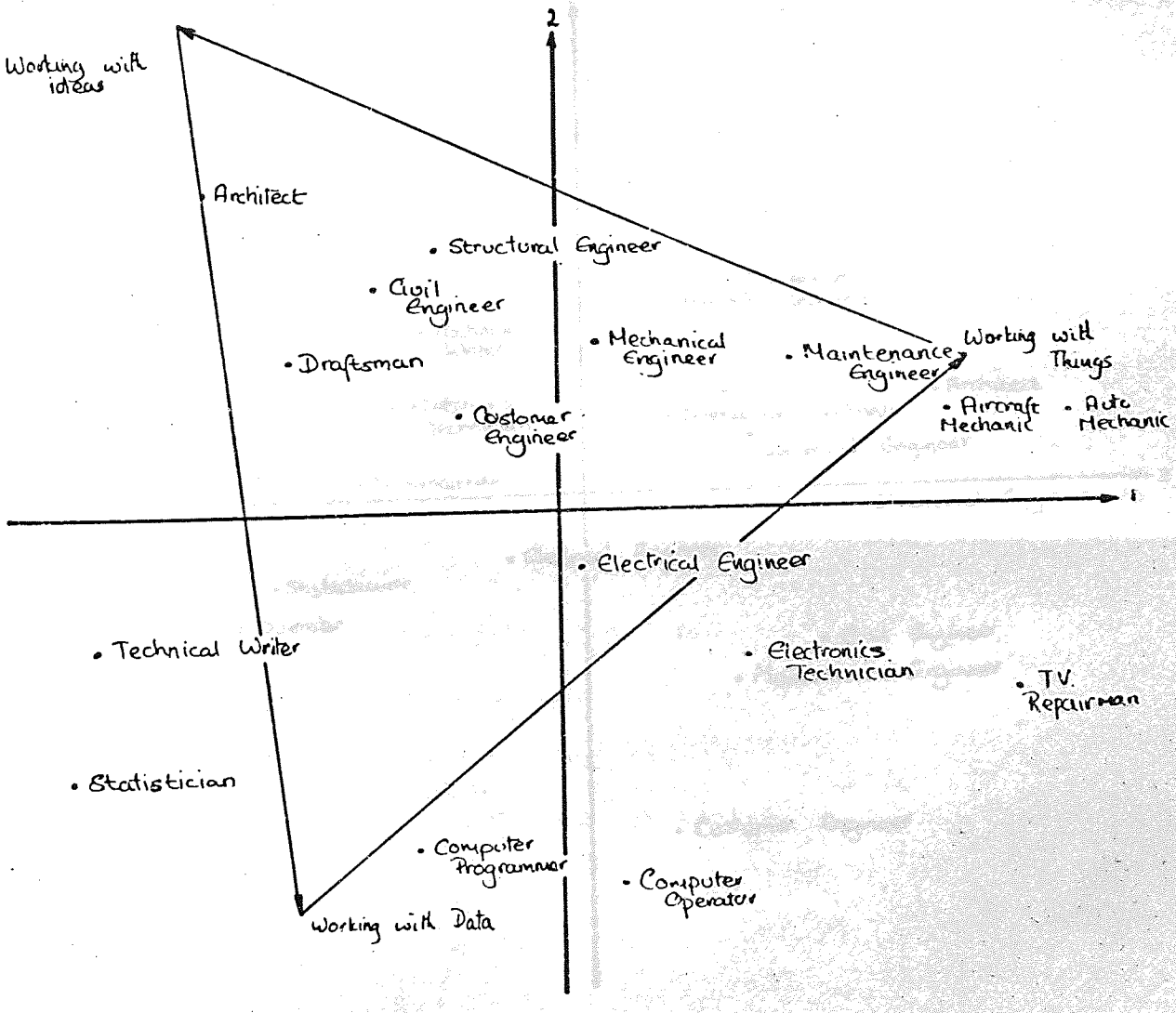
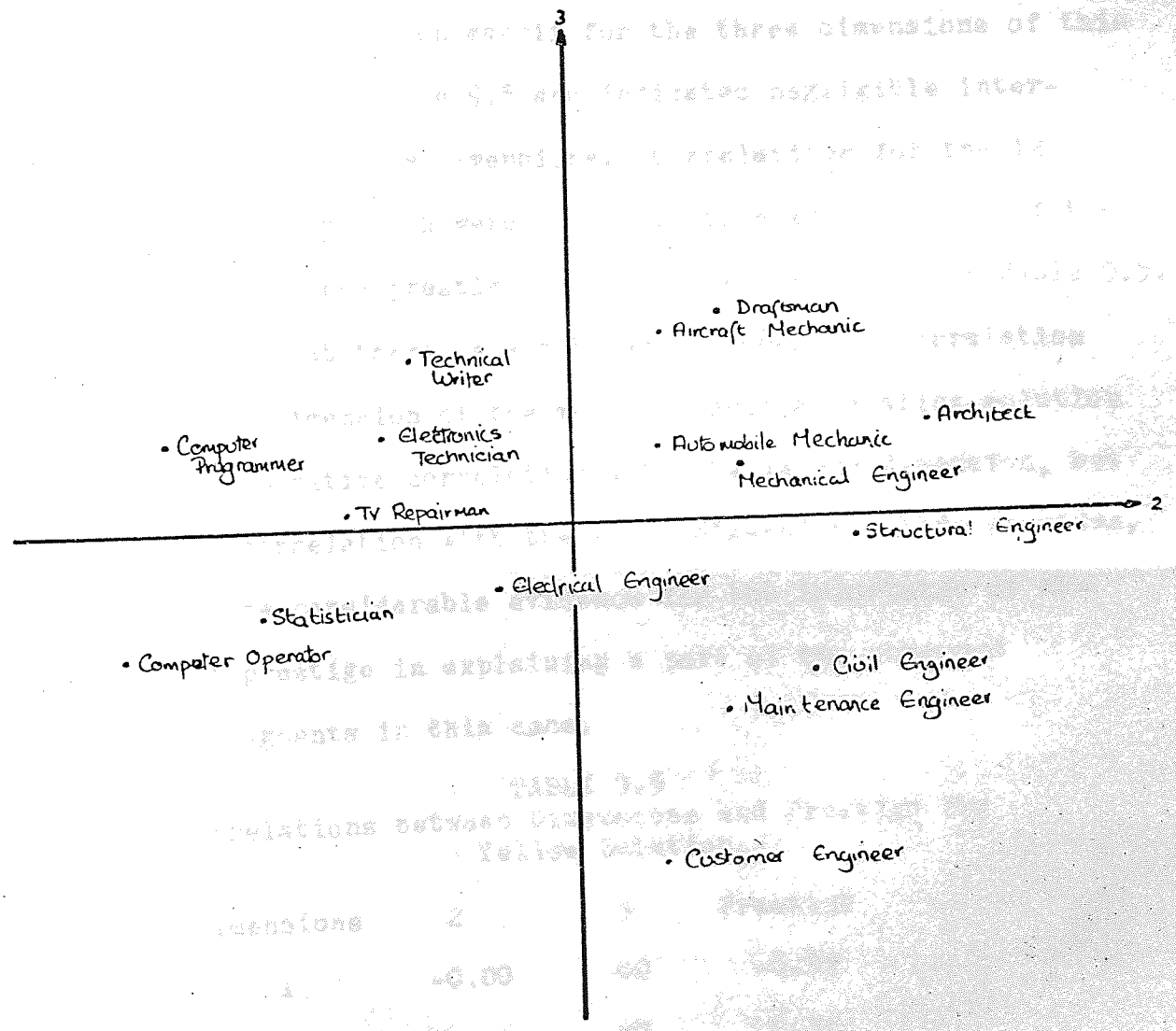


FIGURE 9.24

MINISSA scaling: dimensions 2 and 3: University of Minnesota students (yellow form)



overlaid in the solution.

To examine the structure of this solution further, it was decided to correlate the order of the occupations in this solution with the order of occupations obtained from the prestige rating by the University of Minnesota students. It will also be useful to look at the intercorrelation matrix of the dimensions of this solution. The correlation matrix for the three dimensions of this solution is given in Table 9.5 and indicates negligible inter-correlations between the dimensions. Correlations for the 12 occupational titles which were common to both this section of the questionnaire and the prestige question are also given in Table 9.5. These indicate that there is a substantial negative correlation with the first dimension of the multidimensional scaling solution and a smaller positive correlation with the second dimension, but a negligible correlation with the third dimension. This provides, therefore, some considerable evidence for the importance of the dimension of prestige in explaining a part of the observed similarity judgments in this case.

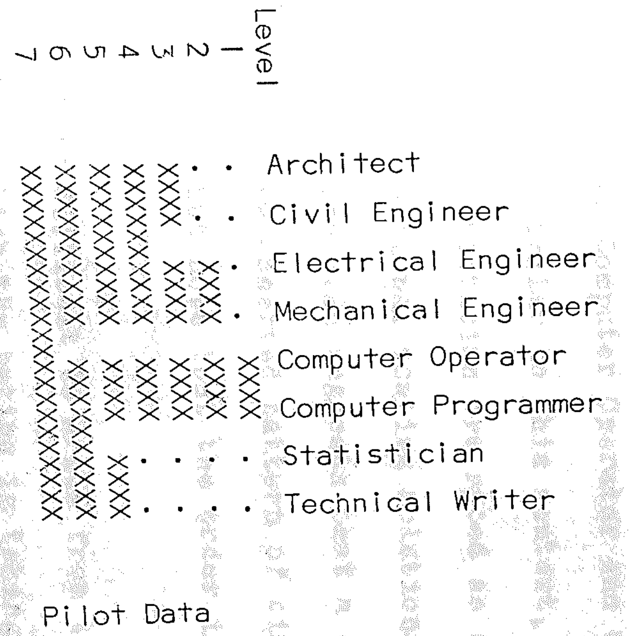
TABLE 9.5
Correlations between Dimensions and Prestige for Yellow Solution.

Dimensions	2	3	Prestige
1	-0.00	00	-0.73
2		00	0.30
3			0.04

The plot of dimensions two and three, which is shown in Figure 9.28 indicates that for this group also there appears to exist a horseshoe structure which distinguishes among the occupations in terms of content. The effect of the first dimension

is to make distinctions within this solution in terms of prestige, but these are obscured in this plot. It is also possible to see that the cluster analysis fits the three dimensional solution well. It is interesting to note in the solution for this subject group how content is related to prestige. If the suggested triangular distinction in terms of content is accepted, it is apparent that working with ideas or data is seen as of higher status than working with things.

9.21 Comparing the structure of this solution with the solutions obtained from the other version of the questionnaire, it is seen that a different set of constructs appear to be used by the subjects to evaluate these occupations. Although some of the content dimensions are similar, because none of the occupations involves working with people - as several of the occupations that are included in both the pilot data set and the white form of the questionnaire obviously do - the distinction made between the occupations might be expected to be different. While this result is not unexpected, what is of greater interest is whether the eight occupations that are included in both the pilot version of the questionnaire and this yellow version were rated in a similar way in these two different contexts. The matrices of similarity ratings for these eight occupations were, therefore, selected out from these data sets and submitted to the MINISSA program for scaling to examine whether the relationships between them were structured in the same way. A hierarchical cluster analysis was also carried out for the two data sets. This is presented in Figure 9.25. There is considerable similarity among these two solutions, although the order in which clusters appear is different for the two sets of data. Two effects seem to be taking place.



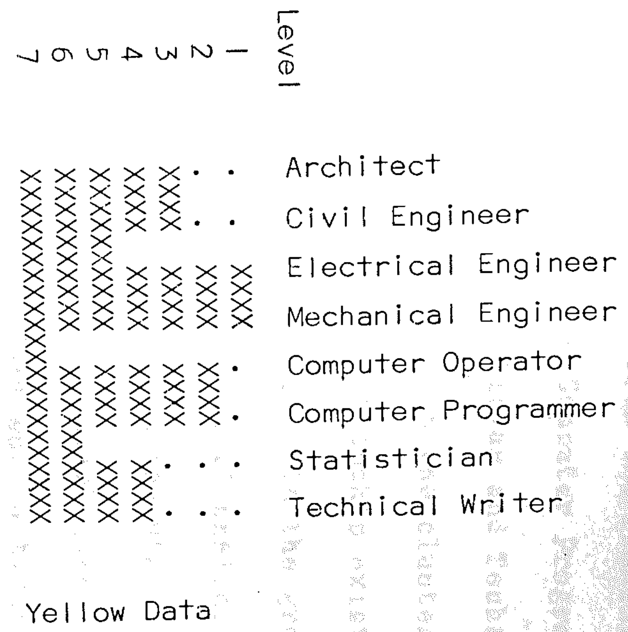


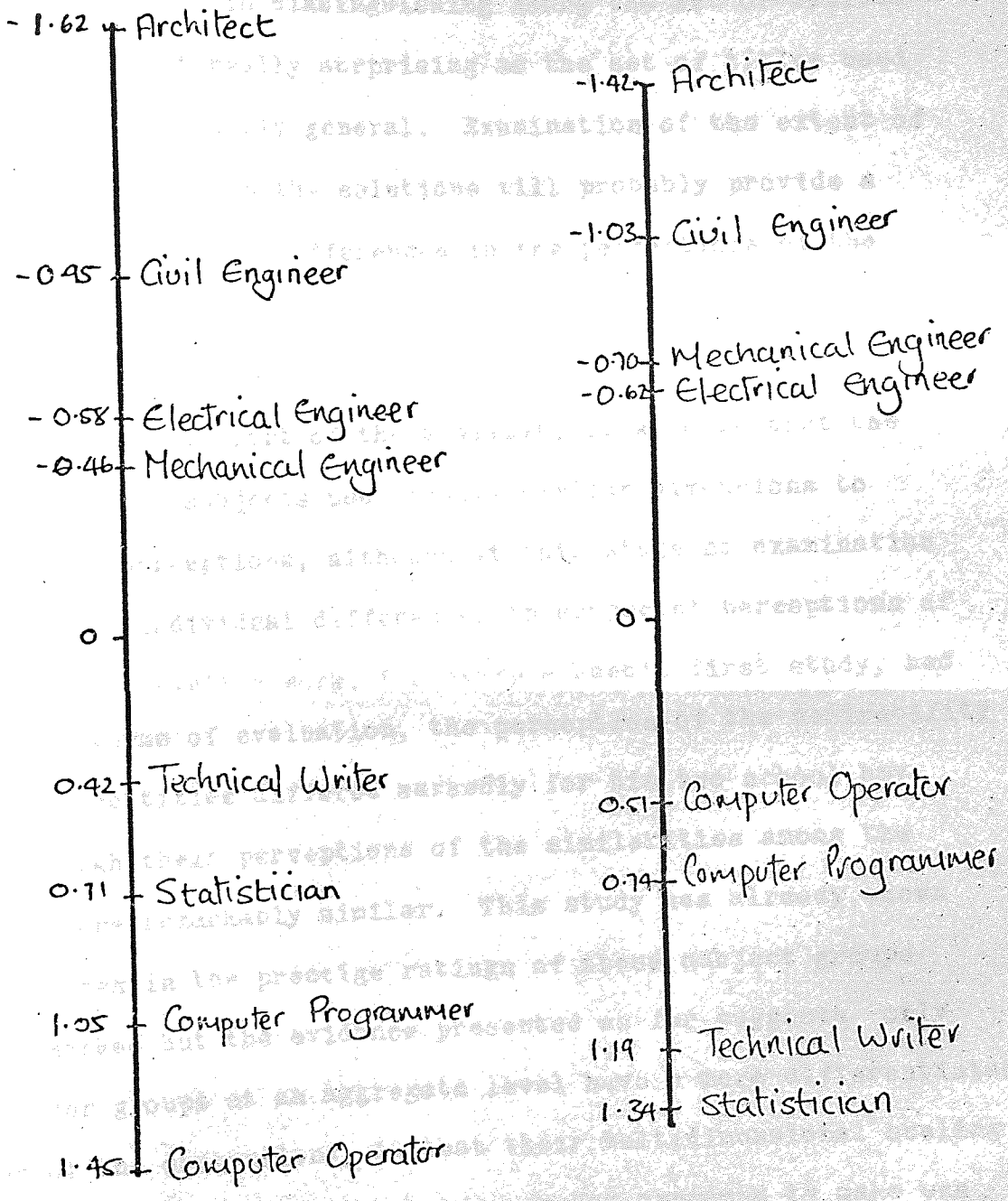
FIGURE 9.25 Hierarchical Clustering: pilot data and yellow data reduced set of titles.

First, in the pilot questionnaire the engineering occupations, in this case including the titles Architect, Civil Engineer, Electrical Engineer and Mechanical Engineer are distinguished as a tight knit cluster from the remaining occupations. The titles Computer Operator and Computer Programmer are also a tight cluster, but the titles Statistician and Technical Writer form a cluster only at a higher level in the clustering, suggesting that only a comparatively weak relationship exists between them in comparison with the other occupations in the group. In contrast with the yellow version of the questionnaire, the subjects appear to have rated the occupations (on the whole) as being less similar than those who filled in the pilot questionnaire. Thus the engineering occupations do not form such a tight knit cluster, perhaps because subjects are making finer distinctions among the occupational titles in this context, where the occupational titles are also being compared with other occupational titles in a similar field. The two titles Computer Operator and Computer Programmer are also seen as less similar in this context, but the titles Technical Writer and Statistician are rated as similar as they were before. The multidimensional scaling solutions for both these sets of data shown in Figure 9.26 suggests that a one dimensional solution represents the observed pattern of similarities among the occupations quite well, but note that the order is different in the two cases.

It is difficult to argue from this data either that the context in which the rating is taking place causes marked differences in the similarity rating or that the context is having no effect on the rating of the occupational titles. Obviously this has not proved a strong test of the range of convenience notion that people will perceive the occupations differently in different contexts. However, comparison of the replies to the two versions of the

FIGURE 9.26

MINISSA scaling: one dimensional plots: pilot data and yellow data: reduced set of titles.



questionnaire used in the main study suggested that, when the occupations are of a similar occupational level, distinctions are made between them in terms of the content of the occupations, but that when occupations also differ in terms of level, a prestige dimension is also used in distinguishing among the set of titles. These results are not really surprising as the set of titles used in both contexts are fairly general. Examination of the extent of individual differences in the solutions will probably provide a better means of exploring differences in the perceptions of the titles.

9.22 To conclude this part of the analysis, it appears that the different groups of subjects use broadly similar dimensions to structure their perceptions, although at this stage no examination has been made of individual differences in subjects' perceptions of the occupations. Earlier work, for example Reeb's first study, had shown that in terms of evaluation, the perception of the desirability of different job titles differed markedly for his two school boy groups, although their perceptions of the similarities among the occupations were remarkably similar. This study has already shown that differences in the prestige ratings of these subject groups were quite marked but the evidence presented so far suggests only that the older groups at an aggregate level have a more differentiated perception of the occupations, in that their multidimensional scaling solutions were more complex. The older groups appeared to make use of more dimensions in their judgements than the younger groups. The nature and cause of this greater differentiation is not at present clear and could be a reflection of greater consensus among the older group as to their ratings or an indication that they are making finer distinctions among the occupations.

The methods used for the analysis of this data have proved fairly satisfactory. The MSPACE programme provided a most helpful aid to the interpretation of the dimensionality of the solutions. Analyzing the data by both hierarchical cluster analysis and multidimensional scaling has generated solutions that have served to complement each other and in this way made the interpretation of the data easier. There are problems in using techniques for analysis which are themselves novel and these will be discussed subsequently.

However, the major significance of the results that have been presented in this chapter is the demonstration of the remarkable similarity in the solutions, both across age groups and countries. These results suggest that developmental differences are probably more important than differences between the two countries. In this case, the differences between the subjects of different ages appears more significant than differences between subjects in different countries. Unfortunately, the nature of the subject populations did not provide as strong a test of this hypothesis in this data as had been originally intended.

Although it is difficult to make comparisons between the solutions directly, the fact that both methods of analyzing the American data suggested a gradation in the solutions, from the younger to the older group, increases confidence in the validity of these findings. The next chapter examines the range of individual differences in the data in greater detail. This is intended to provide additional information to assist in the further interpretation of this data and also to elucidate the nature of the differences in the responses between different groups of subjects.

10. INDIVIDUAL DIFFERENCES SCALING.

10.1 This chapter is concerned with the analysis of the results of the individual differences scaling. The purpose of this analysis is to examine the range and extent of individual differences within the data and, in particular, whether the range of these differences appears to differ across the subject groups.

For this analysis the group configurations from the MINISSA programme were used as starting configurations for the INDSCAL programme. Although INDSCAL does generate group occupational spaces for the occupations, in all cases these were very similar to the initial starting configurations and there is, therefore, little point in presenting these data as well as the group solutions, which were presented earlier. This section is concerned solely with the results from INDSCAL in so much as they give information about the range and extent of individual differences in the solution.

10.2 It should be pointed out that the INDSCAL programme used for this analysis is not nonmetric like the programmes MINISSA and TORSCA that were used for the group analysis. INDSCAL makes the assumption that the distances between the occupations in the solution are a linear rather than a monotonic function of the original similarities ratings. However, in practice, when comparing the results of this scaling procedure to a quasi-nonmetric version of INDSCAL, Carroll (1972), one of the originators of the programme, says that this assumption does not seem to do violence to the quality of the solution obtained, so long as the correct dimensionality is used. The advantage, in this case, of having available

the output of the MSPACE analysis is considerable as it has enabled a more informed choice of dimensionality to be made.

INDSCAL analysis of the data to be reported had, in fact, been carried out for most of the subject groups before the MSPACE programme became available, although at that stage no decision had been made as to the most appropriate dimensionality for the data. Solutions for all the American subject groups had been obtained in four through to two dimensions and the goodness of fit measures for these data are listed in Table 10.1. Solutions for the British subject groups were obtained after the MSPACE analysis had been carried out and were, therefore, only obtained in three through to one dimension. These results are also listed in Table 10.1. In this table, the percentage of variance accounted for is obtained by squaring the correlation between the group solution and original similarities data given in column one. The programme also generates for each subject a set of weights which indicates the extent to which a particular subject uses the different dimensions of the solution. The meaning that can be given to these weights will be discussed subsequently, but at this stage it is important to note that they allow the calculation for each subject of a correlation coefficient that indicates how well a particular subject's data are fitted by the group solution that has been obtained. The correlation coefficient given in the final column indicates the average value of this correlation coefficient for the particular subject group. The extent to which different subjects' data are fitted by the INDSCAL solution provides one way that individual differences in the solutions can be examined. One indication of this is the range of values of the correlation coefficient for a particular subject group.

TABLE 10.1

Summary of overall INDSCAL measures of goodness of fit.

Data Set and Dimensions	Correlation between Data and Fitted (Predicted) Similarities	% age of Variance Accounted for	Average Subject Correlation
Pilot Data			
4	0.707	49.96	0.699
3	0.647	41.86	0.637
2	0.571	32.55	0.559
Students White			
4	0.782	61.12	0.779
3	0.722	52.12	0.719
2	0.647	41.87	0.643
Students Yellow			
4	0.709	50.23	0.705
3	0.667	44.44	0.662
2	0.587	34.48	0.582
Senior High School			
4	0.744	55.40	0.738
3	0.684	46.80	0.677
2	0.609	37.10	
Junior High School			
4	0.679	46.10	0.668
3	0.612	37.5	0.598
2	0.537	28.80	0.523
Aston			
3	0.742	54.99	0.739
2	0.663	43.96	0.661
1	0.552	30.51	0.549
Five Ways			
3	0.730	53.30	0.727
2	0.641	41.00	0.637
1	0.526	27.60	0.521
Sharmons Cross			
3	0.709	50.20	0.703
2	0.630	39.70	0.624
1	0.517	27.70	0.508

10.3 The first set of data to be analyzed using the INDSCAL programme was the pilot data. The solution indicated a reasonable fit for this data in three dimensions. Although the average subject correlation is 0.637, the range of values goes from 0.209 to 0.787, which indicates a range from a subject whose data are fitted very poorly by the solution to a subject with over 60% of the variance in his data accounted for by the solution. This suggests, first of all, that there is a substantial range in the extent to which subjects' data are fitted by the solution. This distribution of the correlation coefficients is presented in Figure 10.1 as a histogram and this provides one indication of the extent of individual differences in the data. Examining the distribution for the two sexes, it was seen that the women were fitted better by the solution than the men. It was decided to test whether there was a difference between the means for this distribution between the men and the women. The results of this t test are given in Table 10.2, which indicates that there is no significant difference between the scores.

TABLE 10.2

INDSCAL pilot data subject correlations: t-test men versus women.

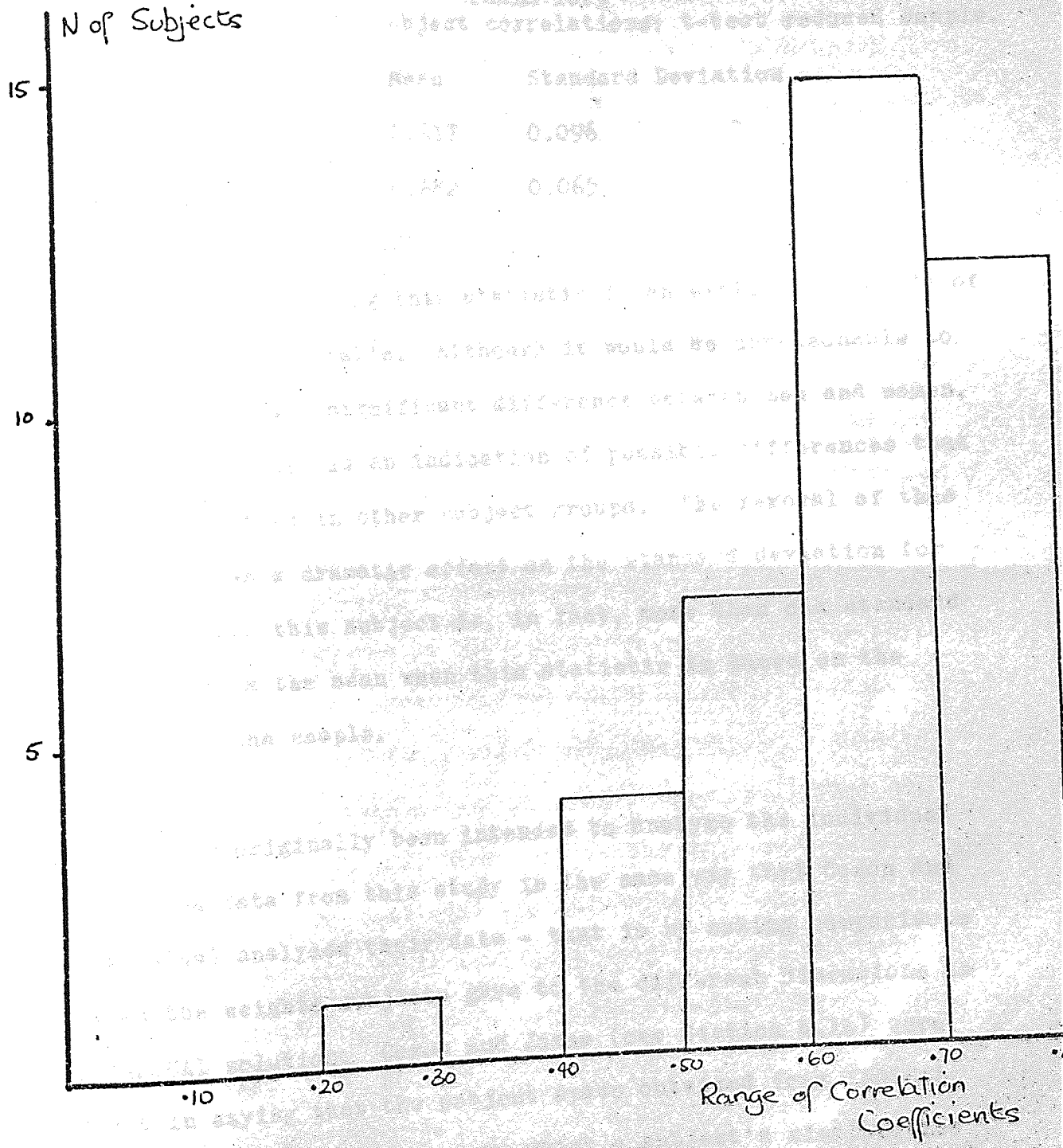
Sample	N	Mean	Standard Deviation
Men	19	0.617	0.096
Women	20	0.658	0.123

$t = -1.17$ $df = 37$ not significant

However, it is impossible not to note that the one extremely low value of the correlation coefficients for one of the women is likely to have a disproportional effect on this solution. It is more than three standard deviations from the mean. The effect of extreme values like this is to increase the possibility of finding a non-significant result. Examination of this subject's questionnaire indicated that she never used the category 7 -

FIGURE 10.1

INDSCAL solution pilot study data: histogram of subject correlation coefficients.



Completely Different, therefore restricting the range of ratings she was making. It was decided, therefore, to recompute the t test without this subject. The result of this is shown in Table 10.3, which indicates that in this case there is a statistically significant difference between the average subject correlation for men and women.

TABLE 10.3

INDSCAL pilot data subject correlations: t-test reduced sample.

Sample	N	Mean	Standard Deviation
Men	19	0.617	0.096
Women	19	0.682	0.065

$t = -2.45$ $df = 36$ $p < .05$

The value of recomputing this statistic in an exploratory study of this sort is considerable. Although it would be unreasonable to say that there is a significant difference between men and women, the adjusted result is an indication of possible differences that should be examined in other subject groups. The removal of this one subject has a dramatic effect on the standard deviation for the women since this subject is, in fact, more than six standard deviations from the mean when this statistic is based on the remainder of the sample.

10.4 It had originally been intended to analyze the individual differences data from this study in the same way that Coxon and Jones(1974a) analyzed their data - that is by making comparisons between the weights subjects gave to the different dimensions in the INDSCAL solution. Coxon and Jones (see Section 4.16) were correct in saying that the subject space obtained from INDSCAL analysis indicates the extent to which a subject's similarities data are explained by the model. They were also correct to say that the relative salience of the dimensions in the subjects' data is shown by the ratio of the weights for each subject.

