PURPOSIVE PREFERENCES FOR MULTI-ATTRIBUTED ALTERNATIVES: A STUDY OF CHOICE BEHAVIOUR USING PERSONAL CONSTRUCT THEORY IN CONJUNCTION WITH DECISION THEORY.

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ABSTRACT

The thesis is based on the notion that a person's behaviour is largely a result of the interplay between his beliefs and values. A model is described which combines Personal Construct Theory (as a means of describing beliefs) and Multi-Attributed Utility Theory (as a means of describing values) in order to predict purposive choice behaviour.

The model is applied to choice of records, books, clothes and role behaviours and is found to predict choices with a high degree of accuracy. Prediction using personal constructs is shown to be superior to that using supplied dimensions. Furthermore, construct weights elicited by a lottery technique are shown generally to be purpose-specific and to give better predictions of behaviour than unit weights.

The model is then used to investigate the sentencing of offenders by magistrates and is again found to predict behaviour with a high degree of accuracy. The data also indicate the problems inherent in using verbal measures of construct similarity since the same words may be used differently and different words may be used similarly.

Claims for the model's broad applicability are illustrated by using the model to reformulate the concepts of 'attention' and 'role' and a means of operationally defining role conflict is suggested.

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"When a man starts to learn, he is never clear about his objectives. His purpose is faulty; his intent is vague. He hopes for rewards that will never materialize, for he knows nothing of the hardships of learning ... Learning is never what one expects. Every step of learning is a new task." (Castaneda, 1970, p.84)

For Denise, who helps me through the "hardships".

GENERAL OVERVIEW

Chapter 1 is an introductory chapter in which Personal Construct Theory and Multi-Attributed Utility Theory are described. The advantages and disadvantages of each theory are outlined and a synthesis is proposed which also incorporates the notion of purpose. The chapter concludes with a summary and statement of aims.

Chapter 2 contains a detailed description of the methodology used in the study, and includes various methodological considerations. The question of validation is raised and the chapter concludes with a summary of the method.

Chapter 3 documents the use of the method with seven subjects. The areas of application include choices among records, books and clothes. The results are discussed in relation to their theoretical and methodological implications. Two variations on the model are also described. One involves the comparison of predictions using constructs and semantic differential scales; the other describes an attempt to indicate the model's applicability in recurrent situations.

Chapter 4 is written in two parts. The first part discusses the problem of ranking and weighting dimensions. The question of unit weighting schemes is discussed and the data from Chapter 3 are analysed in relation to this question. In the second part, applications of the model to the field of personality are discussed and the chapter ends with a summary of the major points thus far.

Chapter 5 documents the use of the method to study the sentencing behaviour of nine magistrates. The question of validation is again discussed, with reference to the theory of generalizability.

Chapter 6 contains the perceived implications of the results and some speculations concerning future use of the model. The studies described in Chapter 1 are reconsidered in terms of the model, and reformulations of the concepts of 'role' and 'attention' are offered.

Chapter 7 contains a summary of the study and conclusions to be drawn from the results. The implications of the results for practical applications are presented, and the chapter concludes with some speculations concerning a theory of values.

CONTENTS

CHAPTER 1

INTRODUCTION

In a recent book on the subject of beliefs and values, Scheibe began with the following supposition:

> "What a person does (his behaviour) depends upon what he wants (his values) and what he considers to be true or likely (his beliefs) about himself and the world (his psychological ecology)." (1970, p.1)

Such a supposition could equally well have been written as an introduction to the present thesis since its main focus of concern is the prediction of behaviour on the basis of beliefs and values. More specifically, a model will be described which uses Kelly's (1955) Personal Construct Theory in conjunction with Raiffa's (1969) Multi-Attributed Utility Theory in order to predict purposive choice behaviour. While the former theory seems appropriate as a description of beliefs, it is difficult to use as a predictor of behaviour. Similarly, the latter theory seems appropriate as a description of values but has not been very successful in predicting behaviour.

The testing of the model's ability to predict behaviour in a variety of choice situations will be described, and the implications for related areas of research will be discussed. However, we begin with a brief description of the two areas to be conjoined and an evaluative survey of earlier work in the area.

PERSONAL CONSTRUCT THEORY (PCT)

The history of psychology is littered with analogies of the sort: man-the-telephone exchange, man-the-hydraulic system, man-the-thermostat, and more recently man-the-computer. In formulating PCT, George Kelly contrived to add another analogy to the list. However, the main difference between the analogies listed and the one chosen by

Kelly is that his is completely human. Kelly takes as his paradigm the scientist. His central argument is that both experimenter and subject are engaged in a process of prediction and control -- that both are attempting to make sense of their environment in order to live in it. In Bartlett's (1932) terms, they are engaged in an "effort after meaning".

Conceptually at least, Kelly's approach bears certain similarities to Brunswik's (1952, 1956) "probabilistic functionalism" in that both are essentially concerned with the adaptive inter-relationship between an organism and its environment. In a similar vein, Peterson and Beach (1967) chose to study "man as an intuitive statistician". The point of view underlying these authors' review of research was that "man must come to terms with his uncertain environment" (p.42). However, their approach was essentially normative since they compared human inferences with the optimal inferences which would be made by what they call "statistical man".

For Kelly, science is not an activity fully differentiated from normal understanding and practised by a trained elite. Rather, it is a universally and uniquely human activity which "scientists" have formalised and made more rigorous in their attempts to achieve understanding of particular classes of phenomena.

Central to Kelly's psychology is that a man may construe his environment in an infinitude of different ways. In this view man is in no sense stimulus-bound, though he may well be bound by his construal of the world. Man is seen as representing or modelling his environment -- this is the only way he can know it -- and is more or less successful in doing so to the extent that he can cope with it through the predictions his constructions permit.

Kelly calls the means of representing the environment "constructs". A person's constructs are the goggles through which he views the world. A construct is a bi-polar dimension, a way of categorising similarities and differences which we perceive in our environment.

Since a man can only know 'reality' through his system of constructs, then we need not include an experimenter's view of what Scheibe calls his "psychological ecology" since his behaviour will be based on his own view. In fact, if we are to predict a person's behaviour in any situation, then we first need to know how he construes the particular situation.

The Repertory Grid

Kelly developed the Repertory Grid as a means of externalising part of a person's construct system. Essentially, a grid is a two-dimensional array in which any particular cell X_{ij} contains information about element j in relation to construct i. (An element is any 'object of construction' and may in some instances be a construct -- ie., one may construe constructs.)

Kelly himself used a dichotomous system of information coding in the grid. For example, elements which are described by one pole of a construct may be designated '✓' and elements which are described by the other pole may be designated 'X'. In addition, the system can be made trichotomous by allowing a "not applicable" response --

the element is described by neither pole of the construct.

While this method was sufficient for Kelly's purposes, it does not allow any fine discriminations to be represented. However, two other forms of the grid have been popularised in recent years. These are the 'ranking' form and the 'rating' form (Bannister & Mair, 1968).

In the ranking form of the grid, the elements are arranged in order of distance from the emergent pole of the construct. Hence, if there are six elements, then the element most like the emergent pole is ranked 1, and the element least like this pole is ranked 6. Thus, the implicit pole may not need to be mentioned, but may affect the ranking. For example, suppose we have a case where two of the elements to be ranked are 'wife' and 'mother-in-law' and the emergent pole of the construct is labelled 'cool'. It is quite likely that the ranking of the two elements would be different if the implicit pole was 'uncool' than if it was 'warm'. (Humphreys, 1973)

In the rating form of the grid, each construct is considered as a linear scale ranging from the emergent pole to the implicit pole. Hence, each element may be assigned a rating which reflects its position on the construct. The use of a rating scale obviates the difficulty described above in relation to ranking. Such a method also allows more discrimination to be made than the trichotomous method.

The rating form of the grid is often compared with Osgood's semantic differential technique (Osgood, Suci & Tannenbaum, 1957). The main difference is that in a grid the dimensions are provided by the subject -- hence the "personal" in PCT. More formally stated, Osgood was interested in what we might call 'public semantic space' whereas Kelly was interested in 'private semantic space'.

Limitations of PCT

Earlier (p. 1) it was stated that PCT is difficult to use as a predictor of behaviour. This conclusion is supported by the fact that very few attempts have been reported in the literature.

Bannister and Mair (1968) include the following description:

> "In an experimental situation (Mair, 1966), the dimensions used to make sense of, and discriminate between different types of paintings were elicited from a group of people; and an attempt was made to explore the degree to which these subjects could take in limited information about each other's preferences, and use it to make accurate predictions about the kind of pictures the others would like best."

Since this is the only description available of an otherwise unpublished study, evaluation is difficult. However, the fact that no results are reported suggests that difficulties were encountered. Furthermore, the grids were obviously not the only basis for prediction since subjects were provided with unspecified "information about each other's preferences".

Reid and Holley (1972) used "repertory grid techniques" to study choice of university. However, their work could hardly be considered as involving 'personal' constructs since they used 32 subjects to elicit 9 constructs which were then provided to the main 70 subjects.

The ratings on these constructs were then related to choice of university. The authors report that "relationships existed between the manner in which the respondents located the universities on the constructs and their decisions on whether or not to apply to them." (p.56). In an attempt to specify the relative importances of "perceptions of universities" and "environmental factors" (which were really biographical details), the data were subjected to factor analysis. Seven factors, accounting for only 48.7% of variance, were obtained. Since the last three factors were described as "not interpretable", this means that only 34% of variance was accounted for, 12.5% being accounted for by the first factor. Hence, although the study is interesting at a conceptual level (ie., relating a person's views to choice behaviour and posing questions about relative importances), the methodology leaves much to be desired and the results are consequently of little value.

The only other major published work which relies on PCT to model behaviour is Duck's work on friendship formation (Duck, 1973a, 1973b, 1975; Duck and Spencer, 1972). Using Kelly's sociality and commonality corollaries, Duck has suggested that friendships are formed initially on the basis of observable similarity, but that as the friendship develops, the focus of attention is psychological similarity. If this is true, argues Duck, then different measures will be appropriate at different stages of friendship, a fact which may explain equivocal results in previous studies of the relationship between personality similarity and acquaintance. Hence, he finds that similarity as measured by the California Personality Inventory characterises early friendship but that longer-standing friendships are characterised by similarity in construing.

Although Duck's results generally support his hypotheses, his work is not without certain difficulties. Two minor problems are that this formulation does not account for 'complementary' friendships in which each person is what the other is not, and that it precludes friendships in which the people are psychologically similar but 'observably' different. More fundamentally, Duck's means of measuring similarity of construing leaves much to be desired since it is based on the verbal labels with which subjects describe their constructs. Evidence will be presented later (Chapter 5) which suggests that although people may employ the same words to describe constructs, the constructs are used very differently in the way they treat what are ostensibly the same elements.

To summarise, PCT has shown itself to be useful as a means of describing beliefs at a particular point in time, as evidenced by the vast number of clinical studies in which its use has been reported. However, it is difficult to extract behavioural predictions from a repertory grid.

MULTI-ATTRIBUTED UTILITY THEORY (MAUT)

Utility theory is a part of measurement theory that deals with evaluating objects by numbers that are consistent with the decision maker's preferences, tastes and values. If the choice entities vary on more than one dimension of value, then they are classed as multi-attributed. Hence, MAUT is concerned with assigning utilities to multi-attributed choice entities.

The assumptions of utility models fall into three categories:

a) Assumptions that the decision maker can exhibit preferences and that he does so consistently as if he were maximising something. These assumptions are often summarised as the "weak order" axiom.

b) Independence assumptions that require preferences among choice entities to be independent of certain manipulations of these choice entities. These assumptions are called cancellation, monotonicity, preferential independence, utility independence and the like.

c) "Technical" assumptions that prohibit abnormalities in preferences. One abnormality is that some choice entity is infinitely desirable ("heaven") or infinitely undesirable ("hell"). "Archimedian" axioms prohibit this from occurring. Another abnormality is that certain choice entities cannot be varied finely enough to produce indifferences with some other fixed choice entities. "Solvability" axioms prohibit such gaps in the set of choice entities. (v.Winterfeldt, 1975).

Although a variety of utility models exist, it is the additive models which have received most attention. These models have intuitive rational appeal and are robust against minor model violations. They can approximate other models rather well when utilities in single attributes are monotone functions of the attribute values (v.Winterfeldt and Fischer, 1973). Arguments for the robustness of such models can be found in Yntema and Torgerson (1961), Fischer (1972) and v.Winterfeldt and Edwards (1973).

The present study will concern itself with the particular additive model proposed by Raiffa (1969). We may represent Raiffa's model thus:

The utility of outcome n, U_n , is given by

$$U_n = \lambda_1 X_{1n} + \lambda_2 X_{2n} + \lambda_3 X_{3n} + \ldots + \lambda_r X_{rn}$$

where X_{rn} is the rating of outcome n on the r^{th} attribute dimension, and λ_r is the weight assigned to the r^{th} dimension.

It can be seen that this model is derived from the additive conjoint measurement model which may be represented thus:

$$F(X_j) = \sum_{i=1}^{n} f_i(X_{ij})$$

(after v.Winterfeldt and Fischer (1973): Model 1.4)

Here, $f_i(X_{ij})$ scales the part-worth of outcome X_j on dimension i. As Raiffa points out, for any X_{ij}, $u_i(X_{ij})$ is monotonically related to $f_i(X_{ij})$.

Given a scaling procedure which yields attribute values $g_i(X_{ij})$, monotonically related to $f_i(X_{ij})$ and hence to $u_i(X_{ij})$, a basic reference lottery ticket (brlt) based procedure may be used to construct the $u_i(X_{ij})$ directly. The relation is of the form

$$u_i(X_{ij}) = \lambda_i \left[g_i(X_{ij}) \right] \qquad \text{where } \sum \lambda_i = 1$$

The λ_i assessed by brlt-based procedures are in fact products of

$$\Big[\underset{w_i}{\text{value-wise importance weight}}\Big] \times \Big[\underset{q_i}{\text{relative scaling factor}}\Big] \times \Big[\underset{h_i}{f_i \text{ to } u_i \text{ correction}}\Big]$$

Hence $u_i(X_{ij}) = w_i q_i h_i \left[g_i(X_{ij}) \right]$

Under conditions of riskless choice we may assume that $h_i = 1$ (i = 1 to n), giving

$$f_i(X_{ij}) = w_i q_i \left[g_i(X_{ij})\right] = \lambda'_i \left[g_i(X_{ij})\right]$$

From a conjoint measurement point of view, the separation of λ_i into $w_i q_i h_i$ and λ'_i into $w_i q_i$ is both unnecessary and vacuous since w_i, q_i and h_i cannot be assessed separately from one another (Humphreys, 1975).

All utility models are normative in the sense that they prescribe the optimal decision, ie., the 'perfect' decision maker should choose the object or outcome with the highest utility. However, it is also possible to use a model in a descriptive sense, ie., by observing the extent to which the model will predict choice behaviour. The normative/descriptive distinction is often blurred in any particular application. The distinction is perhaps best exemplified by the following two statements:

a) People tend to be 'conservative' information processors when compared with Bayes' theorem. (Normative)

b) Bayes' theorem is an imperfect predictor of human information processing behaviour. (Descriptive)

Hence, in the present study Raiffa's model will be used in a descriptive sense in an attempt to predict choice behaviour. Although Raiffa's model was formulated to deal with risky decision situations, it will be applied to what are essentially riskless situations in the present study. However, an additive representation under risk implies an additive representation under certainty.

Limitations of MAUT

Despite the mathematical power and elegance of multi-attributed utility models, their usefulness as either descriptive or normative models depends on the initial selection of attributes. As Raiffa put it:

> "There is a real substantive question that I would like to duck even though it is of major importance; that is: Are these 20 attributes a sufficiently rich and meaningful set of descriptors to capture the essence of the problem area?" (1969, p.22)

Raiffa was not alone in his ducking of the question, for three years later Fischer wrote:

> "... it should be noted that this research completely ignored the problem of defining the list of value attributes relevant to a given decision. These were simply given to the subjects as part of their tasks... This criticism applies not only to the present research, but also to virtually all psychological studies of preferences for multi-attributed alternatives." (1972, p.84-5)

Hence we have a situation where experimenters provide a set of attributes; yet we started with the supposition that a person's behaviour depends upon his own beliefs.

A SYNTHESIS

It would seem that each of the theories described provides an answer to the other's problems. PCT offers a means of eliciting meaningful attribute dimensions and MAUT offers a means of predicting (or, indeed, prescribing) behaviour on the basis of these dimensions.

The first research on the combination was published by Humphreys and Humphreys (1975). This paper indicates which of the MAUT assumptions have a direct bearing on the situation when using a repertory grid. Briefly, these are a) monotonicity of attribute dimensions, and b) weak conditional utility independence.

The Present Study

The present study represents an attempt to develop and apply a model based on PCT and MAUT with the important addition of the notion of 'purpose'. Consider first the following criticisms of Humphreys and Humphreys' work.

The first, somewhat minor point relates to the number of dimensions elicited from each subject. Humphreys and Humphreys cite Kozielecki (1970) as presenting evidence that intuitive decision makers are able to make use of a maximum of about six dimensions of variability at any one time. They therefore elicited only six dimensions from each subject. In the present case, the dimensions will be used in several situations. Hence, although a person may only use six dimensions in any one situation, a 'pool' of dimensions is necessary in order to allow people maximum discrimination within any one situation. That is, the dimensions selected from the pool for use may vary from situation to situation. Furthermore, Miller (1956) makes the point that if the dimensions can be superordinated then many more can be handled. The superordinate nature of constructs is fundamental to Kelly's theory (cf. his organization corollary). Hence, we need not limit the number of dimensions so severely.

The second, major point relates to the nature of the Kelly/Raiffa model. As used by Humphreys and Humphreys, the model was essentially static and offered no possibility for change. That is, given the same elements from which to choose, the model would predict the same choice each time. This is patently not the case in the real world; we do not choose the same book each time we go to the book-case. Brief introspection suggests that what differs between visits to the book-case is the purpose we have in choosing a book. That is, if we are to talk meaningfully about the utility of an object, we must do so in relation to the purpose or goal of the decision maker.

To illustrate this with the Humphreys' example of films, consider the construct 'violent -- non-violent' . This construct may be very important (heavily weighted) if one is choosing a film to see with a squeamish girl-friend. However, if one merely wants to indulge in some temporary 'escapism' such a construct may not contribute much to the choice of film -- although it is still a construct which one brings to bear on films. Hence, the utility of any particular film will depend in part on the purpose one has in choosing a film, and we might therefore expect the pattern of construct weightings to change as the decision situation changes.

To a certain extent, Shepard (1964) anticipated this idea, saying:

> "...the relative weights to be assigned to the component attributes are not always determinate and may, in fact, depend on the adoption of one of several incompatible but equally tenable systems of subjective goals." (p.257)

However, whereas Shepard saw goals as a source of "nonoptimality" and therefore problematic, it is here contended that a consideration of goals or purposes is fundamental to an understanding of decision making behaviour. Hence, the present approach will be to include the notion of purpose in the Kelly/Raiffa model and thereby avoid a static state of affairs.

To be fair to Humphreys and Humphreys, it is not only their research which was static since all applications of MAUT are similar. For example, v.Winterfeldt and Fischer (1973) mention time-variable choices but the models they suggest to deal with such choices employ various methods of time discounting. Similarly, Bauer and Wegener (1975) recognise the need for a model which would allow for "dynamic development over time" (p.412) since their own use of MAUT procedures were merely iterative. Indeed, v.Winterfeldt (1975), in describing the content of his review paper said that "...dynamic decision situations, and group decision makers will be omitted, because appropriate utility models are missing for these cases." (p.12).

To introduce the notion of purpose into a discussion is still seen by many psychologists as an unnecessary act. Indeed, it was not until recently that the use of the word 'teleological' signified anything other than an appeal to god-given goals, and Pittendrigh (1958) coined the term 'teleonomic' in order to avoid such connotations (Lorenz, 1969).

In the present context, the notion of purpose is taken to mean no more than that the person to whom purpose is attributed is behaving in a goal-directed manner. Much behaviour is describable in such terms. Indeed, Sartre (1963) argues that <u>all</u> human actions are directed towards 'ends' and that comprehension of others is achieved only through a realisation of their ends.

Although neither Personal Construct theorists nor Utility theorists discuss purpose directly, such a notion is clearly compatible with PCT and MAUT since it implies that a person anticipates the outcome of his actions and values such outcomes. In the sense that purpose is a property of a system (cf. Taylor, 1964), it can thus be seen to be a property of a system of dynamic beliefs and values.

It should be noted that Scheibe's statement quoted earlier (p.1) does not presume a certain type of behaviour. That is, all behaviour is seen as being guided by the interplay of beliefs and values. Furthermore, this generality is not reduced by either of the theories here considered; both PCT and MAUT are essentially contentless.

Hence, the model may reasonably be expected to have a wide range of applicability in terms of conceptualising different behaviours. Also, to the extent that PCT is a theory of 'personality' (Kelly, 1963), the model may also have applicability in conceptualising different personalities. Both areas of applicability will be explored in later chapters.

SUMMARY STATEMENT AND AIMS

The repertory grid can be used to describe a person's beliefs about a particular set of choice objects. The matrix of ratings contained in the grid can be used as the basis of Raiffa's multi-attributed utility model to predict which of the objects will be chosen. We represent the model thus:

The utility of alternative n, U_n , is given by

$$U_n = \lambda_1 X_{1n} + \lambda_2 X_{2n} + \lambda_3 X_{3n} + \ldots + \lambda_r X_{rn}$$

In this case X_{rn} represents the rating of element n on construct r.

In any particular situation, the model predicts that the decision maker will choose the alternative with the highest value of U. Furthermore, it is hypothesised that the λ-weights will change as a function of the decision situation or the decision maker's purpose.

In general terms, it is the aim of the present study (a) to test the model's ability to predict choice behaviour and, if necessary, further develop the model, (b) investigate the hypothesis that λ-weights change as a function of the decision maker's purpose, (c) given the results of (a) and (b), attempt to apply the model in a previously unexplored 'real life' area. More specific hypotheses will be proposed and tested where appropriate in later chapters.

CHAPTER 2

METHODOLOGY

In order to describe clearly the use of the Raiffa method in conjunction with a repertory grid, it may be helpful to make repeated reference to an example. For this reason, consider the following:

> The subject is a 26-year-old male Clinical Psychologist and the area of decision making he has chosen to consider is related to L.P. records.
>
> He has listed nine different situations in which he chooses a record to play. Examples of these situations are when he wants 'music to doze by', 'music as a background to study' and so forth.
>
> He has also listed ten L.P. records with which he is familiar and which form a cross-section of his musical interest. These ten records have been used as elements in a repertory grid in order to elicit seven constructs and each element has been rated on each construct. For each of his nine situations, the subject has specified the preferred pole of each construct. That is, he has specified on which pole of each construct his 'ideal' element for that situation would lie, and has repeated this procedure for each situation.[1]

In addition to the material already obtained, an intuitive preference ordering of the elements for each situation is required. In practice, each preference ordering is usually obtained immediately prior to the corresponding Raiffa elicitation procedure, since subjects then only need to 'think themselves into' each situation once.

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1. If the ideal point does not lie at the end of the dimension it is necessary to "fold" the dimension about the ideal point (Coombs, 1964). Failure to do so would violate the monotonicity assumption.

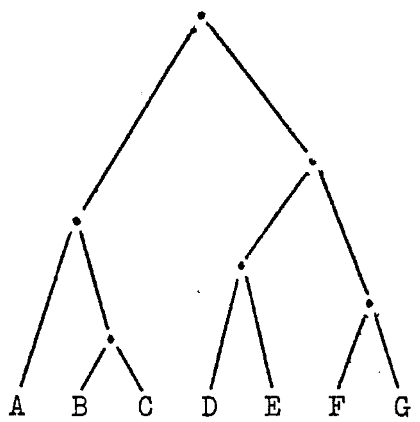
Raiffa discusses several techniques for weighting attribute dimensions, the most promising of which is based on a series of lotteries. Assuming weak conditional utility independence (wcui), a lottery technique may be used to establish relationships between paired sets of dimensions. A hierarchy may be used to decompose the total set of dimensions into subsets, provided there are only two branches at each node of the hierarchy. (Although Raiffa discusses the hierarchical structure of attributes, the use of a hierarchy in decomposition is attributable to Humphreys and Humphreys (1975).)

Use of the lottery method is based mainly on its superiority to other methods in assessing importance weightings. Examples of applications using the method are: evaluation of hypothetical compact cars (Fischer, 1972), evaluation of apartments by students (v.Winterfeldt and Edwards, 1973), and evaluation of cinema films (Humphreys and Humphreys, 1975). In each of these applications, lottery techniques were found to be at least as good or better than alternative methods in predicting wholistic evaluation of outcomes.

Within the additive framework, the two major alternatives to the lottery method are the compensation method and the direct rating method. The former has been used by v.Winterfeldt and Edwards (1973) in the evaluation of apartments by students under riskless choice. They found this method to be inferior to a lottery method but superior to a direct rating method. As might be expected from notions of transitivity, direct rating method has also proved inferior to the lottery method in predicting wholistic evaluation (Fischer, 1972; v.Winterfeldt and Edwards, 1973; Chapman, 1974).

In theory, any hierarchical representation which meets the 'two branches per node' requirement can be used as the basis for the series of lotteries. However, the present author follows Humphreys and Humphreys (op. cit.) in using hierarchical cluster analysis since, as they argue, such a method optimises the chance of satisfying the wcui assumption. The argument is based on the fact that degree of association between constructs decreases as one progresses up the hierarchy. Hence, estimates of λ involving large numbers of constructs have the best chance of meeting the wcui assumption since, if dimensions are value-wise non-independent they will be correlated. That is, λ estimates with a large number of implications have the best chance of displaying value-wise independence. (A more extensive discussion of hierarchical decomposition is contained in Chapter 4).

