Armsby, Pauline. 1986.
Road Accident Risk: An Investigation into
Various Assessment Methodologies.
Available from Middlesex University's Research Repository.

13

Road accident risk: an investigation into various assessment methodologies

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Thesis submitted in partial fullfilment of
the Master of Philosophy degree
for an award by the CNAA
Sponsoring establishment: Middlesex Polytechnic

Collaborating establishment: Transport and Road
Research Laboratory

October 1986

Preface

The original proposal of work to investigate assessment methodologies that could be used to measure road users' perceptions of risk was devised by Dr. A.J. Boyle. The funds to carry out eighteen months of this project were given by the Transport and Road Research Laboratory. (TRRL)

I would like to acknowledge the support and guidance that I received from Dr. A.J. Boyle, and Dr. C.C. Wright my internal supervisor. I would also like to thank Mr. G. Maycock, Dr. G. Grayson and Mr. A. Quimby the staff at TRRL who were involved with this project for the comments and advice that they gave.

Finally I would like to thank Mrs C. Cook for typing this thesis.

ROAD ACCIDENT RISK: AN INVESTIGATION INTO VARIOUS ASSESSMENT METHODOLOGIES

P.M. ARMSBY

ABSTRACT

It has been argued that the major cause of road accidents is due to human error, and that drivers modify their behaviour on the road according to the level of risk they perceive in the road environment. Unfortunately, due to a lack of suitable methodologies no reliable method for assessing drivers' perception of hazards has yet been developed. For this reason several techniques for assessing perception were investigated.

Non-directive, focussed and critical incident interviews, Q-sort and several variants of the repertory grid were used in an attempt to discriminate between old and young male drivers' perception of road hazards.

Only the repertory grid discriminated successfully and in all variants old drivers more often used extremes of the rating scale whereas young drivers more often used mid-scale ratings. It was hypothesised that the extreme responses of the older drivers' reflected their decisiveness, which may arise from their greater experience and confidence. The tendency towards mid-scale ratings for the younger drivers was attributed to their lack of certainty in judgement.

The most successful repertory grid variant, namely the fixed repertory grid, was used on four different groups of young and old drivers and this work revealed further differences between the age groups in correlational structures, element clusterings, and principal component variances. The scales (and the hazards) that were significantly correlated and clustered together, and the structure of the components produced, showed consistency over all four groups.

Further work to develop the repertory grid is suggested and potential applications are discussed. These include using the fixed repertory grid, as a diagnostic instrument for detecting deficiencies in road layout which lead to accidents at blackspots, and as an aid to driver training programmes.

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Road accident risk: an investigation into various assessment methodologies

List of Tables and Figure

TABLES

List of Tables

21. The highly loaded constructs, percentages of variance accounted for and order of importance of Component D for each group.

FIGURES

Chapter 1
Introduction

The causes (or contributory factors) of road accidents were investigated by a major study which carried out in-depth accident investigations. (Sabey and Staughton, 1975, Staughton and Storie, 1977, Sabey and Taylor,1980). This research showed that of the three main causal factors; road environment, road user and vehicle, the road user category was solely responsible in 65% of the accidents and at least partly responsible in 95% of the accidents. Given the magnitude of this human error factor it would seem important to investigate the behavioural aspects in more detail in order to reduce accident rates.

Behaviour on the road is affected by many things including motivation, willingness to accept risks, perception and skill. However it has been argued that road users modify their behaviour from place to place on the road network according to the level of risk they perceive. (Taylor, 1964; Wilde,1981; Nataanen and Summala, 1974; Fuller, 1984). Other variables are not directly affected by features of the environment but are constant over the driving population (and sub groups of that population) over a period of time. Unfortunately, due to the lack of a suitable methodology for assessing road users' perception of risk it has not been possible in the past accurately to determine the extent to which misperceptions of the road environment lead to accidents. Nor has it been possible to discover drivers' perceptions of the various aspects of a specific location and how they contribute to overall risk assessments. The specific aim of this research was then to develop a method for assessing road users' perception of risk at specific sites so that the effect of the road environment could be judged.

The benefits of such a method would be threefold. First it would aid engineers in remedial work at locations in the road where misperceptions were uncovered. Second it would help in the development of driver training programmes by highlighting common misperceptions. Third, it would enable existing theories regarding the influence of perceived risk on the causal factors in road accidents to be clarified.

All of the above theories distinguish between the risk of an accident as perceived by the road user and objective risk. They also assume that road users can perceive a total risk in the environment and that they modify their behaviour according to that assessment. Unfortunately there are two main difficulties in assessing these factors. First the nature and role of 'objective risk' as applied in the theories seems ambiguous. Accidents are not themselves 'objective risks', they are the result of the road users' failure to cope with objective risks. The objective risk is inherent in the road environment. Secondly there is no suitable method of establishing road users' perception of this objective risk. The successful development of an assessment methodology would enable theories of risk perception to be tested.

Perceived risk is made up of many elements, for example, the risk perceived as a result of a road users' knowledge of his or her physical state, of the car driven and area driven in. It is hypothesised that the risk perceived in the road location at any particular time is the most important element of all the aspects of perceived risk. This aspect of perceived risk is mainly generated by the physical characteristic of the location. In this way accurate identification of those aspects of the environment road users are using in their assessments and how much each aspect contributes to the overall risk allocated by the road user becomes crucial. For this reason a number of techniques, consisting of modifications of existing assessment methodologies were investigated with the aim of selecting the best one for further development.

Previous studies on hazard perception have used various methods. Benda and Hoyos (1983) point out that subjects have been asked to identify hazardous objects when driving in real traffic situations, from videos, from slides, and from photographs. In addition, they report that methods of obtaining subjects' evaluations of the hazardousness of the situations have varied between experiments. For example, subjects have given continuous verbal evaluations of the hazards in a traffic situation shown in a film, (Pelz and Krupat, 1974) they have rated their chances of a "near miss" on an 11 point scale from "no chance" to "good chance", (Watts and Quimby, 1980) and they have compared photographs of hazardous situations with reference to hazardousness (Benda and Hoyos, 1983).

It was felt that none of the techniques used previously was ideal. For this reason it was decided that investigations should begin with various sorts of interviewing techniques as these are efficiently used during the early stages of an investigation, to establish a broad outline of the way in which subjects perceive the phenomena under study. These elicit qualitative rather than quantitive data. It was hoped that the results of these interviews would form a basis for investigating other techniques. Other techniques chosen for investigation centred on those involving rating or ranking of hazardous elements, as it was felt that they were conveniently usable methods and would give quantitive results.

Before going on to describe the various methods investigated in this study it may be useful to clarify some definitions. The methods that were assessed aimed to investigate drivers' subjective views on 'hazards' and 'risk' . For this reason these terms are used throughout the rest of this thesis in the context of an individual's perception unless otherwise stated. Thus a hazard is any aspect of the road environment or any combination of circumstances on the road which an individual perceives to be dangerous. A perceived hazard need not be a true hazard in the sense that it directly increases the likelihood of an accident. There may of course be true hazards in an environment which an individual does not perceive, or which are perceived but not reported as a hazard.

Similarly, risk is defined as the individual's perception of the likelihood of an accident in given circumstances. This is rarely quantified in absolute terms, but road users may be capable of making comparisons between risk levels at different sites, and of detecting changes at individual sites over time. It is assumed that perceived hazards are the data used by individuals in assessing apparent risk. No attempt to assess the extent to which perceived risks reflect real risks has been made, or to study individual variations in risk taking behaviour.

The criterion used to judge the success of a technique was its ability to discriminate between old and young (over 45 years, under 25 years) subject groups, two groups with known differences in accident frequency. If more than one 'successful' technique was discovered it was decided that the one best able to discriminate between the two age groups would be further developed.

Three interviewing techniques were investigated to begin with. These were non-directive interviews, focused interviews and critical-incident interviews. All three of these techniques are designed to obtain subjective opinions.

The major feature of the non-directive interview technique (Rogers, 1945) is that the interviewer acts as a reflector of the interviewee's comments and opinions. This eliminates interviewer bias and allows the researcher to establish general views and the extent to which allusions to the area of interest are spontaneously mentioned. In contrast, focused interviews (Merton and Kendall 1946) use set questions related to a particular concrete situation in order to investigate in more detail aspects of that situation deemed to be pertinent. The set questions should encompass all the major areas of enquiry related to the concrete situation being studied, which has previously been analysed by the researcher. Critical incident interviews are designed to investigate how subjects perceive, in the context of a specific event found to have been crucial to the area of enquiry.

Adaption of these techniques in order to investigate road users' perception of hazards was relatively simple. It involved developing a set schedule of questions pertinent to that area, which could be used as a stimulus. During non-directive interviews it was hoped that the broadest interpretation of drivers' perception of hazards would be achieved, which would give information regarding drivers' overall perspectives. The focused interview was designed to cover all the major areas of hazard, and it was envisaged that the results from this part of the study would furnish details relating to these major areas of enquiry. Critical incident interviews it was hoped, would allow information regarding the salient features of accidents and near misses to emerge, which would give further insight into drivers' perceptions of the causal factors involved.

The techniques that it was planned to investigate, which involved rating or ranking tasks were the Q-sort, Semantic Differential and the Repertory Grid. It was decided that it would be most pertinent to rank or rate hazards as these are the data used by individuals in assessing risk.

The Q-sort (Stephenson, 1953) requires subjects to rank a pre-selected list of items on a pre-selected scale. These items can be elicited from the subjects themselves, or the investigator may prescribe them. The items can be drawn from preliminary data such as the interviewing techniques above or from existing published data from the area of investigation. The items can be for example objects, statements, people or photographs. The scales are set by the investigator according to some criterion of relevance, and may be, for instance, 'most agree' to 'most disagree' or something more closely related to the area of investigation.

In order to use this technique for this investigation it was necessary to identify the items and develop appropriate scales. It was hoped that the results from the previous techniques investigated would furnish these.

It was anticipated that the results from the Q-sort would give information regarding the relative importance of various hazards at particular situations. It would also allow establishment of the agreement between drivers regarding the hazardousness of the various elements involved in situations.

The repertory grid (Kelly, 1955, Fransella and Bannister, 1977) is a technique that allows each subject to express his or her feelings about items related to the area of investigation in a personal way. These items are called elements. This technique was originally devised to investigate interpersonal relationships and for this reason the elements were people known to the interviewee. The subject is invited to rate the elements on several different scales corresponding to the alternative 'dimensions of thought' in which he personally understands the elements. These scales are referred to as constructs.

The repertory grid derived from Kelly's Personal Construct Theory. This hypothesises that "every man (is) his own scientist" in that humans anticipate events and continually test the hypotheses they formulate from those anticipations. This aids them in striving to make sense of the situations they encounter. His theory asserted that each person differs in their construction of events, according to their experience. The construct system of individuals, that is, the dimensions of thought that they use, are hierarchical. It was felt that the repertory grid was a useful technique to use in the context of risk perception since a multi-dimensional method had not been used before.

The application of the repertory grid is essentially a two stage process. During the first stage, the elements and the constructs are elicited from each subject using one of several alternative techniques. During the second stage, the subject is invited to rate or score each element in turn on each construct, which produces a grid of ratings.

The repertory grid has been adapted and used in many areas of research since its invention. For example in business applications (Stewart et al, 1981) and in the industrial safety field (Perusse, 1980). However it has never been used for the purposes of assessing road users' perception of hazards so far as the author is aware. In the course of the various applications to which the repertory grid has been put, a number of variations in the methods of eliciting and using elements and constructs have been developed. The options available regarding the adaptation of the repertory grid to this area of investigation were therefore multitudinous. Therefore investigations to discover the most effective variants were limited to small numbers of subjects. In summary, the elements, that is the items for rating, were hazards elicited by various different means, or were hazardous situations; the constructs were scales of measurement relevent to these elements, again arrived at by various different methods.

It was hoped that this technique would enable a detailed understanding of drivers' perception of hazards as well as determining the dimensions of thought that drivers use in perceiving hazards.

Finally the repertory grid was the most complex and time consuming technique to administer, partly due to the nature of its elicitation procedures and partly because so many variants are available for investigation. One variant which used set elements and set constructs obtained from pilot groups of subjects is methodologically similar to the semantic differential technique, (Osgood and Snider, 1969) although the set scales in the semantic differential have been developed in advance by the investigators. However since the fixed repertory grid allowed more freedom in the use of rating scales it was used instead of the semantic differential.

One aid in counter acting the complexity of the repertory grid is the increasing use of computers, and software packages which run and analyse them. For this project the "Flexigrid" (Tsudi , 1984) software package was selected because of its flexibility in options regarding running and analysing grids. This was necessary as the exact details regarding the procedure for running and analysing the grids was not known since this technique had not been used for this purpose before. Unfortunately there were a number of limitations with this program. Some of them were overcome by modifications to the program, but, others could not be dealt with due to lack of time. The most problematic of these were, the inability of the program to accept numbers other than interger values between 1 and 5, and the inflexibility regarding transference of data from this program's file structure to file structures suitable for use in other programs.

The remainder of this thesis is divided into four chapters. Chapter 2 gives details regarding the non-directive, focused and critical incident interviews. Chapter 3 looks at the Q-sort and several variants of the repertory grid. Chapter 4 reports on one of these variants, namely the Fixed repertory grid and Chapter 5 discusses and summarises all of the results and outlines some suggestions for further work.

Finally, it should be noted that although this thesis is entitled, "Road accident risk" this research is largely concerned with investigating road users' perception of hazards. However, perception of hazards together with other aspects of personal perceptions of accident probability, like perceived driving ability, constitutes subjective risk.

Chapter 2
Interviewing techniques

There were two main objectives of these interviews:

(i) To determine whether non-directive interviews, interviews focused on perception of risk, or critical incident interviews would discriminate between old and young drivers.

(ii) To collect materials which would form the basis for other techniques to be used later in the research, that is, the Q-sort and the Repertory Grid.

Before deciding on the final design for this Phase, a number of pilot interviews were carried out with the following main results.

- It took 30-40 minutes to collect a detailed description of the driving and accident history of each subject.

- Subjects had little to say about their general attitudes to driving; both the non-directive interviews and the critical incident interviews were very short.

- Subjects rarely mentioned their perception of risk without a prompt and even then had little to say.

It was therefore decided to run all three interview techniques with each subject, that is a non-directive interview, followed by a focused interview, followed by a critical incident interview.

2.1. Procedure

INSTRUCTIONS TO SUBJECTS

Subjects were made as comfortable and relaxed as possible. They were told that the investigators were studying road users and road use, by interviewing drivers. Confidentiality was assured and the level of the fee paid to each subject was confirmed.

NON-DIRECTIVE INTERVIEWS

Four non-directive questions were asked, in the following order.

(1) Can you give me details of your driving history?

This question was asked in order to discover what aspects of their driving history subjects thought salient. Subjects were first allowed to describe their driving history in their own words and then supplementary questions were asked to fill in any gaps. The schedule of required material is shown as section 1 in Appendix 1.

(2) Can you tell me about any accidents that you have had?

This question was designed to ascertain what subjects considered to be an accident and what features of any accident they considered important. As with the first question, supplementary questions were asked when the interviewer needed further information in order to understand the description. Questions about conviction for driving offences, parking offences and contacts with the police as a result of car use were asked using a similar procedure. The schedule of required information is shown in Section 2 in Appendix 1.

(3) What would you say you like about driving?

(4) What would you say you dislike about driving?

Questions 3 and 4 were intended to give subjects an opportunity to express their views on driving. They were asked after the more straightforward factual questions so that subjects had time to get used to being interviewed. These questions were at the beginning of Section 3 Appendix 1.

FOCUSED INTERVIEWS

There were seven questions making up the focused part of the interview. Supplementary questions were asked as necessary, in order to clear up misunderstandings or ambiguities. The seven questions, in the order in which they were asked, were as follows:

(1) Can you describe a route which you use a lot?
- Which is the most dangerous bit? (and why?)

(2) What do you think about speed limits?

(3) What is your opinion of pedestrians?

(4) What do you think about roads and road signs?

(5) What is your view of different types of weather when driving?

(6) What is your opinion of other drivers?

(7) What is your definition of a road accident?

These questions are shown in Section 3 Appendix 1.

CRITICAL INCIDENT INTERVIEW

There were two main questions in this section.

(1) What is the riskiest situation you have been in when driving?

When subjects had decided on an incident, as full a description as possible was obtained using prompting questions as appropriate.

(2) What do you think the likelihood of you having an accident is? (in the next ten years).

When subjects had answered this question in whatever way they wished, they were asked to rate the liklihood on a scale from 0 to 10 and then to say what they thought the cause or causes of this accident were likely to be. These questions are found at the end of Section 3 Appendix 1.

BUIGRAPHICAL DETAILS

The final stage of the interview involved the collection of biographical details, including age, educational history and job history. The schedule of required information is given in Section 4 of Appendix 1.

METHODS OF RECORDING

Notes were made by the Interviewer during the interviews using copies of the schedule shown in Appendix 1. In addition, all interviews were recorded on tape and subsequently transcribed to facilitate analysis.

SUBJECTS

Subjects were obtained through advertisements posted at Middlesex Polytechnic sites and paid advertisements in local (Enfield) newspapers. Only subjects holding a full driving licence were accepted for interview.

Interviews were conducted only between 9am and 6pm on weekdays and all subjects were paid £5.00 per hour plus travelling expenses if appropriate.

The above points apply to all subjects taking part in all phases of this research.

There were 16 subjects, 15 male and 1 female ranging in age from 18 to 61 (mean 31.1 years)

2.2. Results

The results confirmed those of the pilot studies carried out using these methods. It was found that:-

(a) Driving history and accident history took a long time to record, the average time being 45.15 minutes.

(b) Non-directive interviews were short, with subjects having little or nothing to say about risk perception.

(c) Focused interviews did not produce much information on drivers' perception of risk, subjects usually responding with details about the inconveniences and frustrations of driving.

(d) Critical incident inverviews were short, and tended to contain only a brief description of the circumstances surrounding the incidents being related.

TABLE 1 THE MEAN NUMBER OF MINUTES TAKEN BY THE SIXTEEN SUBJECTS FOR EACH PART OF THE INTERVIEW ALSO EXPRESSED AS A PERCENTAGE OF THE WHOLE INTERVIEW

	Parts of the Interviews					
	Driving and Accident History	Non Directive Interview	Focused Int.	Critical Incident Int.	Biographical Dets	Total
Mean Mins.	45.15	11.55	33.6	9.45	5.25	105
Mean %	43	11	32	9	5	100%

Table 1 shows the mean number of minutes taken by the sixteen subjects in the various parts of the interviews. This is also expressed as a percentage of the whole interview. The most time-consuming part of the interview was the driving and accident history, which consisted mainly of the details of each subject's driving experience. This together with the collection of biographical details accounted for 48% of the total interview time.

The next largest part was the focused interviews. However its length relative to the other interviewing techniques, could have been simply a function of having to work through a set schedule of seven questions as opposed to only four for the non-directive part of the interview, and two for the critical incident part of the interview. In total the interviewing techniques took up 52% of the overall interview time.

In total, 256 references to hazards were made by the sixteen subjects. This gives a mean of sixteen references per subject. The amount of useful information obtained was therefore small considering the time required for interview, (mean 105 minutes) and analysis, approximately nine hours per subject.

The number of references per subject made to hazards ranged between 7 and 27. No reason could be found to differentiate between those subjects with high, and low references to hazard scores. These techniques did not therefore differentiate between old and young subjects.

The information obtained was also idiosyncratic. For example different subjects gave widely different reasons for identifying directional signs as hazards, including 'lights don't work', lack of 'road signs' and 'sign.... in the wrong place' .

It was also observed that the six drivers who had been or were also motorcycle riders were more specific when talking about risk than car-only drivers, particularly when speaking from the motor-cyclist's point of view.

This group of subjects did not make any more references to hazards appropriate to car driving than the other subjects, however they did spontaneously mention hazzards relevent to motor-cyclists.

TABLE 2 THE TOTAL NUMBER OF REFERENCES MADE TO HAZARDS IN THE INITIAL RESPONSES TO THE NON DIRECTIVE, FOCUSED AND CRITICAL INCIDENT QUESTIONS, CATEGORISED INTO FOUR MAIN CAUSAL FACTORS.

Main attributed causal factors	Interview Technique: non directive	focused	critical incident	total
Human	8	31	22	61
Environmental	2	18	2	22
Vehicular	1	1	3	5
Human & Environmental	0	4	2	6
Total	11	54	29	94

Table 2 shows the number of references made to hazardous, dangerous or risky aspects of car driving as inital responses to the non-directive, focused and critical incident questions. These references are categorised into four main attributed causal factors: human, environmental, vehicular and environmental and human combined.

This shows that when references to hazards were made spontaneously to the questions they were most often regarding human type hazards. These include such things as 'misjudged the speed' (2.7)* 'jump the lights' (7.19) and 'pedestrians' (10.22). A full list of the hazards can be seen in App.2..

Of the three interviewing techniques, focused interviews produced the most hazard responses, but as pointed out earlier this technique contained more stimulus questions, which would allow more spontaneous references to be made.

The mean amount of spontaneous references to hazards by each subject was 5.86. This is less than one reference per question per subject. Non directive interviews took up on average 21% of the 3 interviewing techniques time, and accounted for an average of 12% of the initial hazard responses. Focused interviews took up 62% of time and gave 57% of the responses and critical incident interviews took 17% of the time and gave 31% of the responses. This shows that taking time into consideration critical incident interviews were slightly better than the other two techniques in eliciting spontaneous hazard responses.

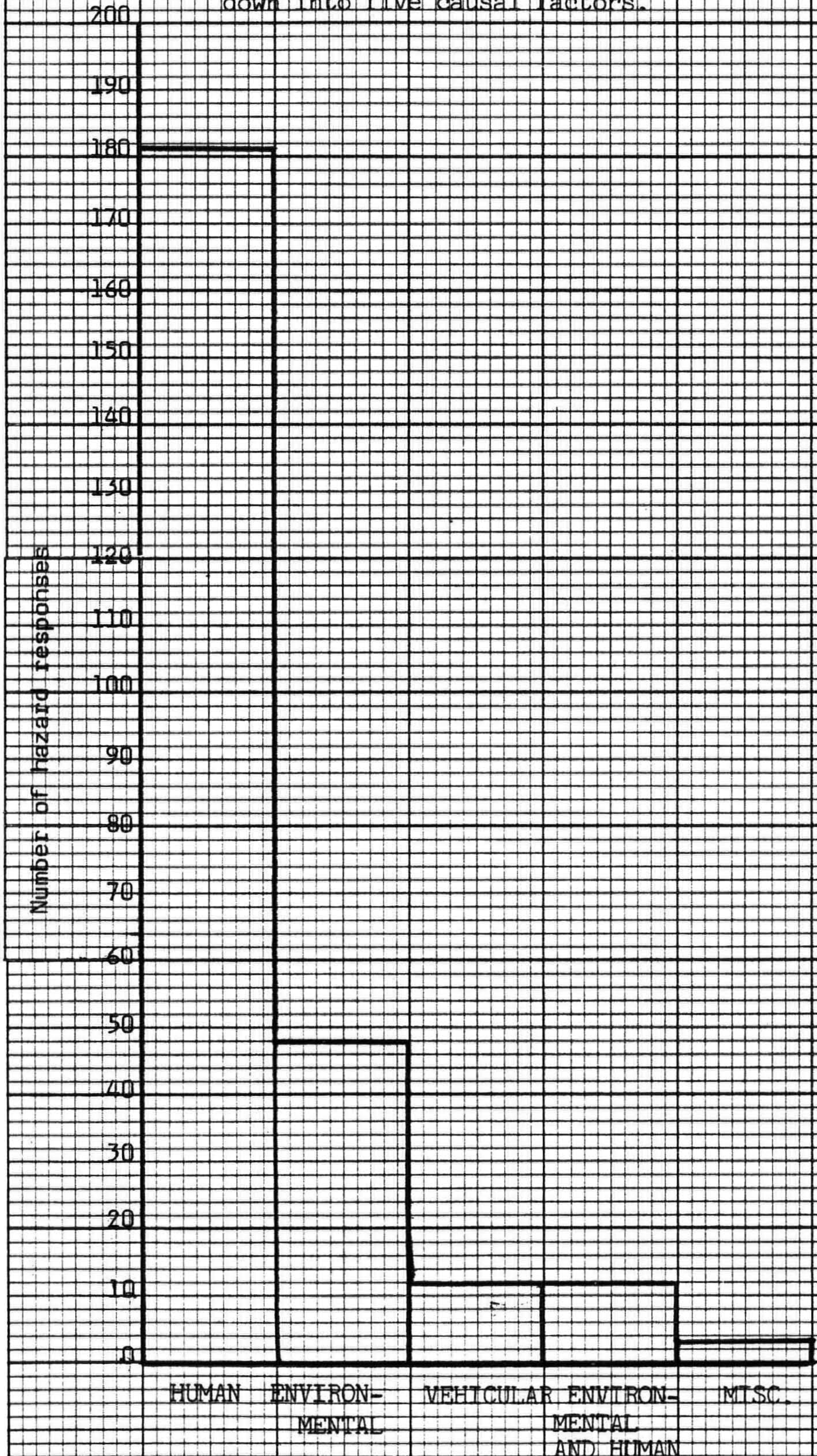
In all three of the techniques used, the responses for all subjects were similar. They rarely spoke about road hazards, that is fixed elements of the road environment. However, they did occasionally mention hazards associated with people, for example pedestrians or 'tailgate' drivers. More often, they spoke about the inconvenience and frustration of driving.

Figure 1 shows the total number of hazards reported by the sixteen subjects over the whole interview. This is again broken down into the four main causal factors. Another miscellaneous category has also been added to account for three references made by subjects to hazards caused by "inappropriate" laws. A list of the hazards reported additional to those spontaneously made can been seen in App 3.

*The numbers given in brackets after a quote refer to the subject number and the page number from the transcript. These are also used in the Appendices with the subjects' responses on.

Figure 1.

The total amount of hazards reported by the sixteen subjects during the non-directive, focused and critical incident interviews, broken down into five causal factors.



As can be seen the majority of references were regarding human type hazards. In this way the pattern of spontaneous responses shown in table 2 is verified by the overall responses. Comparing more closely the spontaneous responses in table 2 with the overall number of responses in Fig. 1 it can be seen that environmental, vehicular and the environmental and vehicular combined categories have approximately doubled whereas the human category has more or less trebled. This shows that responses made further to those sponaneously given, are even more directed towards human type hazards. This was particularly the case with the three subjects that were currently using their motocycles.

Subjects sometimes asked for a paper and pencil to make sketches of the accidents, near misses or road layouts that they were discussing, or they made use of gesticulation. They always talked about a particular junction or road, instead of a general class of road situation, indicating that they were using visual imagery.

2.3 Discussion

Considering the length of the interviews it is perhaps surprising that so little was said directly about hazards and risk. Most of the responses were vague and ambiguous, and because responses were idiosyncratic, there were few points of comparison between subjects.

Overall, the interviewing techniques investigated yielded very little material that was either valuable in its own right or that could be used as background material for the following techniques.

The conversational language made extraction of the salient details difficult, as it often involved condensing a large amount of verbal material down to a brief description. In addition those references that were recorded as hazardous features of driving, were often not explicitly given, but had to be interpreted from the implicit dialogue of the interview. This necessity to interpret by the researcher introduces an added interefering variable, which it would be better to avoid if possible.

The categorisation of hazards into human, environmental, vehicular, and environmental and human combined, also involved a degree of interpretation by the researcher. When subjects reported a hazard they rarely stipulated what the cause of it was. However it did appear that the hazards which were mentioned were mostly concerned with the human element. It seemed that subjects thought about the road environment as a permanently fixed landscape, which it was the driver's job to negotiate successfully. Their responses were not concerned with hazardous features of the environment as such but with driving, given these features as read. It is perhaps for this reason that the interviews gravitated towards the inconvenience and frustrations of driving.

It may be hypothesized that drivers general inability to identify fixed road environment hazards is due to inadequate learning. Drivers may only be able to discriminate between or perceive those hazards of which they have personal experience, or which have been brought to their attention in some other way. Whether those aspects of the road which have been categorised by the road user as hazards, are in fact hazards is questionable. In addition it is not clear whether 'known hazards' are brought to peoples' attention in a systematic way or are contingent upon other factors.

Fixed road hazards may then, not be perceived, until a particular set of circumstances, which leads to an accident or a near miss, turns them into hazards for a given individual. On the other hand hazards involving the dynamic human element are recognised more easily, as evidenced by the results of the interviewing techniques because of the uncertainty inherent in them, due to dynamism. In this way different rules for the classification of dynamic hazards may be in operation.

Car drivers who had been or were motorcyclists seemed better able to identify hazards, particularly when speaking from the motorcyclists point of view. This would be expected if we take into consideration that motorcyclists are more vulnerable to injury and more likely to experience a personal injury accident. (PIA)

In order to counteract the visual imagery used by subjects, and to provide a framework for comparison between subjects, it appeared that future attention should be given to visual forms of presentation. In this way subjects' apparent preference to talk about particular road locations would be satisfied and questioning could be directed specifically towards identification of hazards.

2.4 Summary

In summary, non-directive, focused and critical incident interviews were all equally unsuccessful as methods for revealing people's perception of hazards.

The main reasons were:

(a) Subjects rarely spontaneously talked about hazards and their perceptions of them.

(b) When prompted about specific risks the subjects' responses were vague and ambiguous, for example confounding 'inconvenience' with 'risk' .

(c) The subjects perception of risks, and the way they talked about them, were idiosyncratic.

Chapter 3
Repertory Grid and Q-sort

During this part of the research a number of pilot experiments were carried out which aimed to assess the extent to which the Q - sort and Repertory Grid could be used to discriminate between old and young drivers in terms of perception of risk. This was to be done by trying each of the techniques with small numbers of subjects, varying the means of presentation in the light of earlier results. However since the interviews had proved unsuccessful at eliciting responses regarding subjects perception of road hazards, it was first necessary to explore possible means of obtaining this necessary background information as it would be required to run the Q-sort and the repertory grid. For this reason a number of pre-pilot tests were carried out.

3.1. Pre-Pilot Tests

For both the Q-sort and the repertory grid the first requirement was a list of road hazards (elements) for the subjects to subsequently rank or rate. Additionally for the repertory grid a means of obtaining constructs was required to provide the scales on which the elements could be rated. During this part of the research various methods for eliciting elements and constructs were investigated and the rating and ranking tasks were checked for any difficulties.

There were 11 male subjects ranging in age between 18 and 68 years with a mean age of 31.8 years.

FORMAT OF INTERVIEWS

For all the techniques investigated, the format of the interviews was as follows:

- Instructions to subjects (as in Chapter 2, p 9)
- Collection of Driving and Accident histories (as in Chapter 2, p 9 sections 1 and 2 of Appendix 1)

- Administration of relevant technique. This varied from subject to subject as described below and some subjects took part in more than one technique.

- Collection of biographical information. (as in chapter 2, p11 and section 4 of Appendix 1)

SUMMARY OF TECHNIQUES USED

(a) Element elicitation with focused questions.

In this method the questions used during the focused interviews were extended considerably. For example subjects were encouraged to outline the causes and contributory factors of accidents and near misses. A list of the questions used can be seen in Appendix 4.

(b) Element elicitation using photographs.

Subjects were shown a photograph of a road junction and asked to tell the interviewer anything he thought to be a hazard there. This was repeated for a further two photographs. The 3 photographs were urban junctions in the Stoke Newington London area and are shown on Appendix 5.

(c) Triadic, diadic and full context form eliciation of constructs.

Elements, that is hazardous features of the road were written on cards. In the Triadic method the subject was presented with three of the cards and asked to find a way in which two were similar and one different. The definition of how the two elements were similar became the emergent pole of the construct. The other pole was taken either as the contrast pole (i.e. the definition of the contrasting element), or as the opposite pole, (i.e. the opposite in meaning of the emergent pole). Diadic elicitation was carried out in the same way as for the triadic elicitation, but only two elements were used. Full context form elicitation required subjects to select two elements from the total pool, and to explain why they were similar. The subject then added further elements one at a time and again described how all the elements in the group were similar. This process generated constructs as the subject searched for similarities across increasingly large groups. The elements used were either elicited from the subjects using technique b, above or were set by the researcher.

(d) Triadic elicitation of constructs using photographs as elements.

This technique was the same as triadic elicitation with verbal labels (see above), however a photograph replaced the use of named hazards. The photographs used were urban junctions in the Stoke Newington London area and are in Appendix 5 and 6.

A table of the techniques used on each subject can be seen in Appendix 7. This also includes details of which subjects subsequently carried out rating or ranking tasks in order to check the methods for any difficulties.

3.2. Results & Discussion

(a) Element elicitation with focused questions.

On two replays of the tapes of these interviews it was felt that the responses to the questions were often vague and ambiguous. The questions designed to discover subjects' opinions regarding the causes and contributory factors of accidents merely resulted in subjects repeating their original descriptions. No new information emerged, and for this reason no detailed analyses were done on these interviews. In some cases subjects were asked to draw diagrams of the road environment that they were referring to and this did facilitate discussion to some extent.

It was felt that like the non-directive, focused and critical incident interviews, this technique for eliciting elements was not sufficiently structured to yield a coherent body of information about the subjects' perception of hazards. As with previous techniques, verbal presentation was found to be inadequate.