However, in their analysis, they compared the magnitude of the weights directly across subjects. As a recent paper by MacCallum (1977) points out, when using the INDSCAL procedure it is incorrect to compare subject weights in this way since it normalizes data from individual subjects separately so that each subject is weighted equally. The only comparison that can be meaningfully carried out between subjects is in terms of the ratio of weights between dimensions. Comparison of the magnitude of the weights can only be made within subjects.

This suggests, therefore, that the analysis carried out by Coxon and Jones (described in Section 4.16) is not meaningful, and, although there may be differences between subject groups in the solution they obtained, their procedure for testing this is inappropriate. The recently proposed procedure for an Alternative Least Squares algorithm for individual differences SCALing (ALSCAL), developed by Takane, Young and de Leeuw (1977), is able to provide subject weights which can be directly compared, if one is prepared to assume that the subjects' data are unconditional - that is that all subjects use the rating scale in the same way. In most situations, however, this is probably unreasonable as what one person means by a rating of 7 may not be the same as the next person. The fact is that subjects' data must normally be assumed to be conditional. That is, it is assumed that individual subjects use the response scale consistently, but that different subjects may use it differently, so that all one individual's data is directly comparable, but direct comparison across subjects are not generally meaningful.

This means that it is not possible to make certain types of comparisons within the subject groups as had been hoped. For instance

it is not possible to attempt to identify subjects who use one dimension less than others and suggest, therefore, that their occupational perceptions can be considered as less complex than the remainder of the subjects. However, it is still possible to examine the range of individual differences in the data, which is indicated by the range of the correlation coefficients for the subjects. These indicate the extent to which a particular subject's data are fitted by the group solution. The fact that a particular subject's data have a low correlation with the group solution does not mean that that subject's data are not meaningful or contain a high degree of random error. It does indicate that it is very different from the rest of the subject group. Obviously all the data do contain error to various extents, but the correlation coefficient still provides a good measure of the range of individual differences in the data.

10.5 Before examining each of the individual solutions in turn, it is interesting to make certain comparisons between the INDSCAL solutions that were obtained for the different subject groups. These results were presented in Table 10.1. Examining these results, several patterns are apparent. First of all, for the three American groups who filled in the same version of the questionnaire, there is a trend that suggests that, regardless of dimensionality, there is a better fit for the older University students than the younger High School students and that for the two groups of High School students, it is the Senior High School students whose data are fitted better than the data of Junior High School students. When allowance is made for the fact that, for the University students, a four dimensional solution is more appropriate than a three dimensional solution, the trend becomes even more marked.

This measure provides further indication of a gradation in the quality of the solutions obtained from the older to the younger subjects, which fits well with the results of the earlier analysis of the group data.

Secondly, it is possible to note that, for the group of University students who filled in the yellow form of the questionnaire, the fit of their data in three dimensions is considerably lower than that for the other group of students. This is somewhat surprising since the earlier MSPACE analysis (see Table 9.2) suggested quite a good fit for this group.

The third point to note from this table is that, for the three British subject groups, the fit of their three dimensional solutions is markedly higher than the fit for the American High School students. Note in this case that the fit for the two groups of boys is very similar and slightly better than for the one group of girls.

The fact that this table indicates a low fit for the pilot study data in three dimensions in comparison with the group of University students who filled in the white form of the questionnaire is not necessarily an indication that this group of subjects were a poorer fit. Rather it is directly attributable to the fact that their solution includes 20 rather than 16 occupational titles, so that considerably more information is being summarized for this group. It is, therefore, not possible to compare these measures of goodness of fit directly in this case.

10.6 These goodness of fit measures are, however, only primary

statistics in that they act as summary statistics to describe the group data. They do not give any information about the range of results in the subject groups, which would indicate how much the primary statistic is likely to vary. In this analysis the goodness of fit measures, with which the analysis is primarily concerned, are the subject correlation coefficients. It is therefore appropriate to examine for each of the subject groups in the main study, the range of values taken by the subject correlation coefficients and to calculate in each case a secondary statistic which can be used to summarize the distribution. In this case, the standard deviation would appear to be an appropriate statistic. For each of these groups, therefore, the standard deviation and range of the values taken by the subject correlation coefficients were calculated and these are listed in Table 10.4. These statistics serve to amplify the results given earlier.

TABLE 10.4

Main study INDSCAL analysis: Range of subject correlations by subject group.

Subject Group	Mean	SD	Max	Min
Students White	0.779	0.063	0.888	0.571
Students Yellow	0.663	0.080	0.807	0.431
Senior High School	0.677	0.095	0.811	0.415
Junior High School	0.598	0.131	0.782	0.273
Aston	0.739	0.061	0.837	0.618
Five Ways	0.727	0.063	0.839	0.542
Sharmons Cross	0.703	0.089	0.813	0.370

For the three American subject groups who filled in the same version of the questionnaire, the trend in the results is the same as before. Not only is the mean lower for the younger group, the standard deviation and overall range of scores is also greater for this group than the older groups. The Senior High School students are seen to fill an intermediate position on all these statistics.

It is also interesting to note that, in contrasting the two groups of students who filled in the different versions of the questionnaire, the students who filled in the yellow version not only have a lower mean correlation but a greater standard deviation and range of scores as well.

These results provide evidence for a greater consensus among the University students on the nature of their occupational perceptions and also offer further evidence for the gradation in the results from the Junior High school students through to the University students. The differences between the two University groups also indicate that there are, perhaps, effects on the structure of occupational perceptions as a consequence of the change in the content of the occupations under consideration. In this case not only are different dimensions used in the judgement task but also, with the yellow version of the questionnaire, it is possible to observe that there is greater variation among the students in their replies. This suggests that, although in a general context, there is greater consensus among older groups in their occupational perceptions, once the context becomes more restricted and specialized, the extent of consensus decreases. This is not surprising, especially when it is remembered that the students were much more uncertain about what the jobs included in the yellow version involved than they were about the jobs included in the white version of the questionnaire (see Section 9.7). It would be expected, therefore, that there would be a greater random error component involved in the ratings for this group of students.

The results for the three British subject groups can be compared to the results from the American subjects. In particular, not only is the fit for the solutions higher in all three cases

than for the American High School students, but also the standard deviation and range of the correlation coefficients are much less. This might be taken as an indication of a greater consensus among the British subject groups as to the nature and structure of their occupational perceptions. However, it should be remembered that these subject groups are almost certainly more homogeneous than the American subject groups. First of all, they are single sex subject groups, so that there is no variation on these grounds. The two groups of boys are also from selective schools, and this suggests that these groups are likely to be restricted in range of social class.

10.7 This critical examination of the results from the individual differences scaling suggests that there are a number of factors that need to be further examined in this data. Although the analysis of the American data indicates the existence of age effects, no analysis has yet been made for sex differences within the individual subject groups. It is also possible to examine one set of British data from one of the boys schools for age effects to see whether the fourth formers differ from the sixth formers in the degree to which their data is fitted by the solution. For the American University students it is also possible to contrast the Liberal Arts students and those in related subject areas with the Institute of Technology students (also including some in related fields). These analyses form a natural second stage to the individual differences analysis of this data.

For these five groups of subjects it was decided, therefore, to carry out an analysis to examine how the individual differences in this data were structured. For the two groups of American High School students, the pattern of the correlation coefficients for

the men and the women were contrasted. The results are listed in Table 10.5 and indicate a broad similarity in the range of the correlation coefficients for the males and females in these two samples and no significant differences between them.

TABLE 10.5
US High School Students INDSCAL data: subject correlations - sex differences.

Junior High School

	Mean	Standard Deviation
Men	0.596	0.124
Women	0.600	0.141

t = 0.085 not significant

Senior High School

	Mean	Standard Deviation
Men	0.685	0.098
Women	0.669	0.092

t = 0.565 not significant

Obviously, this is not a very strong test of the differences that might exist in the data since no account is taken of the extent to which men and women might use the dimensions of these solutions to different extents. However, for reasons indicated earlier (see Section 10.4), it is not possible to meaningfully compare results from the INDSCAL analysis in this way. This could not have been anticipated when the study was designed and is an indication of the type of problem that can be encountered when a comparatively new technique is used for data analysis. Although the use of the INDSCAL programme has indicated that a considerable range of individual differences exist in this data, it is only possible to carry out limited analyses to indicate in what ways these differences might be structured.

The next group to be studied was the group of King Edward's

school-boys, which included two age groups. The mean and standard deviation for these two groups are listed in Table 10.6 and once again virtually no differences are shown to exist between the two groups in the extent to which their data is fitted by the INDSCAL solution.

TABLE 10.6
King Edwards School INDSCAL data: subject correlations - age differences.

	Mean	Standard Deviation
Fourth Form	0.731	0.059
Sixth Form	0.748	0.062
$t = -1.04$	not significant	

The final set of data to be analyzed in this way was that from the University of Minnesota students. It had initially been thought that, with the two parallel forms of the questionnaire, it would be possible to contrast both men against women and Liberal Arts against Institute of Technology students. However, when it proved difficult finding women studying in the Institute of Technology to complete the questionnaire, it was decided to concentrate on getting a group of women to complete the yellow form of the questionnaire. It was not expected that there would be differences between students studying different subjects in their replies on the white form of the questionnaire, which contained a more general set of occupational titles. Therefore, four groups of subjects completed the yellow form of the questionnaire, men and women who were either studying Liberal Arts subjects or Technical subjects. For the white version of the questionnaire, only three groups of subjects completed the questionnaire, men who were studying Liberal Arts or Technical subjects and women who were studying Liberal Arts subjects.

The pattern of correlation coefficients from the students who

completed the yellow version of the questionnaire was analyzed first. An analysis of variance was carried out treating sex and academic discipline as two independent factors. The results of this analysis are presented in Table 10.7 and indicate no effect due either to sex, discipline, or to an interaction of these two factors.

TABLE 10.7
Yellow INDSCAL subject correlations: analysis of variance summary table.

Source	SS	DF	MS	F ratio
Sex	88.1	1	88.1	1.365
College	61.4	1	61.4	0.952
Interaction	51.2	1	51.2	0.794
Error	4259.1	66	64.53	
Totals	4459.8	69		

For the groups of students who completed the white form of the questionnaire, it is obviously not possible to carry out an equivalent analysis. The means and standard deviations for the three separate groups were calculated and are listed in Table 10.8. These indicate only very slight differences between the groups, although there is greater variation in the pattern of scores obtained for the women. It seemed most unlikely that these results might be considered to come from different populations so although technically inappropriate, it was decided to compare various pairs of these groups using a t test.

TABLE 10.8
White INDSCAL data subject correlations.

Group	Mean	Standard Deviations
Liberal Arts Men (N=17)	0.771	0.042
Liberal Arts Women (N=20)	0.779	0.081
Institute of Technology Men (N=13)	0.793	0.053

No probabilities approaching what is considered a significant level

were found and these results, therefore, need not be reported.

10.8 The analysis of the data has again been limited by the fact that the anticipated procedure for analyzing these data proved to be inappropriate. The method employed, although it demonstrated the existence of a considerable range of individual differences in the data, has not been able to identify the possible factors that might be determining these results. The analysis presented so far has, therefore, been limited to providing evidence on the range of individual differences that exists in the data. This analysis has also provided further evidence for the existence in the American data of a gradation in the results from the younger to the older groups.

It is difficult to see how, in the circumstances, this analysis might be appropriately extended to go beyond the mere demonstration of the extent of individual differences in the data in order to examine the factors that might be contributing to these differences so as to provide an analysis of how these differences affect the structure of individuals' occupational perceptions. However, before concluding this chapter it is useful to consider the way other workers have used the INDSCAL programme for analysis to see if their approaches might be suitable for this study.

Some workers who have used INDSCAL as a programme for scaling their data have not been primarily interested in the pattern of weights the model generates for each subject, but have used the model because it provides an indication of the extent to which a particular subject's data are fitted by a solution. In this way it is possible to identify particular individuals whose data appear

discrepant from the remainder of the subjects. The analysis presented here has used little more information than this in noting the range of individual differences existing in the data from this study. Another important aspect of the model is that the dimensions of the solution space cannot be rotated and it has been argued (Carroll, 1972) that in many cases the axes of the solution have been readily interpretable. However in this study INDSCAL has not been used to provide a stimulus space.

Other studies have compared the weights subjects use to note whether different groups of subjects structure their perceptions in different ways - for example, to demonstrate differences in the way normal and colour blind people structure their perceptions of colour. Normal subjects use a red-green dimension as well as a yellow-blue dimension. Colour blind subjects distort the normal colour circle because they barely use the red-green dimension. Using the INDSCAL model it is possible to see that these subjects will attach much less weight to this dimension.

However, while this appears an attractive and powerful way to examine individual differences in the dimensions used to structure perceptions, in practice, it is only the ratio of weights between dimension used by subjects that can be compared. For solutions in two dimensions this is no problem but for solutions in higher dimensions the number of weight ratios is large. Shubsachs and Davison calculated relative weights for each subject by comparing the weights used in one dimension with the square root of the sum of weights squared. It is not clear to this author that this can be considered equivalent to calculating a weight ratio between dimensions. It was, therefore, decided that this method would not be used in this study.

The alternative of calculating weight ratios also seemed impractical at this late stage in the analysis, not only because of the large number of calculations that would be involved, but also because it was not readily apparent to the author how the information could be used for interpretation with multidimensional scaling solutions in three and four dimensions. There are two reasons for this. First of all, the nature of the solutions has suggested an interpretation not so much in terms of dimensions of an occupational space, but rather in terms of regions of the space and clusters of the occupations. By weighting dimensions differently subjects are structuring the similarity relationships between the occupations differently, but when this occurs in three or four dimensional space, it is difficult to comprehend all the implications of their doing this. The second reason also relates to the large number of weight ratios that will exist for solutions in three and four dimensions. As the weights cannot be compared across subjects, it is not appropriate to use a Multivaraiate Analysis of Variance to contrast different groups of subjects. However, if separate Analyses of Variance or t tests are used for each ratio in each solution, there is a possibility of labelling a chance result as significant.

The INDSCAL analysis presented here has been concerned only with the solutions from individual subject groups. Coxon and Jones presented a solution for a representative selection of their subjects from different groups. The main reason for not pursuing this same method of analysis has been the limited amount of analysis that it is possible to carry out on these solutions for individual differences. There is also a limitation on the number of subjects that can be included in an INDSCAL analysis. With a stimulus matrix of 16 x 16, the limit is 70 subjects. This also limits the

type of comparisons that could be made as it is impractical to have more than about four different sub-groups of subjects in a single INDSCAL analysis. Although such an analysis might appear more elegant, it seemed to the author to offer few direct benefits.

It might seem that the individual differences scaling has not fulfilled its initial promise. It has not been possible, for example, to compare individuals in terms of the cognitive complexity of their solutions as had been initially hoped. However, this analysis has provided information about the range of individual differences in occupational perceptions. This does have implications for theories of vocational behaviour and development and these will be discussed in the subsequent chapter. An exploratory study using techniques and procedures that are relatively new is also likely to encounter some pitfalls that it was impossible to anticipate. The consequences of these will also have to be reviewed in the discussion. At this stage it is worth pointing out that these episodes have provided useful learning experiences for the author, and that if research went ahead exactly as anticipated, the whole process could be fully automated. Finally in a study that is exploratory, it is useful to emphasize the importance of generating ideas and hypotheses that can be investigated subsequently, perhaps, in an experimental study.

10.9 The final set of data to be reported in this chapter on individual differences concerns the occupational preferences of the subjects from the pilot study. This question on preferences was not analyzed at the same time as the pilot data due to lack of time. However, it does contain information which can be used to relate the individual differences in perceptions to individual differences

in preferences. This information could be useful in demonstrating whether individual differences in preferences appear to be greater than individual differences in perception.

In completing this question, subjects were asked to rate the twenty occupational titles included in the pilot study on a nine point scale ranging from (1) Like very much to (9) Dislike strongly. The rationale for this procedure has been outlined earlier (see Section 5.4). One problem with this type of question is that it asks subjects to express preferences for a set of job titles in which they may have no special interest. However, while it would certainly be useful, in a vocational guidance context, to have individuals express their preference among a set of occupations that they were considering and also interesting to have them rate the titles for similarity so that the preferences could be related to their perceptions of the world of work, in a study that was going to use a standardized testing procedure, this was not a feasible option. This limitation was the reason this question was not included in the main study. In spite of this, it was decided that analysis of this data would be appropriate.

Examination of the raw data for this question demonstrated that individuals used the rating scale in a variety of ways. The overall pattern of responses over all the occupations by category, which is shown in Table 10.9, indicates a trimodel distribution with a slightly greater emphasis on negative rating of the occupations.

TABLE 10.9
Pilot data preferences - distribution of replies by response category

	Response Category								
	1	2	3	4	5	6	7	8	9
N of replies	91	74	82	87	106	63	78	97	142

The large amount of individual variation this conceals is shown by the distribution of individual replies by response category in Table 10.10. It was decided, therefore, to analyze this data for individual differences using multidimensional scaling models for preference data.

10.10 First of all it is useful to draw the distinction that Carroll (1972) makes between two approaches to the analysis of preference data. One approach, which he calls an 'internal' mode of analysis, is based only on the preference data for a group of individuals without reference to any outside or a priori set of stimulus dimensions. This mode of analysis generates a spatial representatio of both individuals and occupational titles from the same set of data and is designed to capture the individuals' preference ordering among the occupations. The second approach, which Carroll calls an 'external' mode of analysis, uses a set of a priori dimensions for the occupational titles, based on some external criteria, and attempts to relate the individuals' preference judgements to the a priori solution. (For the external analysis of the preference data, in this case, the output configuration from the multidimensional scaling of the pair comparison data from the pilot study will be used to provide an initial configuration for the set of occupational titles.)

Secondly it will be useful to describe the models that are available for the analysis of preference data. The INDSCAL model, which was used to analyze the pair comparison data, permits the study of individual differences in cognitive or perceptual structur It is, however, also possible, from the analysis of preference judgements, to study the different ways individuals use these

TABLE 10.10
Pilot data preferences: distribution by response category and subjects.

Subject	Response Category. 1	2	3	4	5	6	7	8	9
1	0	0	2	3	5	3	3	4	0
2	0	5	4	3	1	1	1	0	5
3	1	3	5	2	4	0	2	1	2
4	3	1	2	2	2	2	2	0	6
5	1	0	1	3	3	1	6	2	3
6	1	1	1	1	1	1	3	4	7
7	2	0	1	4	4	3	2	3	1
8	0	0	4	1	3	3	3	4	2
9	4	4	2	2	0	1	1	2	4
10	10	2	0	0	0	1	0	3	4
11	3	5	1	3	0	3	0	0	5
12	2	3	3	3	1	1	2	4	1
13	0	0	2	3	0	1	4	9	1
14	2	2	2	2	0	7	2	2	1
15	1	2	1	2	0	0	1	0	13
16	4	1	1	2	8	0	1	1	2
17	0	2	6	1	3	1	5	2	0
18	1	3	4	4	2	1	2	2	1
19	1	2	4	1	2	1	0	0	9
20	1	4	0	3	2	2	3	2	3
21	0	0	1	3	5	0	2	7	1
22	0	0	1	4	4	2	1	4	4
23	3	3	1	1	2	1	2	3	3
24	2	2	1	1	2	3	4	2	1
25	0	3	3	1	6	3	0	3	4
26	2	3	1	1	1	1	3	4	2
27	1	3	2	1	3	1	5	2	8
28	1	1	4	0	2	0	1	3	0
29	1	2	1	6	7	2	1	0	2
30	1	1	5	1	5	1	2	2	8
31	3	3	0	2	2	0	2	0	1
32	4	4	3	2	2	1	1	2	7
33	8	0	0	0	5	0	0	0	11
34	2	1	2	0	4	0	0	2	4
35	8	1	0	0	1	4	0	3	2
36	2	1	3	3	0	3	3	2	3
37	1	1	3	4	1	3	2	1	3
38	5	2	1	2	3	1	1	2	0
39	7	1	1	5	2	1	2	0	3
40	2	2	3	4	3	1	2	0	3
41	1	0	0	0	5	2	1	10	1

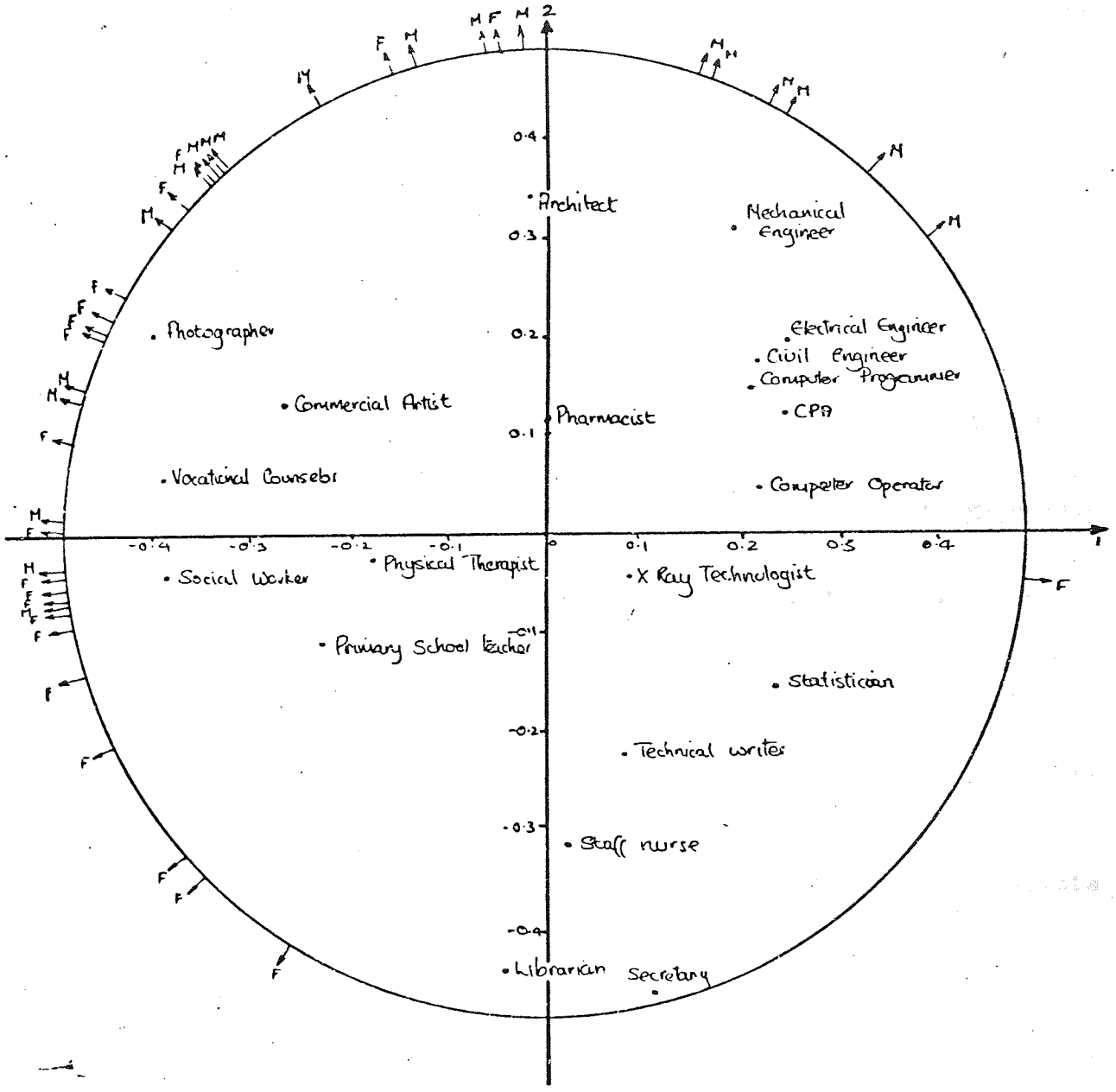
perceptual structures. Although a number of models have been proposed for the analysis of individual differences in preference data, two models, the 'vector' model and the 'unfolding' (or distance) model, are most widely known. Both models assume a set of stimulus points embedded in a multidimensional space and Carroll (1972) shows that these models can be generalized to form a set of four models for preference data, which represent a hierarchy in order of their complexity. These two models will be described first and subsequently the further generalization by Carroll will be presented.

1. Vector model. This is the simplest model where different individuals are represented as distinct vectors in a multidimensional space. Different directions in the space, therefore, represent the preferences of different individuals. The preference order for a particular individual is represented by the projection of the occupational titles onto the vector representing the individual subject. Carroll and Chang (1968) have written a computer programme, MDPREF, which performs an internal analysis of pair comparison or directly judged preference scale values. As can be seen from Figure 10.2, which represents a solution for the preference data from the pilot study, it is possible to represent quite different preference orders with this model, although one unattractive feature of this model is the assumption that preferences change monotonically with all dimensions. To put it simply: "If a certain amount of X is good, then more must be better". In the real world this is rarely true, and this limits the applicability of the model.

2. Unfolding model. Coombs introduced the unidimensional model, where the stimuli are represented as points on a straight line and subjects are represented by 'ideal points' on the line, such that the preference order for a given subject is generated by folding

FIGURE 10.2

MDPREF two dimensional solution: pilot study preference data.



the line at that subject's ideal point. The order of the distances from the subject's ideal point to the points representing the stimuli represents the subject's preference order. To recover the stimulus order on the line, it is necessary to 'unfold' simultaneously all the individual preference scales. The model introduces the concept of an optimal value for each individual in the study. However, even when generalized to the multidimensional case (Bennett and Hays, 1960), it is assumed that a given difference in the position of one stimulus point makes as much difference to one subject as to another, and that all individuals relate to the same set of dimensions within that space. In the multidimensional case, the preference order for an individual is given by the distance from the subject's ideal point to the stimuli, the closer of any two stimuli being the more preferred, and hence the term distance model to refer to this family of models.

The main difference between these two models is, therefore, in the way they treat the notion of a most desired point. Further differences between the models, particularly in relation to data on occupational prestige, are given by Coxon and Jones (1973). Carroll (1972) demonstrates that the vector model can be considered as a special case of the distance model, where the subjects' ideal points are located on infinite distance from the stimulus points. Unfortunately, although computer programmes for multidimensional unfolding have been developed which work well with ideal data, these programmes have not worked so well in practice, so no internal analysis of the preference data for the pilot study has been carried out using this model.

10.11 Carroll (1972) also shows that the unfolding model can be generalized to allow different individuals to weight the dimensions

differently using a modified Euclidean distance equation (2), similar to that used with INDSCAL.

$$d_{ij} = \left[\sum_{t=1}^{r} w_{it} (y_{it} - x_{jt})^2 \right]^{\frac{1}{2}}$$

In this case y is the t^{th} coordinate of individual 'i's ideal point, x_{jt} is the t^{th} coordinate of the j^{th} stimulus point, and d_{ij} is the distance between ideal point i and stimulus point j in a space of r dimensions and w_{it} is the weighting factor of the t^{th} dimension for subject i. Unlike INDSCAL where subject weights range from 0 to 1, with preference data there is no reason why a particular dimension in one subject's solution should not be weighted negatively. In that dimension that individual then has an 'anti-ideal' point which indicates minimum preference rather than the normal ideal point which indicates maximum preference.

A second generalization proposed by Carroll is to relax the assumption that the same basic set of dimensions is used by all individuals. Although it is assumed that there is a common perceptual space, each individual is allowed to rotate the reference axes and weight them idiosyncratically. Rotation only generates a new model when the dimensions are weighted differently by individual subjects. It can readily be seen that these four models form a hierarchy, each simpler model being a special case of the more general ones.

Carroll and Chang (1969) have developed a programme, PREFMAP for relating preference data to a given stimulus space, that is a programme for the external analysis of preference data, which will generate a solution for the data using any of the hierarchy of four models described above. Working either metrically or nonmetrically,

this programme is a generalization of Coombs' original unfolding model. If the programme is used in its metric form, two goodness of fit measures are available, multiple correlation and F ratios from Analyses of Variance, which allow the user to decide which model from the hierarchy is most appropriate for representing his subjects' data. Subsets of subjects might also be allocated to different levels if their fit to one model appears better than to another.

These models might be expected to work well for many different types of preference data, although in some cases, for example the tea tasting data used by Carroll (1972), it is found that for some subjects their preference function is bimodal, which suggests that a cubic function is necessary to fit their data. More detailed descriptions of these models are given in Carroll (1972) and further discussion of some of the implications of using these models can be found in Coxon and Jones (1973) and Coxon (undated).

The external mode of analysis would seem to be especially appropriate to research situations where it is desired to distinguish between subjects' cognitions of the stimulus set and their evaluation of it on specific criteria. As has been pointed out earlier (see Section 9.12) this kind of analysis is most relevant to attempts to distinguish the role of perceptions in vocational behaviour and the relationship between interests, preferences and perceptions. This issue will be considered further in the discussion.

10.12 At this stage, therefore, it was decided to analyze the data from the pilot study using both an internal and an external mode of analysis. In the internal mode only the vector model of MDPREF will be used, but for the external analysis all four models of

Carroll's hierarchy will be applied. These analyses will also be carried out in two and three dimensions as the solutions from the earlier MINISSA scaling could be meaningfully interpreted in both these dimensionalities. For these analyses the initial ratings of the occupations by the subjects were transformed into rank orderings. Both these programmes can handle tied rankings so equal ratings presented no problems for this analysis.

10.13 The two dimensional result of the MDPREF analysis is shown in Figure 10.2. Examination of the roots of the first score matrix indicates that the first two dimensions of the solution accounted for nearly half the variance in the solution and considerably more than the third dimension. The solution in three dimensions is not presented because only a small minority of the subjects appear to use the third dimension. The two dimensional solution demonstrates the existence of considerable individual differences in preferences. One attractive feature of this model is that it allows individuals to have diametrically opposed preference orderings, which is impossible with the alternative distance model for preferences. As the solution in two dimensions does represent some individuals as having almost opposite orderings, it appears that the vector model is quite appropriate for this data.