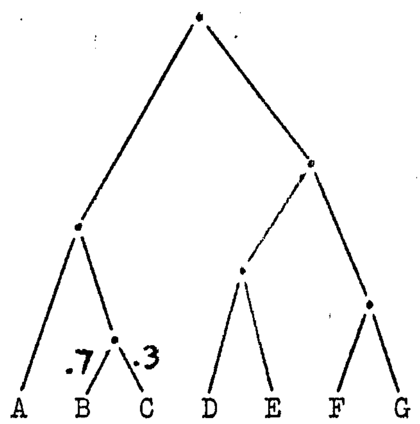
Consider the following hierarchy of constructs:



The first stage in the procedure is to consider the pair of constructs which are most highly related — in this case B and C. For the particular situation under consideration, the subject will have designated one pole of each construct as preferred.

Following Raiffa's notation, let B^* and C^* represent the preferred poles of these constructs, and let B_* and C_* represent the non-preferred poles. The subject is then asked to choose between a gamble and a 'sure thing'. If he chooses the gamble, he might get a stereotype element with the properties $[B^* \text{ and } C^*]$ with probability P, or he might get a stereotype element with the properties $[B_* \text{ and } C_*]$ with probability 1-P. If he chooses the sure thing, he gets a stereotype element with the properties $[B^* \text{ and } C_*]$.

The value of P is then varied until the subject is indifferent between the gamble and the sure thing. It can be shown that, for this value of P, the ratio between P and 1-P is the same as the ratio between the relative weightings of the two constructs. These values may be entered onto the hierarchy as follows:



In this case, when P = 0.7 the subject is indifferent between the gamble and the sure thing.

This procedure is carried out for each node in the hierarchy until the 'top' is reached, at which point each section of the hierarchy will have a number between 0.0 and 1.0 associated with it. Thus, in the present example, the subject would next be offered a gamble between elements with the properties $\left[(B^* + C^*) + A^*\right]$ or $\left[(B_* + C_*) + A_*\right]$ or a sure thing with the properties $\left[(B^* + C^*) + A_*\right]$. At each node, constructs forming subordinate nodes are considered as inseparable units.

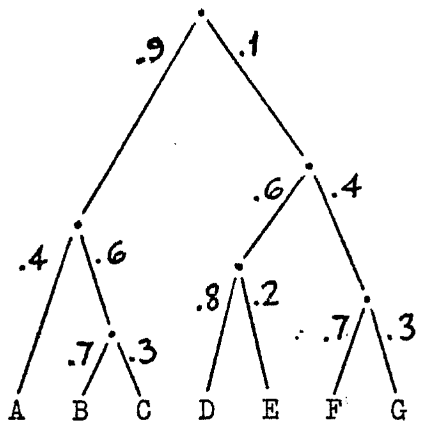
Having dealt with construct A, the next comparison to be made would be D - E, followed by F - G. The subject would then be offered the following choice:

A gamble between elements with the properties:			A sure thing with the properties:
$(D^* + E^*)$ and $(F^* + G^*)$	with probability P		
OR		OR	$(D^* + E^*)$ and $(F_* + G_*)$
$(D_* + E_*)$ and $(F_* + G_*)$	with probability 1-P		

For the present example, the final choice representing the uppermost node of the hierarchy would be as follows:

A gamble between elements with the properties:			A sure thing with the properties:
$(D^* + E^* + F^* + G^*)$ and $(A^* + B^* + C^*)$	P		
OR		OR	$(D^* + E^* + F^* + G^*)$ and $(A_* + B_* + C_*)$
$(D_* + E_* + F_* + G_*)$ and $(A_* + B_* + C_*)$	1-P		

This final choice having been made, each section of the hierarchy should now have a relative weighting associated with it, as follows:



This hierarchy is now analogous to a decision tree, and the 'conditional probability' of each construct can be calculated by multiplying along the arms, eg.

Conditional probability of B = 0.7 x 0.6 x 0.9 = 0.378

It is this conditional probability which Raiffa terms the value-wise importance, λ, of each construct.

When a repertory grid is elicited, it is often the case that the emergent pole of each construct is assigned to the '1' end of, say, a 1 - 5 scale, and the implicit pole is assigned to the '5' end. However, if the grid is to be used to derive a preference ordering, then each construct should be so arranged that the preferred pole is assigned to the '5' end of the scale. A grid which has been so arranged is called a 'preferred pole' grid. Since the preferred pole of a construct may be different for different situations, the preferred pole grid may therefore differ between situations.

Consider the following preferred pole grid for the seven constructs in the example:

CONSTRUCTS	ELEMENTS (L.P's) 1	2	3	4	5	6	7
A	1	4	2	3	5	3	3
B	2	1	5	3	4	2	4
C	4	2	4	1	5	3	1
D	1	2	4	5	3	2	3
E	5	3	3	2	4	1	5
F	3	2	3	1	5	4	4
G	4	1	3	2	3	3	5

The next stage in the technique is to multiply the λ-weighting for each construct by the ratings on that construct. Hence, since $\lambda_A = 0.36$ the ratings on construct A would now look as follows:

A	0.36	1.44	0.72	1.08	1.80	1.08	1.08

When each construct has been weighted, weighted ratings may now be summed for each element. Since it can be shown that the array of sums is a monotonic transformation of an array of expected utilities, then a preference order may now be derived by ranking elements in terms of these sums. That is, the element with the largest sum is taken to be the most preferred element, and so forth. This preference order may then be correlated with the subject's actual preference order for this situation.

This, then, is the basic method of weighting a set of constructs. However, since the pattern of preferred poles may change in relation to different situations -- and even if they stay the same, the relative weightings may change -- the whole procedure must be repeated for each situation.

The correlation between actual and predicted preference order is the main basis for evaluating the descriptive power of the model. As Phillips (1973) has pointed out, there are several reasons why it is not appropriate to apply a traditional test of significance to such a correlation. Indeed, previous research already suggests that the correlation will be non-zero, so to test the result against a null hypothesis would be hypocritical.

Edwards, Phillips, Hays and Goodman (1968) suggest that such a model may be further evaluated by comparing its performance with alternative models. Humphreys and Humphreys (op. cit.) have already favourably compared the Raiffa solution to various other solutions (eg. factor analytic, multi-dimensional scaling, etc.). Hence the present study will concentrate mainly on the correlations, although the results of alternative weighting schemes will be discussed in Chapter 4. In addition, since λ-weights will be obtained for several situations, the hypothesis that any one set of λ-weights may predict choice in other situations will be tested. The question of validation will be returned to in Chapter 5.

SUMMARY OF METHOD

1) Ascertain area of decision making to be considered.
2) Elicit purposes for decision making or situations in which decisions are made.
3) Elicit set of choice objects. Use these as elements in order to elicit constructs. Rate elements on constructs.
4) For each purpose/situation, rank order elements in terms of preference. Elicit weightings on constructs.
5) Combine weightings and ratings to produce prediction of rank

ordering.

6) Compare (correlate) predicted and actual rank ordering.

It can be seen that steps 4 - 6 form an iterative loop which is traversed until no more purposes remain.

In practice, the grid resulting from step 3 is cluster analysed in order to yield the hierarchy of constructs before step 4 is undertaken.

CHAPTER 3

SOME STUDIES USING THE METHOD

In this chapter results obtained using the model in a variety of choice situations are presented. It should be noted that the time commitment per subject is quite high (somewhere in the region of 10 hours $\pm$ 4 hours) and in cases where the 'experiment' has been extended, the time commitment is proportionally greater. Although this amount of time was spread over several weeks by dividing it into discrete sessions, subjects were informed of the total commitment during recruitment.

In view of this time commitment and in view of the fact that (initially, at least) payment of subjects was not feasible, it was felt that recruitment would be most successful if it used personal acquaintance as an introduction. Hence, all subjects described in the present chapter were personal acquaintances of either the author or his wife.

In point of fact, Subject 6 was paid for his co-operation although at no time during the experiment did he know he would be paid. He was paid because a) by this time a limited amount of money had become available, and b) he needed the money. Two days after the conclusion of the experiment he was paid £5 which was calculated on the basis of an estimated 10 hours at the standard rate of 50p per hour. Subject 7 declined to accept a similar offer made after he had completed the experiment.

The sessions used with subjects were organised as follows:

1) An initial session in which the subject delimited the area to be considered and listed the purposes which they brought to the

area. This list was then put aside and elements were elicited by asking the subject to list about 10 objects which they felt represented a good cross-section of the range of objects from which they were used to choosing. In eliciting elements it is important to obtain a representative cross-section since they will then be used to elicit constructs. A 'bias' in element elicitation will increase the probability of a bias in construct elicitation which in turn will limit the situations to which the constructs have applicability.

When subjects were satisfied that they had adequately represented the range, the names of the objects were written on plain, white 128mm x 76mm cards. These cards were then presented to the subject as triads and the subject was asked to consider some way in which any two of the objects seemed similar to each other and thereby different from the third. When the subject had described a construct in this manner, the pole descriptions were written on separate cards which were placed at opposite ends of a 5-point scale represented by five cards bearing the numbers 1 to 5 in order. Subjects were then presented with the complete set of element cards and asked to rate them on the construct by placing them under the appropriate number.

In this way, constructs were elicited using the elements and a rating form repertory grid was generated. In principle, element triads can be chosen randomly. However, in the author's experience, random selection usually results in pairs of elements occurring more than once. In such cases, the 'easy solution' for the subject is to reiterate a construct already elicited on the basis of the recurring pair. For this reason, once the number of elements was known, a list of ten triads was drawn up in which no pair of elements occurred more than once. That is, if the first triad contained elements 1, 2 and 3, no other triad would contain 1 and 3, or 2 and 3, or 1 and 2. With nine or ten elements this is very easy to arrange but obviously gets more difficult as the number of elements decreases.

By arranging the triads in this manner, the opportunity for a broad spectrum of constructs to emerge is maximised without overtly influencing the subject.

As the final exercise in the initial session, subjects were required to state their ideal point on each construct for each purpose. This was done by giving subjects a list of their constructs and asking them to think about their first purpose. With this purpose in mind, they were asked to state at which pole their ideal element would lie for each construct, or whether it would lie somewhere in between. In all cases, subjects stated a pole, thereby obviating the need to fold dimensions about the ideal point.

2) Subsequent sessions in which λ-weights were elicited. Only one set of weights was elicited in any session since this usually took one hour and often longer. As was stated earlier (p.25), in the period between the grid-elicitation and the first weight-elicitation the grid was subjected to hierarchical cluster analysis in order to produce a hierarchy of constructs. Although the hierarchies were checked for excessively high matches, it did not prove necessary to ask any subject to modify his constructs. This was presumably because the triads of elements had been presented in such a way as to

minimise the possibility of very high matches occurring.

Before each weighting session, the gambles indicated by the hierarchy and list of preferred poles were written out on white cards such that the two options of the gamble were on separate cards and the sure thing was written on a third. Hence, each gamble was presented to the subject in the form shown earlier (p.21) with the values of P and 1-P written on smaller pieces of paper placed alongside the corresponding card.

In considering each gamble, the problem is to find a value of P for which the subject is indifferent between the gamble and the sure thing. This problem is equivalent to the problem of threshold determination in psychophysics. In discussing the determination of thresholds, Woodworth and Schlosberg (1954) say:

> "From what has been said the Method of Limits is obviously a very flexible one. It can be used with a wide variety of stimuli and for a wide variety of purposes. It has one final merit: it is the one method that shows clearly the operations which define the concept of 'threshold'. That is, it shows directly where the stimulus passes the boundary separating one response category from another. It is thus the reference experiment for the concept." (p. 199)

In the present case, what is being sought is the value of P where the response changes from 'gamble preferred' to 'sure thing preferred' or vice versa. Hence, a modified form of the method of limits was used in determining the indifference points.

This was done by starting with a high value of P -- i.e., 0.9. If the subject preferred the sure thing, then P must be too low, and if the subject preferred the gamble then P must be too high. In most cases, this value of P proved too high, but in a few cases the value was increased to 0.95 or 0.99 before the subject became indifferent. If P was too high, a value of 0.5 was substituted and for most cases this proved too low. In the few cases where this value of P was not low enough, a value of 0.1 was substituted and this was found to be below the indifference point in all cases.

Hence, an upper and lower limit was established and the value of P was then adjusted alternately from the upper limit downwards and from the lower limit upwards until an indifference point was found. Occasionally an indifference range was found. In these cases the mean value was presented and subjects still professed indifference. Since no range was ever greater than 0.1 it was felt that use of the mean should not seriously distort the results.

When subjects claimed indifference, this was checked by suggesting that if they were indifferent between the gamble and the sure thing they shouldn't mind a fair coin being tossed to determine which they received. In all cases this was accepted, although one subject found it somewhat strange that he had to make so many decisions in order to get to a position where he could toss a coin to decide for him!

In presenting subjects with a sure thing $\left[A^* + B_*\right]$ it is assumed that equivalent indifference points would be obtained using $\left[A_* + B^*\right]$, i.e., the scale between $\left[A^* + B^*\right]$ and $\left[A_* + B_*\right]$ is an interval scale isomorphic with the probability scale. From a purely procedural point of view, it would be possible to test this assumption by presenting each gamble twice -- once with each sure thing combination.

However, from a methodological point of view, it was felt that such blatent consistency checks would make subjects defensive. That is, a large part of their attention would be directed towards remembering what they had said and being consistent rather than acting naturally. For this reason, it was decided not to carry out such checks.

This having been said, it should be noted that gambles were occasionally presented twice, once with each sure thing combination. However, this was not done in any systematic fashion except that it was never done more than once with any one subject. In such cases, the alternative gamble was presented seemingly spontaneously and explained as the experimenter wishing to try an idea which had just occurred to him. In all cases, equivalent indifference points were obtained. While this tends to support the assumption described above, it is still possible that subjects remembered their earlier judgements and responded accordingly.

As was stated above, the elements of the repertory grid were elicited from the subject. As far as the present author can ascertain, this is in contrast to all other reported applications of MAUT with the possible exception of Humphreys and Humphreys (1975) who allowed subjects to choose a sample of six elements from a set of 14 provided.

Subject 1

Subject 1 was a 26-year-old male psychology postgraduate student. The area of decision making he chose to consider related to the playing of L.P. records. Ten records were elicited as elements and these were in turn used to elicit ten constructs. All elements were rated on all constructs, yielding the following repertory grid:

ELEMENTS		1	2	3	4	5	6	7	8	9	10
Zappa. "Hot Rats"	1	2	2	2	3	3	2	4	1	3	3
Whitren. "Raw But Tender"	2	5	1	2	1	1	3	3	4	2	4
Stones. "...Ya-Ya's Out"	3	5	2	2	1	2	2	5	2	2	3
Vivaldi. "Echo Concerto"	4	1	1	5	5	4	5	1	1	3	2
Bach. "Italian Concerto"	5	1	1	5	4	5	4	2	1	3	2
Scarlatti. "Sonata in D"	6	3	1	5	2	5	4	3	1	4	5
Paxton. "Ain't That News"	7	5	1	4	1	2	4	3	4	3	2
Parker. "Bird Symbols"	8	3	3	1	3	1	2	3	1	1	2
Rollins. "East Broadway.."	9	4	5	1	3	1	1	4	1	5	3
Blake. "Blues in Chicago"	10	5	1	2	2	2	3	4	5	1	2

CONSTRUCTS

1	Modular, self-contained	Planned, leading somewhere
2	Loose, running away	Controlled, tight
3	Detached	In touch
4	Flowing	Jerky
5	Decorative	Expressive
6	Gentle	Assaulting
7	Earthy, solid	Airy, cheerful
8	About experience	Abstract
9	Avant-garde	'Blues'
10	Stable mood	Fluctuating mood

FIGURE 1 : Elicited repertory grid for Subject 1.

The subject listed eight purposes which he brought to the area, as follows:

1) To cheer me up.

2) To calm me down.

3) To drive by.

4) To provide background whilst working.

5) To send me to sleep.

6) To dance to.

7) To provide background over dinner.

8) To be stranded on a desert island with.

These are the purposes which he may have in choosing a record from his collection. The final purpose was contributed in a spirit of fun by the subject since he saw the exercise as similar to that carried out on a well-known B.B.C. radio programme.

For each purpose in turn, the subject was asked to rank order the elements in terms of preference, yielding the following matrix: (1 = most preferred, 10 = least preferred)

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	5	2	1	10	6	7	8	3	9	4
	2	9	7	8	1	2	4	3	6	10	5
	3	5	2	1	10	9	8	6	3	7	4
	4	5	9	10	1	2	4	6	7	3	8
	5	8	4	10	1	2	3	5	7	9	6
	6	1	5	3	10	9	8	6	2	4	7
	7	3	7	8	1	2	4	9	6	10	5
	8	5	3	4	10	9	8	7	1	6	2

FIGURE 2 : Intuitive preference orders for Subject 1.

He was then asked to state at which pole of each construct his ideal element would lie, yielding the following matrix:

CONSTRUCTS

PURPOSES	1	2	3	4	5	6	7	8	9	10
1	R	L	L	L	L	L	L	R	L	R
2	L	R	R	R	R	R	L	L	R	L
3	R	L	L	L	L	L	R	R	L	L
4	R	R	R	R	R	R	L	L	R	R
5	L	R	R	R	R	R	L	L	R	R
6	R	L	L	R	L	L	R	R	L	R
7	L	L	L	R	R	R	L	L	L	R
8	L	L	L	L	L	L	R	R	L	L

FIGURE 3 : Construct preferred poles for Subject 1.

Hence, if the left-hand (L) pole of a construct is preferred for a particular situation, the ratings on that construct must be reversed so that they reflect preference. This operation yields the preferred pole grid, as previously mentioned (p. 22).

Then, for each situation in turn, a set of λ-weights was elicited by the method described in Chapter 2, yielding the following matrix:

CONSTRUCTS

PURPOSES	1	2	3	4	5	6	7	8	9	10
1	.05	.11	.15	.14	.095	.28	.03	.01	.085	.05
2	.004	.2	.03	.08	.04	.57	.05	.014	.002	.01
3	.015	.146	.136	.286	.054	.205	.029	.003	.076	.05
4	.01	.07	.042	.21	.03	.374	.13	.074	.05	.01
5	.008	.064	.029	.161	.034	.546	.119	.019	.01	.01
6	.027	.075	.064	.238	.027	.363	.059	.029	.098	.02
7	.013	.092	.074	.241	.197	.295	.035	.028	.015	.01
8	.008	.126	.236	.068	.227	.059	.072	.05	.054	.1

FIGURE 4 : Construct weightings for Subject 1.

For each situation, the weightings and ratings were combined to yield a predicted rank ordering which was then correlated with the actual rank ordering for that situation. Figure 5 shows the correlations between actual and predicted rank orders.

	PURPOSE	CORRELATION (R_S)
1	To cheer me up.	0.820
2	To calm me down.	0.951
3	To drive by.	0.976
4	To provide background whilst working.	0.855
5	To send me to sleep.	0.964
6	To dance to.	0.733
7	To provide background over dinner.	0.915
8	To be stranded on a desert island with.	0.903

FIGURE 5 : Correlations between actual and predicted rank orders for Subject 1.

Subject 2

Subject 2 was a 23-year-old female Trainee Social Worker who wished to consider her decision making in relation to the choice of reading material.

Ten purposes in relation to this area were elicited, and the method as described was carried out using an elicited sample of ten books as elements, ten constructs being elicited. However, only one set of λ -weights was elicited -- those in relation to the first purpose — after which the experiment was terminated by mutual consent since the subject felt that a recent increase in pressure of work would no longer allow her to give the time required. When the subject's actual choice was correlated with predicted choice for the first situation, the result was $R_S = -0.224$.

Subject 3

Subject 3 was a 26-year-old male Probationer Clinical Psychologist who wished to consider his decision making in relation to the playing of L.P. records. Ten records were elicited as elements and these were used to elicit ten constructs.

Although Subject 3 originally listed nine purposes which he brought to this area, only three purposes were investigated. After this time, the subject moved out of the geographical area as a result of a change in job and hence became unavailable for further investigation.

The purposes considered were as follows:

1) As general background.
2) As a background to study.
3) To 'doze' by.

Figure 6 shows the correlations between predicted and actual rank orders.

	PURPOSE	CORRELATION (R_s)
1	As general background.	0.564
2	As a background to study.	0.636
3	To 'doze' by.	0.701

FIGURE 6 : Correlations between predicted and actual rank orders for Subject 3.

Subject 4

Subject 4 was a 25-year-old female Social Worker who wished to consider her decision making in relation to choice of clothes. Ten items of clothing were elicited and used as elements to elicit ten constructs.

Although Subject 4 originally listed eight purposes which she brought to this area, only four were investigated. After this time the subject, like Subject 3, changed job, moved out of the area and hence became unavailable.

Figure 7 shows the correlations between predicted and actual rank orders for the purposes considered.

	PURPOSE	CORRELATION (R_S)
1	To relax in at home.	0.830
2	To go to work in.	0.576
3	To go to a party.	0.600
4	To go on a picnic.	0.540

FIGURE 7 : Correlations between predicted and actual rank orders for Subject 4.

Subject 5

The investigation carried out in collaboration with Subject 5 represents a different use of the model. For this reason, a brief introduction to the use seems appropriate.

Kelly's (1955) original use of the repertory grid was in a therapeutic setting as a means of exploring clients' perceptions of significant other people. This is reflected in his calling the grid the "Role Construct Repertory Grid".

On the basis of Personal Construct Theory it seems reasonable to suggest that people use a particular set of constructs in viewing other people. Furthermore, since they are themselves a member of the class of objects to be construed, it follows that they can use these constructs in relation to themselves. Following this, the present author would argue that the roles which a person adopts can be defined in terms of different weighting sets on the relevant constructs. It is this reasoning which was tested with Subject 5.

Subject 5 was a 24-year-old female Trainee Social Worker who at the time was attending a full-time course leading to the Certificate of Qualification in Social Work.

The nine elicited elements used in the grid were roles with which she had some interaction, and ten constructs were elicited, yielding the grid presented overleaf as Figure 8.

Instead of purposes, a further seven roles were elicited, these being roles which the subject actually occupies at various times, as follows:

1) Wife.
2) Daughter.
3) Student.
4) Neighbour.
5) Consumer.
6) Social Worker.
7) Close friend, same sex.

Hence, the elements were roles which other people occupied and the 'purposes' were roles which the subject occupied. If the above reasoning is correct, the subject should be able to construe herself in the same terms in which she construes others.

Two other slight modifications to the method were used in order to

ELEMENTS		Construct 1	2	3	4	5	6	7	8	9	10
Doctor (G.P.)	1	2	4	4	5	3	2	1	2	1	3
Vicar	2	4	1	5	4	1	1	4	5	2	5
Bus conductor	3	2	4	2	2	5	4	5	1	4	4
School Teacher	4	5	3	5	3	1	3	2	4	2	2
Secretary	5	3	5	1	1	4	4	3	2	3	1
Nurse	6	3	3	4	3	3	1	3	3	4	1
Hairdresser	7	1	4	1	2	5	5	4	1	4	4
Therapist	8	5	2	3	3	1	1	2	4	1	3
Shop assistant	9	2	5	2	1	5	2	4	2	5	2

CONSTRUCTS		
1	Physical things	Mental things
2	'Real world'	Not real world
3	Financial gain	No financial gain
4	Serving	Controlling
5	Personal growth	Not personal growth
6	Caring	Not caring
7	Knowledgeable	Not expected to know
8	Expect results	Don't expect results
9	Expect honesty	Don't expect honesty
10	Probably ambitious	Not necessarily ambitious

FIGURE 8 : Elicited repertory grid for Subject 5.

simplify the task for this subject. In considering the gambles, it was suggested that some omnipotent deity could provide her with a set of construct poles which she had to adopt; however, this deity was perverse enough to offer her a gamble or a sure thing. In this way the construct weightings were derived. Also, in ranking the elements in relation to each role, the subject was asked to choose the element she would most like to be if she could not adopt the reference role. That is, if she was in a situation where she would normally adopt the role of 'wife' but was prevented from doing so by the omnipotent deity, would she rather play the role of bus conductor, doctor or secretary? In this way, a rank ordering of the elements was obtained in relation to each of the seven reference roles.

Figure 9 shows the correlations obtained between predicted and actual rank orders.

	ROLE	CORRELATION (R_S)
1	Wife.	0.900
2	Daughter.	0.917
3	Student.	0.900
4	Neighbour.	0.867
5	Consumer.	0.967
6	Social Worker.	0.917
7	Close friend, same sex.	0.967

FIGURE 9 : Correlations between predicted and actual rank orders for Subject 5.

Subject 6

Subject 6 was a 26-year-old final year Psychology Honours student who wished to consider his decision making in relation to choice of reading material.

He listed five purposes which he brought to this area, as follows:

1) To keep up to date.
2) To read on the Tube.
3) To read on a plane.
4) To while away time at home.
5) To obtain specific information.

The method used with Subject 6 was slightly different in that 20 elements were elicited. These were then divided into two equal-sized groups which will be referred to as element sets 1 and 2. Element set 1 was then used to elicit nine constructs, and all elements were then rated on these constructs. When ranking elements in relation to each purpose, each element set was ranked separately. The reasons behind this modification will be discussed later (p. 57).

The correlations obtained between predicted and actual rank orders are shown in Figure 10, as follows:

	PURPOSE	CORRELATION (R_S) SET 1 ELEMENTS	CORRELATION (R_S) SET 2 ELEMENTS
1	To keep up to date.	0.903	0.830
2	To read on the Tube.	0.758	0.952
3	To read on a plane.	0.855	0.782
4	To while away time at home.	0.818	0.842
5	To obtain specific information	0.903	0.830

FIGURE 10 : Correlations between predicted and actual rank orders for Subject 6.

Subject 7

Subject 7 was a 28-year-old Social Scientist who worked in a research institute. He chose to consider his decision making in relation to the choice of reading material. Nine elements were elicited and used to elicit eight constructs.

