

https://dspace.org/

Attitudes toward working with computers amongst South African tertiary sector users

Argirys, Loukia

2016
http://hdl.handle.net/10539/21354

Downloaded from a DSpace repository. https://dspace.org/

ATTITUDES TOWARD WORKING WITH COMPUTERS AMONGST SOUTH AFRICAN TERTIARY SECTOR USERS

LOUKIA ARGIRYS

Degree awarded with distinction on 8 Dec 1993.

A dissertation submitted to the Faculty of Arts, University of Witwatersrand, Johannesburg, in fulfilment for the requirements of the Degree of Master of Arts

Department of Industrial Psychology
University of Witwatersrand

DECLARATION

I hereby declare that this dissertation is my own unaided work, except were due acknowledgement is made to others. It is being submitted for the Degree of Masters of Arts to the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

Argiry

Loukia Argirys

14th day of June 1993

DEDICATION

To my late father, Spiro Argirys

ACKNOWLEDGEMENTS

I would like to express my sincere thanks and appreciation to the following people, all of whom made this dissertation possible:

Professor James Fisher, my supervisor, for his guidance, support, stimulating comments and constructive criticism throughout the course of this dissertation

Nick, for his patience and understanding during long periods of neglect

Stephanie, to whom I now promise my undivided attention

My mom and family, for their unfailing support, assistance and encouragement

The banking staff who gave generously of their time to distribute the questionnaire on which this dissertation is based. In addition, thanks must go to all the people who completed the questionnaires and who made up the sample

The financial assistance of the University is hereby acknowledged. Opinions expressed or conclusions reached are not necessarily those of the University

The financial assistance of the Centre for Science Development towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the Centre for Science Development.

ABSTRACT

The aim of the present study was to assess employees' attitudes toward working with computers. A review of previous studies conducted within the area of attitudes toward computers and attitudes toward working with computers revealed that the present study needed to consider user-task-system characteristics and that an adequate attitude scale which examined specifically attitudes toward working with computers needed to be developed. In order to conduct the present study, a checklist was developed to assess user-task-system characteristics and an attitude toward working with computers scale was developed and validated. The data was gathered from questionnaires distributed to computer users in a banking institution. Cluster analysis was computed on the checklist items in order to separate users into distinctive groups based on their user-system-job characteristics. Three separate clusters were found. Analysis of variance and Scheffes' test were then conducted on the clusters which revealed that cluster members differed in their favourability toward working with computers. The findings of the present study are discussed and limitations of the present study are acknowledged. Finally, theoretical and practical implications of the study are considered and directions for future research are suggested.

Table of Contents

CHAPTER 1 1

INTRODUCTION 1

CHAPTER 2 4

ATTITUDES AND ATTITUDE MEASUREMENT 4

THE THREE COMPONENT OR TRIPARTITE THEORY OF ATTITUDES 5

The cognitive component 5

The affective component 7

The behavioural component 8

ATTITUDE MEASUREMENT 22

LIKERT'S SCALE METHOD OF SUMMATED RATINGS 23

Direction and degree of attitudes 26

Summary of chapter 28

CHAPTER 3 29

ATTITUDES TOWARD WORKING WITH COMPUTERS 29

ATTITUDES TOWARD COMPUTERS 32

THE HUMAN-COMPUTER INTERACTION 53

User characteristics 58

Task characteristics 65

System characteristics 72

Task match 72

Ease of use 74

Ease of learning 76

JOB DESIGN 80

Summary of chapter 83

CHAPTER 4 85

RATIONALE AND PROCEDURE 85

AIMS OF THE PRESENT STUDY 88

DEVELOPMENT OF THE MEASURING INSTRUMENTS 88
Development of the checklist 89
Development of the Attitudes toward working with computers scale 90
Internal consistency 94
Face validity 94
Subjects 95
Procedure 95
Summary of chapter 96

CHAPTER 5 98
RESULTS 98
INTERNAL CONSISTENCY 98
FACTOR ANALYSIS 102
Measure of sampling adequacy (MSA) 103
Communality estimate (h^2) 105
Scree test 105
Eigenvalues 107
CLUSTER ANALYSIS 117
Correlation coefficients 121
Distance measures 122
Hierarchical agglomerative methods 123
Ward's minimum variance method 123
Cluster A 134
Cluster B 134
Cluster C 135
ANALYSIS OF VARIANCE (ANOVA) 136

CHAPTER 6 145
DISCUSSION 145
ATTITUDES TOWARD WORKING WITH COMPUTERS 145

THEORETICAL IMPLICATIONS AND FUTURE RESEARCH 159
PRACTICAL IMPLICATIONS OF THE PRESENT RESEARCH 160
LIMITATIONS OF THE PRESENT STUDY 162

REFERENCES 165

APPENDIX 1 188

APPENDIX 2 190

APPENDIX 3 192

APPENDIX 4 197

LIST OF TABLES

Tables Page

1. Cronbach's alpha coefficients for the Attitudes toward working with computers scale 100
2. Cronbach's alpha coefficient for the reduced Attitudes toward working with computers scale 100
3. Measure of sampling adequacy (MSA) for items on the Attitudes toward working with computers scale 104
4. Communality estimates (h^2) for items on the Attitudes toward working with computers scale 106
5. Kaiser's eigenvalues for items on the Attitudes toward working with computers scale 109
6. Factor structure 113
7. Items loading on the "Willingness to use a computer" factor 114
8. Items loading on the "Knowledge and understanding of computers" factor 115
9. Items loading on the "Computer attribute" factor 116
10. Cronbach's alpha coefficients for the Attitude toward working with computers factors and the overall attitude 118
11. Cluster analysis for user-system-job characteristics 130
12. One-way analysis of variance of the factors 141
13. Scheffe's test for the clusters and Factor 1 142
14. Scheffe's test for the clusters and Factor 2 142
15. Scheffe's test for the clusters and Factor 3 143
16. Scheffe's test for the clusters and the overall attitude 143
17. Factor means for Clusters A, B and C 144
18. Previous Attitudes toward computers studies factor solutions 150

LIST OF FIGURES

Figure Page

1. The two basic dimensions of behaviour towards attitude objects 9
2. Schematic conception of attitudes 11
3. The Three component theory as may be applied to Attitudes toward working with computers 13
4. A computer is a machine that processes data into information 31
5. A computer processes data automatically under the control of a stored programme 33
6. The intervening role of usability 55
7. Eason's (1984) casual framework of usability 57
8. Two-dimensional conceptual space of user characteritics 61
9. The human-computer task 68
10. A classification of task types 70
11. The relationship between task structure and information needs 71
12. Conceptual structure of system characteristics 79
13. Scree plot of eigenvalues 108
14. Dendrogram of the three cluster solution 131

CHAPTER 1

INTRODUCTION

World-wide technological innovations have changed the face of modern organisations. Computers in particular represent an extremely powerful force, extending man's capacities to seemingly limitless levels (Oborne, 1985). The areas in which computer systems are being introduced are constantly expanding (Wang, 1989) resulting in the nature of work altering and hence emphasising the importance of gaining a complete understanding of the factors that influence employees' attitudes toward working with computers.

Employees' attitudes toward working with computers could be expected to be a salient factor in influencing actual use of them (Igbaria & Parasuraman, 1989). There is evidence that the use of computers by employees appears to be limited due to the prevalence of computer anxiety or fear of computers and negative attitudes toward computers in general (Howard & Smith, 1986; Robey, 1979). This suggests that the potential benefits of computers may not be fully realised (Nickerson, 1981) therefore neither benefiting the employee nor the organisation in the long-term. However, attitudes toward working with computers is an important link that is missing in previous work on computerisation (Rafaeli, 1986).

The aim of the present study was thus to assess employees' attitudes toward working with computers. After reviewing the relevant literature it was evident that previous research within the field had firstly, defined attitudes according to the three component or tripartite theory of attitudes; and secondly, had used inadequate scales to assess attitudes toward working with computers. Hence, for the present study it was decided that an adequate "attitudes toward working with computers" scale should be developed and validated based on the three component theory.

Since the present study dealt with the human operator interacting with a computer to perform his or her work or some aspect of their work, it was concerned with the human-computer interaction. In recent years, emphasis has been placed on the importance of the study of the dynamics of human-computer interaction. Such research attempts to deal with the design of "human interactions with computers for effective working" and "computer interactions with humans for effective

working" (Dowell & Long, 1989, p.1515). The accent is therefore now placed upon the interactions of the entire system: humans, computers, the work to be performed and the organisation in which it occurs (Long, 1989; Wang, 1989). However, past studies conducted on attitudes toward computers and attitudes toward working with computers have not considered the fundamental elements of such an interaction. As a result, in the present study it was decided that user-task-system characteristics should be assessed in order to have a clear understanding of the human-computer interaction.

Furthermore, previous research has demonstrated the effects of various intervening variables on attitudes toward computers and attitudes toward working with computers. An intervening variable which may influence attitudes toward working with computers and not previously considered by past studies, is an individual's job characteristics (Eason, 1988). Another intervening variable which may effect attitudes toward working with computers and also not accounted for by previous research, is an individual's past experience with computers. Fishbein and Ajzen (1975) note that past experience and attitudes can mutually influence one another. Both attitudes and past experience can influence subsequent behaviour, i.e., to use or not to use a computer (Fishbein & Ajzen, 1975). Hence, the present study examined the effects of job characteristics and past experience on an individual's attitude toward working with computers.

Thus, previous research on attitudes toward computers and attitudes toward working with computers have used inadequate measuring instruments to assess attitudes toward working with computers, have not considered user-system-job characteristics and have not taken into account users' past experience. Hence, the aim of the present study was to assess the attitudes of computer users who differ according to their experience and involvement with computers, their task and system characteristics, and their psychological needs. In order to conduct this research, a checklist needed to be developed to assess the user-system-job characteristics and an attitude scale to examine attitudes toward working with computers needed to be developed and validated.

The main body of this dissertation falls into two distinct parts. The theoretical and conceptual framework for the research is covered in Chapters 2 (Attitudes and attitude measurement) and 3 (Attitudes toward working with computers), whilst Chapters 4 (Rationale and procedure), 5 (Re-

sults) and 6 (Discussion) are concerned with the execution, analysis and interpretation of the research.

CHAPTER 2

ATTITUDES AND ATTITUDE MEASUREMENT

The study of attitudes is one of the oldest and most significant areas of social psychological research (Back, 1977). As early as 1918, social psychology was defined as the scientific study of attitudes (Thomas & Znaniecki, 1918). This is not surprising as attitudes represent one's major equipment for dealing with reality, reflects one's style of operation, and one's way of coping with and dealing with problems (Halloran, 1970). In short, attitudes help to make sense and give meaning to individual behaviour and are probably the best basis for prediction yet devised (Halloran, 1970). These qualities have led social psychologists to refer to attitudes as the 'flywheel of social psychology' and it is certainly true that no single area within the discipline has been the subject of so much research (Halloran, 1970). As can be expected with a term that has been used extensively by so many psychologists over such a long period of time, its definition has varied (Triandis, 1971). It is not however the purpose of the present chapter to discuss and critique the multitude of attitude definitions which exist but rather to examine the attitude definition and theory applicable to the present study.

In the present study, an attitude was defined according to the three component or tripartite theory of attitudes. Examination of previous studies within the field attitudes toward computers and attitudes toward working with computers revealed that the majority of these studies had assessed attitudes according to the three component theory. Furthermore, following Fishbein and Ajzen (1975) the three component theory defines an attitude by specifying the essential characteristics of the concept which need to be examined in order to obtain a valid measure of an attitude. That is, the three attitude components need to be examined to attain a valid measure of the concept. As a result, the three component theory was deemed an appropriate theoretical base on which to assess attitudes toward working with computers in the present study. Thus, at this stage it was deemed essential that the three component or tripartite theory of attitudes be discussed in detail.

THE THREE COMPONENT OR TRIPARTITE THEORY OF ATTITUDES

In its early history, the concept of attitude was viewed as being unidimensional. That is, it was generally defined as an individual's affective or emotional orientation towards a stimulus along a single dimension of favourability to unfavourability (Duckitt, 1990). Thurstone and Chave (1929, p.12) for example, define an attitude towards a stimulus as "a general evaluation or feeling of favourability or unfavourability towards." Major attitude measurement methodologies were based on this unidimensional conceptualisation of an attitude (Guttman, 1944; Likert, 1931; Thurstone & Chave, 1929). Allport (1935) however noted that this unidimensional definition of an attitude was oversimplified in that it would not be very useful in the prediction of behaviour. Doob (1947) pointed out that measuring attitudes in terms of affect does not lead to the prediction of a specific behaviour because there may be a number of behaviours that are equally appropriate for an individual occupying a particular position along the affect continuum. Chein (1948) suggested that two people may be equally favourable towards an object but may have different cognitions or beliefs about the object. Further, Fishbein (1965) suggested that it is not necessarily "inconsistent" for an individual to have a favourable attitude towards some "object" and to believe that the "object" has some negative characteristics, qualities and attributes.

These criticisms gave rise to a broader and more complex view of attitudes, i.e., the three component or tripartite theory. The three component theory defines an attitude as "an idea charged with emotion which predisposes a class of actions to a particular class of social situations" (Triandis, 1971, p.2). This definition suggests that attitudes have three components, i.e., the cognitive, affective and behavioural. Each of these attitude components are briefly discussed below.

The cognitive component

There are potentially an infinite number of just noticeable differences in the human environment. However, a fine discrimination of the environment is beyond an individual's capacity and as a result an individual treats many discriminable stimuli as instances of the same thing. In other words, an individual categorises stimuli. Since categorisation simplifies the task of responding to the environment, it has considerable survival value (Triandis, 1971). However, a great loss of information

is involved (Allport, 1954; Bruner, 1958) and misinformation can also occur as when a stimulus is placed in a category it is assumed to have the same associates with other categories. Further, Klineberg (1954) notes that language is a key function in categorisation. When a language provides a term for a particular category, it facilitates the use of this category by those who speak it. Some languages have richer vocabularies for certain domains of concepts than others (Klineberg, 1954).

Categories may be conceived as bei .g organised according to a horizontal dimension of discrimination (e.g., poodle, collie, terrier) and a vertical dimension of level of abstraction (e.g., poodle, dog, animal). Categories are often defined by other categories that are called attributes (Triandis, 1971). Furthermore, it is also important to consider the dimension of centrality of the concepts. Rokeach (1967, 1968) has shown that concepts differ in "centrality." There are certain beliefs that deal with the individual and for which there is unanimous social support. For example, the belief "My name is Mark" is very central to the individual whose name is Mark. There is no public dispute of this statement. Other beliefs are somewhat less central and have no social support. For example, the belief "My mother loves me" is less central and therefore the individual can be less sure about it than he can be about the belief "My name is Mark." Autho ity beliefs are even less central. For example, the belief "The philosophy of Lincoln is basically sound and I am all for it" is a statement that is less central than the previous ones. Authority beliefs centre around an authority figure. Further removed from the central beliefs are peripheral beliefs, e.g., "The United States should have remained neutral during the 1956 crisis of the Suez Canal." The least central are those beliefs that are inconsequential, e.g., "Elizabeth Taylor is more beautiful than Mia Farrow." Other researchers refer to "centrality" as "ego-involvement" (e.g., Sherif, Sherif & Nebergall, 1965). High central beliefs are ego-involving. It may be, however, better to employ the term centrality as it implies that the change of a belief high in this characteristic will also change many other beliefs but the change of a peripheral belief may have an unimportant effect on the organisation of the cognitive system. Nevertheless, the two terms can be used interchangeably and it should be clear that central or highly ego-involving beliefs are more difficult to chang. than peripheral or uninvolving beliefs (Triandis, 1971).

The cognitive component thus denotes the way in which an attitude object is perceived by an individual. It is the mental picture formed by the individual and includes all the individual's thoughts,

beliefs and knowledge about the object (Back, 1977). In the present study, the cognitive component referred to an individual's thoughts, beliefs and knowledge of computer systems.

The affective component

Once a category has been formed it is likely for it to become associated with pleasant or unpleasant states and through conditioning it can acquire the property of arousing positive or negative states in the individual. The way the individual feels about an attitude object is often determined by the previous association of the attitude object with pleasant or unpleasant state of affairs (Triandis, 1971). The affective component thus denotes an individual's feelings of liking or disliking of the attitude object (Jaspars, 1978).

An important connection among categories is the relationship between a category and valued (or disvalued) outcomes. Peak (1955) suggests that the attitude towards a particular stimulus depends on the instrumental relation between the stimulus and one's goals. Thus, one experiences positive affect towards objects that help one reach one's goals and negative affect towards objects that hinder one or lead one to undesirable goals. Specifically, the affective loading towards the attitude object (A) is connected with the probabilities of the outcomes that are salient (P_1, P_2, ... P_n) and the evaluation (E) of each of these outcomes by the equation:

$$A = P_1E_1 + P_2E_2 + ... + P_nE_n$$

(Carlson, 1956; Rosenberg, 1956; Triandis, 1971).

The affective component of attitudes is characterised by the presence of positive or negative emotion. Physiologically, emotion involves mainly a state of arousal which becomes positive or negative when it is cognitively "interpreted" (Triandis, 1971). It has been found that a physiological state of arousal is "labelled" by the individual in terms of his or her available cognitions. If the individual experiences arousal with a sufficient explanation then the individual does not experience emotions such as fear. If the individual experiences the cognitions but not the physiological arousal then he or she again will not experience an emotion. Only when both the arousal and the cognition are present will the individual experience the emotion (Schachter, 1964). On a different note, Zajonc

(1968) has argued that the formation of the affective component or the pleasantness of a stimulus is a function of its familiarity, i.e., the more familiar an individual is with an attitude object the more pleasant the individual will rate that object.

Hence, the affective component refers to an individual's feelings or emotions towards the attitude object. The affective component in the present study referred to an individual's feelings towards working with computers.

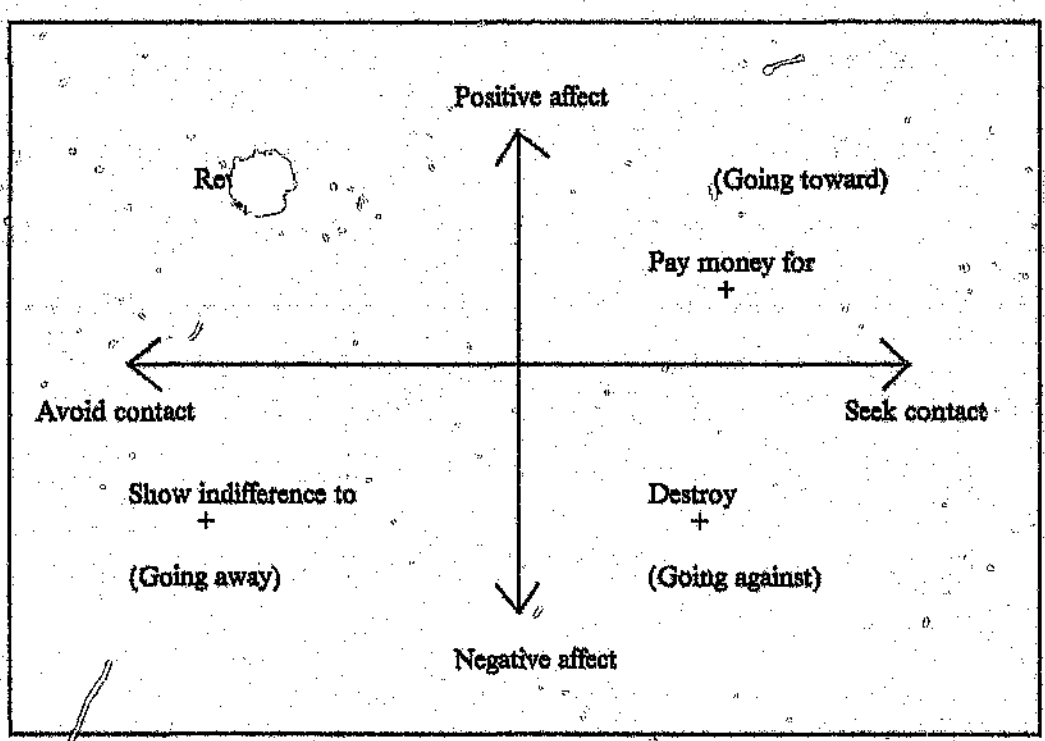
The behavioural component

The behavioural component refers to an individual's actions towards an object or person (Back, 1977). Triandis (1971) notes that there are two main dimensions that underlie behaviour towards any kind of attitude object. The two dimensions are positive versus negative affect and seeking versus avoiding contact. This system of dimensions results in a typology of behaviours that may be described simply as going toward, against or away from the attitude object. Figure 1, indicates this conceptualisation and includes some behaviours to illustrate how they would be positioned in this two-dimensional space.

From Figure 1, it is evident that any behaviour can be conceived as involving a certain amount of seeking or avoiding contact and a certain amount of positive or negative affect. For maximum contact consider the behaviours "to kiss" and "to use a knife against", for minimum contact consider the behaviour "to run away from", for maximum positive affect consider "giving one's life to save the life of another" and for maximum negative affect consider "planning to throw a bomb at him." It is clear that different behaviours involve different mixtures of the two qualities, contact and affect (Triandis, 1971). Empirical evidence has been found to support the two dimensions of behaviour towards attitude objects (Triandis, Vassiliou & Nassiakou, 1968).

The behavioural component thus denotes an individual's intention to behave in a certain way in response to his or her feelings, and is hence the result of the attitude (Schermerhorn, Hunt & Osborn, 1985). In the present study, the behavioural component referred to an individual's behaviour and actions towards computers.