It is interesting also to compare this solution and the arrangement it suggests for the occupational titles with the result obtained from the multidimensional scaling of the pair comparison data which was presented in Figures 5.4 to 5.8. Although there are considerable similarities in the solutions in the way the occupations are grouped together, a few occupations are located very differently. This may, in part, be the result of sex differences in preferences. These are shown by the labeling of the vectors

which indicates that the women, with a few exceptions, prefer the artistic and social occupations while the men, who also rate the artistic occupations highly, prefer the scientific and technical occupations. The changes in the relationships between the occupations indicated by this solution may be partly explained by this variation in preferences. These differences are reflected also in the differences in the scaling solutions that were obtained for the pair comparison data. When solutions were produced for the men and women separately, it seemed that the men and women were making their comparisons between occupations in different terms (see Section 5.21).

The analysis seems to have been most satisfactory. The two dimensional solution demonstrates that a range of individual differences is captured by this vector model. In particular, considerable differences in occupational preferences between the sexes are readily apparent from the solution. Only four occupations - Staff Nurse, Commercial Artist, Certified Public Accountant and Social Worker - loaded highly on the third dimension. This is, perhaps, one indication that the solution obtained from the preference data is simpler than that obtained from the pair comparison data. This frequently occurs with the analysis of preference data as one or two dimensions which are more important to the subjects come to dominate in the way preference judgements are made.

10.14 It is appropriate at this stage to report the results of the external analysis of the preference data which was carried out using the PREFMAP programme. The results of these two different modes of analysis can then be compared. A particular advantage of using PREFMAP is that it produces two goodness of fit measures. These overall goodness of fit measures for the 'average subject' of each

group are presented in Table 10.11. These results indicate that, in both two and three dimensions, there is a gradual increase in goodness of fit as the model for the preference mapping is generalised. However, only the difference between the unfolding model and the vector model is significant in either case. It is interesting to note that using the nonmetric version of the programme increases the degree of fit considerably and that, with the nonmetric solutions, the difference in the degree of fit between the two and three dimensional solutions is less than for the metric version of the programme. It is, therefore, proposed to accept the two dimensional nonmetric solution as providing a satisfactory solution for the data. However, in spite of the fact that, on average, the distance model provides a better fit than the vector model, examination of the correlation coefficients for individual subjects indicates that there are nine subjects whose data are better fitted by the vector model. In fact, there are only 17 subjects for whom the distance model provides a significantly ($p < .05$) better fit than the vector model. For the majority of subjects, it appears to make little difference which model is used as either would give a fairly satisfactory solution.

One reason for this may well be the particular features of the two different models. The analysis using MDPREF has already demonstrated that there is a wide range of individual differences in preferences among this group of subjects and that there are individuals with almost opposite preference orderings. It has already been pointed out that it is impossible for opposite orderings to exist with the distance model unless either individual ideal points are located an infinite distance away from the remainder of the configuration, in which case the two models are equivalent, or unless ideal and anti-ideal points coincide.

TABLE 10.11
Goodness of fit between data and PREFMAP models.

(a) Correlations (average subject)[1]

	3D						2D					
	Metric			Nonmetric			Metric			Nonmetric		
Model	rms[2]	Min	Max	rms	Min	Max	rms	Min	Max	rms	Min	Max
I	8267	3779	9776	9204	6284	9915	7202	2353	9057	8461	6245	9721
II	7635	3634	9459	8809	6691	9830	6734	1998	9025	8144	5670	9560
III	7144	2341	9340	8325	6328	9750	6375	1181	8769	7807	0518	9429
IV	6548	1323	9023	7940	4559	9443	5859	0364	8146	7283	3260	9138

1 Decimal points omitted 2 Root mean square

(b) Analysis of variance between models.

	3D				2D			
	Metric		Nonmetric		Metric		Nonmetric	
Model (df)	F-ratio	Sig[1]	F-ratio	Sig	(df)	F-ratio	Sig	F-ratio Sig
I,II (3,10)	.0000	ns	-.2714	ns	(1,14)	.0000	ns	.4218 ns
II,III(2,13)	-.0001	ns	.1925	ns	(1,15)	.0000	ns	-.0809 ns
III,IV (1,15)	28.45	.01	30.91	.01	(1,16)	5.6609	.05	5.8660 .05

1 Significance level.

The fact that opposite preference orderings exist within the group of subjects necessarily limits the applicability of the distance model to this data.

On the other hand, there are a substantial minority of subjects for whom the distance model provides a significantly better fit than the vector model. It is important to realise that this is not a case of neither model fitting the data well but that both models explain most of the variation in this data rather well.

One modification made by Carroll and Chang to the PREFMAP hierarchy of models is to allow, in the simple unfolding model, for the existence of 'anti-ideal' points. In this analysis the majority of subjects were found to be best fitted by the location of an anti-ideal point in the space, so that the order of distances indicated a reverse order of preference for the subjects. The result is not surprising given the fact that the selection of occupational titles presented to the subjects is unlikely to include occupations of their choice. This also provides one way different subjects can have opposite preference orders among this set of occupational titles.

The PREFMAP solutions are presented in Figures 10.3 and 10.4. The subjects in both figures are labelled male and female and ideal and anti-ideal points are also distinguished. The results of the vector model are shown in Figure 10.3 and are consistent with the results of the earlier analysis using MDPREF. The results of the distance model are shown in Figure 10.4. Unfortunately, a small minority of subjects have ideal points located too far from the remainder of the subjects to be accommodated in the figure. The

FIGURE 10.3

PREFMAP two dimensional solution vector model: pilot study preference data.

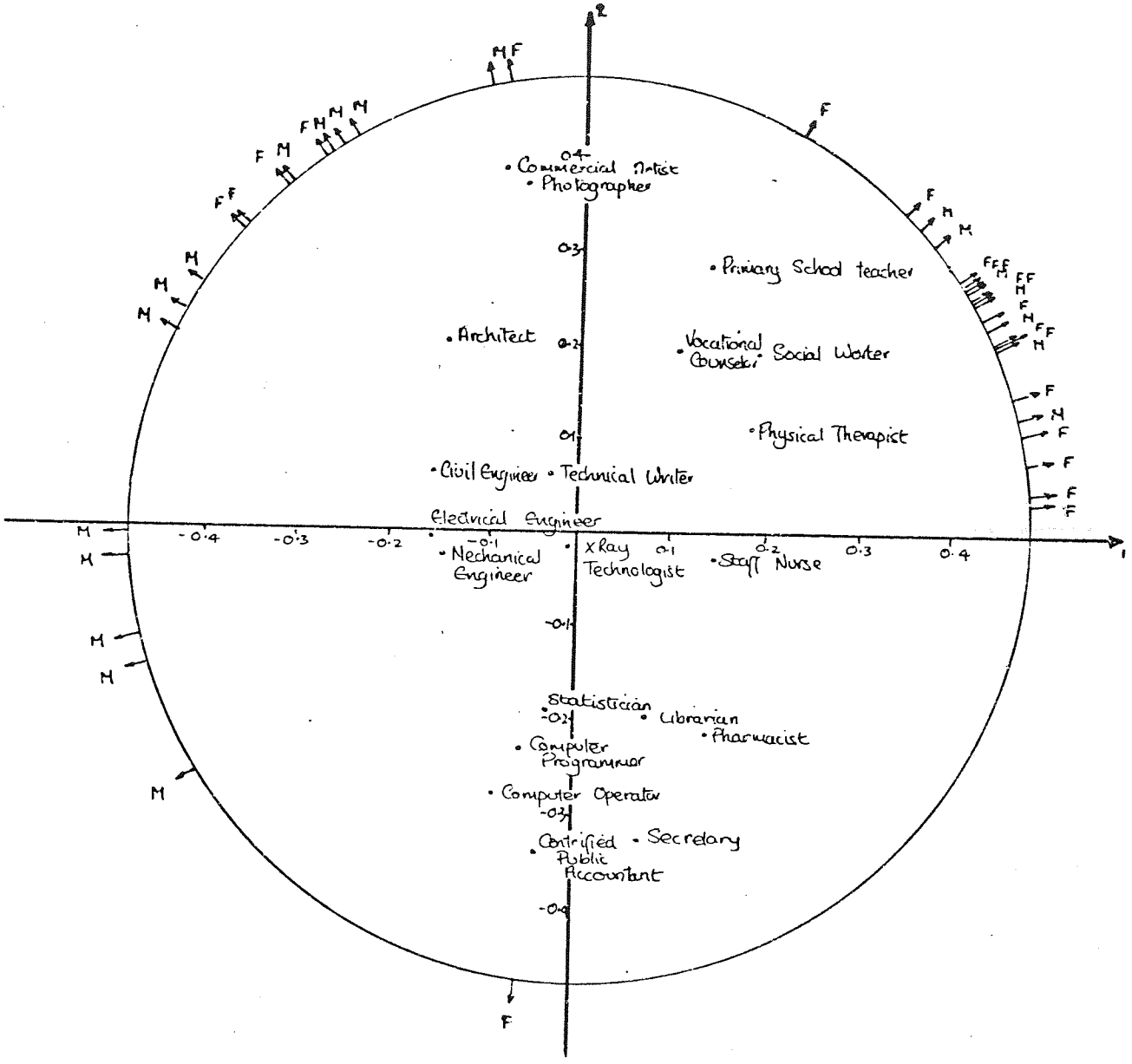
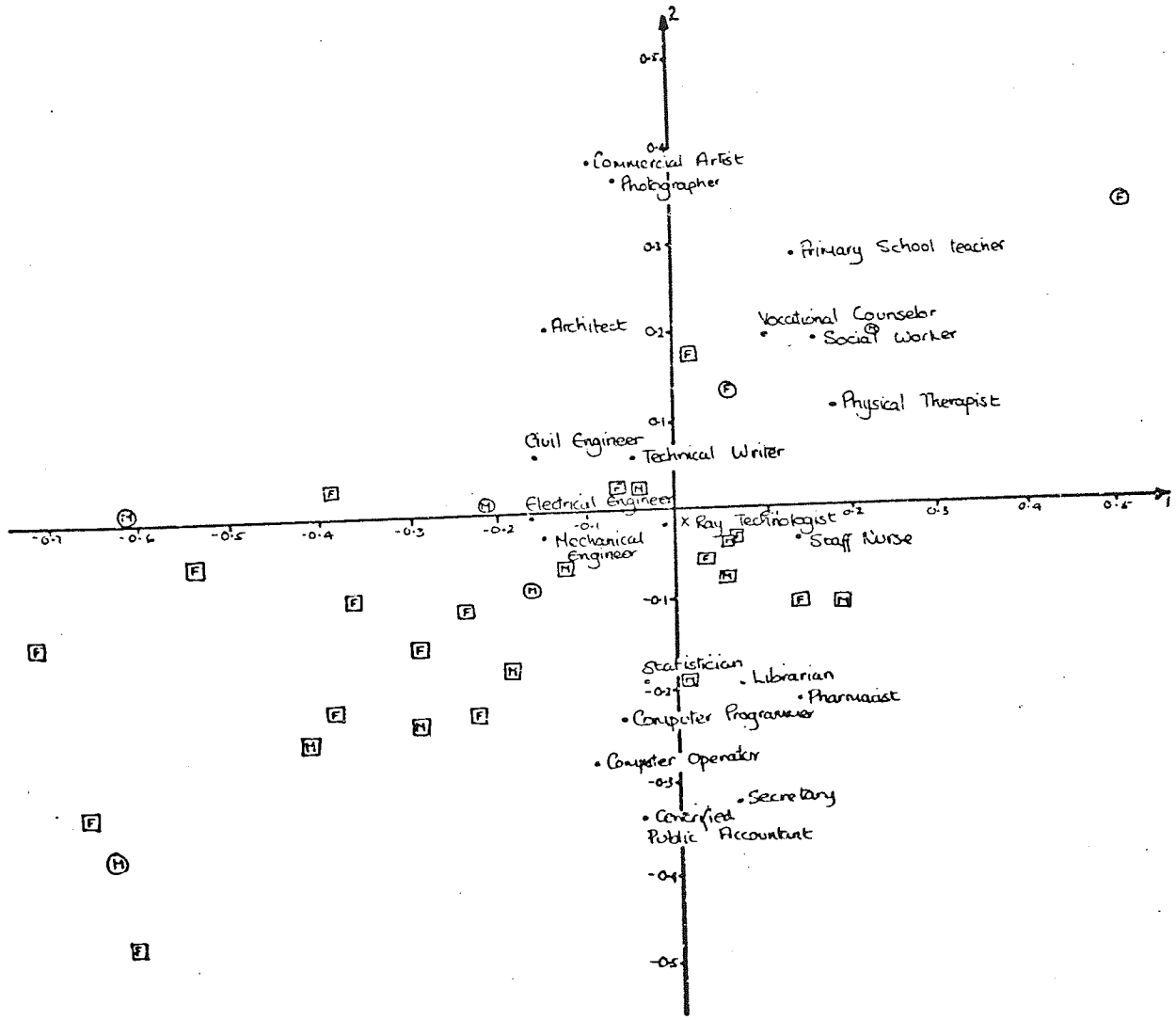


FIGURE 10.4

PREFMAP two dimensional solution distance model:pilot study preference data.



ideal point

anti-ideal point

position of all the ideal points are listed in Table 10.12 and those subjects omitted from the figure are asterisked in the table. The location of the subjects in both figures once again reflects the differences in preferences between the men and the women. This was also noted in the analysis of the data using MDPREF.

Although the distance model provides a better fit to the data reported here than the vector model, it is important to note that both models capture the range of individual differences in preferences. In particular, both models demonstrate differences in the preferences of men and women. The results of these two external analyses of the preference data are also very similar to the internal analysis of the data. The implications of these results will be discussed in the subsequent chapter. Of particular concern will be the appropriateness of the models for preference data for representing preferences among occupations.

10.15 It would appear that, for this subject group, the range of individual differences in preferences is greater than that shown in the pair comparison data. However, it is important to note also that the dimensionality of the space chosen as appropriate for displaying the preference data is lower than that chosen as appropriate for the pair comparison data. It might appear therefore that, although as expected, individual differences are greater in preferences than in perceptions, in making judgements about their preferences among the occupations, subjects use fewer dimensions or less of the information about the differences between occupations than they use in making similarity judgements. Possibly it is unreasonable to expect an analysis in terms of preferences to be able to identify all the underlying perceptual dimensions that are used by subjects to distinguish among the occupations. However,

TABLE 10.12
Coordinates of ideal points.

Subjects	Dimensions 1	2
1	0.06	-0.08
2	1.23	-7.60*
3	2.17	0.02*
4	0.05	-0.03
5	-0.21	0.01
6	-0.61	0.01
7	0.19	-0.11
8	-0.78	-0.34*
9	-0.04	0.01
10	-0.16	-0.08
11	-0.40	-0.25
12	-1.28	1.00*
13	-0.29	-0.23
14	-3.29	-1.66*
15	-0.19	-0.17
16	-0.12	-0.06
17	0.22	0.19
18	0.96	-0.73*
19	-0.63	-0.37
20	0.01	-0.18
21	-0.06	0.01
22	0.03	-0.06
23	0.14	-0.10
24	-0.38	-0.22
25	1.10	1.28*
26	4.00	1.65*
27	-0.47	-0.62
28	-0.22	-0.22
29	-0.23	-0.10
30	0.06	0.13
31	4198.41	-3531.92*
32	0.51	0.33
33	-0.38	0.03
34	0.06	-0.04
35	-0.66	-0.32
36	-0.71	-0.14
37	3.05	2.30*
38	-0.29	-0.15
39	-0.36	-0.09
40	-0.54	-0.05
41	0.02	0.17
42	-0.13	-0.19

* Subjects not shown on Figure

this raises questions about the appropriateness of models used for the description of occupations which are based on an analysis of subjects' preferences alone without consideration of the perceptual dimensions people use to distinguish between occupations. These issues will be considered in the following chapter.

The analyses reported in this chapter have demonstrated the existence of considerable individual differences in subjects' occupational perceptions. Differences among subjects appear more marked among younger age groups and when the subject groups are relatively heterogeneous. However, it has not proved possible to identify the variables that moderate these differences. The fact that the extent of consensus as to the nature of the occupational structure is limited would appear to have important consequences for vocational psychology. For the one group of subjects for whom it was possible to compare perceptual judgements with preference judgements, certain differences in the way these judgements might be made are suggested. These could also influence ideas about how the dimensions that are used to structure occupational information are identified.

11 DISCUSSION

11.1 The purpose of this chapter is to review the results of this study with particular emphasis on their implications for occupational classification and for vocational guidance. The chapter also attempts to integrate the research findings from this study with other studies of occupational perceptions, which have been reviewed earlier (see Sections 3 and 4). This study, which has a major cross-cultural component,also seeks to establish what relevance American work in the field of Vocational Psychology has for research and practice in the United Kingdom. These implications will be discussed in this chapter. The final chapter will evaluate the contribution of the cognitive approach adopted here to vocational psychology. First of all, approaches to occupational classification will be briefly reviewed.

11.2 The description of the world of work has been a major concern of occupational and vocational psychologists for a long time. Finding ways of describing and grouping together occupations in the light of their similarities and differences is of considerable importance to people working in the disciplines concerned with matching people and jobs. It is,therefore, rather surprising that, as Dawis and Lofquist (1975) point out, psychologists have relied on economic and sociological classification systems for most of their purposes. Although the Dictionary of Occupational Titles (DOT, 1939, 1949, 1965) developed by the US Department of Labour does include some information on the psychological dimensions of occupations, for example the Occupational Aptitude Patterns (1970) and Worker-trait requirements (1956), both it and the Classsification of Occupations and Directory of Occupational Titles (CODOT, 1972),

produced by the Department of Employment in this country, can be considered to be primarily in this socio-economic category. These classifications, developed as aids to manpower utilization and planning, are designed to describe all occupations and this encyclopedic coverage is what makes them useful. However, as neither of these classifications is psychologically based, they do not describe occupations in ways that are likely to meet the requirements of occupational and vocational psychologists.

In recent years there has been a revival of interest among occupational and vocational psychologists in the production of occupational classification schemes for a number of reasons. Psychologists have realised the importance of occupational classification to their work in a number of fields, for example, training, vocational guidance and manpower planning. These different interests have caused psychologists to adopt a number of different approaches to occupational classification.

Before thinking about possible approaches to occupational classification and the development of a perspective for considering the process of occupational classification, it is useful, by way of an extended analogy, to look at some of the current developments in the biological sciences. Here classification has a fundamental role, and over the last decade there has been a period of rapid conceptual and procedual change. It seems to the author that psychologists interested in occupational classification can learn a great deal from this work, much of which is reported in Sneath and Sokal's book Numerical Taxonomy (1973).

11.3 As Morgan (1972) has noted, the problems of terminology and conceptualization in the field of occupational classification are

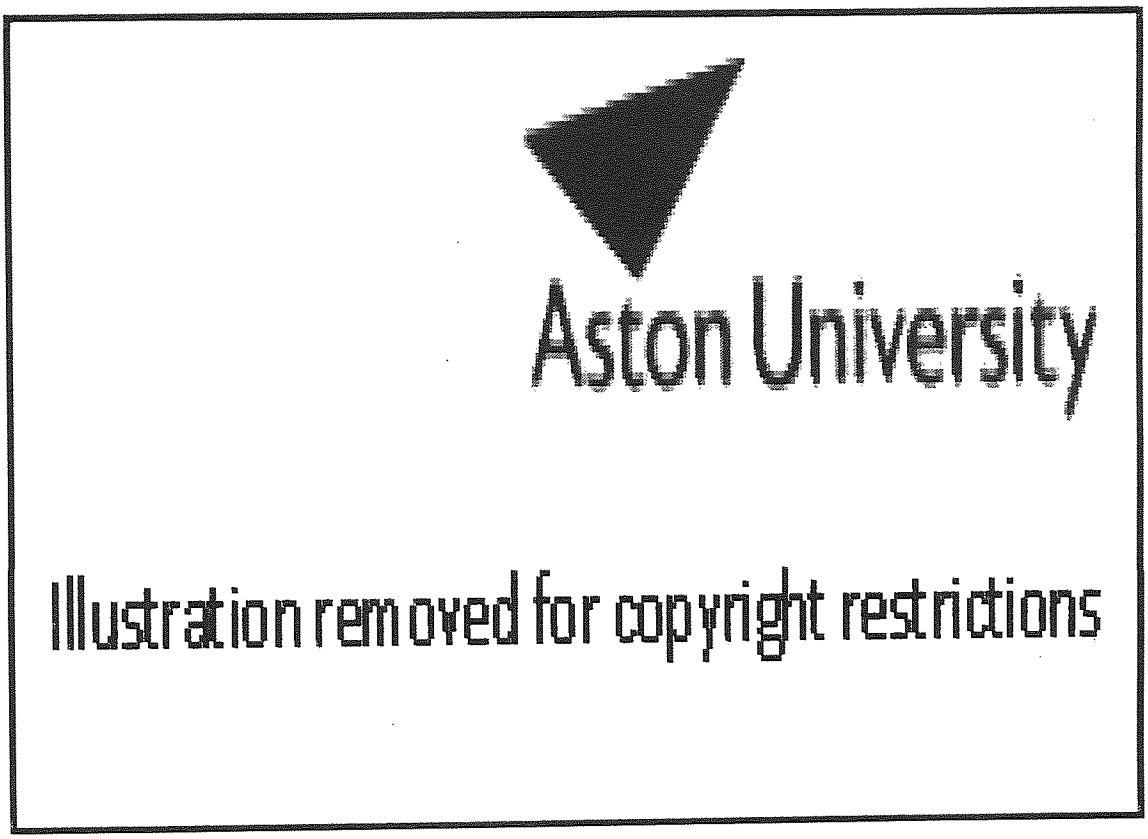
formidable, and it is here that the thinking of psychologists can be informed by work in other disciplines. Gilmour and Walters (1964) usefully summarize the way the term classification is used in philosophy and suggest a series of principles of classification which are listed in Table 11.1. A number of these principles are particularly relevant to occupational classification. Two important points are identified here: (1) the notion of purpose, which ranges along a continuum from general purpose classifications to special purpose classifications, and (2) the notion that it is not always possible to construct general purpose classifications.

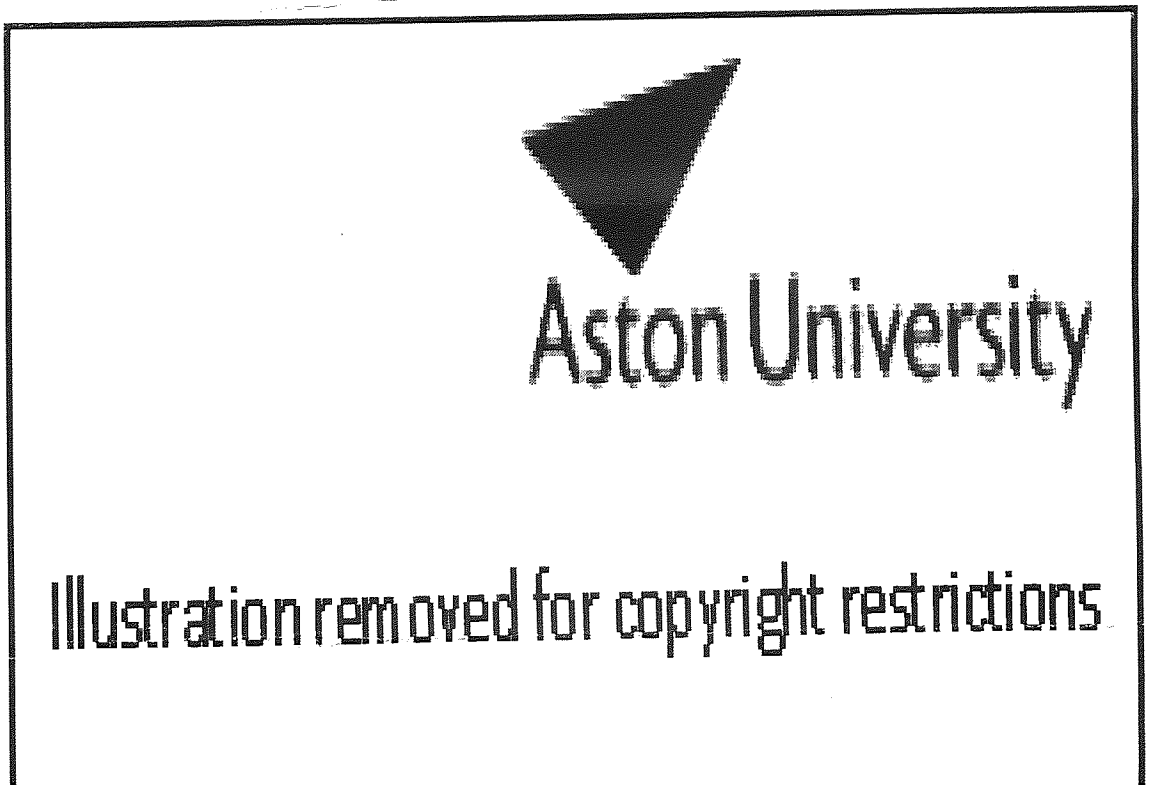
Gilmour and Walters, by stressing the importance of the purpose of a classification, demonstrate that there are always alternative classifications for any set of objects and that classifications must be evaluated in terms of how well they meet the purposes (criteria) for which they are designed. In developing this argument, Sneath and Sokal point out that traditional approaches to taxonomy in the biological sciences have attempted to fill too many functions and consequently have filled none of them well. Instead of trying to develop a taxonomy that attempts (1) to classify, (2) to name, (3) to indicate degree of resemblance and (4) to show relationship by descent, all at the same time, they argue that classification should be based on empirical data alone. Their operational approach, based on empirical analysis, implies that statements and hypotheses about nature should be subject to meaningful questions and that criteria must be established for defining categories and operations.

There are a number of points for psychologists interested in occupational classification to note from this. First of all,

TABLE 11.1

PRINCIPLES OF CLASSIFICATION





(From Gilmour J.S.L. and Walter, S.M., 1964).

to achieve conceptual clarity, it is necessary to specify the purpose of the classification. It is possible to identify very many variables for describing occupations and the vocational behaviour of individuals. It is suggested that, without some theoretical model for understanding the process of vocational behaviour, it is very difficult to decide on which variables to focus attention for the purpose of constructing the occupational classification.

It also seems questionable to the author whether, at the present time, it is useful for psychologists to attempt to construct other than special purpose classifications. Ideally, it would seem attractive to have occupational data banks available which describe occupations in detail on a large number of variables so that the information could be grouped in a number of different ways to fulfil different purposes. However, this seems to be of dubious practicality, because of the inherent difficulty in constructing data banks. This has already been highlighted as one of the major problems in the use of computers in vocational guidance (see Jackson, Sneath and Wallis, 1978). The fact that occupational data have a built-in obsolescence means that the information is always needing to be updated. The sheer number of occupations that can be identified means that the construction of this 'ideal' data bank would be a colossal task. This is, therefore, another reason why classifications need to be based on a theoretical standpoint that suggests key variables that are relevant to the purpose for which the classification is being designed.

11.4 There have been two main approaches to occupational classification by occupational and vocational psychologists. The

first approach that will be discussed has developed from work on training and has involved the attempt to construct task and skills taxonomies on the basis of task and skills analysis. The work of Fleishman (1973) and McCormick et al (1967, 1972) is particularly relevent here. This work has been concerned with identifying the patterns of skills and tasks required in particular jobs so that training programmes can be developed. However, Atkinson (1973) has pointed out that the acquisition of the skills shown by an experienced worker may not be sufficient to make a new worker proficient at the job, and that there may be particular skills that are only required for the learning process.

A second approach has attempted to assess individuals on psychological dimensions, such as abilities, interests, aptitudes, etc., and match the individual to particular job requirements. Interest Inventories are one common psychological tool for this and psychologists, for example, Roe (1956) and Super (1957), have attempted to build classifications of the world of work which use interest categories as one of their dimensions. Approaches used have been either strictly empirical, such as Strong's work (1943, 1955), or more recently, have attempted to develop a theoretical base for describing the world of work (see for example: Dawis and Lofquist, 1975, Holland 1973, Hanson, 1974). Although this work has been hampered by the fact that there is no agreement on the structure of interests or abilities, the recent work in this field can be distinguished from earlier work in that it has been based on the outcome of major research projects that have developed data banks as the basis of their classifications.

For vocational guidance, this work is probably of greater

importance than research concerned with training. It has been concerned with mapping out the dimensions that can be used to describe the world of work in terms of the psychological concepts that are used to describe people. In theory, it might be argued that, if psychologists can identify the skills and tasks required to perform particular jobs, any individual could be trained to do any job. In practice, while recognizing that individuals have the capabilites to perform a range of different jobs, vocational psychologists would want to argue that the individual's assessment of the quality of working life suggests that there is another set of variables to consider in presenting occupational information to people for vocational guidance purposes. Samler (1961) is one of the well known protagonists who has criticized much occupational information for not discussing psycho-social aspects of work. Other studies, for example Hayes (1973), who studied changes in apprentices perceptions of work, have indicated that it is the individual's experience of an occupational role that seems to be most important for the development of an awareness of the psycho-social aspects of work. Hayes suggests that not only should more attention be placed on giving information about the psycho-social aspects of occupations, but that research is also necessary to explore the ways occupational information is communicated.

11.5 The author's own study has been particularly concerned with individual's perceptions of the world of work. Just as ergonomists, looking at man-machine interactions, have studied the human operator's conceptual model of the control process, this study has attempted to identify the structural variables that influence people's perceptions of the world of work. It is suggested that these variables are important in mediating the effectiveness of

communicating occupational information. This view also has possible implications for the way occupational information is structured, and this study has been concerned to identify dimensions that are perceived to differentiate among occupations. This in itself might suggest what occupational information is required by people and in turn help to structure the collection of information about occupations.