Visual presentation again emerged as a possible alternative. With a simple diagram drawn by the subject, the interviewer was able to elicit more information.

It was therefore decided to discontinue verbal presentation, in favour of some sort of visual presentation.

(b) Element elicitation using photographs.

Using this technique, subjects were better able to identify potential hazards. In addition they were able to pick out discrete parts of the road environment that were potentially hazardous.

One example of an element, 'bus stop', highlights a difficulty that emerged. A bus stop can be a hazard in several different ways, in other words it is 'richer' in meaning than some other elements. The fact that some elements might have more than one meaning to a subject may pose problems for subsequent rating on the constructs. For this reason it might be useful to break down elements into their constituent meanings.

During these trials, subjects spontaneously asked what manoeuvres they should imagine themselves to be undertaking, before they could make judgements about potential hazards. They were then asked to identify the hazards separately for each turning movement. This request by subjects suggested that they related their task more clearly to the real world, rather than treating the photographs as Thematic Apperception Test stimuli, which encourages subjects to project future situations. It may be hypothesised that their need to know the particular manouvre, is evidence that perception of hazards is dependent on specific situations.

It appeared therefore that a site visit would be even more fruitful, since the subjects would be confronted with a dynamic road situation and would be directly exposed to a greater variety of hazards.

Some subjects subsequently ranked the hazard elements they had elicited on the scale most dangerous to least dangerous as for the Q-sort: no difficulty was encountered.

(c) Triadic, diadic and full context from elicitation of constructs.

Neither the Diadic or full context form elicitation of constructs was as fruitful as the triadic elicitation method in terms of the variety of construct which emerged, so it was decided to drop them and concentrate on the triadic method.

Although construct elicitation is time consuming using any method, this method was found to be the easiest and quickest to administer. It also produced a considerable variety of constructs particularly when used in conjunection with laddering and pyramiding techniques.

Laddering is a technique which allows the researcher to elicit increasingly superordinate more abstract, constructs from the subject. Pyramiding is the reverse it gives increasingly subordinate, concrete constructs.

Triads produced constructs which were part of pyramid structure, with a superordinate abstract construct at the top and subordinate concrete constructs at the bottom. For example the triad:

(1) Being overtaken

emergent

(2) Being cut up

(3) Blow out — opposite

produced the construct:

One vehicle passes another/not vehicles passing.

Laddering this construct produced the superordinate construct:-

Have no control/you are in control

and by pyramiding, the subordinate construct:-

Car in motion/must stop

was produced.

In this way it was found possible to elicit a rich supply of constructs at all levels of each subjects hierarchy of constructs.

Subjects often found it difficult to give a short definition of their construct. In most cases this could be rectified with a little thought, as in the following example:

Hazard that should be removed/Hazard that can't be removed

which could be shortened to

Removeable hazard/non removable hazard.

However in some cases this was not so easily done, perhaps because the construct was too rich in meaning. For example, in the case of the construct

Has to use the opposite side of the road/does not have to use the opposite side of the road.

As illustrated in Figure 2 contrast poles are often so different in character from the emergent poles from which they are generated that the two fail to link together to produce a meaningful scale.

In fact, it was found that opposite poles produced much more sensible scales than contrast poles in most cases.

Figure 2 Triadic Elicitation of Construct

Triad of elements	1. Sharp Bend 2. High Hedge	3. Pedestrian	
emergent pole	obscures vision ⟷	human hazard	contrast pole
opposite pole	clear view		

It should be noted that the contrast pole often had an opposite pole, so that in effect one triad produced more than one construct. In this example then, the contrast pole 'human hazard' had an opposite pole 'not human hazard'.

In some cases an elicited construct was not relevant to one or more of the elements, or in Personal Construct Theory terms the element was out of the constructs range of convenience. For example there is not much point in trying to rate 'trees' on the construct

> 'Driving carefully around parked cars/not driving carefully around parked cars'

In these cases, subjects were unable to rate the elements on the constructs. When this is the case it is necessary that subjects be allowed to say that a given element is not pertinent to that construct. This is always a matter of personal opinion.

Another possible reason for this problem could have been that the construct was too situational in nature. This means that the construct only relates to a particular situation which is relevent to only the elements in that situation. In this case more careful construct elicitation interviews should prevent its future occurrence.

Apart from this, subjects had no difficulties in completing grids, that is, in rating the elements on the constructs.

(d) Triadic elicitation of constructs using photographs as elements. In terms of effectiveness, the photographs were able to supply a rich source of constructs. However, subjects still found it difficult to give short definitions of their constructs.

The main difference between using photographs as elements and verbal labels was in the type of construct elicited. As would be expected, the constructs obtained using this method tended to focus on differences between the types of road portrayed in the photographs, as opposed to general categories of hazard.

For example constructs like:

Town/residential

were more apparent than:

Removeable hazard/non-removable hazard.

No difficulty in rating the photographs on elicited constructs was evident.

3.3 Summary

In summary the pre-pilot tests showed that:

- verbal elements were better elicited from a visual form of stimulus (i.e. photographs) than from a verbal form.

- photographs of road sites, could themselves be used as elements in order to elicit constructs.

- triadic elicitation procedures were preferable to diadic or full context form procedures.

- there were no insurmountable problems regarding subjects ability to rate or rank hazards.

3.4 Pilot experiments using the Q-sort and the repertory grid

Having now selected the most likely successful methods for element and construct elicitation, a number of techniques were tried on small groups of old and young subjects. 'Old' here means over 45 years old, and 'young' means under 25 years old.

With the repertory grid and Q-sort the following options for obtaining elements had emerged.

(1) Using photographs of road sites as elements

(2) Asking subjects to pick elements from a visual stimulus. This could be from photographs, video recordings or a site visit. Site visits were in fact selected however as it was thought that the dynamic road situation would enable subjects to identify a larger range of hazards.

(3) A third option was to use set elements, which could be derived from pooling the most frequently mentioned ones from 2, above.

The following options were available for obtaining the constructs, required for the repertory grid;

(1) Direct elicitation using triadic comparision of elements

(2) Providing fixed constructs, taken from the most common ones elicited in (1) above.

For the repertory grid alone, therefore, an exhaustive check of all the possible variants that would lead to a completed grid would require the running of six groups of old and young subjects. This number would have to be doubled if both manual and computer administration were to be tested.

Thus the strategy adopted throughout this part of the work was to eliminate techniques as soon as practicable and to concentrate on techniques which appeared successfully to discriminate between old and young subjects, this being agreed as the principal criterion for the purpose of this study.

FORMAT OF INTERVIEWS

For all the techniques investigated, the format of the interviews was as follows:

- Instructions to subjects (as in chapter 2, p 9.)

- Collection of Driving and Accident histories (as in Chapter 2, p 9 and Sections 1 and 2 of Appendix 1)

- Administration of relevant technique. This varied from subject to subject as described below in table 3 , and some subjects took part in more than one technique.

- Collection of biographical information (as in chapter 2 p 11 and section 4 of Appendix 1)

FLEXIGRID SOFTWARE

There is a software package named 'Flexigrid' which helps to run and analyse repertory grids. Using built-in customising procedures it is possible to elicit constructs with diads or triads, to set elements and/or constructs, and to edit introductions. It is suitable for running most variants of the repertory grid. For further information see Tsudi 1984.

Three pilot subjects were run to ensure that the flexigrid software was conveniently usable. A few modifications were made to the program.

In most cases the repertory grid was run using this software. The alternative was manual elicitation and completion of grids.

TABLE 3 TECHNIQUES AND SUBJECTS FOR THE PILOT EXPERIMENT

	TECHNIQUE	METHOD OF PRESENTATION OF ELEMENTS TO SUBJECTS	SITE	NUMBER OF SUBJECTS OLD AGE >45	NUMBER OF SUBJECTS YOUNG AGE <25
(i)	REPERTORY GRID, PHOTOGRAPHS AS ELEMENTS	COMPUTER Triads of Photographs	PHOTOGRAPHS OF 9 LOCAL (Enfield, Middx) Urban T Junctions used as Elements (see APPENDIX 8)	2	2
(ii)	REPERTORY GRID ON SITE	COMPUTER Triads of Subjects' own Elements	DERBY ROAD/LINCOLN (Appendix 9 shows 3 views of this site, used as an aide memoire)	2	2
			KINGSWAY/SOUTHBURY ROAD (Appendix 10 shows 3 views of this site used as an aide memoire)	2	2
(iii)	SEMI- FIXED GRID (FIXED ELEMENTS)	MANUAL Triads of Fixed Elements (Appendix 11)	KINGSWAY/SOUTHBURY ROAD (photographs used as the stimulus, Appendix 10)	2	2
(iv)	FIXED GRID (FIXED ELEMENTS & CONSTRUCTS)	COMPUTER Triads of fixed Elements & Constructs (see Appendix 11 and 12)	KINGSWAY/SOUTHBURY ROAD (photographs used as the stimulus Appendix 10)	2	2
(v)	Q-SORT*	MANUAL	KINGSWAY/SOUTHBURY ROAD (photographs used as the stimulus Appendix 10)	5	5

* Subjects took part in more than one method.

3.5. Results and Discussion

(i) Repertory grid photographs as elements

The constructs that emerged during this part of the study were, as found in the pre-pilot interviews, of a broader nature than those obtained in previous interviews with verbally presented elements. They were concerned with the overall features of different road environments rather than particular hazards. A list of the constructs is given in Appendix 13.

The number of constructs elicited per subject was small, the maximum being 6. In addition, the constructs were often highly matched, i.e., the scores were correlated between constructs. This means that the constructs produced by any one subject were often clustered around a single idea. If the pictures used had been more diverse in character, it is possible that a wider range of constructs would have been elicited from them.

In addition, elements were also often highly matched which implies that the constructs were not discriminating between the photographs very well, which again may have been due to the similarity of the types of roads portrayed in the photographs. It was decided not to continue with this method, partly because of the above deficiencies, and also because a technique that was able to reveal something about subjects' perceptions at a particular site seemed a more appropriate and fundamental short range goal. However, with modification it is possible that this method would be useful in revealing road users' overall risk perception.

(ii) Repertory Grid on site

Initially three sites were investigated using this method. The sites are listed in Table 4 together with the numbers of elements elicited for each. It was decided not to use the Concorde Road/ Lincoln Road site because not enough elements had been forthcoming to produce a reasonable sized grid (For the Flexigrid program a minimum of six elements is required).

Table 4 shows the number of elements elicited at the sites for each subject, and the total number of distinct elements for each site. A list of the elements elicited by each subjects and the total distinct elements for each site is seen in Appendix 14 .

TABLE 4 THE NUMBER OF ELEMENTS ELICITED FROM EACH SUBJECT AT EACH SITE IN THE PILOT EXPERIMENTS, REPERTORY GRID METHOD

Site	Young	Old	Total Distinct Elements
CONCORDE RD/	7	-	
LINCOLN RD			11
	5	5	
DERBY RD/	7	7	
LINCOLN RD			15
	6	8	
KINGSWAY/	11	10	
SOUTHBURY RD			23
	7	7	

As can be seen there is no fundamental difference between age groups in the numbers of elements elicited on site. The total number of different elements for each site increases with the complexity of the site.

Much the same applies to the constructs elicited at these sites. Table 5 shows that there is no appreciable difference between the numbers obtained from old and young subjects. A list of the constructs elicited by each subject and the total distinct constructs for each site is seen in Appendix 15 .

TABLE 5. THE NUMBER OF CONSTRUCTS ELICITED FROM EACH SUBJECT AT EACH SITE IN THE PILOT EXPERIMENTS, REPERTORY GRID METHOD

Site	Young	Old	Total Distinct Constructs
DERBY RD/	4	5	
LINCOLN RD			12
	4	4	
KINGSWAY/	5	4	
SOUTHBURY RD			15
	8	5	

It is not a coincidence that most people produced just four constructs, because this is the minimum required by the flexigrid software. After they had produced 4 constructs on their first 6 elements, subjects were given the option to finish and most of them did. Increasing the complexity of the site did little to change this, apparently because the task was time-consuming and difficult for subjects. In personal construct theory it is recommended that as many different constructs as possible are used (in Fransella & Bannister, 1977).

The main problem with this technique was that the grids were small and time consuming to elicit. This may have something to do with the fact that construct elicitation was carried out using the microcomputer. There appear to be two main disadvantages in this:-

(1) Subjects can finish at their own discretion, after producing only a few of their constructs;

(2) the computer does not ladder or pyramid constructs elicited to explore further dimensions of thought at superordinate and subordinate levels.

In its favour though, computer elicitation can:

(a) detect highly matched elements and constructs and ask the subject to separate them by adding another element or construct;

(b) prevent interviewer bias, which is particularly difficult to avoid with laddering procedures.

Research has shown that computers can be useful and successful in automated psychological testing. (in Shaw, 1982). However it is not clear if the small number of constructs elicited by each subject here was due to the computer administration or some other factor. The pre-pilot tests using the triadic method of elicitation manually did produce a rich supply of constructs from subjects. For this reason it was decided to investigate, manual construct elicitation procedures a little further, using the semi-fixed grid method.

(iii) Semi-fixed grid

With this method, the elements were fixed in advance by the investigator, but the subjects were required to generate their own constructs. The fixed elements consisted partly of those elicited by the other subjects at the site (Kingsway/Southbury Road, Appendix 10) under consideration, while the others were selected as being representative of potential hazards at most locations on the road network. A list is given in Appendix 11. It was decided to use this method to investigate manual construct elicitation further.

The results confirmed those obtained earlier during the pilot studies, where it was found that the labelling of constructs was difficult for subjects. This was perhaps due to the fact that manual elicitation imposed a less disciplined environment on the subject compared with computer elicitation.

It should be noted that a subject would occasionally put forward two or more constructs with almost identical meanings. In these cases, the redundant constructs were eliminated from that subject's grid. This may have occurred because the laddering technique resulted in subjects arriving at the same superordinate construct several times, after starting at different subordinate construct levels. For anyone there are relatively few superordinate constructs. Research has shown that repition of constructs from different triads can also be used as a measure of the superordinacy of the construct being repeated (in Fransella & Bannister, 1977).

Using this method, a satisfactory range of constructs was produced, but the procedure was time-consuming. The problem was that data had to be analysed and interpreted by the interviewer before the subject could actually go through the process of rating the elements. Also manual elicitation involves some interpretation by the interviewer, and some distortion of constructs may occur which would be avoided with computer administration.

Table 6 shows the number of constructs elicited by each subject, (see Appendix 16 for a listing of them all) it also shows those elicited by computer in the previous method listed (c above)

TABLE 6 THE NUMBER OF CONSTRUCTS ELICITED FROM EACH SUBJECT AT THE SAME SITE, IN THE SEMI-FIXED GRID ADMINISTERED MANUALLY, AND THE REPERTORY GRID ON SITE COMPUTER ADMINISTERED, IN THE PILOT EXPERIMENTS

NUMBER OF CONSTRUCTS

Site	Semi fixed Rep Grid Manual Elicitation		Repertory Grid on Site Computer Elicitation	
	Young	Old	Young	Old
Kingsway/	8	6	5	4
Southbury Rd.	11	8	8	5

Comparing these techniques, which both used the same site, (Southbury Rd/Kingsway) it can be seen that manual elicitation is more fruitful in eliciting constructs than computer elicitation. This could be due to a number of factors as follows:

- elements presented to subjects on cards aid subjects in construct elicitation

- the fact that with manual elicitation subjects were obliged to continue eliciting constructs on 8 triads, whereas with the computer administration they had the option to stop after only 4 triads

- researcher/subject interaction aids subjects in exploring their construct system

Further research would be required to check this.
The validity of this method depends on the assumption that each fixed element carries a meaning for each subject in terms of hazard at the site. This is by no means certain, since the

elements actually elicited at the site in fact differ from subject to subject, (as can be seen in Appendix 14). However no subjects found any difficulty in rating the elements, and although subjects were given the opportunity to omit an element, if they did not feel it relevent to the construct they were using, this only occurred once.

In Table 7, four examples are given of subjects who rated the same elements in different ways, although they appeared to be using very similar constructs.

In terms of elements, an important aspect of the method was that photographs of the site were used as a stimulus, and hence we can be sure that all the subjects were responding to the same situation. Thus in the case of element 9 in table 7 for example the fact that one subject rated cars turning right as 5, impedes vision, and the other subjects rated it nearer to no restraint of vision can be attributed to a difference in that subjects' perception of cars turning right at that site, rather than any misinterpretation of the element name or features of that element in relation to its environment.

(iv) Fixed Grid

The elements used for this grid were the same as those used in the semi-fixed grid. These are listed in Appendix 11 . The constructs were selected partly from those elicited by other subjects at the site (Kingsway/Southbury Road) see Appendix sheets 15 & 16 . The others were a representative selection of constructs which had emerged from previous trials, and which were relevant to the fixed elements. A list of the constructs is in Appendix 12 .

It had originally been intended to use the semantic differential method during this part of the study, but since it allowed greater freedom with the definition of rating scales, the fixed grid method was used instead. Kelly's individuality corollary states

TABLE 7 EXAMPLES OF 4 SUBJECTS WHO USED SIMILAR CONSTRUCTS BUT RATED THE SAME ELEMENTS IN QUITE DIFFERENT WAYS ON THOSE CONSTRUCTS

			ELEMENTS														
			CAR OVERTAKING	PEDESTRIANS	WET ROAD	BUS AT STOP	CAR PULLING OUT	FOG	BROW OF HILL	LORRIES	CARS TURNING RIGHT	CAR FOLL. TOO CLOSE	PARKED VEHICLES	NARROW ROAD	OBSTACLE IN ROAD	HIGH SPEED CAR	YARD TURNING
Subject No.	Constructs	Age Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	doesn't obstruct vision/obstructs vision	Y	1	1	1	4	1	5	5	4	1	1	3	2	2	1	1
2	no restraint on vision/impedes vision	Y	1	1	1	5	5	5	5	3	5	1	5	4	1	1	5
3	clear unobstructed vision/obstructed vision	O	1	1	4	1	3	5	2	2	1	2	3	1	4	3	3
4	can see in front/can't see in front	O	1	1	1	5	5	5	5	5	2	2	5	1	5	1	1

that 'persons differ from each other in their construction of events', hence his theory is called personal construct theory. By using fixed constructs there is inevitably a loss in the individuals' personal meaning.

Research which shows that extremity of rating is related to personal constructs, more so than provided constructs, has been used as evidence of the meaningfulness of elicited constructs. (Landfield, 1968; Bonarius, 1970). However there is also evidence to suggest that provided constructs can produce valid results (in Fransella & Bannister, 1977).

The constructs used here were selected from a common pool, it was hoped that they would have meaning for all the subjects. However no two subjects ever gave exactly the same verbal description for a construct, so a degree of interpretation was involved in phrasing the construct pole names. For example Table 7 shows just a few of the wordings that were eventually included under the construct name 'obsures vision/clear view'.

It is possible that the labels for the twelve constructs used were not adequate. For example the construct expected hazard/unexpected hazard could be taken to mean either that the hazard is likely to be present at the site or that it is expected to be a hazard wherever it occurs.

The time taken by subjects to complete the fixed-grid was much less than with the other methods because no construct elicitation was required. All subjects found the task interesting and became engrossed with it. Occasionally, questions were asked about the meanings of constructs. These were resolved by the interviewer.

(v) The Q-sort

Two variants of the Q-sort were investigated. In the first method subjects were asked to rank 15 elements (the same elements as used in the semi-fixed and fixed grid, Appendix 11) on the scale 'most hazardous to least hazardous' . Photographs of the site (Kingsway/ Southbury Rd) were also used as a stimulus. (Appendix 10)

Mann-Witney U tests showed that there was only one significant difference in the responses between old and young subjects. This was for the element 'fog' which was rated as significantly more hazardous by old subjects ($p<05$) (Appendix 17). There was, however, a great deal of variation of opinion between individual drivers in their rating of individual hazards. The responses for each element were distributed over a minimum of eight points for all subjects within the fifteen point scale. Table 8 shows the mean rank and standard deviation for each hazard.

TABLE 8 THE MEAN RANK AND STANDARD DEVIATION OF THE HAZARDS RANKED IN THE Q-SORT ON THE SCALE MOST HAZARDOUS TO LEAST HAZARDOUS

Hazard		Mean ranks	S.D.
1.	car overtaking	7.4	3.24
2.	pedestrians	8.5	4.79
3.	wet road	7.4	4.58
4.	bus at stop	8.0	4.78
5.	car pulling out	5.8	3.05
6.	fog	3.6	4.75
7.	brow of hill	7.4	3.86
8.	lorries	9.9	3.21
9.	cars turning right	8.2	3.55
10.	car following too close	7.6	4.99
11.	parked vehicles	8.9	4.63
12.	narrow road	9.8	3.88
13.	obstacle in road	10.2	2.82
14.	high speed car	7.2	5.29
15.	yard turning	10.1	4.33

In the second variant of this method, rankings were obtained of the 15 elements on 3 different scales:-

(i) most quickly noticed - less quickly noticed
(ii) attracts attention - does not attract attention
(iii) I am in control of the situation - I am not in control of the situation

and then a selected small group of elements were rated on a sliding scale, to identify the 'distances' between the rankings.

These trials were carried out on only 2 old and 2 young subjects, however much the same result began to emerge. There was a great deal of variation in the rankings between individual subjects, and the method did not discriminate between old and young drivers.

No variant of the Q-sort investigated was able to differentiate between old and young subjects because of wide variations between individuals' ranking. There are two possible reasons for this. One is that rankings were affected by individuals personal experience. The other is that visual imaging, which was found to be used by subjects during previous interviews, went one step further to the imaging of a scenario for the subsequent ranking of elements in the order most pertinent to the imaged situation or situations. Either of these alternatives may explain the results, with personal experience affecting the visual imaging process.

3.6 Summary of the results regarding the methods used in pilot experiments.

Pilot experiments using five methods were investigated with the aim of finding a technique that could differentiate between old and young subjects. Initial results concerning the methods showed that:

- when photographs were used as elements the resulting constructs were too general for the purposes of this research.

- using the repertory grid, administered by computer, the number of constructs elicited was too small.

- subjects had no difficulty rating set elements in the semi-fixed grid, and manual elicitation produced a satisfactory number and range of constructs, although the procedure was too time consuming.

- the fixed repertory grid posed no difficulty for subjects to rate although using fixed constructs may result in a loss in personal meaning for each individual subject.

3.7 Overall results from the pilot experiments and implications for further work

With the exception of the Q-sort method all the techniques investigated during this phase required subjects to rate 'hazards' on scales. The Q-sort was discarded because it did not appear to have any discriminative power between old and young age groups.

A comparison of the remaining techniques showed that ratings for older subjects were more often extreme than those of young subjects, whose ratings tended to lie towards the middle of the scale.

Table 9 gives for these subjects the values of the 'midway response index' that is

$$\frac{N\ (1,2,3,4,5)}{N(2,3,4)} \quad \ldots\ldots\ldots\ldots \quad (1)$$

where N(a,b,c...,r) = number of responses with ratings in the range a,b,c,....,r The Mann Whitney U test (Appendix 18) showed that there was a significant difference between the two age groups ($p < 025$). In this way all of the repertory grid based methods differentiated between old and young subjects. The reasons for the difference in response may be as previously stated (p42), i.e. that extreme responses are related to the meaningfulness of the constructs and elements used. (Landfield 1968; Bonarius, 1970). It may be that the old subjects found the constructs more meaningful than the young subjects, although it is ironic that the same research which has been used to show the superiority of elicited constructs and elements over supplied constructs and elements is now used as an explanation for the difference between the old and young age groups on a fixed repertory grid.

Alternatively it could be argued that older people are pre-disposed to answering questionnaires differently from younger people, irrespective of any differences in risk perception or behaviour on the road. One study supports this theory, (Hesterly, 1963) however the older population used in his research were aged over 60 whereas in this sample

TABLE 9 VALUES OF THE MIDWAY RESPONSE INDEX FOR INDIVIDUAL SUBJECTS IN THE PILOT EXPERIMENTS

TECHNIQUE	MIDWAY RESPONSE INDEX	
	Old	Young
Photographs as Elements	.047	.547
	.250	.482
Repertory Grid	.275	.333
(Derby Rd/Lincoln Rd)	.222	.416
	.071	.466
(Southbury Rd/Kingsway)	.428	.378
Semi-fixed grid	.400	.345
	.577	.633
Fixed Grid	.238	.811
	.355	.672

it is over 45. No other reports in the literature of systematic response biases of the type required to explain the difference between old and young subjects' ratings, have been found.

It seems more plausible that older people tend towards extreme responses because they are more experienced in dealing with the hazards being rated. This is consistent with the theory that extreme responses signify meaningfulness. We would expect older drivers to recognise important hazards and assess their relevance quickly and decisively, and conversely to filter out unimportant ones and dismiss them. This would be an efficient way to proceed: it would reduce processing time substantially and allow the driver to concentrate on other aspects of driving.

For the younger driver the time spent on having to consider all potential hazards at any given site because he lacks the experience to select the most important aspects means that he has less time to act, and may become confused or disorientated if required to act quickly. Some evidence to support this theory is available in which younger drivers showed a slower response to hazards in a simulator than older drivers, despite the younger drivers' quicker simple reaction time. (Quimby and Watts, 1981). It may be that speed of response to hazards and certainty of judgement are linked.

Hence the results seem quite plausible, and they suggest a hypothesis about driver behaviour which, if proved correct, would be valuable in helping to explain known differences in personal injury accident rates between old and young drivers.

The phenomenon was apparent in all techniques, but it was most prominent with the fixed grid group of subjects. As well as its discriminatory power, the fixed grid method was found to have several other advantages:

(a) it was the easiest to carry out and quickest to administer, given the necessary background material on which the grid is based,

(b) it produced the most data per subject,

(c) it was useful for comparison purposes between subjects, and

(d) it solved the problems of element and construct elicitation that were encountered in the semi fixed grid, repertory grid, and repertory grid with photos as elements.

The only disadvantage was in the loss of personal meaning for individual subjects. It was decided to continue with this method to confirm whether the results were typical under a range of conditions.

Chapter 4
The Fixed Repertory Grid

Having identified a general tendency for old subjects to rate at the extremes of the hazard scale and young subjects to rate towards the centre, it was decided to carry out more extensive tests on the technique for which this tendency was most pronounced, that is the fixed grid, to test its powers of discrimination. Therefore further subjects were run using this method.

Once it was confirmed that the fixed grid technique continued to discriminate between old and young male drivers the next stage was to investigate whether the technique was applicable under a wider variety of circumstances. Therefore three new groups of subjects were recruited to test the method for (1) females, (2) males at a different but similar site, and (3) males completing the grid manually on site. Once again the criterion for success was whether discrimination could be found between old and young subjects.

The results for all subjects who completed fixed repertory grids are described below.

4.1 Procedure

For all the groups, the format of the interviews was as follows:

- Instructions to subjects (as in Chapter 2, p 9).
- Collection of Driving and Accident histories (as in Chapter 2, page 9 and sections 1 and 2 of Appendix 1)
- Administration of the relevent experimental conditions of this technique, as described below.
- Collection of biographical information (as in Chapter 2, p 11 and section 4 of Appendix 1)

Details regarding how subjects were obtained are in chapter 2 p 12. There were four groups of subjects as follows:-

Group M (Males)

10 old male ranging in age between 52 & 75. (mean 62.3)
10 young male ranging in age between 18 & 23 (mean 19.9)

Group F (Females)

10 old female ranging in age between 47 & 59 (mean 51.0)
10 young female ranging in age between 18 & 22 (mean 20.6)

Group DS (Different Site)

10 Old male ranging in age between 45 & 67 (mean 55.3)
10 young male ranging in age between 19 & 25 (mean 21.0)

Group SV (Site Visit)

10 old male ranging in age between 49 & 63 (mean 52.9)
10 young male ranging in age between 19 & 25 (mean 21.6)

Subjects in Groups M and F were first shown the pictures of Kingsway/ Southbury Road (see Appendix 10), and subjects in group DS were shown the pictures of Glynn Rd/Southbury Rd (see Appendix 19). All subjects were asked to consider themselves as drivers negotiating the junction depicted. The computer displayed the instructions:

> Now we would like you to rate this set of road hazards on some supplied constructs (scales). Please consider all the following supplied constructs.

The first construct then appeared at the top of the screen along with the first element just beneath it. When this element had been rated the next one appeared, and so on until all the fifteen elements had been rated on the first construct. The subjects then had an opportunity to amend any of their entries. After this, the next construct appeared and all 15 elements were rated on it. This procedure was repeated for the 12 constructs. All subjects were presented with the elements and constructs in the same order.

Group SV subjects did not take part in the computer run, but were taken to the site used for groups M and F instead (Kingsway/Southbury Road: see Appendix 10). They were asked to consider themselves as drivers negotiating the junction, and were told they could stand wherever they wanted to. They were then asked to rate, by ringing the appropriate number, the hazards listed down the left hand side of the page, on the scale at the top. The elements and constructs were presented in the same order as in the computer run. The first page of the schedule, shown in Appendix 20, illustrates the general format.

4.2 Results and Discussion

The following results and discussion section has been broken down into four main parts. The first part deals with general results and the following three parts report results from the three main analysis options in the Flexigrid package, that is Grid Analysis for Beginners (GAB), FOCUS hierarchical clustering and Principal Components Analysis (PCA). Comparisons between old and young subject groups are made in each case and a summary concludes each analysis option section.

GENERAL RESULTS

As is frequently the case, the repertory grid and its associated analyses generated large amounts of data. At the most detailed level, individual results might be used to generate hypothesis concering specific elements or constructs and the relationships between these and old and young drivers perceptions of particular sites. At a more general level overall results might be used to develop an understanding regarding how road users go about perceiving road accident risks.

An example grid is shown in Appendix 21. As with previous groups, subjects sometimes asked what manoeuvre they would be carrying out, and they were told to rate the junction as a whole. On occasions this caused some difficulty, particularly for the older subjects.

This may be because their experience may have lead them to recognise that the relative importance of a hazard, as measured by the constructs, depends on a variety of circumstances.

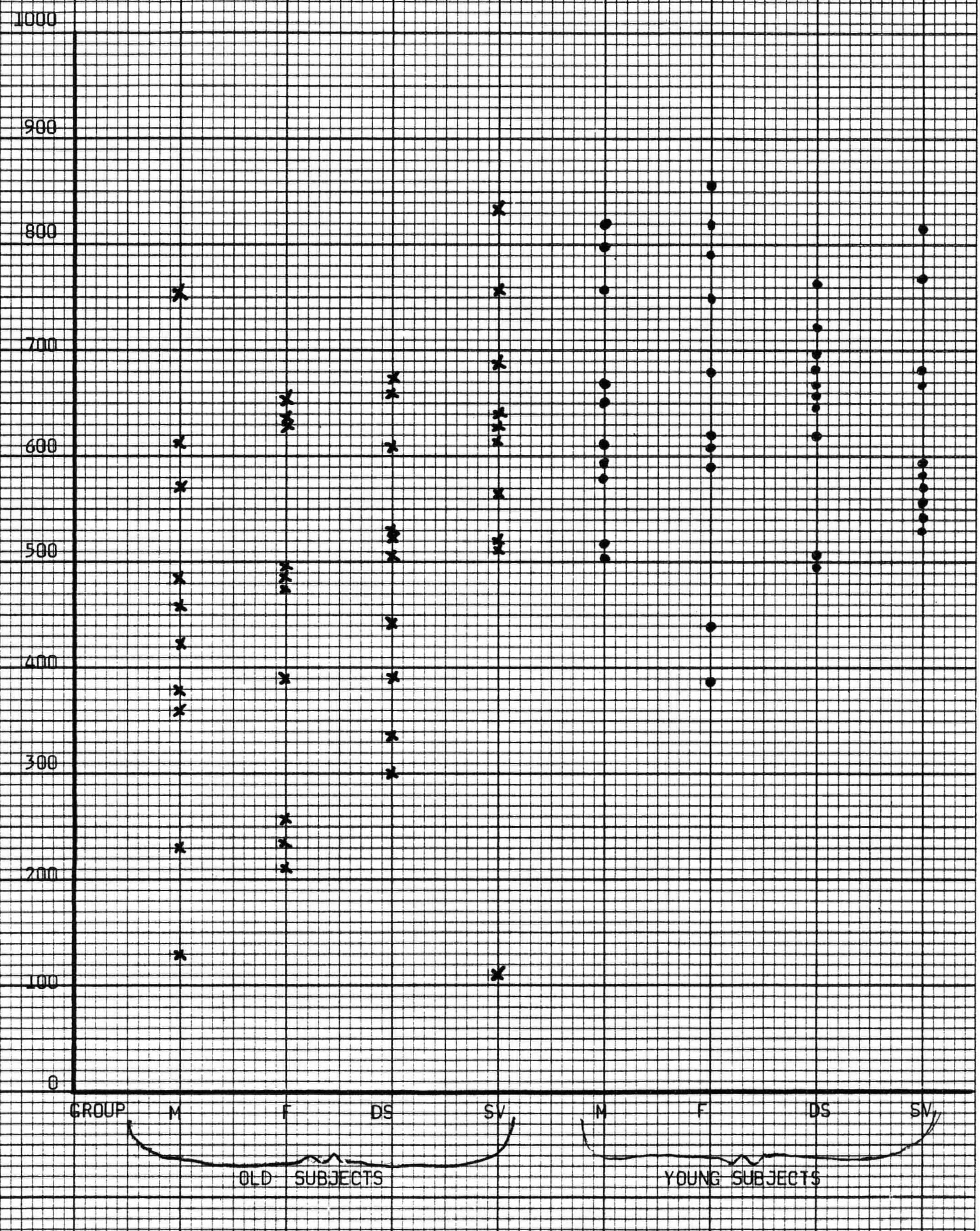
The midway response index referred to earlier on page 46 was calculated, and is graphically represented for all the subjects in the four groups in Figure 3. Mann-Whitney U tests were carried out to discover if there were significant differences overall between the values of old and young subjects' midway response indices, in each group, the results were as follows. (see Appendix 22).