The correlations between predicted and actual rank orders are shown in Figure 11, as follows:

	PURPOSE	CORRELATION (R_s)
1	To read on the Tube.	0.917
2	To read for escape.	0.883
3	To cheer me up.	0.917
4	To give as a present.	0.962
5	To keep up to date.	0.917

FIGURE 11 : Correlations between predicted and actual rank orders for Subject 7.

Discussion

In view of the reasonably high nature of most of the correlations, it may be concluded that the model is a good predictor of choice behaviour (as expressed by wholistic ranking) in the situations studied. Therefore, attention will now be turned to those cases where the model seems to have been less than adequate. The most obvious of these cases is that of Subject 2 (R_s = -0.224).

In view of the results obtained with Subject 1, this result was surprising. However, a brief interview with Subject 2 was sufficient to reveal the reason. Following the repertory grid elicitation which involved the subject thinking in detail about the books used as elements, she had browsed through several of them and had completely re-read three of them. This activity took place in the week which elapsed between eliciting the grid and eliciting the λ-weights, and caused the subject to 're-construe' the books. Hence, the elicited grid no longer represented the subject's view of the books, and as such could not be expected to provide a basis for prediction of choice behaviour.

Unfortunately, circumstances were such that the subject did not have time to start the procedure again and hence the experiment was terminated. However, the single result obtained illustrates the point that an elicited repertory grid may not be stable over time, and indeed in many cases one would expect movement. Future studies could attempt to deal with this point in two ways: a) by having the subject re-rate the elements prior to each λ-elicitation session, or b) by showing the subject his ratings and asking him to adopt the same construing position prior to each λ-elicitation session. Of the two methods, the former is probably preferable since it does not involve the subject adopting a 'false' position.

Obviously, such lengths need only be gone to if there is reasonable reason to believe that the grid may not be stable. Chapman (1974) studied peoples' perceptions of mathematical commands (e.g., 'solve', 'prove', etc.) and although he elicited λ-weights up to eight weeks after eliciting the grid, he still obtained a high level of prediction. It seems intuitively reasonable that peoples' attitudes towards mathematics are more stable than their attitudes towards, say, clothes where one is constantly presented with new 'evidence' as fashion changes.

Although the results for Subject 3 are better than for Subject 2, the correlations obtained are relatively low. It seems likely that this was a result of Subject 3's reaction to the choice between a gamble and a sure thing. The problem manifested itself during the first λ-elicitation session when Subject 3 repeatedly chose the gamble -- whether the ratio of P : 1-P was 0.9 : 0.1 or 0.1 : 0.9 ! When questioned about this behaviour, he said he would always choose the gamble, no matter what the odds were, because he preferred a situation with an uncertain outcome rather than a sure thing.

What might be inferred from this behaviour is that, in terms of a hierarchy of purposes, gambling is a superordinate purpose to record-listening for this subject. In Tversky's (1967) terms, the subject is exhibiting a positive utility for gambling. As Tversky points out, this is not compatible with classical utility theory. In 'normal' situations, the two purposes do not come into contact; the subject's choice of records is usually carried out under conditions of certainty.

Hence, the subject's behaviour in the experimental situation highlights two potential problem areas: a) a possible response bias in relation to gamble situations, and b) a possible inability of subjects to 'think themselves into' the situation sufficiently. This latter is a perennial problem in the decision theory field since many experiments require subjects to imagine that they are in a particular situation -- frequently a future situation.

In this particular case, two methods were used to cope with the situation. The first was aimed at decreasing the attractiveness of the gamble by getting the subject to name the worst element he could think of with the non-preferred combination of properties. When he had named such an L.P., the terms of the gamble were phrased such that if the non-preferred combination was the outcome, then he would have to listen to the detested L.P. for at least half an hour. This achieved the desired result to the extent that he then felt there were conditions under which he would choose the sure thing.

The second method simply involved asking the subject to try to overcome his tendency to choose the gamble. It was suggested that he do this by attempting to role-play someone with the same preferences for L.P.s but who was not particularly attracted to gambles. In a sense, this was conceptually the least satisfactory method since it asked the subject to behave 'unnaturally', i.e., not as he would normally behave. However, the combination of methods did seem to steer the results in the right direction.

In considering choice of clothes with Subject 4, certain additional considerations were highlighted. Reference to Figure 7 (p.37) shows that the result for situation 1 was encouraging (R_s = 0.83), but situation 2 was less so (R_s = 0.576). An examination of the correlation calculations revealed that one element, "long hostess dress", contributed more than 50% of $\sum d^2$, the basis of the Spearman correlation coefficient. When asked to comment about this element in this situation, Subject 4 said:

> "It's got the right characteristics as far as these constructs are concerned -- it's just that it would be 'formally inappropriate', the wrong thing at the wrong time, like a dinner jacket in the morning. When I ranked them, I knew it had a lot of good points, it's just wrong for this occasion."

Similarly, in commenting about the element "short skirt" (which, again, contributed more than 50% of $\sum d^2$) in relation to situation 3, the subject said:

> "It's a bit too constraining. I was thinking of a straight, short skirt, work-type skirt, and it's just not in the party spirit, it's nothing special, it's the sort of thing you'd wear every day."

The problem here can be seen as one of sampling. The subject is saying that her decisions have been based on constructs which do not appear in the grid. Hence the constructs do not form a representative sample of the relevant dimensions and as such cannot be expected to predict behaviour as accurately as might have been expected. It can also be seen as an element sampling problem insofar as an unrepresentative sample of elements will not allow the relevant constructs to emerge.

A further problem which occasionally arises is that a subject may find it difficult to imagine a stereotype element with the given combination of properties. When this happens, it is sometimes possible to refer back to the grid and find an element which is nearest to the ideal position on the constructs under consideration. This element can then be used as a basis from which to work in defining a stereotype element. For example, supposing element X is the best fit, one could then ask the subject to think of an ideal element which is like X but with, say, more of property A.

As one progresses up a hierarchy, the group of constructs to be considered gets progressively larger and therefore may be more difficult to envisage. One possible solution to this problem which may merit investigation would be to ask subjects to name the superordinate constructs represented by the nodes of the hierarchy. Thus, at each node the subject would only have two constructs to consider. As one progresses up a hierarchy, the degree of association (often measured as a percentage matching score[1]) between constructs or clusters decreases. Experience suggests that subjects have difficulty naming nodes which represent a matching score of less than 40%, and hence this should be remembered if node-naming is considered.

Thus far, it has been assumed that if λ-weights are obtained specifically in relation to a particular situation, it should be possible to predict choice behaviour in that situation. In fact, the data presented would seem to support this assumption, with the reservations and limitations already discussed. However, although it has been shown that situation-specific λ-weights enable situation-specific predictions, it could be argued that any one set of λ-weights obtained from a subject may predict behaviour in all situations. In order to negate this argument, it must be shown that λ-weights predict best in relation to the situation for which they were elicited.

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1. A percentage matching score, Q, between two sets of scores is calculated using the formula:

$$Q = \frac{\frac{r \times n}{2} - \sum d}{\frac{r \times n}{2}} \times 100\%$$

where
r = range of scores
n = no. of things rated
d = difference between a pair of scores

It should be noted that Humphreys and Humphreys (1975) attribute this formula to McQuitty (1957) when in fact it was devised by Thomas specifically for use in a grid-elicitation program (Thomas and Mendoza, 1970).

Except in the case of Subject 2 who only considered a single situation, the data obtained allow investigation of this hypothesis. The method is as follows: for each situation in turn, the predicted behaviour may be correlated with the actual behaviour in all other situations. In this way a matrix of correlations between predicted choice and actual choice will be generated for each subject. If λ-weights predict best in relation to the specific situation for which they were elicited, then the highest correlation in each row would be expected to lie on the diagonal of the matrix. Figures 12 - 18 show the correlations thus obtained. (Note: The diagonal of each matrix corresponds to the table of correlations already presented for that subject. Also, the matrices are not symmetrical about the diagonal since the relationship is not symmetrical, i.e., the relationship between the predicted behaviour in situation 1 and the actual behaviour in situation 3 is not necessarily the same as the relationship between the predicted behaviour in situation 3 and the actual behaviour in situation 1.)

In order to simplify the process of scanning the matrices, the highest value in each row is indicated with an asterisk (*).

PREDICTED CHOICE — SITUATION No.	SUBJECT'S CHOICE — SITUATION No. 1	2	3	4	5	6	7	8
1	.820	-.685	.952*	-.891	-.648	.673	-.612	.891
2	-.539	.951*	-.745	.642	.927	-.855	.321	-.624
3	.842	-.515	.976*	-.988	-.612	.588	-.588	.842
4	-.721	.709	-.879	.855*	.739	-.588	.636	-.818
5	-.527	.939	-.733	.588	.964*	-.891	.648	-.648
6	.367	-.618	.479	-.273	-.709	.733*	-.273	.697
7	-.430	.770	-.709	.624	.782	-.661	.915*	-.624
8	.600	-.430	.794	-.745	-.527	.479	-.503	.903*

FIGURE 12 : Table of correlations between predicted and actual choice across situations for Subject 1.

PREDICTED CHOICE — SIT. No.	SUBJECT'S CHOICE — SITUATION No. 1	2	3
1	.564	.830*	-.006
2	.479	.636*	-.139
3	.661	.358	.701*

FIGURE 13 : Table of correlations between predicted and actual choice across situations for Subject 3.

PREDICTED CHOICE — SIT. No.	SUBJECT'S CHOICE — SITUATION No. 1	2	3	4
1	.830*	-.212	.479	.333
2	.455	.576*	.515	-.176
3	.685*	-.321	.600	.079
4	.879*	-.212	.503	.540

FIGURE 14 : Table of correlations between predicted and actual choice across situations for Subject 4.

SUBJECT'S CHOICE

PREDICTED CHOICE — SITUATION No.	SITUATION No. 1	2	3	4	5	6	7
1	.900	.883	.900	-.417	-.567	.800	.900
2	.767	.917	.817	-.183	-.833	.617	.917
3	.667	.583	.900	-.467	-.250	.767	.667
4	-.550	-.317	-.717	.867	.067	-.317	-.433
5	-.533	-.750	-.533	-.067	.967	-.267	-.800
6	.800	.683	.917	-.517	-.217	.917	.717
7	.833	.917	.833	-.217	-.783	.700	.967

FIGURE 15 : Table of correlations between predicted and actual choice across situations for Subject 5.

SUBJECT'S CHOICE

PREDICTED CHOICE — SIT. No.	SITUATION No. 1	2	3	4	5
1	.903	.067	.030	.067	.661
2	-.115	.758	.612	.418	-.261
3	.018	.576	.855	.418	-.358
4	-.285	.721	.406	.818	-.006
5	.564	.079	-.552	.176	.915

FIGURE 16 : Table of correlations between predicted and actual choice across situations for Subject 6, element set 1.

SUBJECT'S CHOICE

PREDICTED CHOICE — SIT. No.	SITUATION No. 1	2	3	4	5
1	.830	.491	.176	.612	.479
2	.123	.952	.758	.842	-.152
3	-.042	.842	.782	.782	-.285
4	.091	.855	.673	.842	-.006
5	.564	.297	-.055	.552	.745

FIGURE 17 : Table of correlations between predicted and actual choice across situations for Subject 6, element set 2.

SUBJECT'S CHOICE

PREDICTED CHOICE	SIT. No. 1	SIT. No. 2	SIT. No. 3	SIT. No. 4	SIT. No. 5
1	*.917	-.917	.817	-.600	*.917
2	-.850	*.883	-.917	.567	-.850
3	.883	-.767	*.917	-.583	.883
4	-.871	.829	-.629	*.962	-.871
5	*.917	-.917	.817	-.600	*.917

<u>FIGURE 18</u> : Table of correlations between predicted and actual choice across situations for Subject 7.

Again, since these data generally support the specificity assumption, attention will be turned to the instances where this is not the case.

It can be seen that in the case of Subject 1 (Figure 12) only one row (situation 1) has its highest value off the diagonal. The easiest way to deal with such results is simply to dismiss them as 'error variance' or some such. However, it is possible that some of the error is explainable in terms of the subject's construing of the situations. That is, in cases where the highest value is off-diagonal, the subject might be expected to construe the two situations denoted by the highest value as similar. Hence in this case Subject 1 might be expected to construe situations 1 and 3 as being similar.

While the method does not involve direct construing of situations in a repertory grid sense, it does provide an operational definition of each situation from the subject's point of view, i.e., his rank ordering of the elements for each situation. Hence, some measure of perceived similarity may be derived by correlating the subject's choice in each of the two situations. In this case, the correlation between Subject 1's rank ordering for situations 1 and 3 = 0.891 and it may be concluded that the subject does see the two situations as being quite similar.

In view of the fact that Subjects 3 and 4 presented particular difficulties already discussed, it seems likely that the cases where prediction is not optimal (Subject 3, situation 1; Subject 4, situations 3 and 4) are mainly a result of these same difficulties. It is perhaps worth noting that even in each of these three cases, the diagonal contains the second-highest correlation in the row.

In the case of Subject 5 (Figure 15) the diagonal contains the highest value in each row. However, in three situations (1, 2 and 6) other situations share first place. That is, the λ-weights obtained for situation 1 predict equally well for situations 3 and 7 in addition to situation 1; those obtained for situation 2 predict equally well for situation 7; and those obtained for situation 6 predict equally well for situation 3.

Again, if the correlations between the subject's choices in these situations are considered, it can be seen that the subject is construing the situations similarly. The following are the values of the relevant correlations between the subject's choices:

Situation 1 Vs Situation 3 : $R_s = 0.867$
Situation 1 Vs Situation 7 : $R_s = 0.900$
Situation 2 Vs Situation 7 : $R_s = 0.917$
Situation 6 Vs Situation 3 : $R_s = 0.767$

Similarly, the relevant correlations for Subject 6 (set 2 elements) are as follows:

Situation 3 Vs Situation 2 : $R_s = 0.721$
Situation 4 Vs Situation 2 : $R_s = 0.903$

Again, in all these cases, the diagonal contains the second-highest correlation in the row.

The data for Subject 7 (Figure 18) contain the best example of the argument that shared predictability follows similarity of construing. In situation 1, the λ-weights predict situation 5 equally well, and in situation 5 the λ-weights predict situation 1 equally well. If the subject's choices in these two situations are correlated, the result is $R_s = 1.0$, i.e., the subject rank ordered the elements identically in the two situations and hence both must have equal predictability.

In highlighting the row maximum, the data are being applied to the question: does any one set of weights predict behaviour in all situations? However, it is also possible to ask a related question: given any situation, would some other set of weights predict behaviour equally well? In this case, it is the column maximum which should lie on the diagonal in order to support the specificity assumption.

In 31 of a possible 37 cases, the row maximum lies on the diagonal. Additionally, in 32 of the 37 cases the column maximum lies on the diagonal. Hence, in both cases the data tend to support the specificity assumption.

Two Further Variations on the Model

As was stated earlier, the use of an elicited repertory grid is assumed to increase the meaningfulness and relevance of the dimensions. However, this assumption had not been tested directly. For this reason, Subjects 1 and 7 were asked to repeat the whole procedure with one small modification: dimensions were provided in the form of a set of nine typical 'semantic differential' scales (c.f. Osgood et al., 1957).

Since there was no obvious basis for choosing scales, they were chosen randomly from the sub-set of 25 used by Humphreys (1972, p.58). The first of the scales used by Humphreys was selected followed by every third scale, i.e., scales 1, 4, 7, 10 and so on, yielding the following list.

1	Wise	Foolish
2	Strong	Weak
3	Good	Bad
4	Important	Unimportant
5	Savory	Tasteless
6	Ferocious	Peaceful
7	Positive	Negative
8	Graceful	Awkward
9	Correct	Incorrect

FIGURE 19 : Semantic differential scales used by Subjects 1 and 7.

For ease of comparison, the constructs of subjects 1 and 7 are presented here.

SUBJECT 1	1	Planned, leading somewhere	Modular, self-contained
	2	Controlled, tight	Loose, running away
	3	In touch	Detached
	4	Jerky	Flowing
	5	Expressive	Decorative
	6	Assaulting	Gentle
	7	Airy, cheerful	Earthy, solid
	8	Abstract	About experience
	9	'Blues'	Avant-garde
	10	Fluctuating mood	Stable mood
SUBJECT 7	1	Story, novel, narrative	Information
	2	Music	Psychology
	3	Black and white	Colour
	4	Historical	Contemporary
	5	Can be opened anywhere	Beginning-to-end job
	6	Transient	Lasting
	7	Many levels of meaning	Straightforward
	8	Mostly 'distant'	Can identify with

FIGURE 20 : Constructs used by Subjects 1 and 7.

Figures 21 and 22 overleaf show the correlations between predicted and actual rank orders for the two dimensional systems. It can be seen that in all cases, predictions based on personal constructs are more accurate than predictions based on supplied dimensions. Furthermore, the predictions based on personal constructs are more consistent, as evidenced by the range of correlations obtained.

PURPOSE	CORRELATION (R_S)	
	PERSONAL CONSTRUCTS	SEMANTIC DIFFERENTIAL
Cheer me up.	0.820	0.467
Calm me down.	0.951	0.782
Drive by.	0.976	0.394
Background whilst working.	0.855	0.333
Send me to sleep.	0.964	0.867
Dance to.	0.733	0.648
Background over dinner.	0.915	0.576
Stranded on desert island with.	0.903	0.515

FIGURE 21 : Comparison of predictiveness of personal constructs and semantic differential scales for Subject 1.

PURPOSE	CORRELATION (R_S)	
	PERSONAL CONSTRUCTS	SEMANTIC DIFFERENTIAL
Read on the tube.	0.917	-0.700
Read for escape.	0.883	0.800
Cheer me up.	0.917	-0.067
Give as a present.	0.962	0.633
Keep up to date.	0.917	-0.450

FIGURE 22 : Comparison of predictiveness of personal constructs and semantic differential scales for Subject 7.

To provide a 'typical' set of dimensions is, of course, an extreme case since these 'typical' dimensions were taken from sets of dimensions designed to be of use in rating as wide a range of 'concepts' (elements) as possible (Osgood et. al., 1957; Osgood, 1969), rather than sets of 'concepts' homogenous with those used in the present study. However, it is quite likely that many psychological experiments have been carried out in similar conditions, where the experimenter's view bears little systematic relationship to the subject's view. One would expect that prediction using semantic differential scales would improve if the scales used were highly correlated with the subject's constructs. However, it is unlikely that a set of semantic differential scales could be found which correlated highly with all subjects' constructs.

The second variation on the model involved Subject 6 and has already been mentioned (p.41). There, 20 elements were divided into two sets, only one of which was used to elicit constructs. However, both sets were rated and both were ranked in relation to each situation.

Edwards (personal communication) has suggested that once the relevant dimensions and weights have been ascertained, they can be applied to a further set of elements. For example, Gardiner and Edwards (1975) describe the development of a set of weighted dimensions relative to the allocation of planning permission in California. In principle, these dimensions and weights could then be used to choose between a further set of applications, or a criterion value could be set below which applications would be rejected outright. Hence, the model could be used as a decision aid in recurring situations. It can be seen that the data obtained from Subject 6 bear directly on this suggestion, and indeed can be taken as some measure of confirmation.

CHAPTER 4

A DISCUSSION OF WEIGHTING

The present author has reported various attempts to apply different weighting schemes to existing data (McKnight, 1974). Although this work is not rigorous enough for inclusion in the main body of the present thesis, it is included as Appendix B. The main failing of the earlier work is that direct rankings were not obtained when using ranks as weightings; rather, constructs were ranked on the basis of the weights obtained by the basic reference lottery ticket (brlt) method, thereby throwing away a lot of the information from the brlts.

In an attempt to redress this failing of the earlier work, three of the subjects described in the previous chapter were at some time asked to rank order their constructs in terms of importance for a particular purpose. All three attempted the task and all three complained that they could not arrive at a satisfactory ranking after about 20 minutes of trying. Before an explanation of this is offered, consider the following study.

Gardiner and Edwards (1975) describe a method of weighting which is relevant here. Basically, their method is to ask people to rank order the dimensions being used and then to compare all possible pairs of dimensions on an importance dimension. Since all possible pairs are considered, internal consistency can be checked (in terms of preservation of ratios) and the subject presented with inconsistencies for reconsideration.

The author was surprised to learn that Gardiner and Edwards have achieved some measure of success with their method since certain points arise. The first is that Fischer and Peterson (1972) reported a lack of success with such a method. Edwards (personal communication) considers the difference to lie in the fact that he requires subjects to start the paired comparisons from the least important dimension whereas Fischer and Peterson started from the most important dimension. However, there is no theoretical reason why this should make any difference.

Furthermore, this method requires the subject to make (n(n - 1))/2 judgements whereas brlt methods require only n - 1 judgements (where n = number of constructs). Hence, it is more time-consuming and likely to be boring whereas brlts, although possibly difficult, are likely to be interesting for reasons offered later. Gardiner and Edwards claim that

> "...unpublished studies strongly argue that the simple rating-scale procedures described below produce results essentially the same as much more complicated procedures involving imaginary lotteries." (1975, p.13).

Since this has not been substantiated by similar published studies (e.g., v.Winterfeldt and Edwards, 1973), brlts would seem to be the best method of weighting constructs.

One reason why the hierarchical decomposition produces such good results may be because the hierarchy used is based on similarities between the dimensions under consideration. That is, the gambles map onto the cognitive structure implied by the grid and hence stand a good chance of being meaningful (and thereby interesting) to the subject. This may go some way towards explaining the current controversy over 'direct' versus 'indirect' weighting methods (for an excellent discussion of this controversy, see Humphreys, 1975), and would seem to suggest that attempts should be made to make either method meaningful if it is to be successful.

To return to the question of ranking, Gardiner and Edwards do not report any difficulties whereas present subjects seemed unable to rank constructs. This difference in ability between the subjects may be attributable to a difference in the nature of the 'stimuli' involved. To elaborate, subjects in the present study were asked to rank bi-polar constructs and were presented with both poles of each construct, e.g., "long -- short"; Gardiner and Edwards' subjects were presented with single descriptors of the dimensions, e.g., "length".

It may therefore be possible to abbreviate the constructs before asking subjects to perform the ranking operation. However, it should be noted that to perform internal consistency cross-checks would alter the nature of the enterprise as presented here. That is, such checks are for the benefit of the 'experimenter' and therefore make the process normative to some degree. While this is acceptable if the model is being used as a decision aid, it distorts the descriptive power of the model unless one assumes that people really are internally consistent -- in which case the 'fault' lies in the nature of the response device.

Of course, the question still remains whether it is worth applying any weighting scheme. Several authors have argued and presented evidence to show that use of equal (or even random) weights produces reasonable predictions (Dawes and Corrigan, 1974; Einhorn and Hogarth, 1975; Wainer, 1976). It is worth noting that all these authors compared equal weights with regression models. In the present case regression is inappropriate since in most cases the number of constructs is greater than or equal to the number of elements and hence a set of weights can be found which will produce 'perfect' prediction. It has been shown that λ-weights are purpose-specific, and hence there is no reason to believe that β-weights would not be purpose-specific. In fact, since β-weights capitalise on random variation in the data, they would probably not predict choice from a different set of elements in the same situation on this basis alone, since the pattern of random variation will be different in the new sample of element ratings.

However, it is possible that equal weights might perform well in the present case, particularly in the light of the suggestion that the weighting problem is subsidiary to the problem of specifying relevant variables (Dawes and Corrigan, 1974; Einhorn and Hogarth, 1975). Since personal constructs are taken to be maximally relevant, is it worth weighting them?

The question is an empirical one to which the data presented in the previous chapter can be applied. For this reason, predictions based on equal weights were correlated with actual choice for all subjects. These correlations can then be compared with those obtained using λ-weights, as shown in Figure 23.

(Note: The equal weights predictions are based on the preferred pole grids rather than the raw grids. This obviates use of what Einhorn and Hogarth (op. cit.) call "unit weights" of +1.0 or -1.0, a special case of equal weights, and is also compatible with Dawes and Corrigan (op. cit.) who specified the direction of the weight even when its size was randomly determined.)

	SITUATION	λ-WEIGHTS	EQUAL WEIGHTS	
SUBJECT 1	1	0.820	0.664	
	2	0.951	0.442	
	3	0.976	0.852	
	4	0.855	0.864	*
	5	0.964	0.542	
	6	0.733	0.509	
	7	0.915	0.952	*
	8	0.903	0.905	*
SUBJECT 2	1	-0.224	-0.106	*
SUBJECT 3	1	0.564	0.633	*
	2	0.636	0.721	*
	3	0.701	0.530	
SUBJECT 4	1	0.830	0.821	
	2	0.576	0.548	
	3	0.600	0.779	*
	4	0.540	0.455	
SUBJECT 5	1	0.900	0.833	
	2	0.917	0.867	
	3	0.900	0.558	
	4	0.867	0.704	
	5	0.967	0.779	
	6	0.917	0.412	
	7	0.967	0.883	
SUBJECT 6 SET 1	1	0.903	0.948	*
	2	0.758	0.658	
	3	0.855	0.709	
	4	0.818	0.515	
	5	0.915	0.885	
SUBJECT 6 SET 2	1	0.830	0.897	*
	2	0.952	0.867	
	3	0.782	0.715	
	4	0.842	0.721	
	5	0.745	0.706	
SUBJECT 7	1	0.917	0.862	
	2	0.883	0.904	*
	3	0.917	0.837	
	4	0.962	0.837	
	5	0.917	0.862	

<u>FIGURE 23</u> : Comparison of correlations obtained using λ-weights and equal weights (* indicates case where equal weights give better prediction than λ-weights).

In 28 out of 38 cases (or approximately 75% of the time), prediction using λ-weights is better than prediction using equal weights. Hence, the use of λ-weights would seem to be justified. However, it is interesting to note that the equal-weights correlations are generally quite high. Taken in conjunction with the 'semantic differential' results presented earlier (p. 56), this would seem to reinforce the view that the selection of constructs is more important than weighting them. However, if the aim is to produce an optimal descriptive system, then equally-weighted personal constructs can be seen as a first approximation and weighting has a positive contribution to make to such an approximation.