Figure 1: The two basic dimensions of behaviour towards attitude objects (Triandis, 1971)



Hence, from the above discussion on the three components one can say that the cognitive representation of a category is the minimum requirement in order for an individual to have an attitude. In addition, the cognitive category must become associated with pleasant or unpleasant events, or desirable or undesirable goals. When this occurs the category becomes charged with affect. The more pleasant the events and the more frequently they occur in the presence of the category, the greater is the amount of affect that becomes attached to the category. Similarly, the more desirable the goals that can be reached through the category, the more the affect (Triandis, 1971). The individual acts accordingly towards the attitude object. Figuratively speaking, the three components of an attitude systematically relate to one another in the following way:

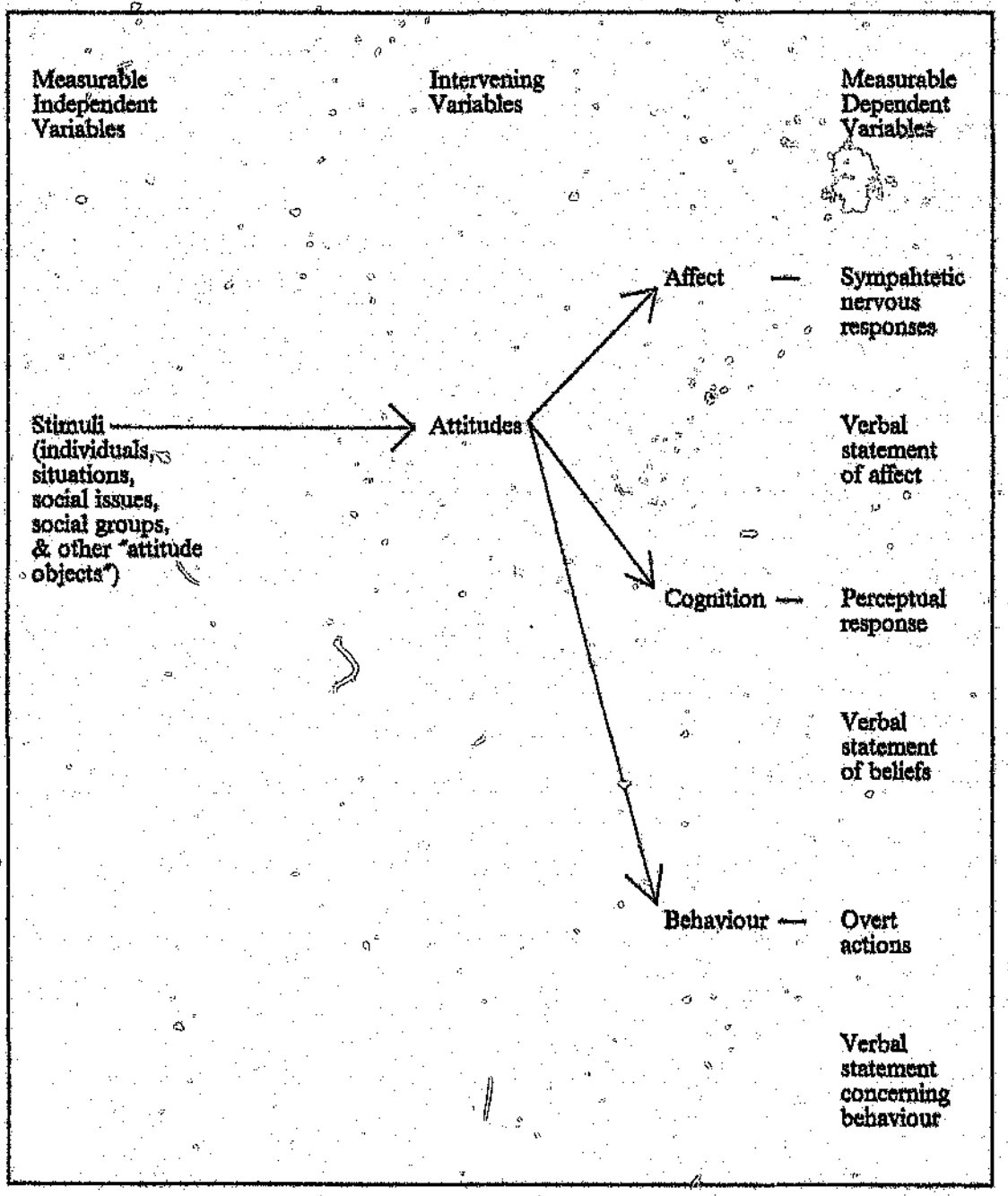
beliefs & values ---create---> attitudes ---that predispose---> behaviour

(After Rosenberg & Hovland, 1960).

From the above diagram, an attitude is seen as a variable that intervenes between beliefs and values as antecedent conditions on the one hand, and intended behaviour on the other (Schermerhorn et al., 1985). Thus, an attitude cannot be observed directly but must be considered as a 'state of readiness' for response (a predisposition to respond in a particular way to the attitude object) which has to be inferred from overt behaviour (Jaspars, 1978). Attitudes are the inferred bases for observed consistencies in the behaviour of individuals. Inferences may be based on observations of either verbal or non-verbal behaviour (Hartley & Hartley, 1952).

Rosenberg and Hovland (1960) represent attitudes as shown in Figure 2. The stimuli are grouped in a category that represents the attitude object. The stimulus may or may not be observable and can best be thought of as an independent or exogenous variable. Cognition, affect and behaviour are three hypothetical unobservable classes of response to that stimulus with each being measured by a variety of subject responses. To a large extent these response classes are abstractions or constructs and are typically inferred from the specific types of measurable responses indicated at the extreme right of Figure 2. Hence, cognitions include perceptions, concepts and beliefs about the attitude object and are usually elicited by verbal questions in written or oral form. An individual's affective response towards the attitude object may be from measures of physiological variables such

Figure 2: Schematic conception of attitudes (Rosenberg & Hovland, 1960)



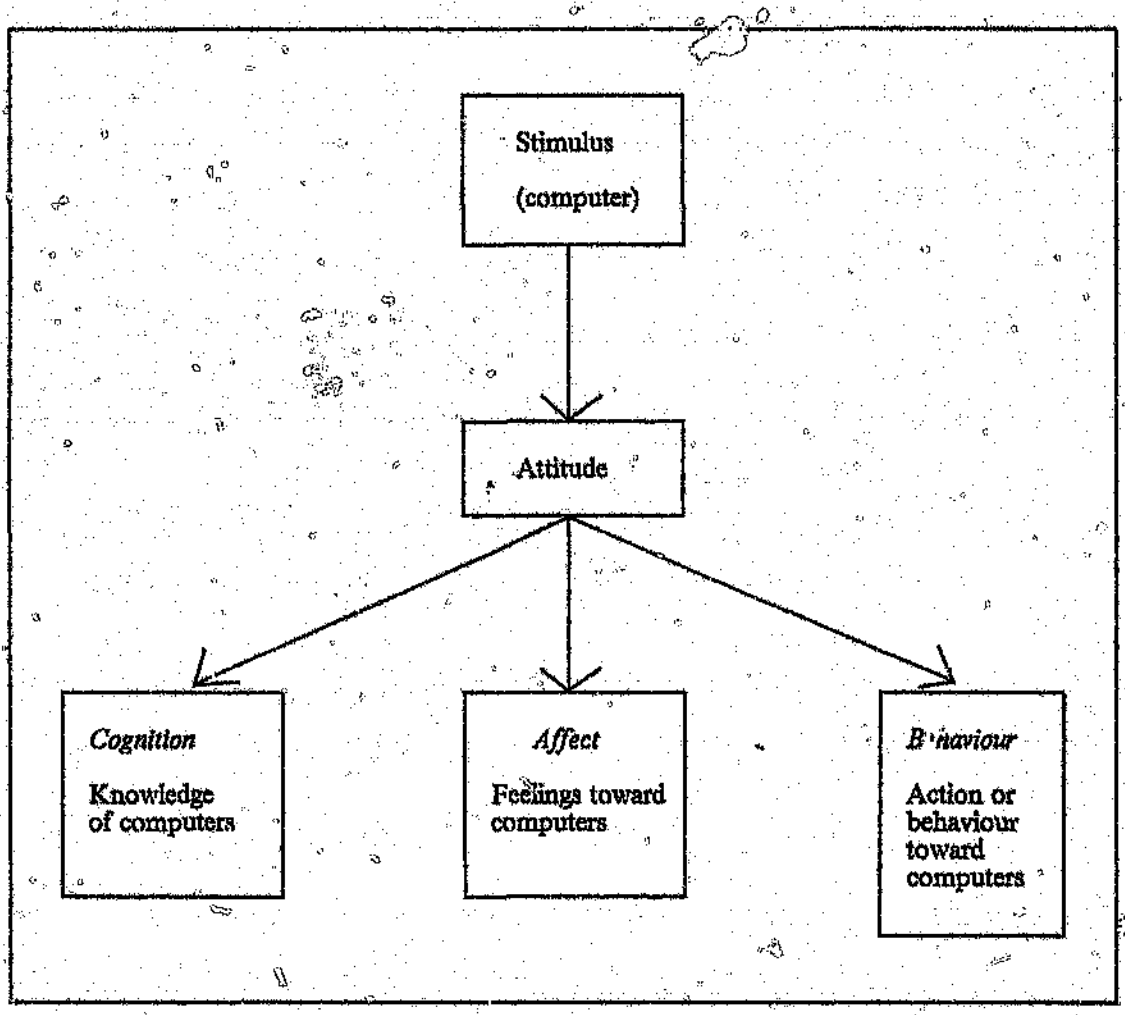
as blood pressure or galvanic response but is typically inferred from verbal statements of how much he or she likes or dislikes the attitude object. Similarly, how an individual acts towards a given situation may be evaluated by how he or she responds when directly confronted with the situation or may be inferred from what the individual says he or she will do in a given situation (Rosenberg & Hovland, 1960).

Following Rosenberg and Hovland's (1960) conceptualisation of attitudes, Figure 3 indicates the way in which the three component theory was used to assess attitudes toward working with computers in the present study. As can be seen in Figure 3, the computer was presented as the stimulus. The cognitive component was assessed by an individual's responses to non-verbal statements on knowledge of computers, the affective component was measured by an individual's responses to non-verbal statements on how the individual feels towards working with computers, and the behavioural component was assessed by an individual's responses to non-verbal statements on the individual's behaviour and actions towards computers.

The aim of the present study was thus to determine the feelings of employees toward working with computers. As a result, the present study focused on the behavioural component of the model, i.e., intentions to work with or use the computer and the way in which the cognitive and affective components of the model impact on such intentions. The fact that previous research has found cognition and affect to be related to intentions to behave (Breckler, 1984; Kothandapani, 1971) suggests that knowledge of computers and feelings towards working with computers should have an impact on intentions to work with or use computers at work.

Although the present study utilised the three component theory to assess attitudes toward working with computers, the theory has a number of shortcomings. Firstly, the interrelationship between the three components and how they influence behaviour has never been definitively clarified (Ajzen & Fishbein, 1980; Taylor, 1984). If the three components comprise an attitude as a second order dimension then it seems logical to expect substantial consistency between the three components. However, high intercomponent correlations do not necessarily follow from the three component theory (Breckler, 1984). For example, Greenwald (1968) mentions that cognition, affect and behaviour can sometimes be the products of very different learning situations. Even if the

Figure 3: The Three component theory as may be applied to Attitudes toward working with computers



three components are produced by the same learning conditions, they may be "coded" differently which implies that they can operate in partial or even complete independence (Greenwald, 1982; Zajonc, 1980). Secondly, Rokeach (1968) states that in experimental research one component of a belief is difficult, if not impossible, to isolate and manipulate independently from a second component. Thirdly, the model implies that behaviour is jointly determined by all three components with the behavioural component often seen as the most important (Duckitt, 1990). One implication of this and the idea that there could be inconsistency between components, was that behaviour might not be strongly predictable from attitude measures such as Likert and Thurstone scales which assessed only the affective component (Duckitt, 1990). Early findings, such as LaPiere (1934) study, which were interpreted as indicating that racial attitudes and behaviour could be quite unrelated were sometimes explained in this way (e.g., Katz & Stotland, 1959; Krech & Crutchfield, 1948; Taylor, 1984). Finally, the three component theory has had little impact on attitude measurement with attitudes continuing to be measured as unidimensional constructs. These problems may have contributed to a decline in interest during the past two decades with unidimensional approaches enjoying a revival (Ajzen & Fishbein, 1980; Fishbein & Ajzen. 1975; Jaspars, 1978). Ostrom (1968, p.27) concludes that "the bulk of attitude research and, consequently, the theory developed to understand the attitude change process, continues to focus primarily on affect to the detriment of understanding the other characteristics of attitude."

The major criticism labelled against the three component theory however, is (as discussed above) whether the cognitive, affective and behavioural components of attitudes are highly correlated and measure the same construct or are relatively independent and should be considered as separate entities. There is considerable disagreement among social psychologists on this issue and the evidence is therefore mixed (Triandis, 1971). McGuire (1985) after reviewing the relevant literature concludes by stating that the three components have proven to be so highly intercorrelated that it is probably not worthwhile to maintain distinctions between them. However Krech, Crutchfield and Ballachey (1962) note that on their review of the literature there is only a "moderately high" relationship between the three components. Since the present study used the three component theory in order to assess attitudes toward working with computers, it therefore examined whether the three components are related to each other or distinguishable from one another. As a result it was deemed appropriate that past research on the three components be discussed in the following section, in order

to overcome previous studies limitations and to enable the present study's findings to be discussed in relation to those of past studies (this is discussed in Chapter 6 (Discussion)).

Oskamp (1977) describes three successive waves of research on the attitude components. The first wave was marked primarily by correlational studies, the second wave consisted of experimental studies and the third wave focused on the conditions under which the attitude components would be similar and the conditions under which they would be different. From this research it is clear that there is a general consistency between the three components but there are also meaningful distinctions and differences among them (Oskamp, 1977). However, the three successive waves of research do not focus on the relationship between the three components simultaneously but on the relationship of two components at a time. In only four studies (i.e., Mann, 1959; Woodmansee & Cook, 1967; Ostrom, 1969; Kothadapani, 1971) have researchers examined the relationship between all three attitude components with the stated goal of testing the three components theory's validity. Hence, it was deemed essential that these four studies be considered in detail below.

After reviewing the relevant literature, Mann (1959) found that racial prejudice had been measured as a cognitive attitude (Adorno, Frenkel-Brunswick, Levinson & Sanford, 1950; Borgardus, 1925), as an affective preference (Criswell, 1937; Northway & Quarrington, 1946) and as an aspect of observable individual behaviour (Minard, 1946; Wilner, Walkley & Cook, 1952). Few, if any, studies had however attempted to measure all three aspects of prejudice simultaneously and to test whether they were related. Thus, Mann (1959) aimed to study the relationship between the cognitive, affective and behavioural aspects of racial prejudice. The sample in his study consisted of black and white Christian students. Each subject was randomly assigned to a six-man group. The groups met in leaderless group discussions four times a week over a three-week period. During the second week subjects were required to fill out three instruments: firstly, a sociometric questionnaire designed to provide a measure of the affective aspect of prejudice. Subjects were required to rank order the group on the criterion "whom would you most like to continue to be friends with at the end of the summer session?" Secondly, to obtain a measure of the cognitive aspect of racial prejudice, the E scale from the California Public Opinion survey was used. Thirdly, subjects were asked to rank other group members on the criterion of "degree of racial prejudice" on the basis of how

they had acted in the group situation in order to obtain a measure of the behaviour aspect of prejudice (Mann, 1959).

Using the data obtained from the the measuring instruments the hypothesis that there is a positive relation between the cognitive, affective and behavioural aspects of racial prejudice was assessed. After analysing the experimental data, Mann (1959) found a positive relation between the cognitive, affective and behavioural aspects of racial prejudice for black students. However, no such relationship among the three components existed for the white students. Further, a negative relationship between the affective and behavioural aspects of racial prejudice for the white students was found. The findings suggest that prejudice is not a simple concept that can be used to describe the same attitudes and behaviours in white and black students. For black students there tends to be a single prejudice factor which is tapped regardless of which aspect of prejudice is being measured. For white students however racial prejudice seems to have three different meanings, two of which are contradictory (Mann, 1959). Mann's (1959) findings are however questionable since the measures of cognition, affect and behaviour were not scaled on a common evaluative continuum (Breckler, 1984). Furthermore, the attitude measures did not logically follow from a definition of the attitude components (Breckler, 1984). Hence, in the present study all three components were scaled on an evaluative continuum and attitude measures followed from the definition of the attitude components.

Woodmansee and Cook (1967) also examined dimensions of racial attitudes. They conducted three studies to explore the organisation of verbal attitudes towards blacks. Their results did not produce components identifiable as cognitive, affective and behavioural. Instead, a series of factor analyses identified eleven subgroups of items related to racial attitudes. The items formed subgroups with each having its focus on common content or substance. Some subgroups dealt with issues of public policy in race relations, others with the nature and proper role of blacks, and others with social relationships with blacks, empathy with their emotional reactions to derogatory treatment, and discomfort at public associations with them. While the items could be classified as cognitive, affective or behavioural the classification did not correspond to the factor structure. Some subgroups contained two or more types of items while items of the same type separated into two or more subgroups. Hence, Woodmansee and Cook (1967) found a large number of "content-defined"

dimensions. Their findings may be contributed to the fact that measures were not classified as ones of cognition, affect or behaviour (Breckler, 1984). In the present study, measures were classified as cognitive, affective and behavioural.

Further, Breckler (1984) criticises Mann (1959) and Woodmansee and Cook (1967) on relying on an exploratory approach as opposed to a confirmatory approach to validation. However, for the present study it was deemed more appropriate to use an exploratory approach in order to ascertain the number of attitude components as opposed to a confirmatory approach were the number of attitude components are prespecified (this is discussed in detail in Chapter 5 (Results) under the heading 'Factor analysis').

Perhaps, the two strongest tests of the three component theory are the studies conducted by Ostrom (1969) and Kothandapani (1971). The purpose of Ostrom's (1969) study was to assess the theoretical value of maintaining the three component classification of evaluative responses. Specifically, Ostrom (1969) examined the convergent and discriminant validity of the three component theory. Ostrom (1969) argued that for the three component distinction to be of value it must be shown that evaluative responses within each component share a unique set of determinants distinct from those of the other components. Hence, Ostrom's (1969) first hypothesis was that individuals would show greater consistency or response to attitude scales measuring the same component than to scales measuring different components. To test this hypothesis, Ostrom (1969) used the Campbell and Fiske (1959) multitrait-multimethod matrix procedure. Campbell and Fiske (1959) note that validation is typically convergent, i.e., a confirmation of a trait (component) by independent measurement procedures. Validation is also discriminant in that one trait should not correlate highly with another trait with which it is intended to differ. The most convenient way to obtain both convergent and discriminant validities is to derive a multitrait-multimethod matrix that presents all intercorrelations resulting when each of the several relatively independent traits (e.g., cognitive, affective and behavioural components) is measured by each of several measuring techniques (e.g., Thurstone, Likert, Guttman and Osgood).

The second hypothesis was that the correspondence between verbal attitude scales and nonverbal attitude responses should be highest when both are drawn from the same attitude component. To

test the second hypothesis, indices of overt behaviour were compared with verbal measures of the cognitive, affective and behavioural components. Construction of verbal measures for the three components required development of a procedure for assessing the amount each verbal statement reflected each component. Scales of attitudes towards the church were prepared using the Thurstone, Likert, Guttman and Guilford techniques (Ostrom, 1969).

Ostrom (1969) confirmed both hypotheses with the dominant feature being a high intercorrelation among the three components and with the uniqueness of each component contributing very little additional variance. Thus, the three components of attitudes are highly interrelated but each of them operates to some extent in a unique way and contributes specific information that increases our understanding of attitudes. Ostrom (1969) suggested that the low unique variance of the attitude components could be due to the homogeneous nature of the attitude issue (church) and the relatively homogeneous population (college students) employed in the study. Hence, the present study assessed a controversial topic, i.e., attitudes toward working with computers, and a wide variety of computer users who differed according to their user-system-job characteristics were examined.

Kothandapani (1971) followed closely upon the design of Ostrom's (1969) research, testing whether the three components of an attitude are distinct, using a multitrait-multimethod approach. Attitudes towards birth control was the issue selected. Kothandapani (1971) overcame Ostrom's (1969) limitations by employing a controversial topic (birth control) and by using opposed groups of users and nonusers of birth control devices as respondents. Moreover, the behaviour in the study could be identified without any difficulty, i.e., either a respondent uses contraceptives or does not use them. With samples drawn from opposite groups (users and nonusers) the possibility of inter-component inconsistency is increased. Direct observation of behaviour (contraceptive usage) was obviously ruled out. An index of contraceptive behaviour was obtained by a self-report from the respondent. Since the issue of birth control is rather involving and people are quite sure of what they practice, the self-reports were considered reliable measures of contraceptive behaviour. Also, a check was made by verifying the self-reports through reliable peer reports and information about receipt of free birth control supplies (Kothandapani, 1971).

The first hypothesis tested whether cognition, affect and behaviour are three distinctly different components of the global attitude structure. Four verbal measures of each component were independently constructed using the techniques of Thurstone, Likert, Guttman and Guilford. The scales were developed using two samples of 36 users and 36 nonusers of contraceptives among low-income black women. Using the statistical technique of factor analysis, the data yielded three factors: cognition, affect and behaviour hence supporting the first hypothesis. The results of a stepwise discriminant analysis of cognition, affect and behavioural components supported the second hypothesis, i.e., that the behavioural component was a better predictor of actual contraceptive behaviour than either the cognitive or affective measures. The behavioural component functions as an organiser, coordinating the cognitive and affective input with the behavioural output. Thus, the main contribution of Kothandapani's (1971) study is that it found the three components of an attitude to be distinguishable from each other.

Bagozzi (1978) re-evaluated both Ostrom's (1969) and Kothandapani's (1971) data using more formal statistical methods. For Ostrom's (1969) data, Bagozzi (1978) agreed with Ostrom's (1969) finding that discriminant validity was demonstrated but very little unique variance was associated with each component. However, the reanalysis of Kothandapani's (1971) data indicated no statistical support for the discriminant validity of the three component theory (Bagozzi, 1978). Bagozzi's (1978) finding was thus inconsistent to that of Kothandapani's (1971).