A critical problem for occupational classification schemes is how they are extended and developed as well as adapted to the changing world of work. A promising approach, used by Dawis and Lofquist (1974) in the Minnesota Occupational Classification System (MOCS), is to consider the occupations that are currently included as benchmarks, or reference points, which serve to assist in the identification of the major dimensions of the world of work. The classification could then be extended if new occupations could be related to existing ones. With this approach, it is particularly important that a representative sample of occupations is used for the construction of the initial data base. It is suggested that research, such as that undertaken by the author, could provide one way that such a classification could be extended, although it would be wise to use a variety of methods to increase the validity of the results.

In distinguishing different approaches to occupational classification it is useful, also, to consider the distinction made by Morgan (1972) between nominal classification and relational classifications. At one extreme he considers a nominal classification that is one that only provides descriptive information about the occupations. This can be contrasted to relational classification - classification of occupations along psychological dimensions to

allow quantitative comparisons. Such a classification would normally be derived from a theoretical framework, for example, as the Minnesota Occupational Classification System is derived from the Theory of Work Adjustment (Dawis, Lofquist and Weiss, 1968). However, there does seem to be danger that such a distinction is starting to confuse the purposes of classification. Theory does provide explanations about how occupations differ, but it is also used to provide hypotheses that can be tested in the data.

The multidimensional scaling and clustering methods used in this study are very relevant to occupational classification. Inevitably much of the data used to describe occupations is either categorical or, at best, of only rank order nature and therefore scaling and related techniques, which do not make many assumptions about the level of measurement of the data, provide one of the most appropriate techniques for grouping the occupations together. They also provide techniques and methods for integrating new data into existing classifications.

11.6 Holland (1976) suggests that occupations should be classified for vocational guidance purposes in the same terms as vocational interests and vocational preferences - that is, in the same way that he proposes to integrate his theory and the structure of the world of work. Holland argues that there is considerable evidence to suggest that people have accurate occupational stereotypes, and he admits that his approach is based on this, for if occupational stereotypes were not valid, interest inventories would have little or no validity since they are based on the assumption that stereotypes are accurate.

However it would seem to the author that two major aspects of vocational guidance are ignored in this argument. Firstly, that people do not have accurate occupational information and their range of occupational knowledge is usually limited, hence the need for vocational guidance. Secondly, that since people's perceptions are based on limited occupational information, while they may be accurate at a most general level, these are frequently inaccurate at a more detailed level. An individual example of this has already been given (see Table 1.1).

This study was attempted because vocational psychologists seemed to have comparatively little information about how occupational perceptions are structured and even the effect of the most basic variables of age and sex had not been examined. Holland's approach, therefore, is based on an assumption which had only been tested in a most limited way and without any knowledge or theory as to how occupational perceptions might be related to interests, preferences, or the process of vocational choice. In contrast, approaches to occupational classification that are based on objective measurement of people at work, such as the Minnesota Occupational Classification System, are limited because of the time and effort required to generate information about very many occupations and because this information becomes obsolete. The study of occupational perceptions was seen, therefore, to be one way that such a classification might be extended as it could be used to assist in the identification of the key variables that people use to structure the world of work.

Data of the type collected here is also intended to assist in making theories of psychologists about the world of work

reflexive. The concepts used to describe both people and job requirements have only a limited lifespan, and psychologists must be aware of the danger of reifying their concepts. This research has not only used mathematical models to assist in the understanding and interpretation of the data, but has also used these models to attempt to understand how individuals model the world. Some psychologists, for example Kelly (1955), would argue that to do the former of these activities, it is necessary to do the latter. To explain how people comprehend the world, psychologists must at the same time comprehend how they, the psychologists, comprehend the world - their theories must be reflexive to allow them to explain their own behaviour as well as that of other people.

11.7 Occupational and vocational psychologists also have ethical responsibilities to their clients when they provide vocational guidance. Recently, the introduction of legislation making discrimination in employment on the grounds of sex illegal has focussed attention on whether the procedures used by psychologists in vocational guidance have been sex stereotyped. Although sex was probably one of the major determinants of occupational roles in primitive societies, the fact that the way labour is divided in different societies varies considerably is indicative that sex-stereotyping is largely founded on prejudice. Legislation against discrimination on racial and sex grounds and the possibility, in the future, of legislation against discrimination on age grounds, all of which are dimensions that have influenced how occupational roles are allocated, indicates the changing dynamics of the labour market. A fourth variable, which is still of relevance to-day in determining an individual's employment opportunities is who that individual's parents are. At one time this might have been justified

as a way of maintaining certain specialist skills which required intensive training over a long period of time. However, this rationale is no longer tenable and allocation of work according to accident of birth can no longer logically be defended. None of these variables should debar people from employment opportunities. This places a special burden on psychologists to dispel misperceptions people may have about the occupations open to them. Evidence reviewed earlier (see Section 3) suggests the existence of strong sex-stereotypes for occupations. The data collected from this study had been intended to examine the extent of sex differences in the perceptions of occupations. The results do suggest differences in occupational preferences, but it was not possible to isolate the extent of sex differences in perceptions in this analysis.

11.8 The data from this study, at an aggregate level, have suggested that there is a considerable consensus in the way occupational perceptions are structured by the subject groups included in this study. At an individual level, however, the data have revealed a considerable amount of individual variation in occupational perceptions. Although it has not proved possible in this analysis to reveal the way this variation might be structured, as had initially been hoped, the demonstration of the existence of individual differences in the perceptions of occupations, which appear greater for the younger age groups, has important implications for vocational guidance. In particular it challenges Holland's notion that it can be assumed that stereotypes about occupations are valid and stable over time.

It can also be argued that this has been implicitly recognized

by people who give vocational guidance. The facts that different interest inventories are considered appropriate for different age groups and, as shown clearly by the two versions of the Edinburgh APU Guide (Closs, 1975), that even different interest categories are appropriate for different age groups, suggest that vocational psychologists recognise that preferences and perceptions change over time. Further evidence to suggest that there are individual differences in the way occupational preferences develop over time is given by Brown (1968), whose data on the development of graduates' occupational choices show that a considerable number of his subjects did not make their choices until their final year at university, though for a small minority of his subjects occupational choices did not change from the age of eleven.

Interest Inventories, it seems to the author, should be considered primarily as empirical instruments which have been demonstrated to work well in practice. However, their relationship to theories of vocational development or to theories of attitudes or personality have not been well worked out. Interest Inventories work, perhaps, because there are very considerable individual differences in occupational preferences. In this study the analysis of the data on occupational preferences from the pilot subjects has shown the extent of these differences. The magnitude of this individual variation may serve in practice to conceal the extent of individual differences in occupational perceptions. These differences, however, could be very important when occupational information is given to people seeking vocational guidance. If people perceive occupations as being related together in different ways, they will be structuring their understanding of this information inappropriately. It is apparent, therefore, that

occupational perceptions are particularly relevant to the study of vocational behaviour. Concepts evolved from the study of occupational perceptions may not only be more easily related to concepts used in other fields of psychology but also be more appropriate to the study of vocational behaviour.

These issues are also relevant to theories of vocational guidance and career development. Recently the traditional theories and approaches to vocational guidance have come under several sorts of criticism. Holland (1973) has suggested that much of the vocational guidance literature is concerned only with college students and ignores the vast majority of people. Warnath (1975) has also criticized many of the assumptions of current theories of vocational development and suggested that these theories ignore the realities of the labour market and the effects of technological change on the nature of work for most people. His sentiments are also echoed in the latest edition of Peters and Hansen's readings on Vocational Guidance and Career Development. They note in their preface, ".....we have omitted a section on theories because they seem to be going nowhere," (1977).

In this country sociologists, particularly Roberts (1977), have also criticized the implications of current theories of career development for vocational guidance and suggested that the opportunity structure is a far more significant factor in determining the range of occupational choices open to a particular individual than is recognized by psychologically based theories. All these factors suggest that the subject area is in a state of flux, unsure of its theoretical basis.

In this situation many vocational psychologists would wish to adopt a strictly pragmatic and eclectic approach to vocational guidance. They would recognize that vocational guidance takes place in a social context and, therefore, must be multidisciplinary. The high rate of unemployment particularly among young people, which is likely to continue for the next five to ten years, and the changing nature of work are also factors to which vocational guidance has to adapt. However, if vocational guidance is to draw on psychological concepts, an atheoretical approach does nothing to resolve the theoretical dilemmas facing the field.

It is suggested here that one of the major theoretical problems facing the subject area is that existing theory is not well related to theory in other areas of psychology. There have, however, been relatively few attempts to do this. The work of Jones(1973) is one isolated example of research which has attempted to do this using Fishbein's (1967) model of attitude to study the development of occupational interests. It was, therefore, felt appropriate that this study should be exploratory in form. The tradition of cognitive psychology also seemed particularly relevant to vocational behaviour and occupational perceptions were felt to be essentially cognitive phenomena.

In a study designed to explore the relevance of a cognitive approach to vocational behaviour, the examination of the structure of occupational perceptions forms a natural starting point. Although vocational behaviour clearly involves sequential processes, unless the component parts of this process are understood, it is difficult to see how adequate models can be developed for the description of this process.

One most obvious process that can be subsumed under the heading of vocational behaviour is occupational decision making. Mitchell and Beach (1976) have reviewed research using either expectancy theory or decision theory to predict occupational preferences and choices. In their conclusions they stress the need for accurate information if people are going to make rational choices. Their review, therefore, suggests an important role for research on how occupational perceptions are structured, which will underpin research on occupational decision making.

11.9 It might appear that the techniques used here to analyze the data are too mathematical or too abstract for an applied field of psychology. However, the function of mathematical models, as Gulliksen (1959) points out, is to enable psychologists to develop a clear statement of their hypotheses. Multidimensional scaling techniques differ from traditional unidimensional psychophysical scaling methods because they do not require knowledge of the dimension to be scaled in advance of data collection. These techniques are, therefore, particularly appropriate for an exploratory study that is attempting to determine the way perceived differences among occupations are structured and also for a field of enquiry where theoretical development in required.

At this stage it is also appropriate to raise some questions about the measurement procedures that have been used in the analysis of the data. In particular it is useful to consider both the extent to which the model is suitable for the data which have been presented and in what ways the model might have been adapted or developed. This has some implications for related research in this field which might want to extend this approach and methodology.

Multidimensional scaling procedures have developed very rapidly over the last decade, but it appears to the author that their use is still fairly restricted. They have not yet become as widely known or used as factor analytic techniques, even though they offer a considerably wider range of measurement models that are, for example, capable of relating cognitive/perceptual data to evaluative data. It is not the purpose of this review to discuss the theory of measurement or theoretical questions about the development of scaling techniques; these are discussed adequately elsewhere (see Coombs, Dawes and Tversky, 1970, and Shepard, Romney and Nerlove, 1972). However, it is useful to note that in employing a particular measurement procedure, in this case scaling techniques, certain assumptions are being made about the data. It is also useful to be aware that it is possible to make a distinction between fitting data to a model and testing how well the data are fitted by the model. In this research study, for the pair comparison data, multidimensional scaling has been used in the former sense, as a technique which has assumed that the measurement model is appropriate and has tried to obtain the 'best' fit between the model and the data. However, with the preference data an attempt has been made to fit the data to a number of different models.

One question which was raised earlier (see section 4.19) is whether the Euclidean distance model is the most appropriate for this type of data. Unfortunately, the author did not have access to a multidimensional scaling programme that would have allowed the testing of other types of distance function. Two alternative metrics might have been considered to be appropriate to this data and it would have been interesting to see whether either the 'City block' metric or the 'Dominance' metric would have given a better fit to this data. These different metrics make different

assumptions about how the distance between two points is calculated. The City block metric assumes that a rectangular grid pattern overlays the space and that the distance between two points is calculated by going along each path in turn, just as in a city where it is only possible for the streets to go in two directions, which are at right angles to each other. The distance between two points is the sum of the differences on each of the two components rather than the length of the straight line joining them. In the Dominance metric it is assumed, in contrast, that the largest single difference dominates all the others.

It has been suggested (Attneave, 1950) that the City block metric is a better fit than the Euclidean metric when the dimensions underlying the judgement process are salient and few in number and that the Dominance metric is more appropriate when one dimension is likely to be superordinate in determining the subjects rating. Although it is not clear that either of these situations applies when studying occupational perceptions, it is possible that they might be more appropriate in certain situations, for instance, where the study involved the study of vocational preferences or in contrasting a particular subset of occupations that differed in specific ways over a limited number of dimensions. In this study the City block metric might have been appropriate for the data concerning the technical occupations. It might also be that people more familiar with a particular occupational area would fit one model better than another because they would make their comparisons in more direct terms. It would be interesting also to test whether particular groups of subjects were fitted better by one model or another. This would have involved using the multidimensional scaling measurement models as a criterion, seeing how well the data

are fitted by the different possible models. In this way the study would have compared different psychological theories about how perceptual judgements are made.

It is suggested, therefore, that these different models would be useful for a study of the sorts of combination rules people use in making vocational decisions and in elucidating what dimensions people perceive in occupational information. Multidimensional scaling methods can also be used to relate cognitions to evaluations, as in the analysis of the pilot study preference data reported in Sections 10.9 to 10.15, although in this study the emphasis has been on the nature of people's perceptions of occupations rather than the evaluations that are made among occupations. Relating the subjects' prestige judgements to the perceptual data is another example of an attempt to relate these two sorts of data.

11.10 When this study was designed, the author only had access to two multidimensional scaling programmes and so the emphasis in the data collection was to generate data appropriate for analysis using these models. The extension of multidimensional scaling to deal with individual differences, using a model that allows subjects to weight the dimensions differently, was important as it permitted examination of the extent of consensus in cognitions. While it has always been clear that there were individual differences in preferences, the extent of individual differences in perceptions has been debated and has important implications for studies in vocational psychology. For example, Holland (1976) argues that vocational interests, vocational choice and occupational membership should be construed in similar terms. It can be seen that this argument suggests that perceptions can be inferred from a knowledge of preferences, rather than that occupational perceptions might themselves be structured

in ways that relate to vocational development or might influence the process of vocational choice. The argument is not about how useful vocational interests are as concepts for vocational psychology, but rather about how theories about vocational behaviour should be structured. The role of perceptions in vocational behaviour has already been discussed (see Section 2) and the point to note here is how developments in measurement procedure can allow psychologists to test new hypotheses about behaviour.

11.11 The development of an integrated series of multidimensional scaling programmes by Coxon et al (1975) has made available a set of programmes for use in a variety of situations for which scaling is appropriate. These include models for relating preferences to cognitions, as well as individual differences scaling programmes. The availability of these programmes suggests that future research in this field could usefully adopt a more integrated approach to the study of the vocational choice process, essentially a longitudinal study, rather than adopting the cross-sectional approach used here, which has been concerned to study one set of variables rather than the interrelationships of several sets of variables.

There does seem to be one important problem here for applied psychologists. The widespread availability of computer programme packages, which give access to a series of advanced statistical procedures, can encourage the blind use of these procedures regardless of the fact that there are still considerable methodological problems that are unresolved or being debated in the literature about how these programmes should be correctly applied. There is an increasing need for training in research methods in this area.

A related problem concerned with using relatively new measurement and statistical procedures is that there are comparatively few published studies which can be used as guidelines for the research worker who wishes to experiment with the use of a particular research procedure. The use of a novel research method, by someone who is not primarily concerned with the development of methods but rather with the application of the new procedure to a particular field of study, can be a risky process if subsequently the research method is shown to have some unforseen limitation. The researcher may also have difficulty in locating professional colleagues who are familiar with how the new procedure might be applied in a particular research situation and with whom he can meet to discuss the development of his own work.

Another problem that can be encountered when using novel techniques of data analysis, is checking that the data is collected in such a way that the intended analysis can be carried out. This is besides making sure that the data collected is usable and does not contain too much missing data. The collection of similarities data is not difficult and there are, in fact, a number of alternative methods that could have been used instead of the method of pair comparisons. However a questionnaire based method had considerable advantages when it was necessary to test groups of subjects together. If data were going to be collected from individual subjects or small groups of subjects (less than ten at a time), a free sorting method might not only be more flexible than a questionnaire based method but also be less monotonous to perform. In this way a free sorting task could be used in parallel with a questionnaire which could be used to collect data directly on specified dimensions. Similarity measures could then be calculated from the results of the free sorting task using the method outlined by Boorman and Arabie (1972).

11.12 At this point it will be useful to review the main findings of this research study in order to detail the problems in the design and development of the study and how they affected the final outcome of the study. This will enable the discussion to focus more critically on what has been learnt from this study and how the results of the study relate to other work in this subject area.

It is appropriate to start with an assessment of the results of the pilot study. At the outset the author was only aware of Reeb's work and the pilot study set out to attempt to replicate this work with a new population. As has already been noted (see Section 4.12), Reeb's results were provocative in suggesting that, at a general level, a two dimensional mapping of the world of work seemed appropriate. However, two main limitations were noted in his study - first of all the failure to take into account the possible range of individual differences in the data and secondly the failure to note that these results applied only at a most general level. For the author's study, the choice of occupational titles was restricted in terms of occupational level. Subsequently analysis for individual differences was also carried out. The initial results of this study, reported in Sections 5.13 to 5.23, indicated that a meaningful interpretation could be given to the data at an aggregate level in two and three dimensions. These results appeared quite compatible with groupings that might be suggested from other sources, for example MOCS (Dawis and Lofquist, 1974) or Holland's three point codes (1973). When the data for the men and women were scaled separately certain differences in the way the occupations were related together were noted, but unfortunately unforeseen assumptions in the INDSCAL scaling algorithm severely limited the analysis of the data for individual differences.

However this analysis did suggest that a considerable range of individual differences existed in the data and it seemed possible that differences between the sexes were one cause of this. Analysis of the data from the second section of the pilot questionnaire which was concerned with preferences, reported in Sections 10.9 to 10.15, suggested that the range of individual differences in preferences was very considerable and that there did appear to be notable sex differences in preferences, which confirm sex stereotypes.

Although it was possible to relate the preference data to the perceptual structure obtained from the pair comparison data, when the preference data were scaled separately, the structure of the solution did differ from and was also somewhat simpler than the structure obtained from the pair comparison data. This suggests that, although the range of individual differences is greater for this data, preference data alone fails to identify all the underlying perceptual dimensions along which the occupations are perceived to vary. This result indicates that studies which attempt to identify the dimensions along which the world of work might be structured from the analysis of preference data, for example, from interest inventories, are likely to underestimate the true complexity of the perceptual structure people use to distinguish among occupations.

11.13 The fact that the pilot study was completed successfully and that the initial analysis of the pilot study data suggested that a meaningful result had been obtained led to the decision to develop and extend the research. The review of related research studies, reported in Sections 4.6 to 4.22, suggested that two factors in particular had been ignored in the investigation of the way occupational perceptions were structured. First of all the range

of convenience of the dimensions used to structure occupational perceptions had not been tested and secondly the subject populations used in these studies had been restricted in terms of age and sex. A third component of the research design was to collect data both in the United States and England so that some cross-cultural comparison of the nature of occupational perceptions could also be made. One change made between the pilot study and the main study was to shorten the first pair comparison section of the questionnaire in order to minimize boredom and fatigue effects and to include a second section designed to provide descriptive information about subjects' stereotypes to complement the pair comparison data. The conceptual framework of the research design was outlined in Sections 6.1 to 6.6 and a description of the questionnaire development for the main study is given in Sections 6.7 to 6.11.

In practice, however, there were a number of problems in trying to carry out the research design as initially planned. The problems that occurred with the arrangements for the data collection and in the actual collection of the data have already been discussed (see Sections 6.12 to 7.11). However only at this stage is it possible to review the consequences which these had for the research study.

11.14 The main limitation to the study was caused by the unforeseen assumptions in the INDSCAL programme. This limited the amount of analysis that it was possible to carry out and as a result it has not been possible to identify the factors that might be correlates of the individual differences observed in the data. However some patterns can be observed in the data. For the three US subject groups who filled in the same white version of the questionnaire, there appeared to be a gradation in their results. This was noted

both for the descriptive data on interests and prestige, for which it appeared that there was less consensus among the younger subject groups as to the ratings they gave the occupational titles, and also for the pair comparison data. The gradation in these data suggested that the younger subjects were less sure of their occupational perceptions and that these subjects also tended to use fewer dimensions to structure their perceptions than older subjects.

It was noted for all the analyses that the groupings and dimensions suggested by the data could be interpreted using the dimensions and categories commonly used to describe the world of work. As well as suggesting that the concepts used for vocational guidance and occupational classification are appropriate, this result suggests that both concepts and test materials used in the United States are likely to have cross-cultural validity. This is not to say that such materials and ideas can be imported carte blanche, but that the essential framework of concepts used to describe work have important similarities between the two countries. The range of differences that is observed across these countries appears no greater than the range of differences observed within the countries. This result, of course, only applies to occupational perceptions. It is possible that there are differences in preferences. However, granted that there is a far greater range of differences in preferences amongst individuals anyway, as evidenced by the analysis from the pilot study, it seems unlikely that the range of differences is greater across cultures, although it is possible that the ordering of preferences may differ.

11.15 Another limitation to the study was that it was not possible to locate groups of subjects in the UK to match the US subjects.

Although this did prevent certain comparisons being made, the general effect on the analysis has not been detrimental. The amount of missing data was generally low, except for one group of British subjects. Once again, this has not caused major difficulties for the interpretation of the data. It appears therefore that the general design framework for the study shown in Table 6.1 has been carried out moderately successfully apart from those limitations that have been noted.

11.16 Although the study used a cross-sectional approach, the inclusion of subjects from different age groups has suggested that developmental differences in the range of individual differences in occupational perceptions are significant. Without carrying out a longitudinal study, it is not possible to be certain that there are not generational differences that are causing this trend in the data. It is suggested that any extension of this research would be wise to attempt a longitudinal study, not only to study the development of occupational perceptions more thoroughly, but also to examine the interrelationship between perceptions, preferences and vocational behaviour. Such a study would, therefore, focus on the process of vocational development rather than the components of that process.

11.17 A major component of the study has been the use of multi-dimensional scaling and related techniques for the analysis of the data. It has been shown that these methods are appropriate for cross-cultural research because they do not impose the researcher's conceptual dimensions on the subjects. There are aspects of the methodology, such as choice of metrics (see Sections 11.9 to 11.11) which it was not possible to investigate in this study. However, the existence of an integrated set of multidimensional scaling techniques

that can be used to provide an analysis of data including perceptual and evaluative components has considerable potential value for vocational guidance research. The method used for the analysis of preference data could also be used to analyse data from interest and personality inventories to reveal how they are structured. It would be possible using these techniques to investigate whether different sections of an interest inventory, such as the Connolly Occupational Interest Questionnaire (Connolly, 1968), appear to be structured in the same way, and whether subjects express a similar ordering of preference over the two sections. This would provide one way of investigating Cooley's (1966) suggestion that interest inventories may frequently be measuring two distinct but related concepts (see Section 2.13). It seems to the author that research in this subject area has a great deal to gain from these methodological innovations.

11.18 In investigating the structure of occupational perceptions further, there seems to be a need to focus more specifically on particular occupational content domains - such as medically related occupations or craft apprenticeships. This research has demonstrated that content domain does affect the dimensions that are used in the judgement task. Frequently in vocational guidance practice clients will be interested in making distinctions between occupations in much more restricted contexts than those used here. There is a need to identify the dimensions people use to make judgements in these situations, which might in fact be more idiosyncratic than the concepts and dimensions that appear to be used at a more general level.

A study more focussed on the occupational choice process might also be able to reveal how individuals explain the causes of their own behaviour. Attribution theory which was developed to deal with questions of 'social perception' - the causes of observed behaviour and the answers given by the 'man in the street' - might be particularly useful to the understanding of this process. In reviewing the processes of causal attribution, Kelley (1973) points out that subjects are often too conservative in their use of information and fail to extract all the possible information from the data. He notes also that the actors in experimental situations tend to attribute their actions to situational constraints, while observers attribute the same actions to the actors' stable personality dispositions. Strong (1976) has suggested that in a counselling interview,the counsellor can influence the sources to which the client attributes his actions. This research has important practical implications for the conduct of interpersonal situations, such as the vocational guidance interview. Attribution theory might, in part, explain why counsellor and client often perceive the interview in very different terms. Kelley suggests that the attributions of cause that people make can influence their behaviour and provide not only an impetus for action but also influence decisions about possible courses of action. In the framework of a cognitively oriented approach to vocational behaviour, it is suggested that the study of causal attributions could provide useful insights into people's perception and understanding of their vocational behaviour. This context would also provide an important real life situation for the examination of causal attributions and their influence on behaviour.

11.19 In reviewing this study it is also important to consider just what can be learnt from an exploratory study of this sort. Almost

by definition an exploratory study adopts an open-ended approach to data analysis. One difficulty, therefore, is making a decision as to where to stop. An example of this, with respect to the individual differences scaling, was shown by the consideration of alternative approaches that might have adopted for that analysis (see Section 10.8). Even in carrying out an experimental study, it is foolish to ignore post-hoc analysis, even if the results of that analysis cannot be given the same status as the initial analyses. The researcher has to make a careful decision as to how much analysis is appropriate. It is almost always possible to carry out more analysis, but the benefits of doing this may be very limited. Sometimes it is only when trying to report a study or develop a particular type of argument from the data that it becomes clear just how much and what analyses are required. It seems to the author that one of the most tangible benefits from carrying out a research study from beginning to end is the experience the researcher gains of making this type of strategic decision.

11.20 In this study there were a number of procedural difficulties where the researcher had to make decisions under close time constraints. On reflection, it seems that the results of most of these decisions did not undermine the study. The one case where the decision made did not have a very satisfactory outcome, was the question on occupational challenge. Even in this case, however, although the data were not very informative on the desired topic, they did not threaten the rest of the study. The experience also made the researcher realise that the concept of challenge was more difficult than anticipated to operationalize. There are several lessons to learn from making such errors. However, it is important not to ignore a concept or area of study just because an initial research exercise was not successful.

In the case of the interest data, the researcher was also faced with making a difficult decision. Here the question format adopted worked well, but the data were difficult to analyze. However the data served one useful purpose in that they suggested possible approaches to the pair comparison data. In this way they fulfilled their subordinate role in the study which was to complement the pair comparison data.

The descriptive data did directly answer some questions - for example, as regards the status of professional engineering occupations. It appeared that the younger High School students did not rate these occupations highly. There were also differences in the way Liberal Arts and Institute of Technology students evaluated these occupations in terms of interest, as well as direct evidence that people on their own admission did not really know what occupations like Civil Engineer involved. All these factors suggest a general ignorance among people in general about what scientific and technical occupations involve.

The individual differences scaling of the pair comparison data from the University Students who filled in the yellow version of the questionnaire, which was concerned with the scientific and technical occupations, also suggested that the range of individual differences was greater for this group of subjects than for those who filled in the white general form of the questionnaire (see Section 10.6). The fact that the MSPACE analysis of these data suggested a comparitively low degree of error in the data (see Section 9.7 and Table 9.2) is a reflection on the fact that the aggregate of subjects' ratings yielded a consistent result. The MINISSA scaling takes no account of the range of scores attributed to the various pairs of

occupational titles but only inconsistencies in the averaged rating of the titles. It is therefore possible for a solution based on the average of subjects' ratings to be consistent and low in error, but yet conceal a wide range of individual differences.

11.21 A final topic for consideration in this discussion concerns the relevence of this research. This involves the demonstration both of how this research is distinguished from earlier related work and how the results of this study can serve to focus and direct work in this area. In terms of existing research and theory, the main theoretical implications of this work for vocational guidance have already been outlined (see Section 11.6 to 11.8). It is proposed that the role of occupational perceptions in vocational behaviour has been underestimated and that perceptions provide a more adequate set of concepts for construing occupational behaviour than preferences. Analysis of preference data alone is likely to underestimate the number of dimensions people use to distinguish among occupations. For vocational guidance purposes, it is important to attempt to identify all the dimensions used to structure occupational perceptions and how these might differ for different people. It is argued that the approach adopted here is more direct and more likely to provide a complete account than more indirect methods based on interest inventories or preference data alone. The fact that the results of this study identify similar dimensions for structuring occupational perceptions as other analyses based on other types of data is evidence for the validity of the methods used in this study. A significant finding of this study concerns the range of individual differences that have been identified in the data. Although further work is required to elucidate fully how these differences are structured, this result directly challenges current assumptions about the consensual nature of occupational perceptions.

The focus in this study on individual differences serves to distinguish this study from other related studies. The range and structure of the subject populations used in this study is considerably wider than those employed elsewhere. This study has also investigated directly the range of convenience of the dimensions used to structure occupational perceptions. The demonstration that there is a limited range of convenience for these dimensions has obvious implications for vocational guidance practice.

Most importantly, this study has adopted an explicity cognitive approach to vocational behaviour. The final assessment of this study, therefore, must be in terms of the relevence of this approach and the extent to which the data presented here demonstrate not only the appropriateness of the approach, but also the contribution that the approach can make to our understanding of vocational behaviour. This theoretical emphasis in the research provided the main purpose for carrying out the study. The final chapter, therefore, reviews the whole study and presents this final assessment.

12. CONCLUSION.

12.1 The main purpose of this final chapter is to assess the relevance of the cognitive approach adopted here to vocational psychology. To do that it will be useful to give a brief recapitulation of the development of the study which will provide a summary of its main points. The main conclusions will also be stated and discussed. Certain implications of this research for further work in the field of vocational psychology will also be discussed.

12.2 At the outset, the introduction described the background and development of the research. Certain continuities and links with other work carried out by the author were also noted. The fact that the author spent a year in the United States gave him the opportunity to carry out a piece of comparative, cross-cultural research. It also meant that the research had to employ a cross-sectional design. The consequences of North American dominance of much of psychology were also discussed. It was intended that this study should have some relevance to the wider question of the extent to which the results of American work could meaningfully be applied elsewhere.