Group M Significant at $p < .005$ for a 1 tailed test
Group F Significant at $p < .025$ for a 1 tailed test
Group DS Significant at $p < .025$ for a 1 tailed test
Group SV non significant

In addition, midway responses were examined separately for each element/ construct combination in the grid (i.e each of the 180 cells in the score matrix). The number of midway responses made by old subjects was deducted from the number made by young subjects. Any positive remainder was then counted as for the hypothesis, that young subjects make more midway responses than old subjects and a binomial distribution was calculated with $p=\frac{1}{2}$. The results for the four groups were as follows:

Group M number of cells where the midway responses were greater for young subjects = 144/180 significant at $P< .0000$
Group F number of cells where the midway responses were greater for young subjects = 143/180 significant at $P< .0000$
Group DS number of cells where the midway responses were greater for young subjects = 125/180 signifcant at $p< .0000$
Group SV number of cells where the midway responses were greater for young subjects = 86/180 non-significant

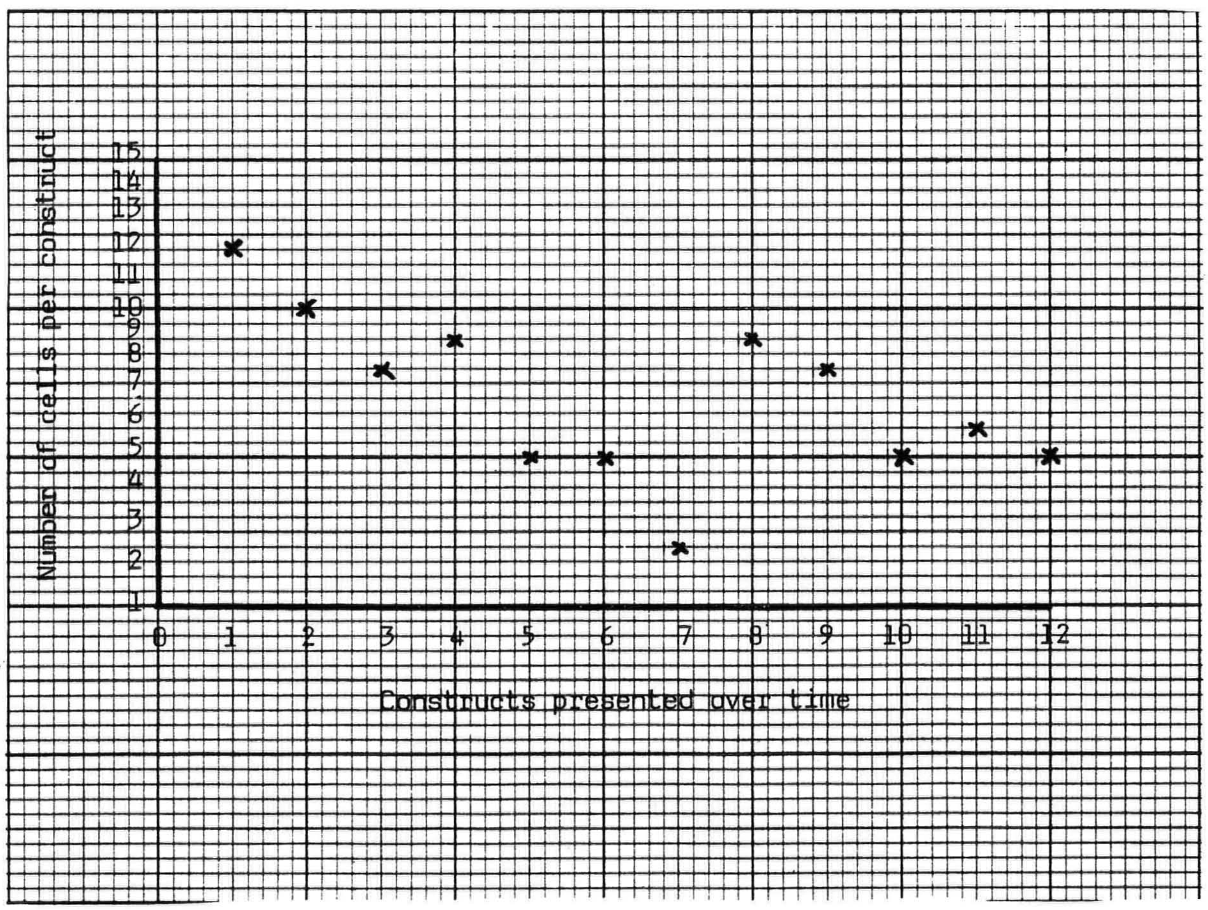
FIGURE 3 GRAPHICAL REPRESENTATION OF THE MIDWAY RESPONSE INDEX FOR THE OLD AND THE YOUNG SUBJECTS IN THE M, F, DS AND SV GROUPS



These cells were not specifically concentrated in any one part of the grid; no one element or construct could be identified for which the level of discrimination between old and young subjects was either especially high or especially low, bearing in mind that a certain amount of variation between cells would be expected purely on the grounds of chance.

The site visits group was therefore the only one not to display a general tendency for the older subjects to make extreme responses. However looking at the pattern of responding in fig. 4 it can be seen that rating made by the older subjects in this group during the first few minutes of their interviews did in fact tend to lie towards the extremes of the scale as with the older subjects in the other groups.

FIGURE 4 The number of cells per construct with more midway responses for young subjects than old subjects, with constructs presented over time.



It may be that the effect of the dynamic road environment gradually imposed itself as each interview progressed, resulting in the older subjects' responses gradually becoming less extreme. The older subjects, when exposed to a stream of stimuli on site, may have become less certain about their opinions than they were when presented with a static picture. The average completion time of the questionnaire was about half an hour, during which time each subject would have been exposed to a number of different situations. For example, a group of pedestrians would attempt to cross the main road or a lorry would turn the corner nearby, mount the kerb and pass close to the subject. On other occasions lorries would enter or leave the nearby yard access causing main road traffic to stop suddenly. All subjects witnessed several incidents during the time they were there, but the incidents were not the same for each subject.

It could be argued that these incidents witnessed are typical of driving conditions, and therefore the response pattern obtained was "normal", whilst the computer administered techniques were "abnormal". However a driver negotiating that or any other junction would not normally have a half an hour to analyse its features and interactions.

Investigation of the differences in response behaviour between old and young subjects showed no differences in the mean ratings. This may have been because midway responses from younger subjects and extreme responses from older subjects were part of an overall pattern, rather than a consistent occurence in each cell. A methodological weakness in the particular grid that was formulated, which was discussed previously, (p 42), may have been partly responsible. The constructs that were used in the grid were a representative selection of personal constructs drawn from other subjects, so that the constructs were known to be applicable to the elements being rated and to be meaningful to some of the subjects. However personal constructs are not the same as fixed constructs - we cannot be sure exactly what meaning any one subject attributes to the set of words used to form them.

Nevertheless, the finding that there is a significant difference between the pattern of response of old and young subjects suggests lines of further work, although these may be more complex than would have been the case had the mean difference been significant.

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Nevertheless, the finding that there is a significant difference between the pattern of response of old and young subjects suggests lines of further work, although these may be more complex than would have been the case had the mean difference been significant.

GRID ANALYSIS FOR BEGINNERS (GAB)

The pattern of responses did show significant differences in most cases, however further analysis which looks at the correlation structure of subjects' ratings is able to uncover any other differences between age groups and subject groups that may be present. For this reason the mean grids were calculated, that is with the mean response for each group of subjects in each cell. These are in Appendix 23. The eight mean grids were then analysed using Grid Analysis for Beginners (GAB).

GAB concentrates mainly on the correlational structure of grids, that is the relationship between constructs and the relationship between elements. The anlyses reported here will look at the similarities and the differences between the correlations of the old and the young subject groups, first for constructs and then for elements. Further details regarding GAB can be found in Appendix 24.

Table 10 shows the construct correlation matrices for old subjects in each of the four experimental groups. From left to right the groups depicted in each cell are M, F, DS and SV. A dot indicates significance between the two constructs at the 10% level, a cross at the 5% level, and a star at the 1% level. As can be seen there is a considerable degree of agreement regarding which constructs are correlated between the four groups.

Table 11 has the same format but shows the correlations for the four groups of young subjects. It also shows that there is agreement regarding the construct correlation pattern.

By comparing the two tables it appears that in general the old and the young subject groups have correlated the same constructs together although there are some differences in detail.

Table 12 shows the number of significant correlations at the 5% level or better for each construct for the old groups and the young groups. This shows that each construct has approximately the same number of other constructs correlated with it. In Personal Construct Theory (PCT) this

TABLE 10

CORRELATIONS BETWEEN CONSTRUCTS: CASES WHERE THE CORRELATIONS ARE SIGNIFICANTLY DIFFERENT FROM ZERO

OLD subjects
Subject group: All

Constructs

	2	3	4	5	6	7	8	9	10	11	12
1		.	++	+			*			+	*
2		+.			****	.+*+	++**	.		*+**	.
3			+	*	.			**.	.		++
4				+			*++	*		**	*
5								+ *+	+	+	+**+
6						****	.+	+		..**	+.
7							. +			.+	+*+
8								+		*+**	+
9									+	.	.
10											.
11											

KEY:

. Difference significant at 10% level
+ Difference significant at 5% level
* Difference significant at 1% level

TABLE 11

CORRELATIONS BETWEEN CONSTRUCTS: CASES WHERE THE CORRELATIONS ARE SIGNIFICANTLY DIFFERENT FROM ZERO

YOUNG subjects
Subject group: All

Constructs

	2	3	4	5	6	7	8	9	10	11	12
1			+ *	+ +			*	.		+	
2		.			****	. . . +	* +	+		+ **	.
3				*	+	+		+	*+		* +
4				**+.			****	***		* +	*
5						. .	++.+	**+	.	*	****
6						*+*		+		. .	+
7								+			**+
8								***		**+*	+ +
9									.	* +	*.
10											
11											*

KEY:

. Difference significant at 10% level
+ Difference significant at 5% level
* Difference significant at 1% level

means that each construct is as important to one group as it is to the other, since numbers of correlations reflect importance, with many correlations signifying greater importance. The largest difference between the two age groups is for construct 9 attracts attention - does not attract attention. This has more correlations for the young subjects so may indicate that it is a more important construct for the younger subjects. The most strongly correlated construct for both groups aggregated was Construct 8 won't injure me/may injure me, which highlights this construct's general importance in perception of hazards. Construct 10 clear view - obscures vision appears to be the least important construct for both age groups.

TABLE 12 THE NUMBER OF SIGNIFICANT CORRELATIONS BETWEEN CONSTRUCTS FOR THE OLD AND FOR THE YOUNG SUBJECT GROUPS.

	No of correlations significant at 5% level			
CONSTRUCT	OLD	YOUNG	DIF	TOTAL
1	6	6	0	12
2	16	11	5	27
3	7	8	-1	15
4	11	15	-4	26
5	12	17	-6	28
6	13	10	3	23
7	12	9	3	21
8	16	19	-3	35
9	9	16	-7	25
10	2	2	0	4
11	15	14	1	29
12	13	15	-3	27
TOTAL SIGNIFICANT	132	142	-12	272
TOTAL POSSIBLE CASES	528	528		1056

The pattern of construct correlations do not then show any major differences between the old and young age groups, except perhaps that young subjects may place more importance on the attractability of hazards (C9).

The construct related to injury (C8) was the most important for both age groups and the construct regarding a hazards' visual obscuration (C10) was least important.

The element correlation matrices for the old subject groups is shown in table 13. This illustrates a general consistency between groups in significantly related elements. Table 14 shows the element correlations for the young subject groups and is also consistent. Comparing tables 13 and 14 there is general agreement regarding the elements that are related except in the cells which show the correlations for elements 3 wet road and 12 narrow road, elements 9 cars turning right and 14 high speed car and elements 11 parked vehicles and 8 lorries. In all three cases the old subject groups have significantly correlated the two elements in question at least at the 5% level whereas the young subject groups have no significant correlations in these cells except in the case of E3 and E12 in the YDS group and E9 and E14 in the YM group.

It is not clear how much importance should be placed on this finding since these three 'odd' cells are only a small part of those element relationships that go to make up the dimensions of thought being used. The relationship of all other elements to an element should be taken into consideration for it is the classification or pattern of relationships of elements that is the important feature especially in an environment where quick and accurate processing is essential.

Table 15 shows the number of significant correlations at the 5% level or better for each element for the old groups and the young groups. As this shows, there are not many differences of any magnitude between the age groups, however when a difference does occur, that is, for elements 8 lorries, 9 cars turning right and 11 parked vehicles, one of the 'odd' cells discussed above has been involved.

TABLE 13

CORRELATIONS BETWEEN ELEMENTS: CASES WHERE THE CORRELATIONS ARE SIGNIFICANTLY DIFFERENT FROM ZERO

OLD subjects
Subject group: All

Elements

	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.*.+		+.	****			***+	****	****	.		.	****	+
2				.*..			.	+++	.++				.++.	
3					.+++	*+					****	.+		
4				****		.	****	*+*+	. *	****		+.*		
5						+	****	****	***+	.++*		+ +.	****	+
6						****					*+	. +		
7							+	+		+ +*	***+	. *		
8								****	++++	*++*		.	+*+	+
9									****	++**		+	*+**	
10													****	
11											..	+**.		
12												.+*.		+
13													.	.
14														.

KEY:

- . Difference significant at 10% level
- + Difference significant at 5% level
- * Difference significant at 1% level

Table 14

CORRELATIONS BETWEEN ELEMENTS: CASES WHERE THE CORRELATIONS ARE SIGNIFICANTLY DIFFERENT FROM ZERO

YOUNG subjects
Subject group: All

Elements

	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	+ +		+ +	****			**+*	++*.	****			.	****	.
2			.	+ +			.	+ .	+ *	+			+	
3					*+**	+					+	++ +		.
4				****		+*	****	**.*	...*	.***	+	. +		
5							**+*	**++	****	. +		*+.*	****	.
6						****					..	*+		+.+
7											++ +	*		
8								**.*	**++				+ .	
9									** +	.+++	.	.	+	.
10										+		. +	****	
11											**.+	..		+ .
12												+.*		
13													. .	
14														.

KEY:

. Difference significant at 10% level
+ Difference significant at 5% level
* Difference significant at 1% level

TABLE 15 THE NUMBER OF SIGNIFICANT CORRELATIONS BETWEEN ELEMENTS FOR THE OLD AND FOR THE YOUNG SUBJECT GROUPS.

Element No. of correlations significant at 5% level

	OLD	YOUNG	DIF	TOTAL
1	24	23	1	47
2	10	9	1	19
3	10	9	1	19
4	20	21	-1	41
5	32	30	2	62
6	10	12	-2	22
7	17	11	5	27
8	29	20	9	49
9	33	21	12	54
10	23	24	-1	47
11	21	13	8	34
12	13	10	3	23
13	13	13	0	26
14	21	15	6	36
15	4	3	1	7
TOTAL SIGNIFICANT	280	234	45	513
TOTAL POSSIBLE CASES	840	840		1680

Element E5 car pulling out is the most correlated element for both the groups aggregated and would consequently be the hazard perceived as most like all the others. Element 15 yard turning is the least correlated element and is therefore the hazard least like all the others.

Broadly, elements are more strongly intercorrelated for the old subjects than the young subjects, and the pattern is similar for the four sub groups. It may tentatively be hypothesised that this means that younger subjects are not classifying hazards adequately, because they have difficulty in processing the information presented to them on the road. Alternatively it could be argued that it is the older drivers who are at fault as they are not differentiating between hazards adequately, ie, they are oversimplifying the task of classification. Conceivably both of these hypotheses could be correct.

At a more specific level the pattern of element correlations at a site may reveal drivers' perceptions regarding the importance of particular hazards.

HIERARCHICAL CLUSTERING (FOCUS)

This analysis re-orders the columns and rows of a repertory grid in order to mazimise the agreement between the ratings of adjacent columns and rows. Constructs are sometimes reversed to aid this procedure, which can make comparisons between grids difficult.

The re-ordered grid is then used as the basis for clustering the elements and the constructs using a percentage scale depicted on a dendrogram. "Good" clusters that are likely to be significant can be identified although as yet there is no reliable measure of significance. In the following text those clusters that are likely to be significant have been treated as significant, and those constructs that have been reversed have a minus sign preceeding the construct number. Further details about FOCUS are given in Appendix 25 .

Figures 5 a-h show the construct clusters for the eight groups. Constructs that have been reversed are here marked with an R. A shaded circle signifies that the elements in that cluster are likely to be significant. Looking at the overall pattern, each one appears to have three clusters except the young SV group which has four. These are marked just beneath the dendrogram with a line indicating all the constructs that are in the cluster. Of the twelve constructs the clusters most often formed include, in what we shall call cluster A - constructs 2, 6 and 7 and in cluster B - constructs 3, 5, 9 and 12 and

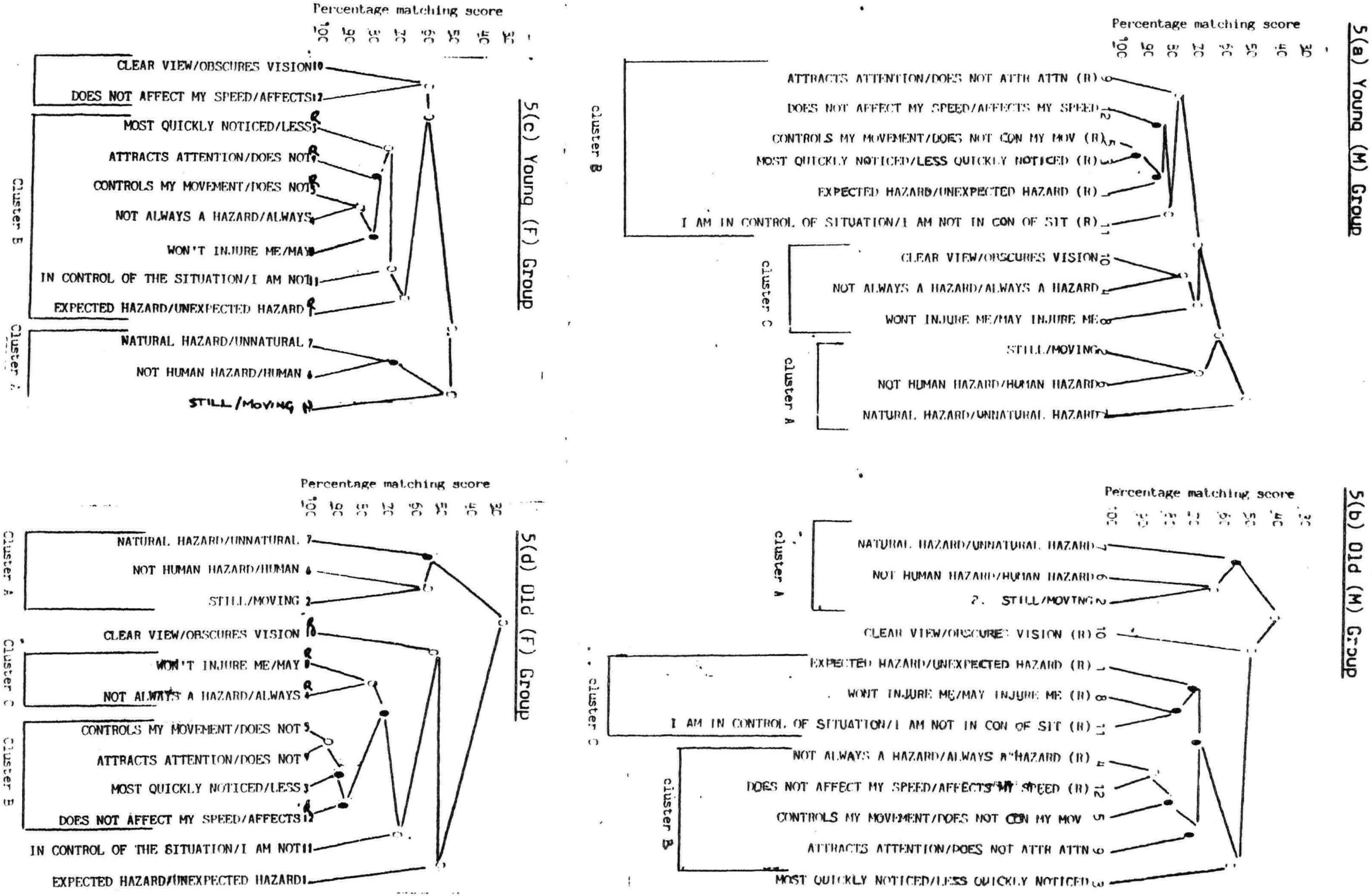
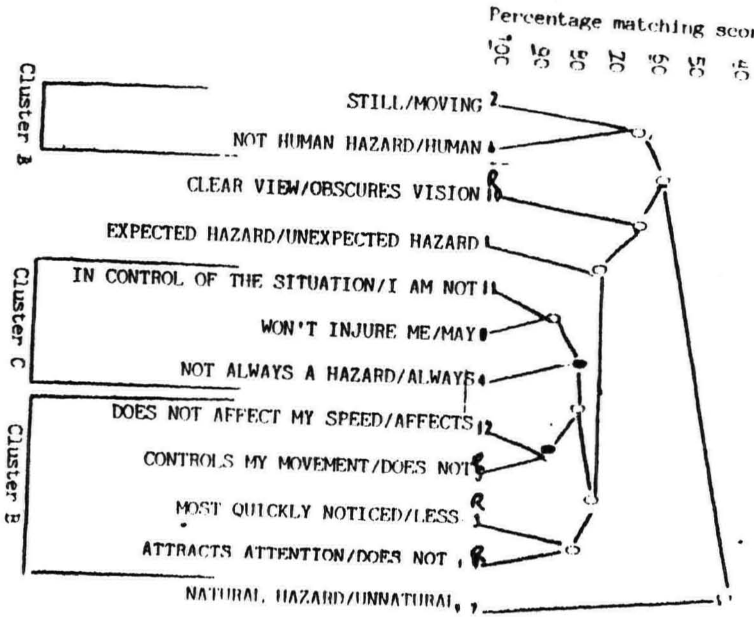
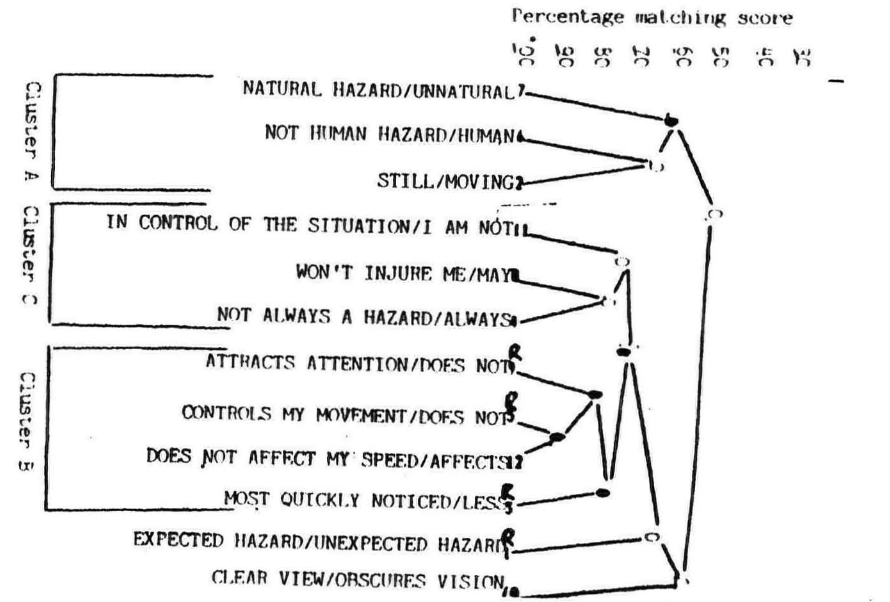


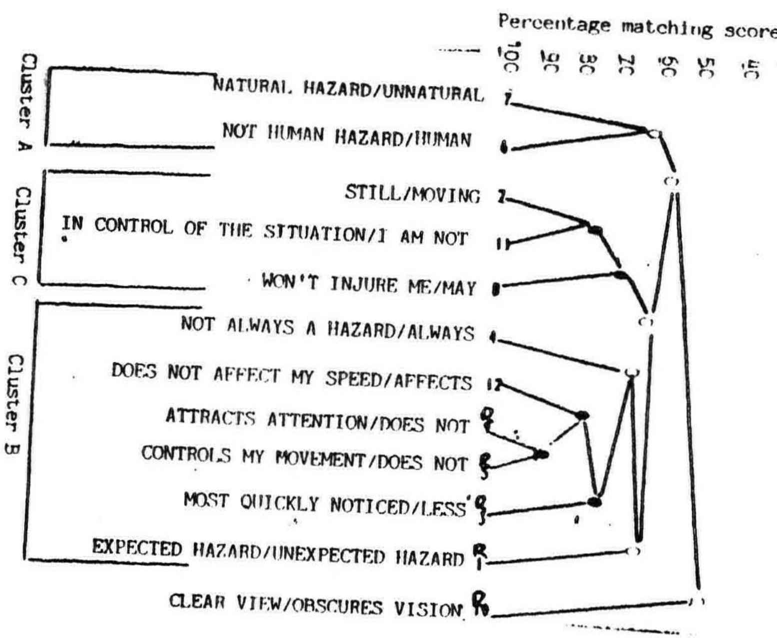
FIGURE 5 FOCUS CLUSTERS



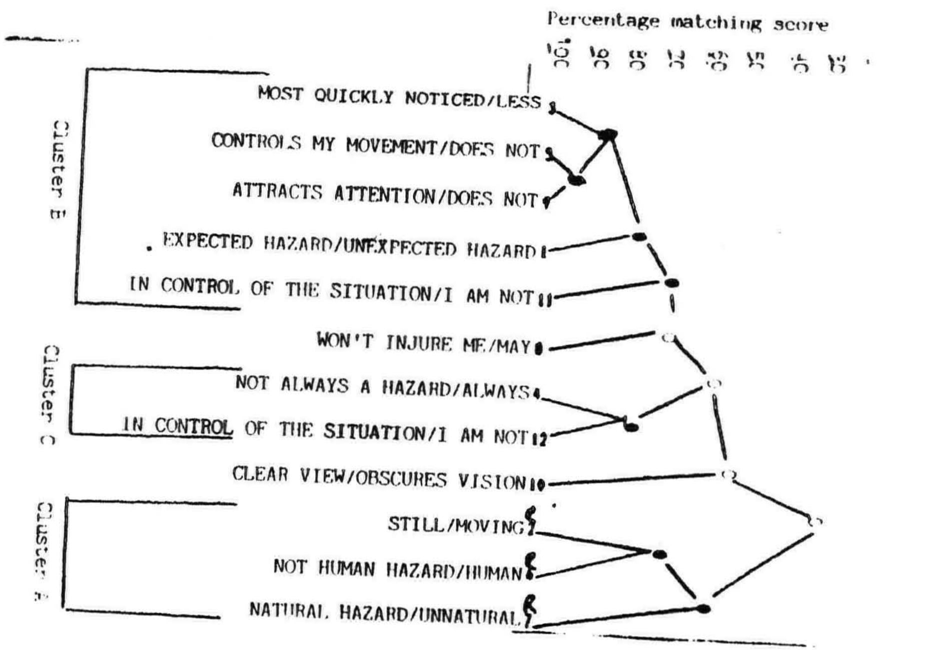
5(g) Young (SV) Group



5(e) Young (DS) Group



5(h) Old (SV) Group



5(f) Old (DS) Group

in cluster C - constructs 4, 8 and 11. The remaining constructs, that is numbers 1 and 10 are often not included in a cluster.

Given this general trend there are variations between the groups in the clusters, in how the constructs have been related and also in which ones have been reversed. The broad similarity of clusters between groups provides evidence that the repertory grid has identified the dimensions that drivers frequently use, and the differences presumably signify differences associated with detailed differences in hazard perception between groups, together with random sampling fluctuations. Before going on to outline the differences, it may be useful to try to summarise the features which they have in common.

<u>Cluster A - hazards' features</u>

This cluster appears to deal with the features of hazards. It relates constructs 2, 6, 7 as follows:

C2	still	moving
C6	not human	human
C7	natural	unnatural

These constructs are less subjective than the others, and more related to observable features of the hazards.

Figures 5 a-h illustrate that these constructs are significantly clustered for groups M old, F old, DS old and young. In addition they are clustered but not significantly for the F old group. For the M and SV young groups construct 7 is not included in the cluster and for the SV old group construct 2 is not included. None of these last three groups has significantly related the constructs in this cluster.

There is evidence then that this cluster is fairly uniform across groups. It appears most strongly related for the older subjects except in the SV group where construct 2-still has been significantly correlated with construct 11 - I am in control of the situation. This division may have been caused by the older subjects realising when they were on site the importance of hazards that are in motion.

Cluster B - reactability

The basis of this cluster centres around constructs 3, 5, 9 and -12 which are related as follows:

C3	most quickly noticed	less quickly noticed
C5	controls my movement	does not control my movement
C9	attracts attention	does not attract attention
C-12	affects my speed	does not affect my speed

It will be recalled that a minus sign preceding a construct number means that the construct has been reversed. This cluster may be interpreted as a measure of judgement, it denotes the drivers' response or reaction to hazards. The F old and DS young group have significantly related these 4 constructs in one cluster, but there are deviations from this in all the other groups. The M young group has clustered them all together however they have also included constructs 1 and 11, although the significant cluster only includes constructs -3, -5 and 12 together with construct -1. The SV old group has also clustered the main constructs together significantly, but has also added (not significantly) constructs -1 and 4. The M old group has replaced construct 3 and C-4. The SV young group has split the 4 construct cluster into two, that is C12 and C-5 and C-3 and C-9. Finally the F young group and the DS old group have both omitted C12 but included constructs 8, 11 and 1, and also C4 in the case of the F young group. The significant clusters within these two clusters varies with the F young group relating C4, 5, 8 and 9 and the DS old group relating C1, 3, 5, 9 and 11.

The array of different constructs in this cluster for the eight groups is detailed in table 16 which shows the constructs that are in each group's cluster and those that are significant. No pattern which distinguishes either all old and young subjects or all of one experimental group from another is apparent from table 16. Yet there are differences between all the groups in the clusters.

TABLE 16 THE CONSTRUCTS AND SIGNIFICANT CONSTRUCTS IN CLUSTER B FOR EACH GROUP

GROUP	CONSTRUCTS IN CLUSTER B							
	1	3	4	5	8	9	11	12
M Old	*		*	*		*		*
M Young	*	*		*		x	x	*
F Old		*		*		*		*
F Young	x	x	*	*	*	*	x	
DS Old	*	*		*	x	*	*	
DS Young		*		*		*		*
SV Old	x	*	x	*		*		*
SV Young		x		*		x		*

x = in cluster
* = in cluster and significant

Cluster C - confidence

This cluster often includes constructs 4, 8 and 11 related as follows:

C4	not always a hazard	always as hazard
C8	won't injure me	may injure me
C11	I am in control of the situation	I am not in control of the situation

Table 16 shows that these constructs have also figured in some groups cluster B, however in most cases where this has occurred, only one of the constructs is related to cluster B. An exception to this is the F young group who have merged what has been called clusters B and C. This is discussed further below.

Cluster C may be interpreted as a measure of confidence in negotiating the hazards. However in many cases this third cluster is quite different. The SV and DS young groups have a cluster consisting of only these three constructs, the SV young groups is significant but the DS young groups is not. For all the other groups there is a great deal of variation in constructs and significant constructs. However all the groups have at least one of the constructs listed above in this cluster except the young F group whose third cluster includes constructs, 10 and 12.

The F young group in Fig. 5c has combined the constructs from what has called components B and C thereby merging the reactability and confidence dimensions. Their third component is unlike any other groups and connects C10 clear view with C12 does not affect my speed. What this may mean is that the young females dimensions of thought regarding hazards have not yet fully formed.