Eiser and van der Pligt (1988) argue that even if one takes Ostrom's (1969) and Kothandapani's (1971) conclusions at face value, one is left with a rather muddling state of affairs whereby any observation of a good match between behaviour and verbally expressed attitudes is taken to show that the different components are interrelated and any observation of a poor match is taken to show that the components are distinct. Eiser and van der Pligt (1988) suggest the need for research that explores factors that can make the relationship between the different components higher or lower. Fazio and Zanna (1981) propose that consistency between behaviour and attitude is likely to be higher for attitudes acquired through direct personal experience. Moreover, Breckler (1984) asserts that some studies may have produced inflated estimates of the associations between cognition, affect and behaviour by relying on self-report measures of the different components typically without the attitude object being physically present. Breckler (1984) argues that this requires subjects to re-

spond not to the object itself but to its symbolic representation in memory. Thus, all self-report responses whether supposedly cognitive, affective or behavioural may be largely mediated by the cognitive system (Breckler, 1984).

Breckler (1984) further asserts that no previous studies have provided clear strong support for the three component theory. Thus, Breckler (1984) designed two studies to validate the three component theory. Breckler (1984) states that five conditions are essential for making a strong test of the three components theory's validity. The five conditions follow from the general principles of construct validity and from the theoretical basis of the three component theory, and are: firstly, both verbal and nonverbal measures of affect and behaviour are required; secondly, dependent measures of cognition, affect and behaviour must take the form of [illegible] attitude object; thirdly, multiple independent measurements of cognition, affect [illegible] needed; fourthly, a confirmatory rather than an exploratory approach to [illegible] should be used, and finally, all dependent measures must be scaled on a common evaluative continuum (Breckler, 1984). Based on these five validity conditions Breckler (1984) designed two studies to validate the three-component theory. Attitudes towards snakes was the issue selected.

Breckler's (1984) first study satisfied the five conditions needed for a strong test of the three component theory's validity. In Breckler's (1984) first study subjects were presented with a live snake. Verbal measures were obtained for all three components with cognition being assessed by the proportion of favourable and unfavourable snake listed thoughts given in the presence of the snake, affect was measured by heart rate, and behaviour by the average distance to which a subject was willing to approach a variety of pictured snakes and the extent of contact in which the subject was willing to engage with a live snake. Nonverbal measures for all three components were obtained by subjects completing certain scales and checklists. Breckler's (1984) first study indicated support for cognition, affect and behaviour as distinct attitude components, although they were moderately intercorrelated with each other ($r = 0.38$ for cognition and affect; $r = 0.50$ for affect and behaviour; and $r = 0.70$ for cognition and behaviour).

The main difference between Breckler's (1984) first study and past studies of the three component theory was the inclusion of nonverbal measures of affect and behaviour, and the presence of the

attitude object to which subjects could respond. Breckler's (1984) second study was thus conducted in order to evaluate the extent to which these two conditions were important in producing the obtained results. Hence, Breckler's (1984) second study followed the same procedure as his first study, expect all measures took the form of verbal self-reports (all nonverbal measures were translated into a verbal report format) and the attitude object was not physically present while subjects responded to the questions. Breckler's (1984) second study found that the three components were distinguishable statistically but the intercorrelations were far higher and more uniform (ranging from r = 0.81 to r = 0.86). The exclusive use of verbal report measures and the physical absence of the attitude object can produce increased (and presumably inflated) estimates of intercomponent correlations. Thus someone who believes, for example, that a snake was perfectly harmless might say they would be afraid of it and that they would be prepared to pick it up but if actually confronted with the snake, whether harmless or not, they might react quite differently (Breckler, 1984). In the present study, non-verbal measures were used for all three components and only computer users were assessed thus all subjects were familiar with the attitude object.

Hence, Breckler's (1984) findings from his two studies indicate that cognition, affect and behaviour are distinguishable components of attitudes. Correlations among the three components were moderate suggesting the practical importance of discriminating among them. Breckler (1984) advises attitude researchers either to measure each of the three components or to specify which of the three is of focal concern. To say a researcher is measuring "attitude" is ambiguous as it does not specify which of the three components is being measured (Breckler, 1984). In the present study, all three components were assessed.

Despite the controversy that exists in the literature concerning whether the three attitude components are interrelated or distinct entities, Ostrom (1969), Kothandapani (1971) and Breckler (1984) found the three components to be interrelated but still distinguishable from each other. These studies thus demonstrate the feasibility of a conceptual separation of the three components of an attitude and provide empirical support for the validity of the three component theory (Kothandapani, 1971). On the basis of this evidence and, as mentioned previously, the fact that the three component theory forms the theoretical base of most attitudes toward computers and attitudes toward working with computers studies, it was considered to be an appropriate framework

to utilise to assess attitudes toward working with computers in the present study. Hence, the aim of the present study was firstly to assess the major controversy of the three component theory, i.e., whether the three components are interrelated or distinct entities; and secondly, to examine employees attitudes toward working with computers.

Since a basic understanding of how attitudes toward working with computers were defined in the present study has been established, it was deemed essential to consider how attitudes toward working with computers were measured in the present study. Hence, it was deemed necessary at this stage that the measurement of attitudes be considered in the following section.

ATTITUDE MEASUREMENT

The first step in a scientific study it to attach a clear meaning to a concept, for it is not possible to study a concept such as attitude unless its exact meaning is understood. Hence, an explicit definition of an attitude appears to be a minimal prerequisite for the development of valid measurement procedures (Ayerst, 1984; Fishbein & Ajzen, 1975). In the present study, as noted earlier, an attitude was defined according to the three component theory. Once a suitable definition of an attitude has been selected it is then necessary for the researcher to decide on the appropriate approach to studying attitudes for his or her particular study. Oskamp (1977) notes five approaches to studying attitudes. These are description, measurement, polls, theories and experiments.

The present study was concerned with the measurement of attitudes. One approach to attitude measurement is the interview. In an interview, the researcher guides the interviewee into discussing topics relevant to the study and the material is recorded and rated at a later date. Frequently the rating is done by a panel of judges working independently and their assessments are correlated. (Ayerst, 1984). Other means of assessing attitudes include the rating of personal documents such as diaries, and projective techniques in which subjects respond to relevant pictures in an unstructured way. These techniques, however, require great expertise and experience and were thus deemed irrelevant to the present study. The most widely used attitude measurement is the instrument known as the measurement scale. For convenience this is usually administered as a ques-

tionnaire (Ayerst, 1984). In the present study, a measurement scale was used to assess attitudes toward working with computers and was administered in the form of a questionnaire.

Over the past decades researchers have developed methods of scale-building with each type of scale having important desirable features but each also being open to criticism. There is thus no method that combines the advantages of all of them and it is therefore important to understand their respective aims and differences between them (Oppenheim, 1966). Oppenheim (1966) suggests that the best method is the one which is most appropriate to a particular problem. After reviewing the relevant literature on the scale-building methods, it was found that the most appropriate scaling technique for the present study was Likert's method of summated ratings. As a result, it was deemed necessary that Likert's method be discussed in detail below as opposed to providing a full examination of the various scaling techniques which exist.

LIKERT'S SCALE METHOD OF SUMMATED RATINGS

The first step in constructing a Likert scale involves collecting a large pool of items. For each item, the researcher first indicates whether it shows a favourable or unfavourable attitude towards the object in question. If the item is ambiguous or appears to indicate a neutral attitude, it is immediately eliminated. Hence, items are merely placed into three categories: favourable, unfavourable and reject (Fishbein & Ajzen, 1975). The remaining items are administered directly to a sample of subjects representative of the target population. Subjects are asked to respond to each item in terms of a five-point scale defined by the labels "strongly disagree", "disagree", "undecided", "agree" and "strongly agree" (Fishbein & Ajzen, 1975). Responses to each item are scored from 1 to 5 or -2 to 2. Strong agreements with favourable items are given a score of 5 or 2, and strong disagreements with items are given a score of 1 or -2. A high score indicates a stand towards one extreme on an issue and a low score a stand towards the opposite extreme. Scoring is reversed for unfavourable items such that disagreement with an unfavourable item results in a high score (Eiser & van der Pligt, 1988; Fishbein & Ajzen, 1975). Hence, each item is a rating device designed to reveal both the direction of the individual's stand on the issue and the degree to which he or she holds it (Sherif & Sherif, 1969). As the name "summated ratings" indicates, a respondent's attitude score is determined by adding his or her ratings for all of the items (Oskamp, 1977).

Constructing a Likert scale requires the elimination of items that do not reflect the attitude under consideration. An item analysis is thus performed and an item is retained if it meets Likert's criterion of internal consistency. The criterion of internal consistency states that the more favourable an individual's attitude the more likely he or she should be to endorse favourable items and the less likely he or she should be to endorse unfavourable items. A correlation between score and item endorsement constitutes the criterion for inclusion of an item in the scale. It follows then that a given item meets the criterion of internal consistency if the item score correlates significantly with the attitude score (Fishbein & Ajzen, 1975). Hence, item analysis discovers the items which agree amongst themselves and discriminate most effectively amongst the subjects (Jaspars, 1978). The items with the highest correlations constitute the Likert scale. This scale can now be given to a new sample of subjects to compute their attitudes. The Likert method of attitude scale construction became and remains the most popular method, and a number of variations of it have also gained wide usage, e.g., one variation is to eliminate the "undecided" or "neutral" category thus forcing respondents to choose between favourable and unfavourable stances (Oskamp, 1977).

The most serious criticism labelled against the Likert scale is that the same total score may be obtained in many different ways. It has been argued that such a score has little or no meaning, or else that two or more identical scores may have totally different meanings. Often for this reason the pattern of responses becomes more interesting than the total score (Oppenheim, 1966). Another criticism is that the scale lacks a neutral point so that one does not know where scores in the middle ranges change from mildly positive to mildly negative (Oppenheim, 1966). The neutral point on the scale is not necessarily the midpoint between two extreme scale scores, moreover, scores in the middle region could be due to lukewarm responses, lack of knowledge, lack of attitude in the respondent or to the presence of both strongly positive and strongly negative responses which would more or less balance each other suggesting that the scale is not unidimensional. Clearly with such different possibilities the neutral point would be difficult to locate and even more difficult to interpret (Oppenheim, 1966). Where this problem is of particular importance one can ascertain for each item the "degree of intensity" or certainty with which it is endorsed or rejected and then plot the average intensity against the scale scores both converted into percentile units. This relationship is usually U-shaped so the lowest intensity is felt about the least extreme items hence locating the neutral point, i.e., the region nearest the low-point on the intensity curve. To ascertain intensity

for each item the number of questions has to be doubled and thus this approach is only used where exceptional importance is attached to the location of the neutral point (Oppenheim, 1966).

A further limitation of the Likert scale is that the scales produced are ordinal rather than equal-interval. That is, respondents can be placed in their rank order on the attitude dimension, however, one is not certain whether the actual attitude distance between two values on the scale is equal to the distance between two other values. For example, is the distance between "undecided" and "agree" (3 and 4, or 0 and 1) the same as the distance between "agree" and "strongly agree" (4 and 5, or 1 and 2)? The distances are numerically equal but may not be psychologically equal. Ordinal scales require the use of nonparametric, distribution-free statistical techniques involving measures such as the median. However, these restrictions are almost universally disregarded largely due to statistical research findings that in most cases violations of the underlying assumptions of the use of parametric techniques do not lead to serious distortions of their results. Thus scores are added, means computed, and t-tests and F tests used on attitude scale results (Oskamp, 1977). Finally, many researchers do not conduct an item analysis thus resulting in no empirical evidence that the items are all measuring the same underlying attitude, nor that they are useful discriminating items (Oskamp, 1977).

However, reliability of Likert scales tend to be good due to the great range of answers permitted to respondents; with a reliability coefficient of 0.85 often being achieved (Oppenheim, 1966). Hence, Likert scales tend to perform very well when it comes to a reliable rough ordering of individuals with regard to a particular attitude (Oppenheim, 1966).

In the present study, Likert's method of summated ratings was the preferred scaling technique as it is firstly, easy to construct; secondly, it provides information about respondents' direction and degree of agreement and disagreement (this is discussed in the section which follows); thirdly, item analysis techniques "purify" the scale hence only the best items from the initial item pool are maintained; fourthly, it is easy for subjects to complete; and finally, it is the most widely used in previous studies on attitudes toward computers and attitudes toward working with computers. Hence, it was deemed an appropriate scaling technique for the present study. The development of

the attitudes toward working with computers scale is discussed in detail in Chapter 4 (Rationale and procedure) under the section 'Development of the Attitudes toward working with computers scale.'

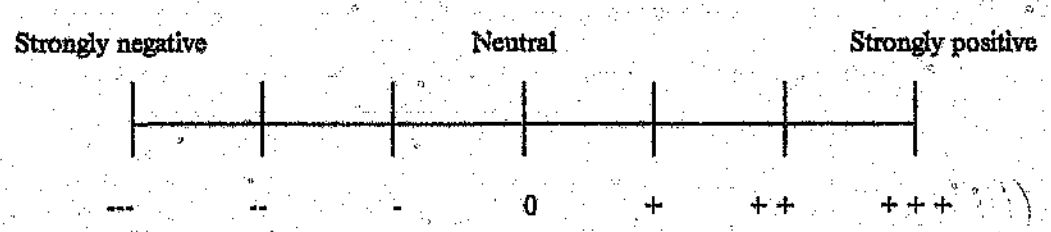
As mentioned above, one of the reasons for choosing the Likert scaling technique was that it enables one to study the attitude dimensions of direction and degree. Hartley and Hartley (1952) note that it is useful to analyse attitudes with respect to dimensions. Each dimension represents a manner of describing the attitudes of individuals quantitatively thereby enabling a large amount of data to be conveniently summarised and comparisons and analyses to be made using statistical techniques. Dimensions can be studied separately or in combination. The more dimensions one studies the more complete is the understanding of an attitude (Hartley & Hartley, 1952). At this stage, it was deemed necessary that the attitude dimensions of direction and degree be briefly discussed.

Direction and degree of attitudes

The simplest attitude dimension which may be assessed is that of direction. In studying this aspect of an attitude one asks whether an individual is for or against a given social stimulus (Hartley & Hartley, 1952). Hence, "direction" of an attitude refers to the residual affect felt towards an object that can be either positive or negative. Positive attitudes predispose the individual to some kind of approach towards the object and negative attitudes predispose to some kind of avoidance of the object (Newcomb, Turner & Converse, 1965).

In addition to identifying the general direction of an individual's attitude one needs to assess variations in degree. Two individual's may hold negative attitudes towards a social stimulus (i.e., they may hold attitudes of the same direction) but one may be strongly antagonistic and the other mildly opposed (Hartley & Hartley, 1952). Since an attitude can be seen as an evaluation of some specified object in "good-bad" terms, it is obvious that the individual may evaluate an object as "extremely good" or as "fairly good." Hence, there are degrees of goodness and badness that may be attributed to the object

It is convenient to regard an attitude towards a specified object as lying at some point on a simple continuum running from large negative values through more moderate negative values to a zero point and then becoming increasingly positive, as illustrated in the figure below (Newcomb et al., 1965).



Once an attitude is located on such a continuum its primary description is complete. Other details may be added but the two key properties of direction and degree can be expressed in terms of this single dimension (Newcomb et al., 1965).

Thus, direction represents the "pro" or "con" nature of an attitude and degree indicates the extent with which the individual holds a particular attitude (Hartley & Hartley, 1952). In the present study, since a Likert scale was used direction was measured by an individual's positive or negative responses and degree was assessed by the "strongly disagree", "disagree", "undecided", "agree" and "strongly agree" labels.

Once the items of the attitude scale had been developed they needed to be validated. Validity refers to the extend to which the measuring instrument measures what it was designed to measure (Anastasi, 1982; Kerlinger, 1981). The validity of a technique is dependent in an intimate way upon its reliability, i.e., the extent to which it yields consistent measures (Krech & Crutchfield, 1984). Hence, a valid measure must be a reliable one (however, a reliable measure is not necessarily valid) (Newcomb et al. 1965). The various techniques utilised in the present study to assess the reliability and validity of the attitudes toward working with computers scale are discussed in Chapter 4 (Rationale and procedure) under the headings 'Internal consistency' and 'Face validity' for the pilot

sample, and in Chapter 5 (Results) under the sections 'Internal consistency' and 'Factor analysis' for the final sample.

Summary of chapter

In the present study, an attitude was defined according to the three component or tripartite theory of attitudes. The three component theory views an attitude as consisting of three components, i.e., a cognitive, affective and behavioural. The three component theory was deemed an appropriate framework on which to assess attitudes toward working with computers in the present study. Hence, the cognitive component referred to knowledge of computers, the affective component to feelings towards working with computers, and the behavioural component referred to an individual's behaviour or actions towards computers. Furthermore, since the attitudes toward working with computers scale was based on the three component theory, the major controversy surrounding the theory, i.e., whether the three components are interrelated or separate entities, was thus assessed in the present study. Likert's scale method of summated ratings was utilised in the present study to develop the attitudes toward working with computers scale. As a result, the attitude dimensions of direction and degree were examined.

CHAPTER 3

ATTITUDES TOWARD WORKING WITH COMPUTERS

Advances in end-user (the consumer of computer services (Smith, 1993)) computing (Benson, 1983; Guimaraes & Ramanujam, 1986) and the expanding role of computers as components of information and decision support systems emphasise the importance of gaining a complete understanding of the factors that influence employees' attitudes toward computers, and the potential use of them at work (Igbaria & Parasuraman, 1989). The importance of understanding the antecedents of computer attitudes is further underscored by Fishbein and Ajzen's (1975) proposition that individuals' attitudes towards an object influence the overall pattern of responses to the object. Some employees have greater latitude concerning their jobs and the use or nonuse of computers in their work than do other employees whose tasks may be more tightly prescribed and who might be required to use computers in their day-to-day work (Nickerson, 1981). Thus, employees attitudes towards computers could be expected to be a salient factor in influencing the actual use of them (Igbaria & Parasuraman, 1989). Attitudes towards working with computers is an important link that is missing in previous work on computerisation (Rafaeli, 1986). As Bergmark (1980) argues the exploitation of computer capabilities is limited by employees' decisions about how they want to use them. More specifically, Brod (1982) suggests that "technostress" may actually reduce the contributions of computers; employees who are concerned about their job security or other aspects of the quality of their working life are likely to avoid using the computer to the extent that they can. There is evidence that the use of computers by employees appears to be limited due to the prevalence of computer anxiety or fear of computers, and negative attitudes toward computers in general (Howard & Smith, 1986; Robey, 1979). These suggests that the potential benefits of computers may not be fully realised (Nickerson, 1981) therefore neither benefiting the employee nor the organisation in the long-term.

Before investigating the area of "attitudes toward working with computers" it is essential to have a clear understanding of what is meant by this phrase. One can approach this by breaking down the phrase into three parts: "attitudes toward", "working with" and "computers."

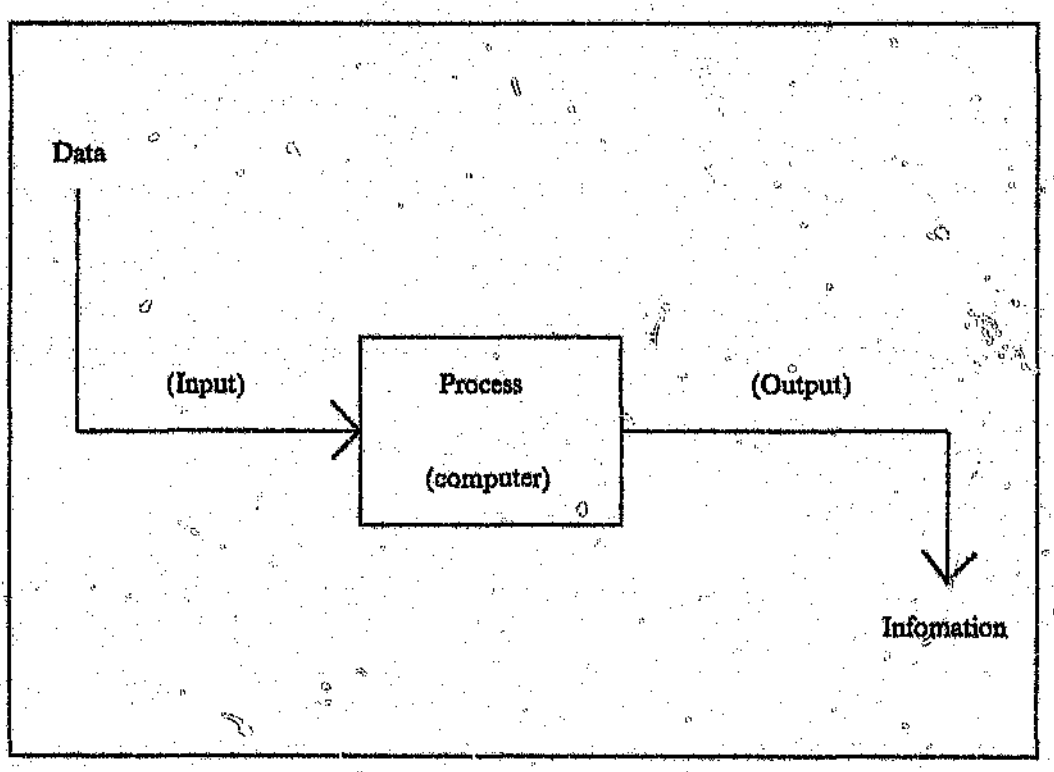
With regards to "attitudes toward", it would be logical to start off by first defining what an attitude is. As discussed in Chapter 2 (Attitudes and attitude measurement), an attitude may be defined as "an idea charged with emotion which predisposes a class of actions to a particular class of social situations" (Triandis, 1971, p.2). This definition suggests that an attitude has three components, i.e., the cognitive, affective and behavioural (Triandis, 1971).

To say that one has a certain "attitude toward" someone or something means that the individual is no longer neutral toward the referents of an attitude. The individual is for or against, positively inclined or negatively disposed in some degree towards them - not just momentarily but in a lasting way, as long as the attitude in question is operative (Sherif et al., 1965). Thus, "attitudes toward" simply implies whether a person likes or dislikes, approves or disapproves and so on, of an individual(s) or an object(s).