The development of the field of vocational psychology as a speciality was commented upon and some of the general features of research in this subject area were also noted. These included the dependence of vocational psychology on concepts from related areas. It was pointed out that these concepts frequently have problematic aspects. An attempt was also made to present some definitions of terms that would be employed in this thesis and to point out possible

areas of confusion that could arise because of differences in usage of special terms between North America and Britain.

12.3 The second section was concerned with outlining a cognitive approach to the subject matter of the thesis. The general antecedents of this approach were briefly noted and cognitively oriented work in the field of personality psychology reviewed. The cognitive orientation in the work and theories of Lewin, Rogers and Kelly, which were described as a 'phenomenological' approach, was discussed. This approach was contrasted to the 'cognitive social learning' approach of Mischel (1973), which was also considered to be cognitive in orientation. It was noted that predictions about behaviour made on the basis of cognitive data have not been bettered by predictions made by other methods.

Although both these approaches emphasize the importance of subjective and cognitive variables in the explanation of behaviour, behaviourally oriented accounts do not consider these variables as the pervasive determinants of behaviour. A purely cognitive account can be seen to be incomplete, but it is asserted in this study that ignoring cognitive variables must also lead to an incomplete account of behaviour.

It was suggested that a cognitive approach can be considered implicit in much of the research and theory of vocational psychology. Various studies, which have drawn on the phenomenological concepts of Rogers and Kelly, were reviewed (See Section 2.6 - 2.7) and contrasted to the approach to vocational behaviour developed by Jones (1973), which drew a parallel between the study of attitudes in social psychology and the study of occupational choice behaviour

(See Sections 2.8 - 2.10). The account by Jones, which has a great deal in common with the work of Mischel, can also be considered explicitly cognitive in orientation in that it stresses the importance of the role of the perception of occupations in vocational behaviour.

It was noted that Jones' concept of perception needed to be circumscribed to bring it into line with the set of variables suggested by Mischel for studying personality. In the study reported in this thesis the perception of occupations is seen as one component of, or set of variables for any account of vocational behaviour. Although this study focusses on the structural variables involved in occupational perceptions, this is considered to be an initial starting point for a cognitive approach to vocational behaviour. The intention of this study, therefore, is not to offer a complete cognitive account of vocational behaviour, but rather to present one particular set of data which are seen to represent a central component of such an account of vocational behaviour. This is, therefore, the first sense in which this study might be considered exploratory. A primary intention of the research has been to investigate whether this explicitly cognitive account is appropriate for the study of vocational behaviour.

12.4 The following two sections completed the review of the literature. They focussed on two approaches to the study of people's perceptions of occupations. Section 3 briefly reviewed research on the content of occupational stereotypes and its relevance to vocational guidance, noting in particular some of the limitations of this type of data. Section 4 was concerned with the structure of occupational perceptions.

This section of the review concentrated on the work of five people who had used multidimensional scaling as a method for studying the structure of occupational perceptions. Although various different limitations were noted in these studies, multidimensional scaling methods were seen as particularly appropriate for this type of study because they did not impose the researcher's dimensions on the data. For this reason the methods were also especially suitable for cross-cultural research. Cognitive complexity was seen as one variable that might be used to distinguish among occupational perceptions. In practice, it was not possible to use it as a variable to distinguish among the subjects because of unforeseen limitations in the multi-dimensional scaling methods.

12.5 The pilot study, which was an attempt to replicate Reeb's work, was reported in Section 5. The main implications of this research for vocational guidance have already been discussed (See Section 11.12). The results of the pilot study provided support for the use of multidimensional scaling methods for the study of occupational perceptions. They also suggested that there might be sex differences in the way these perceptions are structured.

The main study was therefore designed to take account of the results of the pilot study. Two parallel versions of the questionnaire were designed to investigate the range of convenience of occupational perceptions and subject groups of different ages were included. Research data were collected both in the United States while the author was at the University of Minnesota and in England when the author had returned to the University of Aston. Although some difficulties were encountered in finding subject groups in England that were equivalent

to the American subjects, these did not undermine the research design. A more serious limitation to the analysis were certain assumptions in the INDSCAL scaling programme, which made it inappropriate to carry out certain types of comparison across subjects and subject groups (see Section 10.4). This made it difficult to identify the factors that might be affecting the structure of subjects' occupational perceptions. From the limited analysis that was carried out, it proved impossible to identify these factors, although it was apparent that there was a considerable range of individual differences in occupational perceptions.

12.6 The results from the main study were presented in three parts. The first (Section 8) dealt with the descriptive data from the second part of the questionnaire. These results were intended to complement the data from the pair comparison section of the questionnaire and were important in that they suggested possible areas of difference between the subject groups. The question on prestige, for which the data were presented in Section 8.10, showed several differences between the subject groups in terms of the prestige ranking they gave to the occupations. These differences were summarized in Figure 8.1, which showed that, for the American subjects, there was greater consensus among the older groups and greater sex differences between the younger groups. These results suggested that it would be appropriate to see whether sex and age were two factors that might affect the perception of occupations.

The second set of data to be presented in this section was the interest data. The results of this analysis, presented in Section 8.9 and Sections 8.11 to 8.14, showed that there was a general consensus as to which interest categories were most strongly associated with particular occupational titles. Once again the

variation in results appeared greater for the younger subject groups. There were also differences in the way Liberal Arts and Institute of Technology, students rated some of the technically oriented occupations. These results indicated that it would be appropriate to see whether there were differences in the way these groups structured their perceptions of technically related occupations. The interest categories appeared to be used consistently by the different subject groups. Some of the variation in ratings across the subject groups may be accounted for by the fact that, as Walker (1958) noted, certain occupations are less stereotyped than others. These results demonstrated a marked trend for consistency in ratings, which suggested that the analysis of the pair comparison data might also show that the different subject groups structure their occupational perceptions in similar ways.

It was, unfortunately, difficult to investigate the extent of cross-cultural differences in either of these sets of data because only one set of British data was available to compare with the American data. It was therefore difficult to know whether observed differences in the data were caused by genuine differences in perceptions or actual differences in job content. It was also impossible to establish whether the patterns found in the data for the American subjects, that is greater consensus among the older groups and greater sex differences among the younger age groups, would be repeated in the British data.

The question on challenge caused the most difficulty to subjects and the results suggested that, besides the procedural difficulties, this question failed to successfully operationalize this concept. Although this caused an omission in the data, it did not threaten

the design of the study. The question on knowledge of occupations also failed to work well and the data from this question were not analyzed in detail.

The question on educational aspirations revealed not only how the American subject groups compared with the rest of the High School population, but also suggested that there were cross-cultural and sex differences in the level of educational aspirations. Sex differences were less apparent in the American data but sex differences in the British data suggest that in this country girls are less ambitious than boys, although these data need to be interpreted with some caution (see Section 8.16).

Although there were more difficulties with the questions in this section of the questionnaire than with the pair comparison data, these data fulfilled their main purpose in this study in that they provided insights into how occupational perceptions might be structured. They also highlighted some differences between the subject groups.

12.7 Section 9 dealt with the multidimensional scaling and hierarchical cluster analysis of the aggregate data from the pair comparison section of the questionnaire for the different subject groups. These two methods were intended to complement each other. The results of both methods of analysis showed, at an aggregate level, a considerable similarity in the results for all the subject groups who had filled in the same version of the questionnaire. Most significantly, differences between subject groups from England and America were no greater than differences between groups from within the same country. For the American subjects, there was a

gradation in the results from the younger to the older subject groups. This was revealed in the hierarchical cluster analysis and the multidimensional scaling which suggested that the gradation was caused by an increase in the number of dimensions required to explain the data satisfactorily from the younger to the older subject groups. It appears, therefore, that there are developmental differences in occupational perceptions and that multidimensional scaling is able to reveal the structure of these differences.

For the two American student groups who filled in the parallel forms of the questionnaire, differences were noted in the dimensions they used to structure their occupational perceptions, showing that they did use different dimensions in these different contexts. It would appear, therefore, that these occupational concepts have a limited range of convenience. When comparisons were made between the rating of titles in the pilot questionnaire and those same titles rated in the yellow (technical) form of the main study questionnaire, certain differences were noted. These results showed that context could effect even the rating of the same objects.

12.8 Section 10 was concerned with the analysis of the same data for individual differences. Analysis with INDSCAL revealed a considerable range of differences in the data, but as noted earlier (see Section 12.5), it proved impossible to identify the way these differences were structured. For the American subjects the amount of individual variation was greater for the younger subject groups and also greater for the yellow form of the questionnaire than the white form of the questionnaire. These results serve to support the earlier analysis of these data at an aggregate level and provide further evidence for developmental differences in the data.

The second part of Section 10 was concerned with analysis of the preference data from the pilot study for individual differences. The very considerable range of individual differences that was revealed in the preference data indicated the effectiveness of the multidimensional scaling models that are available for handling this kind of data. Differences in the structuring of the occupations in this context showed that information was being lost in this analysis, and that analysis of preference data alone fails to identify all the underlying perceptual dimensions.

This issue was taken up in Sections 11.8 and 11.12 where some of the implications of this analysis for current theories about the relationship between preferences and perceptions were discussed. The results presented here indicate that a considerable range of individual differences exist in the perception of occupations. The range and extent of these differences will vary across contexts and it appears that, at a most general level, these differences diminish for older subjects. However, older subjects' perceptions are, in general, structured in a more complex manner than those of younger subjects. The pattern of these results suggests that perceptions of the world of work are learnt. Although it was not possible in this study to identify in greater detail how these differences were structured, the data that were presented do have important consequences for vocational guidance practice, as has already been noted (see Section 11.8). Practitioners will be well aware that young people frequently have inaccurate occupational stereotypes. These stereotypes will affect the way young people assimilate and structure occupational information.

12.9 Of considerable importance to the thesis have been the methods used for the collection of the data. These methods are an integral part of the research approach adopted here. It was necessary to demonstrate, therefore, that the questionnaires used in this study could collect the kinds of data that were required. Because this study employed largely analytical methods for data collection (see Section 6.4), which are comparitively simple to complete, but require complex analysis, there was always a risk that the data obtained would turn out to be unusable. Gonyea's (1961) study is one example of what can happen. In this respect the study has been successful.

The methods used have been able to demonstrate the existence of groupings and structure in the subjects' occupational perceptions which are similar to those proposed on the basis of psychometric assessment. They have also demonstrated that a considerable range of individual differences exist in occupational perceptions and that perceptions can be related to preferences. It is suggested, therefore, that these methods offer a powerful analytical tool for research in vocational psychology. This study demonstrates a range of applications for these methods in this field. Considerable effort has been put into describing how these methods are used because there are still comparatively few accounts available to the general user. Although there are pitfalls in using the methods and the techniques are still being developed, for most purposes, the suite of ten programmes collected together by Coxon et al (1975) are adequate. Five of these programmes have been used in the analyses presented here. Some of the ways these programmes might be used in this and related research were discussed in Section 11.9 to 11.11 and their appropriateness for this type of research was noted (see Section 11.17).

Although the availability of the MSPACE programme (Spence and Graef, 1974) greatly assists in the interpretation of some of the results of these analyses, the researcher still has to make a considerable number of judgements and decisions as to how best to present his data. In so much as these are subjective, an effort has been made to present as much information as possible, so that the reader can form his/her own opinion as to the appropriateness of the decisions that have been made here.

12.10 There are a number of difficulties involved in trying to develop theories in the area of vocational psychology and some of these have been commented upon at various points (see Sections 1.6 and 11.8). It is argued here that the subject matter of vocational psychology does require a theoretical approach and that, without a well articulated theory, practice is likely to lack a conceptual framework. However, a new theory is not being presented here. Rather the work reported in this thesis provides the outline of an approach that can be used to focus and direct research work in this field. As Blau et al (1956) note, theory derives from and is tested by empirical research. It is hoped that by stimulating further work, the ideas presented in this thesis will lead to conceptual development in this subject area.

It is widely recognized that vocational behaviour takes place in a social context and is affected by many variables operating at a variety of levels. It would appear, therefore, that this behaviour needs to be viewed from a multidisciplinary standpoint. Such a position has been taken by several of the multidisciplinary teams of research workers that have been active in this area, for example,

Ginzberg et al (1951) and Blau et al. One difficulty facing such an approach is whether concepts drawn from different disciplines and from different levels of discourse can be integrated. Whether or not these concepts can be integrated is a continuing debate (see Daws, 1977 and Roberts, 1978). Protagonists for exclusively psychological accounts of vocational behaviour (e.g. Brayfield,1961 and Dawis, England and Lofquist, 1964) have argued that such a single discipline based theory can be appropriate. The question remains, though, whether such accounts must necessarily be partial and incomplete, even in psychological terms, because of the variables they ignore. The conceptual scheme for occupational choice and selection proposed by Blau et al is attractive because it offers a rapprochement between the disciplines.

It is proposed here that some types of psychological account of vocational behaviour are more likely than others to be compatible with work in other disciplines and also more easily related to work in other areas of psychology. It is now more respectable within psychology to consider as relevant to psychological accounts of behaviour the meaning the subject gives to the situation in which he/she finds him/herself. The question remains, however, whether the cognitive approach adopted here can provide the framework for an account of vocational behaviour that can both be related to work in other disciplines and also to work in other areas of psychology.

12.11 Borow (1966) has pointed out that comparatively little is known about the development of occupational motives and roles. This thesis has looked at one aspect of this development - the structure of occupational perceptions. The groupings and dimensions used by

subjects to structure their occupational perceptions seem closely related to the dimensions and groups used in vocational guidance. These results suggest that these dimensions and groupings are appropriate for vocational guidance purposes, although the range of individual differences observed in perceptions indicates that these dimensions cannot be assumed to apply to each individual. However, knowledge of the dimensions people use to structure their occupational perceptions can suggest how occupational information ought to be presented to people and what information people require as well as how that information is likely to be assimilated.

The study of occupational perceptions, it is argued, links occupational information to occupational preferences. The results from this study have demonstrated that multidimensional scaling methods are, for example, able to show how occupational preferences are largely sex-stereotyped, to relate occupational preferences to occupational perceptions, and to indicate that the groupings and structure of occupational perceptions are similar to the dimensions used in occupational classification schemes. Although further work is required to show in more detail how people use these concepts, the results reported here strongly support the use of the cognitive approach adopted for this research.

12.12 This approach can also be related to certain similar approaches in personality and social psychology, which are the two areas of psychology most closely related to the applied field of vocational psychology. Many of the theoretical approaches in psychology are clearly not compatible and it is suggested that the vocational subject area provides one good example of an applied area where the range and

use of concepts from social and personality psychology can be tested in real-life situations. It seems to the author that too few of the concepts used in academic psychology have been grounded in applied settings and that psychologists have relied too heavily on laboratory experiments to test their ideas.

This purposive cognitive approach to human behaviour can also be related more easily to some sociological approaches than certain other psychological approaches. The work of Coxon and Jones, that has been referred to numerous times in this thesis, is directly concerned with the relationship of a person's conception of the structure of society to sociological theories. They note that these conceptions act, in many respects, like scientific theories:

> " - they are put to use to explain everyday occurrences, to account for unexpected happenings, to help assimilate new information, and they sometimes change in response to evidence that they cannot cope with," (Coxon and Jones, 1974).

In so much as this study uses similar techniques and collects data that, although they have been used to address different questions, are quite compatible with the types of data collected by Coxon and Jones, it is easy to see how these two approaches are closely related.

Both these approaches seem also to be in line with Harré and Secord's (1972) naturalistic conception of man as a rule following agent. Their approach to the explanation of social behaviour suggests that:

> "the idea of men as conscious social actors, capable of controlling their performances and commenting intelligently upon them, is more scientific than the traditional conception of the human 'automaton'."

The work reported here is intended to be compatible with their conceptual scheme for social science.

12.13 Several directions for further research have already been noted (see Section 11.8, 11.9, 11.16 - 11.18). In particular, an attempt has been made to show how work in this field can be related to work in other areas of psychology. This study has been cross-sectional in design but it is suggested that subsequent research could most beneficially adopt a longitudinal design which would allow study of the interrelationship and development of the components of vocational behaviour. This is certainly not a novel suggestion, but comparatively few longitudinal and developmental studies have been carried out in this field. Two reasons for this are the difficulty and time required to carry out such studies. Another reason could be that research workers lack a suitable conceptual framework for carrying out these studies. It is suggested that the cognitive approach outlined in this study could provide the basis for such a conceptual framework and thus allow the design of longitudinal process-oriented research studies.

There is a widespread recognition of the need for studies to adopt a more process-oriented viewpoint. Watts and Kidd (1977), in reviewing work carried out in Britain on the evaluation of vocational guidance, note that comparatively little research work has been carried out to investigate the effectiveness of developmentally oriented careers education programmes. Two points from this study are relevant to such research. First of all, it would be possible, in a longitudinal study, to note how people's perceptions of occupations change and develop over time. Such a

study would be able to check on the results of this study, which suggest that people's perceptions do change over time and become more consensually defined. These results suggest that giving vocational guidance to adults should be different from giving vocational guidance to young people. Younger people appear to have less certain occupational perceptions and therefore require both occupational information and also some ideas about how occupations relate to each other. Older people are more likely to know how occupations relate one to another, but as Last (1978) notes, are likely to require more specific occupational information.

Careers education and guidance are clearly about much more than simply learning about occupations and the world of work and concepts such as vocational maturity (Crites, 1965) have been proposed as outcome variables for the assessment of these programmes. At the same time, few would deny that providing information about the world of work and assisting young people in learning about all aspects of work are important features of these programmes. One use of the INDSCAL model developed by Carroll and Chang (1970) is to relate data collected at different times from the same people. This method can be applied both to directly judged similarity data, as in this study, and also to data from questionnaire based research techniques such as the semantic differential. In terms of occupational perceptions, INDSCAL could be used to see in what ways the structure of people's occupational perceptions change.

Secondly, in this type of research situation, there is a need to integrate data collected in a variety of ways from different subject groups. Once again the INDSCAL model can treat these different sets of data as 'pseudo subjects' and demonstrate how

these data relate to each other.

12.14 Finally, it has already been noted that the data from this stucy suggest that the concepts used in vocational guidance to describe work have cross-cultural validity (see Section 11.14), although as the author and colleagues have noted elsewhere:

> "Much of the rich field of theory and research, very largely American, seems too remote, and perhaps too culturally influenced, for British careers staff to ground their practice on". (Jackson, Sneath and Wallis,1978)

This study suggests that research workers in Britain could usefully pay attention to the American literature. Although it will usually be impossible to apply directly research results, because of genuine structural differences between the societies, they can beneficially inform current thinking. The great volume of high quality work being carried out in North America, which is readily accessible through English language journals, should be recognized and utilized in this country.

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APPENDIX A

The Pilot Questionnaire

INSTRUCTIONS - PART 1

The aim of this part of the experiment is to discover the degree of similarity people see between different jobs. Each question gives the name of two jobs and you fill in how similar you think they are. Even if you don't know much about the jobs your opinions will be valuable. The jobs you will be asked to compare are listed below.

Architect	Photographer
Certified Public Accountant	Physical Therapist
Civil Engineer	Primary School Teacher
Commercial Artist	Secretary
Computer Operator	Social Worker
Computer Programmer	Staff Nurse
Electrical Engineer	Statistician
Librarian	Technical Writer
Mechanical Engineer	Vocational Counselor
Pharmacist	X Ray Technologist

Each job is what its title suggests to you. Please try and think of each job as a whole, not for any particular individual, or any special aspect of it. Rate each pair of jobs as to how similar you think they are. Write alongside each pair the number you think is appropriate, using the scale:

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

The idea is to find out how similar you personally find the jobs, so there are no right or wrong answers. 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. Sometimes you may feel as though you've had the same pairs before, but don't try and remember how you checked similar pairs earlier in the test. The pairs have been arranged in random order to help you consider each pair from scratch as you come to it, but try not to give instantaneous first impressions, because we want your true impressions. There is no time limit, but work rapidly. The first part of the test should take about 45 minutes to complete. When you finish it, just turn over the page and complete the second part, which is much shorter and should only take a few minutes to fill in. Finally there is one page of biographical questions which I'd be grateful if you'd complete.

Are there any questions? If not, please start the test.

1	2	3	4	5	6	7
Almost Identical			About as Similar as Different			Completely Different

1. Architect
   Certified Public Accountant
2. X Ray Technologist
   Commercial Artist
3. Vocational Counselor
   Computer Operator
4. Technical Writer
   Computer Programmer
5. Statistician
   Electrical Engineer
6. Staff Nurse
   Librarian
7. Social Worker
   Mechanical Engineer
8. Secretary
   Pharmacist
9. Primary School Teacher
   Photographer
10. Physical Therapist
    Architect
11. Civil Engineer
    Certified Public Accountant
12. Computer Operator
    X Ray Technologist
13. Computer Programmer
    Vocational Counselor
14. Electrical Engineer
    Technical Writer
15. Librarian
    Statistician
16. Mechanical Engineer
    Staff Nurse
17. Pharmacist
    Social Worker
18. Photographer
    Secretary
19. Physical Therapist
    Primary School Teacher
20. Architect
    Civil Engineer
21. Certified Public Accountant
    Commercial Artist
22. X Ray Technologist
    Computer Programmer
23. Vocational Counselor
    Electrical Engineer
24. Technical Writer
    Librarian
25. Statistician
    Mechanical Engineer
26. Staff Nurse
    Pharmacist
27. Social Worker
    Photographer
28. Secretary
    Physical Therapist
29. Primary School Teacher
    Architect
30. Commercial Artist
    Civil Engineer
31. Computer Operator
    Certified Public Accountant
32. Electrical Engineer
    X Ray Technologist
33. Librarian
    Vocational Counselor
34. Mechanical Engineer
    Technical Writer
35. Pharmacist
    Statistician
36. Photographer
    Staff Nurse
37. Physical Therapist
    Social Worker
38. Primary School Teacher
    Secretary
39. Architect
    Commercial Artist
40. Civil Engineer
    Computer Operator

1	2	3	4	5	6	7
Almost Identical			About as Similar as Different			Completely Different

41. Certified Public Accountant
Computer Programmer

42. X Ray Technologist
Librarian

43. Vocational Counselor
Mechanical Engineer

44. Technical Writer
Pharmacist

45. Statistician
Photographer

46. Staff Nurse
Physical Therapist

47. Social Worker
Primary School Teacher

48. Secretary
Architect

49. Computer Operator
Commercial Artist

50. Computer Programmer
Civil Engineer

51. Electrical Engineer
Certified Public Accountant

52. Mechanical Engineer
X Ray Technologist

53. Pharmacist
Vocational Counselor

54. Photographer
Technical Writer

55. Physical Therapist
Statistician

56. Primary School Teacher
Staff Nurse

57. Secretary
Social Worker

58. Architect
Computer Operator

59. Commercial Artist
Computer Programmer

60. Civil Engineer
Electrical Engineer

61. Certified Public Accountant
Librarian

62. X Ray Technologist
Pharmacist

63. Vocational Counselor
Photographer

64. Technical Writer
Physical Therapist

65. Statistician
Primary School Teacher

66. Staff Nurse
Secretary

67. Social Worker
Architect

68. Computer Programmer
Computer Operator

69. Electrical Engineer
Commercial Artist

70. Librarian
Civil Engineer

71. Mechanical Engineer
Certified Public Accountant

72. Photographer
X Ray Technologist

73. Physical Therapist
Vocational Counselor

74. Primary School Teacher
Technical Writer

75. Secretary
Statistician

76. Social Worker
Staff Nurse

77. Architect
Computer Programmer

78. Computer Operator
Electrical Engineer

79. Commercial Artist
Librarian

80. Civil Engineer
Mechanical Engineer

1	2	3	4	5	6	7
Almost Identical			About as Similar as Different			Completely Different

81. Certified Public Accountant
Pharmacist

82. X Ray Technologist
Physical Therapist

83. Vocational Counselor
Primary School Teacher

84. Technical Writer
Secretary

85. Statistician
Social Worker

86. Staff Nurse
Architect

87. Electrical Engineer
Computer Programmer

88. Librarian
Computer Operator

89. Mechanical Engineer
Commercial Artist

90. Pharmacist
Civil Engineer

91. Photographer
Certified Public Accountant

92. Primary School Teacher
X Ray Technologist

93. Secretary
Vocational Counselor

94. Social Worker
Technical Writer

95. Staff Nurse
Statistician

96. Architect
Electrical Engineer

97. Computer Programmer
Librarian

98. Computer Operator
Mechanical Engineer

99. Commercial Artist
Pharmacist

100. Civil Engineer
Photographer

101. Certified Public Accountant
Physical Therapist

102. X Ray Technologist
Secretary

103. Vocational Counselor
Social Worker

104. Technical Writer
Staff Nurse

105. Statistician
Architect

106. Librarian
Electrical Engineer

107. Mechanical Engineer
Computer Programmer

108. Pharmacist
Computer Operator

109. Photographer
Commercial Artist

110. Physical Therapist
Civil Engineer

111. Primary School Teacher
Certified Public Accountant

112. Social Worker
X Ray Technologist

113. Staff Nurse
Vocational Counselor

114. Statistician
Technical Writer

115. Architect
Librarian

116. Electrical Engineer
Mechanical Engineer

117. Computer Programmer
Pharmacist

118. Computer Operator
Photographer

119. Commercial Artist
Physical Therapist

120. Civil Engineer
Primary School Teacher

1	2	3	4	5	6	7
Almost Identical			About as Similar as Different			Completely Different

121. Certified Public Accountant
Secretary

122. X Ray Technologist
Staff Nurse

123. Vocational Counselor
Statistician

124. Technical Writer
Architect

125. Mechanical Engineer
Librarian

126. Pharmacist
Electrical Engineer

127. Photographer
Computer Programmer

128. Physical Therapist
Computer Operator

129. Primary School Teacher
Commercial Artist

130. Secretary
Civil Engineer

131. Social Worker
Certified Public Accountant

132. Statistician
X Ray Technologist

133. Technical Writer
Vocational Counselor

134. Architect
Mechanical Engineer

135. Librarian
Pharmacist

136. Electrical Engineer
Photographer

137. Computer Programmer
Physical Therapist

138. Computer Operator
Primary School Teacher

139. Commercial Artist
Secretary

140. Civil Engineer
Social Worker

141. Certified Public Accountant
Staff Nurse

142. X Ray Technologist
Technical Writer

143. Vocational Counselor
Architect

144. Pharmacist
Mechanical Engineer

145. Photographer
Librarian

146. Physical Therapist
Electrical Engineer

147. Primary School Teacher
Computer Programmer

148. Secretary
Computer Operator

149. Social Worker
Commercial Artist

150. Staff Nurse
Civil Engineer

151. Statistician
Certified Public Accountant

152. Vocational Counselor
X Ray Technologist

153. Architect
Pharmacist

154. Mechanical Engineer
Photographer

155. Librarian
Physical Therapist

156. Electrical Engineer
Primary School Teacher

157. Computer Programmer
Secretary

158. Computer Operator
Social Worker

159. Commercial Artist
Staff Nurse

160. Civil Engineer
Statistician

1	2	3	4	5	6	7
Almost Identical			About as Similar as Different			Completely Different

161. Certified Public Accountant
Technical Writer

162. X Ray Technologist
Architect

163. Photographer
Pharmacist

164. Physical Therapist
Mechanical Engineer

165. Primary School Teacher
Librarian

166. Secretary
Electrical Engineer

167. Social Worker
Computer Programmer

168. Staff Nurse
Computer Operator

169. Statistician
Commercial Artist

170. Technical Writer
Civil Engineer

171. Vocational Counselor
Certified Public Accountant

172. Architect
Photographer

173. Pharmacist
Physical Therapist

174. Mechanical Engineer
Primary School Teacher

175. Librarian
Secretary

176. Electrical Engineer
Social Worker

177. Computer Programmer
Staff Nurse

178. Computer Operator
Statistician

179. Commercial Artist
Technical Writer

180. Civil Engineer
Vocational Counselor

181. Certified Public Accountant
X Ray Technologist

182. Physical Therapist
Photographer

183. Primary School Teacher
Pharmacist

184. Secretary
Mechanical Engineer

185. Social Worker
Librarian

186. Staff Nurse
Electrical Engineer

187. Statistician
Computer Programmer

188. Technical Writer
Computer Operator

189. Vocational Counselor
Commercial Artist

190. X Ray Technologist
Civil Engineer

191. Photographer
Social Worker

192. Commercial Artist
Vocational Counselor

193. Certified Public Accountant
Physical Therapist

194. Librarian
Technical Writer

195. Civil Engineer
Statistician

196. Computer Programmer
Secretary

197. Mechanical Engineer
Primary School Teacher

198. Computer Operator
Architect

199. Electrical Engineer
X Ray Technologist

200. Pharmacist
Staff Nurse

Part 2

Please rate your preferences for the jobs listed below on the 9 point rating scale, where (1) means you think you would like the job very much, (5) that you are indifferent to it and (9) that you think you would dislike it strongly.

1	2	3	4	5	6	7	8	9
Like very much				Indifferent				Dislike strongly

Please write your ratings alongside the job titles.

1. Pharmacist ____
2. Computer Programmer ____
3. Electrical Engineer ____
4. Staff Nurse ____
5. Photographer ____
6. Mechanical Engineer ____
7. X Ray Technologist ____
8. Computer Operator ____
9. Commercial Artist ____
10. Vocational Counselor ____
11. Physical Therapist ____
12. Technical Writer ____
13. Architect ____
14. Social Worker ____
15. Certified Public Accountant ____
16. Civil Engineer ____
17. Primary School Teacher ____
18. Secretary ____
19. Librarian ____
20. Statistician ____

Part 3 Biodata

1. Sex: ____Male

   ____Female

2. Age: ____

3. Major: _____

4. In what college are you currently enrolled? (e.g., CLA, IT, GRAD, etc)

   _____

5. Class:

   1) ____Freshman

   2) ____Sophomore

   3) ____Junior

   4) ____Senior

   5) ____Graduate, Adult Special, Professional

6. Where were you brought up?

   1) ____Twin Cities

   2) ____Minnesota (excluding Twin Cities)

   3) ____Out of State

7. Have you ever worked full time? ____Yes

   (exclude part time or voluntary work) ____No

IF YES

8. Description of job/jobs:

   1) _____

   2) _____

   3) _____

9. Number of years worked: ____

10. Father's Occupation: _____

APPENDIX B

Occupational Information

OCCUPATIONS - Definitions from Occupational Outlook Handbook 1974-75.
US Dept of Labor, Bureau of Labor Statistics, 1974.
US Govt Printing Office, Washington.