Hence, the findings of Dawes and Corrigan regarding random weights can perhaps best be interpreted in the light of their own comments. They say "The whole trick is to decide what variables to look at" (1974, p.105). Given an appropriate set of variables, random weights may perform reasonably, but properly-elicited weights would be expected to perform even better. Given an inappropriate set of variables, choice of weighting schemes is arbitrary.

Construct Weighting and Personality

In Chapter 1 it was suggested that the model may have applicability in the area of personality, and it is this suggestion which will now be considered. Essentially, the suggestion is that different personalities may express themselves in different styles of decision making; furthermore, 'style' may be characterised as certain parameter-combinations within the model.

However, before proceeding there is a problem which should be borne in mind concerning λ-weights. As was stated earlier (p. 9) λ-weights are components of value-wise importance weights and relative scaling factors which cannot be separated. Speculations about the cognitive basis of personality will concern value-wise importances, not λ-weights. If it was possible to control relative scaling such that it was kept constant, arguments could be based on λ-weights; but such control is not possible. Hence, speculations are likely to be approximate at best, and should be treated as such.

Consider, then, the behaviours which might be expected to result from various 'extreme' patterns of weightings. If all constructs are weighted equally[1], then choice would become difficult since, in real life, most choice objects have both positive and negative aspects. Hence, a person who weights all constructs equally would appear to an observer to be very unsure; such a person would be continually weighing pro's and con's without doing much. Furthermore, if such behaviour extended over a variety of situations, the person might find life difficult. Indeed, if clinical reports are acceptable data here, then there exists a class of people seeking help who are characterised by such behaviour and who frequently describe themselves as 'without purpose' or 'aimless' (e.g., Ryle, 1975).

From a clinical point of view, it is important to distinguish such

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1. The suggestion here is different from that discussed earlier in the context of the work of Dawes and Corrigan (1974) and Einhorn and Hogarth (1975). Earlier, the term 'appropriate variables' was used to suggest that a certain set of constructs have <u>unit</u> weights, the implication being that remaining constructs have <u>zero</u> weights. Here, the suggestion is that all (or a large number of) constructs have equal, non-zero weights.

people from depressive patients who, given their existing construct system, cannot reconcile contradictions between preferences and desires. They are therefore 'without purpose' since they are unable to formulate a purpose which is not immediately contradicted by some other purpose or consequence.

Incidentally, such a formulation may offer a means of distinguishing between cognitive complexity (Bieri, 1961) and schizophrenic thought disorder (Bannister, 1960), since 'complexity' and 'confusion' seem to bear many similarities. In the present terms, confusion would be characterised by unstable weights over a large number of constructs, whereas complexity would be characterised by stable weights over a large number of constructs.

Similarly, the description of the "authoritarian personality" presented by Adorno and co-workers (1950) can be interpreted within the framework of the model. Typically, the description of the authoritarian person suggests a refusal to adjust the weightings of certain key constructs over situations. Hence, a construct such as 'good -- bad' is carried into all situations and weighted highly. Furthermore, Adorno's work suggests that constructs tend to be used in an 'either/or' sense with no possible mid-position.

An interesting property of measures of authoritarianism is that they have thus far failed to correlate with a wide variety of current indices of decision making behaviour (Wright, 1976; Wright and Phillips, 1976). Hence, the present model may offer a method of investigating the concept within a decision theoretic framework.

In considering personality it is usually the movement of weightings (or lack of it) across situations which is interesting, since it is difficult to make inferences from static patterns of weightings. To illustrate this point, consider the 'major construct' results included in Appendix B (p.161) where the particular subject's behaviour was based almost totally on one construct. Presented with only this datum, it may have been tempting to attribute to that subject traits like 'single-mindedness', 'monolithic construing' and so forth. However, the subject also demonstrated that he brought other (and more) constructs to bear at different times. Hence, the construing/weighting combination is the subject's approach to the situation given a specific purpose, rather than a rigidity of construing/weighting across situations.

It has been argued that since both PCT and MAUT are contentless, the model should be applicable to a wide range of behaviours. The above paragraphs indicate how the model can be used to conceptualise certain types of behaviour and it may therefore prove instructive to see how far claims for the model's generality can be taken.

It can be argued that decisions underly all purposive activity since there is usually more than one way to achieve any goal. The question is: Can the model be applied to any such situation? In principle, the answer to this question would seem to be 'yes'. For example, a military general choosing a plan of action is considering alternatives; furthermore, the constructs in terms of which he considers such alternatives will be differentially important. Similarly, a teacher compiling a course of instruction can be viewed in terms of the model, as can a parent buying a pet for a child, or an athlete working out a training schedule.

As Edwards and Tversky say:

> "Men make choices. They choose what to have for dinner, whom to marry, whether or not to make war." (1967, p.7).

What is argued here is that the same process is involved in all these activities. In view of this claimed generality, a previously unexplored area was sought in which to apply the model. The area chosen was the sentencing of offenders in Magistrates' courts and Chapter 5 documents this application.

(Retrospectively, it can be seen that the model could also have been used to prescribe the choice of area of application, given the perceived set of viable alternatives!)

SUMMARY

The main points thus far may be summarised as follows:
The repertory grid is a useful way of describing a person's beliefs about an area. However, elicitation of the grid presents 'sampling' problems in that, if the elicited elements do not fully represent the area then the relevant constructs may not be elicited.

Raiffa's multi-attributed utility model can be successfully combined with an elicited grid in order to predict wholistic choice behaviour. Furthermore, the λ-weights have been shown to be situation-specific. However, the brlt method of eliciting λ-weights, although effective, tends to be tedious. Direct assessment of weights would only seem to be feasible with a small number of constructs. Also, the work of Fischer and Peterson (1972) suggests that a possible failing in direct assessment is that the ratio of largest weight : smallest weight is too small. This suggestion is supported by the present study.

CHAPTER 5

THE MAGISTRATE STUDY

Previous studies of decision making related to the legal system have tended to focus on the question of guilt in the light of evidence (e.g. Goldsmith, 1973). Typically, the decision maker is presented with evidence in a numerical form and his use of this evidence is compared with some model of optimum use, e.g., Bayes' theorem.

The present study begins with the assumption that the accused has been declared guilty, either on his own admission or in the opinion of the Bench. The magistrate must now select a sentence from a range of possible sentences, and it is this choice decision with which the present investigation is concerned.

Devlin (1970) suggests five aims of the penal system, these being: a) retribution, b) individual deterrence, c) general deterrence, d) protection of the public, and e) rehabilitation. In view of this it is hypothesised that any particular magistrate will have different purposes in sentencing different cases. Operationally, the hypothesis is that, as previously, weights on constructs will change from case to case.

If the legal system leaves room for personal construing and if sentencing behaviour is based on this construing, then it would seem reasonable to expect magistrates to differ in their behaviour. Hence, it is hypothesised that there will be differences between magistrates in terms of sentencing behaviour.

Methodological Considerations

In view of the fact that magistrates tend to be very busy people, it was decided to simplify the design as much as possible in order to minimise the time requirement. To this end, a set of ten sentences were selected as providing a reasonable cross-section of available sentences, and these were provided as elements to all magistrates who took part in the study. These sentences were:

1) Absolute discharge.
2) Conditional discharge, 1 year.
3) Probation, 1 year.
4) Fine £5.
5) Fine £25.
6) Fine £100.
7) Imprisonment, 1 month.
8) Imprisonment, 3 months.
9) Imprisonment, 6 months.
10) Crown Court committal.

Furthermore, only three situations were considered, these being provided in the form of case histories. Case 1 involved a fairly trivial case of shop-lifting; case 2 involved the threatening use of a knife under the influence of drink; and case 3 involved larceny of a valuable piece of silverware. The cases are presented in full as Appendix C.

It was felt that by providing elements and considering only three cases, a single session of approximately 2½ hours would be sufficient. In view of this, it was not feasible to cluster analyse the constructs into hierarchical form. The initial intention had been to provide an arbitrary hierarchy based on perceived similarity (i.e., on the basis of what is known as an 'eyeball analysis'). However, a pilot study indicated that presentation of gambles in relation to sentencing would be viewed by magistrates as ludicrous.

In view of the fact that the method does not include formal consistency checks, it is all the more important that the subject's task should be as meaningful as possible. For this reason it was decided not to present gambles but to obtain direct assessments of the λ-weights. This was done by asking the subjects to rank order their constructs. They were then asked to consider the most and least important constructs as lying at opposite ends of a 10-point scale (10 = most important) and to place the remaining constructs along this scale according to their relative importance. It was felt that ranking would provide the required meaningfulness while a magnitude ratio of 10:1 would provide the discrimination required while placing minimal demands on the subject.

A further variation was that constructs were not elicited by triadic presentation of elements. Again, the pilot study had indicated that such a form of presentation would reduce the meaningfulness of the task. That is, given three sentences and asked to say in which way two were similar and thereby different from the third, most magistrates would probably find it hard to consider the question seriously.

Hence, constructs were elicited 'conversationally', i.e., subjects were asked to talk about the various properties of sentences, what made an ideal sentence, and so forth. Following this, the ideas which the subject had expressed were offered back, in identical words where possible, as the basis of dimensions along which sentences could vary. For example, a magistrate might mention the rehabilitative aspect of sentences. He would later be offered the term "rehabilitative" as one pole of a dimension and asked what the other pole would be. The reply to this question was usually of the form "not rehabilitative" and the magistrate was then asked if he could construe sentences as varying along such a dimension. If so, the construct was added to his pool of constructs.

When construct elicitation was completed, ideal points were determined by asking the subject to think about Case 1 and to state at which pole their ideal sentence would lie for each construct, or whether it would lie somewhere inbetween the poles. This was then repeated for each case in turn. All subjects stated a pole, thereby obviating the need to fold constructs about the ideal point. However, one magistrate seemed to have an intuitive grasp of ideal points and folding since, when rating the elements on a particular construct for a given case, he rated his preferred sentence lower than two other sentences; he then said that this did not make sense -- his preferred sentence must be rated higher than the others because he preferred it to the others. He then proceeded without prompting to effectively fold the construct about his preferred element by rating it 5 and moving the other two sentences down to 4. As far as is known, all magistrates were naive with respect to decision theory.

The pilot study also indicated that the ratings of elements were likely to change from case to case. This was not surprising since it seems intuitively reasonable that, for example, a probation sentence may be rehabilitative in some cases but would be laughed at by certain offenders. Hence, before rating elements on each construct, subjects were asked whether or not the ratings on the construct in question would change from case to case. If they answered in the affirmative, they were asked to rate the elements specifically in relation to each case in turn.

It should be noted that this represents a significant extension to the model. As used in Chapter 3, the model assumed that 'beliefs' were held constant and 'values' changed across situations (p.43). However, as used here, the model assumes a more dynamic state of affairs in which both beliefs and values change across situations.

Earlier (p.58) it was stated that three subjects found it impossible to rank order constructs, and the suggestion was then made (p.60) that this was because constructs were presented in their bipolar form. Hence, when magistrates were asked to rank order their constructs, they were presented with a single description of each construct, e.g., "rehabilitation", each written on a separate card. The fact that magistrates were able to perform the ranking under these conditions can be taken as support for the earlier suggestion.

The subjects reported in this chapter were all magistrates. Subjects 1 to 8 sat on a West Middlesex Bench and Subject 9 sat on a Buckinghamshire Bench. Subjects 1, 2, 4 and 7 were male, and all subjects were in the age range 35 - 65. Subjects offered their services on a voluntary basis and no payment was ever mentioned or offered.

The methodology may be summarised as follows:

1) Present subjects with list of available sentences (elements).
2) Subject reads case histories (Appendix C) and, for each case in turn, rank orders the elements in terms of preference. (The rank orders for all subjects are presented as Appendix D).
3) Constructs elicited conversationally.
4) Preferred poles of constructs determined for each case.

5) Elements rated on constructs, case-specifically where necessary.

6) For each case, constructs rank ordered and weighted.

Results

As with earlier results, the first comparison of interest is between observed and predicted behaviour. The following table presents the correlations between observed and predicted behaviour for each subject:

SUBJECT No.	CASE 1	CASE 2	CASE 3
1	0.961	0.948	0.948
2	0.921	0.618	0.994
3	0.694	0.855	0.945
4	0.945	0.897	0.879
5	0.873	0.964	0.824
6	0.733	0.891	0.988
7	0.864	0.985	0.864
8	0.970	0.909	0.915
9	0.903	0.797	0.927

FIGURE 24 : Correlations between observed and predicted rank ordering of sentences.

Again, the question may be asked whether any one particular set of weights will predict all behaviour for the subject. The following tables present the correlations between each prediction with all other choices for each subject, in exactly the same manner as before (p.48). Again, the highest value in each row should lie on the diagonal. For ease of scanning, the highest value in each row is indicated with an asterisk (*).

Once again, the hypothesis that weights are situation-specific is generally supported since only four out of a possible 27 values lie off-diagonal.

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.961	-.906	-.942
2	-.785	*.948	.912
3	-.845	*.985	.948

SUBJECT 1

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.921	-.606	-.982
2	-.909	.618	*.994
3	-.909	.618	*.994

SUBJECT 2

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	.694	*.755	.433
2	.467	*.855	.667
3	.121	.418	*.945

SUBJECT 3

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.945	.630	-.630
2	.667	*.897	.121
3	-.636	-.139	*.879

SUBJECT 4

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.873	.824	-.170
2	.770	*.964	-.036
3	-.558	-.467	*.824

SUBJECT 5

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.733	.148	-.088
2	-.400	*.891	.406
3	-.345	.236	*.988

SUBJECT 6

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	.864	*.948	-.100
2	.815	*.985	-.100
3	-.233	.082	*.864

SUBJECT 7

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.970	.394	-.018
2	.279	*.909	.709
3	.312	.570	*.915

SUBJECT 8

SUBJECT'S CHOICE

PREDICTED CHOICE	1	2	3
1	*.903	.600	-.533
2	.603	*.797	.148
3	-.315	-.085	*.927

SUBJECT 9

FIGURE 25 : Correlations between predicted choice and subject's choice across situations.

Since all magistrates considered what were ostensibly the same three case histories and chose from the same set of sentences, various inter-subject comparisons may be made.

Experimenter's Impressions

What was immediately obvious was the range of reactions to the case histories. For example, in case 1 some magistrates expressed the view that the public should be protected since it was they who 'paid' for such crime in the form of higher prices; on the other hand, the view was expressed that supermarkets bring such action upon themselves by the nature of their displays; or that the defendant needed support over a difficult period.

Similarly, in case 2, some magistrates focussed on the fact that the defendant had threatened with a knife, some saw the whole matter as fairly trivial, and others suggested that the defendant may have an incipient drink problem for which treatment and support would be appropriate.

The second major impression was that, although the same words were used time and again in construing, the meaning of the words varied to quite an extent. That is, although most magistrates mentioned, for example, the rehabilitative aspect of sentences, they differed in the extent to which they attributed rehabilitative properties to the sentences.

Quantitative Treatment of Data, and Discussion

If magistrates do focus on different aspects of the cases, then they might be expected to differ in their sentencing of each case. The degree to which this is true can be investigated by inter-correlating all magistrates' sentence-orders within each case. The following tables represent such correlations:

CASE 1

SUBJECT No.	1	2	3	4	5	6	7	8	9
1									
2	.988								
3	.303	.291							
4	.915	.879	.436						
5	.600	.618	.691	.770					
6	.885	.848	.467	.970	.739				
7	.685	.661	.776	.842	.927	.812			
8	.691	.679	.782	.800	.885	.830	.958		
9	.800	.764	.333	.921	.667	.952	.715	.733	

CASE 2

SUBJECT No.	1	2	3	4	5	6	7	8	9
1									
2	.709								
3	.370	.697							
4	-.224	.164	.636						
5	-.212	.200	.673	.976					
6	.600	.709	.915	.382	.442				
7	-.176	.309	.600	.770	.818	.345			
8	.309	.624	.952	.709	.685	.794	.600		
9	-.145	.164	.612	.958	.958	.382	.697	.667	

CASE 3

SUBJECT No.	1	2	3	4	5	6	7	8	9
1									
2	.988								
3	.988	1.0							
4	.842	.830	.830						
5	.818	.830	.830	.709					
6	.830	.818	.818	.612	.648				
7	.952	.964	.964	.794	.891	.818			
8	.648	.685	.685	.806	.697	.539	.782		
9	.842	.830	.830	.709	.794	.830	.927	.806	

FIGURE 26 : Inter-subject correlations between sentence orders for each case.

For case 1, the range of correlations is 0.291 to 0.988. If the mean correlation is taken as a rough measure of agreement, then in this case the agreement is reasonably high (mean R_S = 0.739).

For case 2, the mean correlation is lower (mean R_S = 0.519) and the range is greater (-0.224 to 0.976). Case 3 would seem to be the one about which there is most agreement since the mean correlation is high (mean R_S = 0.811) and the range is smaller than for the other two cases (0.539 to 1.0).

Hence, within any one case magistrates may vastly differ (e.g., subjects 1 and 4, case 2) or may completely agree (e.g., subjects 2 and 3, case 3). Since the cases allow such a range of responses, it is to the credit of the Kelly/Raiffa model that predictions are as good as they are.

It is difficult to discuss agreement or disagreement with reference to a correlation matrix. However, since magistrates rank ordered the sentences a further analysis may be carried out. Consider the following argument.

For each magistrate considering a particular case, the ordinal 'distance' between any two sentences can be specified in terms of the number of intervening ranks in the preference ordering. Hence, a confusion matrix (Kruskal, 1964) can be generated for each magistrate in relation to each case, this matrix containing the distance between each sentence and every other sentence.

If such a matrix was subjected to multi-dimensional scaling, the original uni-dimensional ordering would of course be recovered. That is, a matrix generated thus must of necessity scale perfectly in one dimension.

If the confusion matrices of all magistrates in relation to a particular case are considered, a 'group confusion matrix' may be generated by taking the mean inter-sentence distances. This group matrix may then be subjected to multi-dimensional scaling and the extent to which it fails to scale in one dimension represents a measure of disagreement within the group.

The goodness of fit of a multi-dimensional scaling solution to the data can be expressed in terms of what Kruskal (1964) calls 'stress'; the larger the stress, the worse the fit to the data. Hence, the stress associated with a one-dimensional scaling of a group confusion matrix represents a measure of the disagreement within the group in relation to the case in question.

On the basis of this argument, group confusion matrices were generated for each case and these are presented as Appendix E. These matrices were then subjected to multi-dimensional scaling using program KYST[1] (Kruskal, Young and Seery, 1972) and solutions were sought in 1 to 3 dimensions. The following table shows the stress associated with each solution in each case.

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1. The author is greatly indebted to Peter Whalley for his help in running this program. Following Smith, Shoben and Rips (1974) a Euclidean distance metric was chosen.

		Dimensions		
		1	2	3
Case	1	0.119	0.008	0.008
	2	0.209	0.013	0.008
	3	0.067	0.014	0.009

FIGURE 27 : Table of stress associated with multi-dimensional scaling solutions of group confusion matrices.

It can be seen that there is most disagreement about Case 2, with less disagreement about Case 1 and least disagreement about Case 3. Hence, the statements made earlier (p. 78) on the basis of the correlation matrices are supported.

Furthermore, Kruskal (1964) also presents guidelines for interpreting the value of the stress associated with a solution, as shown in the following table.

Stress	Goodness of fit
0.2	Poor
0.1	Fair
0.05	Good
0.025	Excellent
0.0	Perfect

FIGURE 28 : Interpretation of stress values.
(Adapted from Kruskal, 1964, p.3)

Hence the disagreement over Case 2 is sufficient to yield a "poor" one-dimensional solution, whereas the solution for Case 1 is "fair" and that for Case 3 is "good/fair". The question of disagreement will be returned to later in the present chapter (p.89).

Since all magistrates considered the same sentences, each construct may be compared with every other construct in terms of their treatment of the elements. Of the 1749 between-subject correlations, only two indicate identical ordering of the elements. Each of these two will now be considered.

The first concerns Subject 2 and Subject 4. A correlation of 1.0 was obtained between Subject 2's construct 1 and Subject 4's construct 2 in relation to Case 3. In terms of the words used, this means that Subject 2's use of the term "protection of public" is identical to Subject 4's use of the term "individual deterrent". The situation is further confounded by the fact that Subject 2 employs the term "individual deterrent" and Subject 4 uses the term "protection of others". Hence, at times these two subjects use the same words differently and at other times use different words in the same way.

Similarly, a correlation of 1.0 was obtained between Subject 3's construct 1 and Subject 6's construct 1, both constructs being specific to case 3. In terms of words used, Subject 3's "short, sharp shock" is identical to Subject 6's "help" in relation to case 3. However, Subject 3 also uses the term "help" and Subject 6 uses the term "short, sharp shock". Hence, these two subjects use the same words differently and different words in the same way.

Earlier (p.7) Duck's work on friendship formation was criticised because he used verbal similarity to indicate similarity of construing. The present data indicate the danger involved in such an enterprise, particularly in view of the high verbal agreement between all subjects in construing.

It is only because subjects have common elements that construing across subjects may be compared; but a list of 1749 such correlations is not very instructive. However, Thomas, McKnight and Shaw (1976) offer a method of comparing any two grids which have common elements. The method involves hierarchical cluster analysis of the constructs of a pair of grids considered as a single grid. On the basis of this analysis it is possible to arrange the total array of constructs such that each construct is more like its immediate neighbours than any other constructs. Given such an array, what is of interest is the degree to which the two sets of constructs are intermingled. Hence, the occurrence of adjacent constructs from different grids is noted and weighted with the level of match at which the two constructs are connected in the hierarchy. The values thus obtained are summed and the resultant sum represents a measure of the degree of similarity between the two sets of constructs.

However, since the maximum value of this sum depends on the number of constructs in each grid, it is scaled to lie between a maximum of 1.0 and a minimum of 0.0. In this way, some degree of comparability is obtained between similarity scores. It should be noted that the method is such that the probability of obtaining a similarity score close to 1.0 is low, i.e., the distribution of similarity scores is skewed.

Using this technique, a similarity matrix may be generated which relates each magistrate's grid with every other magistrate's grid. The following table shows the result of such an analysis.

SUBJECT No.	1	2	3	4	5	6	7	8	9
1									
2	.155								
3	.395	.123							
4	.243	.113	.400						
5	.336	.108	.367	.216					
6	.233	.104	.365	.232	.132				
7	.269	.122	.417	.212	.265	.195			
8	.196	.064	.204	.294	.160	.222	.254		
9	.308	.123	.415	.335	.157	.440	.291	.213	

FIGURE 29 : Inter-subject similarity matrix.

If this matrix is subjected to hierarchical cluster analysis[1], the following hierarchy results:

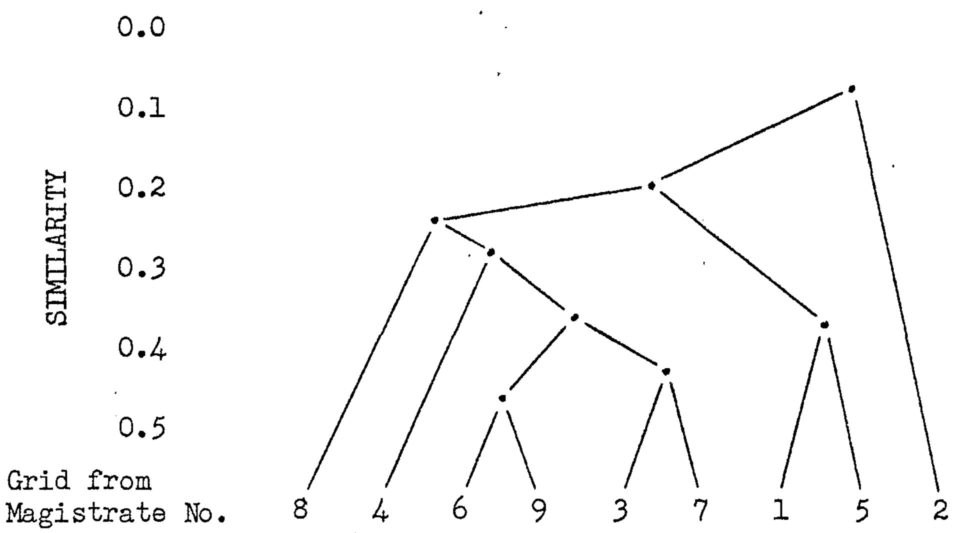


FIGURE 30 : Hierarchical cluster analysis of inter-subject similarity measures.

1. It would also be possible to cluster analyse the three matrices presented earlier as Figure 26 (p.77). However, such analyses would not allow comparisons of magistrates across cases.

Two interesting observations may be made on the basis of this hierarchy. The first concerns Subject 9, who differed from the other subjects in that she sat on a different Bench. To the limited extent that such a statement can be made on the basis of these data, it may be stated that construing would not seem to be 'Bench-specific' in that Subject 9 does not construe in a manner vastly different to the other subjects.

The second point concerns Subject 2 who appears to be the 'outsider' of the group. This is interesting because Subject 2 was unsure about his suitability as a subject in view of his limited experience -- he had only been a magistrate for about four months and had not yet undergone training, the other subjects having had at least four years experience.

From time to time considerable anxiety is expressed in the newspapers and elsewhere at what is regarded as inconsistent sentencing by magistrates' courts. Devlin (1971) reported the effect of varying several legal factors (previous convictions, etc.) on the sentencing process, but his results are presented as averages across subjects and therefore can only be taken to indicate trend (c.f. the average correlations presented earlier (p.78)). However, the present method allows consideration of individuals and comparisons between individuals. Furthermore, if the primary focus of concern was the sentencing process we could pin-point the areas of agreement and disagreement between magistrates, either in terms of constructs used or the importance attached to such constructs.