The term "working with", denotes the actual behaviour of using a computer to achieve one's goal. This does not apply, for example, to a person who uses a computer printout to analyse data but to a person who actually uses a computer system to obtain that printout, i.e., the person is interacting with the computer - the user and the computer communicate directly with each other via a keyboard and a screen. In fact, one could take this a step further and argue that the user is not actually interacting or communicating with the computer but with the individual(s) who designed that particular software system.

Finally, the definition of the term "computer." A computer is a data processing machine, i.e., data flows into the machine as input and information flows from the machine as output. This is depicted in Figure 4. The word "process" implies that a change takes place, that the data is in some way restructured or manipulated. Data processing thus involves filtering and summarising data so that underlying patterns can be perceived (Davis, 1989). A computer processes data automatically with no need for human intervention. However, in order for the computer to function without direct human control, it must be given a set of instructions called a programme to guide it.

Figure 4: A computer is a machine that processes data into information. It accepts data, processes data and generates information as output (Davis, 1989)



The programme is physically stored inside the machine, making it a stored programme. This can be seen in Figure 5. Thus, a computer may be defined as "a machine that processes data into information under the control of a stored programme" (Davis, 1989, p.3).

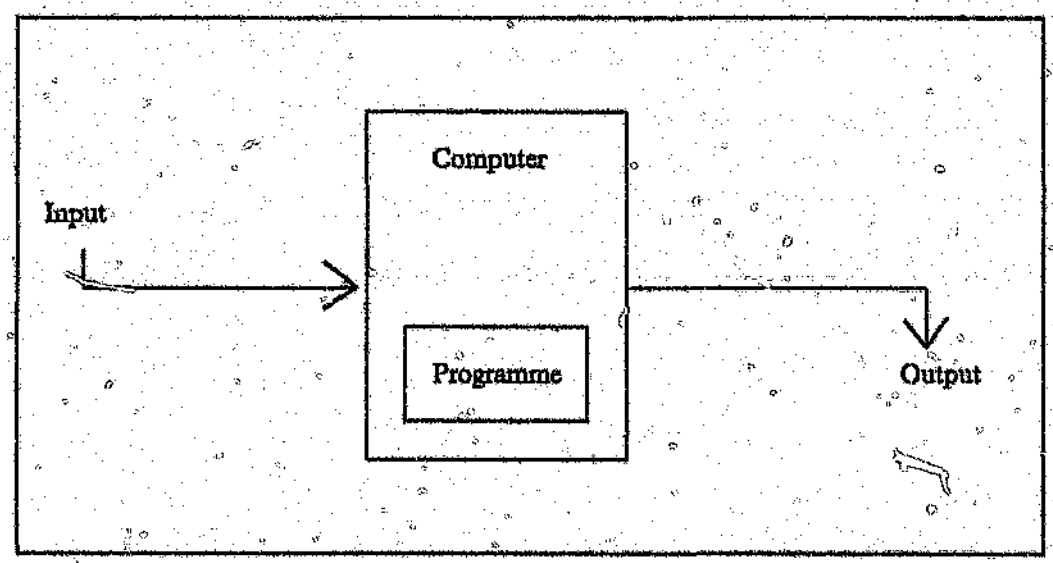
Thus, from the above discussion on the meaning of the phrase "attitudes toward working with computers" it may be concluded that this phrase refers to feelings or thoughts of like or dislike, approval or disapproval and so forth, toward a data processing machine which an individual interacts with in order to perform his or her task.

ATTITUDES TOWARD COMPUTERS

A computer is something few individuals can ignore and most have strong attitudes toward it. For some individuals it is a little-understood or misconstrued device which threatens their way of life, taking away jobs, removing the human element in life and replacing it with the inhuman (Eason & Damodaran, 1981). Three major reasons have been offered to explain negative effects toward computers (Dambrot, Watkins-Malek, Silling, Marshall & Garver, 1985). Firstly, functional problems within computer systems. These problems include start and stop difficulties, limited usefulness of some systems, and limited availability and access to shared computer terminals. Ideally, users would like to have immediate access to the computer on a continuing basis so that they are able to work with the computer on a problem whenever and for as long as needs be (Nickerson, 1981). However, this is extremely difficult as it requires every user to have their own private terminal devoted exclusively to their own use; that a single system has no more subscribers than it can accommodate simultaneously; and that the system be backed up by an alternative for coverage in the event of system failure (Nickerson, 1981). Interruptions during work sessions due to computer downtime can also be annoying and disruptive. If interruptions occur too frequently or are too devastating when they do occur users may simply forsake the system and find other ways to get their work done; or if they are truly captive of the system because they cannot do their work without it they become exceedingly unhappy (Nickerson, 1981).

Further, there are many complaints about the inconsistency and compatibility of computer systems and languages. This exists as most software systems are collections of components that have

Figure 5: A computer processes data automatically under the control of a stored programme (Davis, 1989)



been developed by different people. In designing the command languages for these components each of the developers have used their own intuitions (Nickerson, 1981). Furthermore, there is no theory of command language design or even a set of well-established design guidelines and as a result command language is often arbitrary and unnatural (Nickerson,1981). Computer language is thus no less particular and no more reassuring to the inexperienced user (Galagan, 1983).

Finally, documentation is often inaccurate, incomplete, poorly organised and out of date (Nickerson, 1981). Further, besides presenting new ideas and an extensive technical vocabulary, documentation is organised around machine functions rather than tasks the user might need to perform (Galagan, 1983). Hard-copy and on-line documentation are important as they serve both tutorial and reference functions. Beginning users need to be able to read something that will introduce concepts and information in a logical sequence and that will answer questions they do not know enough to ask. More experienced users need an information source to which they can refer to in order to find answers to specific questions. Documentation should thus be clear, accurate, complete, well-organised and current in order to aid the user and to avoid frustration (Nickerson, 1981).

Secondly, inadequate training in understanding and using computers. The initial training needs of a beginning user are sufficient contextual information to understand what the computer system can do for him or her, his or her function or work role (Damodaran & Eason, 1981). The user also requires a working knowledge of routine operational procedures. Learning to use computers requires movement in small steps along the learning curve and organisations can only benefit from this by exposing employees to the fundamentals of computers (Galagan, 1983). Employees tend to be less resistant to using a computer when they perceive its value as a tool for a job they must actually do (Galagan, 1983). Many individuals are given inadequate training during their initial contact with computers and have avoided subsequent use of computers (Rivizzigho, 1980). Further, many users are uncomfortable in not understanding the computer system and fear breaking the computer or wiping out a database (Bloom, 1985). The more complex the system the greater is the fear of catastrophic results from human mistakes. Beginners tend to fear that incorrect commands will "crash" the system, commands are irrevocable and will consume large chunks of computer time, and funds and valuable data will be lost forever in computer storage (Bloom, 1985).

Training is thus essential as it aims to lower computer anxieties or fears by presenting facts about computers to dispel unfounded fears, patiently persuading users that computers will positively influence their working lives (Bloom, 1985).

As early as 1967, the importance of computer training was noted by Mayer. Mayer (1967) stressed that a lack of efficient and effective training techniques was one of the users difficulties in achieving maximum interaction with the computer. Mayer (1967) noted the need for training in the initial use of the system, the need for training to help the novice update his or her skills, and to provide occasional assistance as the user gained more experience and expertise with the system. Further, Kennedy (1975) asserts that it is imperative that computer training does not antagonise the trainee and that by the end of the training session it should have resulted in the trainee having a positive attitude toward the computer. The need to reduce or prevent the trainee from experiencing fear is also important, as fear of the computer inhibits learning (Kennedy, 1975). Thus, the basic approach is to alter users' attitudes with improved learning emerging from more positive thinking about computers (Bloom, 1985). In a study by Guimaraes and Ramanujam (1986) on personal computing problems it was found that respondents were most concerned about training, control and integration issues, and much less concerned over cost or personal motivation and adoption issues. Requests for assistance in dealing with technical, security and data integrity problems were also rated as causing a high level of concern. The most critical personal computing problem was identified as the lack of user education regarding an organisation-wide and long-term perspective about personal computing. The nature of the training was found to be too technical and limited in scope. Its goal should be to impart the basic skills necessary for using computer software (Guimaraes & Ramanujam, 1986). Computer training and education are extremely important as they create greater awareness among users of the organisation-wide impact of personal computing and the need for ensuring the integrity of both organisational data and applications (Guimaraes & Ramanujam, 1986).

Thirdly, general resistance to change and new technology. Reaction of the majority of employees affected by any technological change is anxiety and fear (Barnes, 1980). Often employees feel anxious that they will lose their jobs and be unemployed. Some studies show that where new technology has been introduced employees have been cut down to one half (Downing, 1984).

Davies (1984) argues that new technology may cause a decrease in some jobs but an increase in others. Hirschowitz (1990) notes that it is the more highly trained employees that will maintain their jobs. New technology will only be a threat to employees who are unable or not prepared to learn new skills. However, the future ability of new technology to displace employees seems virtually indisputable (Apex, 1984). Other employees may not fear unemployment but will resent the need to change employment at a time, and perhaps on terms, imposed on them with little choices (Barnes, 1980).

Employees may also find that the new technology has changed their jobs and that different skills are now required (Gassman, 1981). Employees may need to move away from work requiring manual skills and may be required to develop cognitive, perceptual and reasoning tasks to operate the new technology (Hirschowitz, 1990). This may result in the employees doubting their capabilities to cope with these changes (Barnes, 1980). Others employees may fear the effects on their status or their prospects of promotion and feel that upward mobility has been decreased as a result of the technology (Barnes, 1980). Further, some employees fear technology will "take over", resulting in the user losing control of the situation (Morrow, Prell & McElroy, 1986). Clegg (1989) advocates that information technology diminishes the control that employees have over their work. Clegg (1989) accuses information technology designers as behaving as if humans in systems are sources of error and unpredictability that they need automating out and that they should perform leftover tasks only. Moreover, new technology is advancing so fast that employees cannot maintain an understanding of the technology. Their training equips them only to operate the machine and not understand its processes. Thus employees are required to work with a machine's "thinking" and their right to think and perform the task as they see fit is eliminated. The employee is thus offered little or no opportunity for personal involvement in the task and becomes subservient to the technology (van der Veer, Green, Hoc & Murray 1988).

Furthermore, employees may fear that information technology leads to employee constraint and social isolation. Information technology has led to much more constrained work since all jobs can now be done from one workplace (Salvendy, 1984). Employees may become attached to their electronic workstations to such an extent that when they are required to leave the machine they may show mild behavioural disturbances such as anger or decreased effectiveness (Oborne, 1985).

Face to face contacts can be replaced by information technology communication systems thereby reducing interpersonal contact and the formation of workgroups (Olson, 1982). With the ability to communicate electronically it will be no longer necessary for employees to be physically located in a central place to perform work or even to work the same hours thus frustrating an individual's natural urge for social attachment (Oborne, 1985). Finally, individuals may also fear negative evaluations - awkwardness when using unfamiliar equipment can bring with it expectations of being judged harshly. Users may feel stupid for having to ask questions about the technology (Bloom, 1985).

Thus, functional problems within computer systems, inadequate training in understanding and using computers, and general resistance to change and new technology may all combine to frustrate users and lead to negative evaluations of information technology systems. For some people however, the spirit of technological advance, intention and discovery is deeply exciting and the computer is a device of intrigue and wonderment (Eason & Damodaran, 1981). As a result, some employees have positive attitudes toward computers and are attracted to the benefits of the computer such as time savings, accuracy of output, improvement in the quality of working life, changes made by computer technologies on job enhancement, broadening the range of activities that a particular job encompasses (Curley, 1989), greater control over work and greater flexibility within jobs (Gattiker & Larwood, 1986) and elimination of many of the tedious aspects of work thereby enriching the job (Gattiker, 1988). Thus the potential benefits resulting from information technology have been predicted to be many and varied (Hirschheim, 1985).

One of the key areas where technological benefits are predicted is in the area of employee productivity. Abraham (1981) sees productivity enhancements occurring in five areas. These areas are: firstly, better utilisation of human resources - by reducing the number of employees or by having the same number perform more work; secondly, increased performance - through the increase of output per person; thirdly, increased quality of decisions, work, products and services - through improvements in the handling and dealing of information; fourthly increased efficiency - through the performance of tasks in less time; and finally, increased effectiveness - through, for example, improved organisational communication.

In general, the use of technology in organisations has been assumed to substantially increase the productivity of employees (Apex, 1984; Salvendy, 1984). The increased flexibility that computers bring into the organisation results in increased access to data, increased communication and new ways of thinking and collaborating which should enable better work to be performed. However, Clegg (1989) advocates that technology may in fact decrease overall productivity. It may cause the pursuit of efficiency rather than effectiveness, increased activity is often confused for increased production. For example, although wordprocessing is supposed to increase the speed and accuracy of document preparation, it may encourage less accurate typing performance with time being wasted on subsequent editing (Oborne, 1985). Wordprocessing may also encourage authors to revise and amend drafts extensively, perhaps more than is necessary (Rafaeli & Sutton, 1986).

An alternative way of viewing technological benefits is offered by Lodahl (1980) who refers to them as "value-added" benefits. Value-added benefits are extra facilities provided to the employee which extend his or her capabilities. Price (1979) notes four value-added benefits resulting from technology. First, increased information accessibility - an information system provides information that is more up to date and accurate and further provides the means to search, define requirements and retrieve relevant information quickly and cheaply; second, increased people accessibility - permits people to communicate efficiently even though both parties may not be at the same place or are not simultaneously available; third, increased control over personal activities - for example, the use of electronic message systems enable employees to control when they wish to look at messages rather than having to endure constant telephone interruptions while trying to concentrate; and fourth, increased individual contribution - employees can spend more time on their primary tasks rather than auxiliary (but essential) support tasks.

However, whether technology yields benefits such as those predicted above depends on a variety of social and behavioural aspects related to work and general organisational life (Hirschheim, 1985). If it is predicted that technology will lead to better decision making and greater productivity then it must be assumed that some understanding of what employees do in organisations is held (Hirshheim, 1985). Hirschheim (1985) concludes that predictions such as those discussed above heighten expectations, fuel economic considerations of technology and perpetuate the technical bias of the technology.

Although much has been written about technology and its likely effects, a considerable portion of it is little more than unfounded speculation of experts in the field (Hirschheim, 1985) and not necessarily the opinions of potential users (Zoltan & Chapanis, 1982). Hirschheim (1985) notes three alternative positions on the effects of technology on individuals, organisations and society. The three positions (optimism, pessimism and pluralism) reflect an underlying value position about technology and how society might or should deal with it. The values are not manifest but intrinsic to the view held and individuals may not even be aware that the view they hold has a particular value position (Hirschheim, 1985). The three positions are discussed below.

The optimist position asserts that technology increases the productivity of employees, creates as many jobs as it destroys, increases organisational effectiveness and creates exciting new varieties of work. Communications are enhanced; the quality of working life improves with fewer menial tasks and more leisure; and medical facilities, home life, travel, education and so on, improve through the use of information technology (Hirschheim, 1985).

The pessimist position contends that technology does little to increase productivity as most jobs are too unstructured to automate. It is believed that technology will create widespread unemployment; that the remaining work will be deskilled yielding less job satisfaction and that the general quality of working life will be deleteriously affected. The technology will lead to a further centralisation of power and a lessening of personal privacy and freedom (Hirschheim, 1985).

The pluralist position is a compromise between the above two positions. It proposes that there are possibilities created by technology which are positive and negative depending on the way the technology is used. This position is therefore concerned with the development of criteria for social and technological acceptance and the application of "acceptable" technologies in appropriate circumstances (Hirschheim, 1985).

Hirschheim (1985) however mentions that the three alternative positions on impact are actually generalisations and the distinction between them is sometimes not clear. Nevertheless, the views do have a strong theoretical base and as a means of summarising and categorising fundamental

stances on impact, they provide a useful basis by which to explore the organisational and social consequences of technology (see Hirschheim, 1985).

From the above discussion it is clear that there are no definite answers as to how information technology affects individuals and organisations. Various types of information technology affect individuals differently, for example, it has been shown that mainframe operators maintain more control over their work than PC operators (Gattiker & Nelligan, 1988). Some organisations find new technology well accepted by employees other organisations encounter considerable resistance (Hirschowitz, 1990).

The type and size of an organisation, the manner in which the technology is installed in the organisation, and the way in which the employees are introduced to and trained on the facilities are important determinants of employees attitudes toward information technology (Gattiker & Nelligan, 1988; Morieux & Sutherland, 1988; van der Veer et al., 1988). Industrial relations within the organisation or industry may have a significant effect on information technology in the organisation. The degree to which unions interpret information technology as positive or negative influences on the quality of worklife of their members will determine the attitudes of many employees (van der Merwe, 1986).

Individual employees also differ in their attitudes toward information technology based on their personal disposition and demographic details such as sex, age or culture (Gattiker & Larwood, 1986). Some studies show that women perceive computers as more of a threat to their job security and less useful in increasing production than men do (Gattiker & Nelligan, 1988; Gutek & Bikson, 1985). Another intervening variable which can influence attitudes toward working with computers is an individual's past experience with computers. Fishbein and Ajzen (1975) report that past experience and attitudes can mutually influence one another. For example, an individual who has just lost a valuable script on the computer due to computer downtime is likely to have a negative attitude toward computers due to this bad experience. Both attitudes and past experience can influence subsequent behaviour, i.e., to use or not to use a computer (Fishbein & Ajzen, 1975). Previous studies have not, however, considered the effects of past experience on attitudes toward working with computers.

Ignorance of the technology encourages fear and thus resistance whereas familiarity with the system leads to more positive attitudes and less anxiety (Oborne, 1985). In a study by Arndt, Feltes and Hanak (1983) it was found that familiarity with information equipment was positively related to attitudes toward the equipment. Familiarity with information equipment was found to reduce anxiety in two different ways. Firstly, users who had experience with the equipment were less anxious about it; and secondly, frequency of use was positively related to anxiety reduction, and more positive evaluations of the equipment's effect on work capabilities. Arndt et al. (1983) conclude by stating that use of information equipment leads to positive attitudes toward the equipment and that training is essential in order to reduce unfavourable attitudes and promote the beneficial aspects of the instrument. Therefore well-exposed, trained and informed personnel have less resistance to and greater acceptance of the technology (Apex, 198-).

Attitude surveys have investigated public response to many issues, however, relatively few have been performed to investigate reactions to computers (Oborne, 1985). The studies which have been carried out can be divided broadly into two: those which have surveyed general public opinion and those which have investigated the attitudes of individuals who have to use computers at work (Oborne, 1985).

Attitudes to computers colour an individual's response to the technology in many ways. As Eason and Damodaran (1981) state a negative attitude to the computer system will turn even minor problems into major obstacles whilst a positive attitude should have the opposite effect. Smith (1981) studied general attitudes toward computers and in order to construct the relevant scale he gathered statements on attitudes toward computers and their use in society from previous research (i.e., Lee, 1970; Martin & Norman, 1973; and Packard, 1978). After a priori examination of the statements, forty statements were selected which covered a wide range of feelings about computers. These statements were factor analysised using the principal components method. A three factor rotated solution was accepted as defining the most useful subscales within the instrument. Internal consistency reliabilities for the three subscales were 0.87, 0.71 and 0.60 respectively which were considered satisfactory. Smith (1981) described the three factors relating to attitudes toward computers as follows: Firstly, apprehension over computerisation - this negative construct based in concerns over the effects of computers on the individual's self image, opportunities for advancement

and privacy. Secondly, acceptance of computers - this positive construct emphasised the positive uses of computers in enhancing individual's lives. Thirdly, superiority and threat of computers - a negative construct which is concerned with fears for the employee's future, loss of freedom, and so on.

Smith (1981) further used cluster analysis to determine whether any group of individuals would emerge who differed both in their attitudes toward computers and their personal background characteristics. Five clusters emerged, with cluster 1 consisting of the oldest members who were the least educated and rarely used the computer in their work. For this cluster, computers had a basically positive role in society although there were some important negative effects on jobs. Cluster 2 members used a computer often, had a strongly positive attitude toward computers and strongly rejected all negatively stated items. Computers were seen as being unambiguously good for society and the individual. Cluster 3 consisted of the youngest members and were the best educated. These cluster members had some experience with computers and expressed both good and bad aspects to the role of computers in society. Cluster 4 consisted of members who held a negative attitude toward computers and who rarely used a computer. Finally cluster 5 members were very well educated, had almost no experience with computers and held strong anti-computer attitudes.

Thus, Smith's (1981) study firstly highlights the existence of a positive to negative continuum of public attitudes toward computers. Secondly, it offers a tentative answer to the basic question of what is meant by either a positive or negative or a balanced view of computers and their role in society. A person with a highly positive attitude toward computers is likely to be male, under thirty years of age, relatively highly experienced with computers and either studying or working in commerce, selected clerical occupations or certain physical science areas such as engineering. The highly positive person likes to see computers used as much as possible, computers are good for society in all major respects and hold no threat or negative implications of importance for society. The highly negative person is likely to be a female around thirty years of age, very well educated with a strong orientation towards the arts or humanities professions. The strongly negative person by virtue of their vocational orientation is unlikely to have any direct experience in the use of a computer, is alienated by computers and is very concerned over effects on people at both an individual and social level. A balanced view of computers in society was reflected in the sample as a whole. Computers

were seen as being both indispensable to and desirable for modern society and its living standards but a strong moderating influence was reflected in concerns over the potential impact of computers on work opportunities in particular. However contrary to expectations the study found that the most negative group was exceptionally well educated and the most positive group was not the best educated. The least well educated and oldest group which might have been expected to be negative in attitude because of computer effects on the workplace was in fact balanced in its profile. Smith (1981) concludes by stating that positive attitudes are very frequent amongst regular computer users who stress the benefits of the technology to humanity. Negative attitudes are more likely to exist amongst individuals who very rarely, if ever, come into contact with computers (Smith,1981).