ARCHITECT

Architects design a wide variety of structures such as houses, churches, hospitals, office buildings and airports. They also design multibuilding complexes for urban renewal projects, college campuses, industrial parks and new towns. Besides designing structures, architects may also help in selecting building sites, preparing cost and land use studies, and long-range planning for site development.

When working on large projects, or for large architectural firms, architects often specialise in one phase of the work such as designing, drafting, specification writing or administering constructional contracts. This often requires working with engineers, urban planners, landscape architects and other design personnel.

37,000 registered 1972. Less than 5% women. 40% self-employed.

CERTIFIED PUBLIC ACCOUNTANT

Accountants prepare and analyse financial reports to help managers make decisions. Public accountants are independent practitioners or employees of accounting firms. Accountants often specialise in areas such as auditing, taxes or bugeting and control. Many public accountants specialise in auditing (the reviewing of a client's financial records and reports to judge their reliability). Others advise on tax matters or on other financial and accounting problems.

140,000 CPA's 1972. 3% women.

CIVIL ENGINEER

A civil engineer designs and supervises the construction of roads, harbors, airfields, tunnels, bridges, water supply systems and buildings. Major specialities within civil engineering are structural, hydraulic, environmental, sanitary, transportation, (including highways and railways), and soil mechanics.Many

civil engineers are in supervisory or administrative positions ranging from site supervisor of a construction project or city engineer to top level executive. Some are engaged in design, planning, research and inspection, others teach in colleges or universities or work as consultants.

180,000 in 1972. Approximately 1% of all engineers are women - 10^6 in total.

COMMERCIAL ARTIST

A commercial artist usually works as a member of a team which creates the artwork in newspapers and magazines and on billboards, brochures, catalogs and television commercials. A variety of specialists work together to turn out the finished product. Some commercial artists specialise in producing fashion illustartions, greetings cards or book illustrations or in making technical drawings for industry.

60,000 in 1972. 40% women.

COMPUTER OPERATOR

Computers require specialised workers, computer operators, to code "input", operate the console and translate "output" into words and numbers. Computer operators must also understand the whole system in order to recognise errors in input or other factors that prevent the computer from operating properly.

480,000 in 1972 including console, auxiliary equipment and keypunch operators. 40% console and auxiliary equipment operators women (paid approximately $177 a week). 90% keypunch operators women (paid approximately $125 a week).

COMPUTER PROGRAMMER

An electronic computer can process masses of information with great speed and accuracy but the machine cannot think for itself. The programmers job is to prepare step by step instructions for the computer to follow. Before a computer can process a problem, exact and logical steps for its solution must be worked out by

the programmer, who then prepares detailed instructions to tell the machine how to process the data. Many programmers specialise in either business or scientific applications. Although a simple program can be written in a few days, one designed to produce many different kinds of information may require a year or more to develop. Many programmers work in teams on particular projects.

186,000 in 1972. 25% women.

ELECTRICAL ENGINEER

Electrical engineers design, develop and supervise the manufacture of electrical and electronic eqipment. These include electric motors and generators; communications equipment; electronic equipment such as heart pacemakers, pollution measuring instrumentation, radar, computers, lasers and missile guidance systems; and electrical appliances of all kinds. They also design and assist in operating facilities for generating and distributing electrical power.

Electrical engineers usually specialise in a major area of work such as electronics, electrical equipment manufacturing, communications or power. Many are engaged in research, design and development activities.

230,000 in 1972. Women 1% of <u>all</u> engineers - 10^6 in total.

LIBRARIAN

Librarians make information available to people. They select and organise collections of books, periodicals, pamphlets, manuscripts, clippings and reports and assist readers in their use. Librarians classify and catalogue materials.

125,000 professional librarians in 1972 - 50%in schools, 40% in public libraries, colleges and universities. 85% of total women but only 65% in colleges and universities.

MECHANICAL ENGINEER

Mechanical engineers are concerned with the production, transmission and use of power. They design and develop machines that produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines and nuclear reactors.

They also design and develop a great variety of machines that use power - refrigeration and air conditioning equipment, elevators, machine tools, printing presses, steel rolling mills and many others. Many specialised areas of work have developed depending on the industry (eg. motor vehicles, marine equipment, steam power, heating).

Many mechanical engineers do research, development, test and design work. Others work in administration and management or do maintenance, marketing and sales and activities related to production and operation in manufacturing. Some teach in colleges or universities or work as consultants.

210,000 in 1972 - 75% in manufacturing. Women 1% of all engineers - 10^6 in total.

PHARMACIST

Pharmacists dispense drugs and medicines prescribed by medical practitioners and supply and advise people on the use of many medicines that can be obtained with or without perscriptions. Pharmacists must understand the use, composition and effect of drugs and be able to test them for purity and strength. They also asvise physicians on the proper selection and use of medicines. Pharmacists work either in community pharmacies or in hospitals and clinics where they advise on the properties of drugs as well as dispensing them.

131,000 licensed pharmacists in 1972. 10% women.

PHOTOGRAPHER

Photographers use their cameras and other equipment to record people and events on film. Many photographers specialise in areas such as portrait, commercial or industrial photography. Other specialities include press photography (photojournalism), ariel photography, instrumentation photography, educational photography, science and engineering photography.

77,000 photographers in 1972. 50% commercial studios. 25% women.

PHYSICAL THERAPIST

Physical therapists help people with muscle, nerve, joint and bone diseases and injuries to overcome their resulting disabilities. They perform and interpret tests and make measurements to establish muscle strength, motor development, functional capacity and respiratory and circulatory efficiency in order to develop programs for treatment. They evaluate the effectiveness of the treatment and discuss the patient's progress with physicians, psychologists, occupational therapists and other specialists. They help disabled persons adjust to and accept their handicaps.

18,000 in 1972. 75%in hospitals or nursing homes. 75% women.

PRIMARY SCHOOL TEACHER (Kindergarten and Elementary)

Primary school teachers introduce children to science, numbers, language and social studies to develop the individual's capabilities in these subject areas. Their primary job is to provide a good learning environment and to plan and present programs of instruction using materials and methods suitable for the students they are teaching.

1.3 million in 1972. 1 in 6 involved in team teaching. 85% women.

SECRETARY

Secretaries transmit information to their employers' staff and to people in other organisations. They relieve their employers of routine tasks. Although usually involved in typing and taking dictation, they also perform many other administrative tasks. Some secretaries have special skills such as medical secretaries, legal secretaries and technical secretaries.

3 million secretaries and stenographers in 1972. 95% secretaries. 95% women.

SOCIAL WORKER

A caseworker works with individuals to identify their problems through interviews. They aid in understanding and solving problems and help secure needed services, education and job training. Through group activities, social workers help people to understand

themselves and others better, to overcome racial and cultural prejudices, and to work with others in achieving a common goal. In community organisations, social workers organise political, civic, religious, business and union groups to combat social problems through community action.

185,000 in 1972. Approximately 66% women.

STAFF NURSE

Staff nurses provide skilled bedside nursing care and carry out medical treatment plans prescribed by physicians in hospitals. They also supervise other nurses, aides and orderlies. They usually work with groups of patients requiring similar care.

500,000 in hospitals. 33% part-time. 99% women.

STATISTICIAN

With their knowledge of statistical methods and of a particular subject area (such as economics, human behaviour or engineering), statisticians collect, analyse and interpret numerical data. They may use statistical techniques to predict such things as population growth or economic conditions, to develop quality control tests for manufactured products or to help business managers or politicians make decisions and evaluate the results of their actions. Many statisticians plan surveys, design experiments and analyse data.

23,000 in 1972. 66% in private industry. 33% women.

TECHNICAL WRITER

Technical writers organise, write and edit material about science and technology in order to establish clearer communication between scientists, engineers and other technical specialists and users of their information. Their products take many forms including publicity about new scientific and technical achievements, instructions on the assembly of missile systems and instructions on how to use household appliances. They also write for scientific and engineering periodicals and for popular magazines.

20,000 in 1972.

VOCATIONAL COUNSELOR

Vocational counselors help job seekers evaluate their abilities and interests so that they can choose, prepare for and adjust to a suitable field of work. The extent of counseling services offered varies according to the sort of job seeker and the type of agency. Job seekers may include veterans, youths with little or no work experience, handicapped people, and individuals displaced by automation or industry shifts. Advise would also be given to people unhappy in their present employment.

Over 8,500 in 1972. 50% women.

X RAY TECHNOLOGIST

X Ray technologists, usually supervised by radiologists (physicians who specialise in the use of X rays), operate X ray equipment to diagnose and treat patients. Some specialise in such areas as radiation therapy or nuclear medicine.

55,000 in 1972. 75% in hospitals. 66% women.

POLICE OFFICER

Security of cities and towns depends greatly on the work of local police officers whose jobs range from controlling traffic to preventing and investigating crimes. Whether on or off duty, officers are expected to exert their authority whenever necessary.

370,000 in 1972. Mostly men but with increasing numbers of women being recruited.

APPENDIX C

Pilot Study Codebook

PILOT STUDY CODEBOOK.

COLUMN	QUESTION	ITEM	CODES
Card 1			
1-4		Identification Number	As on Schedule
5		Card Sequence Number	1
6-80	1-75	Pair Rating of Occupations (Order as on Schedule)	1. Almost Identical 2. Very Similar 3. Mostly Similar 4. About as Similar as Different 5. Mostly Different 6. Very Different 7. Completely Different 0. Blank/No Answer 9. Any Other Answer
Card 2			
1-4		ID Number	As above
5		Card Sequence Number	2
6-80	76-150	Pair Rating of Occupations (Order as on Schedule)	As Above
Card 3			
1-4		ID Number	As above
5		Card Sequence Number	3
6-55	150-200	Pair Rating of Occupations (Order as on Schedule)	As above
56-75		Preference Ranking of Occupations (Order as on Schedule)	1. Like Very Much 2. 3. 4. 5. Indifferent 6. 7. 8. 9. Dislike Strongly
76		Sex	1. Male 2. Female
77-78		Age (in years)	As on Schedule 00 Blank/No Answer
79-80		BLANK	

APPENDIX D

Pilot Study Transformation Matrix

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	20	39	58	77	96	115	134	153	172	10	29	48	67	86	105	124	143	162
2		11	21	31	41	51	61	71	81	91	101	111	121	131	141	151	161	171	181
3			30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190
4				49	59	69	79	89	99	109	119	129	139	149	159	169	179	189	2
5					68	78	88	98	108	118	128	138	148	158	168	178	188	3	12
6						87	97	107	117	127	137	147	157	167	177	187	4	13	22
7							106	116	126	136	146	156	166	176	186	5	14	23	32
8								125	135	145	155	165	175	185	6	15	24	33	42
9									144	154	164	174	184	7	16	25	34	43	52
10										163	173	183	8	17	26	35	44	53	62
11											182	9	18	27	36	45	54	63	72
12												19	28	37	46	55	64	73	82
13													38	47	56	65	74	83	92
14														57	66	75	84	93	102
15															76	85	94	103	112
16																95	104	113	122
17																	114	123	132
18																		133	142
19																			152

APPENDIX E

Main Study Questionnaires

MAIN STUDY QUESTIONNAIRE - UNIVERSITY OF MINNESOTA STUDENTS
WHITE FORM

UNIVERSITY OF MINNESOTA
TWIN CITIES

Student Life Studies
Office for Student Affairs
328 Walter Library
Minneapolis, Minnesota 55455

INDIVIDUAL DIFFERENCES IN JOB PERCEPTION

The aim of the first part of the questionnaire is to discover the degree of similarity people see between different jobs. Each question gives the name of two jobs and you fill in how similar you think they are. Even if you don't know much about the jobs your opinions will be valuable. The jobs you will be asked to compare are listed below.

Architect	Photographer
Certified Public Accountant	Police Officer
Civil Engineer	Primary School Teacher
Commercial Artist	Secretary
Computer Operator	Social Worker
Electrical Engineer	Staff Nurse
Librarian	Statistician
Pharmacist	X Ray Technologist

Each job is what its title suggests to you. Please try and think of each job as a whole, not for any particular individual, or any special aspect of it. Rate each pair of jobs as to how similar you think they are. Write alongside each pair the number you think is appropriate, using the scale:

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

The idea is to find out how similar you personally find the jobs, so there are no right or wrong answers. 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. Sometimes you may feel as though you've had the same pairs before, but don't try and remember how you checked similar pairs earlier in the test. The pairs have been arranged in random order to help you consider each pair from scratch as you come to it, but try not to give instantaneous first impressions, because we want your true impressions. There is no time limit but work rapidly. When you finish one section just go on to the next part.

1. Architect
   Certified Public Accountant
2. X Ray Technologist
   Commercial Artist
3. Statistician
   Computer Operator
4. Staff Nurse
   Electrical Engineer
5. Social Worker
   Librarian
6. Secretary
   Pharmacist
7. Primary School Teacher
   Photographer
8. Police Officer
   Architect
9. Civil Engineer
   Certified Public Accountant
10. Computer Operator
    X Ray Technologist
11. Electrical Engineer
    Statistician
12. Librarian
    Staff Nurse
13. Pharmacist
    Social Worker
14. Photographer
    Secretary

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

15. Police Officer
Primary School Teacher

16. Architect
Civil Engineer

17. Certified Public Accountant
Commercial Artist

18. X Ray Technologist
Electrical Engineer

19. Statistician
Librarian

20. Staff Nurse
Pharmacist

21. Social Worker
Photographer

22. Secretary
Police Officer

23. Primary School Teacher
Architect

24. Commercial Artist
Civil Engineer

25. Computer Operator
Certified Public Accountant

26. Librarian
X Ray Technologist

27. Pharmacist
Statistician

28. Photographer
Staff Nurse

29. Police Officer
Social Worker

30. Primary School Teacher
Secretary

31. Architect
Commercial Artist

32. Civil Engineer
Computer Operator

33. Certified Public Accountant
Electrical Engineer

34. X Ray Technologist
Pharmacist

35. Statistician
Photographer

36. Staff Nurse
Police Officer

37. Social Worker
Primary School Teacher

38. Secretary
Architect

39. Computer Operator
Commercial Artist

40. Electrical Engineer
Civil Engineer

41. Librarian
Certified Public Accountant

42. Photographer
X Ray Technologist

43. Police Officer
Statistician

44. Primary School Teacher
Staff Nurse

45. Secretary
Social Worker

46. Architect
Computer Operator

47. Commercial Artist
Electrical Engineer

48. Civil Engineer
Librarian

49. Certified Public Accountant
Pharmacist

50. X Ray Technologist
Police Officer

51. Statistician
Primary School Teacher

52. Staff Nurse
Secretary

53. Social Worker
Architect

54. Electrical Engineer
Computer Operator

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

55. Librarian
Commercial Artist

56. Pharmacist
Civil Engineer

57. Photographer
Certified Public Accountant

58. Primary School Teacher
X Ray Technologist

59. Secretary
Statistician

60. Social Worker
Staff Nurse

61. Architect
Electrical Engineer

62. Computer Operator
Librarian

63. Commercial Artist
Pharmacist

64. Civil Engineer
Photographer

65. Certified Public Accountant
Police Officer

66. X Ray Technologist
Secretary

67. Statistician
Social Worker

68. Staff Nurse
Architect

69. Librarian
Electrical Engineer

70. Pharmacist
Computer Operator

71. Photographer
Commercial Artist

72. Police Officer
Civil Engineer

73. Primary School Teacher
Certified Public Accountant

74. Social Worker
X Ray Technologist

75. Staff Nurse
Statistician

76. Architect
Librarian

77. Electrical Engineer
Pharmacist

78. Computer Operator
Photographer

79. Commercial Artist
Police Officer

80. Civil Engineer
Primary School Teacher

81. Certified Public Accountant
Secretary

82. X Ray Technologist
Staff Nurse

83. Statistician
Architect

84. Pharmacist
Librarian

85. Photographer
Electrical Engineer

86. Police Officer
Computer Operator

87. Primary School Teacher
Commercial Artist

88. Secretary
Civil Engineer

89. Social Worker
Certified Public Accountant

90. Statistician
X Ray Technologist

91. Architect
Pharmacist

92. Librarian
Photographer

93. Electrical Engineer
Police Officer

94. Computer Operator
Primary School Teacher

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

95. Commercial Artist
Secretary

96. Civil Engineer
Social Worker

97. Certified Public Accountant
Staff Nurse

98. X Ray Technologist
Architect

99. Photographer
Pharmacist

100. Police Officer
Librarian

101. Primary School Teacher
Electrical Engineer

102. Secretary
Computer Operator

103. Social Worker
Commercial Artist

104. Staff Nurse
Civil Engineer

105. Statistician
Certified Public Accountant

106. Architect
Photographer

107. Pharmacist
Police Officer

108. Librarian
Primary School Teacher

109. Electrical Engineer
Secretary

110. Computer Operator
Social Worker

111. Commercial Artist
Staff Nurse

112. Civil Engineer
Statistician

113. Certified Public Accountant
X Ray Technologist

114. Photographer
Police Officer

115. Pharmacist
Primary School Teacher

116. Librarian
Secretary

117. Electrical Engineer
Social Worker

118. Computer Operator
Staff Nurse

119. Commercial Artist
Statistician

120. Civil Engineer
X Ray Technologist

121. Certified Public Accountant
Architect

122. Pharmacist
Primary School Teacher

123. Librarian
Computer Operator

124. Electrical Engineer
Statistician

125. X Ray Technologist
Photographer

126. Commercial Artist
Social Worker

127. Secretary
Civil Engineer

128. Police Officer
Computer Operator

129. Pharmacist
X Ray Technologist

130. Staff Nurse
Librarian

PLEASE GO ON TO THE NEXT SECTION

This second section of the questionnaire asks about more specific attitudes and opinions about jobs. The jobs considered are some of the ones that were used in the first part of the questionnaire, but some extra ones are included as well.

Interests and the Satisfactions of Jobs.

Here is a table of interests that people might want to satisfy at work and a list of jobs they might do. Thinking of each interest in turn, try to decide which jobs people with that particular interest would find most satisfying. It's easiest to work from column to column circling your responses. Circle as many jobs for each interest as you consider appropriate.

If, for example, you think someone with Artistic Interests would find being an Architect a satisfying job, circle the A for Artistic and so on.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Certified Public Accountant	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Civil Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Operator	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Programmer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Draftsman	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Electrical Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Librarian	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Maintennance Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Pharmacist	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Photographer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Police Officer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Primary School Teacher	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Secretary	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Social Worker	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Staff Nurse	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Statistician	A	B	C	Ma	Me	MS	OP	O	Sc	SS
X Ray Technologist	A	B	C	Ma	Me	MS	OP	O	Sc	SS

Aspirations

1. What is the highest educational level you intend to achieve?

_____ Two year degree

_____ Four year degree BA/BS

_____ Master's degree MA/MS

_____ Professional degree MD/PhD

2. What job do you hope to be doing in 10 years time? _____

Prestige of Jobs.

From the list of jobs printed below, please pick out the three which in your own personal opinion have the highest prestige. Write the name of each job in the spaces provided.

Now from the same list try to pick out the three jobs you think have the lowest prestige. Write your answers in the spaces provided.

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

High Prestige		Low Prestige	
_____	Highest	_____	Lowest
_____	Second highest	_____	Second lowest
_____	Third highest	_____	Third lowest

The Challenge of Different Jobs.

It is more difficult to be successful in some jobs than others. We all recognise that there are some jobs we could never work at successfully, however interesting they might seem to us. Similarly there are some jobs which are easy to perform, but that offer little long term challenge and quickly become dull and boring to work at day in and day out.

Think carefully about each job in the following list as to how challenging you would find it if it was your regular job. Rate each job on the 7 point scale of how challenging it would be to you. Circle one number for each job.

	Much too challenging	Too challenging	Very challenging	Challenging	Fairly challenging	Not too challenging	Not at all challenging
Aircraft Mechanic	1	2	3	4	5	6	7
Architect	1	2	3	4	5	6	7
Certified Public Accountant	1	2	3	4	5	6	7
Civil Engineer	1	2	3	4	5	6	7
Computer Operator	1	2	3	4	5	6	7
Computer Programmer	1	2	3	4	5	6	7
Draftsman	1	2	3	4	5	6	7
Electrical Engineer	1	2	3	4	5	6	7
Electronics Technician	1	2	3	4	5	6	7
Librarian	1	2	3	4	5	6	7
Maintennance Engineer	1	2	3	4	5	6	7
Pharmacist	1	2	3	4	5	6	7
Photographer	1	2	3	4	5	6	7
Police Officer	1	2	3	4	5	6	7
Primary School Teacher	1	2	3	4	5	6	7
Secretary	1	2	3	4	5	6	7
Social Worker	1	2	3	4	5	6	7
Staff Nurse	1	2	3	4	5	6	7
Statistician	1	2	3	4	5	6	7
Television Repairman	1	2	3	4	5	6	7

Activities.

This question aims to discover how you think people working in different occupations spend their time. Please complete each of the five unfinished sentences. One sentence has been completed as an example.

EXAMPLE I believe that a Computer Programmer spends most of the time designing and writing computer programs to solve complex mathematical and statistical problems.

1. I believe that an Architect spends most of the time _____

_____

2. I believe that a Certified Public Accountant spends most of the time _____

_____

3. I believe that an Electrical Engineer spends most of the time _____

_____

4. I believe that a Pharmacist spends most of the time _____

_____

5. I believe that a Social Worker spends most of the time _____

_____

BIOGRAPHICAL QUESTIONS

These questions are included so that this group of students can be compared to other groups of Minnesota students and to equivalent groups in England. No individuals will be identified from the questionnaires and all responses are completely confidential.

1. Class: _____ freshman (45 units or less completed)
_____ sophomore (46 to 90 units completed)
_____ junior (91 to 135 units completed)
_____ senior (136 or more units completed)
_____ graduate, adult special, professional

2. Sex: _____ male
_____ female

3. Age: _____ years

4. Major: _____

5. In what college are you currently enrolled? (e.g., CLA, IT, GRAD, etc) _____

6. Grade Point Average: _____

7. Where were you brought up? (where you spent the longest time in childhood)

_____ Twin Cities _____ Minnesota (excluding the Twin Cities) _____ Out of State

8. Occupation of Parents or Guardians (if retired or deceased please give previous occupation)

Mother/Female Guardian: _____

Father/Male Guardian: _____

9. Have you ever worked full time? (exclude part time or voluntary work) _____ Yes _____ No

10. If yes, Description of job/jobs: i) _____

ii) _____

iii) _____

11. If yes, Number of years worked: _____

THANK YOU FOR FILLING OUT THE QUESTIONNAIRE

MAIN STUDY QUESTIONNAIRE - UNIVERSITY OF MINNESOTA STUDENTS
YELLOW FORM

UNIVERSITY OF MINNESOTA
TWIN CITIES

Student Life Studies
Office for Student Affairs
328 Walter Library
Minneapolis, Minnesota 55455

INDIVIDUAL DIFFERENCES IN JOB PERCEPTION

The aim of the first part of the questionnaire is to discover the degree of similarity people see between different jobs. Each question gives the name of two jobs and you fill in how similar you think they are. Even if you don't know much about the jobs your opinions will be valuable. The jobs you will be asked to compare are listed below.

Aircraft Mechanic
Architect
Automobile Mechanic
Civil Engineer
Computer Operator
Computer Programmer
Customer Engineer
Draftsman
Electrical Engineer
Electronics Technician
Maintennance Engineer
Mechanical Engineer
Statistician
Structural Engineer
Technical Writer
Television Repairman

Each job is what its title suggests to you. Please try and think of each job as a whole, not for any particular individual, or any special aspect of it. Rate each pair of jobs as to how similar you think they are. Write alongside each pair the number you think is appropriate, using the scale:

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

The idea is to find out how similar you personally find the jobs, so there are no right or wrong answers. 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. Sometimes you may feel as though you've had the same pairs before, but don't try and remember how you checked similar pairs earlier in the test. The pairs have been arranged in random order to help you consider each pair from scratch as you come to it, but try not to give instantaneous first impressions, because we want your true impressions. There is no time limit but work rapidly. When you finish one section just go on to the next part.

1. Statistician
   Computer Programmer
2. Computer Operator
   Architect
3. Draftsman
   Television Repairman
4. Mechanical Engineer
   Aircraft Mechanic
5. Civil Engineer
   Automobile Mechanic
6. Electronics Technician
   Technical Writer
7. Maintennance Engineer
   Electrical Engineer
8. Structural Engineer
   Statistician
9. Customer Engineer
   Computer Programmer
10. Television Repairman
    Computer Operator
11. Aircraft Mechanic
    Draftsman
12. Automobile Mechanic
    Mechanical Engineer
13. Technical Writer
    Civil Engineer
14. Electrical Engineer
    Electronics Technician

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

15. Structural Engineer
Maintennance Engineer

16. Statistician
Customer Engineer

17. Computer Programmer
Architect

18. Computer Operator
Aircraft Mechanic

19. Draftsman
Automobile Mechanic

20. Mechanical Engineer
Technical Writer

21. Civil Engineer
Electrical Engineer

22. Electronics Technician
Structural Engineer

23. Maintennance Engineer
Statistician

24. Architect
Customer Engineer

25. Television Repairman
Computer Programmer

26. Automobile Mechanic
Computer Operator

27. Technical Writer
Draftsman

28. Electrical Engineer
Mechanical Engineer

29. Structural Engineer
Civil Engineer

30. Maintennance Engineer
Electronics Technician

31. Statistician
Architect

32. Customer Engineer
Television Repairman

33. Computer Programmer
Aircraft Mechanic

34. Computer Operator
Technical Writer

35. Draftsman
Electrical Engineer

36. Mechanical Engineer
Structural Engineer

37. Civil Engineer
Maintennance Engineer

38. Electronics Technician
Statistician

39. Television Repairman
Architect

40. Aircraft Mechanic
Customer Engineer

41. Automobile Mechanic
Computer Programmer

42. Electrical Engineer
Computer Operator

43. Structural Engineer
Draftsman

44. Maintennance Engineer
Mechanical Engineer

45. Electronics Technician
Civil Engineer

46. Statistician
Television Repairman

47. Architect
Aircraft Mechanic

48. Customer Engineer
Automobile Mechanic

49. Computer Programmer
Technical Writer

50. Computer Operator
Structural Engineer

51. Draftsman
Maintennance Engineer

52. Mechanical Engineer
Electronics Technician

53. Civil Engineer
Statistician

54. Aircraft Mechanic
Television Repairman

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

55. Automobile Mechanic
Architect

56. Technical Writer
Customer Engineer

57. Electrical Engineer
Computer Programmer

58. Maintennance Engineer
Computer Operator

59. Electronics Technician
Draftsman

60. Civil Engineer
Mechanical Engineer

61. Statistician
Aircraft Mechanic

62. Television Repairman
Automobile Mechanic

63. Architect
Technical Writer

64. Customer Engineer
Electrical Engineer

65. Computer Programmer
Structural Engineer

66. Computer Operator
Electronics Technician

67. Draftsman
Civil Engineer

68. Mechanical Engineer
Statistician

69. Automobile Mechanic
Aircraft Mechanic

70. Technical Writer
Television Repairman

71. Electrical Engineer
Architect

72. Structural Engineer
Customer Engineer

73. Maintennance Engineer
Computer Programmer

74. Civil Engineer
Computer Operator

75. Mechanical Engineer
Draftsman

76. Statistician
Automobile Mechanic

77. Aircraft Mechanic
Technical Writer

78. Television Repairman
Electrical Engineer

79. Architect
Structural Engineer

80. Customer Engineer
Maintennance Engineer

81. Computer Programmer
Electronics Technician

82. Computer Operator
Mechanical Engineer

83. Draftsman
Statistician

84. Techanical Writer
Automobile Mechanic

85. Electrical Engineer
Aircraft Mechanic

86. Structural Engineer
Television Repairman

87. Maintennance Engineer
Architect

88. Electronics Technician
Customer Engineer

89. Civil Engineer
Computer Programmer

90. Draftsman
Computer Operator

91. Statistician
Technical Writer

92. Automobile Mechanic
Electrical Engineer

93. Aircraft Mechanic
Structural Engineer

94. Television Repairman
Maintennance Engineer

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

95. Architect
Electronics Technician

96. Customer Engineer
Civil Engineer

97. Computer Programmer
Mechanical Engineer

98. Computer Operator
Statistician

99. Electrical Engineer
Technical Writer

100. Structural Engineer
Automobile Mechanic

101. Maintennance Engineer
Aircraft Mechanic

102. Electronics Technician
Television Repairman

103. Civil Engineer
Architect

104. Mechanical Engineer
Customer Engineer

105. Draftsman
Computer Programmer

106. Statistician
Electrical Engineer

107. Technical Writer
Structural Engineer

108. Automobile Mechanic
Maintennance Engineer

109. Aircraft Mechanic
Electronics Technician

110. Television Repairman
Civil Engineer

111. Architect
Mechanical Engineer

112. Customer Engineer
Draftsman

113. Computer Programmer
Computer Operator

114. Electrical Engineer
Structural Engineer

115. Technical Writer
Maintennance Engineer

116. Automobile Mechanic
Electronics Technician

117. Aircraft Mechanic
Civil Engineer

118. Television Repairman
Mechanical Engineer

119. Architect
Draftsman

120. Customer Engineer
Computer Operator

121. Computer Programmer
Statistician

122. Technical Writer
Maintennance Engineer

123. Automobile Mechanic
Television Repairman

124. Aircraft Mechanic
Draftsman

125. Computer Operator
Electrical Engineer

126. Architect
Civil Engineer

127. Electronics Technician
Customer Engineer

128. Structural Engineer
Television Repairman

129. Technical Writer
Computer Operator

130. Mechanical Engineer
Automobile Mechanic

PLEASE GO ON TO THE NEXT SECTION

This second section of the questionnaire asks about more specific attitudes and opinions about jobs. The jobs considered are some of the ones that were used in the first part of the questionnaire, but some extra ones are included as well.