Hence, if the aim of the legal system is to reduce variability between magistrates, the method could be used as an integral part of training to make explicit the belief/value system and to measure deviation from the standard. Even if this is not the aim of the legal system, it would seem to occur informally, as evidenced by the hierarchy presented above (Figure 30). If the exercise was to be repeated in two years, Subject 2 would probably be seen to be integrated into the group.

Hence, understanding between people is equivalent to shared construing (c.f. Kelly's commonality corollary: "To the extent that one person employs a construction of experience which is similar to that employed by another, his processes are psychologically similar to those of the other person." See also, Thomas et. al.(1976)). Formulated in this way it can be seen that arguments about subjectivity and objectivity resolve themselves. There is no longer a strict dichotomy; rather, the two terms indicate opposite poles of a dimension, 'objectivity' indicating totally shared construing and 'subjectivity' indicating no shared construing. Similarly, the act of teaching can be seen as an attempt to produce shared construing and hence formal learning can be measured as the degree of overlap between the learner's and teacher's construct systems.

Validation Revisited

Newman (1975) has suggested that the theory of generalizability (Cronbach et. al., 1972) can be used to 'validate' MAUT procedures. His suggestion is based on the argument that observations produced by MAUT techniques should be generalizable to a larger population of which the individual is a part. The method of testing this involves applying an analysis of variance; low generalizability is indicated by, for example, situation/subject interaction effects accounting for a large part of the total variance.

However, it is contended that such validation is inappropriate in the present case. The Kelly/Raiffa model was chosen because there were individual differences in behaviour, these differences having been demonstrated earlier (p.80), and it was hoped that the model would be sensitive to such differences. The corollary to this sensitivity is, of necessity, a lack of generalizability. Hence, if the model is to be validated relative to the purpose of its use, a high subject/case interaction should be found. (Note: If the model was being used as described earlier as an integral part of training, Newman's arguments about validation would be appropriate. Indeed, they are appropriate in all cases where agreement is sought or valued. However, MAUT is being used increasingly precisely because of its sensitivity to individual differences.)

Since an analysis of variance model is inappropriate for the data under consideration, multi-dimensional unfolding[1] was attempted using program KYST. It would not make sense to attempt unfolding across cases since magistrates are expected to view sentences differently for each case (p.72); an unfolding across cases would seek a common 'sentence space'. Hence, unfolding was attempted within each case. However, the solutions obtained were degenerate with magistrates densely clustered and closest to non-preferred sentences. This was presumably due to insufficient data for the analysis; with

1. For a concise description of multi-dimensional unfolding, see Coombs, Dawes and Tversky (1970, p.55). Unfolding theory was specifically developed for the analysis of preferential choice data (Coombs, 1950).

only nine magistrates there is insufficient variability in the data to enable the magistrates to be separated and a sensible solution to be found.

Hence, multi-dimensional scaling was applied to the data, again using program KYST. For this purpose, a correlation matrix was generated by correlating each sentence ranking with every other sentence ranking, yielding a 27 x 27 half-matrix (i.e., from Appendix D each row is correlated with every other row). Since scaling was attempted, it was reasonable to operate across cases since magistrates are expected to work within a common framework — the "legal system".

Solutions were sought in 1 to 4 dimensions, and the stress for each solution was as follows:

1 dimension	:	0.068
2 dimensions	:	0.046
3 dimensions	:	0.031
4 dimensions	:	0.022

In view of the fact that all these values are acceptably low, the one-dimensional and two-dimensional solutions only will be considered since interpretation of three-dimensional and four-dimensional solutions is increasingly difficult.

The one-dimensional solution is presented overleaf (Figure 31) in terms of the cases which the points represent. It can be seen that the three cases separate out quite well. Only two points (those indicated by arrows) are 'out of case'. (Note: Where several points coincide, these points are written in a vertical column.)

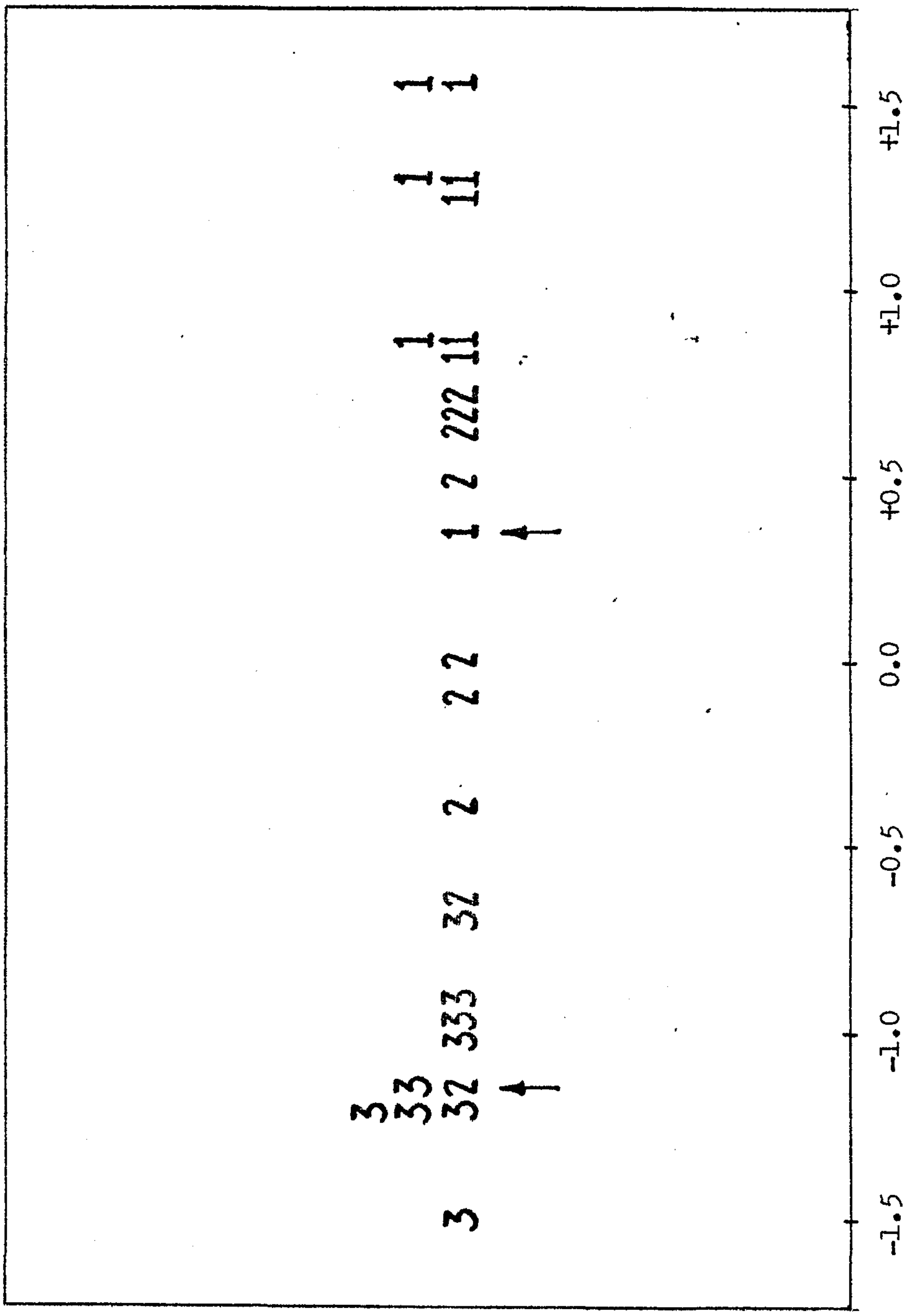


FIGURE 31 : One-dimensional scaling solution.

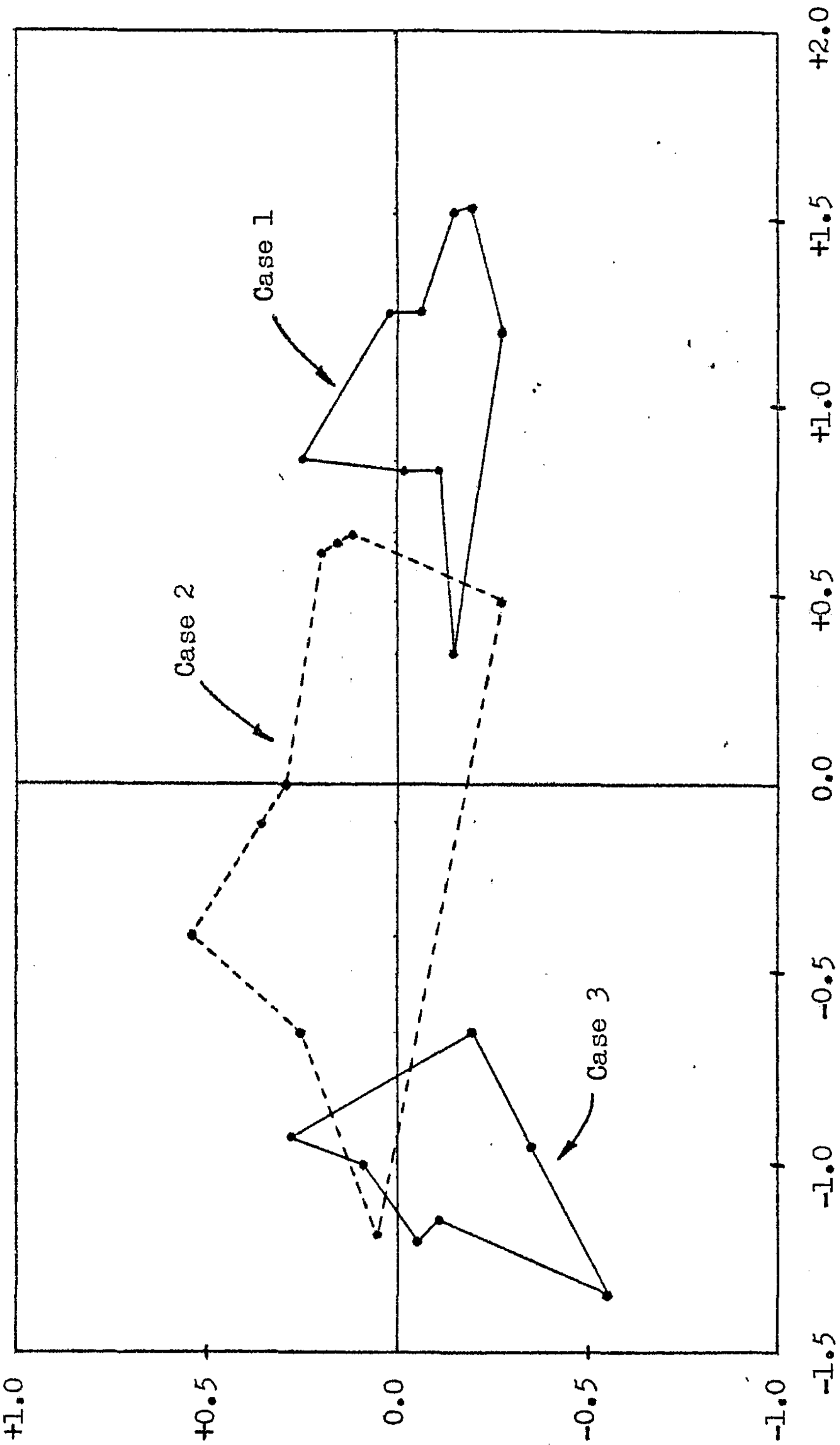
The dimension would seem to be interpretable[1] in terms of severity of sentencing, with low values to the right (Case 1) and high values to the left (Case 3).

Considering the two-dimensional solution, two methods of display are possible. If all points representing Case 1 are joined a polygon is formed. By joining Case 2 points to each other and Case 3 points to each other, three such polygons are formed (Figure 32). Alternatively, if the three points representing each magistrate are joined, nine triangles are formed (Figure 33). Hence, Figures 32 and 33 contain the same points; only the method of representation differs.

Considering Figure 32, dimension 1 (X-axis) is of course almost identical with the one-dimensional solution and hence is interpretable in the same way. Furthermore, the 'spread' of each case on dimension 1 is as would be expected from earlier analyses (pp. 78 & 80). Case 3 has least spread and Case 2 has most spread, representing the relative amounts of disagreement within cases.

The interpretation of dimension 2 (Y-axis) is more difficult and the relative amounts of spread do not help. Cases 2 and 3 have equal spread and Case 1 slightly less. If the points are collapsed onto

1. In considering interpretation of dimensions, the general theme of the thesis should be borne in mind, i.e., such interpretations represent the experimenter's construct system, or possibly the experimenter's view of the subjects' construct systems. It would obviously be preferable to enlist the help of subjects in interpreting such dimensions but in the present case this was not feasible and hence 'projective identification' must be undertaken.



<u>FIGURE 32</u> : Two-dimensional scaling solution (by cases).

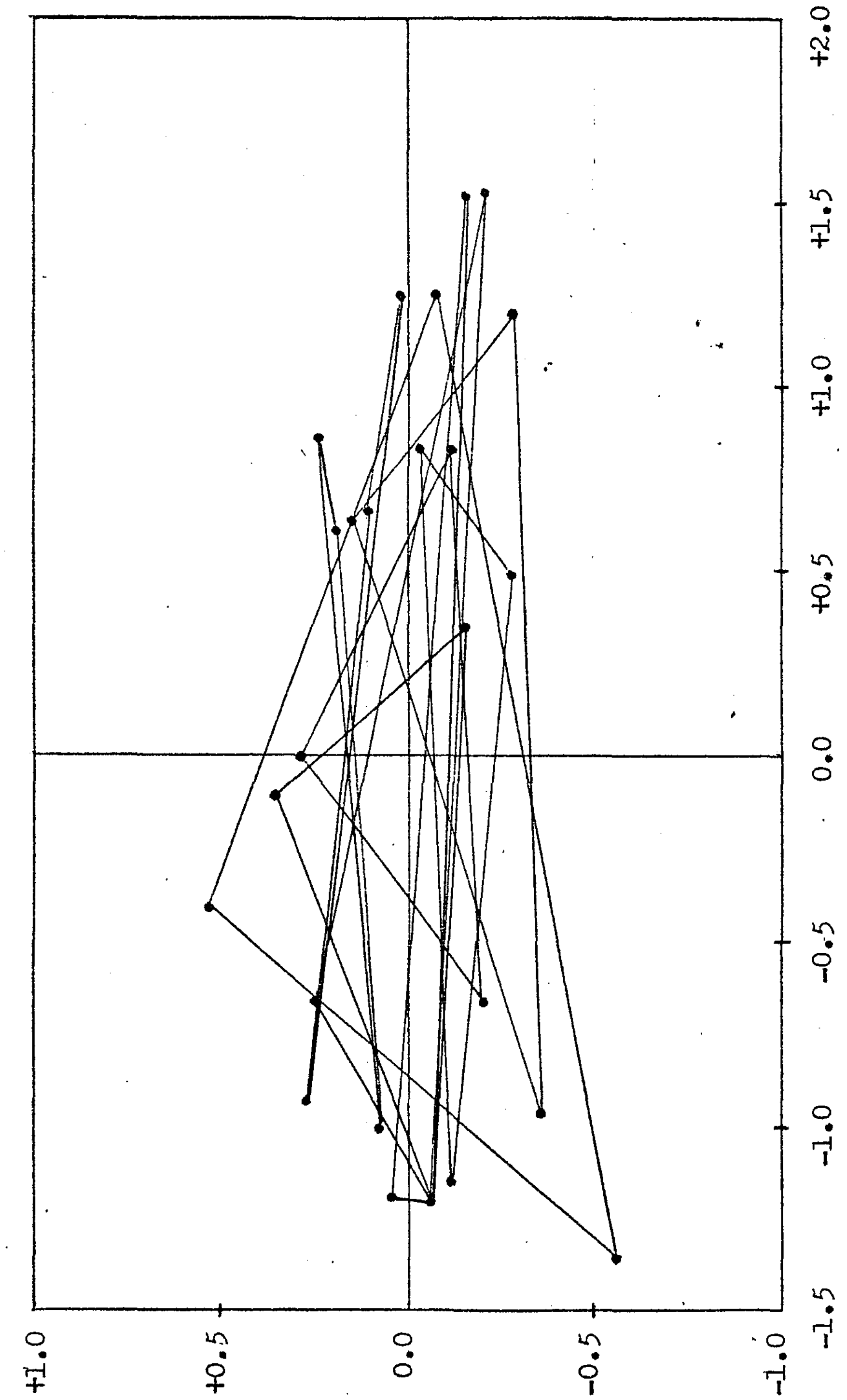


FIGURE 33 : Two-dimensional scaling solution (by magistrates).

this dimension it can be seen that, in general, Case 2 lies above Cases 1 and 3. Hence, the problem is to discover some way in which Cases 1 and 3 are similar and thereby different from Case 2.

Reference to the cases (Appendix C) shows that Cases 1 and 3 are both 'crimes of property' -- they both involve larceny. On the other hand, Case 2 involves what is potentially a 'crime against the person'. Hence, it is possible that this dimension represents severity of crime, since most people would agree that crimes against the person are more severe than crimes of property.

The fact that there is not a great deal of overlap between the polygons can be taken to mean that tha cases are discriminably different. Also, if the legal system was totally prescriptive each polygon would be collapsed to a point. Hence, although the magistrates agree in the sense that they separate the cases, there is room for personal construing and hence disagreement within cases.

This disagreement is highlighted in Figure 33. It can be seen that some magistrates are represented by large triangles while others are represented by relatively smaller or long and thin triangles.

Such results suggest that the Kelly/Raiffa model would have fared badly if validated in accordance with the theory of generalizability. Conversely, the model would need to be insensitive to individual differences in order to fare well in such a validation and hence would not produce such accurate predictions of choice behaviour.

CHAPTER 6

SOME IMPLICATIONS AND SPECULATIONS

In view of the foregoing results, the Kelly/Raiffa model would seem to be useful in predicting certain classes of decision making behaviour. In this chapter, some implications of the model are suggested and some speculations on future use are offered.

Implications of PCT for MAUT

Raiffa recognised the difficulty in arriving at a relevant sample of dimensions, and the repertory grid offers a way around the difficulty. The MAUT procedure is strengthened by the use of personally relevant dimensions. There are also historical precedents to suggest that this is a desirable direction for decision theory to move in. The two most influential developments in the history of decision theory have both involved increasing the degree to which the theory takes account of individuals, i.e., the move from 'expected value' to 'expected utility' and from 'objective' to 'subjective' probability, yielding the powerful Subjective Expected Utility (SEU) model.

In fact, since decisions underly most behaviour, decision theory should occupy a central position in psychology. The fact that it does not occupy such a position suggests that, as it stands, decision theory does not offer a means of conceptualising many psychological phenomena[1]. It

1. The author has also received a suggestion from a psychologist working within decision theory which places responsibility with psychologists rather than the model. That is, many psychologists seem to resist axiomatic theories, possibly because a) they have to learn a lot before they are in a position to state their own 'mini-extension' to the theory, and b) it is extremely difficult to 'waffle' within an axiomatic theory. The suggestion is an interesting one, even if a little cynical.

has already been suggested that the model has broad applicability across situations. However, the model is also applicable to different concepts within psychology. To illustrate this, two novel applications of the model are later presented as possible re-formulations of the established concepts of 'attention' and 'role'.

Implications of MAUT for PCT

The main implication that MAUT has for PCT is that it moves it out of the solely descriptive sphere into the predictive sphere. The concept of a weighted construct suggests action much more strongly than an unweighted construct. Furthermore, the addition of MAUT techniques increases the areas in which the grid can be used to measure change since a person's values may change without any change in construing. To date, most measures of importance of constructs have been based on order of elicitation or frequency of repetitiion (c.f. Reid, 1976). MAUT techniques offer a way of extending the notion of importance of constructs.

Implications of Purpose/Situation Specificity

Perhaps the most important implication of the addition of purpose to the Kelly/Raiffa model is that it makes explicit a relationship which has remained implicit for so long. That is, the concept of utility is only really meaningful in relation to the goal or purpose of the decision maker. The utility of a hammer is high if one is trying to hang a picture but low if one is repairing a watch. Although this fact has been implicitly recognised for a long time, it has been largely ignored experimentally by studying static, single-goal conditions.

With the addition of situation specificity, the model can be seen to have increased applicability to dynamic decision situations. Dynamic decision situations are characterised by sequential decision making under changing circumstances, changing values, and changing information (see Rapoport, 1975). With interactive computer back-up, the model could provide a powerful tool in dynamic decision making.

Prescriptive Use of the Model

As was stated earlier, any model of decision making may be used to describe decision making or prescribe decision making. There is no sense in which a prescriptive use can be validated since its outputs have absolute status. However, if a model has high descriptive powers, then if used prescriptively its outputs should not seem unreasonable. That is, since the present model has been shown to have high descriptive powers, it could be used to prescribe a choice decision and the person using it should not feel unhappy with its choice.

If a user does feel unhappy with the model's prescription, then it is reasonable to assume that his beliefs and values have been inadequately encapsulated. Hence, the model could be used recursively in order to successively refine his beliefs and values. In such cases, the purpose of the model would be to make explicit the decision maker's beliefs and values and relationships between them in complex situations. This suggestion is similar to the use of MAUT techniques described by Bauer and Wegener (1975). However, by allowing different people or groups to specify the "goal system" these authors also use the technique to highlight areas of potential conflict between people or groups. Such a use would also be possible with the present model.

In addition, the model would also seem to have prescriptive applicability in recurring situations. For example, consider the case of an industrial manager who repeatedly has to choose between tenders for a particular type of contract. If he were to construe the tenders and derive weightings for his constructs, his decision could be prescribed. Next time he has to choose between tenders, all he has to do is rate them on the constructs and his decision can again be prescribed.

A further application might occur if a manager has to choose between more tenders than he can realistically 'handle'. If he were to construe a representative subset of the tenders and derive weightings for his constructs, his decision could be prescribed once he has rated all tenders on all constructs. That is, the 'value system' is elicited on the basis of a representative subset and then applied to the total sample.

The data presented for Subject 6 in Chapter 3 suggest that such an application would be practical. However, the selection of elements would be crucial since a 'biased' sample might not allow the relevant constructs to emerge.

Further Applications

Earlier in the present chapter (p. 94) it was stated that the model would be used to reformulate the concepts of attention and role. However, before this is attempted, a task which remains untackled is to consider applying the model to the three studies criticised in Chapter 1.

The first concerned Mair's (1966) study of artistic preference behaviour. In the present terms, a repertory grid could be elicited using a negotiated set of paintings as elements. A set of construct weights could then be elicited, and preference behaviour could then be predicted. Furthermore, the model could also be used to explain why people choose different types of painting for different rooms in their houses, since the rooms are equivalent to situations as used in Chapter 3.

The second was Reid and Holley's (1972) study of choice of university. This study would have been much improved by the use of personal constructs and MAUT techniques. For example, some prospective students may be more concerned with 'percentage of female students' or 'availability of marijuana' in choosing universities than the dimensions offered by Reid and Holley. Furthermore, MAUT techniques would have enabled them to answer their questions about relative importances from their subjects' points of view.

The third was Duck's work on friendship formation (Duck, 1973a, 1973b, 1975; Duck and Spencer, 1972). By using members of a group as elements, and by applying MAUT techniques to weight the elicited constructs, similarity could be investigated in terms of both construing and weighting. The repertory grid has been used to investigate group structure (Thomas et. al., 1976), but the notion of changes in weighting has not yet been applied to groups and may offer a means of operationalising Duck's theory of friendship development.

If these arguments are accepted, then the minimal claim which can be made for the present model is that it offers an improvement over previous methods. However, it is also contended that the model has much wider applicability than previous methods. In order to illustrate this claim, the seemingly disparate concepts of attention and role will be discussed within the framework of the model.

A Discussion of Attention

The 'founding fathers' of modern psychology (e.g., Wundt, Titchener, Helmholtz) devoted a great deal of time and experimental effort to elaborating the concept of attention. However, despite its auspicious beginnings, research on attention fell into disrepute as behaviourism became increasingly popular. A 'mentalistic' concept such as attention was unacceptable to exponents of behaviourism and such was the influence of the behaviourist movement that attention research ceased until the 1950's.

The re-emergence of attention research followed the publication of Broadbent's "Perception and Communication" in 1958 and since then articles and books on the subject have proliferated. Broadbent proposed a "filter" theory of attention, the filter being 'active' in the sense that it is seen as having the ability to select a message from a set of parallel messages stored in a short term memory.

Treisman (1960, 1964) has proposed a model of attention which owes much to Broadbent's formulation but can be seen as making more explicit the selection rules governing the action of the filter. In Treisman's model, parallel messages are analysed for crude physical properties (e.g., loudness, pitch, etc.). The information resulting from this analysis is available to conscious perception and can be reported by the subject. In addition to extracting such characteristics, the mechanism can act to "attenuate" the signal strength of the output from these analysers, and it is in this way that the filter operates.

Deutsch and Deutsch (1963) have proposed a model which is similar to Treisman's, not surprisingly since they draw on the same experimental data. However, these authors consider Treisman's model to contain redundant sections. Their own model incorporates the notion of importance; the most important stimulus captures the attention. Importance is largely a function of past experience, but transient changes in importance may be brought about by context, instructions and so forth (Deutsch, 1960).

Although other models of attention exist, the three mentioned are usually considered to be the most important[1] (Moray, 1969).

When talking about attention in an educational context, the concept of 'interest' is often mentioned; teachers say that they try to raise interest levels in order to maintain attention, and learners say that their attention drifts because they are not interested. This suggests

1. Much work of a physiological nature has been carried out under the heading of 'attention research'. Typically, attention has been equated with level of arousal and attributed to such structures as the reticular activating system (e.g., Hernandez-Peon, 1961). But such studies are analogous to investigating the ignition switch of a car in order to discover why it goes to London. It is obvious that a certain level of activity is required, and indeed the time-span of attention may be physiologically determined, but to a psychologist uncommitted to a reductionist approach the interesting questions are likely to concern the content of attention.

that attention may be considered in terms of the Kelly/Raiffa model. In these terms, the two necessary conditions for attention are a) that the elements of construction lie within the range of convenience of the constructs, and b) that the constructs be relatively highly weighted.