There are surprisingly few attitude studies about computers in the literature (Gamble, 1988) and those that have been conducted do not really answer the basic question of how people feel toward computers (Zoltan & Chapanis, 1982). Orcutt and Anderson (1974), for example, allowed subjects to play the "Prisoner's Dilemma" game via a computer terminal. One-half of the subjects were told their opponent was human for the first thirty games. The remaining subjects were led to believe the reverse. In fact, the opponent was always a computer and only the strategy employed by the computer was varied. Following those trials subjects were given an attitude questionnaire. Results indicated that subjects perceived the computer opponent as more depersonalising and more powerful than the human opponent (Orcutt & Anderson, 1974).

Quintanar, Crowell and Pryor (1982) demonstrated the susceptibility of computer attitudes to manipulation regardless of the baseline attitudes of the individual. Quintanar et al. (1982) aimed to study the effects of the varying degree of human-like responses exhibited by the computer. Their sample consisted of introductory psychology students who were exposed to a textbook-based quiz administered by either a human-like programme (involving the use of the subject's name, use of the personal pronoun, and so on) or a mechanistic programme requiring numerical responses. The experimental design was such that all subjects failed the initial quiz, undertook a period of relearning and then passed the retest. The results showed that the human and mechanistic type programmes were rated as such by the subjects. The human-like programme was perceived as more human, less honest and less courteous than the mechanistic programme. Users perceived the computer to be more responsible for their quiz failure under the human-like mode of operation

than under the mechanistic. Further, subjects exposed to the human-like programme scored higher and extended greater amounts of time thinking about and reflecting upon quiz items on both the initial test and the retest than subjects exposed to the mechanistic programme. Quintanar et al. (1982) conclude their study by stating that a person's attitudes (and perhaps performance) apparently can be manipulated depending on the computer's responses. The question remains however whether people's attitudes toward computers based on such game-playing interactions are representative of attitudes toward computers in real-world applications (Zoltan & Chapanis, 1982).

There is however some consensus on the structure of general attitudes toward computers which has been confirmed by studies conducted by Lee (1970), Coovert and Goldstein (1980) and Zoltan and Chapanis (1982). These studies are discussed below.

Lee (1970, p.53) conducted a survey on "popular beliefs and attitudes about one of the prime symbols of our rapidly changing technology - the electronic computer." Three thousand people aged eighteen and older were interviewed and it was found that the American public view computers and their significance in terms of two independent attitude dimensions. The first views the computer as a beneficial tool to be utilised by man. The second portrays the computer as an autonomous entity that can perform the functions of human thinking hence downgrading humans. Thus, Lee (1970) found that what people think is true about computers, what they think this means for the future and how they feel about these things are all dynamically and intimately organised around two major attitude systems. However, Lee (1970) collected his data in 1963 and it is possible (if not highly likely) that attitudes may have changed in the intervening years as computers are now so much more commonplace then they were in 1963. Nevertheless, subsequent surveys of public opinion have produced a surprisingly similar trend (e.g., Ahl, 1975).

Coovert and Goldstein (1980) investigated the personality variable, locus of control, as a predictor of users' attitudes toward computers. They used a slightly modified version of Lee's (1970) scale (the word "computer(s)" was inserted on Lee's (1970) scale for the words "electronic brain machine") to study the attitudes of undergraduate students. Coovert and Goldstein (1980) classified the view of the computer as a tool to be utilised as having a positive or favourable attitude toward computers and the view of the computer as a mind-controlling entity as having a negative or

unfavourable attitude. Coovert and Goldstein (1980) found that internals have a more positive attitude toward computers than externals. Coovert and Goldstein (1980) conclude by stating that by assessing an employee's internal-external locus of control, employers would be able to predict the employee's attitude toward having their jobs and job environments modified by a computer.

Zoltan and Chapanis (1982) investigated the reactions of "professionals" (certified public accountants, lawyers, pharmacists and physicians) to specific features of computers and to potential uses and applications of the computer. A 64-item questionnaire was distributed through the mail to the subjects and a factor analysis of their responses to the attitude items yielded six factors; three of which reflected some form of positive attitude (e.g., the computer as a desirable and useful machine, and so on). The other three factors included negatively toned responses (e.g., the computer is impersonal and cold, and so forth). Zoltan and Chapanis (1982) findings are consistent with Lee's (1970) finding that computers are "beneficial tools of man" but are inconsistent with Lee's (1970) second finding that views computers as "awesome thinking machines." Zoltan and Chapanis (1982) did however find that their subjects expressed discontent with several aspects of computers, specifically dissatisfaction with the depersonalising nature of computers and with the difficulty and complexity of computer languages. Thus the major thrust of Zoltan and Chapanis's (1982) findings confirm the structure postulated by Lee (1970) and Coovert and Goldstein (1980).

Furthermore, Gamble (1988) studied managers attitudes toward computers in the largest hospitality industry in the United Kingdom. In order to assess attitudes toward computers Gamble (1988) used the scale developed by Zoltan and Chapanis (1982). Gamble (1988) found that hospitality managers described computers in mainly positive terms, with the most strongly expressed adjectives being "systematic", "precise", "organised", "efficient" and "fast". Gamble (1988) compared his results to Zoltan and Chapanis's (1982) results and found that the first nine adjectives were almost the same set in each though listed in a slightly different sequence. The largest most marked differences were that computers are seen as less personal, less affordable, less easy, more complicated and colder by the American professionals. The American perspective is generally that of a more clinical, less human device than that obtained in the United Kingdom. Furthermore, Gamble (1988) found that hospitality managers strongly believe that they need more training for working with computers, that computers simplify complex problems, help them at work and are fun to use. Gamble (1988) thus

concludes by stating that American and British professionals differed quite strongly on the following: Americans were less inclined to view that society relies too heavily on computers and that short of physical violence one cannot damage a computer. British managers were much more likely to see themselves as limiting factors in the use of computers and were more inclined to view that a computer's capabilities for speed are often overestimated (Gamble, 1988). Hence, Gamble's (1988) findings indicate that hospitality managers in the United Kingdom attribute more positive aspects to computers as opposed to negative which are consistent with Zoltan and Chapanis's (1982) findings.

However, on examination of the scale items used by Lee (1970) and Zoltan and Chapanis (1982) to measure attitudes toward computers, it is clear that such a structure of general attitudes toward computers is questionable. For example, items on Lee's (1970) scale include: "They work at lightning speed", "There is no limit to what these machines can do" and "They can be used for evil purposes if they fall into the wrong hands." Items on Zoltan and Chapanis's (1982) scale include: "Computers are smarter than people", "Most computer systems will not accept spelling errors" and "Short of physical violence, you cannot damage a computer." It is evident that such items are obtuse and clumsy, and in turn it is doubtful how such items can be used to generate a structure of general attitudes toward computers. Furthermore, at this stage it was deemed necessary that the psychometric qualities of Lee's (1970) and Zoltan and Chapanis's (1982) attitudes toward computer scales be considered in some detail, as well as other research studies which have utilised their scales in order to assess attitudes toward computers.

In order to develop the attitude towards computers scale for his study Lee (1970) conducted 100 intensive interviews with a diverse general public sample and made a psychological analysis of the humour in over 200 computer cartoons that had appeared in various popular magazines. The resulting 20 questionnaire items covered major themes, beliefs and ideas about computers (Lee, 1970). Lee (1970) conducted a factor analysis using the Varimax procedure of the responses to the attitude items and found that, as previously mentioned, two major orthogonal factors emerged. Factor 1, involved the positively toned set of beliefs infused with the notion that computers are beneficial instruments for man's purposes; and Factor 2, viewed the computer as a relatively autonomous machine that can perform the functions of human thinking. These two factors were found to be

virtually independent of each other, i.e., the correlation of index scores based on these factors was reported at -0.02. Lee (1970) however does not report on any internal consistency measure of the scale.

Moreover, Morrison (1983) replicated Lee's (1970) study to ascertain whether the attitudes people had toward computers in 1970 still existed. Four hundred and twelve Australian students responses were divided into two equal sets, with 206 responses in each set. The data in each set was then subjected to principal components analysis. Analysis of the data in the first set revealed a four factor solution. At close inspection, Morrison's (1983) attitude structure beared little similarity to Lee's (1970). The first factor defined a negative attitude toward computers. Morrison (1983) found the "awesome machine" factor denoted in Lee's (1970) study to be divided into two smaller factors. All items that loaded on the second factor loaded on the awesome machine factor. The third factor was defined by the additional items of the awesome machine perspective and expressed an inadequate understanding of computers, to the point of astonishment. The fourth factor reflected concern about the real positive and negative implications of widespread computer application. This factor represented a realistic concern of the third factor. To investigate the stability of the attitude structure revealed in the first data set the responses of the remaining 206 subjects were also factor analysed and a five factor solution emerged. The first two factors of the first analysis had been reproduced in the analysis of the second data set. The remaining two factors identified in the first analysis were also present though their order of extraction was slightly altered. The third factor of the second analysis was a simple dimension of computer acceptance.

Thus, there appeared to be four dimensions common to the two analyses. Also, the largest amount of variance was explained not by the "beneficial tool of man" factor as in Lee's (1970) study but by a factor representing negative attitudes toward the possible disemploying and dehumanising effects of computers, and fears for their reliability and their power over the lives of individuals (factor 1 in both analyses). A similar amount of variance was accounted for by the "awesome machine perspective" identified by Lee (1970) (factor 2 and 3 in analysis 1; and factors 2 and 4 in analysis 2). Lastly, the beneficial tool of man perspective seemed to be represented by a number of smaller factors (factor 4 in analysis 1; factor 3 and perhaps 5 in analysis 2). Morrison (1983) however does not report on the internal consistency measure of the scale.

Hence, given the intervening period between Lee's (1970) study and Morrison's (1983) study it is not unexpected, as stated previously, that their findings differ. Further, in view of the different populations (North American verses Australian) and sample sizes (3000 versus 412) it would be surprising if Morrison's (1983) study showed similar findings to Lee's (1970) (Morrison, 1983).

Finne (1987) studied dimensions of attitudes toward computers. Using a slightly modified version of Lee's (1970) attitude scale (items were slightly changed for local terminology and conditions) data was collected on a sample of 378 South African undergraduate business administration students. Finne (1987) factor analysed the data and found that a four factor solution provided the most viable set of factors and which correlated closely with Morrison's (1983) results. A two factor solution was also generated to allow comparison with Lee's (1970) results. The comparison with Lee's (1970) two factors showed a strong similarity between the factors providing support for the two underlying dimensions of attitude established in the study. However, the two factor solution had a high proportion of unexplained variance whereas the four factor solution explained 13,3%. Finne (1987) thus felt that the additional factors could provide more insight into the attitudes toward computers construct. Further, a good correlation existed between Lee's (1970) first factor and the first of the four factor solution. Finne (1987) notes that little is lost in the first factor by choosing a four factor structure but there could be some gains in interpretation sensitivity by including the additional factors.

Finne (1987) compared his results to Morrison's (1983) results. The first three factors correlated well with Morrison's (1983) results although the order of extraction differed. No relationship for the fourth factor was found. The first factor extracted in Finne's (1987) study was positive and corresponded to Lee's (1970) "beneficial tool of man" perspective whilst the first three factors extracted in Morrison's (1983) study were negative. These findings indicated that Finne's (1987) study showed greatest variance on the positive aspects of computing while Morrison's (1983) study showed greatest variance on the negative. Finne's (1987) first factor accounted for 16,9% of the variance and loaded highly on variables dealing with the excitement of new technology and with their value to commerce. Factor 2 dealt with variables relating to negative effects on society and individuals, and to fear of the power of computers over people. It accounted for 13,4% of the variance. The third factor explained 6,6% of the variance and had certain aspects of the "awe and

wonder" of Lee's (1970) second dimension. The final factor explained 6.5% of the variance and dealt with more positive aspects of computers. It appeared to reflect a "technical appreciation" dimension of attitudes. Thus Finne's (1987) study identified four components in the attitudes toward computer construct which agrees with earlier work. Finne (1987) concludes by stating that although the dimensions extracted in a factor analysis are dependent on the items available in the survey instrument, it is clear that attitudes toward computers consist of both positive and negative aspects. Thus, a simple pro-con attitude scale is unlikely to provide sufficient insight for studies of the role of attitudes in computer use. However, Finne (1987) does not report on any internal consistency measure for the attitude scale.

Nonetheless, Lee's (1970), Morrison's (1983) and Finne's (1987) studies all stress the fearful and awesome aspects of the computer but in a different order of importance.

Zoltan and Chapanis's (1982) attitudes toward computers scale, on the other hand, consisted of a "General attitudes" section (which contained 41 pairs of adjectives assembled in a semantic differential format) and a "General statement" section (which contained a series of 23 Likert-type statements to elicit beliefs about and reactions towards specific features of computers, and potential uses and applications of computers). Questionnaire items were selected from the Adjective Checklist Manual (Gough & Heilbrun, 1965) and from findings of previously published articles. Three successive pilot tests and a review by the research staff of the Communications Research Laboratory at Hopkins were conducted on the questionnaire. The final version of the questionnaire was the result of the review. Further, a principal component analysis on all 64 items was performed as the interest lay in assessing the general attitude components. The results of the factor analysis yielded the following six factors: Factor 1, reflected the view of the computer as a sound working machine; Factor 2, was found to be made up of a negatively toned set of adjectives: dehumanising, depersonalising, impersonal, cold and unforgiving; Factor 3, represented the view of the computer as a desirable and useful machine; Factor 4, reflected the view of the computer as a slave to man and not as a potentially controlling force; Factor 5, viewed computers as fun, enjoyable, stimulating and challenging; and lastly Factor 6, expressed discontent with computers in terms of their ease of use. Although Zoltan and Chapanis (1982) conducted three pilot tests and a factor analysis on their

attitudes toward computers scale, they too do not report on any internal consistency measure of their scale.

Gardner, Young and Ruth (1989) reviewed three previous factor analysis based studies of attitudes toward computers (i.e., Lee (1970); Zoltan & Chapanis (1982) and Morrison (1983)) and compared them with the factor analysis solution found in their study. Gardner et al. (1989) designed a questionnaire to assess attitudes of users toward the computer milieu. After factor analysing the questions it was found that the primary factor which accounted for 34% of the variance, consisted of statements which emphasised the degree of pleasure obtained from working with computers. This factor was labelled the enjoyment variable. Factor 2 accounted for 13% of the variance and included statements which covered the ability of computers to improve the individual's quality of life and was labelled the quality of life factor. The third factor broached the sensation of trepidation caused by computers and was termed the fear factor. It accounted for 9% of the variance. Factor 4 explained 7% of the variance, it summarised the frustration encountered when using the computer and was thus called the anxiety factor. The final factor addressed the handiness of computers and was labelled the service factor. It also accounted for 7% of the variance (Gardner et al., 1989).

Gardner et al. (1989) compared their results with the factors found in previous studies and found the existence of similar positive and negative factors through the years spanned by the studies but in a different order of importance. Lee (1970), Zoltan and Chapanis (1982) and Morrison (1983) emphasised the fearful and awesome aspects of the computer. Gardner et al. (1989) found that the first and second factors emphasised the pleasure (factor 1) and the improved quality of life (factor 2) attributable to the computer whereas the fear (factor 3) and anxiety (factor 4) the computer creates followed as less important factors. Gardner et al. (1989) state that the shift of attitudes seems to indicate a realisation in individuals that the computer is an aid rather than a threat. Further, Gerdner et al. (1989) note that the relative position of the positive factors in their study indicates the greater importance of the beneficial aspects of the computer than the fear inducing factors which were highly prominent in the previous studies. Gardner et al. (1989) conclude by stating that previous studies findings appear to substantiate the generally held feeling that people are getting more accustomed to computers. The feelings of awe have disappeared and positive factors now dominate. Gardner et al. (1989) however do not report on the internal consistency of the scale.

However, the transfer of the structure of general attitudes toward computers to attitudes toward working with computers has not been sufficiently validated (Rafaeli, 1986). As can be seen by the studies cited above general attitudes toward computers rather than the specific context of working with a computer have been assessed. In view of this Rafaeli (1986), Igbaria and Parasuraman (1989) and Igbaria and Chakrabarti (1990) developed scales to measure attitudes toward working with computers which need to be discussed in their own right in the section which follows.

Rafaeli (1986) developed a 9-item scale to measure attitudes toward working with computers and tested it on a sample of 284 white collar employees from three manufacturing organisations. The aim of Rafaeli's (1986) study was to illustrate some correlates of employees' attitudes toward working with computers. In order to develop his attitudes toward working with computers scale, Rafaeli (1986) brainstormed twenty potential items for the measure. The items were administered to a pre-test sample of 75 white collar employees and an iterative components analysis with a Varimax rotation was performed on all twenty items. Using Kaiser's criterion of eigenvalues greater than one, two factors were found to emerge from the data. The two factors bore meaningful resemblance to the "positive" and "negative" factors in previous studies on general attitudes toward computers. Factor 1, referred to positive attitudes toward working with computers; and factor 2, addressed negative attitudes. Only nine items had significant loadings on one of the two factors. Further, in order to establish the construct validity of the scale Rafaeli (1986) again factor analysised the responses from the study sample to the attitude index. This yielded the same pattern of two factors. Finally, Rafaeli (1986) assessed the internal consistency of the scale by using Cronbach's alpha coefficients. Alpha coefficients for the two factors were found to be satisfactory, i.e., 0.80 and 0.64 respectively. Thus, the construct validity and internal consistency reliability for Rafaeli's (1986) scale are deemed satisfactory.

However on closer examination of Rafaeli's (1986) scale items, they appear extremely superficial and do not seem to capture the essence of actually interacting with a computer at work. For example, consider the items "Would like to see part or all of my job done by a computer", "Would discourage anyone from allowing a computer to be placed on their desk" and "Would not feel comfortable using a computer instead of a telephone or a letter." Furthermore, the three components that constitute an attitude (as discussed in Chapter 2 (Attitude and attitude measurement))

are vaguely dealt with in this scale. For instance, does the item "Computerising part of my job would make my company more competitive" refer to the cognitive or affective component?

Igbaria and Parasuraman (1989) developed and tested a path model of individual difference variables as antecedents of computer anxiety and attitudes toward microcomputers among managers. In order to assess attitudes toward microcomputers a twenty item scale was factor analytically developed and tested in a pilot study involving a separate sample of students. The item pool from which the scale was developed included items adapted from prior studies (Howard, 1986; Howard & Smith, 1986; Igbaria, Pavri & Huff, 1989; Raub, 1981; Reece & Gable, 1982; Swanson, 1982) as well as items generated to capture issues salient to the use of microcomputers in organisations. The authors state that the scale items include cognitive, affective and behavioural elements. Examples of the scale items are: "A microcomputer would give me more opportunities to obtain the information that I need" and "I wouldn't use a microcomputer because it is too time consuming." On close examination of the scale items it does not appear as if all three components of an attitude were assessed. It seems as if only the behavioural component was examined. Although the internal consistency reliability of the scale in the pilot and main study was 0.82 and 0.91 respectively, no measures to assess the validity of the scale are reported by the authors. Further, in a study by Parasuraman and Igbaria (1990) which too examined the determinants of computer anxiety and attitudes toward microcomputers among managers in a variety of organisations, the attitudes toward microcomputers scale developed by Igbaria and Parasuraman (1989) was utilised.

Igbaria and Chakrabarti (1990, p.229) examined the "relationship between demographic variables, computer training and experience, management support and system quality and computer anxiety, and attitudes toward microcomputers." In order to assess attitudes toward working with microcomputers a 10-item scale was developed. The items used to construct the attitude scale were adopted from prior research (Howard, 1986; Howard & Smith, 1986; Igbaria & Parasuraman, 1989; Raub, 1981; Reece & Gable, 1982; Swanson, 1982) with some new items generated to capture issues salient to the use of microcomputers in organisations. The items of this scale are more centred around the human-computer interaction, for example, "Using a microcomputer allows me to access, store and retrieve information easily without difficulties." Although the authors state that all three components of an attitude were considered, on examination of the scale items it appears as

if only the behavioural component was assessed. Furthermore, the authors only state the internal consistency coefficient of the scale (which was satisfactory; $\alpha = 0.80$). No measures to assess the validity of the scale are reported. It appears as if Igbaria and Chakrabarti (1990) developed a reduced scale of Igbaria and Parasuraman (1989) to assess attitudes toward microcomputer use.

Thus, from the above discussion it is clear that an appropriate scale which assesses specifically attitudes toward working with computers is lacking in previous research. Hence, for the purpose of the present study it was deemed necessary that a scale be developed to assess attitudes toward working with computers. As discussed in Chapter 2 (Attitudes and attitude measurement), the development of the attitude scale was based on the three components that constitute an attitude, i.e., the cognitive, affective and behavioural. Thus, indices of all three components of an attitude were included in the scale. The development of the attitude scale for the present study is discussed in Chapter 4 (Rationale and procedure) under the section 'Development of the Attitudes toward working with computers scale.' At this stage it was however deemed necessary that the human-computer interaction be examined as the area of attitudes toward working with computers falls within the human-computer interaction paradigm.