Interests and the Satisfactions of Jobs.

Here is a table of interests that people might want to satisfy at work and a list of jobs they might do. Thinking of each interest in turn, try to decide which jobs people with that particular interest would find most satisfying. It's easiest to work from column to column circling your responses. Circle as many jobs for each interest as you consider appropriate.

If, for example, you think someone with Artistic Interests would find being an Architect a satisfying job, circle the A for Artistic and so on.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Certified Public Accountant	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Civil Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Operator	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Programmer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Draftsman	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Electrical Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Librarian	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Maintennance Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Pharmacist	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Photographer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Police Officer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Primary School Teacher	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Secretary	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Social Worker	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Staff Nurse	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Statistician	A	B	C	Ma	Me	MS	OP	O	Sc	SS
X Ray Technologist	A	B	C	Ma	Me	MS	OP	O	Sc	SS

Aspirations

1. What is the highest educational level you intend to achieve?

_____ Two year degree

_____ Four year degree BA/BS

_____ Master's degree MA/MS

_____ Professional degree MD/PhD

2. What job do you hope to be doing in 10 years time? _____

Prestige of Jobs.

From the list of jobs printed below, please pick out the three which in your own personal opinion hav the highest prestige. Write the name of each job in the spaces provided.

Now from the same list try to pick out the three jobs you think have the lowest prestige. Write your answers in the spaces provided.

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

High Prestige		Low Prestige	
_____	Highest	_____	Lowest
_____	Second highest	_____	Second lowes
_____	Third highest	_____	Third lowest

The Challenge of Different Jobs.

It is more difficult to be successful in some jobs than others. We all recognise that there are some jobs we could never work at successfully, however interesting they might seem to us. Similarly there are some jobs which are easy to perform, but that offer little long term challenge and quickly become dull and boring to work at day in and day out.

Think carefully about each job in the following list as to how challenging you would find it if it was your regular job. Rate each job on the 7 point scale of how challenging it would be to you. Circle one number for each job.

	Much too challenging	Too challenging	Very challenging	Challenging	Fairly challenging	Not too challenging	Not at all challenging
Aircraft Mechanic	1	2	3	4	5	6	7
Architect	1	2	3	4	5	6	7
Certified Public Accountant	1	2	3	4	5	6	7
Civil Engineer	1	2	3	4	5	6	7
Computer Operator	1	2	3	4	5	6	7
Computer Programmer	1	2	3	4	5	6	7
Draftsman	1	2	3	4	5	6	7
Electrical Engineer	1	2	3	4	5	6	7
Electronics Technician	1	2	3	4	5	6	7
Librarian	1	2	3	4	5	6	7
Maintennance Engineer	1	2	3	4	5	6	7
Pharmacist	1	2	3	4	5	6	7
Photographer	1	2	3	4	5	6	7
Police Officer	1	2	3	4	5	6	7
Primary School Teacher	1	2	3	4	5	6	7
Secretary	1	2	3	4	5	6	7
Social Worker	1	2	3	4	5	6	7
Staff Nurse	1	2	3	4	5	6	7
Statistician	1	2	3	4	5	6	7
Television Repairman	1	2	3	4	5	6	7

Activities.

This question aims to discover how you think people working in different occupations spend their time. Please complete each of the five unfinished sentences. One sentence has been completed as an example.

EXAMPLE I believe that a Computer Programmer spends most of the time designing and writing computer programs to solve complex mathematical and statistical problems.

1. I believe that an Architect spends most of the time _____

2. I believe that a Certified Public Accountant spends most of the time _____

3. I believe that an Electrical Engineer spends most of the time _____

4. I believe that a Pharmacist spends most of the time _____

5. I believe that a Social Worker spends most of the time _____

BIOGRAPHICAL QUESTIONS

These questions are included so that this group of students can be compared to other groups of Minnesota students and to equivalent groups in England. No individuals will be identified from the questionnaires and all responses are completely confidential.

1. Class: _____ freshman (45 units or less completed)
   _____ sophomore (46 to 90 units completed)
   _____ junior (91 to 135 units completed)
   _____ senior (136 or more units completed)
   _____ graduate, adult special, professional

2. Sex: _____ male
   _____ female

3. Age: _____ years

4. Major: _____

5. In what college are you currently enrolled? (e.g., CLA, IT, GRAD, etc) _____

6. Grade Point Average: _____

7. Where were you brought up? (where you spent the longest time in childhood)

   _____ Twin Cities _____ Minnesota (excluding the Twin Cities) _____ Out of State

8. Occupation of Parents or Guardians (if retired or deceased please give previous occupation)

   Mother/Female Guardian: _____

   Father/Male Guardian: _____

9. Have you ever worked full time? (exclude part time or voluntary work) _____ Yes _____ No

10. If yes, Description of job/jobs: i) _____
    ii) _____
    iii) _____

11. If yes, Number of years worked: _____

THANK YOU FOR FILLING OUT THE QUESTIONNAIRE

MAIN STUDY QUESTIONNAIRE - HIGH SCHOOL STUDENTS
DESCRIPTIVE AND BIOGRAPHICAL QUESTIONS

This second section of the questionnaire asks about more specific attitudes and opinions about jobs. The jobs considered are some of the ones that were used in the first part of the questionnaire, but some extra ones are included as well.

Interests and the Satisfactions of Jobs.

Here is a table of interests that people might want to satisfy at work and a list of jobs they might do. Thinking of each interest in turn, try to decide which jobs people with that particular interest would find most satisfying. It's easiest to work from column to column circling your responses. Circle as many jobs for each interest as you consider appropriate.

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Computer Operator	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Programmer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Draftsman	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Electrical Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Librarian	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Pharmacist	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Photographer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Police Officer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Primary School Teacher	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Secretary	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Social Worker	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Staff Nurse	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Statistician	A	B	C	Ma	Me	MS	OP	O	Sc	SS
X Ray Technologist	A	B	C	Ma	Me	MS	OP	O	Sc	SS

Aspirations

1. What is the highest educational level you intend to achieve?

_____ High School Graduation

_____ Vocational Technical Certificate

_____ Two year degree AA

_____ Four year degree BA/BS

_____ Master's degree MA/MS

_____ Professional degree MD/PhD

2. What job do you hope to be doing in 10 years time? _____

Prestige of Jobs.

From the list of jobs printed below, please pick out the three which in your own personal opinion have the highest prestige. Write the name of each job in the spaces provided.

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Architect	Electronics Technician	Secretary
Automobile Mechanic	Librarian	Social Worker
Certified Public Accountant	Maintennance Engineer	Staff Nurse
Civil Engineer	Pharmacist	Statistician
Computer Operator	Photographer	Technical Writer
Draftsman	Police Officer	Television Repairman

High Prestige		Low Prestige	
_____	Highest	_____	Lowest
_____	Second highest	_____	Second lowest
_____	Third highest	_____	Third lowest

The Challenge of Different Jobs.

It is more difficult to be successful in some jobs than others. We all recognise that there are some jobs we could never work at successfully, however interesting they might seem to us. Similarly there are some jobs which are easy to perform, but that offer little long term challenge and quickly become dull and boring to work at day in and day out.

Think carefully about each job in the following list as to how challenging you would find it if it was your regular job. Rate each job on the 7 point scale of how challenging it would be to you. Circle one number for each job.

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Architect	1	2	3	4	5	6	7
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Computer Programmer	1	2	3	4	5	6	7
Draftsman	1	2	3	4	5	6	7
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Electronics Technician	1	2	3	4	5	6	7
Librarian	1	2	3	4	5	6	7
Maintennance Engineer	1	2	3	4	5	6	7
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Photographer	1	2	3	4	5	6	7
Police Officer	1	2	3	4	5	6	7
Primary School Teacher	1	2	3	4	5	6	7
Secretary	1	2	3	4	5	6	7
Social Worker	1	2	3	4	5	6	7
Staff Nurse	1	2	3	4	5	6	7
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Television Repairman	1	2	3	4	5	6	7

Activities.

This question aims to discover how you think people working in different occupations spend their time
Please complete each of the five unfinished sentences. One sentence has been completed as an example

EXAMPLE I believe that a Computer Programmer spends most of the time designing and writing compute
programs to solve complex mathematical and statistical problems.

1. I believe that an Architect spends most of the time _____

_____

2. I believe that a Certified Public Accountant spends most of the time _____

_____

3. I believe that an Electrical Engineer spends most of the time _____

_____

4. I believe that a Pharmacist spends most of the time _____

_____

5. I believe that a Social Worker spends most of the time _____

_____

BIOGRAPHICAL QUESTIONS

These questions are included so that this group of students can be compared to other groups of Minnesota students and to equivalent groups of students in England. No individuals will be identifi from the questionnaires and all responses are completely confidential.

1. Grade: _____

2. Sex: _____ male

_____ female

3. Age last birthday: _____ years

4. Where were you brought up? (where you spent the longest time in childhood)

_____ Twin Cities _____ Minnesota (excluding the Twin Cities) _____ Out of State

5. Occupation of Parents or Guardians (if retired please give previous occupation)

Mother/Female Guardian: _____

Father/Male Guardian: _____

THANK YOU FOR FILLING OUT THE QUESTIONNAIRE

MAIN STUDY QUESTIONNAIRE - UK VERSION

THE UNIVERSITY OF ASTON IN BIRMINGHAM

Gosta Green, Birmingham B4 7ET/Tel: 021.359 3611 Ex

Applied Psychology Department

INDIVIDUAL DIFFERENCES IN JOB PERCEPTION

The aim of the first part of the questionnaire is to discover the degree of similarity people see between different jobs. Each question gives the name of two jobs and you will fill in how similar you think they are. Even if you don't know much about the jobs your opinions will be valuable. The jobs you will be asked to compare are listed below.

Architect	Photographer
Chartered Accountant	Police Officer
Civil Engineer	Primary School Teacher
Commercial Artist	Radiographer
Computer Operator	Secretary
Electrical Engineer	Social Worker
Librarian	Staff Nurse
Pharmacist	Statistician

Each job is what its title suggests to you. Please try and think of each job as a whole, not for any particular individual, or any special aspect of it. Rate each pair of jobs as to how similar you think they are. Write alongside each pair the number you think is appropriate, using the scale:

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

The idea is to find out how similar you personally find the jobs, so there are no right or wrong answers. The position (4) on the scale is not meant to be the average of your ratings, but try <u>not</u> to see all the pairs as either (7) Completely Different, or (6) Very Different. Sometimes you may feel as though you've had the same pairs before, but don't try and remember how you checked similar pairs earlier in the test. The pairs have been arranged in random order to help you consider each pair from scratch as you come to it, but try not to give instantaneous first impressions, because we want your true impressions. There is no time limit but work rapidly. When you finish one section just go on to the next part.

1. Architect
   Chartered Accountant

2. Radiologist
   Commercial Artist

3. Statistician
   Computer Operator

4. Staff Nurse
   Electrical Engineer

5. Social Worker
   Librarian

6. Secretary
   Pharmacist

7. Primary School Teacher
   Photographer

8. Police Officer
   Architect

9. Civil Engineer
   Chartered Accountant

10. Computer Operator
    Radiologist

11. Electrical Engineer
    Statistician

12. Librarian
    Staff Nurse

13. Pharmacist
    Social Worker

14. Photographer
    Secretary

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

15. Police Officer
    Primary School Teacher

16. Architect
    Civil Engineer

17. Chartered Accountant
    Commercial Artist

18. Radiologist
    Electrical Engineer

19. Statistician
    Librarian

20. Staff Nurse
    Pharmacist

21. Social Worker
    Photographer

22. Secretary
    Police Officer

23. Primary School Teacher
    Architect

24. Commercial Artist
    Civil Engineer

25. Computer Operator
    Chartered Accountant

26. Librarian
    Radiologist

27. Pharmacist
    Statistician

28. Photographer
    Staff Nurse

29. Police Officer
    Social Worker

30. Primary School Teacher
    Secretary

31. Architect
    Commercial Artist

32. Civil Engineer
    Computer Operator

33. Chartered Accountant
    Electrical Engineer

34. Radiologist
    Pharmacist

35. Statistician
    Photographer

36. Staff Nurse
    Police Officer

37. Social Worker
    Primary School Teacher

38. Secretary
    Architect

39. Computer Operator
    Commercial Artist

40. Electrical Engineer
    Civil Engineer

41. Librarian
    Chartered Accountant

42. Photographer
    Radiologist

43. Police Officer
    Statistician

44. Primary School Teacher
    Staff Nurse

45. Secretary
    Social Worker

46. Architect
    Computer Operator

47. Commercial Artist
    Electrical Engineer

48. Civil Engineer
    Librarian

49. Chartered Accountant
    Pharmacist

50. Radiologist
    Police Officer

51. Statistician
    Primary School Teacher

52. Staff Nurse
    Secretary

53. Social Worker
    Architect

54. Electrical Engineer
    Computer Operator

1. Almost Identical
2. Very Similar
3. Mostly Similar
4. About as Similar as Different
5. Mostly Different
6. Very Different
7. Completely Different

55. Librarian
Commercial Artist

56. Pharmacist
Civil Engineer

57. Photographer
Chartered Accountant

58. Primary School Teacher
Radiologist

59. Secretary
Statistician

60. Social Worker
Staff Nurse

61. Architect
Electrical Engineer

62. Computer Operator
Librarian

63. Commercial Artist
Pharmacist

64. Civil Engineer
Photographer

65. Chartered Accountant
Police Officer

66. Radiologist
Secretary

67. Statistician
Social Worker

68. Staff Nurse
Architect

69. Librarian
Electrical Engineer

70. Pharmacist
Computer Operator

71. Photographer
Commercial Artist

72. Police Officer
Civil Engineer

73. Primary School Teacher
Chartered Accountant

74. Social Worker
Radiologist

75. Staff Nurse
Statistician

76. Architect
Librarian

77. Electrical Engineer
Pharmacist

78. Computer Operator
Photographer

79. Commercial Artist
Police Officer

80. Civil Engineer
Primary School Teacher

81. Chartered Accountant
Secretary

82. Radiologist
Staff Nurse

83. Statistician
Architect

84. Pharmacist
Librarian

85. Photographer
Electrical Engineer

86. Police Officer
Computer Operator

87. Primary School Teacher
Commercial Artist

88. Secretary
Civil Engineer

89. Social Worker
Chartered Accountant

90. Statistician
Radiologist

91. Architect
Pharmacist

92. Librarian
Photographer

93. Electrical Engineer
Police Officer

94. Computer Operator
Primary School Teacher

1. Almost Identical
2. Very Similar
3. Mostly Similar
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5. Mostly Different
6. Very Different
7. Completely Different

95. Commercial Artist
Secretary

96. Civil Engineer
Social Worker

97. Chartered Accountant
Staff Nurse

98. Radiologist
Architect

99. Photographer
Pharmacist

100. Police Officer
Librarian

101. Primary School Teacher
Electrical Engineer

102. Secretary
Computer Operator

103. Social Worker
Commercial Artist

104. Staff Nurse
Civil Engineer

105. Statistician
Chartered Accountant

106. Architect
Photographer

107. Pharmacist
Police Officer

108. Librarian
Primary School Teacher

109. Electrical Engineer
Secretary

110. Computer Operator
Social Worker

111. Commercial Artist
Staff Nurse

112. Civil Engineer
Statistician

113. Chartered Accountant
Radiologist

114. Photographer
Police Officer

115. Pharmacist
Primary School Teacher

116. Librarian
Secretary

117. Electrical Engineer
Social Worker

118. Computer Operator
Staff Nurse

119. Commercial Artist
Statistician

120. Civil Engineer
Radiologist

121. Chartered Accountant
Architect

122. Pharmacist
Primary School Teacher

123. Librarian
Computer Operator

124. Electrical Engineer
Statistician

125. Radiologist
Photographer

126. Commercial Artist
Social Worker

127. Secretary
Civil Engineer

128. Police Officer
Computer Operator

129. Pharmacist
Radiologist

130. Staff Nurse
Librarian

PLEASE GO ON TO THE NEXT SECTION

This second section of the questionnaire asks about more specific attitudes and opinions about jobs. The jobs considered are some of the ones that were used in the first part of the questionnaire, but some extra ones are included as well.

Interests and the Satisfactions of Jobs

Here is a table of interests that people might want to satisfy at work and a list of jobs they might do. Thinking of each interest in turn, try to decide which jobs people with that particular interest would find most satisfying. It's easier to work from column to column circling your responses. Circle as many jobs for each interest as you consider appropriate.

If for example, you think someone with Artistic Interests would find being an Architect a satisfying job, circle the A for Artistic and so on.

	Artistic	Business Management	Clerical/Computational	Mathematic	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Chartered Accountant	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Civil Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Commercial Artist	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Operator	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Computer Programmer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Draftsman	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Electrical Engineer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Librarian	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Pharmacist	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Photographer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Police Officer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Primary School Teacher	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Radiographer	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Secretary	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Social Worker	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Staff Nurse	A	B	C	Ma	Me	MS	OP	O	Sc	SS
Statistician	A	B	C	Ma	Me	MS	OP	O	Sc	SS

Prestige of Jobs

From the list of jobs printed below, please pick out the <u>three</u> which <u>in your own personal opinion</u> have the highest prestige. Write the name of each job in the spaces provided.

Now from the same list try to pick out the three jobs you think have the lowest prestige. Write your answers in the spaces provided.

Aircraft Mechanic	Electrical Engineer	Primary School Teacher
Architect	Electronics Technician	Radiographer
Chartered Accountant	Garage Mechanic	Secretary
Civil Engineer	Librarian	Social Worker
Commercial Artist	Pharmacist	Staff Nurse
Computer Operator	Photographer	Statistician
Draftsman	Police Officer	Television Repairman

High Prestige		Low Prestige	
_____	Highest	_____	Lowest
_____	Second highest	_____	Second lowest
_____	Third highest	_____	Third lowest

The Challenge of Different Jobs

It is more difficult to be successful in some jobs than others. We all recognise that there are some jobs we could never work at successfully, however interesting they might seem to us. Similarly there are some jobs which are easy to perform, but that offer little long term challenge and quickly become dull and boring to work at day in and day out.

Think carefully about each job in the following list as to how challenging you would find it if it was your regular job. Rate each job on the 7 point scale of how challenging it would be to you. Circle one number for each job.

	Much too challenging	Too challenging	Very challenging	Challenging	Fairly challenging	Not too challenging	Not at all challenging
Aircraft Mechanic	1	2	3	4	5	6	7
Architect	1	2	3	4	5	6	7
Chartered Accountant	1	2	3	4	5	6	7
Civil Engineer	1	2	3	4	5	6	7
Commercial Artist	1	2	3	4	5	6	7
Computer Operator	1	2	3	4	5	6	7
Draftsman	1	2	3	4	5	6	7
Electrical Engineer	1	2	3	4	5	6	7
Electronics Technician	1	2	3	4	5	6	7
Garage Mechanic	1	2	3	4	5	6	7
Librarian	1	2	3	4	5	5	7
Pharmacist	1	2	3	4	5	6	7
Photographer	1	2	3	4	5	6	7
Police Officer	1	2	3	4	5	6	7
Primary School Teacher	1	2	3	4	5	6	7
Radiographer	1	2	3	4	5	6	7
Secretary	1	2	3	4	5	6	7
Social Worker	1	2	3	4	5	6	7
Staff Nurse	1	2	3	4	5	6	7
Statistician	1	2	3	4	5	6	7
Television Repairman	1	2	3	4	5	6	7

Activities

This question aims to discover how you think people working in different occupations spend their time. Please complete each of the five unfinished sentences. One sentence has been completed as an example.

EXAMPLE I believe that a Computer Programmer spends most of the time designing and writing computer programs to solve complex mathematical and statistical problems.

1. I believe that an Architect spends most of the time _____

_____

2. I believe that a Chartered Accountant spends most of the time _____

_____

3. I believe that an Electrical Engineer spends most of the time _____

_____

4. I believe that a Pharmacist spends most of the time _____

_____

5. I believe that a Social Worker spends most of the time _____

_____

Biographical Questions

These questions are included so that this group of students can be compared to other equivalent groups. No individual will be identified from the questionnaires and all responses are completely confidential.

1. Sex : _____ male

_____ female

2. Age : _____ years

3. Ages of brothers and sisters

Put 'at school', 'at college/university' or say what job.

_____ years _____

_____ years _____

_____ years _____

_____ years _____

_____ years _____

_____ years _____

4. Occupation of Parents or Guardians (if retired, please give previous job)

Mother/Female Guardian : _____

Father/Male Guardian : _____

5. Subjects best at : _____

6. Subjects weak at : _____

7. The job you would really like : _____

8. The job you think you will get : _____

9. If you had a magic wand and could have any job you wanted in the world, what would it be?

_____

10. What is the highest educational level you hope to achieve? (tick one)

_____ C.S.E.

_____ GCE (O Level)

_____ GCE (A Level)

_____ Secretarial or other specialised training such as apprenticeship or nursing qualification

_____ HNC, ONC, HND, OND certificates

_____ Degree BA/BSc/BEd etc (at polytechnic or university)

_____ Higher than a degree MA/MSc/PhD, Professional Qualification for Law, Medicine, Engineering etc.

MAIN STUDY QUESTIONNAIRE - SHARMONS CROSS
BIOGRAPHICAL QUESTIONS

1. Age: years

2. Ages of brothers and sisters. For each one put 'at school', 'at college/university', or say what job they do.

..... years .....

..... years .....

..... years .....

..... years .....

..... years .....

..... years .....

3. Occupation of Parents or Guardians (if retired, please give previous job)

Mother/Female Guardian : .....

Father/Male Guardian : .....

4. School subjects best at : .....

School subjects weak at : .....

5. The job you would really like : .....

The job you think you will get : .....

6. If you had a magic wand and could have any job you wanted in the world, what would it be?

.....

7. What is the highest educational level you hope to achieve? (tick one)

..... CSE

..... O Level GCE

..... A Level GCE

..... Secretarial or other specialised training such as apprenticeship or nursing qualification

..... HNC, ONC, HND, OND certificates

..... Degree BA/BSc/BEd etc (at polytechnic or university)

..... Higher than a degree, MA/MSc/PhD, professional qualification for law, medicine, engineering etc.

APPENDIX F

Letter of Introduction

UNIVERSITY OF MINNESOTA
TWIN CITIES

Student Life Studies
Office for Student Affairs
328 Walter Library
Minneapolis, Minnesota 55455

Dear Student,

How do people distinguish different jobs? Psychologists, sociologists and economists all have ideas about how jobs relate one to another. But in what ways do most people think about jobs?

I am a graduate student from England visiting the University of Minnesota and for my Ph.D. dissertation I am conducting a study to look at differences in the way students see jobs. I hope this will say something about the picture students have of different jobs and how that influences the way they look at the world of work. Next Fall, when I return to England, I will be repeating the stud with equivalent groups of British students to find out if there are cross-cultura differences in students' perceptions of jobs.

The questionnaire I am using in the study consists of three sections. The first, which is the longest, asks you to rate the degree of similarity you see among a selection of different jobs. The second section asks about more specific attitudes towards the jobs and the third section asks for some background inform-ation about you.

Your completed questionnaire will be held in the strictest confidence. As all the questionnaires are anonymous, it will be impossible for any individual to be identified from the data. The number is used only to keep track of returned questionnaires.

Filling out the questionnaire should take about 40 minutes. Please read the instuctions to each section carefully and respond to all the questions, even if they do not seem directly applicable to you. Should you have any questions, or want any more information about the research, please call me at 373-4057.

Thank you for cooperating in the study and for helping me collect the research data for my dissertation.

Sincerely,

Charles Jackson

Charles Jackson

APPENDIX G

Main Study Codebooks

MAIN STUDY CODEBOOK.

COLUMN	QUESTION	ITEM	CODES
Card 1			
1-4		Identification Number	As on Schedule
5		Card Sequence Number	1
6-80	1-75	Pair Rating of Occupations (Order as on Schedule)	1. Almost Identical 2. Very Similar 3. Mostly Similar 4. About as Similar as Different 5. Mostly Different 6. Very Different 7. Completely Different 0. Blank/No Answer 9. Any Other Answer
Card 2			
1-4		Identification Number	As above
5		Card Sequence Number	2
6-60	76-130	Pair Rating of Occupations (Order as on Schedule)	As above
61-70		Architect - Interest Rating (Order as on Schedule)	0. Not Relevent 1. Relevent Interest
71-80		Certified Public Accountant (US Subjects) Cartered Accountant (UK Subjects)	As above
Card 3			
1-4		Identification Number	As above
5		Card Sequence Number	3
6-15		Civil Engineer	As above
16-25		Computer Operator (US Subjects) Commercial Artist (UK Subjects)	As above
26-35		Computer Programmer (US Subjects) Computer Operator (UK Subjects)	As above
36-45		Draftsman (US Subjects) Computer Programmer (UK Subjects)	As above
46-55		Electrical Engineer (US Subjects) Draftsman (UK Subjects)	As above
56-65		Librarian (US Subjects) Electrical Engineer (UK Subjects)	As above

Card 3 continued		
66-75	Maintennance Engineer (US Subjects) Librarian (UK Subjects)	As above *
76-80	BLANK	
Card 4		
1-4	Identification Number	As above
5	Card Sequence Number	4
6-15	Pharmacist	As above
16-25	Photographer	As above
26-35	Police Officer	As above
36-45	Primary School Teacher	As above
46-55	Secretary (US Subjects) Radiographer (UK Subjects)	As above
56-65	Social Worker (US Subjects) Secretary (UK Subjects)	As above
66-75	Staff Nurse (US Subjects) Social Worker (UK Subjects)	As above
76-80	BLANK	
Card 5	US Subjects	
1-4	Identification Number	As above
5	Card Sequence Number	5
6-15	Statistician	As above
16-25	X Ray technologist	As above
26	BLANK	
27	Educational Aspirations	1. High School Graduation 2. Vocational Technical Certificate 3. Two Year Degree (AA) 4. Four Year Degree (BA/BS) 5. Master's Degree (MA/MS) 6. Professional Degree (MD/PhD 0. Blank/No Answer 9. Any Other Answer
28	BLANK	
29-30	Highest Prestige Job	Codes for next 6 items 01. Aircraft Mechanic 02. Architect
31-32	Second Highest Prestige Job	03. Automobile Mechanic 04. Certified Public Accountant
33-34	Third Highest Prestige Job	05. Civil Engineer 06. Computer Operator 07. Draftsman
35-36	BLANK	08. Electrical Engineer

Card 5 continued

37-38	Lowest Prestige Job	09. Electronics Technician 10. Librarian
39-40	Second Lowest Prestige Job	11. Maintennance Engineer 12. Pharmacist
41-42	Third Lowest Prestige Job	13. Photographer 14. Police Officer
43-44	BLANK	15. Primary School Teacher 16. Secretary 17. Social Worker 18. Staff Nurse 19. Statistician 20. Technical Writer 21. Television Repairman 00. Blank/No Answer 99. Any Other Answer
45-64	Challenge Rating of Jobs (Order as on Schedule)	1. Much Too Challenging 2. Too Challenging 3. Very Challenging 4. Challenging 5. Fairly Challenging 6. Not Too Challenging 7. Not At All Challenging 8. Any Other Answer 9. Two or More Ratings 0. Blank/No Answer
65-66	High School Grade (High School Students only)	As on Schedule
67	University Class	1. Freshman 2. Sophomore 3. Junior 4. Senior 5. Graduate 0. Blank/No Answer 9. Other
68	Sex	1. Male 2. Female 0. Other
69-70	Age in Years	As on Schedule
71-72	College (University Students only)	02. Business 03. Veternary Medecine 04. Dentistry 05. Dental Hygiene 06. Education 07. Institute of Technology 08. Graduate 09. Law 10. College of Biological Sciences 11. Medecine 12. Medical/Dental Technology 14. Nursing 15. Pharmacy 17. Liberal Arts 18. University College 19. General College 20. Public Health 21. Physical Therapy

Card 5 continued

		23. Occupational Therapy 30. Agriculture 31. Forestry 32. Home Economics 00. Blank 99. Other
73-74	Grade Point Average (University Students only)	As on Schedule (omitting decimal point)
75	Where Brought Up	1. Twin Cities 2. Minnesota (excluding Twin Cities) 3. Out of State
76	Have you ever worked Full time?	1. Yes 2. No
77-78	Years Worked	As on Schedule

* University Students only

Card 5	UK Students	
1-4	Identification Number	As above
5	Card Sequence Number	5
6-15	Staff Nurse	As above
16-25	Statistician	As above
26	BLANK	
27-28	Highest Prestige Job	01. Aircraft Mechanic 02. Architect
29-30	Second Highest Prestige Job	03. Chartered Accountant 04. Civil Engineer 05. Commercial Artist
31-32	Third Highest Prestige Job	06. Computer Operator 07. Draftsman 08. Electrical Engineer
33-34	BLANK	09. Electronics Technician 10. Garage Mechanic
35-36	Lowest Prestige Job	11. Librarian 12. Pharmacist
37-38	Second Lowest Prestige Job	13. Photographer 14. Police Officer 15. Primary School Teacher
39-40	Third Lowest Prestige Job	16. Radiographer 17. Secretary 18. Social Worker
41-42	BLANK	19. Staff Nurse 20. Statistician 21. Television Repairman
43-63	Challenge Rating of Jobs (Order as on Schedule)	Codes as for US Data
64	Sex	1. Male 2. Female 0. Blank/No Answer
67	Age in Years	Code as on Schedule

Card 5 continued

67	Educational Aspirations	1. CSE 2. O Level GCE 3. A Level GCE 4. Secretarial/Apprenticeship 5. HNC/ONC/OND/HND 6. Degree (BSc/BA/BEd) 7. Professional Qualification 0. Blank/No Answer 9. Any Other Answer

NOTE: SHARMONS CROSS STUDENTS ONLY COMPLETED THE PAIR COMPARISON SECTION AND FINAL THREE ITEMS.