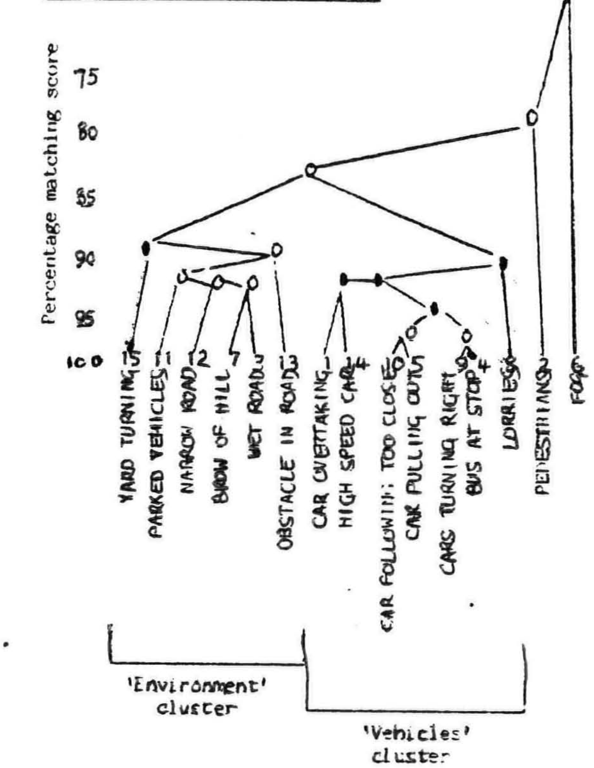
These different patterns may correspond to important differences in the way in which groups construe hazards. The construct analysis shown above is very complex and unique for each group. It has shown that there are differences between each group in terms of the dimensions used, and that there is a degree of similarity as well. The element analysis considered next should reveal the pattern of relationships between elements that relate to these dimensions.

Figures 6 a-h show the element clusters for the eight groups. As can be seen there is a great deal of variation between all the eight groups in the pattern of clusters.

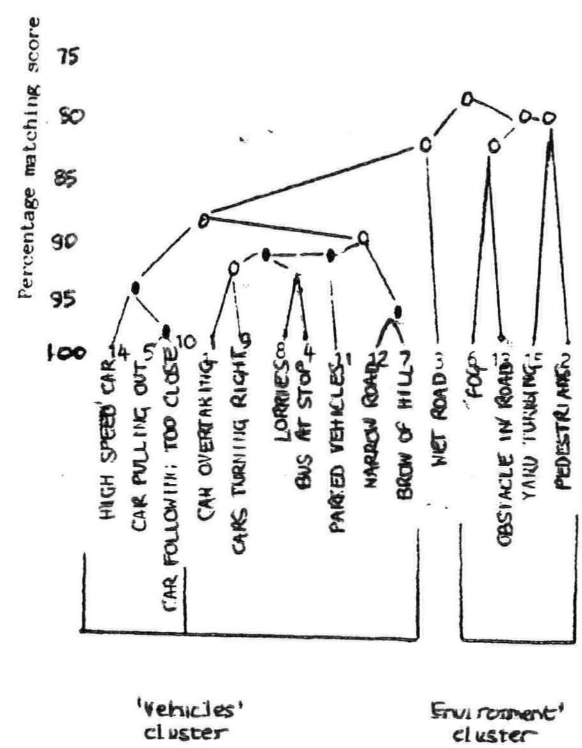
An extremely broad reading of the groupings could be interpreted as the hazardous elements being divided into two main groups, one which incorporates all "hazards of the environment" and the other which includes "hazards involving vehicles" . In most cases there is

FIGURE 6 FOCUS ELEMENT CLUSTERS

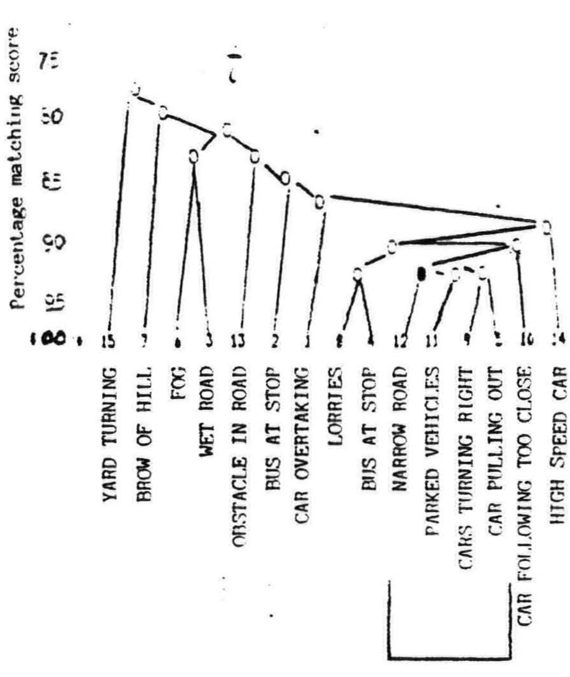
6(a) Young (M) Group



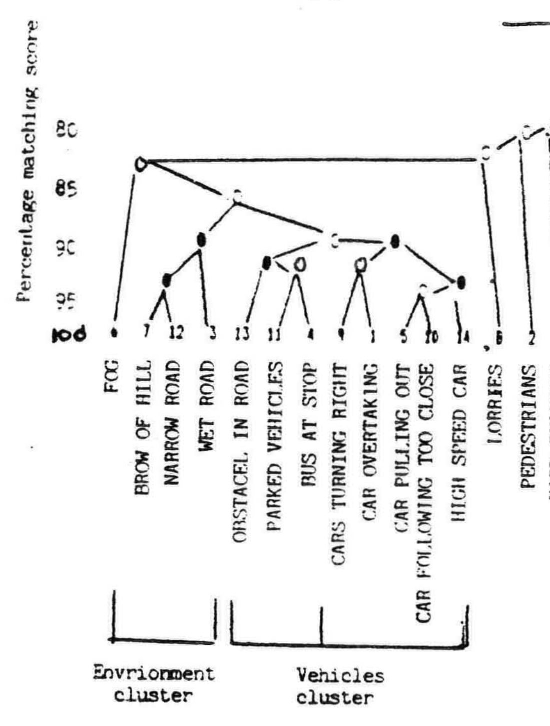
6(b) Old (M) Group



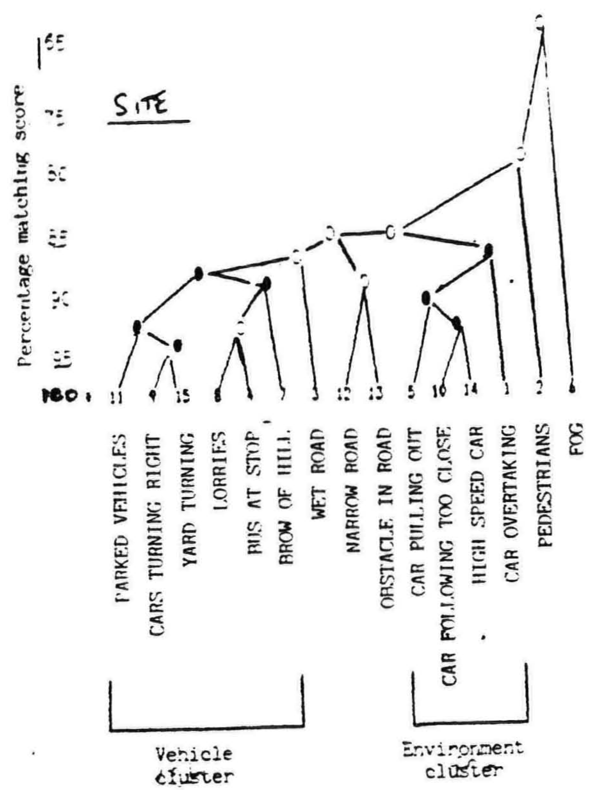
6(c) Young (F) Group



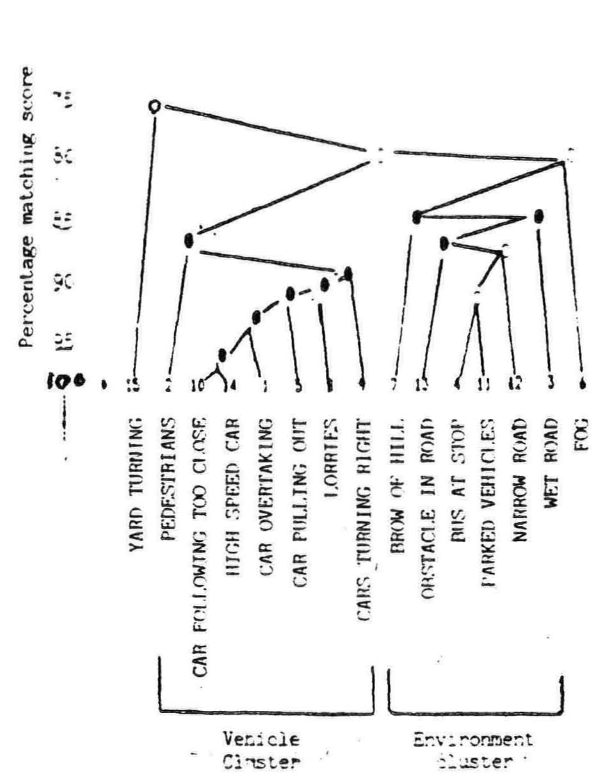
6(d) Old (F) Group



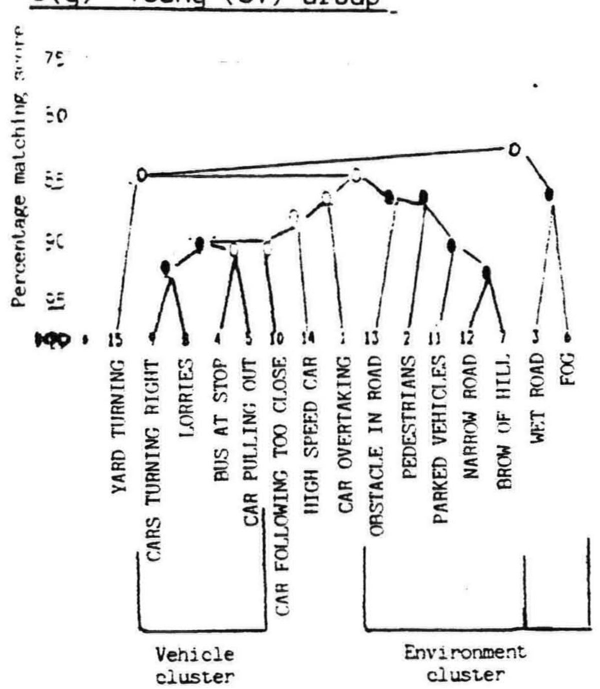
6(e) Young (DS) Group



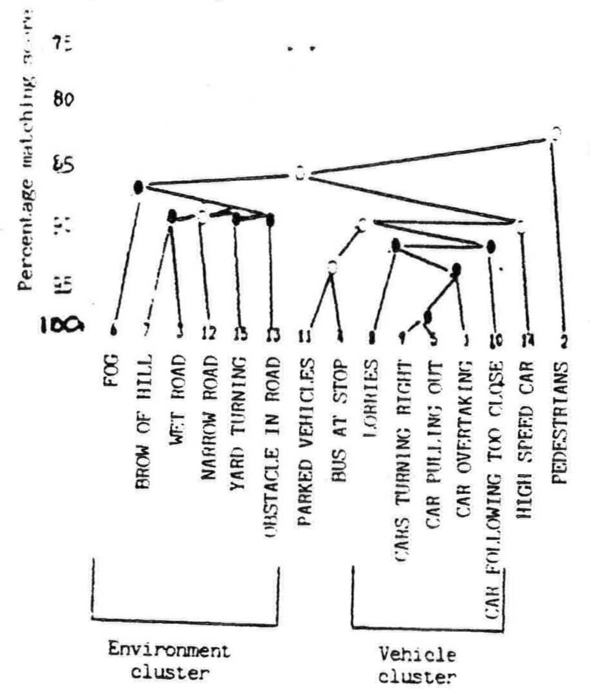
6(f) Old (DS) Group



6(g) Young (SV) Group



6(h) Old (SV) Group



agreement about which hazards fall into which category, but there are some differences between the eight groups. Table 17 shows how the elements were categorised by each of the eight subject groups.

TABLE 17 THE CATEGORIES "ENVIRONMENT" (E) "VEHICULAR" (V) AND "NEITHER" (O) INTO WHICH ELEMENTS WERE CATEGORISED BY THE EIGHT SUBJECT GROUPS.

GROUPS	ELEMENTS														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
M Old	V	E	E	V	V	E	V	V	V	V	E	V	E	V	E
M Young	V	O	E	V	V	O	E	V	V	V	V	E	E	V	E
F Old	V	O	E	E	V	O	E	O	V	V	V	E	E	V	E
F Young	V	V	E	V	V	E	O	V	V	V	E	V	V	V	O
DS Old	V	V	E	E	V	E	E	V	V	V	E	E	E	V	O
DS Young	V	O	E	E	V	O	E	E	E	V	E	E	E	V	O
SV Old	V	O	E	V	V	E	E	V	V	V	V	E	E	V	E
SV Young	V	E	O	V	V	O	E	V	V	V	E	E	E	V	O

The table illustrates elements 1 car overtaking, 5 car pulling out, 10 car following too close and 14 high speed car are categorised by all groups as vehicular. Elements 8 lorries and 9 cars turning right are also most often put in this category. In the environment category elements 3 wet road, 6 fog, 7 brow of hill, 12 narrow road 13 obstacle in road and 15 yard turning are most often identified. This leaves elements 2 pedestrians, 4 bus at stop and 11 parked vehicles which are not consistantly marked in either group.

In this way a picture begins to emerge regarding the differences between the groups. The following concentrates on the clusters which are likely to be significant, that is those with a shaded circle.

Groups M young, SV old and DS old and young are quite straightforward in their groupings. They have each produced two "good" clusters that fall into the environment and vehicular catego-res although as outlined above in table 17 they have included different elements in these clusters. The F young group has only one 'good' cluster which includes elements usually found in both the environment and the vehicular category. These are E12 narrow road, E11 parked vehicles, E9 cars turning right and E 5 cars pulling out.

The other three groups, that is M old, F old and SV young, all have three 'good' clusters which can be interpreted in different ways. The M old group have broken their vehicular category into two with the faster, more dangerous vehicles forming one cluster and the less dangerous ones in another. For the F old group the additional cluster includes elements from the environment and vehicles categories, that is elements 13 obstacle in road, 11 parked vehicles and 4 bus at stop. These appear to be hazards that are likely obstructions to unimpeded driving. Finally the SV young group has produced three "good" clusters by virtue of the fact that E3 wet road and 6 fog were rated differently from the rest of the elements. This group has then formed two environment clusters.

In summary the element clusters for the eight groups have an overall similarity in that they delineate between elements of the environment and vehicular elements, however there is some disagreement about which elements belong to which category. Apart from this overall similarity the pattern of clusters differs somewhat between groups, with each grid showing a complex and unique pattern.

PRINCIPAL COMPONENTS ANALYSIS (PCA)

PCA attempts to explain the total variance of one set of vectors of a matrix in factors or 'hypothetical constructs' In the following analysis the construct vectors have been analysed so that the components produced are interpreted by loadings on all the constructs. Since constructs are bi-polar so are components. Factor scores for the elements then illustrate how relevant each one is to either pole of the component. The Analysis here used varimax rotated components which facilitates interpretation. Further information relating to PCA is in Appendix 26.

Each of the eight mean grids produced four components. Appendix 27 shows these together with the factor scores for each element that relates to each of the components. All subsequent tables and figures illustrated here refer to these data.

The four factors produced by each group were the same or similar between groups and have been labelled A, B, C and D. In addition the total variance explained by the four components was approximately the same for all the groups. The following section will describe the main features of a components for all of the groups, and then show how the elements related to that component. This format will be repeated for each of the components. It should be noted that components are notoriously difficult to interpret particularly in Personal Construct Theory since they incorporate a number of constructs which when fused together form a super-ordinate 'super-construct'. The reader may wish to interpret the components outlined here in his or her own way. [Table 18 shows the most important constructs in component A, that is the ones that have high factor loadings. Any loading above .7 is deemed to be high and a minus sign indicates that the construct poles should be reversed. This table also shows what percentage of the total variance is explained by this component for each of the eight groups and the order of its importance.

As can be seen the main constructs are:

Left Pole	Right Pole
2 still	moving
6 not human	human
7 natural	unnatural.

TABLE 18 THE HIGHLY LOADED CONSTRUCTS, PERCENTAGES OF VARIANCE ACCOUNTED FOR AND ORDER OF IMPORTANCE OF COMPONENT A FOR EACH GROUP

	OLD				YOUNG			
CONSTRUCTS	M	F	DS	SV	M	F	DS	SV
1 expected hazard - unexpected hazard								
2 still - moving	.797	.719	.926	.890	.911	.981	.836	.752
3 most quickly noticed- less quickly noticed								
4 not always a hazard- always a hazard								
5 controls my movement- does not con my mov								
6 not human hazard- human hazard	.899	.866	.921	.896	.743	.902	.932	.932
7 natural hazard- unnatural hazard	.811	.904	.792	.748	.825	.782	.712	.820
8 wont injure me- may injure me			.782					
9 attracts attention- does not attr attn	.773							
10 clear view-obscures vision								
11 I am in control of situation-I am not			.777	.883				
12 does not affect my speed-aff my speed								
% variance accounted for	32.5	27.0	31.3	30.3	22.9	23.2	24.8	22.5
Order of importance	1	1	1	1	2	2	1	2

These all appear to relate to the 'features of hazards'. This component corresponds closely to the FOCUS cluster A (see p 69). A clear difference between the old and the young age groups is that less variance is accounted for by this component for the young subjects than the old subjects. The order of importance therefore varies between the age groups, except in the case of the young DS group who have also made this their most importance component. However it should be noted that the second most important component of the DS young subjects is of more or less the same value as this one (22.4% variance accounted for).

It may then be argued that young subjects higher accident rate is due to them not placing enough importance on the features of hazards or not recognising and indentifying them as readily. This is consistent with the hypotheses previously outlined regarding the extreme response style of older subjects (p 48).

Looking at the elements which relate most strongly to this component in figures 7 a and b, there is some disagreement between the groups but on the whole it is agreed that E3 wet road and E6 fog are the most extreme cases for the still, not human and natural pole and E1 car overtaking, E10 car following too close and E14 high speed car are the most extreme cases for the moving, human and unnatural pole. Across the four groups and the age groups there is good agreement concerning the relationship of the various elements to this component.

Component B is illustrated in Table 19. This shows the important constructs to be:

LEFT POLE	RIGHT POLE
5 controls my movement	does not control my movement
9 attracts attention	does not attract attention

This may be interpreted as signifying the reactability of subjects to the hazards, in that the constructs relate to reactions towards hazardous elements. This component corresponds closely to the FOCUS cluster B in that it includes two of the constructs from it (see p 70).

Fig 7a The factor scores for each element on Component A for the various young groups

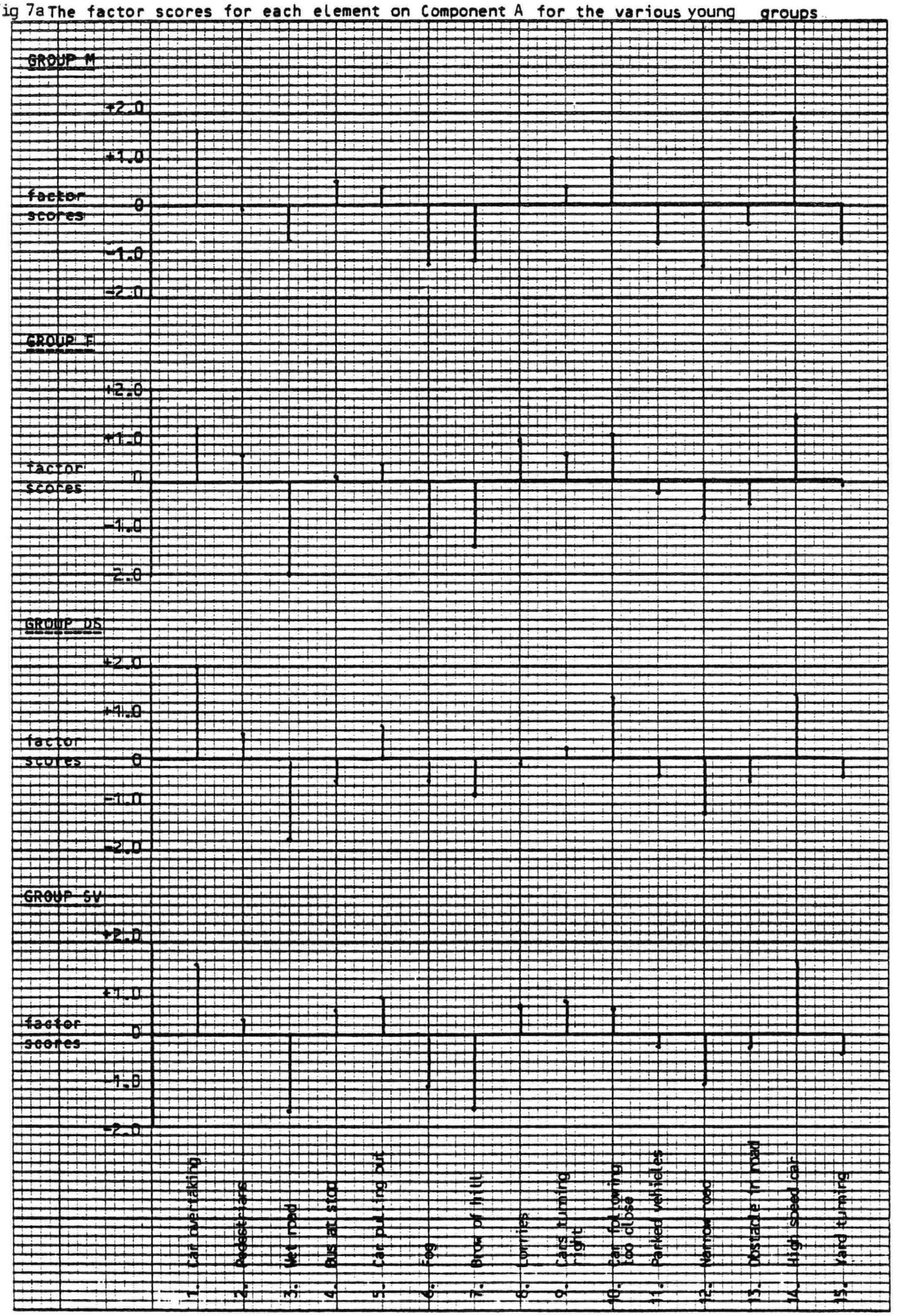


Fig 7b The factor scores for each element on Component A for the various old groups

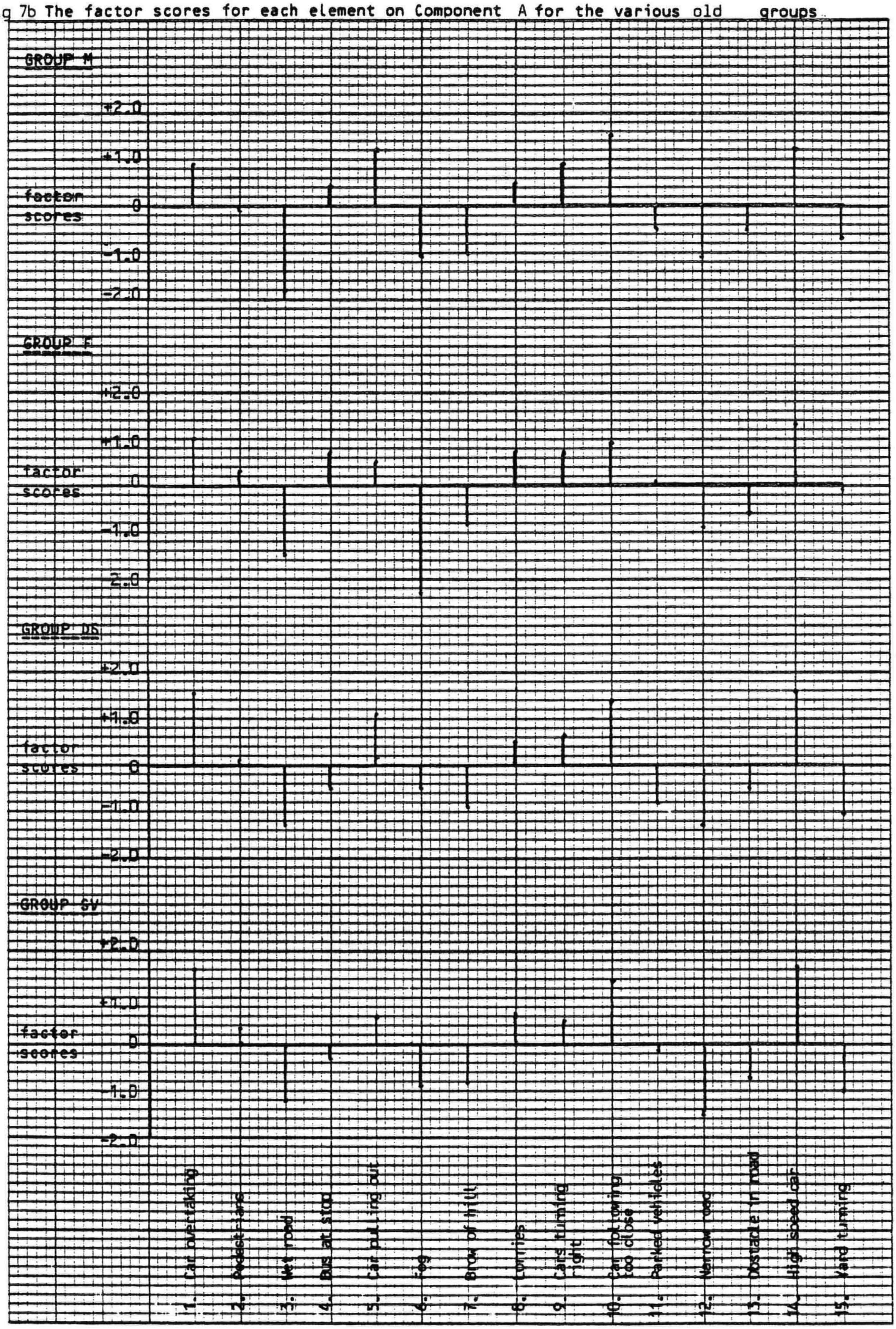


TABLE 19 THE HIGHLY LOADED CONSTRUCTS, PERCENTAGES OF VARIANCE ACCOUNTED FOR AND ORDER OF IMPORTANCE OF COMPONENT B FOR EACH GROUP

	OLD				YOUNG			
CONSTRUCTS	M	F	DS	SV	M	F	DS	SV
1 expected hazard-unexpected hazard	-.775							-.781
2 still - moving								
3 most quickly noticed-					.709			
4 not always a hazard-always a hazard	-.906		-.831			-.899	-.821	
5 controls my movement-does not cont my mov		.912	.726	.810	.831	.797		.872
6 not human hazard-human hazard								
7 natural hazard-unnatural hazard								
8 wont injure me-may injure me							-.863	
9 attracts attention-does not att attn		.865		.859	.808	.757	.825	
10 clear view-obscures vision								
11 I am in control of sitaution-I am not					-.827			
12 does not affect my speed-aff my speed	-.881			-.786	-.875			-.720
% variance accounted for	26.3	22.6	24.0	22.4	36.2	27.5	22.4	22.6
Order of importance	2	2	2	2	1	1	2	1

It should be noted that although the M old group does not load highly on constructs 5 or 9 it does on constructs 4 and 12, which appear to be related to this component, for some of the other groups. It is however possible that this component for the M old group does not correspond to the other groups' component B. Another alternative might be that what we have called component D for the M old group is really component B. This highly loads in construct 5, but on no other constructs, it is fourth in importance and explains only 12.1% of the variance.

The main difference between the old and young subjects here is again the order of importance. For the old subjects this component is second in importance but for the young subjects, except in the DS group, it is first.

On the whole by comparing the percentage of variances accounted for between the old and the young subjects, it would seem that they are similar. In this way it can be seen that the main difference between the age groups is that the young subjects do not place enough importance on component A.

It might be argued from this that the main difference found between old and young subjects is that old subjects assess the hazard and then react while young subjects react before assessing the hazard. While this is, probably, an oversimplication, it could form a basis for the generation of testable hypotheses concerning the difference in accident rates among old and young subjects. More detailed work on hypotheses of this kind might also result in techniques of driver training specifically designed to reverse the order of precedence of the components in young subjects.

The fact that this component which includes construct 9 attracts attention - does not attract attention explains the most variance for young subjects confirms the GAB results (see p 61) where it was noted that construct 9 appeared to be more important to the younger subjects than the older subjects.

The relationship of the elements to component B are in figures 8 a and b and again show patterns of similarity, but also some differences in

Fig 8a The factor scores for each element on Component B for the various old groups

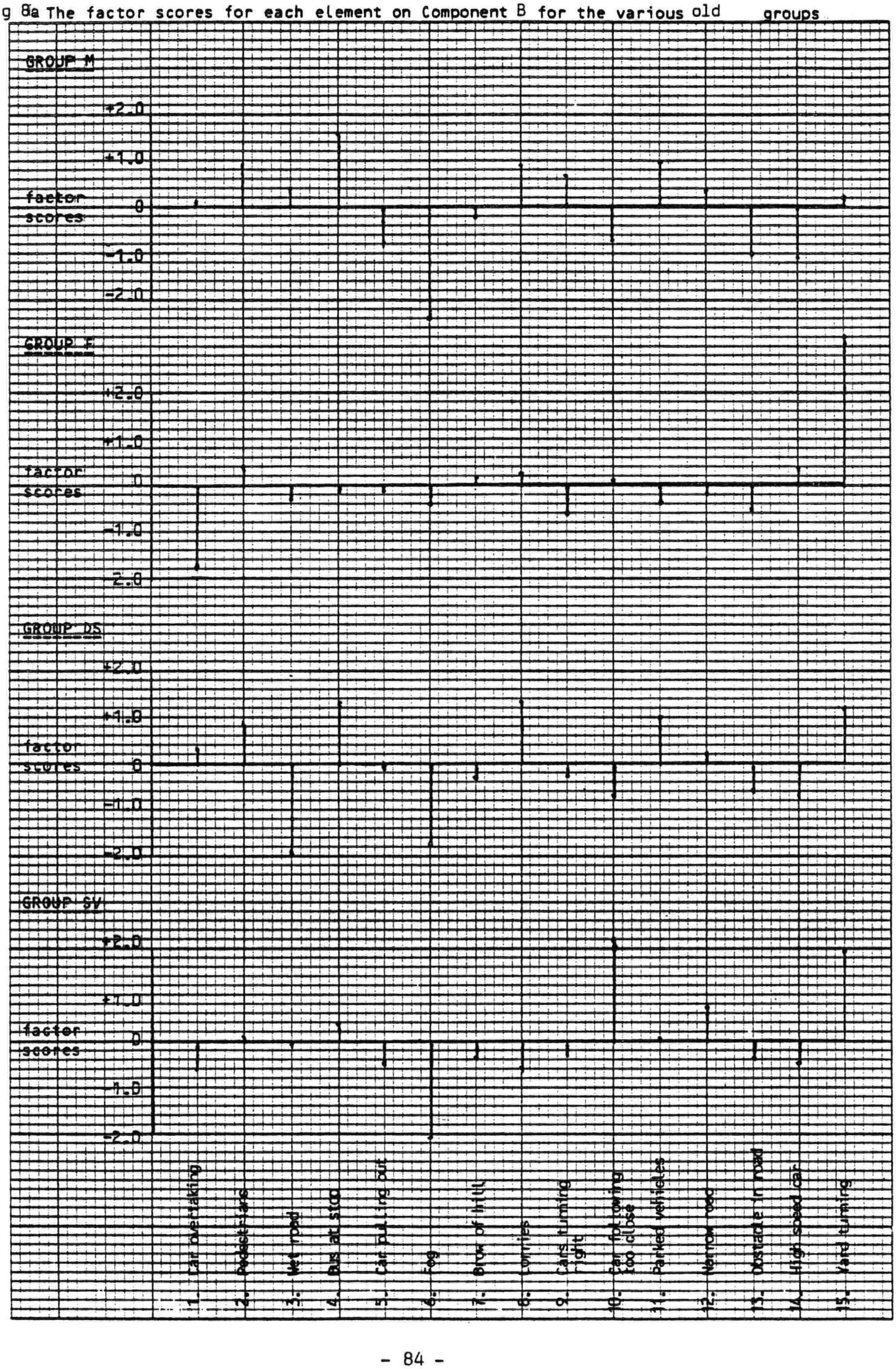
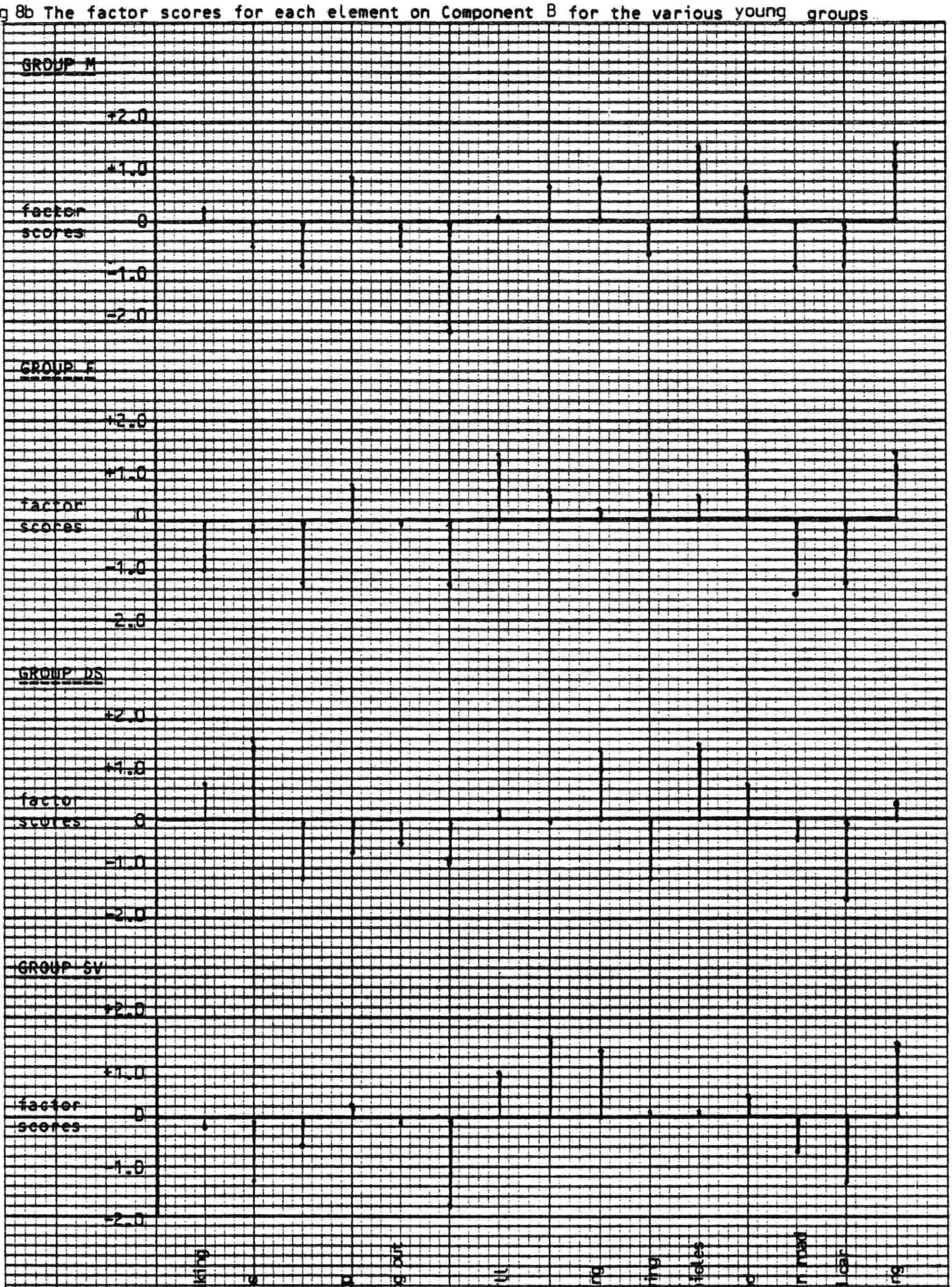


Fig 8b The factor scores for each element on Component B for the various young groups



detail between groups. The reactable pole is extreme on E6 fog in most cases and the less reactable pole is extreme on E15 yard turning quite often. The exceptions to this are for the F old group whose factor scores for E6 fog are not extreme and the M old and DS young groups whose factor scores for E15 yard turning are not extreme.