Hence, the drifting of attention may be seen as fluctuations in the weights on constructs, thereby altering the preferences among elements, and is analogous to a dynamic decision situation. Furthermore, the 'raising of interest' described by teachers can usually be seen as an attempt to increase the weights on certain constructs. Everyone is familiar with statements of the type "Attend to this now because it will be useful in such-a-way later." Such statements are aimed directly at influencing relative weightings.

Although the Kelly/Raiffa model is not seen as a direct competitor to existing models of attention, it is possible that it could be used to extend such models. In particular, the model would seem to be compatible with the Deutsch's model, containing as it does the notion of importance weightings.

A Discussion of Role

"The concept (of role) has not proved to be fruitful, however, in psychological research." (Miller and Swanson, 1960, p.400).

Although this comment may surprise some psychologists, its credibility is strengthened by the fact that it is made by a leading authority on the psychology of identity.

The literature on roles suggests why such a comment is possible. For example, Sarbin and Allen (1968) say:

> "In spite of the demonstrated utility of concepts elaborated by role theorists, some critics continue to point to the fact that certain vagaries seem to surround the central term role." (p.488).

Similarly, Thomas and Biddle (1966) say:

> "The concept of role is the central idea in the language of most role analysts but, ironically, there is probably more disagreement concerning this concept than there is for any other in role theory." (p.29).

The concept of role is used so generally that its applicability is severely limited; it is almost impossible to derive an operational definition of what a role means to the individual occupying it, and attempts to do so usually degenerate into vast, unstructured lists of behaviours.

What typifies many approaches to role theory is that a particular role is 'defined' independently of the person occupying it.

> "...conduct adheres to certain 'parts' rather than to the players" (Sarbin and Allen, op. cit., p.489).

However, the present thesis has been concerned to show that an individual's behaviour depends on his own beliefs and values. Since there is no obvious reason to believe that role behaviour is of a qualitatively different type to that studied, it would seem reasonable to formulate the concept of role in terms of the Kelly/Raiffa model.

The data for Subject 5 presented in Chapter 3 suggest that such a formulation is feasible. That is, a person employs a set of constructs in relation to roles in general; any particular role which the person adopts can be defined as a set of weightings on these constructs, each construct having a preferred pole; and the preferred poles and weightings will be different for different roles.

For example, consider Subject 5's construct 9 "expect honesty -- not necessarily expect honesty". In relation to the role of "wife" this construct has a weighting of 0.23, whereas in relation to the role of "student" it has a weighting of 0.049. Furthermore, the preferred pole also changes between these roles, the left-hand pole being preferred in the role of wife and the right-hand pole being preferred in the role of student. In the former role, the construct is fairly important and in the latter it is fairly unimportant.

Hence it is possible to define a role in terms of the person's own beliefs and values. Instead of assuming that the role is delimited by the expectations of others, this formulation assumes that such delimitation can only occur if the person construes such expectations as relevant, if he construes them at all.

Although developed independently, the present formulation can be seen to bear certain similarities to the concept of role implicit in the work of Fishbein and Raven (1962). Fishbein has been very much concerned with beliefs and values, although he prefers the term attitude to value. Attitudes are seen as "learned predispositions to respond to an object or class of objects in a favourable or unfavourable way" and beliefs are "hypotheses concerning the nature of these objects and the types of actions that should be taken with respect to them" (Fishbein, 1967, p.257).

In developing their measure of attitudes and beliefs, the AB Scales, Fishbein and Raven (1962) presented subjects with adjective pairs taken from Osgood's semantic differential work (Osgood et. al., 1957). These subjects were asked to 'role-play' various kinds of people in rating the concept of ESP on the scales. Hence, Fishbein and Raven are implicitly defining a role as a particular combination of beliefs and values. However, as a research tool their AB Scales have all the same disadvantages discussed in relation to semantic differential scales earlier (p. 57).

In addition to offering an operational definition of roles, the present formulation also offers a method of defining and exploring role conflict. That is, role conflict can be seen as requiring two conditions to be met: a) the preferred pole of at least one construct must lie at opposite ends for the two roles, and b) the construct must be highly weighted.

For example, consider again Subject 5's construct 9. In relation to the role of wife this construct has a weighting of 0.23 and in relation to the role of neighbour it has a weighting of 0.185. Hence, the construct is fairly important in both roles. However, the preferred pole lies at opposite ends for these two roles. Thus, the formulation would suggest that conflict would be experienced if the person attempted to adopt both roles simultaneously and that such conflict would centre on the question of what Subject 5 has called "honesty". Although in this case the two roles may never be adopted simultaneously, similar conflicts are obviously anticipated, for example, by rules which prevent surgeons operating on close relatives.

Such a formulation seems to offer real promise in systematically investigating the concepts of role and role conflict without pre-judging the content of any situation, and future work should attempt to test the usefulness of the method in this area.

CHAPTER 7

SUMMARY AND CONCLUSIONS

Personal Construct Theory offers a useful model of an individual's beliefs; but as it stands it is poor at explaining or predicting behaviour.

Multi-Attributed Utility Theory is a powerful model of choice behaviour but its usefulness depends on the initial selection of attributes.

A combination of the two models has been shown to predict wholistic choice of films (Humphreys and Humphreys, 1975), but as used by these authors the model was essentially static.

Evidence has been presented which demonstrates that weightings of constructs change as a function of the decision maker's purpose. Areas investigated included choice of records, choice of books, and choice of clothes.

If elements are used to elicit constructs, then it is important that the elements elicited are a representative cross-section. Even so, it is still possible that relevant constructs will not be elicited, but this possibility is minimised.

Evidence has been presented which demonstrates that prediction on the basis of elicited dimensions is more accurate than prediction on the basis of supplied dimensions.

Although evaluation of weights by hierarchical decomposition is time-consuming, results would seem to justify the time spent since equal weights did not predict behaviour as accurately or as consistently.

It is suggested that the hierarchical method is maximally meaningful because it maps onto the subject's cognitive structure.

The model was applied in the area of magistrates' sentencing behaviour and was found to predict such behaviour reasonably well. Since all magistrates considered the same sentences, it was possible to make inter-subject comparisons. Such comparisons suggested that two people may use the same words to mean different things and, conversely, two people may use different words to mean the same thing.

An analysis of all possible inter-comparisons yielded the finding that the most recently recruited magistrate had a view least like other magistrates.

The combination of PCT and MAUT is seen as being beneficial for both systems and the addition of the notion of purpose is seen as making the model less static. It also makes explicit the relative nature of utility.

Given the model's high descriptive power, it should be possible to use the model prescriptively with a minimum of experienced stress. It could also be used recursively as a means of clarifying a person's beliefs and values. Evidence has been presented which indicates that the model may also be useful in situations where the same constructs are used repeatedly with the same weights but with different choice entities.

A tentative description of the model's application to the areas of 'attention' and 'role' was presented. In particular, the model suggests a simple operational definition of role conflict. In view of the seemingly disparate nature of the concepts of attention and role, it will be interesting to see what other areas of application suggest themselves.

Implications for Practice

The results and discussions contained in the present thesis can be seen to have various implications with respect to prediction or prescription of choice behaviour. These implications may be summarised as follows:

1) In any situation, the choice of attributes is absolutely crucial. In order to obtain maximum relevance, repertory grid techniques may be used to elicit personal constructs.

2) If constructs are elicited by presenting triads of elements, then the selection of elements is equally crucial since a biased set of elements will probably produce a biased set of constructs.

3) If a relevant set of constructs has been elicited, weighting may not be necessary in some situations. Unit weights may provide sufficient predictive or prescriptive power.

4) If unit weights are insufficient, then brlts should be used. The gambles should be based on a hierarchical cluster analysis of constructs, if feasible. Direct rating is only feasible with a small number of constructs and, if used, steps should be taken to ensure that a sufficiently large magnitude ratio can be expressed between most and least important constructs.

5) Weights will be purpose-specific. In the case of unit weights, the direction of weights may be purpose-specific.

Speculations Towards a Theory of Values

The fundamental behavioural unit from which values are inferred is the preference of one thing over another. To say that a person prefers object or outcome A to object or outcome B is to say that the person has a scale of value on which A is greater than B. Hence, any theory of values should account for preferential choice behaviour.

To the extent that values are inferred from behaviour, then animals may also be seen as having values. For example, Deutsch and Jones (1960) report an experiment in which rats "preferred" pure water to a weak salt solution. Young (1955) presents information on such preference patterns in many organisms under different circumstances.

The present thesis has been concerned to demonstrate the relative nature of values -- relative in a between-individual sense and relative in the sense of variable within an individual. (For a general discussion of the relativity of values, see Ingarden, 1975.) The between-individual variation can be seen as reflecting the differences in belief systems or construct systems. Furthermore, similarity between individuals can be seen in terms of the societal belief system. That is, society offers (through the process of socialization) a framework of beliefs within which there is room for individual construing. Hence, a psychological theory of values should focus on the individual.

The data presented in the thesis support the view that variability of values within the individual is related to the purpose or goal of the individual. But what is a goal? Consider the statement "My goal is to get to Glasgow". In this case, the state of being-in-Glasgow would satisfy the goal, but the goal does not exist 'in vacuo'. That is, one would want to be in Glasgow for a purpose. To put it another way, the state of being-in-Glasgow is preferred over other possible states, and this preference is relative to a goal of which the original goal ("to get to Glasgow") can be seen as a sub-goal.

If this example is generalisable, then we may say that all goal statements are conceivable as value statements. Or, in hierarchical terms, the goal relative to which preferences are made is merely a higher-order value. Hence, repeated posing of the question "why?" causes a person to 'ladder' (Hinkle, 1965) up his value-hierarchy. But what is at the top? Is there an ultimate value? If there is, then it is likely to be that of 'survival' of the individual.

It is an empirical question whether a person's values can be adequately represented in hierarchical terms and, if so, the nature of the most superordinate values. However, to the extent that the notion of values can replace that of goal, then a theory of values should concern itself with what is traditionally termed 'motivation'. That is, a theory of values should be concerned with the directionality of behaviour (rather than motivation in the sense of 'activation' (Kelly, 1958)).

If the foregoing is accepted, then preference behaviour or the process of evaluation can be seen to be predictive, a notion which accords well with Kelly's notion of man-the-scientist. That is, to prefer one object or outcome over another is to predict that it will facilitate the attainment of higher order preferences.

To talk about the 'process of evaluation' is to stress the psychological nature of values. That is, values are not seen as residing in the environment or in a person but are seen as arising out of the individual's interaction with his environment. They are ascribed by the person on the basis of his interaction with the environment. Hence, any theory of values should consider the process of evaluation.

One question which has been consistently evaded is "Where do values come from?" and such a question is obviously relevant to a theory of values. Minimally, the origin of values can be seen to be 'society', but the argument has already been advanced that society only offers a framework. Hence, a theory of values should concern itself with the origin of an individual's values within this framework, and indeed should allow for values to develop which lie outside this framework. The sociological concept of 'deviance' can be seen as the holding of values which lie outside the societal framework.

In Miller, Galanter and Pribram's (1970) terms, values are a part of the Image or knowledge of the world. To the extent that this Image or system of beliefs is personally elaborated, then the values a person holds will also be personal.

Scheibe (1970) has said that

> "...no theory of values has ever been able to explain the origin of values so as to account for their sheer number and variety." (p.56)

However, if it is accepted that to a large extent values originate in a person's belief system and that the belief system is personally elaborated and therefore unique, then the "number and variety" of values is not surprising.

To summarise, a psychological theory of values should

a) account for choice behaviour,

b) focus on the individual,

c) concern itself with the directionality of behaviour,

d) suggest a structure of values,

e) concern itself with the process of evaluation, and

f) suggest a source of values and a process of development.

It can be seen that the present study tackles only the first three requirements, and it would be a truism to say that "more work is needed" in the field of values. In the words of T.S. Eliot,

"In my end is my beginning." (East Coker).

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APPENDIX A

SUBJECT No. 1

Area Considered: L.P. Records

CONSTRUCTS		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
	1	2	5	5	1	1	3	5	3	4	5
	2	2	1	2	1	1	1	1	3	5	1
	3	2	2	2	5	5	5	4	1	1	2
	4	3	1	1	5	4	2	1	3	3	2
	5	3	1	2	4	5	5	2	1	1	2
	6	2	3	2	5	4	4	4	2	1	3
	7	4	3	5	1	2	3	3	3	4	4
	8	1	4	2	1	1	1	4	1	1	5
	9	3	2	2	3	3	4	3	1	5	1
	10	3	4	3	2	2	5	2	2	3	2

ELEMENTS

1. Frank Zappa -- "Hot Rats"
2. Jaki Whitren -- "Raw But Tender"
3. Rolling Stones -- "Get Yer Ya-Ya's Out"
4. Vivaldi -- "Echo Concerto"
5. Bach -- "Italian Concerto"
6. Scarlatti -- "Sonata in D"
7. Tom Paxton -- "Ain't That News"
8. Charlie Parker -- "Bird Symbols"
9. Sonny Rollins -- "East Broadway Rundown"
10. Blind Blake -- "Blues In Chicago"

CONSTRUCTS

1. Planned, leading somewhere -- Modular, self-contained.
2. Controlled, tight -- Loose, running away.
3. In touch -- Detached.
4. Jerky -- Flowing.
5. Expressive -- Decorative.
6. Assaulting -- Gentle.
7. Airy, cheerful -- Earthy, solid.
8. Abstract -- About experience.
9. Blues -- Avant-garde.
10. Fluctuating mood -- Stable mood.

PURPOSES

1. To cheer me up.

2. To calm me down.

3. To drive by.

4. To provide background whilst working.

5. To send me to sleep.

6. To dance to.

7. To provide background over dinner.

8. To be stranded on a desert island with.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	5	2	1	10	6	7	8	3	9	4
	2	9	7	8	1	2	4	3	6	10	5
	3	5	2	1	10	9	8	6	3	7	4
	4	5	9	10	1	2	4	6	7	3	8
	5	8	4	10	1	2	3	5	7	9	6
	6	1	5	3	10	9	8	6	2	4	7
	7	3	7	8	1	2	4	9	6	10	5
	8	5	3	4	10	9	8	7	1	6	2

Intuitive rank ordering of elements for each purpose.

		CONSTRUCTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	R	L	L	L	L	L	L	R	L	R
	2	L	R	R	R	R	R	L	L	R	L
	3	R	L	L	L	L	L	R	R	L	L
	4	R	R	R	R	R	R	L	L	R	R
	5	L	R	R	R	R	R	L	L	R	R
	6	R	L	L	R	L	L	R	R	L	R
	7	L	L	L	R	R	R	L	L	L	R
	8	L	L	L	L	L	L	R	R	L	L

Construct preferred poles for each purpose.

		CONSTRUCTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	.05	.11	.15	.14	.095	.28	.03	.01	.085	.05
	2	.004	.2	.03	.08	.04	.57	.05	.014	.002	.01
	3	.015	.146	.136	.286	.054	.205	.029	.003	.076	.05
	4	.01	.07	.042	.21	.03	.374	.13	.074	.05	.01
	5	.008	.064	.029	.161	.034	.546	.119	.019	.01	.01
	6	.027	.075	.064	.238	.027	.363	.059	.029	.098	.02
	7	.013	.092	.074	.241	.197	.295	.035	.028	.015	.01
	8	.008	.126	.236	.068	.227	.059	.072	.05	.054	.1

Construct weightings for each purpose.

SUBJECT No. 2

Area Considered: Reading Material.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	2	4	5	5	2	4	4	2	1
	2	5	2	1	2	4	2	2	1	4	3
	3	2	4	3	4	3	5	1	2	2	4
	4	1	4	3	5	3	2	5	5	1	2
	5	2	5	3	4	1	1	2	5	3	2
	6	3	2	1	4	2	1	5	5	1	1
	7	4	2	1	1	5	3	1	3	4	2
	8	1	1	4	5	2	4	3	5	5	2
	9	2	4	1	2	1	2	5	5	1	2
	10	3	4	3	4	3	2	2	5	1	1

ELEMENTS

1. Lord Of The Rings.
2. The Ragged Trousered Philanthropists.
3. Bird Lives.
4. The Pattern Of The Past.
5. Narziss And Goldmund.
6. Journey To Ixtlan.
7. Physical Geography.
8. The Cortina Owner's Handbook.
9. The Wizard Of Earthsea.
10. The Island Of The Mighty.

CONSTRUCTS

1. Pessimistic -- Optimistic.
2. Fact -- Fiction.
3. Explanation -- Mystification.
4. Unnatural forces -- Natural forces.
5. Exotic -- Mundane.
6. Super-awareness -- Dead.
7. Real places -- Imaginary.
8. Antithesis -- Synthesis.
9. Sensing -- Measuring.
10. Things changing shape -- Solidity.

PURPOSE

1. To cheer me up.

	ELEMENTS									
	1	2	3	4	5	6	7	8	9	10
1	7	4	1	6	8	9	5	10	3	2

Intuitive rank ordering of elements for the purpose.

	CONSTRUCTS									
	1	2	3	4	5	6	7	8	9	10
1	R	R	L	R	L	L	R	R	L	R

Construct preferred poles for the purpose.

	CONSTRUCTS									
	1	2	3	4	5	6	7	8	9	10
1	.724	.068	.01	.038	.008	.04	.017	.049	.026	.02

Construct weightings for the purpose.

SUBJECT No. 3

Area Considered: L.P. Records.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	4	5	1	5	2	3	2	4	3
	2	3	4	5	1	5	1	4	3	2	2
	3	4	4	3	4	4	3	1	5	1	3
	4	1	3	4	1	3	3	5	2	5	4
	5	1	4	2	5	2	1	4	4	2	5
	6	5	1	1	5	1	5	5	3	2	5
	7	5	4	1	3	5	1	2	4	5	3
	8	4	2	5	1	5	1	5	4	2	1
	9	2	4	5	2	4	5	1	3	5	1
	10	1	3	5	4	2	2	1	2	5	4

ELEMENTS

1. Jimi Hendrix -- "Are You Experienced?"
2. Yes -- "Yessongs. Vol.1."
3. Beethoven -- "Pastorale"
4. Elton John -- "Don't Shoot Me, I'm Only The Piano Player."
5. Pink Floyd -- "Ummagumma. Vol.1."
6. Debussy -- "Moods"
7. Judy Collins -- "In My Life"
8. Rolling Stones -- "Sticky Fingers"
9. Tchaikovsky -- "No.5"
10. Simon And Garfunkel -- "Bridge Over Troubled Waters"

CONSTRUCTS

1. Rough -- Refined.
2. Less meaningful -- Personal.
3. Sad, despondent -- Lively.
4. Extravert -- Introvert.
5. Innovating -- Historically predictable.
6. Well-structured, produced -- Basic.
7. Making me think of outdoors -- Indoors, oppressive, inside myself.
8. Transient -- Mood-producing.
9. Words important -- Sound important.
10. Of political importance, revolutionary -- Politically conforming, conservative.

PURPOSES

1. As general background.

2. As a background to study.

3. To 'doze' by.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	5	4	7	2	6	1	10	3	8	9
	2	6	4	8	5	9	1	10	3	2	7
	3	4	2	5	8	7	1	6	3	9	10

Intuitive rank ordering of elements for each purpose.

		CONSTRUCTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	L	L	R	L	R	R	L	L	R	R
	2	L	L	R	L	L	R	R	L	R	R
	3	L	R	R	L	L	L	L	R	R	L

Construct preferred poles for each purpose.

		CONSTRUCTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	.049	.327	.104	.073	.002	.023	.044	.14	.207	.031
	2	.032	.288	.06	.032	.002	.007	.139	.432	.001	.007
	3	.107	.03	.182	.16	.12	.049	.098	.03	.194	.03

Construct weightings for each purpose.

SUBJECT No. 4

Area Considered: Clothes.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	2	5	2	4	1	5	2	3	3
	2	4	4	3	5	2	1	3	2	3	5
	3	2	4	5	1	3	2	5	3	1	2
	4	2	4	1	4	3	5	1	5	3	5
	5	3	1	5	4	2	1	3	2	2	5
	6	3	3	2	1	1	4	5	3	2	5
	7	1	2	4	1	3	5	4	4	2	4
	8	1	1	2	5	2	3	3	1	4	4
	9	3	4	2	1	4	4	3	2	1	4
	10	3	4	1	5	2	5	1	2	3	5

ELEMENTS

1. Long Skirt.
2. Trousers (decent).
3. Jeans.
4. Long Hostess Dress.
5. Simple Cotton Dress.
6. Two-Piece Suit.
7. Thick Pullover.
8. Short Skirt (plain).
9. Blouse.
10. Midi-Length Black Dress.

CONSTRUCTS

1. Restrained, 'prim and proper' -- Easy.
2. Feeling 'cold', 'straight' -- Feeling seductive.
3. Feminine -- 'Butch'.
4. Casual -- Formal.
5. Inspiring confidence -- Makes me feel awkward.
6. Bright and gay -- Sombre.
7. Slimming -- 'Stumpifying'.
8. Simple -- Complex.
9. Comfortable -- Uncomfortable.
10. Country -- Town.

PURPOSES

1. To relax in at home.

2. To go to work in.

3. To go to a party in.

4. To go on a picnic in.

PURPOSES	ELEMENTS 1	2	3	4	5	6	7	8	9	10
1	2	6	4	2	8	9	5	7	2	10
2	6	1	9	10	3	5	8	4	2	7
3	3	5	7	1	6	10	8	9	2	4
4	2	8	1	9	5	7	3	4	6	10

Intuitive rank ordering of elements for each purpose.

PURPOSES	CONSTRUCTS 1	2	3	4	5	6	7	8	9	10
1	R	R	L	L	R	L	L	L	L	L
2	L	L	L	R	L	L	L	L	R	R
3	R	R	L	R	L	L	L	R	L	R
4	R	R	L	L	L	L	L	L	L	L

Construct preferred poles for each purpose.

PURPOSES	CONSTRUCTS 1	2	3	4	5	6	7	8	9	10
1	.026	.008	.009	.112	.001	.029	.107	.003	.69	.015
2	.006	.009	.03	.032	.429	.014	.451	.018	.009	.002
3	.006	.113	.188	.001	.002	.065	.041	.002	.581	.001
4	.12	.034	.18	.16	.022	.036	.12	.024	.144	.16

Construct weightings for each purpose.

SUBJECT No. 5

Area Considered: Roles.

	ELEMENTS									
CONSTRUCTS	1	2	3	4	5	6	7	8	9	10
1	2	4	2	5	3	3	1	5	2	
2	4	1	4	3	5	3	4	2	5	
3	4	5	2	5	1	4	1	3	2	
4	5	4	2	3	1	3	2	3	1	
5	3	1	5	1	4	3	5	1	5	
6	2	1	4	3	4	1	5	1	2	
7	1	4	5	2	3	3	4	2	4	
8	2	5	1	4	2	3	1	4	2	
9	1	2	4	2	3	4	4	1	5	
10	3	5	4	2	1	1	4	3	2	

ELEMENTS

1. A Doctor (G.P.)
2. A Vicar.
3. A Bus Conductor.
4. A School Teacher.
5. A Secretary.
6. A Nurse.
7. A Hairdresser.
8. A Therapist.
9. A Shop Assistant.

CONSTRUCTS

1. Concerned with physical things -- Concerned with mental things.
2. Not in touch with 'real world' -- In touch with 'real world'.
3. Financial gain from relationship -- No financial gain.
4. Serving -- Controlling.
5. Concerned with personal growth -- Not concerned with personal growth.
6. Caring -- Not involved in caring.
7. Expected to be knowledgeable -- Not expected to know anything.
8. Expect concrete results -- Don't expect concrete results.
9. Expect honesty -- Not necessarily expect honesty.
10. Probably ambitious -- Not necessarily ambitious.

PURPOSES

1. Wife.

2. Daughter.

3. Student.

4. Neighbour.

5. Consumer.

6. Social Worker.

7. Close Friend (same sex).

PURPOSES	ELEMENTS 1	2	3	4	5	6	7	8	9
1	3	2	9	5	6	4	7	1	8
2	5	2	9	4	8	3	7	1	6
3	3	4	9	2	6	5	8	1	7
4	8	4	5	7	3	2	6	9	1
5	1	9	3	8	4	5	2	7	6
6	1	4	8	5	6	2	9	3	7
7	5	1	9	3	6	4	8	2	7

Intuitive rank ordering of elements for each purpose.

PURPOSES	CONSTRUCTS 1	2	3	4	5	6	7	8	9	10
1	R	R	R	L	L	L	L	L	L	R
2	R	R	R	L	R	L	L	R	L	R
3	R	L	R	L	L	R	L	L	R	L
4	L	R	R	L	R	L	R	R	R	R
5	L	R	L	R	R	R	L	L	R	R
6	R	R	R	L	R	L	L	L	L	L
7	R	L	R	L	L	L	R	R	L	R

Construct preferred poles for each purpose.

		CONSTRUCTS									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	.04	.04	.04	.06	.08	.365	.06	.035	.23	.05
	2	.076	.05	.103	.239	.016	.251	.028	.025	.162	.05
	3	.06	.073	.065	.016	.088	.081	.446	.022	.049	.1
	4	.084	.09	.091	.075	.081	.2	.1	.044	.185	.05
	5	.068	.194	.049	.146	.025	.068	.195	.101	.084	.07
	6	.023	.1	.191	.034	.019	.167	.139	.109	.208	.01
	7	.101	.028	.12	.08	.09	.186	.085	.06	.2	.05

Construct weightings for each purpose.

SUBJECT No. 6

Area Considered: Reading Material.