APPENDIX H

Summary of Interest Data

JOBS VERSUS INTERESTS DATA (%ages)

1. University Students.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	96	11	14	58	37	2	8	38	28	12
Certified Public Accountant	0	89	78	84	1	0	77	1	2	14
Civil Engineer	20	25	26	73	71	2	10	49	54	23
Computer Operator	1	16	66	56	54	0	38	0	23	1
Computer Programmer	4	23	62	85	30	1	30	1	40	1
Draftsman	75	6	29	50	53	2	18	12	15	5
Electrical Engineer	6	13	22	82	70	2	8	2	71	2
Librarian	11	21	71	5	2	2	60	2	1	65
Maintennance Engineer	1	14	10	23	86	2	6	25	25	14
Pharmicist	0	22	30	34	2	86	13	2	70	38
Photographer	95	8	2	2	22	2	4	70	10	13
Police Officer	0	7	5	1	7	15	11	73	1	88
Primary School Teacher	46	2	18	32	1	6	14	11	10	86
Secretary	3	47	92	8	5	2	95	2	0	9
Social Worker	6	8	14	2	2	34	22	26	5	99
Staff Nurse	2	11	22	11	3	95	30	2	40	70
Statistician	0	49	73	91	5	2	41	2	25	2
X Ray Technologist	1	1	14	24	50	91	7	1	69	26

JOBS VERSUS INTERESTS DATA (%ages)

2. University Students - Men.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	94	11	17	61	37	0	10	29	33	15
Certified Public Accountant	0	90	75	78	0	0	81	0	1	14
Civil Engineer	19	18	25	79	71	0	7	51	57	19
Computer Operator	0	11	64	53	46	0	29	0	24	0
Computer Programmer	4	14	57	86	14	1	25	1	46	0
Draftsman	75	4	31	44	56	1	19	12	18	4
Electrical Engineer	7	10	28	85	65	1	6	1	74	1
Librarian	11	17	75	1	0	3	64	1	0	65
Maintennance Engineer	0	15	8	22	85	1	4	31	24	12
Pharmicist	0	31	31	32	3	85	15	1	62	43
Photographer	94	7	3	3	19	1	6	64	14	12
Police Officer	0	11	4	0	10	17	11	74	0	87
Primary School Teacher	47	3	25	31	0	7	19	10	7	86
Secretary	3	51	90	8	3	3	94	0	0	10
Social Worker	7	10	15	3	1	26	21	29	3	99
Staff Nurse	0	15	29	10	3	93	33	1	29	61
Statistician	0	42	72	87	1	3	40	3	25	1
X Ray Technologist	0	1	10	19	47	92	6	1	67	25

JOBS VERSUS INTERESTS DATA (%ages)

3. University Students - Women

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	98	11	11	55	36	4	6	51	21	7
Certified Public Accountant	0	87	83	92	2	0	72	2	2	13
Civil Engineer	21	34	26	64	71	4	13	45	51	28
Computer Operator	2	23	68	60	64	0	51	0	23	2
Computer Programmer	4	36	68	83	51	0	38	0	32	2
Draftsman	75	7	26	57	49	2	15	11	11	6
Electrical Engineer	6	17	15	77	75	2	11	4	68	2
Librarian	11	26	66	9	4	2	55	4	2	64
Maintennance Engineer	2	13	11	25	87	4	9	17	26	15
Pharmicist	0	11	28	36	2	89	9	2	79	32
Photographer	96	9	2	2	24	2	2	77	6	13
Police Officer	0	2	6	2	4	13	11	72	2	89
Primary School Teacher	45	2	7	34	2	6	6	13	15	85
Secretary	4	41	94	7	7	2	96	4	0	0
Social Worker	6	6	13	0	2	43	24	23	7	100
Staff Nurse	6	6	13	13	4	98	26	2	55	83
Statistician	0	58	74	96	9	0	41	0	25	2
X Ray Technologist	2	0	21	30	54	91	9	0	72	26

JOBS VERSUS INTERESTS DATA (%ages)

4. University Students - Liberal Arts.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	96	16	18	68	38	3	9	46	25	11
Certified Public Accountant	0	92	76	89	1	0	78	1	1	17
Civil Engineer	21	30	32	76	73	3	16	44	48	31
Computer Operator	1	23	73	62	59	0	49	0	28	1
Computer Programmer	1	9	32	72	85	44	0	44	1	37
Draftsman	1	75	31	59	51	1	20	16	17	9
Electrical Engineer	9	13	27	82	76	1	13	4	65	1
Librarian	14	21	69	9	3	3	56	4	1	68
Maintennance Engineer	1	14	14	24	87	3	11	30	23	13
Pharmicist	0	17	32	47	3	89	13	3	82	41
Photographer	95	11	4	4	25	1	6	79	13	16
Police Officer	0	4	6	1	7	17	10	72	1	90
Primary School Teacher	48	1	16	32	1	9	13	11	16	92
Secretary	3	45	94	13	7	3	95	3	0	7
Social Worker	9	6	14	1	3	38	24	31	6	100
Staff Nurse	4	6	21	16	4	94	30	3	55	75
Statistician	0	58	78	96	9	3	45	3	25	3
X Ray Technologist	1	0	21	32	51	93	10	1	79	31

JOBS VERSUS INTERESTS DATA (%ages)

5. University Students - Institute of Technology.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	96	6	9	46	35	0	7	28	32	13
Certified Public Accountant	0	85	82	78	0	0	76	0	2	9
Civil Engineer	19	19	17	69	69	0	2	56	63	13
Computer Operator	0	7	56	48	46	0	24	0	17	0
Computer Programmer	7	11	48	85	11	2	13	0	44	0
Draftsman	76	2	26	37	56	2	15	7	13	0
Electrical Engineer	4	13	17	82	61	2	2	0	80	2
Librarian	7	20	74	0	0	2	65	0	0	61
Maintennance Engineer	0	15	4	22	83	2	0	19	28	15
Pharmicist	0	30	26	17	2	83	13	0	54	35
Photographer	96	4	0	0	17	2	2	57	7	9
Police Officer	0	11	4	0	7	13	13	74	0	85
Primary School Teacher	44	4	20	32	0	4	15	11	4	78
Secretary	4	50	89	2	2	2	96	0	0	11
Social Worker	4	11	15	2	0	28	20	20	4	98
Staff Nurse	0	19	24	6	2	96	32	0	20	65
Statistician	0	37	67	85	0	0	35	0	24	0
X Ray Technologist	0	2	6	13	50	89	4	0	56	19

JOBS VERSUS INTERESTS DATA (%ages)

6. High School Students.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	92	18	13	77	41	0	24	43	19	6
Certified Public Accountant	2	69	73	85	6	3	61	2	6	32
Civil Engineer	35	23	35	56	74	5	12	42	31	17
Computer Operator	2	21	75	74	56	4	33	0	31	6
Computer Programmer	9	27	63	75	50	2	27	1	37	4
Draftsman	76	14	20	64	49	2	18	20	18	12
Electrical Engineer	16	14	31	71	83	2	12	21	42	8
Librarian	6	38	43	16	4	2	66	1	4	69
Pharmacist	4	40	29	53	7	86	28	1	58	33
Photographer	86	13	5	12	28	0	7	77	16	16
Police Officer	4	17	8	14	18	29	28	69	5	77
Primary School Teacher	41	18	29	63	6	10	24	20	28	71
Secretary	5	70	60	43	11	3	85	3	1	38
Social Worker	6	23	21	14	10	28	41	21	7	89
Staff Nurse	6	20	25	33	13	85	38	4	41	62
Statistician	6	54	62	84	21	6	35	11	25	24
X Ray Technologist	13	14	32	52	60	85	26	3	68	23

JOBS VERSUS INTERESTS (%ages)

7. Senior High School Students

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	98	19	23	79	53	0	19	57	28	11
Certified Public Accountant	2	83	83	94	4	2	72	0	4	38
Civil Engineer	49	19	40	72	81	2	15	53	40	19
Computer Operator	4	21	77	74	68	4	40	0	36	4
Computer Programmer	6	25	74	85	60	0	40	2	45	2
Draftsman	89	4	32	70	53	2	28	21	23	13
Electrical Engineer	21	6	38	87	85	2	21	23	49	8
Librarian	4	32	55	8	2	0	77	0	4	72
Pharmacist	4	40	32	45	8	91	34	0	77	36
Photographer	94	11	6	2	28	0	4	85	17	17
Police Officer	2	11	2	8	17	23	21	62	6	79
Primary School Teacher	34	11	34	57	2	8	23	17	25	81
Secretary	4	79	66	36	8	4	94	0	0	31
Social Worker	6	21	21	8	6	34	43	25	6	89
Staff Nurse	6	17	23	32	13	87	42	2	51	66
Statistician	4	60	72	89	23	2	49	11	32	28
X Ray Technologist	15	8	32	57	74	87	19	2	85	21

JOBS VERSUS INTERESTS (%ages)

8. Junior High School Students.

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	87	17	2	76	28	0	28	28	11	2
Certified Public Accountant	2	54	63	76	9	4	50	4	9	26
Civil Engineer	22	26	30	39	67	9	9	30	22	15
Computer Operator	0	22	74	74	43	4	26	0	26	9
Computer Programmer	11	28	52	65	41	4	13	0	28	6
Draftsman	63	24	9	59	46	2	9	20	13	11
Electrical Engineer	11	22	24	54	80	2	2	20	35	9
Librarian	9	43	30	24	6	4	54	2	4	65
Pharmacist	4	39	26	61	6	80	22	2	39	30
Photographer	78	15	4	22	28	0	11	70	15	15
Police Officer	6	24	15	20	20	35	35	76	4	76
Primary School Teacher	48	26	24	70	11	11	24	24	30	61
Secretary	6	61	54	50	13	2	76	6	2	43
Social Worker	6	24	22	20	13	22	39	17	9	89
Staff Nurse	6	24	26	35	13	83	33	6	30	59
Statistician	9	48	52	78	20	11	22	11	17	20
X Ray Technologist	11	20	33	46	46	83	33	4	50	24

JOBS VERSUS INTERESTS DATA (%ages)

9. Senior High School Students - Boys

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	96	24	16	68	48	0	20	52	16	8
Certified Public Accountant	0	76	72	92	8	4	64	0	0	40
Civil Engineer	36	24	36	60	84	4	20	32	32	16
Computer Operator	4	20	76	68	52	8	32	0	32	4
Computer Programmer	8	24	72	80	44	0	28	4	44	0
Draftsman	84	4	20	64	36	4	24	12	12	8
Electrical Engineer	24	4	40	84	84	4	20	24	36	8
Librarian	0	24	36	4	0	0	76	0	4	56
Pharmacist	0	32	16	36	4	88	24	0	72	20
Photographer	88	4	4	0	20	0	4	84	8	12
Police Officer	0	12	0	8	16	32	12	56	0	64
Primary School Teacher	24	8	36	52	0	12	24	8	12	68
Secretary	4	72	52	48	8	4	92	0	0	12
Social Worker	0	28	20	4	8	24	36	20	0	88
Staff Nurse	4	12	12	32	12	80	32	4	44	44
Statistician	0	48	68	96	20	4	48	12	36	24
X Ray Technologist	20	4	24	44	68	80	12	0	84	4

JOBS VERSUS INTERESTS DATA (%ages)

10. Senior High School Students - Girls

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	100	14	32	91	59	0	18	64	41	14
Certified Public Accountant	4	91	95	95	0	0	82	0	9	36
Civil Engineer	64	14	45	86	72	0	9	77	50	23
Computer Operator	4	23	77	82	86	0	50	0	41	4
Computer Programmer	4	27	77	91	77	0	54	0	45	4
Draftsman	95	4	45	77	73	0	32	32	36	18
Electrical Engineer	18	9	36	91	86	0	23	23	64	9
Librarian	9	41	77	14	4	0	77	0	4	91
Pharmacist	9	50	50	54	14	95	45	0	82	54
Photographer	100	18	9	4	36	0	4	86	27	23
Police Officer	4	9	4	9	18	14	32	68	14	95
Primary School Teacher	45	14	32	64	4	4	23	27	41	95
Secretary	4	86	82	23	9	4	95	0	0	54
Social Worker	14	14	23	14	4	45	50	32	14	91
Staff Nurse	9	23	36	32	14	95	54	0	59	91
Statistician	9	73	77	82	27	0	50	9	27	32
X Ray Technologist	9	14	41	73	83	95	27	4	86	41

JOBS VERSUS INTERESTS DATA (%ages)

11. Junior High School Students - Boys

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	82	14	4	73	23	0	27	18	9	4
Certified Public Accountant	4	54	64	77	9	4	41	4	9	18
Civil Engineer	23	14	18	45	69	9	0	32	18	9
Computer Operator	0	14	82	82	27	4	18	0	27	4
Computer Programmer	14	27	64	68	18	4	9	0	45	4
Draftsman	73	18	4	68	45	0	9	9	9	0
Electrical Engineer	14	14	23	64	86	0	4	27	23	4
Librarian	14	41	23	32	4	0	41	4	4	73
Pharmacist	4	36	36	50	9	73	14	0	36	23
Photographer	77	18	4	27	32	0	14	68	18	23
Police Officer	4	18	14	23	18	27	36	77	9	68
Primary School Teacher	41	27	27	64	14	18	23	14	27	64
Secretary	9	50	45	50	9	0	73	4	4	36
Social Worker	4	9	4	23	14	18	23	9	9	86
Staff Nurse	4	9	23	27	14	82	18	14	27	64
Statistician	4	41	50	73	14	9	18	9	18	4
X Ray Technologist	9	9	36	41	36	77	27	4	50	27

JOBS VERSUS INTERESTS DATA (%ages)

12. Junior High School Students - Girls

	- Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	92	21	0	79	33	0	29	37	12	0
Certified Public Accountant	0	54	62	75	8	4	58	4	8	33
Civil Engineer	21	37	42	33	67	8	17	29	25	21
Computer Operator	0	29	67	67	58	4	33	0	25	12
Computer Programmer	8	29	42	62	62	4	17	0	12	8
Draftsman	54	29	12	50	46	4	8	29	17	21
Electrical Engineer	8	29	25	46	75	4	0	12	46	12
Librarian	4	46	37	17	8	8	67	0	4	58
Pharmacist	4	42	17	71	4	87	29	4	41	37
Photographer	79	12	4	17	25	0	8	71	12	8
Police Officer	8	29	17	17	21	42	33	75	0	84
Primary School Teacher	54	25	21	75	8	4	28	33	33	58
Secretary	4	71	62	50	17	4	79	8	0	50
Social Worker	8	37	37	17	12	25	54	25	8	92
Staff Nurse	8	37	29	42	12	83	46	0	33	54
Statistician	12	54	54	83	25	12	25	12	17	33
X Ray Technologist	12	29	29	50	54	87	37	4	50	21

JOBS VERSUS INTERESTS DATA (%ages)

13. High School Students - Boys

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	89	19	11	70	36	0	23	36	13	6
Certified Public Accountant	2	66	68	85	8	4	53	2	4	30
Civil Engineer	30	19	28	53	77	6	11	32	25	13
Computer Operator	2	17	79	74	40	6	25	0	30	4
Computer Programmer	11	25	68	74	32	2	19	2	45	2
Draftsman	79	11	13	66	40	2	17	11	11	4
Electrical Engineer	19	8	32	74	85	2	13	25	30	6
Librarian	6	32	30	17	2	0	60	2	4	64
Pharmacist	2	34	25	43	6	81	19	0	55	21
Photographer	83	11	4	13	25	0	8	77	13	17
Police Officer	2	15	6	15	17	30	23	66	4	66
Primary School Teacher	32	17	32	57	6	15	23	11	19	66
Secretary	6	62	49	49	8	2	83	2	2	23
Social Worker	2	19	13	13	11	21	30	15	4	87
Staff Nurse	4	11	17	30	13	81	25	8	36	53
Statistician	2	45	60	85	17	6	34	11	28	15
X Ray Technologist	15	6	30	43	53	79	19	2	68	15

JOBS VERSUS INTERESTS DATA (%ages)

14. High School Students - Girls

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	96	17	15	85	46	0	24	50	26	6
Certified Public Accountant	2	72	78	85	4	2	70	2	9	35
Civil Engineer	41	26	43	59	72	4	13	52	37	22
Computer Operator	2	26	72	74	72	2	41	0	33	9
Computer Programmer	6	28	59	76	70	2	35	0	28	6
Draftsman	74	17	28	63	59	2	20	30	26	20
Electrical Engineer	13	20	30	67	80	2	11	17	54	11
Librarian	6	43	56	15	6	4	72	0	4	74
Pharmacist	6	46	33	63	9	91	37	2	61	46
Photographer	89	15	6	11	30	0	6	78	20	15
Police Officer	6	20	11	13	20	28	33	72	6	89
Primary School Teacher	50	20	26	70	6	4	24	30	37	76
Secretary	4	78	72	37	13	4	87	4	0	52
Social Worker	11	26	30	15	9	35	52	28	11	91
Staff Nurse	9	30	33	37	13	89	50	0	46	72
Statistician	11	63	65	83	26	6	37	11	22	33
X Ray Technologist	11	22	35	61	67	91	33	4	67	30

JOBS VERSUS INTERESTS DATA (%ages)

15. UK Schoolboys

	Artistic	Business Management	Clerical/Computational	Mathematical	Mechanical	Medical Service	Office Practices	Outdoor	Scientific	Social Service
Architect	94	4	8	47	29	0	37	45	12	0
Chartered Accountant	4	55	65	92	2	0	74	8	10	6
Civil Engineer	37	6	22	49	74	0	23	49	31	8
Commercial Artist	90	16	4	8	6	0	12	27	4	4
Computer Operator	2	12	90	82	29	0	39	0	61	0
Computer Programmer	2	12	90	86	20	0	37	0	65	2
Draftsman	82	6	10	47	41	2	45	18	18	2
Electrical Engineer	6	10	29	51	86	2	8	16	53	4
Librarian	4	10	43	10	2	0	55	0	0	53
Pharmacist	2	14	23	29	10	88	16	2	78	20
Photographer	94	4	0	2	14	0	12	72	10	6
Police Officer	2	4	12	8	10	14	30	74	2	72
Primary School Teacher	35	6	18	55	6	8	12	18	12	67
Radiographer	2	0	23	23	31	59	16	4	71	22
Secretary	0	35	59	33	2	0	80	0	0	14
Social Worker	0	4	14	2	0	25	23	47	0	96
Staff Nurse	2	12	20	14	10	86	22	4	33	69
Statistician	0	27	72	94	6	0	55	2	43	0

APPENDIX I

Factor Analysis - Technical Details

FACTOR ANALYSIS OF US STUDY DATA: TECHNICAL DETAILS.

1. Number of Subjects in Analysis = 198. (20 subjects excluded because of missing data.)

2. Mean and Standard Deviation of Challenge Ratings

Occupation	Mean	Standard Deviation
1 Aircraft Mechanic	3.93	1.48
2 Architect	3.36	1.19
3 Certified Public Accountant	4.72	1.55
4 Civil Engineer	3.90	1.44
5 Computer Operator	5.06	1.51
6 Computer Programmer	4.39	1.55
7 Draftsman	4.51	1.49
8 Electrical Engineer	3.21	1.43
9 Electronics Technician	3.78	1.63
10 Librarian	6.24	1.16
11 Maintennance Engineer	5.31	1.58
12 Pharmacist	4.04	1.53
13 Photographer	4.27	1.49
14 Police Officer	3.77	1.66
15 Primary School Teacher	4.67	1.51
16 Secretary	5.96	1.24
17 Social Worker	4.42	1.57
18 Staff Nurse	4.52	1.51
19 Statistician	4.48	1.70
20 Television Repairman	5.20	1.51

3. Pearson Product Moment Correlation Matrix*.

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	13	20	40	30	22	29	44	57	-14	46	18	-13	05	-02	14	00	04	31	56
2		25	28	-07	-11	29	10	11	13	10	06	22	17	10	09	25	17	17	08
3			37	02	07	06	22	26	-00	15	17	-10	00	12	18	11	13	35	17
4				14	18	22	42	34	-07	27	18	-06	06	08	06	18	12	26	26
5					66	38	20	39	-05	20	10	-11	-06	-16	35	04	08	22	29
6						31	29	25	-11	09	09	-10	-02	-08	20	00	09	31	33
7							21	39	14	26	09	06	13	-06	19	15	24	25	33
8								68	-16	29	18	-10	08	-10	-06	-10	01	38	41
9									-06	32	26	-12	-00	-21	13	-02	13	38	44
10										02	18	10	11	15	16	23	22	12	-05
11											11	-03	-05	03	13	-01	04	27	40
12												07	-00	-04	19	14	30	26	20
13													10	14	03	28	11	-03	-06
14														31	14	33	29	06	06
15															12	43	23	00	-01
16																20	39	16	24
17																	39	08	05
18																		23	21
19																			41

* Decimal points omitted

4. Communality Estimate.

Occupations	Communality
1	0.674
2	0.336
3	0.340
4	0.412
5	0.711
6	0.693
7	0.513
8	0.612
9	0.654
10	0.241
11	0.347
12	0.281
13	0.169
14	0.226
15	0.495
16	0.388
17	0.520
18	0.448
19	0.383
20	0.502

5. Method of Extraction: 1. Principal Factor with Iterations
2. Kaiser Criterion for Retaining Factors
3. Varimax Rotation

APPENDIX J

Coordinates of Multidimensional Scaling Solutions

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Pilot Study Data.

Occupational Title	MINISSA coordinates 3D solution I	II	III
1. Architect	-0.887	0.615	-0.006
2. Certified Public Accountant	-0.300	-0.796	-0.532
3. Civil Engineer	-1.004	0.138	-0.070
4. Commercial Artist	-0.483	0.982	-0.368
5. Computer Operator	-0.436	-0.829	0.155
6. Computer Programmer	-0.320	-0.717	0.158
7. Electrical Engineer	-1.014	-0.049	0.225
8. Librarian	0.503	-0.283	-0.757
9. Mechanical Engineer	-0.859	0.082	0.411
10. Pharmacist	0.558	-0.510	0.802
11. Photographer	-0.306	1.101	0 043
12. Physical Therapist	0.894	0.321	0.737
13. Primary School Teacher	0.973	0.383	-0.490
14. Secretary	0.542	-0.623	-0.630
15. Social Worker	1.092	0.347	-0.123
16. Staff Nurse	0.823	-0.127	0.565
17. Statistician	-0.286	-0.525	-0.363
18. Technical Writer	-0.226	0.124	-0.444
19. Vocational Counselor	0.805	0.481	-0.110
20. X Ray Technologist	-0.069	-0.115	0.796

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Junior High School Students.

	MINISSA coordinates 3D solution		
Occupational Titles	I	II	III
1. Architect	-0.893	0.390	0.052
2. Certified Public Accountant	0.286	-0.601	-0.644
3. Civil Engineer	-0.647	0.292	-0.654
4. Commercial Artist	-0.716	0.825	0.100
5. Computer Operator	-0.422	-0.737	-0.513
6. Electrical Engineer	-0.955	-0.302	-0.470
7. Librarian	0.929	-0.165	0.054
8. Pharmicist	0.223	-0.569	0.863
9. Photographer	-0.673	0.453	0.738
10. Police Officer	0.492	1.122	-0.314
11. Primary School Teacher	0.929	0.425	-0.245
12. Secretary	0.762	-0.370	-0.283
13. Social Worker	0.698	0.545	0.029
14. Staff Nurse	0.557	-0.070	0.717
15. Statistician	0.002	-0.749	-0.047
16. X Ray Technologist	-0.574	-0.490	0.618

Three-Dimensional Coordinates of MINISSA Solution of Occupatioal Pairwise Similarities Ratings: Senior High School Students.

Occupational Titles	MINISSA coordinates 3D Solution I	II	III
1. Architect	-0.833	-0.445	-0.219
2. Certified Public Accountant	-0.059	0.702	-0.601
3. Civil Engineer	-0.900	-0.084	-0.319
4. Commercial Artist	-0.549	-0.731	-0.610
5. Computer Operator	-0.463	0.790	0.139
6. Electrical Engineer	-1.011	0.160	0.410
7. Librarian	0.673	0.591	-0.187
8. Pharmacist	0.294	0.134	1.100
9. Photographer	-0.377	-1.013	0.023
10. Police Officer	0.986	-0.804	0.098
11. Primary School Teacher	0.919	-0.161	-0.549
12. Secretary	0.426	0.537	-0.457
13. Social Worker	0.953	-0.315	-0.073
14. Staff Nurse	0.669	0.072	0.646
15. Statistician	-0.265	0.650	-0.165
16. X Ray Technologist	-0.462	-0.083	0.762

Four-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Student White Data.

Occupational Title	MINISSA coordinates 4D solution I	II	III	IV
1. Architect	-0.684	-0.724	0.020	0.092
2. Certified Public Accountant	-0.005	0.466	-0.413	0.705
3. Civil Engineer	-0.610	-0.340	0.473	0.409
4. Commercial Artist	-0.293	-0.892	-0.468	-0.010
5. Computer Operator	-0.631	0.704	-0.208	0.171
6. Electrical Engineer	-0.992	0.101	0.425	0.142
7. Librarian	0.600	0.169	-0.671	-0.002
8. Pharmacist	0.175	0.508	0.658	-0.603
9. Photographer	-0.326	-0.617	-0.425	-0.682
10. Police Officer	0.822	-0.165	0.778	0.458
11. Primary School Teacher	0.969	-0.520	-0.189	0.086
12. Secretary	0.409	0.578	-0.705	-0.054
13. Social Worker	0.776	-0.401	0.330	0.118
14. Staff Nurse	0.586	0.360	0.356	-0.519
15. Statistician	-0.309	0.396	-0.065	0.483
16. X Ray Technologist	-0.487	0.377	0.103	-0.704

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Student Yellow Data.

Occupational Title	MINISSA coordinates 3D solution I	II	III
1. Aircraft Mechanic	-1.156	-0.722	-0.219
2. Architect	-0.322	-0.944	0.222
3. Automobile Mechanic	-0.197	0.239	-0.932
4. Civil Engineer	-0.811	0.842	0.252
5. Computer Operator	1.141	-0.484	0.009
6. Computer Programmer	0.980	0.230	0.512
7. Customer Engineer	1.239	0.259	0.170
8. Draftsman	-1.064	-0.331	0.457
9. Electrical Engineer	0.075	-0.128	-0.160
10. Electronics Technician	-0.261	0.727	-0.032
11. Maintennance Engineer	0.617	0.371	-0.508
12. Mechanical Engineer	0.478	-0.429	0.254
13. Statistician	-0.386	0.597	-0.382
14. Structural Engineer	0.124	0.422	0.148
15. Technical Writer	-0.613	0.386	0.521
16. Television Reparman	0.157	-1.036	-0.310

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Aston School Data.

Occupational Title	MINISSA coordinates 3D solution I	II	III
1. Architect	-0.829	-0.066	-0.512
2. Chartered Accountant	-0.401	0.833	0.104
3. Civil Engineer	-0.891	-0.018	-0.211
4. Commercial Artist	-0.317	0.162	-0.917
5. Computer Operator	-0.603	0.252	0.669
6. Electrical Engineer	-1.034	-0.457	0.181
7. Librarian	0.445	0.735	-0.083
8. Pharmacist	0.325	-0.804	0.644
9. Photographer	-0.259	-0.518	-0.697
10. Police Officer	1.048	-0.478	-0.482
11. Primary School Teacher	1.138	0.401	-0.141
12. Radiographer	0.419	0.732	0.359
13. Secretary	0.879	-0.129	-0.212
14. Social Worker	0.880	-0.424	0.465
15. Staff Nurse	-0.453	0.550	0.404
16. Statistician	-0.346	-0.774	0.430

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Five Ways Data.

Occupational Title	MINISSA coordinates 3D solution I	II	III
1. Architect	-0.767	-0.533	0.319
2. Chartered Accountant	-0.371	0.465	0.620
3. Civil Engineer	-0.918	-0.267	-0.004
4. Commercial Artist	-0.382	-0.897	0.448
5. Computer Operator	-0.604	0.657	0.063
6. Electrical Engineer	-1.032	0.250	-0.393
7. Librarian	0.475	0.118	0.770
8. Pharmacist	0.274	0.504	-0.878
9. Photographer	-0.328	-0.944	-0.306
10. Police Officer	1.012	-0.589	-0.052
11. Primary School Teacher	1.063	-0.115	0.228
12. Radiographer	0.439	0.565	0.635
13. Secretary	0.914	-0.226	-0.175
14. Social Worker	0.768	0.193	-0.729
15. Staff Nurse	-0.143	0.718	0.319
16. Statistician	-0.400	0.102	-0.864

Three-Dimensional Coordinates of MINISSA Solution of Occupational Pairwise Similarities Ratings: Sharmons Cross Data.

Occupational Titles	MINISSA coordinates 3D solution I	II	III
1. Architect	-0.817	0.417	0.587
2. Chartered Accountant	-0.478	-0.643	0.478
3. Civil Engineer	-0.989	0.281	-0.350
4. Commercial Artist	-0.280	0.416	0.709
5. Computer Operator	-0.581	-0.588	-0.304
6. Electrical Engineer	-1.106	0.132	-0.412
7. Librarian	0.514	-0.479	0.642
8. Pharmacist	0.527	-0.335	-0.834
9. Photographer	-0.262	0.915	0.232
10. Police Officer	0.899	0.739	-0.186
11. Primary School Teacher	1.111	-0.027	0.491
12. Radiographer	0.235	-0.804	0.206
13. Secretary	0.755	0.303	0.124
14. Sccial Worker	1.026	-0.006	-0.509
15. Staff Nurse	-0.457	-0.549	-0.042
16. Statistician	-0.096	0.229	-0.833