Each group appears to have a fairly different pattern of elements related to this component which makes it difficult to make comparisons between experimental groups or age groups. One exception to this is for E1 car overtaking which is highly loaded towards the reactable pole of this component for both the female age groups but not for any of the male groups. Other groups that differ considerably from the rest are the SV old group who rate E10 car following too close as much less reactable than all the other groups and the SV young group who rate E2 pedestrians as much more reactable than any other groups.

Table 20 illustrates Component C which is highly loaded on constructs

	LEFT POLE	RIGHT POLE
3	most quickly noticed	less quickly noticed
10	obscures vision	clear view

This may be labelled as the 'visibility of hazards' component as it seems to relate to conspicuity, and it appears to be similar for all the groups. The component does not correspond to any of the clusters from the FOCUS analysis.

Regarding the elements related to component C Figures 9 a and b show that E6 fog, E7 brow of hill and E8 lorries are often on the visible pole of this component and E15 yard turning is often on the less visible pole.

TABLE 20 THE HIGHLY LOADED CONSTRUCTS, PERCENTAGES OF VARIANCE ACCOUNTED FOR AND ORDER OF IMPORTANCE OF COMPONENT C FOR EACH GROUP

	OLD				YOUNG			
CONSTRUCTS	M	F	DS	SV	M	F	DS	SV
1 expected hazard-unexpected hazard		.846		.869				
2 still - moving								
3 most quickly noticed less quickly noticed	.778			.884		.862		.898
4 not always a hazard always a hazard								
5 controls my movement-does not cont my mov								
6 not human hazard-human hazard								
7 natural hazard unnatural hazard								
8 wont injure me-may injure me								
9 attracts attention does not attr att			.743					
10 clear view-obscures vision	-.849	-.782	-.896		-.897	-.889	-.883	-.789
11 I am in control of situation-I am not								
12 does not affect my speed-aff my speed								
%variance accounted for	13.6	14.0	16.9	15.7	14.7	15.4	14.4	16.0
Order of importance	3	4	3	3	3	3	4	4

Fig 9a The factor scores for each element on Component C for the various old groups.

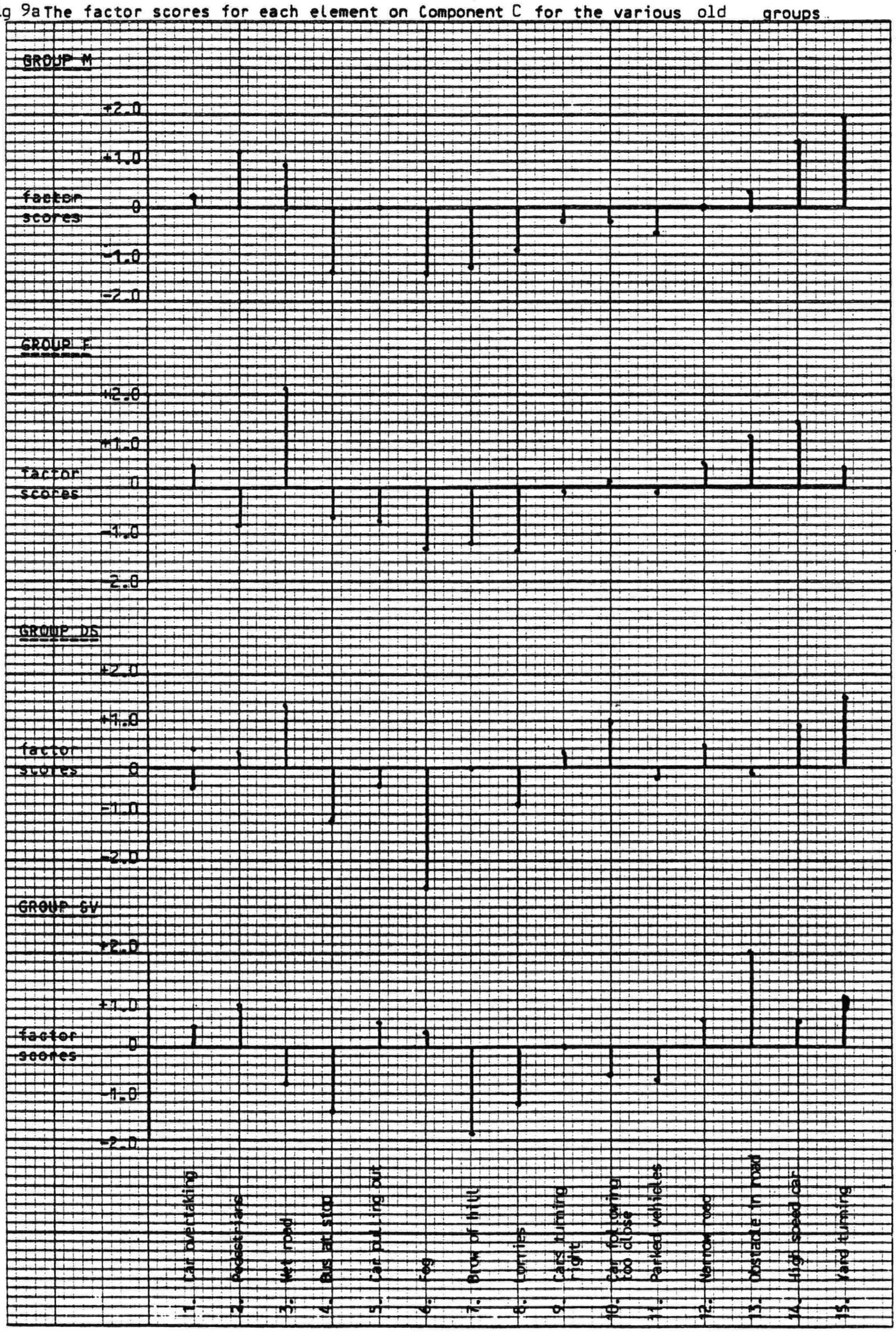
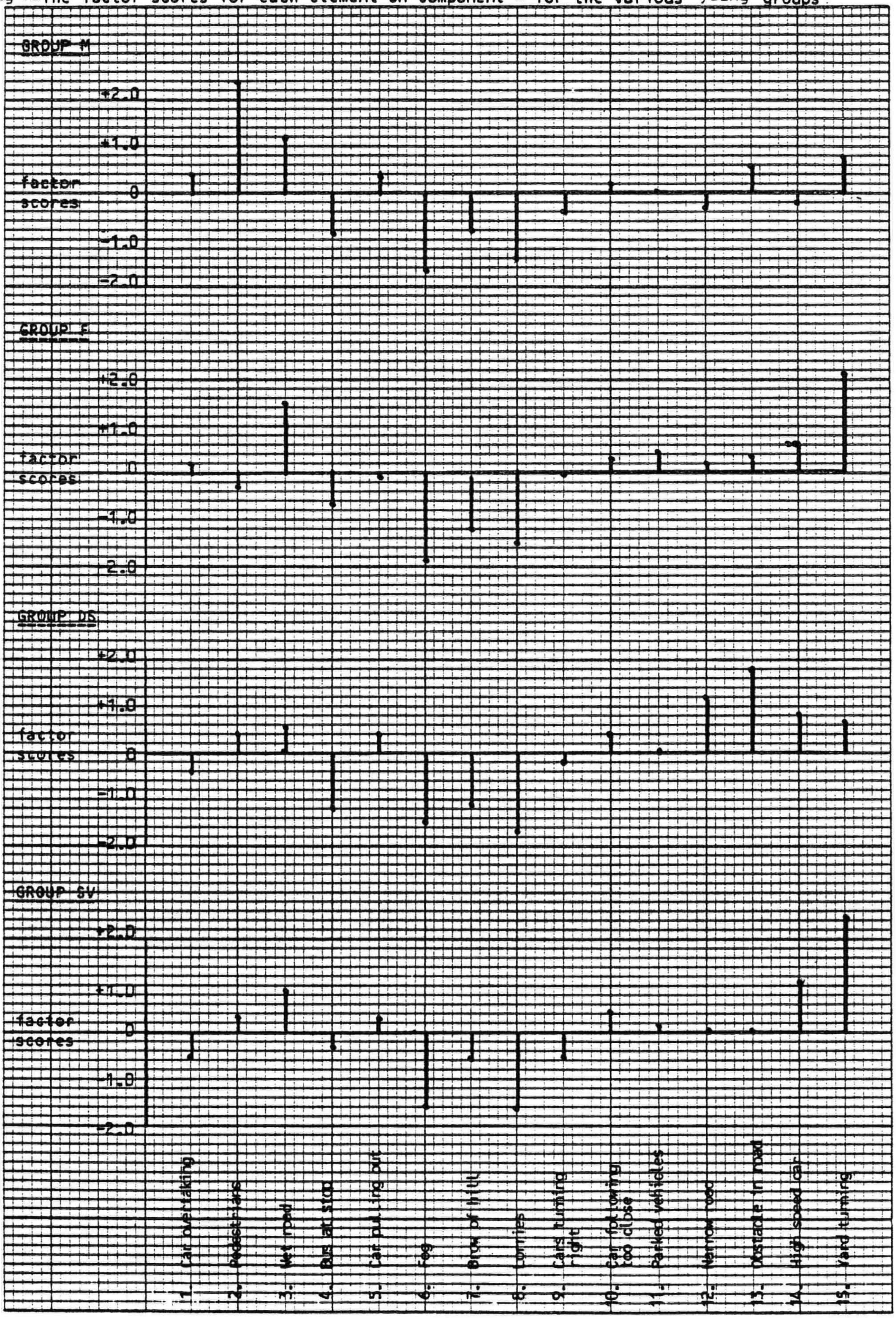


Fig 9b The factor scores for each element on Component C for the various young groups.



Again there are exceptions in some groups to this and each groups pattern of elements differs to some degree.

Finally table 21 shows component D which does not appear to have any consistent pattern of constructs, although in some groups it may be similar to FOCUS cluster C labelled "confidence" (see p 71). The constructs in this component appear to be those that do not figure largely in any other components. It is possible that this component is different for each group of subjects.

Regarding the elements shown in figures 10 a and b the variation between the groups of those which have extreme factor loadings supports this, although there are some general consistencies. For example all the young groups and the SV old group have put E2 pedestrians at one pole and five of the groups have put E15 yard turning at the opposite pole. It would however seem that the differences between the groups here are more marked than the similarities.

In summary the PCA analysis has shown that the most important component for the old and for the young subjects are different. The young subjects appear not to place enough importance on the features of hazards, that is those things which are most easily noticeable and less a matter of judgement, such as motion (C2) whether or not human (C6) and whether or not natural (C7). Apart from this three of the four components produced by each of the eight groups were fairly similar. Variations between groups occurred regarding some of the elements that were most strongly related to each of the components.

TABLE 21 THE HIGHLY LOADED CONSTRUCTS, PERCENTAGES OF VARIANCE ACCOUNTED FOR AND ORDER OF IMPORTANCE OF COMPONENT D FOR EACH GROUP

	OLD				YOUNG			
CONSTRUCTS	M	F	DS	SV	M	F	DS	SV
1 expected hazard-unexpected hazard			.890		.938			
2 still - moving								
3 most quickly noticed-less quickly noticed								
4 not always a hazard-always a hazard		.850		.895				.828
5 controls my movement does not cont my mov	.855						.780	
6 not human hazard-human hazard								
7 natural hazard-unnatural hazard								
8 wont injure me-may injure me						.709		.880
9 attracts attention-does not attr attn								
10 clear view-obscures vision								
11 I am in control of situation-I am not		.822				.886		.750
12 does not affect my speed-aff my speed							-.850	
% variance accounted for	12.1	16.9	12.0	12.0	12.0	13.3	20.0	21.3
Order of importance	4	3	3	4	4	4	3	3

Fig 10a The factor scores for each element on Component D for the various old groups

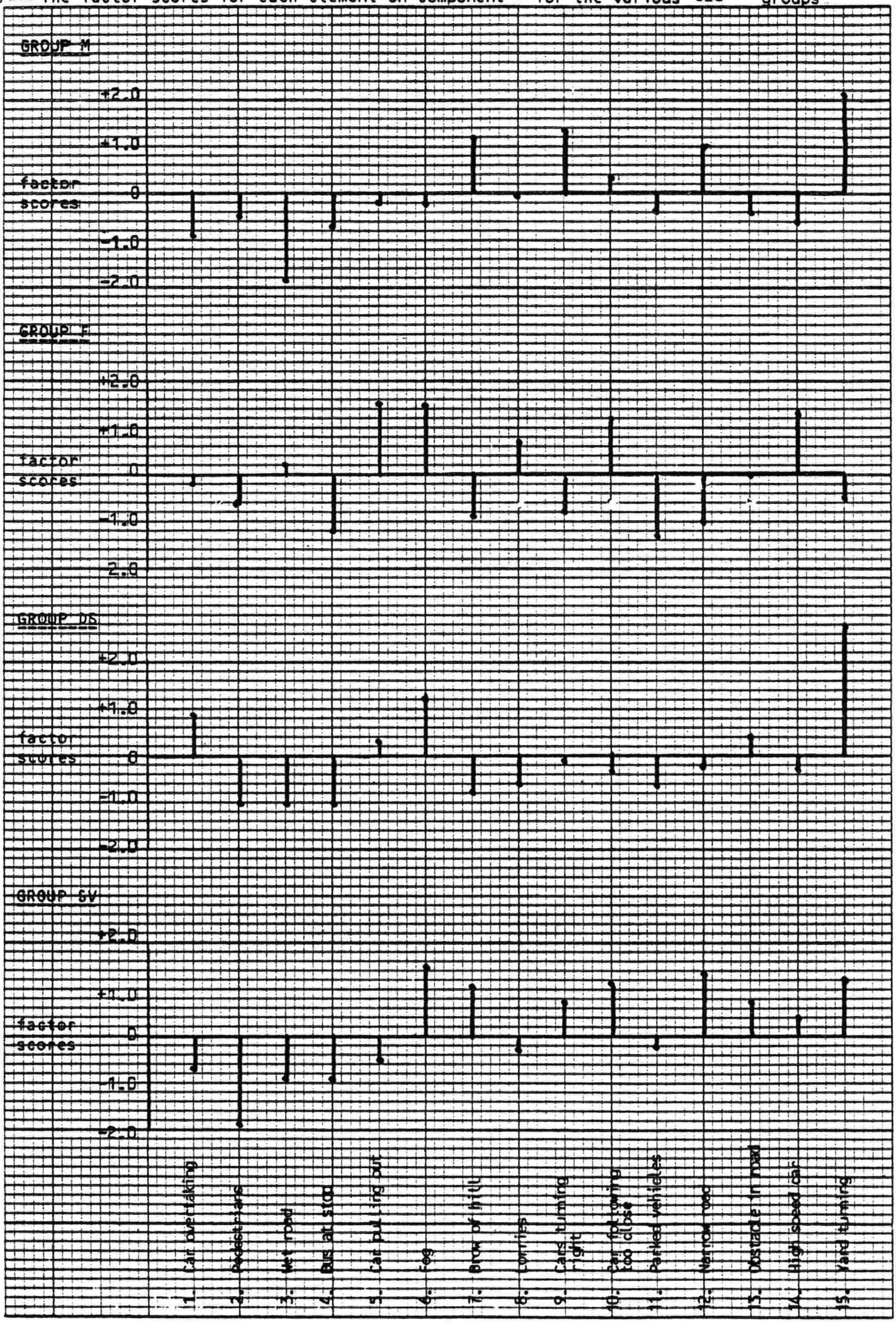
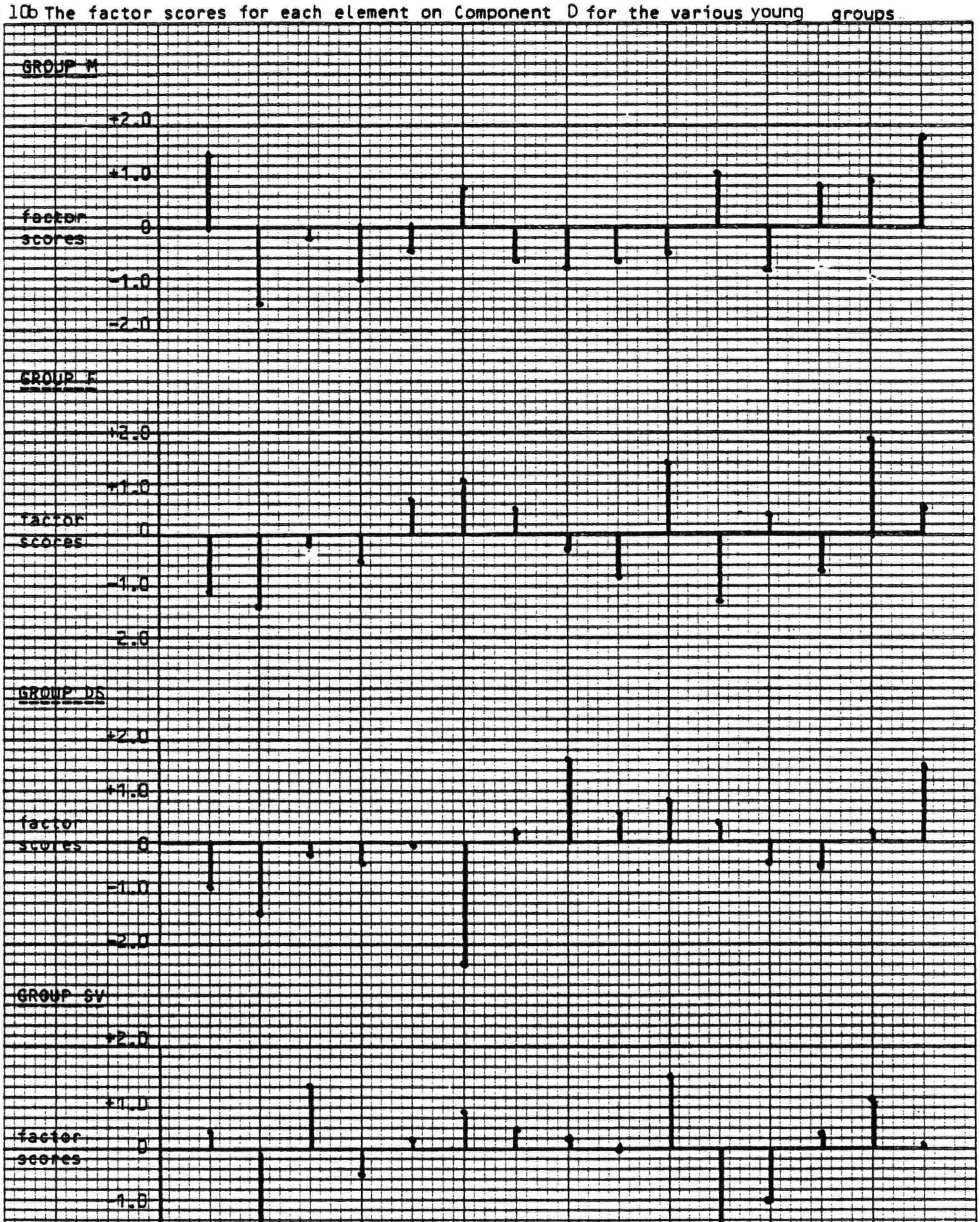


Fig 10b The factor scores for each element on Component D for the various young groups



4.3 Summary

The fixed repertory grid was completed by 10 old and 10 young subjects in four experimental groups (M, F, DS and SV). This made a total of eight groups. A significant midway response bias by the younger subjects, and extreme response tendecy for the older subjects was found in groups M, F and DS. It was hypothesised that older subjects rated extremely because they are more certain of their judgements. It was also hypothosised that the old SV group did not rate extremely because, being exposed to a continual stream of stimuli during the half hour it took them to complete the grid, resulted in them becoming less certain of their opinions. No corresponding differences in the mean ratings were found.

Grid Analysis for Beginners (GAB), Hierarchical clustering (FOCUS) and Principal Components Analysis (PCA) were run on the mean grids for each of the eight groups. That is grids with the mean response for each group in each cell.

GAB, FOCUS AND PCA analyses identified some similarities and some differences between the old and young subject groups in each of the experimental groups.

The GAB analyses revealed differences between the age groups in each experimental group, in that there were more element correlations for old subjects than young subjects. It was then hypothesised that this may mean that either young subjects are not classifying elements accurately or old subjects are oversimplifying the classification task.

The FOCUS analyses showed a degree of similarity in construct and element clusters for the old and young groups. But there were also differences between the groups in exactly how the constructs were related to each other and in the structural details of the sub clusters of elements. Each group appeared to display a unique pattern of construct and element relationships within a broadly consistent framework.

The PCA results also showed similarities between the groups as well as differences. The three clusters from FOCUS corresponded to three of the PCA components, but PCA was able to detect a further difference between the old and the young subject groups that FOCUS, or GAB had not been able to. This was the difference in the variance accounted for by one of the components. This difference regarding the importance placed on a component implies that old and young drivers may be using a differently balanced framework of perceptual dimensions, which may result in them encoding information differently.

There were also some difference between groups in the constructs and elements that were most highly related to the components. No consistent pattern which differentiated either all old groups from all young groups or one experimental group from the others was found.

The fixed repertory grid did then differentiate between old and young drivers in a number of ways. The implications of these results and suggestions for further work are in the concluding chapter.

Chapter 5
Conclusions

The main objectives of this work were, to investigate a number of assessment methodologies for their success in assessing road users' subjective evaluations of road hazards at particular sites, and to develop the most successful of them. The criterion used to judge the success of a technique was its ability to differentiate between old (over 45 years) and young (under 25 years) drivers. This is because these two groups have known differences in their accident frequency and are therefore presumed to perceive hazards differently.

It is possible that the accident rate of younger drivers is, irrespective of any differences in risk perception, due to different views on the level of risk that they are willing to accept. However, although perception of risk and willingness to accept risk can be discussed separately, there is evidence that the two interact, with perception influencing willingness and vice versa. In the same way the level of experience of a driver will interact with perception, although it should be noted that in this research experience was not controlled for directly.

The first techniques to be assessed were non-directive, focused and critical incident interviews. These were all unsuccessful in eliciting responses regarding road hazards. Of those hazards that were reported there were more which included a human element than there were features of the fixed road environment. It seemed that drivers considered the road environment as a permanently fixed landscape which it was their job to negotiate successfully.

It is possible that hazards of the road were infrequently referred to as subjects were not able to identify them unless confronted with an actual situation. As no specific sites were presented to the subjects as a stimulus, their responses may have been fixed at a general level, including human hazards that can occur anywhere on the road network. There was further evidence to suggest that subjects needed a stimulus related to particular sites, as they often asked for a paper and pencil to make sketches of the road layouts that they were discussing, and they always talked about a particular junction or road rather than a general class of road situation.

The results from this part of the study showed that the interviewing techniques were not successful as methods for uncovering drivers' perception of hazards. However they were useful in that they revealed the importance of visual stimuli.

A number of pre-pilot tests which aimed to check the response to visual stimuli and prepare the Q-sort and the repertory grid were next done. These showed that visual forms of presentation, that is photographs, were better at eliciting hazard responses, particularly discrete parts of the road environment, and that the methods could be successfully adapted to suit requirements.

Pilot experiments which investigated four variants of the repertory grid, and the Q-sort were next investigated and these all included some form of visual presentation. No real problems in the administration of any of the techniques were encountered. The Q-sort did not differentiate between old and young subject groups, as there was a great deal of variation between individual subjects in their ranking of the hazards. This may have been because they ranked them in the order most pertinent to a particular situation known only·to themselves. This hypothesis is supported by the fact that in some cases during Q-sort and repertory grid trials subjects spontaneously asked what manoeuvre they should imagine themselves undertaking. In this case it would seem appropriate to stipulate in future not only the junction to be rated but also the details of the man uvre being executed and the surrounding traffic flows etc. It is felt that further work on this technique may be profitable.

In all the variants of the repertory grid investigated there was a significant response bias, with the younger drivers most often responding at the mid scale points and the older drivers most often responding at the extremes of the scale. This phenomenon was most apparent for the fixed repertory grid variant so it was selected as the

most successful technique for further investigation.
It was hypothesised that the extreme response style displayed by the older drivers, was due to their greater certainty of judgement regarding the hazards rated. No other explanation of a systematic response bias of the type required to account for the difference between old and young subjects' ratings was found. This discrimination was not perhaps as significant as if there had also been differences in the means, however after running further subjects on the fixed repertory grid the phenomenon was still apparent.

All of the variants of the repertory grid investigated used only small samples of drivers, however differentation between the age groups was still achieved. It is possible that further work on the other variants that were not selected would be useful and the results from this study give some indication of how this may be achieved. In the variant which used photographs of sites as elements the broader nature of the results may allow it to be used in a broader context to investigate road users general perception of hazardous environments.

The repertory grid administered in a standard way, that is with personal constructs and elements may be best applied to individual drivers for the purpose of, for example, investigating the particular problems of high accident rate drivers or disabled drivers. As stated previously constructs are always personal so the best possible technique should be the standard one, however where information regarding the generality of road users' perception of hazards is required a fixed grid, which uses a consensus of elements and constructs, is the best possible alternative, (providing that a concensus is possible) because it allows comparison between grids.

This research investigated a semi-fixed grid, which used set elements with personal constructs, and a fixed grid which used the same set elements together with set constructs. Where elements and constructs were set they were derived from a consensus of a small number of other subjects. Further work on exactly how generalisable elements and constructs are needs to be done, to see if those reported differ markedly between sub groups of the driving population and or different site types. The elements and constructs used here may not have been ideal but they were derived from a consensus of subjects opinions about one site.

In all the fixed repertory grid tests only two sites were investigated, which were similar in configuration. This is obviously inadequate to definitively test a methodology therefore once it is established how generalisable elements and constructs are, repertory grids should be run for a number of different types of site. In addition photographs of sites were mainly used in these experiments; in future it may be better to use video recordings since this would add realism to the task without introducing a lot of "noise" into the results, because of the variation in stimuli experienced between subjects when asked to rate hazards on site.

Most of the repertory grid variants that were assessed used a micro-computer for administration. It was felt that for eliciting elements and or constructs which was done in every technique except the fixed repertory grid this was not ideal, as it appeared to impede elicitation processes. However the use of a micro-computer does aid the handling of data and analysis immensely. As to whether the fixed repertory grid subjects were affected by simply feeding their ratings into the computer is not clear, although it is unlikely that this would account for the response difference between old and young subject groups.

The fact that the older drivers who completed their fixed grid manually on site did not show an extreme response tendency after rating the hazards on the first few constructs, could be interpreted as evidence that the computer itself had affected older drivers' ratings previously. This seems unlikely, although further work would be required to check this.

The statistical analyses that were done on the mean grids for all the groups investigated, all used the correlational structure of the rows and or columns as their basis. In this way differences between extreme responses and midway responses were not apparent, as differences in scaling do not change correlations which are independent of the scale of measurement.

It was felt that the results from the statistical analyses were more important than the response bias finding since they enabled a clearer interpretation of the data to be made. However it should be noted that calculation of the mean grids resulted in the scale of measurement being reduced considerably for both age groups. This may have been because opinions differed within groups on the rating in any one cell, which is consistent with the Q-sort findings. Yet correlational structures showed that there was general agreement between the hazards that were correlated with each other over the constructs, and the constructs that were correlated together over the elements.

The analyses showed that in general there was a lot of agreement between the way males at two different but similar sites, females, and male subjects completing their grids manually on site perceive hazards. This is important since it indicates that the results form a meaningful pattern, and that there is stability in the way that drivers deal with their environment. However the fact that some differences between the age groups were uncovered indicates that the method may be of help in explaining the differences in accident rates between old and young drivers.

It was found that hazards were more highly correlated for old subjects than they were for younger subjects. This may mean that the younger subjects have not adequately classified those hazards. It may account for the younger subjects' slower reaction times to hazards, cited previously, because their cognitive processes are not as organised as those of the older driver. However it must not be overlooked that the older drivers may be overclassifying hazards and becoming functionally fixed.

The significance of these extra correlations may be related to subjects' overall hazard perception in the way outlined above, or it may be peculiar to the sites investigated. It is possible that the hazards with less correlations for the younger subjects are rated as unlike other hazards because they are felt to be particularly hazardous at that site. Investigating a number of sites would clarify this, although the latter explanation seems more plausible since, as the results from this research have suggested, it appears that drivers perceive hazards in a site-specific way. Should this interpretation be correct then the repertory grid could be used as a diagnostic instrument for discovering the perceived causal factors of accidents at particular sites, which would aid engineers in their assessments of sites requiring remedial work.

In relation to the pattern of constructs, although there was no noticeable difference between the correlational structures of the old and young subject groups there is now evidence that the perception of hazards is a multi-dimensional thought process. The components generated from the Principal Components Analysis (PCA) were obviously restricted by the constructs used in the fixed grid, however these constructs, as stated before, were elicited from a number of subjects. Given that these twelve constructs produced four fairly uniform components for each of the groups there is strong evidence that drivers use similar dimensions of thought in perceiving hazards.

In further research it would be useful to investigate whether these dimensions differ at different types of site. This would involve, as stressed previously, further investigation of the constructs used by drivers. In addition, examination of how the hazards relate to the dimensions should be further researched. It may also be useful to explore professional drivers' components, as the evidence from this research shows that the more experienced driver uses the same dimensions but apportions different amounts of importance to some of them. If the results from this research are confirmed, in that inexperienced drivers consistently place less importance on the dimension that encompases descriptions of the outward most manifest features of hazards, then this would aid driver training programmes. For example stress could be placed on teaching recognition skills.

The conclusions drawn from this research regarding how the fixed repertory grid may be used are necessarily tentative. One of the main objectives of this research was to select one technique from a number investigated, that could assess drivers perception of hazards. It is felt that this objective has been achieved, although further research is required to examine exactly how it may best be applied.

APPENDICES

(1) The schedule of required information for the non-directive, focused and critical incident interviews.

(2) A list of the hazards referred to in the initial responses to the non-directive, focused and critical incident interviews by all the subjects.