		ELEMENTS (Set 1)									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	2	4	2	4	5	5	5	5	4
	2	5	5	5	5	1	1	5	5	4	5
	3	5	5	4	5	4	5	4	3	4	5
	4	1	3	3	3	2	1	1	1	3	5
	5	3	2	3	4	1	2	5	5	3	2
	6	2	1	1	3	5	5	5	5	1	4
	7	5	4	4	3	2	4	2	2	4	2
	8	4	2	1	2	1	1	1	1	1	1
	9	3	2	1	1	3	3	1	1	2	2
	10										

SUBJECT No. 6

Area Considered: Reading Material.

		ELEMENTS (Set 2)									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	4	2	1	5	4	5	3	4	3
	2	5	5	5	5	5	5	5	5	3	5
	3	5	4	4	4	2	1	4	5	5	5
	4	1	3	1	1	1	1	1	4	5	4
	5	3	3	3	5	5	4	5	3	1	3
	6	2	1	2	3	5	5	5	4	2	5
	7	5	4	4	4	4	3	2	5	4	1
	8	5	1	3	4	1	3	1	3	1	2
	9	3	1	4	2	1	3	1	2	2	1
	10										

ELEMENTS (Set 1)

1. Organizational Behavior And Human Performance.
2. Scientific American.
3. Far East Economic Review.
4. McKeachie And Doyle.
5. Larousse.
6. The Malayan Cook Book.
7. The Road To Wigan Pier.
8. Fiesta.
9. Sunday Times / Observer.
10. History Of The Pin-Up.

ELEMENTS (Set 2)

1. Psychological Review.
2. Guardian.
3. O.S.8 Handbook.
4. Human Associative Memory.
5. Brave New World.
6. As You Like It.
7. The Cripple Tree.
8. A.A. Book Of The Road.
9. Habitat Catalogue.
10. The Day Before Yesterday.

CONSTRUCTS

1. Academic -- Non-academic.
2. Food -- Non-food.
3. Fiction -- Non-fiction.
4. No pictures -- Lots of pictures.
5. Segmented -- Not segmented.
6. Current affairs -- Not current affairs.
7. Historical -- Not historical.
8. Light reading -- Heavy reading.
9. Clear -- Unclear.

PURPOSES

1. To keep up to date.
2. To read on the 'Tube'.
3. To read on a plane.
4. To while away time at home.
5. To obtain specific information.

		ELEMENTS (Set 1)									
		1	2	3	4	5	6	7	8	9	10
PURPOSES	1	2	1	3	5	10	9	8	7	4	6
	2	9	4	1	10	5	6	7	8	2	3
	3	8	5	1	9	7	6	3	4	2	10
	4	8	5	2	7	4	3	9	10	1	6
	5	5	1	4	3	6	7	9	10	8	2

Intuitive ranking of elements for each purpose.

PURPOSES	ELEMENTS (Set 2) 1	2	3	4	5	6	7	8	9	10
1	2	1	5	4	9	10	7	8	3	6
2	9	1	7	10	5	8	4	6	2	3
3	7	3	6	9	2	10	1	8	5	4
4	8	1	7	10	5	9	6	3	2	4
5	5	6	4	3	9	8	10	2	1	7

Intuitive rank ordering of elements for each purpose.

PURPOSES	CONSTRUCTS 1	2	3	4	5	6	7	8	9
1	L	R	R	L	L	L	R	L	L
2	R	R	R	R	L	L	R	L	L
3	R	R	R	L	L	L	R	L	L
4	R	R	R	L	L	L	R	L	L
5	L	R	R	R	L	L	R	L	L

Construct preferred poles for each purpose.

PURPOSES	CONSTRUCTS 1	2	3	4	5	6	7	8	9
1	.12	.061	.24	.015	.013	.12	.06	.111	.26
2	.081	.03	.052	.021	.015	.054	.021	.581	.145
3	.084	.05	.062	.12	.06	.056	.12	.291	.157
4	.013	.035	.043	.09	.225	.013	.135	.357	.089
5	.008	.009	.932	.013	.011	.012	.006	.002	.007

Construct weightings for each purpose.

SUBJECT No. 7

Area Considered: Reading Material.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	1	1	5	3	3	4	4	5	1	
	2	4	3	3	1	1	5	3	3	4	
	3	1	1	3	1	1	4	1	5	1	
	4	1	3	5	1	2	4	5	5	1	
	5	5	4	1	1	1	2	1	1	5	
	6	5	4	1	5	5	3	1	5	5	
	7	1	3	5	4	4	5	5	5	1	
	8	3	1	1	4	5	3	1	1	4	
	9										
	10										

ELEMENTS

1. Sartre Trilogy.
2. Puckoon.
3. Lasky's Catalogue.
4. Bird Lives.
5. Lennon Remembers.
6. Psychology Today.
7. Guardian.
8. Book Of British Birds.
9. Steppenwolf.

CONSTRUCTS

1. Story, novel, narrative -- Information.
2. Music -- Psychology.
3. Black and white -- Colour.
4. Historical -- Contemporary.
5. Can be opened anywhere -- Beginning-to-end job.
6. Transient -- Lasting.
7. Many levels of meaning -- Straightforward.
8. Mostly 'distant' -- Can identify with.

PURPOSES

1. To read on the 'Tube'.

2. To read for 'escape'.

3. To cheer me up.

4. To give as a present.

5. To keep up to date.

		ELEMENTS								
		1	2	3	4	5	6	7	8	9
PURPOSE	1	8	7	2	6	5	3	1	4	9
	2	2	4	9	3	5	8	7	6	1
	3	8	4	3	6	7	5	1	2	9
	4	1	5	9	4	6	7	8	2	3
	5	8	7	2	6	5	3	1	4	9

Intuitive rank ordering of elements for each purpose.

		CONSTRUCTS							
		1	2	3	4	5	6	7	8
PURPOSE	1	R	R	R	R	L	L	R	L
	2	L	R	L	L	R	R	L	R
	3	L	L	R	L	L	L	R	L
	4	L	L	R	L	R	R	L	L
	5	R	R	R	R	L	L	R	L

Construct preferred poles for each purpose.

		CONSTRUCTS							
		1	2	3	4	5	6	7	8
PURPOSE	1	.205	.045	.005	.137	.428	.047	.086	.047
	2	.173	.14	.06	.019	.08	.04	.128	.36
	3	.23	.05	.05	.06	.14	.07	.29	.11
	4	.05	.08	.12	.05	.07	.45	.07	.11
	5	.328	.05	.05	.328	.081	.045	.073	.045

Construct weightings for each purpose.

SUBJECT No. 1

Area Considered: L.P. Records.

		ELEMENTS									
		1	2	3	4	5	6	7	8	9	10
SEMANTIC DIFFERENTIAL SCALES	1	3	2	3	3	3	3	2	3	3	2
	2	2	2	1	3	3	2	4	2	2	2
	3	1	1	1	1	1	1	2	1	2	1
	4	2	1	2	2	2	2	2	1	4	1
	5	2	3	1	3	3	3	3	3	3	3
	6	1	3	1	5	3	2	3	3	1	3
	7	1	1	1	3	3	2	3	1	1	1
	8	1	1	3	1	1	1	3	1	4	3
	9	3	3	3	3	3	3	3	3	3	3
	10										

PURPOSES	SEMANTIC DIFFERENTIAL SCALES 1	2	3	4	5	6	7	8	9
1	R	L	L	R	R	L	L	L	L
2	L	R	L	L	L	R	R	L	L
3	R	L	L	R	L	L	L	L	L
4	L	R	L	R	L	R	R	L	L
5	L	R	L	R	R	R	R	L	L
6	R	L	L	R	L	L	L	L	L
7	L	R	L	R	L	R	R	L	L
8	L	L	L	L	L	L	L	L	L

Scale preferred poles for each purpose.

PURPOSES	SEMANTIC DIFFERENTIAL SCALES 1	2	3	4	5	6	7	8	9
1	.03	.067	.36	.02	.032	.284	.067	.09	.05
2	.074	.099	.147	.031	.025	.469	.025	.098	.032
3	.035	.13	.14	.035	.16	.241	.086	.14	.033
4	.025	.15	.06	.025	.1	.399	.064	.14	.037
5	.02	.16	.072	.02	.017	.325	.068	.288	.03
6	.015	.213	.081	.015	.08	.319	.053	.189	.035
7	.02	.12	.144	.02	.04	.359	.051	.216	.03
8	.063	.123	.172	.042	.148	.222	.123	.074	.033

Scale weightings for each purpose.

SUBJECT No. 7

Area Considered: Reading Material.

SEMANTIC DIFFERENTIAL SCALES	ELEMENTS 1	2	3	4	5	6	7	8	9	10
1	1	5	3	2	2	1	2	1	1	
2	1	3	5	1	1	3	3	2	1	
3	1	1	3	1	1	3	3	1	1	
4	1	2	5	1	1	3	4	3	1	
5	3	1	5	2	2	4	4	3	3	
6	2	3	4	1	1	4	3	5	2	
7	3	2	1	2	3	2	3	1	3	
8	4	3	5	3	5	3	3	2	3	
9	3	3	4	3	3	3	3	2	3	
10										

		SEMANTIC DIFFERENTIAL SCALES								
		1	2	3	4	5	6	7	8	9
PURPOSES	1	R	L	L	R	L	L	L	L	L
	2	L	L	L	L	L	L	L	L	L
	3	R	R	L	R	L	L	L	L	L
	4	L	L	L	L	L	L	L	L	L
	5	L	L	L	L	L	L	L	L	L

Scale preferred poles for each purpose.

		SEMANTIC DIFFERENTIAL SCALES								
		1	2	3	4	5	6	7	8	9
PURPOSES	1	.05	.034	.616	.034	.137	.076	.019	.01	.024
	2	.05	.072	.479	.048	.179	.067	.029	.038	.038
	3	.05	.09	.419	.09	.091	.067	.057	.068	.068
	4	.05	.046	.693	.031	.015	.086	.019	.024	.036
	5	.2	.014	.028	.014	.065	.024	.072	.058	.525

Scale weightings for each purpose.

APPENDIX B

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" A NOTE ON THE WEIGHTING OF CONSTRUCTS"

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CENTRE FOR THE STUDY OF HUMAN LEARNING

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INTRODUCTION.

In recent years, decision theorists have become increasingly aware that real-life decisions are seldom composed of only one dimension of variability. In response to this awareness, a class of models has been developed which are capable of handling multi-dimensional situations. These models have come to be known as "multi-attributed utility" models. Although the mathematical basis for these models is fairly well established, the problem of where to get relevant attributes or dimensions has been largely avoided. As Fischer (1972) puts it....

> "...it should be noted that this research completely ignored the problem of defining the list of value attributes relevant to a given decision. These were simply given to subjects as part of their tasks... This criticism applies not only to the present research, but also to virtually all psychological studies of preferences for multi-attributed alternatives." (p.84-5)

One notable exception to this criticism was Humphreys and Humphreys' (1973) use of the Kelly Repertory Grid technique as a basis for providing relevant dimensions. Since a review of the Humphreys' work in relation to repertory grids is being undertaken elsewhere (McKnight, 1975a), we need not consider the details of their research here. Suffice to say that it provided a useful lead in attempting to make decision theory more applicable to real-life situations. Following this lead, recent research by the present author has been directed towards the use of Raiffa's (1969) model of multi-attributed utility as a basis for weighting and combining constructs in a variety of decision-making situations.

To elaborate, although a person may use the same constructs in different situations, the relative importance of these constructs may change depending upon the situation. Although the terms in which a person construes, say, books may stay the same to a large extent, the weightings applied to the constructs may vary as a function of the situation in which the person wants to read a particular book.

To illustrate the point being made, consider the construct "clarifying -- mystifying" in relation to books. If one is choosing a textbook from which to work for an exam, such a construct may be very important (ie., heavily weighted). However, if one is choosing a novel to read on a long journey, such a construct may not contribute much to the choice of book -- although it is still a construct which one brings to bear on reading material. This is somewhat over-simplified, but the implications of weighted constructs are more fully discussed elsewhere (McKnight, 1975b).

Although the Raiffa technique provides quite good results, it is not without its own attendant difficulties. In particular, the consideration of reference gambles is a long, tedious task which subjects do not enjoy, the more so since they are required to consider so many gambles over the course of the experiment[1].

1. For a detailed account of the use of the Raiffa technique in conjunction with a repertory grid, and some of the methodological problems therein, see McKnight (1974).

The most obvious way to simplify the technique would be to let subjects 'intuitively' assign importance weightings to the constructs. That is, merely ask subjects how important they felt each construct was in a particular situation. However, Chapman (1974) found that results obtained using subjects' intuitive weightings of constructs were grossly inferior to those obtained by the Raiffa method.

In view of these considerations, it was decided to investigate alternative methods of weighting constructs. Since the Raiffa results are quite good in that they predict behaviour reasonably well, it was decided to apply various weighting schemes to existing data. In this way, the 'predictive power' of each new scheme could be compared with the existing Raiffa results for the same data.

The present paper describes several methods of weighting constructs and compares each method to the corresponding Raiffa results (Part 1). It then describes a method of optimising the Raiffa weightings and reflects on the problems encountered (Part 2). In all cases, the data used are real data obtained from one subject over eight situations. That is, eight sets of Raiffa weights have been elicited from the subject, each set being in relation to a particular decision situation.

PART 1 : IN SEARCH OF A METHOD.

The first line of approach was to consider what would happen if constructs were assumed to be equally weighted. This is equivalent to assuming that constructs are completely unweighted. Hence we may merely arrange the grid into the 'preferred pole' form (McKnight, 1974), sum ratings across constructs, and rank order the sums. This procedure was applied to S1's eight situations and the resulting rank orders were correlated with S1's actual choice in each situation. We may compare these correlations with those obtained between the Raiffa predictions and S1's choices as follows:-

	SITUATIONS							
	1	2	3	4	5	6	7	8
RAIFFA	.903	.820	.855	.976	.733	.915	.951	.964
UNWEIGHTED	.905	.664	.864	.852	.509	.952	.442	.542
DIFFERENCE	-.002	+.156	-.009	+.124	+.224	-.037	+.509	+.422

This comparison produced the surprising result that in three of the eight situations, better predictability was obtained by <u>not</u> weighting the constructs. Although this result is surprising, it is hardly a basis for not weighting constructs. This is particularly evident if we look at the range of results for each 'treatment'. The Raiffa results have a range of .976-.733 =0.243 while the unweighted results have a range of .952-.442 =0.510. Also, the negative differences are quite small while the positive differences are much larger. Hence, although unweighted results are marginally better than the Raiffa results in three out of eight cases (situations 1, 3 and 6), the Raiffa results are more consistent.

The next line of approach was to consider what would happen if we introduced a very basic form of weighting. The most basic weighting scheme is simply to use rank orders as weightings, ie., given 10 constructs, the most important construct is weighted by a factor of 10 and the least important is weighted by a factor of 1. Since this work was carried out retrospectively, it was not possible to ask the subject to rank order the constructs for each situation. Hence, for the purpose of comparison, the constructs were ranked in terms of the Raiffa weights. The correlations between 'rank-weighted' predictions and actual choices may then be compared with those obtained using unweighted predictions, as follows:-

	SITUATIONS							
	1	2	3	4	5	6	7	8
UNWEIGHTED	.905	.664	.864	.852	.509	.952	.442	.542
RANK-WEIGHTED	.864	.770	.939	.952	.612	.939	.506	.639
RAIFFA	.903	.820	.855	.976	.733	.915	.951	.964

It can be seen that in six of the eight cases, better predictability is obtained by the introduction of a very basic weighting scheme. Also, the predictability is slightly more consistent, as evidenced by the range of .952-.506=0.446. However, this scheme only produces results better than the Raiffa method in two of the eight cases (situations 3 and 6) and is less consistent. In principle, it would be possible to compare all possible rank-orders with the subject's chosen rank-order and select the one which gave the best predictability.

However, for 10 constructs there are 10! = 3628800 possible rank-orders, and since there are at least eight situations per subject, we would have to calculate at least 29030400 correlations per subject. Even in these days of 'computer power' the task would be formidable, and furthermore, such a random search could hardly be considered methodologically justifiable.

Leaving aside the issue of how to rank-order constructs for the moment, the next stage was to make the distribution of weightings a little more sophisticated. The use of the rating scale suggested the work of Helson (1964) on Adaptation-level Theory. In studying subjective ratings, Helson made use of a geometric series of the form...

$$\frac{1}{x^5}\ ;\ \frac{1}{x^4}\ ;\ \frac{1}{x^3}\ ;\ \frac{1}{x^2}\ ;\ \frac{1}{x}\ ;\ x\ ;\ x^2\ ;\ x^3\ ;\ x^4\ ;\ x^5$$

Hence it was decided to make the weightings form such a series. This method had a certain intuitive appeal since it smacked of psychophysics, 'hard' psychology, and the stuff that 'laws' are made of (Helson's original work was based on a reformulation of the Fechner Law). However, as soon as one tries to apply the method, the problem arises "how big should x be?"

Picking one of the decision situations at random, x was set to 0.9 and the correlation between predicted and actual ordering was calculated to be 0.576. By reducing x to 0.8, the correlation was increased to 0.648, and by further reducing x to 0.6 the correlation was increased to 0.842.

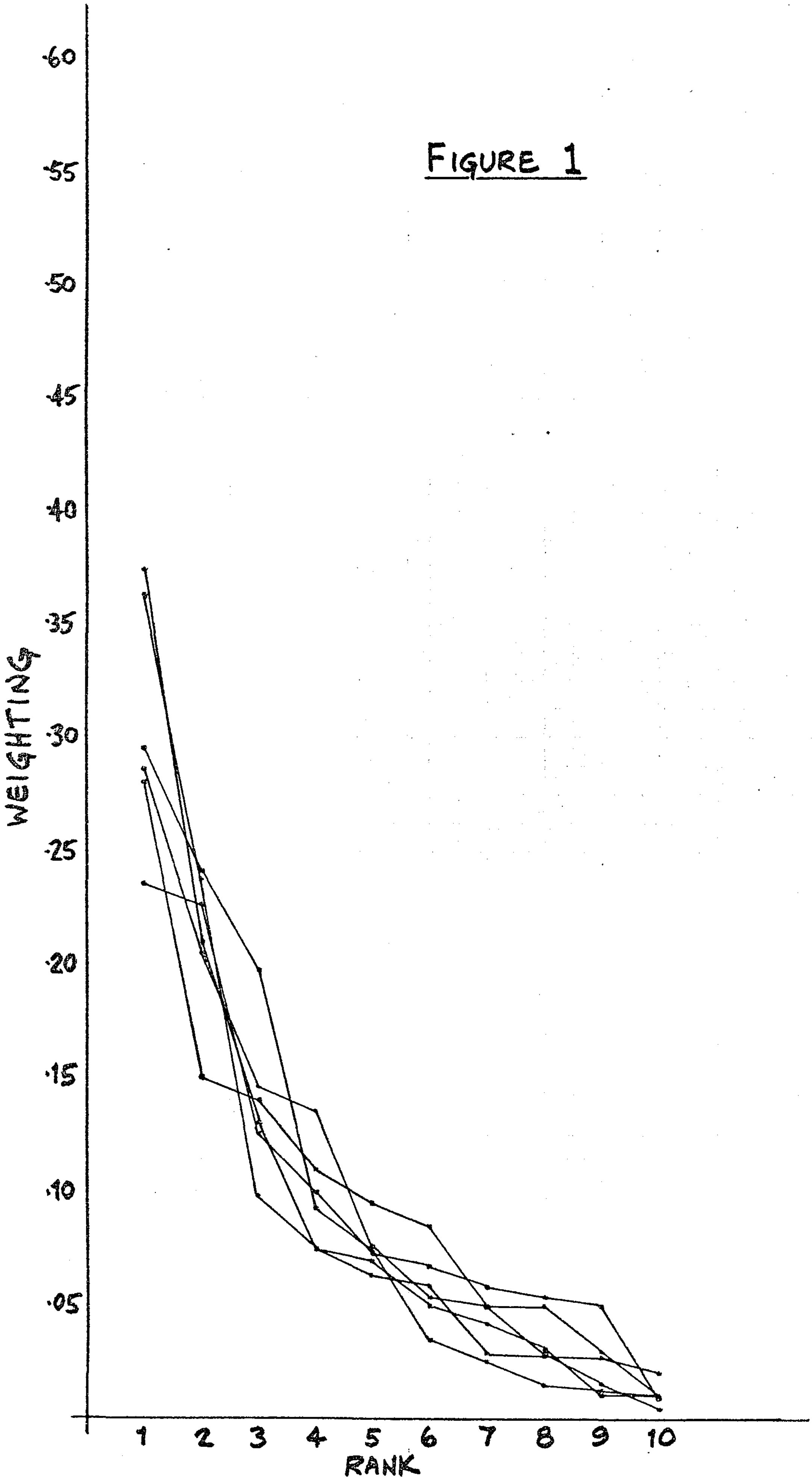
Obviously, one can continue this approach ad nauseam, or at least until one begins to 'hunt' around a maximum correlation. However, conceptually at least, such a method is only marginally better than the 'random' search for an optimal rank-ordering. With this in mind, it was decided to plot the 'pattern' of weightings for each situation in an attempt to provide a guide for the search.

Having plotted the patterns, there appeared to be some degree of similarity between six of the situations while the remaining two were similar to each other but slightly different from the majority. The six are presented as Figure 1 and the two are presented as Figure 2.

Visual inspection of the two sets of plottings suggested an exponential decay curve. For this reason, a curve-fitting program (Telfit, 1969) was used to fit such a curve to each set of data. The resulting curves together with their equations are shown superimposed on the original data in Figures 3 and 4. These curves were used to provide weightings which were then used to predict the subject's rank-ordering. The resulting correlations thus obtained can be compared with the Raiffa results as follows:-

	SITUATIONS							
	1	2	3	4	5	6	7	8
RAIFFA	.903	.820	.855	.976	.733	.915	.951	.964
EXPONENTIAL	.912	.600	.830	.939	.733	.794	.736	.782
DIFFERENCE	-.009	+.220	+.025	+.037	0	+.121	+.215	+.182