THE HUMAN-COMPUTER INTERACTION

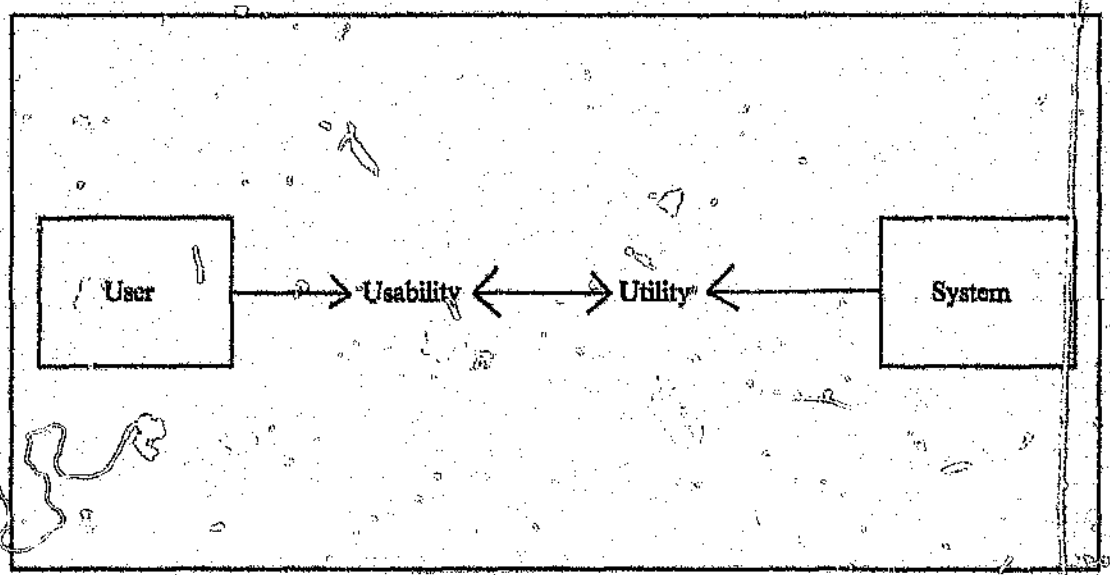
The interaction between humans and computers is becoming an area of growing interest (Coombs & Alty, 1981) due to the need for a wide cross-section of people to utilise them in the workplace. The study of the human-computer interaction extends from not only the ergonomic or design considerations of hardware but also to the cognitive needs of users and their requirements for efficient operating systems and friendly software (Fried, 1982).

The general form of the human-computer interaction has improved immensely in the past few decades. A few years ago, interaction with a computer required the accurate typing of obscure commands exact to the position of every bracket and semi-colon and often producing from the computer an array of equally obscure and often unreadable alphanumeric strings. Successful interaction meant considerable human adaptation to the unbending and unforgiving computer (Eason, 1991). Today the computer industry has sought more natural ways of interaction which

are "user friendly", are experienced as easy-to-use and need little specialist training. Although modern forms of interaction are much superior to their predecessors there still remains strong evidence that users experience many difficulties in making use of computer systems. Hence, the concepts of functionality and usability are important in the study of the human-computer interaction. Functionality refers to the functions the system has to be able to perform in order to support the required range of organisational tasks (Eason, 1988). Usability, on the other hand, denotes that the system must offer its functionality in such a way that the users will be able to master and exploit it without undue strain on the users capacity and skills (Eason, 1983). Usability thus intervenes between the functionality of a system and the degree to which users are able or willing to use a system (Eason, 1984). The intervening role of usability is depicted in Figure 6. A simple viewpoint is that acceptance of a system depends upon perceived utility, i.e., whether the user sees it as being of benefit to him or her. As systems become more multifunctional acceptance should increase because the utility of the system is increasing. Often, however as systems become more multifunctional so users encounter many problems in successfully using them. Hence, these problems may limit the degree to which potential utility becomes actual utility (Eason, 1984).

Oborne (1985) describes the computer and its user as a closed-loop system with each only being able to perform to the level allowed by the other. The nature of the user and the job he or she has undertaken are the factors which define the requirements the user will have of a computer system (Eason & Damodaran, 1981). Eason (1984) reports that usability of a computer system is seen as a product of the interaction of three variables - the system, the user and the task. Issues that fall under the system variable are ease of use, ease of learning and task match. Ease of use refers to the effort that is required to operate a system once it has been understood and mastered by the user. The term ease of learning refers to the effort required to understand and operate an unfamiliar system. This depends upon the knowledge the user possesses and the ease with which this knowledge can be mapped onto the unfamiliar system. A task match exists if the functions provided by the system match those required by the user to complete the task. Issues that concern the user variable are knowledge, experience, involvement, discretion, and so on. For example, a novice will find a

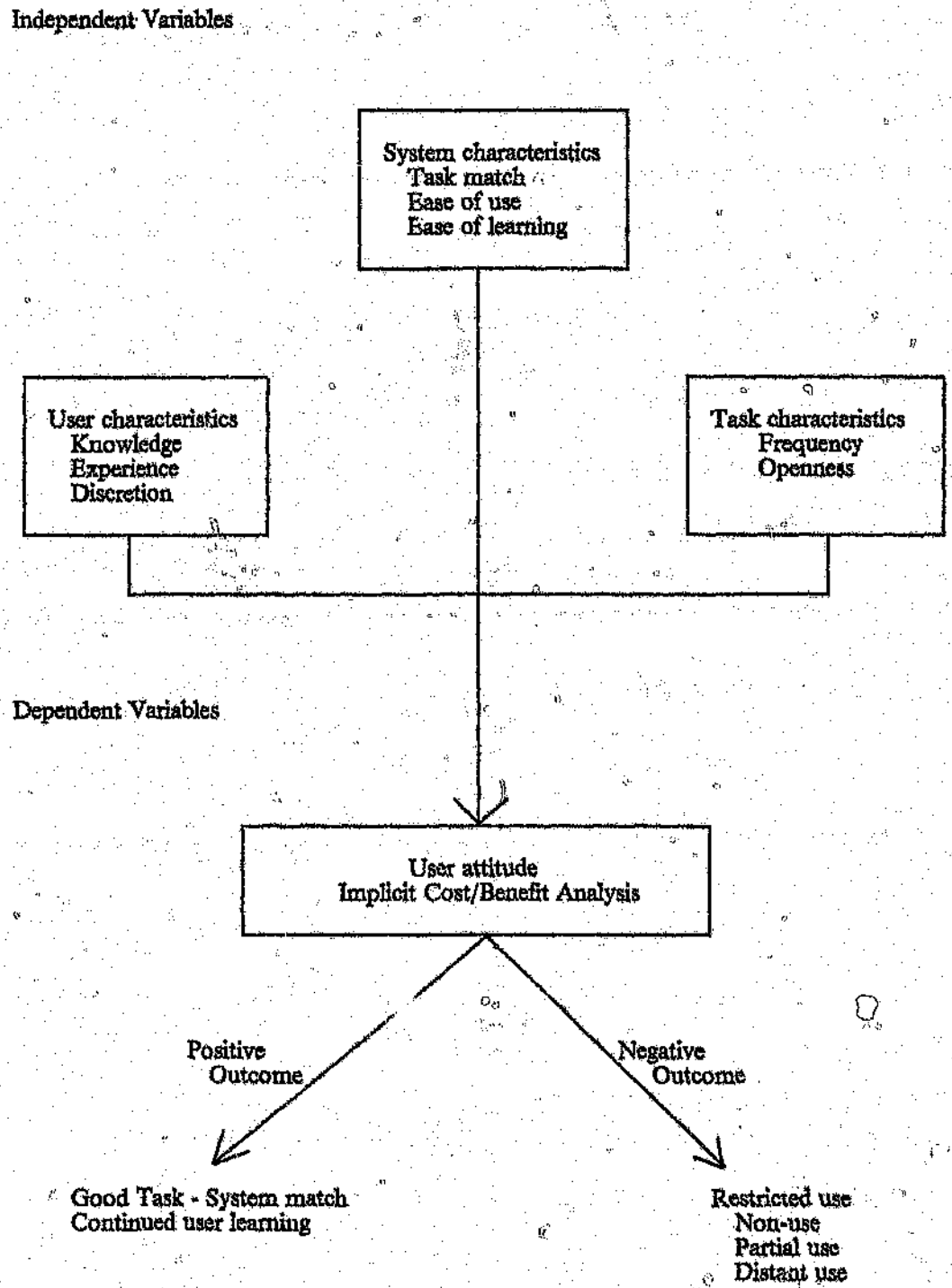
Figure 6: The intervening role of usability (Eason, 1984)



full, self-explanatory dialogue very helpful whereas the experienced user will find the same dialogue tedious and obstructive. Many users have considerable discretion over how they define and engage in their tasks, and discretion over whether and how they use systems to help them. All users have some degree of discretion; whenever a system offers a choice it gives a user discretion. However, users with the greatest discretion pose the greatest problem. They need alot of flexibility in the system so that they may achieve a match with their personally defined task needs and yet they are likely to be the least tolerate of ease of use and ease of learning problems. Issues under the task variable are frequency and openness. It is relatively easy to handle the ease of use issue for a simple, closed task because the system can offer the few options that are needed in a well-defined structure. If the task is open-ended the options may have to be much greater and more choice equates with more difficulty in use.

The interaction of the three variables determines the user's response to each session of use, known as a task episode. Over a number of task episodes there develops a pattern of responses which indicates more or less usability. The user's attitude is the result of a cost/benefit assessment where the benefits are in terms of the ability of the system meeting the user's needs and the costs are mainly in terms of effort. A negative cost/benefit assessment by the user does not allow for the realisation of the full potential of a system. Negative assessments are accompanied by feelings of frustration and negative attitudes toward the computer (Eason & Damodaran, 1981). A negative outcome of the cost/benefit analysis results in restricted use in the form of non-use, partial use (i.e., only using part of the facilities when a greater proportion are relevant to the task), or distant use (i.e., not using it oneself but asking someone to use it on your behalf). A number of positive cost/benefit assessments by the user are accompanied by positive attitudes toward the computer result in a good task-system match and continued use of a system (Eason, 1984). Figure 7, presents Eason's (1984) causal framework of usability. Taking Eason's (1984) casual framework of usability a step further, a number of studies have shown that attitudes toward various features of an information system and computers in general are related to user behaviour (Robey, 1979). In fact, attitudes toward information systems have been found to be associated with information system usage (Lucas, 1975; Robey, 1979).

Figure 7: Eason's (1984) causal framework of usability



For the purpose of the present study, the independent and dependent variables of Eason's (1984) model were only assessed, i.e., user-task-system combinations and users' attitudes. The consequences of the positive and negative attitudes (i.e., good task-system match and restricted use) were not measured in the present study.

At present much is known about system characteristics but little is known about the shaping effects of user and task variables (Eason, 1984). These are all the more important as, in most applications, user and task variables have to be taken as given; it is not within the designer's power to manipulate them. If we want usable systems therefore we must fit them to the users rather than hope the users will fit themselves to the systems (Eason, 1984).

Thus, from the above discussion it is apparent that it is essential to consider user, task and system characteristics. However, before investigating past studies considerations of these three concepts, it is necessary to have a clear understanding of each of them. Hence, at this juncture it was deemed necessary that the following section deals briefly with each of these characteristics.

User characteristics

Previous research aimed at establishing user characteristics have failed to report carefully the defining characteristics of their samples thus making the interpretation and generalisation of research findings difficult (Fisher, 1991).

A major difficulty in the interpretation of research findings is the number of different terms used to describe subject groups (Fisher, 1991). These terms vary between research reports, are used interchangeably within a report and are often applied without definition (Fisher, 1991). Paxton and Turner (1984), for example, found that the majority of authors do not differentiate between naive and novice computer users. As a result, Paxton and Turner (1984) use the terms naive and novice interchangeably throughout their report. Allwood (1986) points out that the concept of a novice is not used uniformly in the literature. The term novice has been used to refer to anything from users with no previous computer experience to users approaching expert status. Often the term novice is used to denote the least experienced among the subjects available to a researcher

(Allwood, 1986). Furthermore, many different labels are used to denote user groups throughout the literature. For example beginner, casual, infrequent, occasional, experienced and expert (Fisher, 1991). Although some researchers have used labels accurately in their reports (e.g., Shneiderman, 1976) the majority of researchers use labels loosely and inaccurately.

It is thus clear from the above that a more thorough understanding of some of these labels is necessary in order to distinguish user attributes (such as intention, level of task involvement, goals, and so forth) which underpin the need for a distinction in the first place (Fisher, 1991). Fisher (1991) notes that fundamental distinctions can be made between the terms novice and naive, and experienced and expert.

Novice users are individuals who are inexperienced in a certain task or situation. Through continued exposure to the task and tools the novice gains experience though whether this experience manifests itself in greater expertise depends upon factors such as task openness (Harker & Eason, 1980) and the extent to which the user needs to develop and use more detailed understandings of the operating system, and so on (Fisher, 1991).

A naive user is an individual who lacks developed power of analysis, reasoning or critical capability in a particular situation. The naive user needs to use computers in a meaningful way for particular tasks but has no desire to understand the operating system or application being used (e.g., Eason & Damodaran, 1981).

Experienced users are individuals who have developed skills or knowledge from extensive exposure or participation. Although experienced users are in direct contrast to novice, the term experienced tells us nothing about the quality of experience (Fisher, 1991).

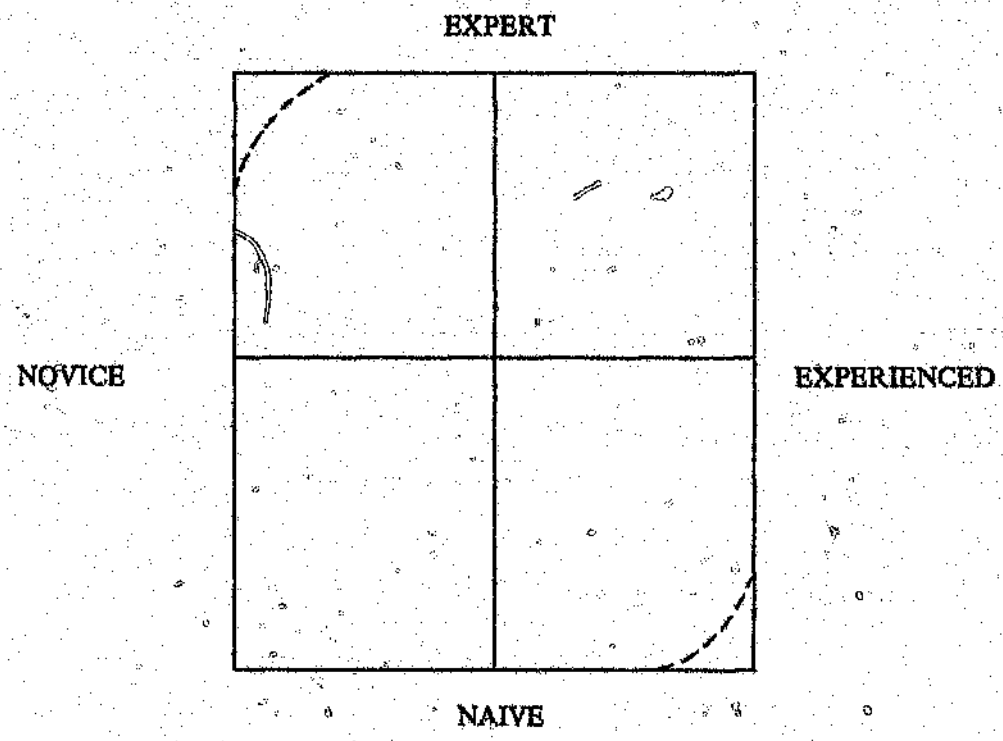
An expert user is an individual who gains and intentionally uses skills and knowledge about dynamic substrates of the operating system and its interactions, and so on. Expert users stand in direct contrast to naive users (Fisher, 1991).

Figure 8, indicates the novice to experienced and naive to expert dimensions. In this two dimensional space any user may be located and can move and be 're-typed' according to task specific or research specific circumstances (Fisher & Currin, 1986). The purpose of this two dimensional-space conceptualisation is to consider the relative position of a user at a given time for a given task. This conceptualisation is however in direct contrast to the way in which terms are typically used in research but it suggests that "a more pragmatic appreciation of the novice-experienced and the naive-expert distinctions may lead to greater precision by producing research findings of a more generalizable nature" (Fisher, 1991, p.440).

In the relevant studies that have been reviewed however, user characteristics are poorly accounted for. Little attempt has been made to differentiate among users of computers in terms of their different levels of experience and involvement. For example, Zoltan and Chapanis (1982) defined experienced computer users as respondents who indicated that they had received some form of computer training and inexperience users were defined as respondents who had never learned how to use a computer. It was found that experienced users reported more positive attitude towards computers than inexperienced users. Experienced users perceived computers as easy, powerful and unthreatening and emphasised that computers would be helpful to their work and would be welcomed in their homes. Inexperienced users, on the other hand, perceived computers as more impersonal, intelligent and more costly than experienced users and indicated that a specific computer language needs to be mastered to become proficient in computer use. Hence, Zoltan and Chapanis (1982) state that users with little or no computer experience may attribute some inaccurate perceptions about computers due to their lack or limited experience with computers. Zoltan and Chapanis's (1982) findings however are based on a unique sample (Baltimore lawyers, accountants, physicians and pharmacists), a very small response rate (27,7%) and a very broad operationalisation of experience - anyone who had had some form of computer training.

Rafaeli (1986) studied the relationship between usage of computers and attitudes toward working with them. Rafaeli (1986, p.92) hypothesised that "employees who make more extensive use of a computer on their job will report more positive attitudes toward working with computers." In order to assess current usage of computers Rafaeli (1986) used the item "On your current job, to what extent do you use a computer to support your work." Responses ranged from "not at all" to "very

Figure 8: Two-dimensional conceptual space for user characteristics (Fisher, 1991)



much." It was found that usage of computers was consistently related to positive and negative attitudes. Hence, Rafaeli (1986) concludes by stating that employees who have more experience in working with a computer report a more positive attitude toward computers than employees who are not familiar with computers or for whom the computer is still novel (i.e., who have less computer experience). However, Rafaeli (1986) used the terms usage of computers and computer experience interchangeably. These terms were not clearly defined nor adequately assessed.

In Dambrot et al.'s (1985) study of university students, computer experience was examined in terms of completion of a computer course, knowledge of a computer language, intention to major in computer science and reported use of computers. Students indicated their use of computers by being grouped into one of the following three computer usage groups: never used, limited use and extensive use. Computer attitude was found to be positively related to computer experience (Dambrot et al., 1985).

Igbaria et al. (1989) investigated the relationship between microcomputer usage along five dimensions and the relationship between each dimension and demographic variables, computer experience, user training and computer anxiety. Since levels of usage vary for different people, Igbaria et al. (1989) used the following five dimensions of computer usage to assess system usage. Firstly, inclusion of computer analysis in decision making; secondly, actual daily use of computers; thirdly, frequency of use; fourthly, number of packages used; and finally, level of sophistication of usage. Further, computer experience was assessed by asking subjects to indicate whether they had experience in using different types of computer software and computer languages, and in the development of computerised information systems. Computer training was measured by individuals' responses to a question which asked them to report the extent of training in computers they had received from four sources: college courses, vendor training, in house training and self trained.

Igbaria et al. (1989) found that education was unrelated to the use of microcomputers in decision making, level of sophistication and the number of packages used but was positively related to duration and frequency of use. Microcomputers were used more extensively and more often by more educated respondents. Users with less formal education tended to use microcomputers for more communication purposes while users with higher degrees used microcomputers for a greater variety

of tasks. Users with more computer experience clearly seemed to use microcomputers more often than others. The implication is that the greater the years of experience with computers the more managers will use microcomputers in their tasks and for a larger number of applications. Hence, the extent of microcomputer usage is positively correlated with prior user experience. Furthermore, users who have computer training use more varied and sophisticated computer applications more often and for a greater number of hours per day. Thus education, computer experience and training are essential as they may influence an individual's microcomputer usage (Igbaria et al., 1989).

In the study by Igbaria and Chakrabarti (1990) it was found that computer experience and training were positively related to attitudes toward working with microcomputers. In order to assess computer experience Igbaria and Chakrabarti (1990) also asked respondents to indicate whether they had experience in using different types of software and computer languages, and in the development of computerised information systems. To assess computer training individual's responded by reporting whether they had computer training in each of the following: college courses, vendor training, in house training and self-training. Igbaria and Chakrabarti (1990) state that their finding that users who have more computer training have more positive atitudes toward working with computers indicates that increases in training programmes may foster feelings of "self-efficacy" (Gist, 1987), i.e., the belief that one can develop the skills necessary to use computers and strengthen confidence in one's ability to master and use them in one's work (Igbaria & Parasuraman (1989) support this belief too).

Kerber's (1983) study aimed to determine the attitudes of students toward computer applications and to determine if these attitudes were related to experience with computers, beliefs about computers or personality characteristics of students. In order to assess experience with computers respondents indicated the number of computer science courses taken, experience with computers in non-computer science courses and job experience with computers. Respondents also indicated the nature of the experience with the computer by checking as many of the following as applied: writing your own programme, used a programme you wrote, used a programme written by someone else, and/or used a computer to prepare a written document. The number of these items checked constituted a measure of the variety of experience with computers. Also, respondents who checked at least one of these experiences rated how difficult it was for them to learn to use the computer.

Kerber (1983) found that experience with computers is correlated significantly with attitudes toward specific computer applications.

Stone (1990) studied the influence of managers' training and experience with personal computers, frequency of use and computer anxiety on their attitudes toward using computers. Personal computer training and experience were assessed by 11 items adapted from Pavri's (1988) scale assessing microcomputer use in organisations. Training was measured by asking respondents to indicate what training they had received from different sources, such as, college courses, vendor training, in-house training and self-training. Experience in working with computers was assessed by asking respondents what exposure they had to different types of computer software, languages, modelling, programming and development of computerised information systems. Frequency of use of personal computers was measured by four questions drawn from Pavri's (1988) questionnaire. Stone (1990) found that training, experience in using computers, frequency of use and computer anxiety all have positive associations with attitudes toward computers, i.e., the more computer experience managers have the more favourable their attitudes toward computers, and so on.

Despite the poor definitions and broad operationalisations of computer users' experience and involvement in past studies it may be concluded that users who have more experience with computers, who have received more computer training and who use the computer frequently have positive attitudes toward working with computers. Furthermore, users with a positive attitude toward working with computers perceive the computer more favourably, i.e., easy to use, powerful, unthreatening, helpful and welcomed.