(3) A list of the hazards referred to, additional to those spontaneously made, in the non-directive, focused and critical incident interviews by all the subjects.

(4) A list of the focused questions for eliciting elements in the pre-pilot tests.

(5) The three photographs used for element elicitation in the pre-pilot tests.

(6) The six photographs, used in addition to those in Appendix 5, in the photographs as elements pre-pilot tests.

(7) A table of the techniques used on each subject in all the pre-pilot tests.

(8) Photographs of nine local (Enfield, Middx) T junctions used as elements in the repertory grid-photographs as elements pilot experiments

(9) Three views of the site Derby Rd/Lincoln Rd used as an aide memoire in the repertory grid on site pilot experiments.

(10) Three views of the site Kingsway/Southbury Rd. used as an aide memoire in the repertory grid on site pilot experiments, and used as a stimulus in the semi fixed grid, fixed grid and Q-sort.

(11) A list of the set elements used in the Q-sort, semi fixed

repertory grid and the fixed repertory grid.

(12) A list of the set constructs used in the fixed repertory grid.

(13) Constructs elicited in the photographs as elements pilot experiments.

(14) A list of the elements elicited by each subject at each site and the total distinct elements at each site, in the pilot experiments repertory grid on site.

(15) A list of the constructs elicited by each subject at each site and the total distinct constructs at each site in the pilot experiments repertory grid on site.

(16) A list of the constructs elicited in the semi-fixed grid, pilot experiments at Kingsway/Southbury Road.

(17) Mann-Whitney U tests for the Q-sort pilot experiments.

(18) Mann Whitney U test for the values of the midway response index for individual subjects in the pilot experiments.

(19) Photographs of three views of Glynn Road/Southbury Road, for the different site (DS) fixed repertory grid subjects

(20) Example of the manually completed grid schedule

(21) An example fixed grid

(22) The Mann-Whitney U test for the difference in midway response index between old and young subjects in groups M, F, DS and SV.

(23) The mean grids for the old subjects and the young subjects for groups M, F, DS and SV.

(24) A brief explanation of Grid Analysis for Beginners GAB.

(25) A brief explanation of Hierarchical clustering FOCUS.

(26) A brief explanation of Principal Components Analysis PCA.

(27) Factor loadings for each construct on the four components for groups M, F, DS and SV old and young groups together with the factor scores for each element that relates to each of the components.

APPENDIX 1

THE SCHEDULE OF REQUIRED

INFORMATION FOR THE NON-DIRECTIVE, FOCUSED AND CRITICAL INCIDENT INTERVIEWS

NAME........................ LICENCE [ ] SUB NO.:

1. DRIVING HISTORY Can you give me details of your driving history?

Do you have an advanced driving qualification? [ ]

Dates	Licence Prov. Full	Vehicle Type Van/Cycle Lorry/Car	Owner	SDP and/ or work	Approx p/w		Typical weeks driving	
					miles	hrs	Times	road type

Additional Comments

Holiday driving/abroad

Illness

Longest Trips

Other car drivers

Drivers of your car

etc.,

2. Accident History Can you tell me about any accidents that you have had?

Date	

Convictions: Can you tell me if you have any driving convictions?

Date	Circumstances/Offence	Fine/Disqual.

Parking Offences

Date	Circumstances	Penalty

Police Have you had any contact with the police when driving?

Date	Circumstances	Outcome

3.Questions

1. What would you say you like about driving?

2. What would you say you dislike about driving?

3. Can you describe a route that you use a lot? Which is the most dangerous bit? (and why)

4. What do you think about speed limits?

5. What is your opinion of pedestrians?

6. What do you think about roads and road signs?

7. What is your view of different types of weather when driving?

8. What is your opinion of other drivers?

9. What is your definition of a road accident?

10. What is the riskiest situation you´ve been in when driving?

11. What do you think the likelihood of you having an accident is?
(in the next 10 years)

12. In the scale from 0-10 where?

13. What might the cause(s) be?

4. Personal Details

Name   Tel No.

Address   Age

Sex

Do you live alone? how it affects driving

Children   Ages

Educational History

Date	Level Self	Date	Level Spouse/Parents

Date	Job Self	Date	Job Spouse/Parents

Where did you see the advertisement for this interview?

APPENDIX 2

A LIST OF THE HAZARDS REFERRED TO IN THE INITIAL RESPONSES TO THE NON-DIRECTIVE, FOCUSED AND CRITICAL INCIDENT INTERVIEWS BY ALL THE SUBJECTS

question	subject	page	Non-directive interview	hazard category
A	8	1	unmarked junction (car emerges)	E
B	2	7	misjudged the speed	H
B	1	4	overtake car turning right (thought it was	H
			motorway not dual carriageway)	V
B	12	7	track road wet	H
B	13	4	distracted	H
B	14	4	wrong way up a one way road	H
B	16	10	side road not marked up (car emerges)	E
1	8	12	lorry drivers right up close (behind)	H
2	2	10	drive too fast in dangerous conditions ----- fog	H
2	2	10	" " " " decent conditions	H
2	10	10	full beam on	H
			Total	11

			Focused interview	
3	6	20	both directions car doing 60 mph on little flick	
			in bend	H
3a	4	11	TL's 3 lanes and the other side only 2 lanes	E
3a	8	15	juggernauts turning (right)	H
	9	13	take a chance turning right	H
	5	20	getting onto the right....to turn right if there's	
			a lot of traffic	H & E
	5	20	getting on roundabout (if there's a lot of traffic)	H & E
	7	15	long run from one set of TL's to another... put	
			foot down before you realise your at the TL's	H
	10	19	dual carriageway down to one lane...steep hill	
			(before) really put their boot down	H & E
	10	19	parked vehicles...no road markings...you've got	
			to creep right out	E
	10	19	college gates	E
	14	8	no white lines down the road	E

	14	8	junction...do not get a good view of the traffic coming in both directions	E
	15	5	traffic lights...not working	E
	11		cycle lane...ends (at crossroads)	E
4	8	16	speed kills	H
	9	14	drive too slowly	H
	9	14	drive too quickly (under particular conditions)	H
	7	16	doing 80 mph...police car...slow down...bloke behind going to go straight into you	H
	10	21	kids and little ones running about (+ speeding)	H
	14	18	fast area of road that allows them to go more than 30	H & E
5	2	14	jaywalkers	H
	2	14	zebra crossing...suddenly step out (pedestrians)	H
	2	14	someone too close behind you	H
	8	17	children...take more chances	H
	8	17	and the elderly	H
	1	10	people do silly things (step out at zebra's)	H
	10	22	pedestrians...cross just before crossing in a dangerous white line area	H
	10	23	pedestrian crossing...other motorists overtaking you	H
	10	23	children	H
	11	8	children	H
	11	8	pedestrian crossings...dangerous in places...like coming off roundabouts	E
	12	13	older ones (pedestrians)	H
	12	13	children "	H
	14	9	pedestrians...walk out in front of you	H
6	7	17	road signs...broken...lights do not work	E
7	9	10	people tend to slow down...its dodgy (weather conditions)	H
	6	25	rain...car doesn't accelerate...windscreen wipers stop, lights go out	V
	6	25	snow...drive too fast	H
	6	25	fog.... " " "	H
	12	15	icy...most dangerous	E
	14	11	blinded by the glare (sun)	E

	16	18	fear...fog	E
	8	19	rain...worst weather condition...dipped headlights (coming towards you)...cannot see	H
	7	17	drivers do not drive according to the weather	H
	10	27	worst are fog, ice and snow...most poeple do not have a clue how to drive in fog. no...or inadequate lights	H
	12	15	worst...very thick fog	E
	12	15	accidents...happen fog or snow	E
	13	10	odd one ore two are very dangerous (other drivers)	H
	14	11	tend to pull out...more reckless (London drivers)	H
	14	11	road...goes from three lanes to two lanes to one	E
9	12	16	cat or dog run out	E
	12	16	fallen masonry	E
	12	16	wasp or bee in the car	E
	12	16	sneezing	H
			Total	54

Critical incident interviews

2	20	car overtaking	H
3	13	when had a few drinks	H
4	16	caravan...(no) extending mirrors...could not see behind	V
8	21	not adhere to sequencing of lights	H
9	21	patch of ice	E
1	14	ice conditions	E
5	25	(lorry shedding its load)	V
7	18	motorway...fog...pile up	E & H
10	31	(jumping the lights)	H
12	18	left hand bend, and I lost the back of the car	E & H
13	11	changing chanel on the radio and almost go into the back of another car	H
13	11	motorcyclists...you do not seem them	H
14	12	pull out...do not appreciate how fast they are going	H
16	20	parked car (pulling out)	H
16	20	chap I'm following behind...steps on the motorway	H

11	5	23	someone come out a side road	H
13	4	18	burst tyre	V
	9	22	impatience causes a lot of accidents	H
	9	23	coming out side turning...do not make that decision quick enough or they make the wrong decision	H
	5	24	turning right without giving signals	H
	7	19	jump the lights	H
	10	32	anticipation (wrong?)	H
	11	12	pull out (not) making certain	H
	12	17	driving too fast	H
	13	13	(lack of) concentration...distractions at the side of the road	H
	14	13	not concentrating...in a day dream	H
	14	13	somebody in front of you suddenly stopping	H
13	15	12	lack of concentration	H
	16	21	a misjudgement	H
				Total 29

KEY

H = human

E = environmental

V = vehicular

APPENDIX 3

A LIST OF THE HAZARDS REFERRED TO, ADDITIONAL TO THOSE SPONTANEOUSLY MADE, IN THE NON-DIRECTIVE, FOCUSSED AND CRITICAL INCIDENT INTERVIEWS BY ALL THE SUBJECTS.

Subject no.	Page of transcript		less initial response (prev)
2	9	wheel fall off	V
	14	older pedestrians	H
	14	pedestrian (shoppers)	H
	15	do not know where your going...not concentrating on driving	H
	15	one way system	E
	16	lack of place direction signs	E
	16	not indicating correctly	H
	16	parking where they shouldn't	H
	17	snow and ice	E
	18	dog (in car) distract you	H
	18	kids " " " "	H
3	10	(lack of) road signs	E
	10	" " pedestrian crossings	E
	10	speeding (cars)	H
	11	snow	E
	13	brake pads worn	V
	13	car coming out of side road	H
4	5	stalling	H
	8	heart attack...driver collapsing	H
	8	blow out	V
	8	speed...skidding	H
	11	drinks	H
	13	other cars and lorries	H
	13	motorbikes go up the inside of vehicles	H
	14	(clapped out car)	H
	15	cutting in front if overtaking	H
	15	women in front too slow and cautious	H
	16	someone walked out on a zebra crossing	H
	17	(traffic by) zebra crossing	H
	17	dog running out	H & E
	17	something falling off the back of a lorry	H & E

4	17	black ice	E
	18	places where you should have white lines and bend signs	E
8	13	lorries park in residential area	H
	14	lorries speeding	H
	14	" spray	H
	14	" jack-knife	H
	14	other drivers	H
	15	traffic coming round the junction	H
	16	motorway (impression of standing still)	H
	17	women...by Tesco's	H
	18	dipped headlamps (law) + rain...lights dazzle	*
	21	(not) concentrating...road curved and I come to a RAB	E & H
	22	drinking and driving	H
9	5	parked...edging out	H
	6	(driving damaged car) one headlight, front...banging	H
	10	playing games...won't let anybody go...loose concentration	H
	13	parked vehicles	H
	15	speed (with) ice, rain or fog - people drive in the wrong conditions	H
	16	blow out	V
	19	(not enough warning of road changes)	E
	19	(when) you do not know where you are driving	H
	20	dogs	E
	20	cyclists	H
	21	rain...traffic is increased	E & H
1	8	bottle necks	E
	10	ran straight out in front (pedestrian)	H
	10	hedge right by the road	E
	10	parked cars	H
	10	pedestrians running for buses	H
	10	ice cream vans - little kids	H
	12	no parking on pavements...back roads...even narrower	*
	13	one way street...people overtake on inside (inexperienced driver)	H

1	14	old drivers	H
	15	down hill...brakes went	V
	15	no barriers at the edge of the road	E
5	7	(car following too close)	H
	7	lorries fast	H
	8	ice	E
	9	parked cars...places they shouldn't	H
	15	old lady walked out into the road	H
	18	other drivers speed	H
	20	traffic at lights - frustration	H
	21	people going too slow	H
	22	people looking round for places	H
	25	timber sticking out of a lorry	H
6	2	car pulled out	H
	2	map (reading)...carry on driving	H
	4	speed	H
	4	drink and drive	H
	5	groups of people...trying to cross	H
	6	lorries pulling out	H
	11	(wrongly anticipated)	H
	15	decided to overtake 'cos he thought I was pulling out	H
	21	roundabout	E
	22	(not) concentrating	H
	24	zooming around...country lanes	H
7	6	overtake parked lorry	H
	7	snow, ice	E
	8	(car overtaking)	H
	13	state of vehicle	H
	13	remoulds	V
	16	(pedestrian) walk straight out on the zebra crossing	H
	17	new in town, looking for signposts	H
	17	sign post dirty	E
10	9	little electric cars	V
	12	motorcyclist	H
	13	overcareful...hesitate	H
	14	(no) white line (priority)	E

10	14	car...pulled out	H
	20	slight bend - deceptive straight road	E
	20	pulled out round bus...misjudged it	H
	20	sign...in the wrong place	E
	20	frustration in the rush hour	H
	28	hand signals...bloke behind doesn't know what they mean	*
11	1	motorway about 70 mph can't feel the sense of speed	H
	2	busy place	H
	8	going along fast	H
	8	turning left at no left turn	H
	10	hasty drivers	H
12	6	drive when you are tired	H
	6	drive on side lights	H
	10	frustrated...slow coach...zoom up the inside	H
	10	distractions...(too many people in car)	H
	10	distractions...animals in cars	H
	14	overtaking...dangerous spot	H
	14	hesitate...going across a major road	H
	15	sunset...glare	E
	17	bad weather	E
	17	bad road conditions	E
	17	not using mirrors	H
	17	wrongly indicating	H
	17	kiddies on bikes	H
	17	football...on the road	H
	18	drunken friend (in car)	H
13	3	pulling in and out in front of other cars	H
	3	hesitated then pulled out	H
	6	pull out and not speed up	H
	7	roundabout...pulling out	H
	7	overtaking...road narrows...cars...going too fast	H
	8	children	H
	8	old people	H
	8	mental patients	H
	9	traffic...stand still	H
	10	continental drivers...roundabout in wrong direction	H

13	10	too fast if there is a...school or urban area (drivers perception)	H
	10	vehicles (bad condition)	H
	10	weather conditions...ice...fog...drivers' perception	H
	10	children...with their cycles	H
	10	ice cream van	H
	11	slow car pulling out	H
	12	pull over lanes	H
	13	high speed	H
14	4	skidded...brakes weren't very good...condition of of road surface and narrow lane	H & E
	6	roundabout...dart out and ...cut their way in	H
	17	tense...and rushing...pull out	H
	8	minor road...bus coming the other way	E & H
	9	cyclists	H
	11	fog	E
	11	cold...windows freeze over again	E
	11	overtake...in the wrong place	H
	12	mud and...a bit wet...didn't perceive danger of skid	H
15	6	speed on bends	H
	8	snow and ice	E
	9	overtaking	H
	9	pulling out	H
	12	clear road 30-40 miles...into traffic jam would not adjust to new situation	H
	12	attractive girl...distracts my attention	H
16	13	dithering drivers	H
	17	(lack of gap) shoot out a bit quick	H
	17	a bit tight behind	H
	21	miscalculation of distance	H
		Total	162

APPENDIX 4

A LIST OF THE FOCUSED QUESTIONS FOR ELICITING ELEMENTS IN THE PRE-PILOT TESTS

(1) Accident History - whilst you tell me about each accident I want you to note down all the key words ie the words that express some part of the accident.

(a) Describe the scene?
(b) What happened/was there just before?
(c) What happened/was there just after?
(d) What was/were the cause(s)?
(e) What was/were the contributory factors (by %)?
(f) Where does the blame lie?
(g) How could this be prevented in future?

(2) Repeat (1) for seen accidents, speculate on the unknown aspects.
(3) Repeat (1) for heard of accidents, speculate on the unknown aspects.
(4) Repeat (1) for likely accidents, speculate on the unknown aspects.
(5) Repeat (1) for most risky near-miss (incident when driving), speculate on the unknown aspects.
(6) Repeat (1) for imagined bad accident, speculate on the unknown aspects.

(7) Tell me a route you use a lot, noting down dangerous risky or hazardous features as you come to them.

(a) what is the most dangerous part of the route.?
(b) why?
(c) describe the scene there.

(8) Repeat for another route.

(9) (a) Definition of an accident?
(b) Definition of a slip road?
(c) Definition of a junction? necessary action at?

(10) Tell me all the hazardous/risky/dangerous things you can think of on the road?

(11) Take each one from question 10 and try to enlarge it by,

(a) Thinking of a situation when it was there/happended
(b) Going through a route with it in
(c) Outlining other types of similar hazards.

(12) Give them a category of road features/hazards and ask them to fill it in with as many things as possible

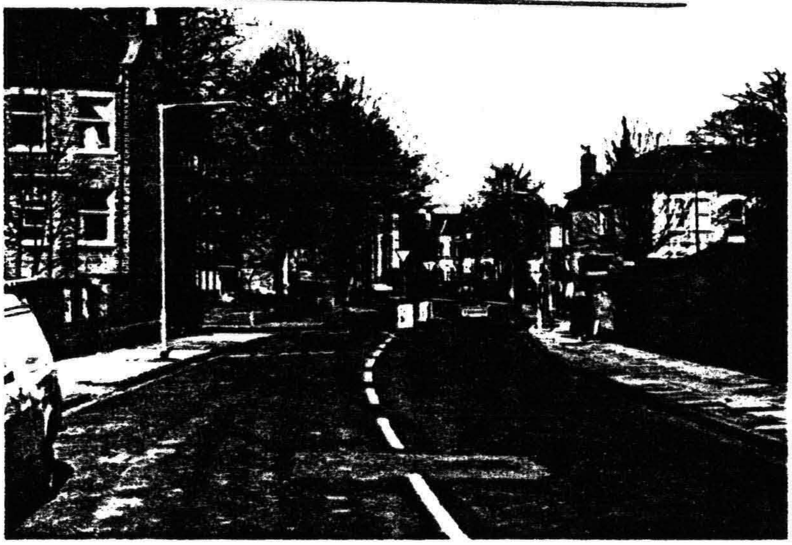
Types of road
Types of junction
Features of the achial road
Concrete permanent added features on the road
Non Concrete permanent added features on the road
Others on the road
Road surface conditions
Surrounding conditions
Types of transport
Legal autonomous happenings
Illegal happenings
Non autonomous happenings
Safety features of the road

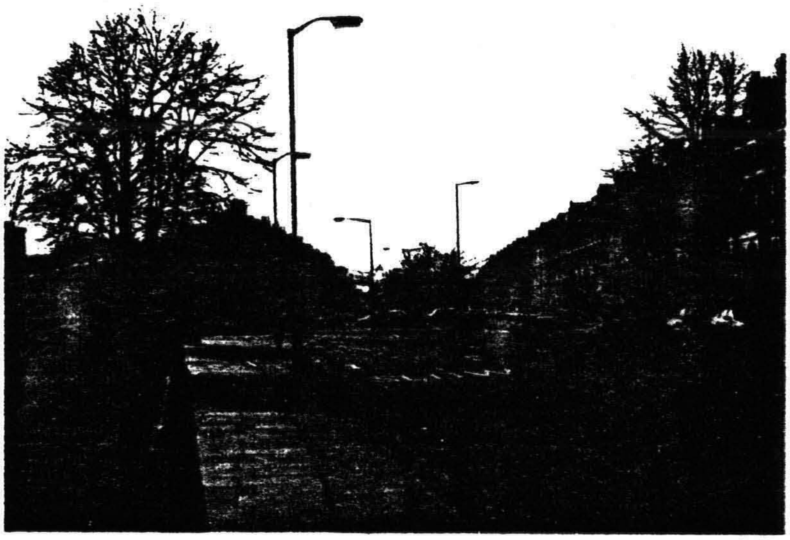
APPENDIX 5

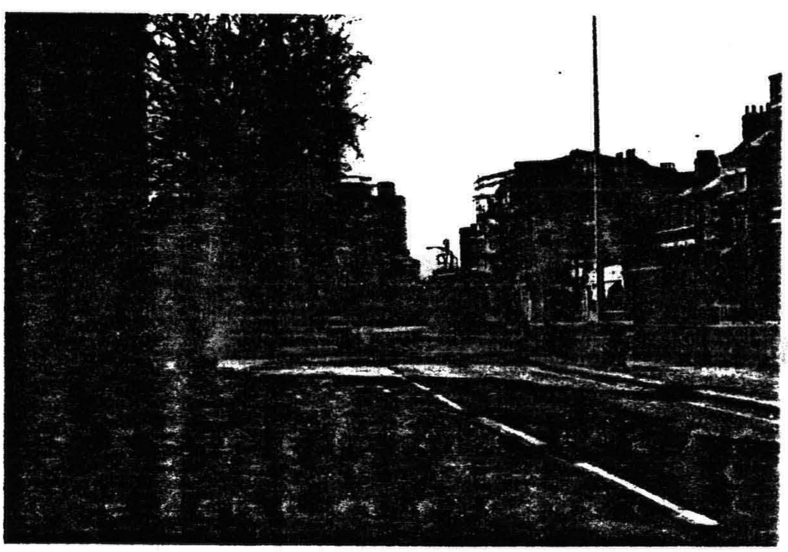
THE THREE PHOTOGRAPHS USED FOR ELEMENT ELICITATION IN THE PRE PILOT TESTS.

APPENDIX 6

THE SIX PHOTOGRAPHS, USED IN ADDITION TO THOSE IN APPENDIX 5, IN THE PHOTOGRAPHS AS ELEMENTS PRE-PILOT TESTS.







Appendix 7

A TABLE OF THE TECHNIQUES USED ON EACH SUBJECT IN ALL THE PRE-PILOT TESTS.

Technique	Subject 1	2	3	4	5	6	7	8	9	10	11
Element elicitation											
Focused questions' (1)	/	/	/	/	/						
Questioning on photographs (2)						/		/	/		/
Construct elicitation											
Elements written on cards											
Triadic – set elements		/	/	/	/						
Triadic – elicited elements						/		/	/		/
Diadic – set elements			/								
Diadic – elicited elements						/					
Full context form - elicited elements			/	/							
Triadic - photo's as elements							/			/	
Subjects who rated their grid						/	/	/	/	/	/
Subjects who ranked – set elements					/					/	
Subjects who ranked – elicited elements											/

Note 1 see appendix 4 attached. Not all questions were asked to all subjects.

2 The photographs used can be seen on App. 5

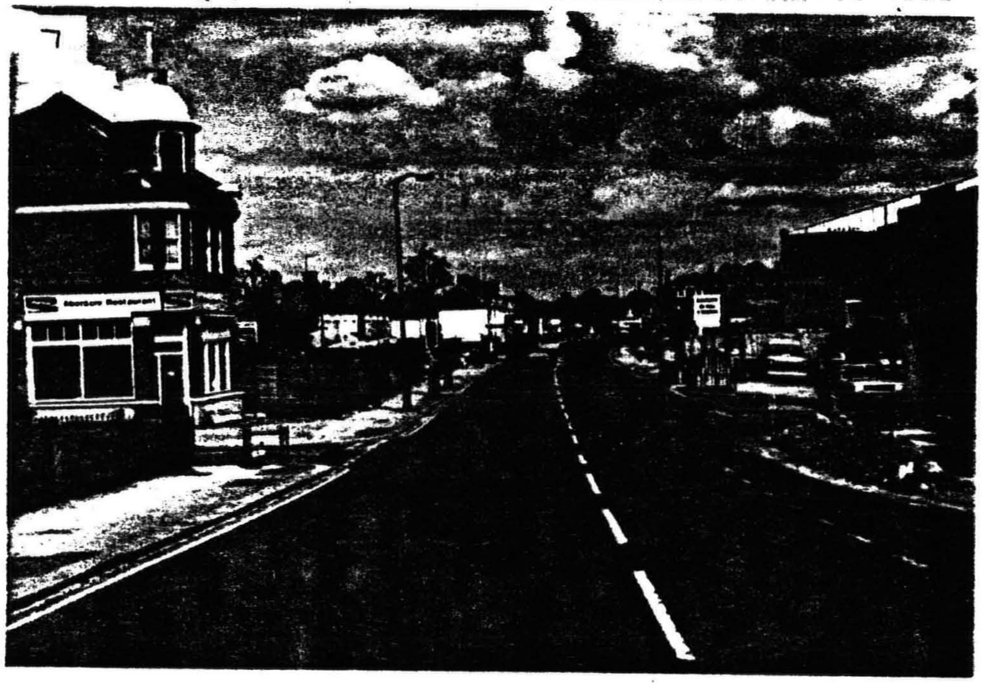
APPENDIX 8
PHOTOGRAPHS OF NINE LOCAL (ENFIELD, MIDDX) T JUNCTIONS USED AS ELEMENTS IN THE REPERTORY GRID-PHOTOGRAPHS AS ELEMENTS PILOT EXPERIMENTS

4

5

6

7



8

9

APPENDIX 9

THREE VIEWS OF THE SITE DERBY RD/LINCOLN RD USED AS AN AIDE MEMOIRE IN THE REPERTORY GRID ON SITE PILOT EXPERIMENTS.

APPENDIX 10

THREE VIEWS OF THE SITE KINGSWAY/SOUTHBURY RD. USED AS AN AIDE MEMOIRE IN THE REPERTORY GRID ON SITE PILOT EXPERIMENTS, AND USED AS A STIMULUS IN THE SEMI FIXED GRID, FIXED GRID AND Q-SORT

APPENDIX 11

A LIST OF SET ELEMENTS USED IN THE Q-SORT, SEMI FIXED REPERTORY GRID AND THE FIXED REPERTORY GRID

Kingsway/Southbury Road - taken from those already elicited from the site mentioned by more than one subject

1) car turning right
2) high speed car
3) parked vehicles
4) car pulling out
5) narrow road
6) brow of hill
7) yard turning
8) bus at stop
9) pedestrians

Extra potential hazards not previously mentioned

10) obstacle in road
11) lorries
12) wet road
13) fog
14) car overtaking
15) car following too close

APPENDIX 12 A LIST OF THE SET CONSTRUCTS USED IN THE FIXED REPERTORY GRID

Kingsway/Southbury Road - Taken from those already elicited from the site

1)	obscures vision	-	clear view
2)	moving	-	still
3)	I am in control of situation	-	I am not in control of situation
4)	natural hazard	-	unatural hazard
	were drawn more directly from those elicited		
5)	always a hazard	-	not always a hazard
6)	controls my movement	-	does not control my movement
7)	human hazard	-	not human hazard
	were more inferential		

Extra constructs added from previous information

8)	expected hazard	-	unexpected hazard
9)	may injure me	-	won't injure me
10)	attracts attention	-	does not attract attention
11)	most quickly noticed	-	least quickly noticed
12)	affects my speed	-	does not affect my speed

APPENDIX 13

Constructs elicited in the (Photo's as elements) pilot experiments

Age group		Pole/Contrast	
Young	1.	Blind Right Turn	/Not blind
	2.	Right of Way	/No right of way
	3.	Clear left turn	/Blind left turn
	4.	Wide clear road	/Narrow obstructed road
	5.	Less obstacles required	/More obstacles required
	6.	Emerging traffic	/No emerging traffic
Young	1.	Beware oncoming traffic	/Proceed
	2.	Road narrows	/Full road
	3.	Reduce speed stop junction	/Clear road proceed
	4.	Road bends reduced vision	/Straight road good vision
	5.	Little time to act	/More time to act
Old	1.	Hazards clear	/Hazards unclear
	2.	Clear vision	/Unclear vision
	3.	Normal Positioning	/Manouvre antic
	4.	Dangerous parking	/Safe parking
	5.	Road obstruction	/Road clear
	6.	High speed	/Low speed
Old	1.	Emerging Traffic	/No emerging traffic
	2.	Clear view of pedestrians	/Limited vision
	3.	Full width road	/Narrow road
	4.	No overswing	/Overswing
	5.	Long range	/Short range
	6.	Clear vision	/Limits vision

APPENDIX 14

A list of the elements elicited by each subject at each site and the total distinct elements at each site in the pilot experiments repertory grid on site

Age group	Concorde Road/Lincoln Road
Young	1. parked car
	2. fence
	3. narrow road
	4. cars turning right
	5. cars edging out
	6. car park
	7. bushes
Old	1. traffic emerging
	2. parked vehicles
	3. cars turning right
	4. no give way sign
	5. low kerb
Young	1. parked cars
	2. road bends
	3. car emerging side turning
	4. cars turning into turning
	5. telegraph pole

Total distinct elements

1. parked cars
2. cars turning right
3. cars edging out
4. fence
5. narrow road
6. car park
7. bushes
8. no give way sign
9. low kerb
10. road bends
11. telegraph pole

Age Group   <u>Derby Road/Lincoln Road</u>

Young
1. parked cars
2. cars pulling out
3. sweet shop
4. children
5. cars turning in
6. road narrows
7. pedestrians

Old
1. parked cars
2. speed
3. rat run
4. turning right
5. pedestrians
6. lorries
7. jack the lad
8. hesitating car

Old
1. narrow road
2. parked cars
3. children
4. dogs
5. speed
6. cars emerging from side turning
7. cars turning in

Young
1. turning right
2. parked cars
3. dip in road
4. double parking) from
5. rain) role
6. car pulling out) titles

<u>total distinct elements</u>

1. parked cars
2. cars pulling out
3. sweet shop
4. children
5. cars turning in
6. road narrows
7. pedestrians
8. speed
9. rat run
10. turning right
11. lorries
12. jack the lad
13. hesitating car
14. dogs
15. dip in road

Age group		Kingsway/Southbury Road
Old	1.	cars turning right
	2.	bus station
	3.	high speed driver
	4.	cars stopping
	5.	vehicles parked
	6.	drivers pulling out
	7.	narrow road
	8.	brow of hill
	9.	yard turning
	10.	bus stop
Young	1.	building on right
	2.	wall and sign
	3.	sharp turn left
	4.	filter-cars in
	5.	blind exit
	6.	left turners
	7.	parked vehicles
	8.	narrow road
	9.	bad right turn markings
	10.	short cut
	11.	heavy vehicles in short cut
Young	1.	blind hill
	2.	cars pulling out
	3.	children
	4.	bus at stop
	5.	queuing cars at lights
	6.	people
	7.	indicating too early for
Old	1.	cars speeding
	2.	cars not indicating
	3.	cars from factory

4. parked cars
5. pedestrians
6. cars turning right
7. buses turning right

Total distinct elements

1. cars turning right
2. bus station
3. high speed driver
4. cars stopping
5. vehicles parked
6. drivers pulling out
7. narrow road
8. brow of hill
9. yard turning
10. bus at stop
11. building on corner
12. wall & sign on corner
13. sharp left turn
14. cars turning left
15. bad right turn markings
16. short cut
17. heavy vehicles
18. children
19. queuing cars at lights
20. pedestrians
21. indicating too early
22. cars not indicating
23. buses turning right

APPENDIX 15

A list of the constructs elicited by each subject at each site and the total distinct constructs at each site in the pilot experiments, Repertory grid on site

Age group		Derby Road/Lincoln Road	
Young	1.	potential movement	static hazard
	2.	directly ahead	sides of road
	3.	doesn't obstruct vision	obstructs vision
	4.	may block road	permanent hazard
Young	1.	temporary	permanent
	2.	obstructive	negative
	3.	likely to encounter	not likely to encounter
	4.	static	moving
Old	1.	driver justifying act	no justifying needed
	2.	dont obscure vision	obscured vision
	3.	active pot hazard	static pot hazards
	4.	unpredictable	predictable
	5.	bad braking	good braking
Old	1.	mobile	static
	2.	most dangerous	less dangerous
	3.	uncontrolled	controlled
	4.	human	inanimate

Total distinct constructs

1.	potential movement	static hazard
2.	directly ahead	sides of road
3.	doesn't obstruct vision	obstructs vision
4.	may block road	permanent hazard
5.	obstructive	negative
6.	likely to encounter	not likely to encounter

7.	over justify act	no justification needed
8.	unpredictable	predictable
9.	bad braking	good braking
10.	most dangerous	least dangerous
11.	uncontrolled	controlled
12.	human	inanimate

Age group <u>Kingsway/Southbury Road</u>

Young	1.	Vision obstructions	non visual
	2.	immobile	mobile
	3.	left vision	right vision
	4.	turning right	turning left
	5.	controlled	uncontrolled
Young	1.	to do with road	not to do with roads
	2.	stopped vehicles	moving vehicles
	3.	not moving hazards	moving hazards
	4.	not people	people
	5.	cant overtake	can overtake
	6.	cant see through	can see through
	7.	not to do with nature	to do with nature
	8.	all the time	not all the time
Old	1.	involves turning right/left	not turning
	2.	unobstructed	obstructed view
	3.	do	dont cut accross others path
	4.	does not	cause cars go over white line
Old	1.	seen	unseen
	2.	moving	still
	3.	unsure	sure
	4.	other persons	myself
	5.	required to stop	not required to stop