FIGURE 1



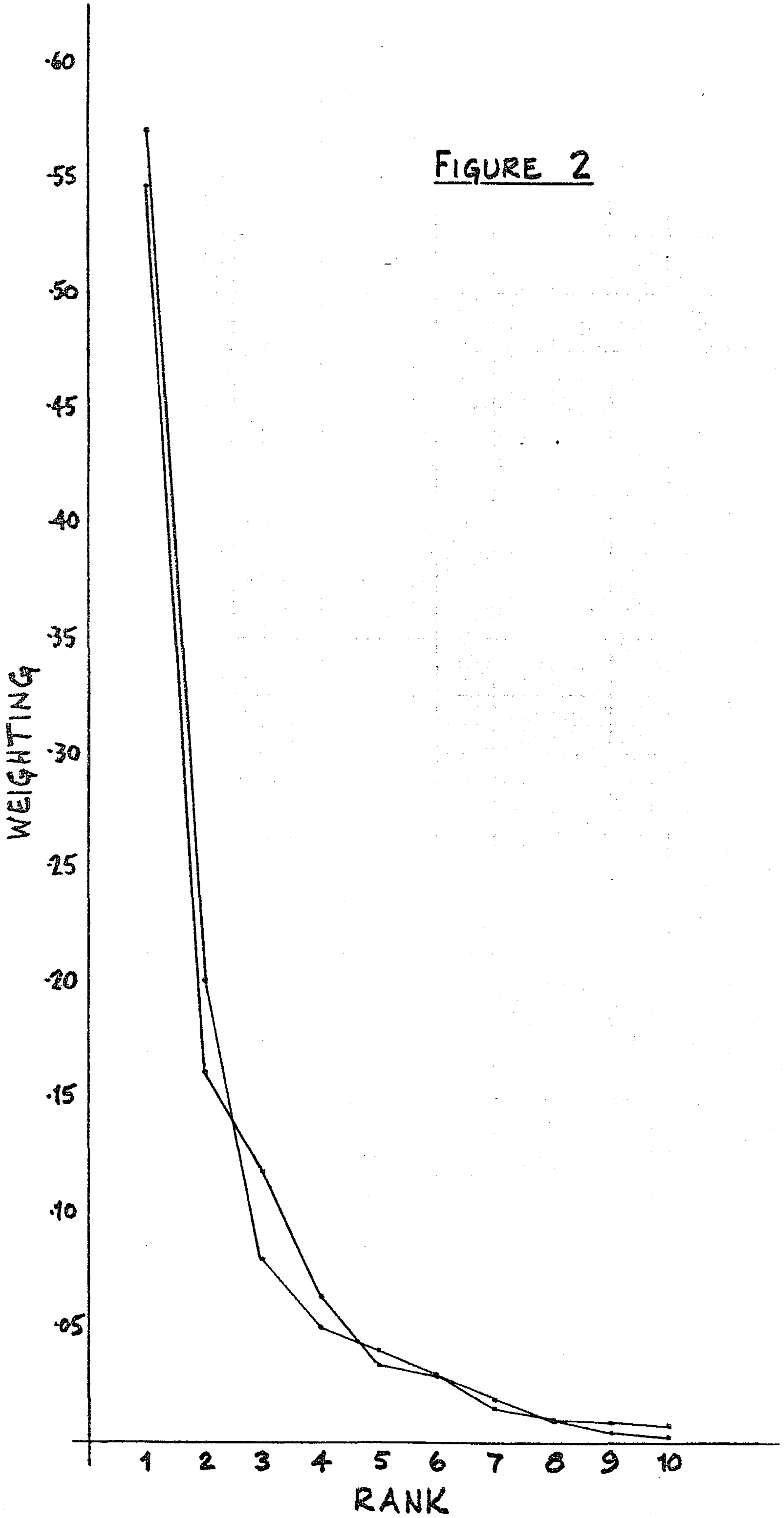


FIGURE 2
WEIGHTING
·60
·55
·50
·45
·40
·35
·30
·25
·20
·15
·10
·05
1
2
3
4
5
6
7
8
9
10
RANK

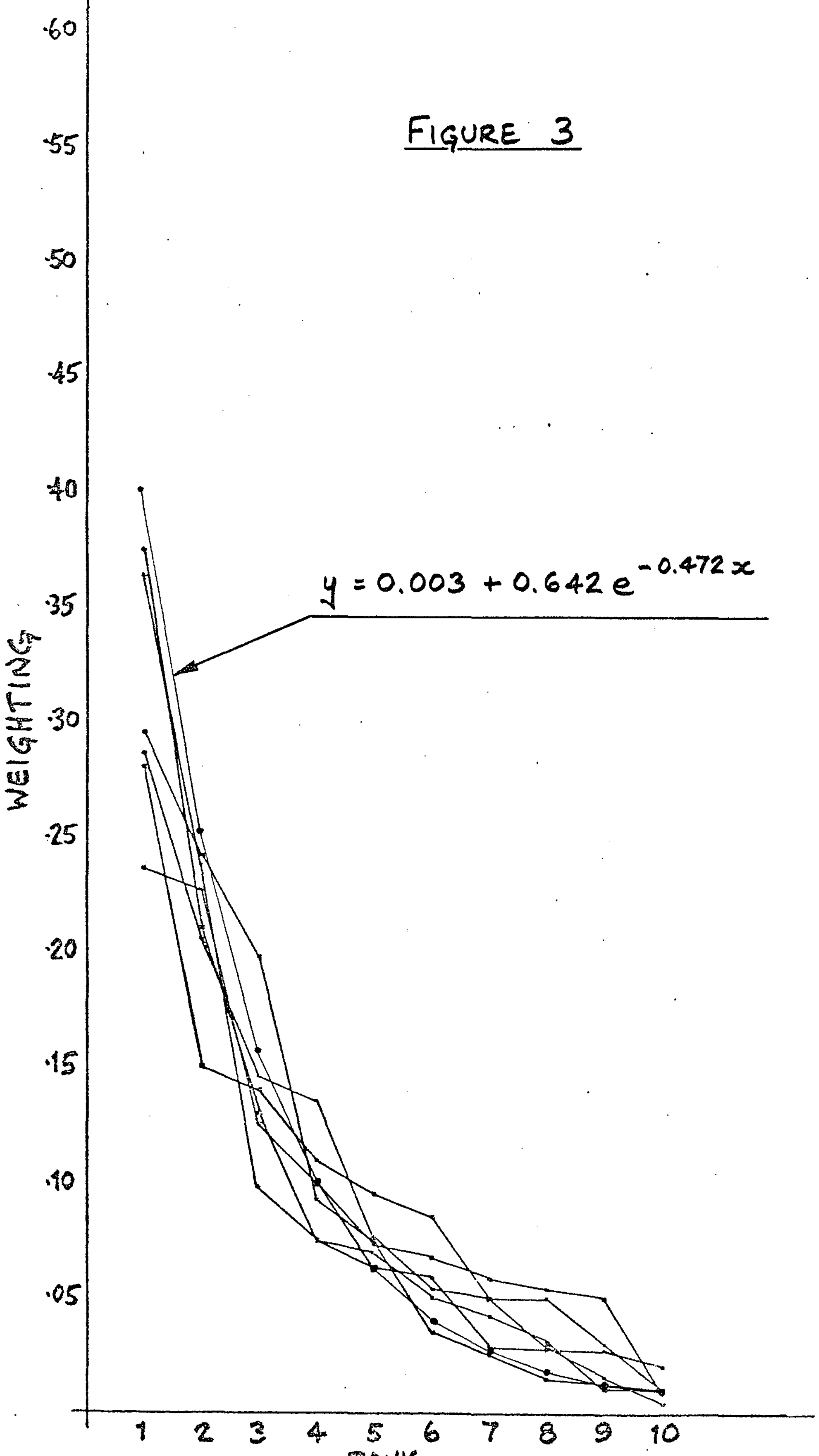


FIGURE 3
$y = 0.003 + 0.642\, e^{-0.472x}$
WEIGHTING
·60
·55
·50
·45
·40
·35
·30
·25
·20
·15
·10
·05
1
2
3
4
5
6
7
8
9
10
RANK

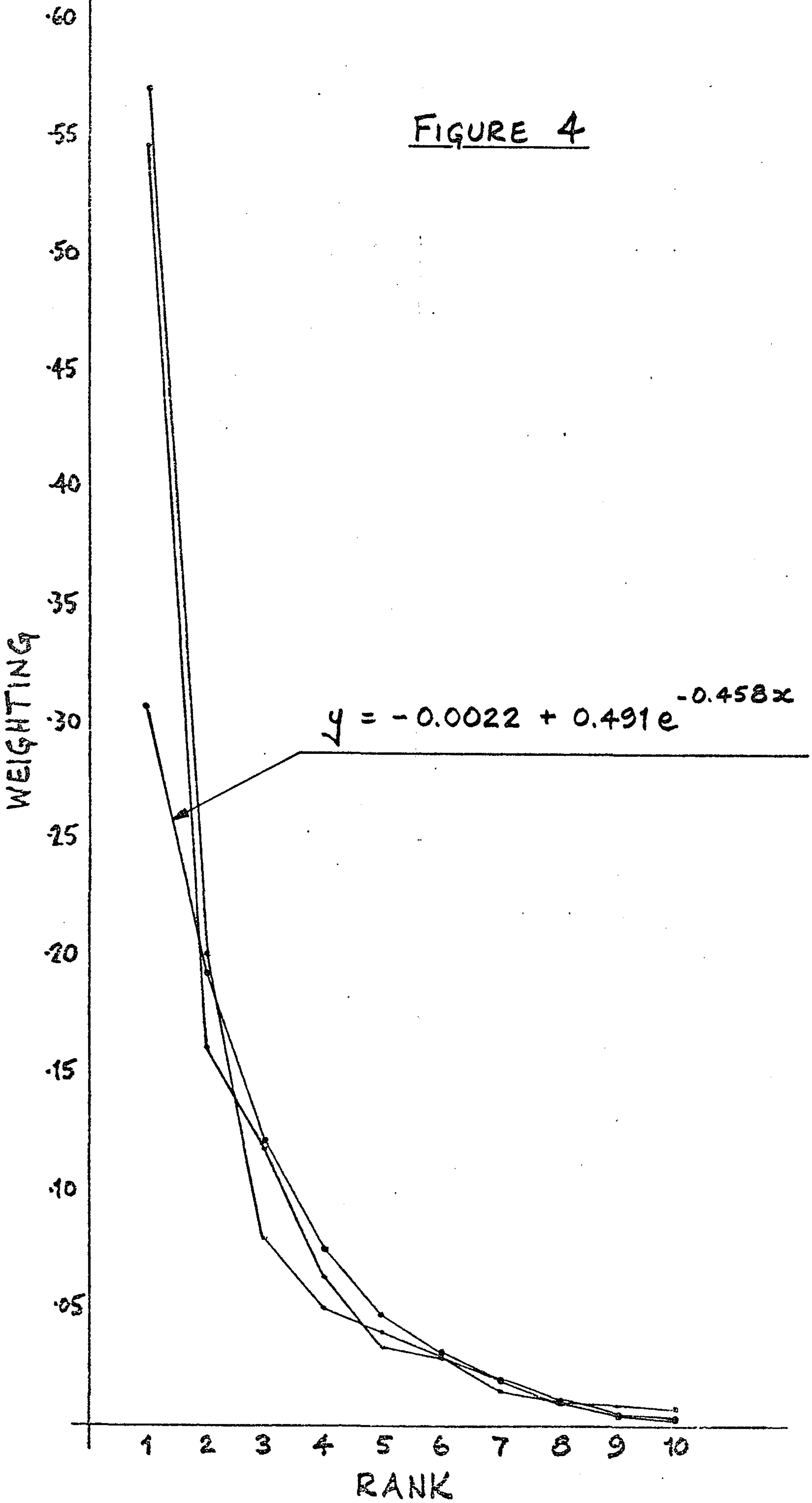


FIGURE 4
$y = -0.0022 + 0.491e^{-0.458x}$
WEIGHTING
·60
·55
·50
·45
·40
·35
·30
·25
·20
·15
·10
·05
RANK
1
2
3
4
5
6
7
8
9
10

It can be seen that the exponential results are better than the Raiffa results in only one case (situation 1) and that they are as good as the Raiffa results in one further case (situation 5). In the case of situations 7 and 8 this is hardly surprising since the one thing which distinguishes these two situations is lacking in the corresponding exponential curve, ie., the extreme 'dominance' of one construct. So dominant is the one construct in these two cases that ranking in terms of just this construct produces better results than the exponential curve, as follows:-

	SITUATION	
	7	8
RAIFFA	.951	.964
EXPONENTIAL	.736	.782
MAJOR CONSTRUCT	.942	.918

This is a particularly anomalous result if we remember that the present discussion started from the assumption that decision situations are multi-dimensional. However, the Raiffa method does give better results than the major construct results; the point to be made is that some situations are more multi-dimensional than others.

The inadequacy of the exponential results is further stressed by the other six situations. If we plot the median pattern of the six sets of weightings in Figure 1 and use this to derive a set of weightings, the results thus obtained are better than those obtained using the exponential curve, as the following table indicates:-

	SITUATIONS					
	1	2	3	4	5	6
RAIFFA	.903	.820	.855	.976	.733	.915
MEDIAN	.939	.770	.830	.976	.661	.915
EXPONENTIAL	.912	.600	.830	.939	.733	.794

In only one case does the exponential result surpass the median result (situation 5). Hence, exponential curve-fitting would not seem to be the answer in the present case. However, it is interesting that the pattern of weightings was similar in each situation. This in itself may merit future investigation since a particular decision 'style' may be reflected in a characteristic pattern of weightings. That is, some people may be characteristically more multi-dimensional than others in their decision-making. Again, this point will be more fully dealt with elsewhere (McKnight, 1975b).

PART 2 : IN SEARCH OF PERFECTION.

The final stage of the curve-fitting phase was to fit a curve through the median curve described earlier. The best fit available was found to be given by the seventh-order polynomial expression:-

$$y = .291 - .040988x - .035873x^2 - .014231x^3 + .02552x^4 - .010118x^5 + .001847x^6 - .000163x^7$$

At this stage it was felt that the original data -- the behaviour of a subject -- was being 'left behind'. For this reason, it was decided to approach the problem from a different angle by saying "Given the subject's choice behaviour, what should the weightings be in order to match this behaviour perfectly?" To do this using only the choice behaviour and the grid would be an enormous task since, as we saw earlier, there are over three million possible rank-orderings of constructs. Also, in true Bayesian spirit, it would be sub-optimal not to use available information (ie., the Raiffa weightings) as a basis for revision of opinion. Hence, the method chosen was to adjust the Raiffa weightings in such a way that the predicted ordering more closely resembled the subject's real ordering.

Taking situation 8 as an example, consider the relationship between real and predicted orders:-

ELEMENT No.	1	2	3	4	5	6	7	8	9	10
REAL RANK	8	4	10	1	2	3	5	7	9	6
PREDICTED RANK	8	6	10	1	2	3	4	7	9	5
DIFFERENCE (d)	0	2	0	0	0	0	1	0	0	1
d^2	0	4	0	0	0	0	1	0	0	1

Since our measure of correlation (Spearman Rho) varies as an inverse function of Σd^2, we must try to reduce the value of this term. Given this strategy, a reasonable tactic would be to consider first the element which contributed the largest amount to Σd^2 and attempt to reduce this amount. Hence, in the present example, we should try to reduce the amount of d^2 contributed by element 2 since this is the largest single amount. That is, we must 'improve' (where 1=best and 10=worst) the predicted ranking of this element. In order to do this, we must find a construct on which this element is rated highly. Consider the preferred pole grid for this situation:-

		ELEMENTS (L.P. RECORDS)									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	4	1	1	5	5	3	1	3	2	1
	2	2	1	2	1	1	1	1	3	5	1
	3	2	2	2	5	5	5	4	1	1	2
	4	3	1	1	5	4	2	1	3	3	2
	5	3	1	2	4	5	5	2	1	1	2
	6	2	3	2	5	4	4	4	2	1	3
	7	2	3	1	5	4	3	3	3	2	2
	8	5	2	4	5	5	5	2	5	5	1
	9	3	2	2	3	3	4	3	1	5	1
	10	3	4	3	2	2	5	2	2	3	2

Scanning down the column which represents element 2, we see that this element is rated highest on construct 10. Furthermore, only one other element (No.6) has a higher rating on this construct. Hence, we increase the weighting on construct 10. At this stage, the amount of increase was fairly arbitrary since no guidelines existed. Originally the weighting on this construct was 0.01, and by increasing this to 0.03 we get the following result:-

ELEMENT No.	1	2	3	4	5	6	7	8	9	10
REAL RANK	8	4	10	1	2	3	5	7	9	6
PREDICTED RANK	8	5	10	1	2	3	4	7	9	6
DIFFERENCE (d)	0	1	0	0	0	0	1	0	0	0
d^2	0	1	0	0	0	0	1	0	0	0

In this case, $\sum d^2 = 2.0$ and the corresponding correlation

Rs = 0.988. Using the same method, the correlation for situation 7 was increased to 0.964. Flushed with this apparent victory, it was decided to attack the worst correlation, situation 5, in which the situation was as follows:-

ELEMENT No.	1	2	3	4	5	6	7	8	9	10
REAL RANK	1	5	3	10	9	8	6	2	4	7
PREDICTED RANK	3	6	5	8	7	10	9	1	2	4
DIFFERENCE (d)	2	1	2	2	2	2	3	1	2	3
d^2	4	1	4	4	4	4	9	1	4	9

In this example, d^2 is much more evenly distributed, but elements 7 and 10 do have more than other elements. Hence, it was decided to attempt to reduce d^2 for element 7. For situation 5 the preferred pole grid was as follows:-

		ELEMENTS (L.P. RECORDS)									
		1	2	3	4	5	6	7	8	9	10
CONSTRUCTS	1	2	5	5	1	1	3	5	3	4	5
	2	4	5	4	5	5	5	5	3	1	5
	3	4	4	4	1	1	1	2	5	5	4
	4	3	1	1	5	4	2	1	3	3	2
	5	3	5	4	2	1	1	4	5	5	4
	6	4	3	4	1	2	2	2	4	5	3
	7	4	3	5	1	2	3	3	3	4	4
	8	1	4	2	1	1	1	4	1	1	5
	9	3	4	4	3	3	2	3	5	1	5
	10	3	4	3	2	2	5	2	2	3	2

Scanning down element 7 we see that it is rated highly on constructs 1 and 2. However, in both these constructs several other elements are rated as high and hence reweighting the construct would have too many ramifications. This would also seem to be true for constructs 5 and 8, on which element 7 is rated fairly highly. The way round this problem is to consider the mean rating on each construct and measure the deviation from this mean for element 7, as shown in the following table:-

CONSTRUCT No.	1	2	3	4	5	6	7	8	9	10
AVERAGE RATING ($\bar{X}$)	3.4	4.2	3.1	2.5	3.4	3.0	3.2	2.1	3.3	2.8
ELEMENT 7 - $\bar{X}$	+1.6	+0.8	-1.1	-1.5	+0.6	-1.0	-0.2	+1.9	-0.3	-0.8

Since we want to improve the predicted ranking of element 7, we increase the weighting on that construct which has the maximum positive deviation, ie., construct 8. This yields the following results:-

ELEMENT No.	1	2	3	4	5	6	7	8	9	10
REAL RANK	4	6	5	9	7	10	8	1	3	2
PREDICTED RANK	1	5	3	10	9	8	6	2	4	7
DIFFERENCE (d)	3	1	2	1	2	2	2	1	1	5
d^2	9	1	4	1	4	4	4	1	1	25

Thus we have reduced d^2 for element 7 but increased d^2 for element 10. In fact, if we look at the real and predicted rankings for these two elements we find that the differences between real and predicted are in opposite directions, a point which is lost by considering d^2. Hence, every time we reduce d^2 for element 7 we will increase d^2 for element 10, and vice versa.

This is an important point since it indicates another reason why the correlation may not be 1.0 in any particular situation. That is, even if the Raiffa technique produces 'perfect' weightings, the subject's choice may not be based on the relationships embodied in the grid. This situation may arise in two ways:- a) the subject may be making his decision on the basis of constructs which do not appear in the grid, and b) the subject may have reconstrued (in the sense of re-rated) various elements.

An example of the former situation arose with S4 who had chosen to consider decisions in relation to clothes. The particular situation involved the choice of clothes to wear to a party. The major source of error in the predicted ordering was the element "short skirt (plain)" which had a predicted rank 3 and an actual rank 9. When asked what was unsuitable about this element for this situation, S4 said "It's a bit too constraining, I was thinking of a straight short skirt, work-type skirt, and it's just not in the party spirit, it's nothing special, it's the sort of thing you'd wear every day." S4 agreed that these considerations were not reflected in the constructs in the grid. Hence, it is not surprising that the Raiffa prediction for this situation was weak.

An example of the latter case arose with S2 who had chosen to consider decisions in relation to books. During the time which elapsed between the grid-elicitation and the first weighting-elicitation, S2 re-read some of the books used as elements. The Raiffa prediction was exceptionally weak and this was traced back to the fact that, although S2 was still construing the books in the same terms, her rating of the books had changed as a result of re-reading.

The matter is further complicated by the fact that Personal Construct Theory, the theoretical basis of the repertory grid (Kelly, 1955), actually predicts a certain amount of construct movement over time. The fact that Chapman (op. cit.) did not encounter problems with this is probably attributable to the stability of people's construing of mathematical command terms. However, since one is constantly seeing new clothes, reading new books, hearing new records and so forth, a certain amount of construct movement is to be expected. Hence, if we asked subjects to rank order the elements at various intervals (say, every month), we would expect the Raiffa prediction to be progressively weaker and weaker.

Of course, the various sources of 'noise' in the system are not mutually exclusive, and hence in any one situation the fact that the correlation is less than 1.0 may be due to both construct movement and weighting inaccuracy.

CONCLUSIONS.

1). Although the curve-fitting approach was not very successful in the present case, comments about decision 'style' made earlier (p.162) would seem to merit further investigation. For this reason, curve-fitting should be maintained as an available technique for future work.

2). The method of rank-ordering constructs by means other than the Raiffa method was left aside earlier (p.155) since it has not yet been systematically investigated. It would seem worthwhile to investigate whether subjects themselves can simply rank-order constructs in terms of their differential applicability to different situations. Tentative preliminary investigations suggest that subjects may find this task very difficult.

3). In view of the possible construct movement, two lines of approach seem possible:-

a) During a weighting-eliciting session, the subject could be asked to re-rate his elements on his constructs. This would yield a measure of the movement which has taken place.

b) During a weighting-eliciting session, the subject could be 'talked back into' his grid so that he adopts the same construing position each time.

Of course, neither approach takes account of the fact that decisions may be based on constructs which simply are not represented in the grid. In fact, it would be quite difficult to take account of such constructs since, although they can be elicited (see p.167), they would need to be systematically incorporated in the hierarchy used for the weighting-elicitation. The time taken for such incorporation may allow further additional constructs to come into play, and hence we would be back where we started.

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* Note: The majority of this paper has been incorporated in a revised form into Chapter 2 of the present thesis.

APPENDIX C

CASE 1

Defendant:	John Smith (male, aged 28).
Charge:	Larceny of various foodstuffs, value £1.50.
Plea:	Consents summary trial / pleads guilty.
Prosecution case:	Store detective saw.defendant wandering around, looking "slightly dazed". Occasionally put items of food in his shopping bag. He was stopped as he left the store and the items were found in his bag. When charged and cautioned, he made no reply.
Defence:	The defendant does not remember going into the store or putting food in his bag, but he does not deny that he was found in possession. He has been worrying a lot about his wife lately since she is expecting their third child.
Background:	Defendant is married with two children (aged 2 and 4). Earns £20 per week (after deductions) as a labourer in a garden centre. Has held same job for last six years. Rent £7.50 per week; no other income or financial commitments. No previous convictions.

CASE 2

Defendant:	Frederick Bloggs (male, aged 47).
Charge:	Possession of an offensive weapon (lock-knife) and using it in a threatening manner.
Plea:	Elects summary trial / pleads guilty.
Prosecution case:	Police were called to despatch department of factory where they found the defendant sitting in a corner holding the knife. The department manager claims he told the defendant to go home since he smelled heavily of alcohol and seemed a little unsteady, whereupon the defendant pulled out the knife and threatened him with it. He offered no resistance to the Police, and when charged and cautioned made no reply.
Defence:	The defendant uses the knife in his work and for fishing. He feels that the drink must have "got the better of him".
Background:	Defendant is married with two children, both married and living in their own homes. Earns £30 per week (after deductions) as packer in despatch department. Has held job for three years. Rent £8 per week; Wife working part-time earns £8.50 per week (after deductions); T.V. rental £1.50 per week. No previous convictions.

CASE 3

Defendant:	Albert Smuggins (male, aged 32).
Charge:	Larceny of silver teapot, value £250.
Plea:	Consents summary trial / pleads not guilty.
Prosecution case:	Defendant seen by plain clothes policeman to go up to antique stall in street market. While salesman was dealing with another customer, the defendant placed the teapot in his bag and walked away. He was arrested and the teapot was found in his bag. When charged and cautioned, he made no reply.
Defence:	The defendant had no intention of stealing the teapot. He had picked it up to examine it, and it must have over-balanced and fallen into his bag when he returned it to the front of the stall. (The defendant is legally represented).
Verdict:	Guilty.
Background:	Defendant is single. Has had several short-term employments recently. Now earns £38 per week (after deductions) as a building labourer. Rent £7 per week. No other income or financial commitments.

/contd...

Previous Convictions:	Feb. 1960.	Larceny.	Fine £2.
	Jan. 1962.	Larceny.	Fine £5.
	May 1964.	Larceny.	Fine £10.
	Jan. 1968.	Larceny.	Probation 2 years.
	Aug. 1973.	Larceny.	Imprisonment 3 months.

APPENDIX D

Case		Magistrate	Sentence 1	2	3	4	5	6	7	8	9	10
CASE 1	Magistrate	1	4	2	1	3	5	6	7	8	9	10
		2	4	1	2	3	5	6	7	8	9	10
		3	10	3	2	9	1	4	6.5	6.5	6.5	6.5
		4	6	4	1	2	3	5	7	8	9	10
		5	10	2	4	3	1	5	6	7	8	9
		6	6	4	1	2	3	5	8.5	8.5	8.5	8.5
		7	10	3	1	4	2	5	6	7	8	9
		8	10	2	1	4	3	5	7.5	7.5	7.5	7.5
		9	6	5	2	1	4	3	8.5	8.5	8.5	8.5
CASE 2	Magistrate	1	10	9	8	7	6	5	4	1	2	3
		2	10	9	5	8	7	1	2	3	4	6
		3	10	8	4	9	1	2	3	5	6	7
		4	10	5	2	4	1	3	6	7	8	9
		5	10	4	3	5	1	2	6	7	8	9
		6	10	8	7	9	1	3	2	4	5	6
		7	10	2	1	8	4	3	5	6	7	9
		8	10	9	2	8	1	3	4	5	6	7
		9	10	5	3	4	1	2	7.5	7.5	7.5	7.5
CASE 3	Magistrate	1	10	9	8	7	6	5	4	3	2	1
		2	10	9	8	7	6	5	4	3	1	2
		3	10	9	8	7	6	5	4	3	1	2
		4	10	9	8	7	6	1	5	2	4	3
		5	10	9	5	8	7	6	2	1	3	4
		6	7	7	7	7	7	7	7	3	2	1
		7	10	9	6	8	7	5	4	3	1	2
		8	10	8	4	9	7	1	6	3	2	5
		9	10	8	4	9	7	5	6	3	2	1

Rank Ordering of Sentences by Each Magistrate for Each Case.

APPENDIX E

1	0.0									
2	4.4	0.0								
3	5.7	1.9	0.0							
4	3.9	2.3	2.2	0.0						
5	4.8	1.7	2.2	2.4	0.0					
6	3.3	2.4	3.2	2.6	2.1	0.0				
7	2.9	4.2	5.4	4.2	4.1	2.2	0.0			
8	3.0	4.8	6.0	4.8	4.7	2.8	0.6	0.0		
9	3.1	5.3	6.6	5.3	5.2	3.3	1.1	0.6	0.0	
10	3.2	5.9	7.1	5.9	5.8	3.9	1.7	1.1	0.6	0.0

CASE 1 Mean Confusion Matrix.

1	0.0									
2	3.4	0.0								
3	6.1	2.7	0.0							
4	3.1	1.7	3.2	0.0						
5	7.4	4.4	2.4	4.3	0.0					
6	7.3	4.1	2.1	4.2	1.9	0.0				
7	5.6	4.1	3.4	3.9	3.4	2.2	0.0			
8	4.9	4.1	3.8	3.7	4.5	3.5	1.3	0.0		
9	4.1	3.8	4.1	3.3	4.9	3.9	2.0	0.9	0.0	
10	2.9	3.6	4.5	2.8	5.4	4.8	2.9	2.0	1.1	0.0

CASE 2 Mean Confusion Matrix.

1	0.0									
2	1.1	0.0								
3	3.2	2.1	0.0							
4	2.0	1.3	2.1	0.0						
5	3.1	2.0	1.9	1.1	0.0					
6	5.2	4.1	2.4	3.2	2.1	0.0				
7	5.0	3.9	2.7	3.0	1.9	2.0	0.0			
8	7.0	5.9	3.8	5.0	3.9	2.4	2.0	0.0		
9	7.7	6.6	4.4	5.7	4.6	3.3	2.9	1.6	0.0	
10	7.3	6.2	4.3	5.3	4.2	3.4	2.8	1.7	1.2	0.0

CASE 3 Mean Confusion Matrix.