However, Fisher (1991) argues that the lack of precise descriptions of subjects' experience restricts the confidence with which research findings can be compared or generalised, or easily replicated. Descriptive statements about samples of users selected in research designs aid qualitative and quantitative comparisons from study to study. Consideration of both depth and breadth of user experience and how this may be relevantly partitioned within the context of the research question is necessary (Fisher, 1991). The intention of differentiation among users of computers hinges upon assumptions about needs of users with different involvement and it is possible to identify some dimensions, such as, length of use (how many months, years), frequency of use (how often per day,

week), duration of use (how long is a typical session), repetitive quality of use (fixed/routine or flexible/creative involvement), breadth of use (number of different applications or operating systems) and depth of use (formal training or knowledge of computer systems or computer science) (Fisher & Kaplan, 1990). Such categorisation can only aid comparison and generalisation of findings to the benefit of researchers and designers and perhaps increase the value of ergonomics guidelines when manifested in real systems for use by real end-users (Fisher, 1991).

Hence in the present study, the dimensions identified by Fisher and Kaplan (1990) were utilised to measure computer users' experience and involvement.

Task characteristics

The study of task is essential to any complete understanding of the functioning of the human-computer interaction. The analysis of task derives the demands made on the operator by the task so that these demands can be compared with human capabilities to find human or system mismatches (Drury, 1983). The user will evaluate the system as a tool by virtue of its ability to service his or her task. The "fit" between tool and task will be the users main assessment criterion. If, for example, the system serves his or her task needs poorly, it stands condemned as a poor system (Eason & Damodaran, 1981). Moreover, task characteristics are important to consider as an individual's involvement with the computer will depend upon his or her task. However, past research on attitudes toward computers and attitudes toward working with computers have not taken into account computer users' task characteristics.

The initial problem encountered in any discussion of tasks lies in the definition of what constitutes a "task" (Companion & Corso, 1982). Task definitions vary greatly with respect to their breadth of coverage. At one end of this dimension are definitions that view the task as the totality of the situation imposed on the individual whereas on the other end of the dimension are definitions that treat a task as a specific performance (Fleishman, 1975). The diversity of opinion is also reflected in the extent to which tasks are defined as being external to or an intrinsic part of the individual. Some definitions take into account the propensity of individuals to redefine an imposed task in terms of their own needs, values, experiences, and so forth (Fleishman, 1975). Other researchers

define a task in terms of stimulus material and instruction to the individual. The instructions indicate the activities to be performed with respect to the stimuli and the goals to be achieved (Fleishman, 1975).

However, most researchers consider tasks as consisting of interrelated processes and activities. For example, Miller (1966, p.11) states that "a task is any set of activities, occurring at about the same time, sharing some common purpose that is recognised by the task performer." Or as Thibaut and Kelly (1959, p.150) note "a task is a problem, assignment, or stimulus-complex to which the individual or group responds by performing various overt and covert operations." Companion and Corso (1982) however, note two problems with the definition of task. Firstly, the level of analysis used as the basis for the definition, i.e., what is defined as the task in one situation may be a subtask in another analysis. Secondly, the question of who defines the task, i.e., the task performer may perceive the task differently to a system analyst who is merely observing the subject. Companion and Corso (1982) state that what is required is a general definition of task which is appropriate at all levels of analysis.

Fleishman (1975) argues that one should not debate about the definitions of task as if only one were possible but rather one should adopt or develop a definition that will permit the derivation of terms that reliably describe tasks and distinguish among them. These derived terms can provide the conceptual basis for classification. Thus, Fleishman (1975, 1978) states that what is needed is a system for classifying tasks that will lead to improved generalisations and predictions of human performance.

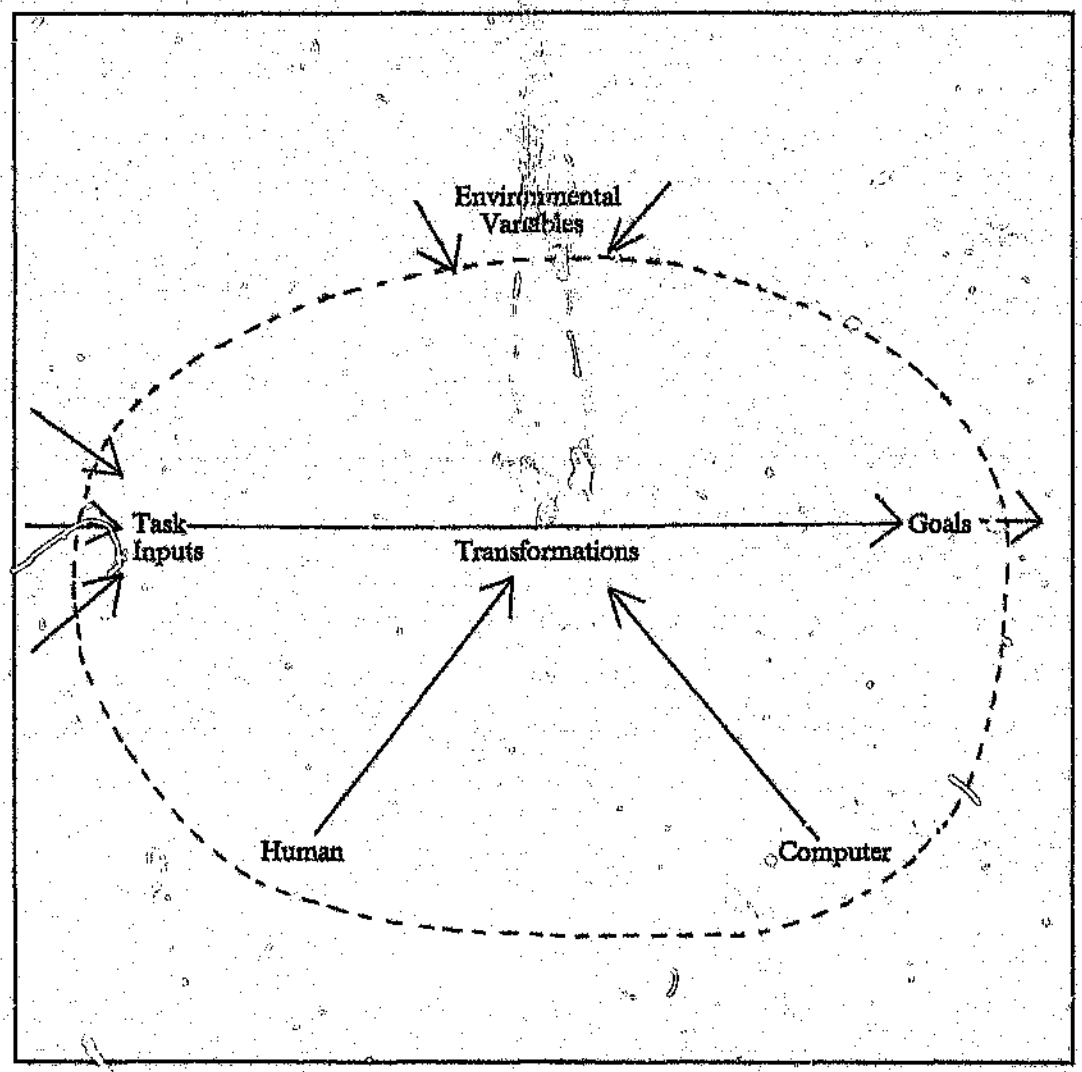
Eason (1980) states that a task involves the transformation of inputs to outputs which meet goal requirements. The task involves the gradual change of inputs through a series of states until the goal is achieved. The nature of the task inputs, the goal requirements and the environmental variables are outside the control of the task performing system. These factors determine the variance with which the task system must be able to cope. The task performing system with which the present study was concerned with is that in which humans and computers are the interacting agents which effect the transformations. Thus, if the two agents are to co-operate in effecting the necessary task transformations they must share a common "model" of the task (Eason, 1980). This is depicted

in Figure 9. The two agents contributing to the task transformation differ according to their respective contributions. The computer is good at mass storage of information, fast and accurate retrieval, information processing and following predefined instructions, however it remains relatively non-adaptive (i.e., it is programme following). On the other hand, the human operator is good at pattern recognition, goal formulation, identifying new issues and resolving ambiguity and uncertainty, hence man is adaptive (i.e., self-programming). Thus, humans and computers have complementary characteristics (Eason, 1980). The computer handles the bulk routine information processing leaving the human operator free to provide the adaptive component thus providing a fast, accurate and adaptive task performing system (Licklider, 1960).

Eason (1980) further discusses tasks as having two important characteristics: structure and frequency. With regards to task structure, many tasks hardly vary in their external parameters from one occasion to the next. The task inputs vary only within limited ranges, the goals remain the same and environmental variables stay within tolerable limits. The task transformation process too proceeds through a predictable series of stages which vary little from one occasion to another. These tasks are called "closed" as external parameters do not cause internal variance (Eason, 1980). At the other extreme, tasks are characteristised by their openness to external parameters. In these tasks some of the input parameters may fluctuate widely and unpredictably or openness may result from instability in the goal requirements of the task. Hence, the task performer has to adjust the transformation process to cope with a wide range of inputs and a range of outputs. These tasks are called "open" (Eason, 1980). Stated more simply, task structure refers to the ordering of tasks along a continuum or dimension which at one extreme has completely structured tasks in which the objectives, the method, the sequence and sometimes even the timing of behaviour are repeated each time the task is undertaken. At the other extreme, are unstructured tasks in which the manner of execution of the task differs on each occasion (Eason, 1976).

Task frequency refers to the human operator (the task performer) learning about the task and as a result changing his or her approach to the task making himself or herself a source of openness in the task performance system. The human operator becomes more skilled the more frequently he or she engages in a task and develops a repertoire of "action programmes" (March & Simon, 1958) to match the range of task requirements. For repetitive elements of the task, a task performer de-

Figure 9: The human-computer task (Eason, 1980)



velops automatic sequences of responses which require hardly any external input to guide their execution. The beginner or infrequent task performer however will exhibit search responses, will make mistakes and will make rather indirect progress towards his or her goal (Eason, 1980). Figure 10, provides a simple matrix of task structure and t.. frequency. The matrix simplifies the two extremes - many task performing systems operate between the extremes. The matrix includes examples of the kinds of tasks in which human-computer systems are employed in each cell.

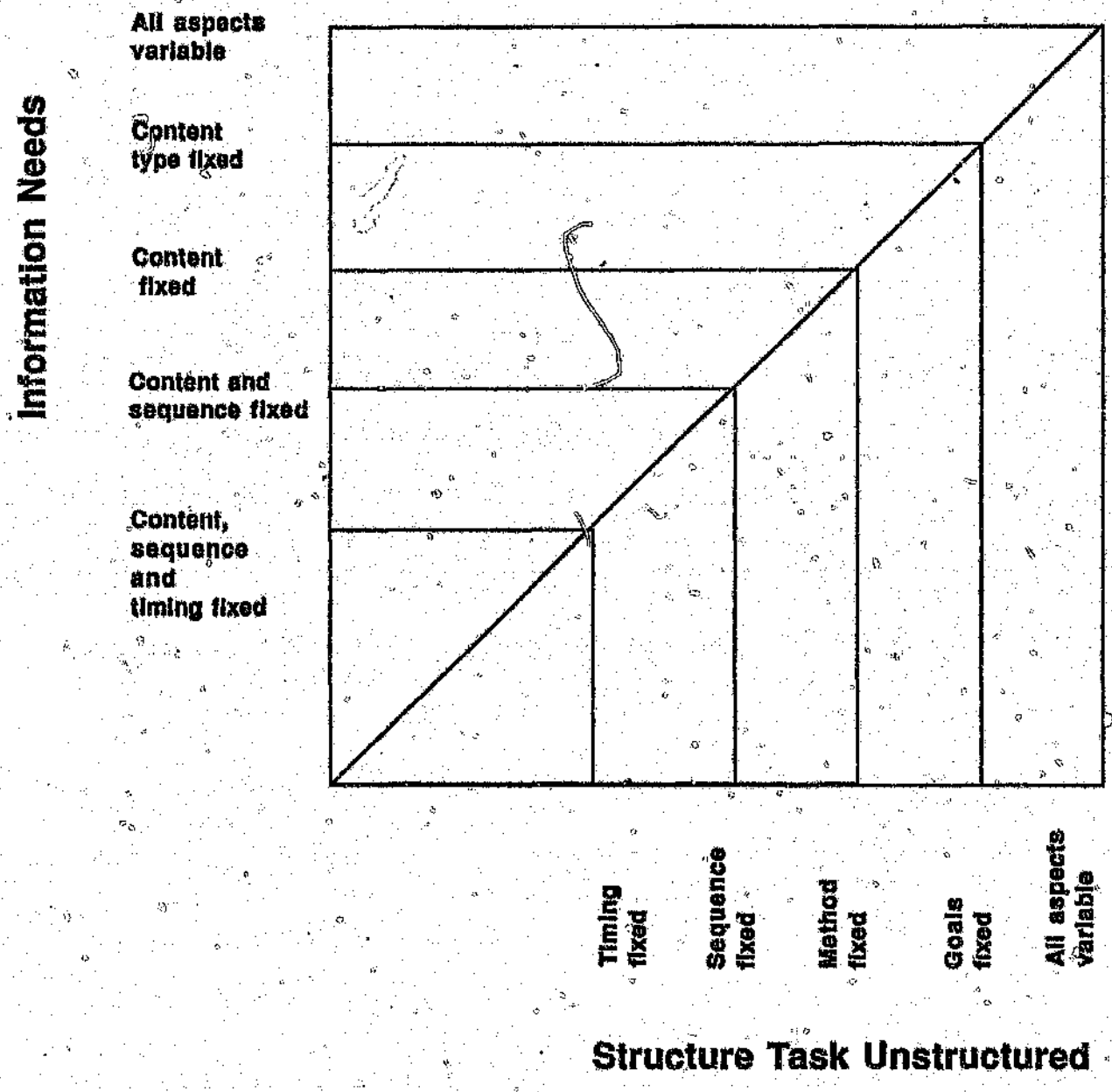
Furthermore, Eason and Damodaran (1981) note that another important task characteristic is that of information. To accomplish a task the user needs to handle specific pieces of information and to serve these needs the computer must provide the user with appropriate information-handling techniques. A user may require input, output or processing facilities, or a combination of these (Eason & Damodaran, 1981). The aspects of the computer system of most relevance to the provision of these needs is the set of software facilities which specifies the options available to the user. For users who only need input facilities a fairly limited set of facilities will suffice, however, many users have processing needs and may thus require a complex set of facilities (Eason & Damodaran, 1981). Thus, the successful completion of a task requires that the necessary relevant information is freely available to the subject (Eason & Damodaran, 1981). Considering the above mentioned task characteristics, an interesting relationship exists between the structure of a task and the information needs of the performer. That is, a structured task will always have similar information needs and thus require a less flexible computer system where as the less structured the user's task the more flexible the computer system needs to be, offering the user a progressively wider set of options (Eason & Damodaran, 1981). The relationship between task structure and information needs is presented in Figure 11.

For computer system designers task analysis should provide a useful source of information about the human-computer interface (Johnson & Johnson, 1989) and reduce the need for them to rely on their own sense and experience (Hammond, Jorgenson, Maclean, Barnard & Long, 1983; Hannigan & Herring, 1987). Walsh, Lim, Long and Carver (1988) suggest that task analysis should supplement user requirements elicitation to ensure that the system which is subsequently developed reflects the user's needs concerning functionality in terms of the task to be performed. Thus, task

Figure 10: A classification of task types (Eason, 1980)

Task Frequency	Task structure	
	Closed	Open
Frequent	Games Machine usage	Process control Statistics
Infrequent	Banking C. A. I.	Decision support Design aids

Figure 11 : The relationship between task structure and information needs (Eason & Damodaran, 1981)



analysis can lead to the identification of problems, difficulties, procedures and knowledge which may contribute to the design of the user interface (Walsh, Lim & Long, 1989).

As mentioned previously, past studies on attitudes toward computers and attitudes toward working with computers have not considered users' task characteristics. Task characteristics are important to consider in order to have a complete understanding of the human-computer interaction. Hence, it was deemed necessary that task characteristics be assessed in the present study. Following Eason's (1984) causal framework of usability and the above discussion, task characteristics were measured by task structure, frequency and information for the purpose of the present study.

System characteristics

A computer system needs to be able to provide each user with a task match (it must have utility to provide a benefit to the user) and it must be easy to use and easy to learn (in order to minimise costs in terms of effort) (Eason, 1984). Thus task match, ease of use and ease of learning are important system characteristics which need to be considered when dealing with the human-computer interaction. However, previous studies on attitudes toward computers and attitudes toward working with computers have failed to consider system characteristics. In the present study, it was deemed necessary to examine system characteristics and these are thus briefly discussed below.

Task match

The most important feature of a system is that it should provide a way of serving the user's task needs. That is, a task match must exist between the user and the system. A task match is a measure of the correspondence between the service provided by the computer and the needs arising out of the user's task. It can therefore be influenced by changes in either the service or the task (Stewart, 1986). A way of serving a user's task needs is to provide a facility to match each need, i.e., facilities presented should be an exact match with the tasks that have to be undertaken. Hence, the system does exactly what is required by the user (Eason, 1988). This may be appropriate for well structured tasks but is more difficult when tasks vary considerably from one user to another and from one occasion to another. For example, Eason, Damodaran and Stewart (1974) report that managers experienced a poorer task fit than other users and attributed this to the complexity, openness

and lack of structure in managerial tasks. The recognition of the variety of user task needs has, however, lead to the creation of much more flexible systems. These systems have a wide range of available functionality and provide the user with many facilities whereby the work of the system can be matched more exactly to the specific needs at the time (Eason, 1988). Nevertheless, the problem is that the flexibility is gained at the cost of complexity which makes the system difficult for the user to use. Thus, too much functionality is gained at the expense of usability (Eason, 1988). Hannigan and Kerswell (1986), for example, found that of 25 functions available on advanced private automated telephone exchanges, 10 facilities accounted for 83% of usage. Eason (1988) also found that of the 36 on-line functions available to a branch banking staff to obtain information about customer's accounts, 5 functions accounted for 75% of usage. Half of the functions were rarely used although each of them was designed with a common banking task in mind. These studies show that there was much more functionality in the system that the users could use with benefit but were not making use of it (Eason, 1988).

When tasks are ill-structured or vary across the user population, a set of criteria of the requisite level of functionality and the system flexibility will be established in order to enable the user to locate the function required. There are two associated criteria of importance: first, user task needs are rarely stable over time, i.e., users learn from their use of the system and thus redefine their tasks and task needs. Therefore, it is essential that the system is adaptable and elaborate to meet users' changing needs. Second, many systems allow a great deal of choice about the functionality and the specific form in which it is offered. This provides users with the opportunity to have the system tailored to meet their specific requirements and hence this customisation feature of a system is a very important property in meeting user needs. Thus, users will be able and willing to operate the system to customise it to meet a unique set of requirements. However, users tend not to do this and where it is intended that this feature will be used it will probably be necessary to provide support for customisation when the system is installed (Eason, 1988).

Thus, there are two routes by which the functionality of a system may be determined. One route is to establish a direct match between what the system provides and the tasks the user has to perform. This works best when tasks are well structured (Eason, 1988). The second route provides a wide range of functions from which the user can select that which is required. This route is more

suited to ill-structured tasks which will require different services on different occasions. The effect of this approach is that the sophistication of the computer is in the user's hands at the cost of the system not being matched to the user's specific needs. Users may thus need support to use the customisation facilities to create a match with their task needs (Eason, 1988).

A system's functionality can be evaluated by asking users how well the service matches their task requirements. The specific dimensions that are used for rating need to reflect the functionality of the system (Eason, 1988). Stewart (1986), for example, evaluated information system services provided to managers and used nine dimensions which are common properties of such information services, i.e., availability, timeliness, precision, relevance, comprehensiveness, validity, reliability, privacy and safety. Gower and Eason (1989), on the other hand, in evaluating a text processing service used dimensions such as turnaround time, editing capability and print quality. In the present study, a wide variety of users were used who utilise different systems for different purposes. As a result, to examine task match using explicit dimensions of particular systems would be difficult. Thus, the focus of the present study was to assess task match in a general manner hence covering all users and all systems utilised.

Once a system has functionality the next step is to ensure that it is delivered in a way the users feel able to operate. It is in this domain that the importance of "ease of use" and "ease of learning" are emphasised. In general, a user seeks a way of interacting with a system which fits his or her capabilities and skills for processing information (Eason, 1988). The following section discusses the concepts of "ease of use" and "ease of learning" in some detail.

Ease of use

A user must firstly know how to acquire inputs into the system and to acquire outputs from the system. For these purposes the system needs to match the user's motor skills capabilities, i.e., the way one uses their hands, feet, speech and so on, to communicate and act; and ones perceptual characteristics, i.e., the way one uses their eyes, ears and other senses to capture information from around one (Eason, 1988). Users are often infuriated by the rigidity of many systems which must receive literally everything in the right place before they will respond, i.e., the syntax demands that

every comma must be present and in the right place. Occasional users, in particular, are rarely exact and will have difficulty remembering complex syntax rules. Hence, it is important that systems are tolerant of a range of inputs (Eason, 1988). The rhythm of work in the human-computer interaction is linked to the response speed of the computer which can be very disruptive if it is too fast or too slow. Whilst a speed of a few seconds is normally recommended the actual speed required develops upon the stage of the task (Eason, 1988). A related issue to the rhythm of the interaction is the control the user has over it. The user may be interrupted and may need to go to another task or may want to go from one part of the system to another and check some information and then come back to continue the first task, and so forth. As technology develops there are more opportunities for the user to control these aspects of interaction, to "freeze" the task and return to it later, to undo what has recently been undertaken and return to an earlier point, and so on. Whether these facilities are desirable or add to the complexity with which the user has to deal depends upon the nature of the task environment and the expertise of the user (Eason, 1988).

As the mutual dependence between the human and computer deepens it is not the input or output facilities that constitute the main problem but the central processing undertaken by the communicating partners. If a system is to be usable it has to exhibit ways of operating that are compatible with the normal cognitive process of a human (Eason, 1988). Achieving a cognitive match of this kind depends upon the understanding of human cognitive functioning; which is a young area of research in the human-computer interaction field. There are however some practical implications that can be applied to the development of applications on existing technology and four such areas are: firstly, the operation of the system should appear natural to the user, i.e., the way it behaves should match user expectations; secondly, in evaluating a system it is particularly important to explore how far its version of task reality conforms with the views of the target users; thirdly, navigatability is important, i.e., the computer system needs status indicators to show the user where they are, what the system is doing and constantly available lists of options are needed to show the user what is possible from that point; and finally, the user needs to know what the system is doing in respect of the task and this needs to be transparent to the user. The user, for example, needs to know when something has been filed, that a message has been read by a recipient, and so forth (Eason, 1988).