Total distinct constructs

1.	vision obstructions	non visual
2.	immobile	mobile
3.	left vision	right vision
4.	turning right	turning left
5.	controlled	uncontrolled
6.	to do with the road	not to do with the road
7.	stopped vehicles	moving vehicles
8.	not people	people
9.	can't overtake	can overtake
10.	can't see through	can see through
11.	not to do with nature	to do with nature
12.	all the time	not all the time
13.	do	don't cut across others path
14.	does not	cause cars to go over white line
15.	required to stop	not required to stop

APPENDIX 16

A list of the constructs elicited in the semi fixed grid pilot experiments at Kingsway/Southbury Road

Age group			
Young	1.	braking problems	less braking problems
	2.	more caution & forethought	less concentration required
	3.	can't anticipate so well	anticipate conditions
	4.	can do something about	can't do something about
	5.	less likely (not around more)	more likely (around more)
	6.	doesn't obstruct vision	obstructs vision
	7.	can be in control of situation	cant be in control of situation
	8.	same speed	must slow down
Young	1.	there permanently	temporary hazard
	2.	difficult to correct	could be corrected
	3.	expected hazard	unexpected hazard
	4.	cant take account of	can take account of
	5.	stationary	moving
	6.	potentially less hazardous	potentially more hazardous
	7.	impeded vision	no restraint on vision
	8.	doesn't make you become a hazard	makes you become a hazard
	9.	less space & time to deal with foreseeable hazard	more space & time to deal with foreseeable hazard
	10.	doesn't increase hazard	increases hazard
	11.	fixed place hazard	unfixed place hazard
Old	1.	can happen any time	only sometimes
	2.	usual	unusual
	3.	evasive action necessary	straight forward driving
	4.	clear unobstructed vision	obstructed vision
	5.	could be altered	cant be altered
	6.	vulnerable hazard	less vulnerable hazard

Old	1.	more hazardous	least hazardous
	2.	not human hazard	human hazard
	3.	obstruction to me	not obstruction to me
	4.	need not stop for	must stop for
	5.	no action required	action required
	6.	need not slow down for	must slow down for
	7.	cant see in front	can see in front
	8.	involves pedestrians	doesn't involve pedestrians

APPENDIX 17

Mann Whitney U tests for the Q-sort pilot experiments

ELEMENTS	OLD: SUBJECTS' RANK					OLD: RANK OF RANKS PER ELEMENT	YOUNG: SUBJECTS' RANK					YOUNG: RANK OF RANKS PER ELEMENT
1. car overtaking	7	10	8	10	7	34	2	6	7	5	13	21
2. pedestrians	12	3	14	2	13	30	7	8	13	2	11	25
3. wet road	10	11	2	13	2	29.5	11	4	10	1	10	25.5
4. bus at stop	13	2	10	3	14	35	13	9	1	9	6	24.5
5. car pulling out	4	5	6	9	4	28.5	8	5	3	12	2	26.5
6. fog	1	1	1	1	1	17.5	2	1	15	4	9	37.5
7. brow of hill	6	8	7	6	9	30	5	14	5	13	1	24.5
8. lorries	14	13	11	7	11	34	6	10	14	6	7	21
9. cars turning right	8	9	12	5	5	26.5	10	7	8	15	3	28.5
10. car foll too close	2	14	3	12	6	27	2	3	11	7	15	28
11. parked vehicles	11	4	13	4	15	29.5	12	12	2	11	5	25.5
12. narrow road	15	6	4	15	8	26.5	9	13	6	10	12	28.5
13. obstacle in road	9	12	9	11	12	28.5	14	11	12	8	4	26.5
14. high speed car	3	15	5	14	3	30.5	4	2	9	3	14	24.5
15. yard turning	5	7	15	8	10	24.5	15	15	4	14	8	30.5

Mann Whitney U tests for the Q-sort pilot experiments

$$U = n \quad n + \frac{nx\,(nx + 1)}{2} - Tx$$

E1 $$U = 5 \times 5 + \frac{5\,(6)}{2} - T$$

	U = 25 + 15 = 40 - 34	= 6	non sig
E2	U = 25 + 15 = 40 - 30	= 10	non sig
E3	U = 25 + 15 = 40 - 29.5	= 10.5	non sig
E4	U = 25 + 15 = 40 - 35	= 5	non sig
E5	U = 25 + 15 = 40 - 28.5	= 11.5	non sig
E6	U = 25 + 15 = 40 - 37.5	= 2.5	sig at P<05 for a 1 tailed test
E7	U = 25 + 15 = 40 - 30	= 10	non sig
E8	U = 25 + 15 = 40 - 34	= 6	non sig
E9	U = 25 + 15 = 40 - 28.5	= 11.5	non sig
E10	U = 25 + 15 = 40 - 28	= 12	non sig
E11	U = 25 + 15 = 40 - 29.5	= 10.5	non sig
E12	U = 25 + 15 = 40 - 28.5	= 11.5	non sig
E13	U = 25 + 15 = 40 - 28.5	= 11.5	non sig
E14	U = 25 + 15 = 40 - 30.5	= 9.5	non sig
E15	U = 25 + 15 = 40 - 30.5	= 9.5	non sig

APPENDIX 18

Table The Mann-Whitney U test for the values of the midway response index for individual subjects in the pilot experiments.

	MIDWAY RESPONSE INDEX			
TECHNIQUE	Old	Rank	Young	Rank
Photographs as elements	.047	1	.547	16
	.250	5	.482	15
Repertory Grid	.275	6	.333	7
(Derby Rd/Lincoln Rd)	.222	3	.416	12
	.071	2	.466	14
(Southbury Rd/Kingsway)	.428	13	.378	10
Semi-fixed grid	.400	11	.345	8
	.577	17	.633	18
Fixed grid	.238	4	.811	20
	.355	9	.672	19

$$U = 10 \times 10 + \frac{10\ (10 + 1)}{2} - 139$$

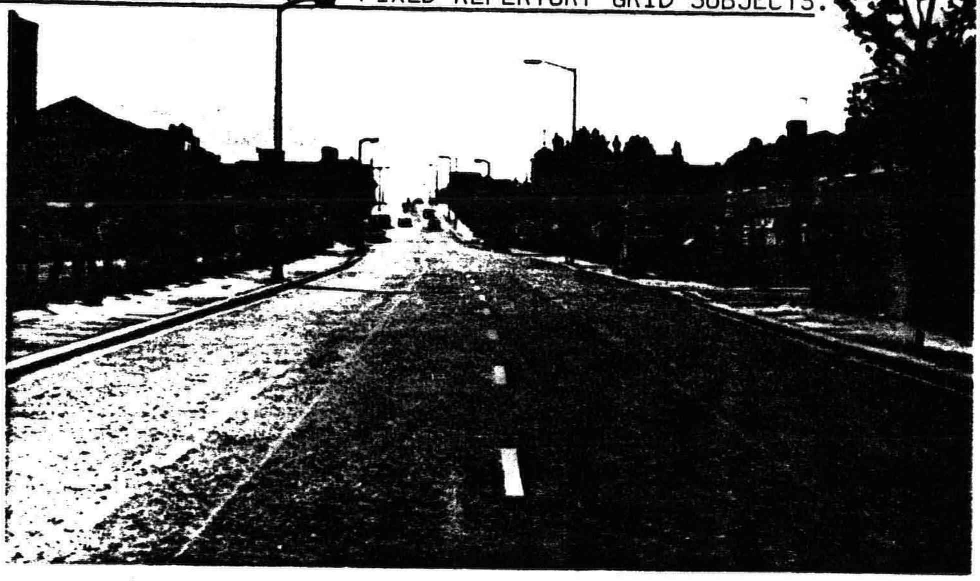
$$U = 100 + \frac{121}{2} - 139$$

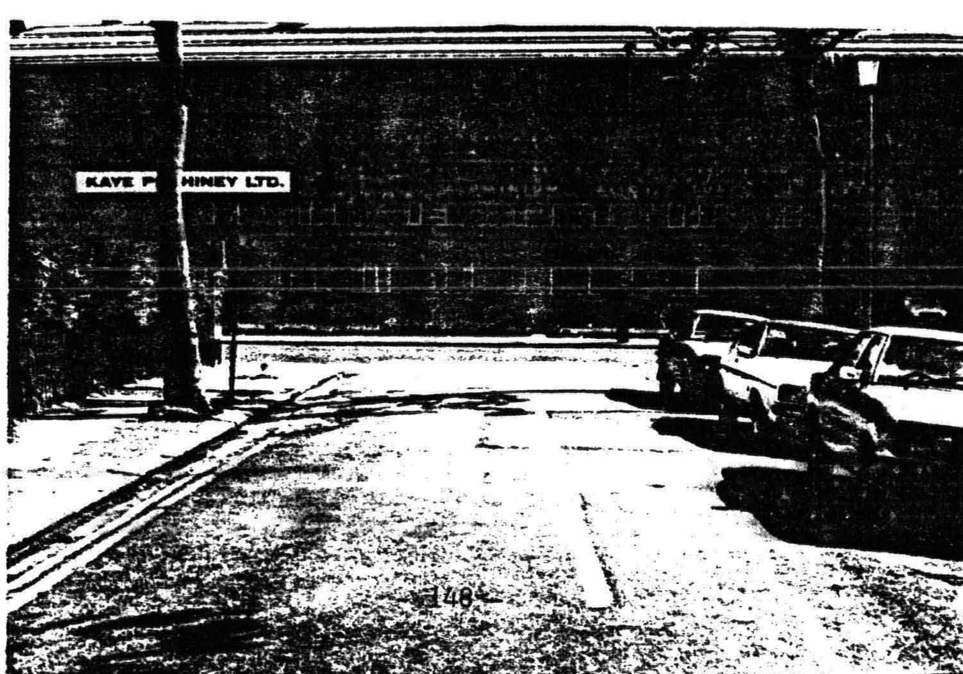
$$U = 160.5 - 139 = 21.5$$

significant at p < 025
for a 1 tailed test

APPENDIX 19

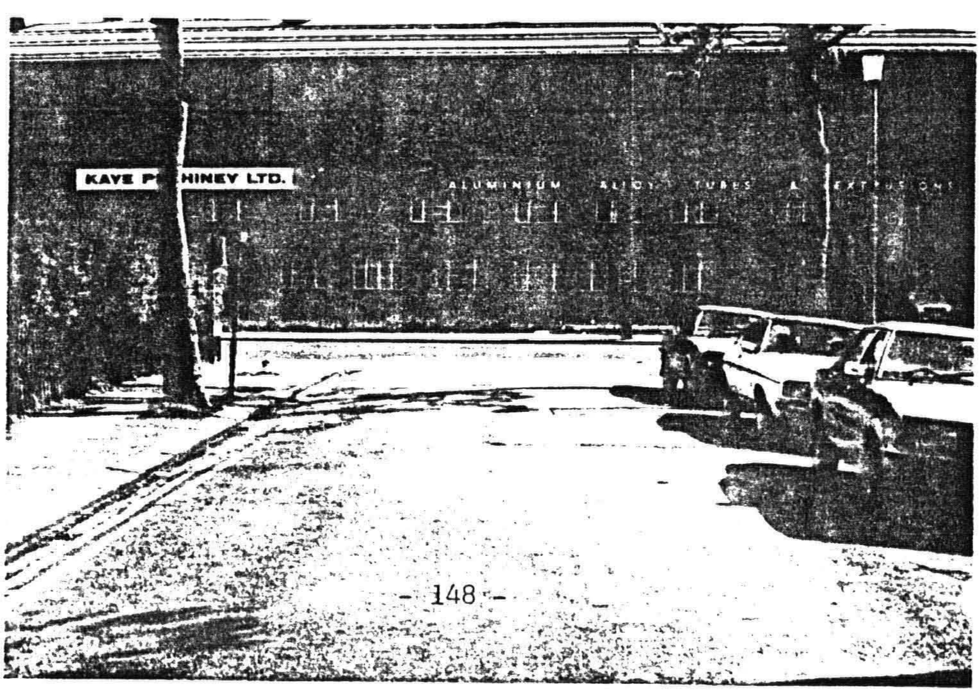
PHOTOGRAPHS OF THREE VIEWS OF GLYNN ROAD/SOUTHBURY ROAD, FOR THE DIFFERENT SITE (DS) FIXED REPERTORY GRID SUBJECTS.





APPENDIX 19

PHOTOGRAPHS OF THREE VIEWS OF GLYNN ROAD/SOUTHBURY ROAD, FOR THE DIFFERENT SITE (DS) FIXED REPERTORY GRID SUBJECTS.



APPENDIX 20 EXAMPLE OF THE MANUALLY COMPLETED GRID SCHEDULE

	EXPECTED HAZARD				UNEXPECTED HAZARD
CAR OVERTAKING	1	2	3	4	5
PEDESTRIANS	1	2	3	4	5
WET ROAD	1	2	3	4	5
BUS AT STOP	1	2	3	4	5
CAR PULLING OUT	1	2	3	4	5
FOG	1	2	3	4	5
BROW OF HILL	1	2	3	4	5
LORRIES	1	2	3	4	5
CARS TURNING RIGHT	1	2	3	4	5
CAR FOLL TOO CLOSE	1	2	3	4	5
PARKED VEHICLES	1	2	3	4	5
NARROW ROAD	1	2	3	4	5
OBSTACLE IN ROAD	1	2	3	4	5
HIGH SPEED CAR	1	2	3	4	5
YARD TURNING	1	2	3	4	5

APPENDIX 21 AN EXAMPLE FIXED GRID

This is 1ANDREWs GRID .Old

POLE	/CONTRAST		*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EXPECTED HAZARD	/UNEXPECTED HAZARD	1	*	3	2	3	1	3	5	1	1	1	3	1	2	5	4	1
STILL	/MOVING	2	*	5	5	1	1	3	3	1	3	4	4	1	1	1	5	1
MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	3	*	5	2	1	1	1	1	1	1	1	5	1	1	1	5	5
NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	4	*	1	1	5	1	5	5	5	1	1	5	1	5	5	5	5
CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	5	*	3	3	1	3	3	1	5	5	2	1	5	5	1	1	1
NOT HUMAN HAZARD	/HUMAN HAZARD	6	*	5	5	1	5	5	1	1	1	3	5	1	1	1	5	1
NATURAL HAZARD	/UNNATURAL HAZARD	7	*	5	1	1	5	5	1	5	5	5	5	5	5	5	5	5
WONT INJURE ME	/MAY INJURE ME	8	*	3	1	3	1	3	5	3	1	1	5	3	3	1	4	1
ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	9	*	1	1	1	1	1	1	1	5	1	1	3	1	1	1	5
CLEAR VIEW	/OBSCURES VISION	10	*	3	1	1	3	1	5	5	3	3	3	3	1	3	1	1
I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	11	*	1	1	1	1	3	5	1	1	1	1	1	1	1	3	1
DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	12	*	5	3	5	3	5	5	3	1	3	5	3	3	5	3	1

```
* * * * * * * * * * * * * * YARD TURNING
* * * * * * * * * * * * * HIGH SPEED CAR
* * * * * * * * * * * * OBSTACLE IN ROAD
* * * * * * * * * * * NARROW ROAD
* * * * * * * * * * PARKED VEHICLES
* * * * * * * * * CAR FOLL TOO CLOSE
* * * * * * * * CARS TURNING RIGHT
* * * * * * * LORRIES
* * * * * * BROW OF HILL
* * * * * FOG
* * * * CAR PULLING OUT
* * * BUS AT STOP
* * WET ROAD
* PEDESTRIANS
CAR OVERTAKING
```

The filename is: Q1ANDR

APPENDIX 22

THE MANN-WHITNEY U TEST FOR THE DIFFERENCE IN MIDWAY RESPONSE INDEX BETWEEN OLD AND YOUNG SUBJECT - MALES (M)

n = 10 OLD	RANK	n = 10 YOUNG	RANK
.238	2	.811	20
.355	3	.672	16
.455	6	.505	8
.755	17	.583	11
.494	7	.761	18
.427	5	.594	12
.383	4	.650	15
.572	10	.800	19
.133	1	.516	9
.616	14	.605	13
T_1 =	69	T_2 =	141

$$U = N_1 N_2 + \frac{Nx\ (Nx + 1)}{2} - Tx$$

$$U = 10 \times 10 + \frac{10(10 + 1)}{2} - 141$$

$$U = 100 + \frac{10 \times 11}{2} - 141$$

$$U = 100 + 55 - 141$$

$$U = 14$$

sig at $p < .005$ for a 1 tailed test

THE MANN-WHITNEY U TEST FOR THE DIFFERENCE IN MIDWAY RESPONSE INDEX BETWEEN OLD AND YOUNG SUBJECTS FEMALES (F)

OLD No. 10	RANK	YOUNG No. 10	RANK
.255	3	.661	15.5
.394	5	.822	19
.661	15.5	.605	11
.227	2	.611	12
.211	1	.755	17
.644	13.5	.383	4
.477	8	.866	20
.488	9	.588	10
.644	13.5	.444	6
.466	7	.788	18

T_1 77.5 T_2 132.5

$$U = n_1 n_2 + \frac{n_x (n_x - 1)}{2} - T_x$$

$$U = 10 \times 10 + \frac{10\ (10 + 1)}{2} - 132.5$$

$$U = 100 + 55 - 132.5$$

$$U = 22.5$$

significant $p < .025$ (one - tailed test)

THE MANN-WHITNEY U TEST FOR THE DIFFERENCE IN MIDWAY RESPONSE INDEX BETWEEN OLD AND YOUNG SUBJECTS DIFFERENT SITE (DS)

OLD No. 10	RANK	YOUNG No. 10	RANK
.672	16	.655	12.5
.300	1	.494	5
.394	3	.722	19
.527	8.5	.655	12.5
.338	2	.661	14
.438	4	.627	11
.666	15	.694	18
.611	10	.761	20
.511	7	.500	6
.527	8.5	.688	17

$T_1 = 75$ $T_2 = 135$

$U = 155 - 135$
$= 20$

significant $p < 0.025$ (1 tailed)

THE MANN-WHITNEY U TEST FOR THE DIFFERENCE IN MIDWAY RESPONSE INDEX BETWEEN OLD AND YOUNG SUBJECTS SITE VISITS (SV)

OLD No. 10	RANK	YOUNG No. 10	RANK
.761	17	.527	4
.116	1	.816	19
.688	16	.566	7.5
.644	13	.533	5
.833	20	.538	6
.566	7.5	.583	10
.511	2	.772	18
.627	12	.572	9
.616	11	.683	15
.516	3	.677	14
	102.5		107.5

$U = 47.5$ n.s.

APPENDIX 23 THE MEAN GRIDS FOR THE OLD SUBJECTS AND THE YOUNG SUBJECTS

MEAN GRID FOR - OLD SUBJECTS MALES (M)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON'T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS		
2.4	2.0	3.8	3.4	3.0	2.5	3.3	2.4	3.3	2.1	2.6	2.8	YARD TURNING	15
3.9	5.0	3.3	4.0	2.2	4.7	5.0	4.2	1.3	2.5	4.1	3.8	HIGH SPEED CAR	14
3.7	2.2	2.2	4.1	1.7	2.3	4.4	3.1	1.7	2.8	3.1	4.4	OBSTACLE IN ROAD	13
1.9	1.4	1.2	3.6	2.9	1.9	2.4	2.1	1.9	1.9	2.0	3.4	NARROW ROAD	12
2.1	1.7	1.5	3.0	2.3	2.4	4.5	2.4	2.0	3.5	2.1	3.0	PARKED VEHICLES	11
2.4	4.5	2.4	4.4	2.3	4.6	4.6	4.0	1.3	3.0	4.2	3.6	CAR FOLL TOO CLOSE	10
2.2	3.4	2.3	2.8	2.6	4.3	4.9	2.7	1.3	3.2	2.6	3.3	CARS TURNING RIGHT	9
2.5	3.1	1.1	2.9	2.5	3.6	4.8	2.5	2.1	3.9	2.6	3.4	LORRIES	8
2.4	1.4	1.2	3.8	2.7	1.8	2.4	2.5	2.0	4.4	2.4	3.9	BROW OF HILL	7
3.7	1.8	1.4	4.8	1.6	1.5	1.0	3.5	1.8	5.0	4.1	4.9	FOG	6
2.8	4.0	2.2	3.8	1.9	4.6	4.9	3.6	1.3	3.9	3.6	4.4	CAR PULLING OUT	5
2.4	1.9	1.1	2.5	2.1	3.4	4.6	2.0	1.2	3.6	2.3	3.4	BUS AT STOP	4
2.9	1.8	1.4	3.1	2.5	1.4	1.2	2.4	2.0	1.3	1.5	4.1	WET ROAD	3
2.4	4.3	2.4	2.9	1.8	4.8	1.9	1.5	1.8	2.3	3.0	3.2	PEDESTRIANS	2
3.2	4.6	2.1	3.2	1.8	4.4	5.0	3.4	1.4	3.1	3.2	3.6	CAR OVERTAKING	1

MEAN GRID FOR - YOUNG SUBJECTS MALES (M)

EXPECTED HAZARD/UNEXPECTED HAZARD	STILL/MOVING	MOST QUICKLY NOTICED/LESS	NOT ALWAYS A HAZ/ALWAYS	CONTROLS MY MOVEMENT/DOES NOT	NOT HUMAN HAZARD/HUMAN	NATURAL HAZARD/UNNATURAL	WON'T INJURE ME/MAY	ATTRACTS ATTENTION/DOES NOT	0 CLEAR VIEW/OBSCURES VISION	1 IN CONTROL OF THE SITUATION/I AM NOT	2 DOES NOT AFFECT MY SPEED/AFFECTS		
2.9	1.9	3.8	2.7	3.4	2.2	3.3	1.9	3.2	1.9	2.1	2.4	YARD TURNING	15
2.6	4.9	2.1	4.4	2.0	4.0	4.8	4.7	1.2	2.6	3.5	3.9	HIGH SPEED CAR	14
2.6	2.0	2.5	3.5	1.8	2.6	3.3	3.1	1.4	2.9	2.7	4.5	OBSTACLE IN ROAD	13
2.3	1.3	2.3	2.9	2.5	1.9	3.2	2.2	2.6	2.7	2.0	3.3	NARROW ROAD	12
2.7	1.4	2.6	2.5	3.0	2.3	4.4	2.2	2.9	2.9	2.0	2.6	PARKED VEHICLES	11
2.0	4.1	2.5	4.3	2.5	3.8	4.3	4.1	1.9	2.9	2.9	3.6	CAR FOLL TOO CLOSE	10
2.0	2.9	2.1	3.0	3.0	2.9	4.2	3.2	2.5	2.9	2.5	3.2	CARS TURNING RIGHT	9
2.2	3.7	1.9	2.9	2.5	2.8	4.8	3.7	2.2	3.9	2.4	3.2	LORRIES	8
1.8	1.7	1.6	3.5	2.2	1.8	2.4	2.4	2.0	3.6	2.5	3.9	BROW OF HILL	7
2.8	1.7	1.1	4.7	1.5	2.0	1.5	3.8	1.2	5.0	3.4	4.8	FOG	6
2.1	3.2	2.1	3.1	2.1	3.5	4.3	4.0	1.7	3.3	2.8	4.0	CAR PULLING OUT	5
2.5	2.3	1.8	2.6	2.7	3.7	4.4	3.1	1.9	3.7	2.3	3.2	BUS AT STOP	4
2.2	2.0	1.7	3.5	2.2	2.2	1.7	3.6	2.0	1.9	2.8	4.2	WET ROAD	3
2.0	3.5	2.4	2.5	2.5	5.0	1.9	2.1	2.5	2.3	2.8	3.4	PEDESTRIANS	2
2.8	5.0	2.6	3.3	2.6	3.9	4.5	3.9	1.9	3.4	2.8	3.7	CAR OVERTAKING	1

MEAN GRID FOR - OLD SUBJECTS FEMALE (F)

	1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON´T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS
YARD TURNING 15	2.1	3.0	3.6	3.4	2.7	1.8	3.3	2.4	3.1	2.1	2.3	2.9
HIGH SPEED CAR 14	3.1	5.0	3.0	4.3	1.9	4.9	5.0	4.5	2.0	2.5	3.7	2.6
OBSTACLE IN ROAD 13	3.5	1.5	2.0	3.9	1.6	2.6	3.8	3.5	2.1	2.6	2.1	4.1
NARROW ROAD 12	1.6	1.2	1.8	3.4	1.7	1.1	2.1	3.0	2.1	2.5	2.0	4.3
PARKED VEHICLES 11	1.9	1.1	1.5	3.5	2.0	3.2	4.7	2.9	1.9	3.2	2.2	3.9
CAR FOLL TOO CLOSE 10	2.5	4.2	1.8	4.3	2.5	4.9	5.0	4.3	1.9	2.0	3.8	2.7
CARS TURNING RIGHT 9	1.6	3.9	1.7	2.9	1.9	3.9	4.8	3.8	2.0	3.2	2.3	4.1
LORRIES 8	1.4	4.3	1.9	3.9	2.1	3.4	4.7	4.0	1.9	4.2	2.6	3.3
BROW OF HILL 7	1.1	1.3	1.5	3.3	2.1	1.0	1.7	2.9	1.9	4.5	2.3	4.0
FOG 6	2.4	2.4	1.0	4.4	1.8	1.0	1.0	3.5	1.6	4.6	3.2	4.9
CAR PULLING OUT 5	1.8	4.2	1.9	3.9	1.7	4.7	5.0	4.3	1.9	3.7	3.6	4.4
BUS AT STOP 4	1.9	1.7	1.8	3.5	2.1	3.8	4.5	2.7	1.7	4.2	2.4	3.1
WET ROAD 3	2.6	1.7	1.8	3.7	1.6	1.2	1.0	3.4	2.2	1.1	2.4	4.1
PEDESTRIANS 2	1.4	4.1	2.2	3.3	1.7	4.9	3.3	2.0	1.9	1.9	2.8	3.9
CAR OVERTAKING 1	2.5	4.9	2.5	3.7	1.3	4.9	5.0	4.3	2.0	3.4	2.4	3.9

MEAN GRID FOR - YOUNG SUBJECTS FEMALE (F)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON'T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS		
2.2	2.8	3.6	3.1	3.4	2.7	3.6	2.6	3.5	2.3	3.7	2.5	YARD TURNING	15
2.5	4.7	2.2	4.5	1.7	4.8	2.9	4.9	1.2	2.4	4.1	3.4	HIGH SPEED CAR	14
3.6	2.4	2.5	3.7	1.7	2.9	3.5	3.7	1.6	2.9	3.4	4.4	OBSTACLE IN ROAD	13
2.4	1.5	1.8	2.8	2.6	2.9	3.4	2.6	2.8	2.6	3.6	3.4	NARROW ROAD	12
2.2	1.2	2.3	3.2	2.4	3.7	4.1	2.7	2.8	3.1	3.1	3.3	PARKED VEHICLES	11
2.4	3.9	2.0	3.3	2.6	4.6	4.5	4.1	1.9	2.5	3.8	3.2	CAR FOLL TOO CLOSE	10
1.3	3.0	2.1	2.8	2.5	3.6	3.7	3.0	2.3	3.4	3.4	3.3	CARS TURNING RIGHT	9
1.9	4.1	1.5	3.0	3.0	3.9	3.9	3.4	2.3	4.0	3.3	3.0	LORRIES	8
1.7	1.5	1.5	3.0	3.0	2.3	2.4	3.2	2.9	4.4	3.8	4.1	[illegible] OF HILL	7
3.0	1.7	1.4	3.7	1.6	1.3	1.0	4.3	1.5	4.9	3.6	4.8	FOG	6
2.3	3.4	2.5	3.3	2.3	4.0	4.1	3.8	2.1	3.5	3.8	3.7	CAR PULLING OUT	5
1.9	2.4	1.8	3.1	2.8	3.4	3.8	2.8	2.4	4.0	3.2	3.4	BUS AT STOP	4
2.3	1.5	2.1	3.6	1.9	1.4	1.1	4.0	2.0	1.3	3.5	4.6	WET ROAD	3
2.0	3.6	2.1	3.3	1.9	4.7	2.7	2.3	2.5	2.9	2.9	3.8	PEDESTRIANS	2
3.3	4.8	2.0	3.6	2.4	4.5	4.8	3.5	2.0	3.4	3.4	3.4	CAR OVERTAKING	1

MEAN GRID FOR - OLD DIFFERENT SITE SUBJECTS (DS)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON'T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS	Element	No.
3.6	1.5	4.1	2.7	3.0	1.8	3.2	2.1	3.0	1.7	2.1	2.6	YARD TURNING	15
1.9	4.8	1.9	4.1	1.7	4.8	4.6	3.7	1.6	2.5	3.2	2.7	HIGH SPEED CAR	14
2.8	2.0	1.4	4.0	1.8	2.3	3.6	2.8	1.6	3.3	2.0	4.0	OBSTACLE IN ROAD	13
2.2	1.8	1.9	3.1	1.9	1.4	2.2	2 2	2.2	2.1	1.8	3.6	NARROW ROAD	12
1 9	1.5	1.6	3.5	1.9	2.4	4 2	2 4	2 3	3.2	2.0	3.4	PARKED VEHICLES	11
2.2	4.5	1 7	4 3	2 5	4.9	4.8	4 3	1.6	2.0	3.5	2 7	CAR FOLL TOO CLOSE	10
1.8	2 9	2 2	3.8	1 9	4.3	4.4	3.1	1.8	3.1	2 7	3.4	CARS TURNING RIGHT	9
1 6	3 7	1.8	3 1	2 3	3 9	4.6	3 1	2 2	41.	2.4	3.0	LORRIES	8
1.3	1 4	1 9	4 0	1 9	1.9	2 0	3 0	1.8	3.6	2.0	3.9	BROW OF HILL	7
2.7	2.3	1.0	4 4	1.4	1 7	1.0	3.5	1 3	5.0	3 0	4.7	FOG	6
2.0	3.6	1 9	3 4	1 8	4.4	4.7	3.9	2 3	3 5	3.2	3.9	CAR PULLING OUT	5
1.7	1 8	1.3	3 2	2 3	3.2	4.1	2.2	1.9	3.9	2.1	3.1	BUS AT STOP	4
2.2	1.3	1.1	3.7	1.5	1.4	1.4	3.4	1.9	1.4	1.9	4.1	WET ROAD	3
2.4	3.7	2.0	2.9	2.5	4 7	2.9	2.2	2.4	2 0	1.9	3.4	PEDESTRIANS	2
3 2	5.0	1.7	3.1	2.0	4.8	4.9	4.0	1.7	3.5	3.5	2.9	CAR OVERTAKING	1

MEAN GRID FOR - YOUNG DIFFERENT SITE SUBJECTS (DS)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON'T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS		
2.9	2.8	3.2	3.0	2.9	3.3	4.5	2.6	3.3	2.7	2.3	3.1	YARD TURNING	15
3.3	4.7	2.8	4.3	2.0	4.6	4.7	4.1	1.4	2.5	4.4	3.9	HIGH SPEED CAR	14
4.4	1.7	2.8	3.6	2.0	3.2	3.5	3.5	2.1	2.5	2.7	4.2	OBSTACLE IN ROAD	13
2.7	1.7	1.7	3.3	1.8	2.2	2.8	2.6	2.6	2.2	2.2	3.9	NARROW ROAD	12
3.0	1.2	2.0	3.2	2.7	3.3	4.5	2.5	2.7	3.5	2.7	3.3	PARKED VEHICLES	11
3.1	4.0	2.7	4.2	2.4	4.7	4.6	4.1	1.8	2.9	3.7	2.9	CAR FOLL TOO CLOSE	10
3.4	2.7	2.3	2.4	2.6	3.4	4.4	3.1	2.7	2.9	3.3	3.5	CARS TURNING RIGHT	9
1.5	3.4	1.9	3.1	2.6	3.5	4.4	3.5	2.0	3.9	3.1	3.4	LORRIES	8
1.8	1.7	2.2	3.4	2.6	2.3	2.4	3.0	1.9	4.5	3.1	3.8	BROW OF HILL	7
3.3	1.9	1.2	4.1	1.4	1.8	1.0	4.1	1.4	4.8	4.0	4.8	FOG	6
2.9	3.3	3.0	3.3	2.0	3.8	4.1	3.8	2.2	3.3	4.0	4.2	CAR PULLING OUT	5
1.4	1.9	1.9	3.6	2.1	3.4	4.4	3.2	1.7	4.1	3.3	3.8	BUS AT STOP	4
2.3	2.2	1.7	3.7	2.3	1.6	1.1	3.7	1.9	1.9	2.9	4.1	WET ROAD	3
1.6	2.9	2.4	2.9	2.3	4.9	1.7	2.2	2.9	2.0	3.6	3.9	PEDESTRIANS	2
3.6	4.7	2.4	2.8	2.3	4.7	4.8	3.4	2.3	3.7	4.0	3.7	CAR OVERTAKING	1

MEAN GRID FOR - OLD SUBJECTS SITE VISITS (SV)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON´T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS		
3.0	2.3	3.1	3.9	3.1	3.2	3.5	2.8	3.4	2.3	2.5	3.5	YARD TURNING	15
3.0	4.2	2.0	4.4	2.5	4.9	4.9	4.4	1.4	2.3	4.3	3.1	HIGH SPEED CAR	14
4.1	2.4	2.8	3.8	2.1	3.1	3.8	2.8	2.5	3.0	2.5	3.7	OBSTACLE IN ROAD	13
2.6	1.8	2.1	3.2	2.4	2.3	2.4	1.9	2.7	2.5	2.2	3.6	NARROW ROAD	12
2.1	2.0	2.2	3.2	1.9	3.4	3.9	2.8	2.4	3.6	2.7	3.3	PARKED VEHICLES	11
2.5	3.8	1.8	3.7	2.6	4.6	4.6	4.2	2.6	2.5	3.9	2.5	CAR FOLL TOO CLOSE	10
1.9	3.2	2.4	3.8	2.4	4.0	4.2	3.7	1.7	2.9	2.9	3.8	CARS TURNING RIGHT	9
2.4	3.6	1.4	3.2	2.4	3.5	4.4	3.7	2.0	3.7	2.6	3.8	LORRIES	8
1.4	1.8	1.4	4.0	1.8	2.5	2.4	2.9	1.9	4.0	2.6	4.0	BROW OF HILL	7
2.9	2.5	1.6	4.0	1.6	1.8	1.1	3.3	1.2	4.9	2.8	4.6	FOG	6
2.6	2.6	2.1	3.1	1.7	4.1	4.1	3.6	2.0	3.2	3.4	4.0	CAR PULLING OUT	5
2.5	2.0	1.2	3.0	2.4	3.2	3.7	2.1	2.0	3.3	2.7	3.5	BUS AT STOP	4
1.8	1.6	1.5	3.1	2.2	1.6	1.5	2.9	2.0	1.9	1.7	3.9	WET ROAD	3
1.9	3.6	2.7	3.1	2.1	4.6	2.3	2.4	1.9	2.3	2.9	3.9	PEDESTRIANS	2
3.5	4.2	2.5	2.9	1.7	4.8	4.5	3.9	1.9	2.7	3.7	3.9	CAR OVERTAKING	1

MEAN GRID FOR - YOUNG SUBJECTS SITE VISITS (SV)

1 EXPECTED HAZARD/UNEXPECTED HAZARD	2 STILL/MOVING	3 MOST QUICKLY NOTICED/LESS	4 NOT ALWAYS A HAZ/ALWAYS	5 CONTROLS MY MOVEMENT/DOES NOT	6 NOT HUMAN HAZARD/HUMAN	7 NATURAL HAZARD/UNNATURAL	8 WON'T INJURE ME/MAY	9 ATTRACTS ATTENTION/DOES NOT	10 CLEAR VIEW/OBSCURES VISION	11 IN CONTROL OF THE SITUATION/I AM NOT	12 DOES NOT AFFECT MY SPEED/AFFECTS		
2.7	1.9	4.1	3.4	3.1	2.7	3.9	2.8	3.7	2.4	3.1	2.6	YARD TURNING	15
3.9	4.9	3.1	4.5	1.4	5.0	4.5	4.5	1.8	2.3	4.2	3.6	HIGH SPEED CAR	14
3.8	2.1	2.3	4.1	1.7	2.7	3.5	3.4	2.0	2.6	2.8	4.0	OBSTACLE IN ROAD	13
1.8	1.6	2.3	2.8	1.9	2.2	2.8	2.2	3.2	2.8	1.9	3.8	NARROW ROAD	12
2.6	1.4	2.2	3.3	2.3	3.5	4.0	2.4	2.6	2.6	2.0	3.2	PARKED VEHICLES	11
2.9	3.1	2.2	3.9	2.5	4.5	4.3	3.8	2.1	2.4	3.6	3.8	CAR FOLL TOO CLOSE	10
1.9	2.6	2.4	3.1	3.0	3.7	4.5	2.8	2.4	3.3	3.4	3.5	CARS TURNING RIGHT	9
2.3	3.4	1.4	2.9	2.6	3.3	4.6	3.5	2.1	3.7	2.9	3.5	LORRIES	8
2.0	1.7	1.9	3.7	2.0	2.0	2.5	2.8	2.6	4.3	2.4	3.6	BROW OF HILL	7
3.8	1.9	1.5	4.5	1.4	1.9	1.0	4.2	1.4	4.4	3.4	4.9	FOG	6
2.9	3.0	2.8	3.4	1.8	3.8	4.6	3.8	2.1	3.1	3.3	4.2	CAR PULLING OUT	5
2.7	2.2	1.6	3.2	2.2	3.3	4.5	2.9	1.8	3.4	2.9	3.4	BUS AT STOP	4
2.8	1.8	1.8	3.7	1.6	1.8	1.2	3.9	2.3	1.5	3.0	4.8	WET ROAD	3
2.7	2.3	2.1	2.5	2.3	3.9	3.3	2.1	2.2	1.8	2.3	3.8	PEDESTRIANS	2
3.2	4.6	2.2	4.0	2.1	4.6	4.9	3.5	1.9	2.8	3.2	3.9	CAR OVERTAKING	1

Appendix 24 A brief explanation of Grid Analysis for Beginners, (GAB)

GAB - Stands for Grid Analysis for Beginners and as its title implies it is a simple analysis which looks at the relationship between constructs and the relationship between elements.

A typical printout like the one shown below will give:

1) the raw grid

2) a matrix of relationships between constructs. In the top right segment is the correlation between each possible pair on constructs. One asterisk by a value indicates significance at the 5% level and two asterisks at the 1% level, for a two tailed test.

   The bottom left segment shows the total relationship score for each pair of constructs, which is the correlation squared and multiplied by 100, so that the figure represents the variance in common between two constructs.

   The diagonal line of the matrix shows the summed absolute relationship score for each single construct in common with every other construct.

3) a list of constructs in order of importance i.e. in order of their contribution to the total variance, which is indicated by the diagonal line of the previous matrix. With this is a listing of the "components". These are not principal components in any factor analytic sense, but a simple cluster analysis, which takes the construct containing the most variance and lists all significantly related constructs. It then takes the next most important construct, not included in the previous one(s) and does the same, and so on until all the constructs are included.

4) a simple graph, which plots the inter-relationship of the constructs in two dimensional space. The axes of the graph being the principal constructs from the first two components.

5) a matrix of relationships between elements. Like 2, above but for elements.

6) elements in order of importance and "components". Like 3, above but for elements.

7) a simple graph of elements. Like 4 above but for elements.

Further information on GAB can be found in P G Higginbotham and D Bannister 1983 "The GAB Computer program for the Analysis of Repertory Grid Data".

ELEMENT analysis (ELEMENTs are sorted according to importance)

Top-right is correlation matrix.(leading decimal point suppressed).
Diagonal is summed abs- relationships
Bottom-left is individual relationships
2-tail P: *=5%, **=1%,nn=df<1

	7	6	9	15	14	13	1	8	2	5	10	3	4	11	12
7	270	93**	-60*	-21	-89**	37	3	10	-27	-23	-6	52	27	3	9
6	87	258	-65*	-10	-84**	27	3	-4	-29	-39	-30	36	23	-3	2
9	-37	-42	245	13	52	-49	18	36	51	33	43	-27	-21	51	-19
15	-4	-1	2	237	0	-77**	-69*	-60*	-35	-50	-36	-17	-47	-10	32
14	-79	-70	27	0	235	-13	12	-15	20	43	25	-43	-19	-3	-16
13	14	7	-24	-60	-2	195	38	22	-27	35	19	27	61*	9	-6
1	0	0	3	-47	1	15	163	46	52	28	15	-36	32	40	-2
8	1	-0	13	-36	-2	5	21	160	48	22	51	6	28	36	-25
2	-7	-9	26	-12	4	-7	27	23	146	16	21	-18	-14	17	-40
5	-5	-15	11	-25	19	12	8	5	3	136	44	5	-10	22	-28
10	-0	-9	19	-13	6	4	2	26	4	19	125	15	2	41	-18
3	27	13	-7	-3	-18	7	-13	0	-3	0	2	124	41	-27	-23
4	7	5	-5	-22	-4	38	10	8	-2	-1	0	17	121	10	-15
11	0	-0	26	-1	-0	1	16	13	3	5	17	-7	1	91	-10
12	1	0	-4	10	-2	-0	-0	-6	-16	-8	-3	-5	-2	-1	59

0) This column sorts the ELEMENTs in terms of contribution to variance
1) This and the next columns give - for the respective components-
the principal ELEMENT as nr. 1 and then the number of the successive ELEMENTs in order of importance

	0)	1)	2)	3)	4)	5)	6)	7)	8)	9)
BROW OF HILL	7	1								
FOG	6	2								
CARS TURNING RIGHT	9	3								
YARD TURNING	15		1							
HIGH SPEED CAR	14	4								
OBSTACLE IN ROAD	13		2					2		
CAR OVERTAKING	1		3							
LORRIES	8		4							
PEDESTRIANS	2			1						
CAR PULLING OUT	5				1					
CAR FOLL TOO CLOSE	10					1				
WET ROAD	3						1			
BUS AT STOP	4							1		
PARKED VEHICLES	11								1	
NARROW ROAD	12									1

ELEMENT 15 Horizontal, 7 Vertical

```
                  I
                  I
                 6I
                  I
                  I
                  I
                  I
                  I
                 3I
      13   1 8   4   1I1  12
----------------------------------------------------
             510 2  I
                  I
                  I
                  I 9
                  I
                  I
                  I
                  I14
                  I
```

Output from FLEXIGRID, v3.1 April 1985. Copyright (C) Finn Tschudi. University of Oslo. NORWAY.
GAB analysis for data file 93JOHN ++
This is 3JOHNs grid

CONSTRUCT analysis (CONSTRUCTs are sorted according to importance)

Top-right is correlation matrix.(leading decimal point suppressed).
Diagonal is summed abs- relationships
Bottom-left is individual relationships
2-tail P: *=5%, **=1%,nn=df<1

	6	7	8	2	9	11	1	3	12	5	10	4
6	219	60*	44	80**	-65**	22	27	53*	-42	3	7	3
7	36	196	54*	45	-67**	33	57*	35	-10	5	25	16
8	19	29	169	43	-38	53*	52*	37	27	22	-8	25
2	63	20	18	159	-53*	11	22	33	-32	12	-3	-10
9	-42	-44	-15	-28	156	-4	-42	-8	2	26	-12	14
11	5	11	28	1	-0	137	65**	2	35	-10	33	50
1	7	33	27	5	-17	42	134	-5	5	7	3	15
3	28	12	14	11	-1	0	-0	117	-33	53*	-32	-16
12	-17	-1	7	-10	0	13	0	-11	95	-38	33	31
5	0	0	5	1	7	-1	1	28	-14	81	-47	-15
10	1	6	-1	-0	-1	11	0	-11	11	-22	78	39
4	0	3	6	-1	2	25	2	-3	5	-2	15	69

0) This column sorts the CONSTRUCTs in terms of contribution to variance
1) This and the next columns give - for the respective components-
the principal CONSTRUCT as nr. 1 and then the number of the successive CONSTRUCTs in order of importance

```
POLE                       /CONTRAST
NOT HUMAN HAZARD           /HUMAN HAZARD             0)  1)  2)  3)  4)  5)  6)
NATURAL HAZARD             /UNNATURAL HAZARD          6   1
WONT INJURE ME             /MAY INJURE ME             7   2   2
STILL                      /MOVING                    8       1
ATTRACTS ATTENTION         /DOES NOT ATTR ATTN        2   3
I AM IN CONTROL OF SIT     /I AM NOT IN CON OF SIT    9   4
EXPECTED HAZARD            /UNEXPECTED HAZARD        11       3
MOST QUICKLY NOTICED       /LESS QUICKLY NOTICED      1       4
DOES NOT AFFECT MY SPPED/AFFECTS MY SPEED             3   5           2
CONTROLS MY MOVEMENT       /DOES NOT CON MY MOV      12           1
CLEAR VIEW                 /OBSCURES VISION           5               1
NOT ALWAYS A HAZARD        /ALWAYS A HAZARD          10                   1
                                                      4                       1
```

CONSTRUCT 8 Horizontal, 6 Vertical

```
                          I
                          I
                          I
                          I
                          I    2
                          I
                          I
                          I          7
                          I  3
                       10 5I 4    111
--------------------------------------------------------------------------
                          I
                          I 12
                          I
                          I
                     9    I
                          I
                          I
                          I
                          I
```

Appendix 25 A brief explanation of FOCUS (hierarchical clustering)

FOCUS is a method of cluster analysis for elements and constructs. It works by re-ordering columns so as to maximise the agreement between the ratings of adjacent pairs of columns in the case of elements, and re-ordering rows in the same way for constructs. As constructs are bipolar, maximising agreement between ratings of adjacent pairs of rows, may best be achieved by reversing some of the constructs so that for example ratings

1, 2, 3, 4, 5 become
5, 4, 3, 2, 1

For this reason comparison of two FOCUS analyses can sometimes be difficult.

In the re-ordered grid then, the further apart the columns (rows), the smaller the similarity between the elements (constructs), with the middle element (constructs) having more meaning to all other elements (constructs). The relationship between elements (constructs) is quantified by a percentage scale on a dendrogram.

To identify "good" clusters that are not artifactual outcomes of the computational proceedures, the following guidelines are recommended:-

> The 'inner simi' which is the mean similarity in the submatrix consisting of these points, should be high relative to the 'middle simi' which is the similarity between members of the cluster and all other points. At the very minimum, 'inner simi' should be larger than 'mid simi'.
>
> There should be a large difference between 'matching' and 'mean similarity between clusters', the magnitude of which is not given.
>
> As a cluster becomes more inclusive the Z score, which is computed from the standard deviations of the inner and mid simi, should increase by a minimum of .10.
>
> Little confidence can be given to clusters with a Z score which is less than 2.0.

Further information regarding FOCUS can be found in D Jankowicz and L Thomas 1982 "An algorithm for the cluster analysis of repertory grids in human resource development" Personnel Review "(4) 15-22".

Appendix 26 Principal Components Analysis (PCA)

This analysis seeks to explain the total variance of one set of vectors of a matrix in factors or 'hypothetical constructs'.

Several options regarding how the analysis will be done must be decided on and a flow diagram of those options chosen here is below.

PCA output choices in Flexigrid

Data first analysed by
1) Constructs - standard
2) Elements

1

Transformation of data matrix
1) None
2) Subtract scale midpoint
3) Remove grand mean
4) Remove Construct mean
5) Remove Construct and Element mean
6) Correlate Constructs (standardise by Constructs)

6

Maximum no. of components 0-8

8

Relative variance of a component
.1 - when to stop factoring?

.1

Varimax rotation + no. of comps

Yes. 8

The first option is whether to analyse by construct vectors or by element vectors. In practice the former is usually chosen.

The next option concerns the sort of transformation to be done on the data matrix. The ussal transformation is to standardise by constructs which has the effect of removing information on different means and standard deviations for constructs. This means that information regarded as 'irrelevant' is removed.

One may next stipulate the maximum number of components required in output, although this number may not be achieved if the relative variance of a component, which is the next option to be set, will not allow components of a large enough size to be produced. .1 is the suggested value.

Finally there is an option regarding rotation of the components. This moves the axes to the 'best possible' position, which enables clearer interpretations to be made. The rotation is varimax.

A typical printout contains:-

1) the raw grid.

2) a table of the minimum mean maximum and standard deviation of each variable (i.e. construct vector).

3) a correlation matrix.

4) a table of principal components. That is a list of factor loadings for each construct on each component. These values may range between -1 to +1. Minus scores indicate that the construct should be reversed for that component.

   The % ACC column, (otherwise known as the communality) is the sum of the squares of all the loadings for each construct. This gives a percentage value which indicates how much of the total variance of each construct is explained by the components produced.

   The percentage of variance explained by each component is also given.

5) a table of factor scores for each element as it relates to each component is then given. These values usually range between -3 and +3. Minus values refer to the left pole of the constucts important in the component, and plus scores to the right side. Values of 2 or more are rare as they only account for 5% of values. Percentage accounted for is also given for factor scores.

6) a table of varimax rotated components.

7) a table of factor scores for the elements after varimax rotation.

Further information regarding PCA can be found in P Slater (ed) "Dimensions of Intrapersonal Space" vol. 2 John Wiley and sons 1977.

APPENDIX 27 FACTOR LOADINGS FOR EACH CONSTRUCT ON THE 4 COMPONENTS FOR GROUPS M, F, DS AND SV OLD AND YOUNG GROUPS TOGETHER WITH THE FACTOR SCORES FOR EACH ELEMENT THAT RELATE TO EACH OF THE COMPONENTS

MALES (M) OLD

This is a table of varimax rotated components
****

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	-0.033	0.775	0.147	-0.459
2	STILL	/MOVING	0.797	0.141	0.365	-0.336
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.343	0.180	0.778	0.357
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	-0.108	0.906	-0.116	0.165
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	-0.277	-0.156	0.064	0.855
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.899	-0.097	0.194	-0.038
7	NATURAL HAZARD	/UNNATURAL HAZARD	0.881	-0.192	-0.073	-0.006
8	WONT INJURE ME	/MAY INJURE ME	0.647	0.610	-0.017	-0.018
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.773	-0.043	0.248	0.321
10	CLEAR VIEW	/OBSCURES VISION	0.139	0.242	-0.849	0.128
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.657	0.635	0.086	0.159
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	-0.061	0.881	-0.152	-0.317
			32.467	26.298	13.622	12.135

Rotated factor scores
****

		1	2	3	4
1	CAR OVERTAKING	0.921	-0.055	0.231	-0.996
2	PEDESTRIANS	-0.070	-0.920	1.198	-0.528
3	WET ROAD	-1.824	-0.367	0.943	-1.917
4	BUS AT STOP	0.407	-1.620	-1.380	-0.706
5	CAR PULLING OUT	1.239	0.764	-0.008	-0.145
6	FOG	-1.051	2.395	-1.354	-0.188
7	BROW OF HILL	-1.003	0.209	-1.252	1.235
8	LORRIES	0.469	-0.892	-0.931	-0.032
9	CARS TURNING RIGHT	0.949	-0.669	-0.252	1.297
10	CAR FOLL TOO CLOSE	1.524	0.653	-0.253	0.330
11	PARKED VEHICLES	-0.464	-1.004	-0.520	-0.451
12	NARROW ROAD	-1.098	-0.362	-0.061	1.066
13	OBSTACLE IN ROAD	-0.508	0.988	0.219	-0.461
14	HIGH SPEED CAR	1.191	1.094	1.433	-0.576
15	YARD TURNING	-0.683	-0.214	1.987	2.073

FEMALES (F) OLD

This is a table of varimax rotated components
****

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	-0.115	-0.107	0.846	0.250
2	STILL	/MOVING	0.719	-0.021	0.056	0.485
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.529	0.603	0.477	-0.105
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	0.002	-0.312	0.242	0.850
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	-0.196	0.912	-0.009	-0.035
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.866	-0.183	-0.012	0.222
7	NATURAL HAZARD	/UNNATURAL HAZARD	0.904	-0.162	-0.062	0.043
8	WONT INJURE ME	/MAY INJURE ME	0.479	-0.528	0.021	0.472
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.016	0.865	0.108	-0.130
10	CLEAR VIEW	/OBSCURES VISION	-0.126	-0.262	-0.782	0.147
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.343	0.080	-0.150	0.822
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	-0.683	-0.490	-0.165	-0.012
			27.038	22.560	14.025	16.851

Rotated factor scores
****

		1	2	3	4
1	CAR OVERTAKING	1.011	-1.759	0.454	-0.295
2	PEDESTRIANS	0.344	0.370	-0.792	-0.592
3	WET ROAD	-1.528	-0.268	2.113	0.233
4	BUS AT STOP	0.699	-0.118	-0.535	-1.182
5	CAR PULLING OUT	0.475	-0.108	-0.785	1.558
6	FOG	-2.306	-0.393	-1.295	1.516
7	BROW OF HILL	-0.830	0.053	-1.238	-0.932
8	LORRIES	0.737	0.193	-1.350	0.755
9	CARS TURNING RIGHT	0.745	-0.612	-0.103	-0.815
10	CAR FOLL TOO CLOSE	0.935	0.140	0.137	1.231
11	PARKED VEHICLES	0.040	-0.429	-0.070	-1.328
12	NARROW ROAD	-0.948	-0.170	0.525	-1.029
13	OBSTACLE IN ROAD	-0.574	-0.502	1.069	0.061
14	HIGH SPEED CAR	1.264	0.366	1.468	1.306
15	YARD TURNING	-0.061	3.238	0.402	-0.486

DIFFERENT SITE (DS) OLD

This is a table of varimax rotated components
****

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	0.890	-0.056	-0.063	0.006
2	STILL	/MOVING	-0.082	0.926	-0.079	0.022
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.544	0.062	-0.485	-0.507
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	-0.094	0.057	0.831	-0.113
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	0.386	0.117	-0.726	-0.412
6	NOT HUMAN HAZARD	/HUMAN HAZARD	-0.110	0.921	-0.214	-0.050
7	NATURAL HAZARD	/UNNATURAL HAZARD	-0.020	0.792	-0.448	-0.084
8	WONT INJURE ME	/MAY INJURE ME	0.049	0.782	0.492	-0.030
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	0.290	-0.101	-0.536	-0.743
10	CLEAR VIEW	/OBSCURES VISION	0.062	0.008	-0.101	0.896
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.247	0.777	0.429	0.149
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	0.135	-0.415	0.668	0.447
			11.962	31.275	23.995	16.883

Rotated factor scores
****

1	CAR OVERTAKING	0.866	1.536	-0.308	0.405
2	PEDESTRIANS	-0.986	0.041	-0.937	-0.312
3	WET ROAD	-0.973	-1.327	1.879	-1.331
4	BUS AT STOP	-0.959	-0.458	-1.322	1.069
5	CAR PULLING OUT	0.326	1.053	0.029	0.402
6	FOG	1.235	-0.477	1.773	2.562
7	BROW OF HILL	-0.837	-0.896	0.345	0.049
8	LORRIES	-0.583	0.488	-1.301	0.836
9	CARS TURNING RIGHT	-0.082	0.647	0.322	-0.327
10	CAR FOLL TOO CLOSE	-0.247	1.389	0.680	-0.989
11	PARKED VEHICLES	-0.564	-0.805	-1.049	0.204
12	NARROW ROAD	-0.224	-1.257	-0.166	-0.253
13	OBSTACLE IN ROAD	0.487	-0.468	0.566	0.151
14	HIGH SPEED CAR	-0.285	1.561	0.652	-0.959
15	YARD TURNING	2.826	-1.029	-1.164	-1.505

SITE VISITS (SV) OLD

This is a table of varimax rotated components
****

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	-0.013	0.129	0.869	0.092
2	STILL	/MOVING	0.890	-0.027	0.056	-0.187
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.039	-0.221	0.884	0.105
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	0.016	-0.061	0.194	0.895
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	0.085	-0.810	0.094	0.453
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.896	-0.196	0.282	-0.126
7	NATURAL HAZARD	/UNNATURAL HAZARD	0.748	-0.257	0.044	0.102
8	WONT INJURE ME	/MAY INJURE ME	0.698	0.130	-0.060	0.435
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.203	-0.859	0.013	-0.107
10	CLEAR VIEW	/OBSCURES VISION	-0.134	0.683	-0.349	0.350
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.883	0.113	-0.241	0.112
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	-0.376	0.786	0.169	-0.132
			30.252	22.356	15.662	11.992

Rotated factor scores
****

1	CAR OVERTAKING	1.593	0.558	0.440	-0.725
2	PEDESTRIANS	0.291	-0.100	0.930	-1.913
3	WET ROAD	-1.213	-0.043	-0.775	-0.905
4	BUS AT STOP	-0.345	-0.375	-1.180	-0.871
5	CAR PULLING OUT	0.559	0.470	0.462	-0.485
6	FOG	-0.932	2.049	0.329	1.461
7	BROW OF HILL	-0.822	0.390	-1.866	1.022
8	LORRIES	0.613	0.634	-1.154	-0.313
9	CARS TURNING RIGHT	0.473	0.320	-0.099	0.733
10	CAR FOLL TOO CLOSE	1.424	-2.206	-0.608	1.115
11	PARKED VEHICLES	-0.130	-0.015	-0.724	-0.153
12	NARROW ROAD	-1.484	-0.673	0.549	-1.330
13	OBSTACLE IN ROAD	-0.668	0.379	2.020	0.727
14	HIGH SPEED CAR	1.631	0.539	0.590	0.440
15	YARD TURNING	-0.989	-1.926	1.087	1.195

MALES (M) YOUNG

This is a table of varimax rotated components
###

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	0.103	0.006	0.938	0.011
2	STILL	/MOVING	0.225	0.911	0.069	-0.038
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	-0.709	0.045	0.534	-0.378
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	0.636	0.102	0.239	0.551
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	-0.831	0.254	0.196	-0.182
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.139	0.743	-0.291	-0.358
7	NATURAL HAZARD	/UNNATURAL HAZARD	-0.431	0.825	0.118	0.141
8	WONT INJURE ME	/MAY INJURE ME	0.565	0.654	0.151	0.248
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.808	-0.312	-0.056	-0.195
10	CLEAR VIEW	/OBSCURES VISION	0.245	-0.041	-0.083	0.897
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.827	0.287	0.164	-0.409
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	0.875	0.057	0.098	0.248
			36.234	22.923	11.946	14.691

Rotated factor scores
###################

		1	2	3	4
1	CAR OVERTAKING	-0.177	1.645	1.365	-0.441
2	PEDESTRIANS	0.461	-0.103	-1.523	-2.433
3	WET ROAD	0.871	-0.796	-0.230	-1.119
4	BUS AT STOP	-0.914	0.488	-1.028	0.921
5	CAR PULLING OUT	0.460	0.389	-0.501	-0.272
6	FOG	2.181	-1.265	0.832	1.693
7	BROW OF HILL	-0.051	-1.185	-0.718	0.334
8	LORRIES	-0.671	1.022	-0.863	1.381
9	CARS TURNING RIGHT	-0.850	0.435	-0.712	0.450
10	CAR FOLL TOO CLOSE	0.615	0.957	-0.519	-0.122
11	PARKED VEHICLES	-1.469	-0.835	1.087	-0.038
12	NARROW ROAD	-0.676	-1.255	-0.798	0.280
13	OBSTACLE IN ROAD	0.917	-0.416	0.808	-0.563
14	HIGH SPEED CAR	0.865	1.732	0.992	0.197
15	YARD TURNING	-1.561	-0.815	1.808	-0.768

FEMALES (F) YOUNG

This is a table of varimax rotated components
##

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	-0.561	-0.175	-0.110	-0.062
2	STILL	/MOVING	-0.254	0.891	-0.000	0.135
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.212	0.165	0.862	-0.026
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	-0.899	-0.165	0.082	0.136
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	0.797	-0.034	-0.091	0.259
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.119	0.902	0.104	-0.067
7	NATURAL HAZARD	/UNNATURAL HAZARD	0.337	0.782	0.173	-0.292
8	WONT INJURE ME	/MAY INJURE ME	-0.560	-0.022	0.151	0.709
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	0.757	-0.289	0.320	-0.319
10	CLEAR VIEW	/OBSCURES VISION	0.139	-0.085	-0.889	-0.110
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.257	-0.095	0.018	0.886
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	-0.571	-0.615	-0.344	0.029
			27.456	23.199	15.371	13.328

Rotated factor scores
#####################

		1	2	3	4
1	CAR OVERTAKING	-1.024	1.231	0.121	-1.101
2	PEDESTRIANS	-0.152	0.633	-0.353	-1.407
3	WET ROAD	-1.288	-2.024	1.445	-0.247
4	BUS AT STOP	0.748	0.071	-0.646	-0.569
5	CAR PULLING OUT	-0.048	0.383	-0.038	0.752
6	FOG	-1.268	-1.232	-1.855	1.083
7	BROW OF HILL	1.258	-1.425	-1.140	0.524
8	LORRIES	0.573	0.927	-1.517	-0.384
9	CARS TURNING RIGHT	0.236	0.649	0.026	-0.827
10	CAR FOLL TOO CLOSE	0.544	1.026	0.301	1.412
11	PARKED VEHICLES	0.465	-0.246	0.448	-1.386
12	NARROW ROAD	1.376	-0.824	0.195	0.447
13	OBSTACLE IN ROAD	-1.483	-0.532	0.341	-0.707
14	HIGH SPEED CAR	-1.296	1.390	0.531	1.933
15	YARD TURNING	1.360	-0.026	2.141	0.478

DIFFERENT SITE (DS) YOUNG

This is a table of varimax rotated components
****

	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	-0.089	0.364	-0.577	-0.297
2	STILL	/MOVING	0.204	0.866	-0.075	0.090
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	0.271	0.355	-0.655	0.515
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	0.821	-0.087	-0.115	-0.248
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	-0.503	-0.114	0.096	0.780
6	NOT HUMAN HAZARD	/HUMAN HAZARD	-0.074	0.932	-0.166	0.024
7	NATURAL HAZARD	/UNNATURAL HAZARD	-0.033	0.712	-0.105	0.565
8	WONT INJURE ME	/MAY INJURE ME	0.863	0.114	-0.010	-0.065
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.825	-0.228	-0.291	0.300
10	CLEAR VIEW	/OBSCURES VISION	0.057	0.084	0.883	-0.093
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.271	0.691	0.181	-0.474
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	0.355	-0.133	0.078	-0.850
			22.380	24.764	14.438	20.004

Rotated factor scores
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		1	2	3	4
1	CAR OVERTAKING	-0.733	2.025	0.449	-0.904
2	PEDESTRIANS	-1.628	0.492	-0.420	-1.378
3	WET ROAD	1.204	-1.762	-0.524	-0.219
4	BUS AT STOP	0.666	-0.502	1.212	0.392
5	CAR PULLING OUT	0.504	0.727	-0.396	-0.085
6	FOG	0.938	-0.500	1.518	-2.373
7	BROW OF HILL	-0.168	-0.846	1.111	0.225
8	LORRIES	0.058	-0.056	1.761	1.551
9	CARS TURNING RIGHT	-1.435	0.224	0.215	0.627
10	CAR FOLL TOO CLOSE	1.105	1.278	-0.388	0.828
11	PARKED VEHICLES	-1.505	-0.423	-0.047	0.400
12	NARROW ROAD	-0.663	-1.208	-1.157	-0.377
13	OBSTACLE IN ROAD	0.427	-0.510	-1.860	-0.454
14	HIGH SPEED CAR	1.572	1.441	-0.774	0.235
15	YARD TURNING	-0.342	-0.380	-0.698	1.532

SITE VISITS (SV) YOUNG

This is a table of varimax rotated components
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	POLE	/CONTRAST	1	2	3	4
1	EXPECTED HAZARD	/UNEXPECTED HAZARD	0.781	0.152	0.239	0.212
2	STILL	/MOVING	0.102	0.752	-0.018	0.445
3	MOST QUICKLY NOTICED	/LESS QUICKLY NOTICED	-0.160	0.199	0.898	0.027
4	NOT ALWAYS A HAZARD	/ALWAYS A HAZARD	0.254	-0.152	-0.087	0.828
5	CONTROLS MY MOVEMENT	/DOES NOT CON MY MOV	-0.872	0.050	0.078	-0.162
6	NOT HUMAN HAZARD	/HUMAN HAZARD	0.126	0.932	0.184	0.023
7	NATURAL HAZARD	/UNNATURAL HAZARD	-0.440	0.820	0.034	-0.164
8	WONT INJURE ME	/MAY INJURE ME	0.269	0.112	0.059	0.880
9	ATTRACTS ATTENTION	/DOES NOT ATTR ATTN	-0.596	-0.262	0.586	-0.279
10	CLEAR VIEW	/OBSCURES VISION	-0.246	-0.058	-0.789	-0.081
11	I AM IN CONTROL OF SIT	/I AM NOT IN CON OF SIT	0.140	0.515	0.165	0.750
12	DOES NOT AFFECT MY SPPED	/AFFECTS MY SPEED	0.720	-0.392	-0.060	0.390
			22.556	22.494	15.936	21.308

Rotated factor scores
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		1	2	3	4
1	CAR OVERTAKING	0.175	1.539	-0.504	0.325
2	PEDESTRIANS	1.301	0.291	0.305	-2.425
3	WET ROAD	0.625	-1.680	0.912	1.205
4	BUS AT STOP	-0.184	0.510	-0.342	-0.520
5	CAR PULLING OUT	0.065	0.825	0.339	0.161
6	FOG	1.804	-1.104	-1.562	0.717
7	BROW OF HILL	-0.901	-1.603	-0.592	0.437
8	LORRIES	-1.637	0.586	-1.794	0.178
9	CARS TURNING RIGHT	-1.270	0.681	-0.542	0.046
10	CAR FOLL TOO CLOSE	-0.052	0.495	0.271	1.375
11	PARKED VEHICLES	-0.058	-0.334	0.142	-1.647
12	NARROW ROAD	-0.371	-1.072	-0.088	-1.000
13	OBSTACLE IN ROAD	0.657	-0.313	-0.049	0.157
14	HIGH SPEED CAR	1.320	1.562	1.031	0.946
15	YARD TURNING	-1.474	-0.382	2.473	0.042

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