Usability aspects that are associated with the ease of use of the system can be evaluated by asking users to rate the operational characteristics of the system (e.g., the keyboard, log on procedures, data input, and so on). However, usability problems are usually associated with attempts to use specific facilities to achieve particular task purposes (Eason, 1988). It may therefore be appropriate to obtain a rating for each facility on the system. There are two main issues which can lead to an evaluation showing a system to be easier to use than it is. First, regular users have overcome most difficulties they experienced when first using the system. It is thus important to include users with the full range of system experience or to ask regular users to evaluate ease of use as they first experienced the system. Second, users tend to assess the system in terms of the facilities they use and ignore the rest. Hence, it is important to obtain responses from users who have made use of the full array of facilities (Eason, 1988).

In the present study, a wide variety of users were assessed thus controlling for users with a full range of system experience. The focus of the present study was not however to examine ease of use of specific facilities of systems (due to the wide range of users and facilities) but rather a general assessment of ease of use was made to cover all users and systems.

Ease of learning

From the above discussion on the system characteristics of task match and ease of use it is clear that a system provides a potential array of information facilities. If they are to have an impact upon the task performance of the organisation they must match the information needs of tasks as they occur. This requires that the user "operates" the system to achieve this match and in doing so the user may experience ease of use problems. A way to overcome these problems is to build up the user's knowledge and skills with respect to the system and its potential (Damodaran, 1986). This can be achieved by the "point of need" or user support facilities associated with the system, i.e., the sources of help and advice users can turn to when they are in the process of using the system (Eason, 1988). User support facilities include in-system support aids, training courses, computer manuals, liaison staff and local experts. These facilities are briefly discussed below.

In-system support refers to help screens, explanatory error messages, on-line manuals, demonstration routines and so on, which are all easily accessible at any time from the main screen. It provides a very supportive environment in which a user can learn about a facility before using it and at any point in its use can obtain more information. However, in-system support aids have not been found to be very useful as "you need help facilities to explain the help facilities." Often information systems designers report to the technical language they themselves use and this confuses the user (Eason, 1988).

Training courses are essential to ensure all users can cope adequately with the computer system. Training users in the operational use of new equipment is only part of the adaptation users need to make to take advantage of the computer system. Users may have to make emotional changes before they can make cognitive gains as they may feel threatened by the technology and fear they will not be able to cope. Users may also need to view their jobs differently, their tasks may be different and they will need to be able to decide which facilities of the system are to be used for which task purposes, and so on (Eason, 1988). Hence, training courses should not only teach users how to operate the computer but also how to deal with emotional changes that they experience. Regular or full-time users may need to attend a full training course whereas occasional users' training is usually limited to a short "familiarisation" session (Eason, 1988).

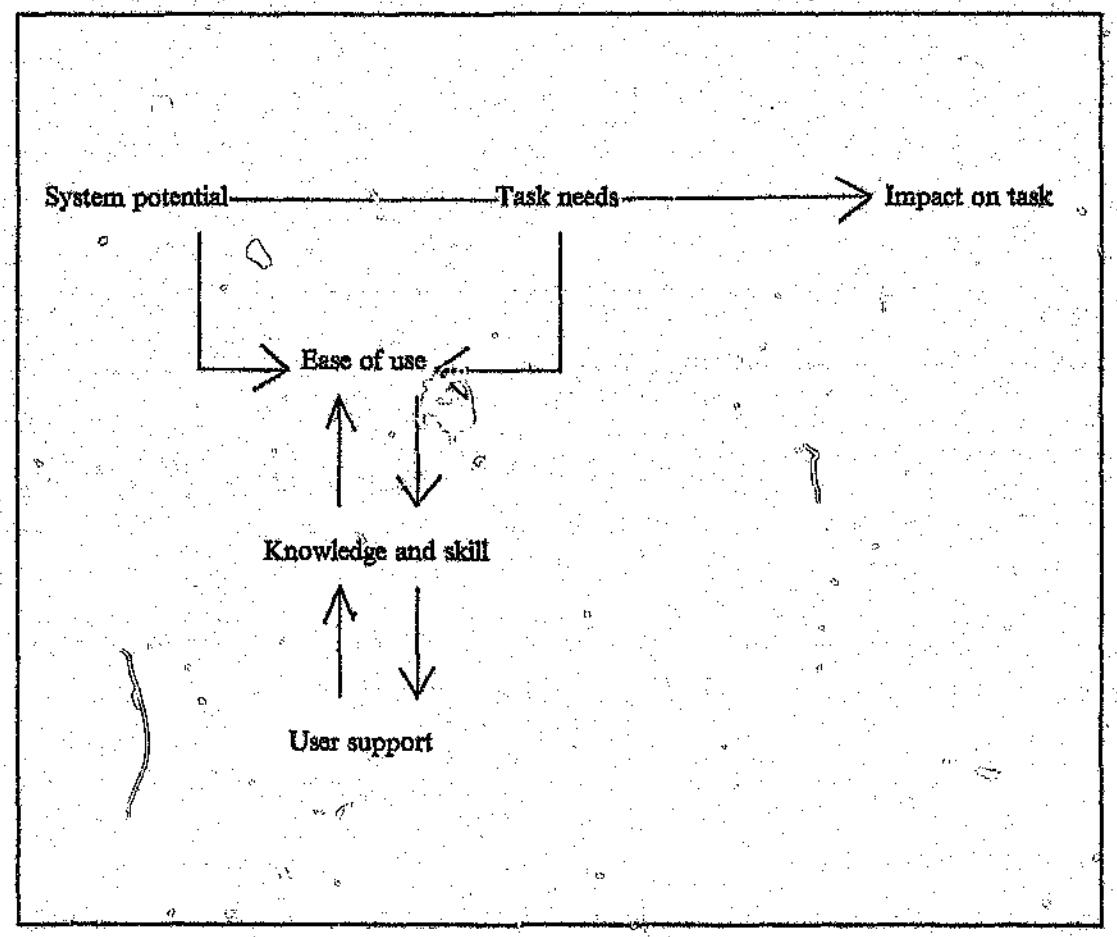
Computer manuals are other forms of documentation. Computer manuals are the most frequent formal method of providing "point of need" support but are not regarded as very useful (Damodaran, 1986). Manuals are usually described as formal technical accounts of the system that do not start from the user's problem and are often out of date (Damodaran, 1986). However, there are good reasons for good documentary support, i.e., it can be studied off-line and away from the system, and a paper-based document still provides the most flexible and easy to search medium for complex material (Eason, 1988). A system and its documentation can provide a supportive, learning environment for its users. However, although the system can explain itself, the purposes of its facilities, the way it operates, and so forth, the designer of user support aids does not know the particular circumstances of the user and the task that is being attempted. If the user's problem is that he or she does not know whether the system can assist his or her task, then he or she is unlikely to find the in-system facilities of direct assistance. In these circumstances users seek help

from their colleagues or the technical staff who support the system (Eason, 1988). In fact, the most popular forms of support are other people (Damodaran, 1986; Eason et al., 1987; Gerstberger & Allen, 1968). The general finding is that people search on a "least effort" principle (Zipf, 1965) and this usually means asking someone who may know the answer and who is easily accessible (Damodaran, 1986). The liaison staff (in-house technical specialists) allow users to discuss any problem they are experiencing with the system and relate it to the way the system operates (Eason, 1988). Although, the liaison staff may provide a very flexible form of support, it has been found that users do not turn to the official support staff or help but rather to a member of the user's immediate work group, i.e., the local expert (Damodaran, 1986). The local expert is knowledgeable, accessible and knows the task environment. However, the local expert's knowledge may not be very reliable and could lead his or her colleagues into bad habits and false beliefs. Further, local experts do not have an official responsibility to support their colleagues and might consider it a nuisance which impedes the performance of assigned tasks (Eason, 1988).

If user support is good, there should be fewer ease of use problems and users will be able effectively to exploit the potential of the system to support their tasks. If user support is weak, skills and knowledge are less likely to develop and the user may make more limited use of the system or may even concluded that it is too difficult to use and cease using it. Thus, user support facilities can be a powerful way of helping users obtain the best possible match between their needs and the potential of the system (Damodaran, 1986). Figure 12, represents the conceptual structure of the system characteristics concepts. Thus, the provision of an acceptable and usable form of human-computer interaction is dependent upon flexible and powerful systems characterised by ease of use and well developed ease of learning facilities (Bjorn-Andersen, Eason & Robey, 1986).

The ease with which a system can be learnt is a combination of the ease of use of its operating procedures and the adequacy of the user support facilities which are there to facilitate learning. It is thus possible to seek ratings of the various forms of user support facilities available (Eason, 1988). However, a problem of user support evaluations is that a user may make little or no use of some forms of help and are therefore only able to offer an evaluation of some (but not all) facilities based on real experience (Eason, 1988). Hence, in the present study ease of learning was not assessed by making explicit inquiry into the various facilities available but was measured

Figure 12. Conceptual structure of system characteristics (Damodaran, 1986)



generally. Further, since a wide range of users were used it was assumed that their responses sufficiently covered the ease of learning issue.

Since the present study dealt with the human-computer interaction it was essential that user-task-system characteristics be considered in order to assess attitudes toward working with computers. Moreover, a user's attitude toward working with computers is largely established by his or her job design (Eason, 1988). Hence, it was deemed necessary that job design factors be considered in the present study. At this juncture, it was deemed appropriate that the concept of job design be discussed.

JOB DESIGN

Davis and Canter (1955, p.3) define job design as "the organisation of a job to satisfy the technical-organisational requirements of the work to be accomplished and the human requirements of the person performing the work." Davis and Canter (1955) further note that the process of job design is accomplished by carrying out the following three activities. First, specifying the content of individual tasks; second, specifying the method of performing each task including the machinery and tools used and any special techniques; and third, combining individual tasks into specific jobs. The first and third activities determine the content of the job while the second indicates how the job is to be performed (Davis & Canter, 1955).

The development of a theory concerned with the analysis and design of interacting technological and social systems has furthered the examination of questions of organisation and job design in complex environments (Davis, 1979). Louis Davis and the Tavistock Institute developed the "socio-technical system" approach to job design (Bolweg, 1976). Davis (1957) states that a job design theory can best be conceptualised in a three-dimensional framework, i.e., an organisational, technical and personal framework. The organisational dimension includes factors involved in the structure of the organisation, e.g., communication and coordination systems, policies of delegation of authority and responsibility, management operational practices and policies, and so on. The technical dimension includes factors involved in the production process such as inspection and control systems, work methods, work performance standards, tool, equipment and product design,

and so forth. The personal dimension includes such personal behaviour influencing factors as personal and group motivation and attitudes, personality characteristics, identification with and perception of the organisation, aspirations and rewards, and so on. Davis (1957) refers to this framework as the "job-centered" approach to job design. The job-centered approach is thus concerned with satisfying the needs of the organisation, the technical process and the individual employee in order to maximise productivity. This approach is based on the hypothesis that there is an organisation-worker-job interaction and thus a job cannot be designed independently of the organisation, worker and process variables. Changing any of these job design variables in isolation from the others may cause a decrease in productivity. Further, consideration of effects stemming from the interaction among the variables is necessary (Davis, 1957; Davis & Canter, 1955). Hence, Davis (1957) concludes by noting that the area of job design is complex and multi-dimensional involving organisational, technical and personal dimensions.

Several studies carried out by the Tavistock Institute showed clearly that the introduction of technical change without due regard to the social implications resulted in a failure to realise the expected improvements in organisational performance (Trist & Bamforth, 1951). In studies conducted by Trist and Bamforth (1951) and Rice (1958) the interdependence between the technical organisation of work and the social patterns of the workforce was clearly shown. In both studies the introduction of new technology was unsuccessful because there was no "fit" between the technical and social subsystems. Further, in both studies the classical paradigm of industrial job design, i.e., "one man - one job" was broken up by the assignment of a number of tasks to a group of workers. The basic principle which emerged from these studies was that a one-sided optimisation of the technical system will result in less than optimum performance because of the neglect of the social system and joint optimisation of the two systems will lead to more optimum performance (Bolweg, 1976).

Hence, the socio-technical systems theory rests on two essential premises. First, in any organisation in which individuals are required to perform organisational activities there is a joint system operating, a socio-technical system. When work is to be done and when individuals are the required actors in the performance of this work then the desired output is achieved through the actions of a social system and a technological system (Davis, 1979). These two systems must be separated from one another, initially, to determine the requirements of each. Once the requirements have

been ascertained the socio-technical system process proceeds by recombining the variables in each system in such a way that the two systems are ultimately jointly optimised (Hirschheim, 1985). Thus, the concept of joint optimisation is proposed which states that it is impossible to optimise jointly the correlative independent social and technical systems (Davis, 1979). Second, a socio-technical system is embedded in an environment that is influenced by culture, values, generally acceptable practices and permits certain roles for organisations, groups and individuals in it (Davis, 1979). The emphasis on environmental forces suggest that socio-technical systems fall within a larger body of "open systems" theories, i.e., there is a constant interchange between what goes on in an organisation and what goes on in the environment; the boundaries between the environment and the system are highly permeable and what goes on outside affects what goes on inside (Davis & Trist, 1979).

Furthermore, attitudes of employees are not only decided by external rewards and sanctions but also by certain intrinsic characteristics of the tasks. Hence, empirical evidence suggests that employees prefer tasks of a substantial degree of wholeness and where the individual has control over the materials and the processes involved (Emery, 1959). These requirements have been translated into a set of psychological job requirements. These psychological job requirements are first, the need for the content of a job to be reasonably demanding or challenging in terms other than sheer endurance and to provide a minimum of variety (not necessarily novelty); second, the need to be able to learn on the job and to go on learning; third, the need for some minimal area of decision-making that the individual can call his or her own; fourth, the need for some minimal degree of social support and recognition in the workplace; fifth, the need for the individual to be able to relate what he or she does and what he or she produces to his or her social life; and finally, the need to feel that the job leads to some sort of desirable future (Bailey, 1983). The psychological job requirements represent a minimal set of criteria according to which one could design and evaluate jobs in technological settings (Thorsrud, 1973). It is assumed that by meeting the six requirements the individual will be better motivated and will take initiative where necessary and the total organisational functioning will be improved (Bolweg, 1976). In the present study, job design factors were assessed according to the above six psychological job requirements.

As mentioned previously, a user's attitude toward working with computers is largely established by his or her job design (Eason, 1988). A job may be defined as a collection of tasks and some users have jobs which are almost wholly composed of computer-related tasks. For other users the computer system is a minor component of the total job (e.g., the managing director). The proportion of the job which is devoted to tasks for which the computer is used has important consequences for the attitudes of the user and hence for the design of acceptable systems (Eason & Damodaran, 1981). For example, consider the attitude of a user whose job is peripheral to the computer system. The user will regard the computer system as one of the many tools he or she uses to do his or her job. The user's main concern will be that the system serves his task needs well and that it demands less from him in terms of effort and time than other ways of accomplishing his task. If this is so he can devote his energies to pursuing tasks which he considers to be of central relevance to his job and which, for him, answer his psychological needs for interesting, rewarding and satisfying work. The use of the computer is unlikely to be a major source of satisfaction or dissatisfaction at work and thus unlikely to affect the user's attitude toward the computer (Eason & Damodaran, 1981). However, for a user who is in permanent contact with the computer system, the system is an important part of working life and as such it becomes involved in the person's efforts to meet his psychological needs in the work situation. In short, the person for whom there is a strong job-system identification is likely to treat the computer as an important source of satisfaction or dissatisfaction at work and thus likely to affect the user's attitude toward the computer (Eason & Damodaran, 1981). Job factors are thus important determinants of user responses to the computer as they define the task and therefore the task needs placed on the system (Eason & Damodaran, 1981). However, previous studies have not taken into account users' job characteristics.

Summary of chapter

Attitudes toward working with computers refers to feelings or thoughts of like or dislike, approval or disapproval and so forth, toward a data processing machine which an individual interacts with in order to perform his or her task. Although previous studies have been conducted on attitudes toward computers and attitudes toward working with computers they have the following shortcomings.

Firstly, the instruments used to measure attitudes toward working with computers are extremely superficial and do not capture the essence of actually interacting with a computer at work. Also, the three components that constitute an attitude are poorly dealt with by the scales used in previous studies. Secondly, since we are dealing with the human-computer interaction, user, task and system characteristics are essential to consider in order to have a clear understanding of the functioning of this interaction. However, past research findings are based on broad operationalisations of users experience and involvement, and task and system characteristics have not been taken into account. Previous research has also neglected the fact that job design factors largely establish a user's attitude toward working with computers. Finally, past experience with a computer is an intervening variable that may have an effect on attitudes toward working with computers however, this is not considered in past studies. Taking the above shortcomings into consideration the aim of the present study was to explore the attitude differences of computer users with different levels of experience and involvement; taking into account their task, system and job characteristics. Users' past experience with computers were also considered. In order to conduct the present research, a checklist needed to be developed to assess user-system-task characteristics and job design factors, and a scale to assess attitudes toward working with computers needed to be developed and validated.

CHAPTER 4

RATIONALE AND PROCEDURE

From the theory and research reviewed in the first three chapters of this dissertation, it is clear that past studies in the area 'attitudes toward computers' (e.g., Coovert & Goldstein, 1980; Lee, 1970; Zoltan & Chapanis, 1982) and 'attitudes toward working computers' (e.g., Igbaria & Parasuraman, 1989, Rafaeli, 1986) have focused on general attitudes toward computers and not specifically on attitudes toward working with computers. That is, the behaviour of actually interacting with a computer has not always been assessed. Thus, the present study aimed to assess how employees' feel towards using or interacting with computers in order to perform their work or some aspect of their work.

Although many different definitions of an attitude exist, the present study attitude was defined according to the three component or tripartite theory. This theory was deemed appropriate for the present study, as previous studies which have attempted to measure attitudes toward computers and attitudes toward working with computers have mainly used the three component theory to assess attitudes.

Lee (1970) and Coovert and Goldstein (1980) postulated a general structure of attitudes toward computers. This structure was later confirmed by Zoltan and Chapanis's (1982) findings. As will be recalled from Chapter 3 (Attitudes toward working with computers), examination of the scale items used by the above mentioned researchers makes it clear that such a structure is questionable due to the inadequacy of the scale items. Further, attitudes toward computers as opposed to attitudes toward working with computers were assessed. As a result, a number of researchers attempted to develop a scale to measure the specific context of working with a computer (e.g., Igbaria & Chakrabarti, 1990; Rafaeli, 1986). However, these scales possess superficial items which do not capture the essence of actually interacting with a computer at work, and the three components that constitute an attitude are either vaguely dealt with or only one of the three components have been assessed. For the present study, it was thus deemed necessary that an appropriate scale which assesses specifically attitudes toward working with computers be developed. The scale was based on the three component theory of attitudes thus incorporating indices of all three attitude components.

Since the present study dealt with the human interacting with a computer to perform his or her work or some aspect of their work, it was concerned with the human-computer interaction. Eason's (1984) causal framework of usability was deemed an appropriate framework for the present study, as usability of a computer system is seen as a product of the interaction of three variables: the system, the user and the task. As will be remembered from Chapter 3 (Attitudes toward working with computers) under the section 'The Human-computer interaction', the interaction of the three variables determines the user's response to each session of use, known as a task episode. Over a number of task episodes there develops a pattern of responses which indicate more or less usability. The user's attitude is the result of a cost/benefit assessment where a negative assessment is accompanied by negative attitudes toward the computer system and results in restricted use in the form of non-use, partial use or distant use; and a positive assessment is accompanied by positive attitudes toward the system and results in a good task-system match and continued use of a system (Eason, 1984). The present study's concern was to examine user's attitudes toward working with computers, and as a result only user-task-system combinations and user's attitudes were assessed. The consequences of the positive and negative attitudes (i.e., good task-system match and restricted use) were not measured in the present study.

Thus, it is logical following Eason's (1984) casual framework of usability that user, task and system characteristics be considered. Eason (1984) notes that much is known about system characteristics but little is known about the shaping effects of user and task variables. These variables are important to consider in order to fit computer systems to users rather than hope that users will fit themselves to the system (Eason, 1984). However, previous studies considerations of user characteristics are based on poor definitions and broad operationalisations of experience and involvement. Hence, in order to overcome this shortcoming of previous studies, the present study considered both the depth and breadth of a user's experience and involvement, i.e., length of use, frequency of use, duration of use, repetitive quality of use and depth of use were measured (Fisher & Kaplan, 1990).

Further, computer users' task and system characteristics have not been assessed in previous research. The present study thus deemed it necessary that task and system characteristics be considered in order to have a clear understanding of the human-computer interaction. Following Eason's (1984) causal framework of usability the present study assessed task characteristics with regards to

task structure or openness and frequency. Eason and Damodaran (1981) also note information as an important characteristic of tasks therefore information was also considered. System characteristics were too be assessed by Eason's (1984) causal framework variables, i.e., of ease of use, ease of learning and task match.

Furthermore, a user's attitude toward working with a computer is largely established by his or her job design (Eason, 1988) however past studies have not considered job design factors. The present study thus considered the effects of job design factors on users' attitudes toward working with computers. Job design was examined from a socio-technical approach as the emphasis laid in satisfying the user's psychological needs in terms of discretion, interesting and rewarding work, and so on. The six socio-technical design principles suggested by Davis (1979), as described in Chapter 3 (Attitudes toward working with computers) under the heading 'Job design', were considered in the present study in order to assess job design factors.

Finally, previous research has demonstrated the effects of various intervening variables on attitudes toward computers (e.g., Coovert & Goldstein, 1980; Dambrot et al., 1985; Gilroy & Desai, 1986; Howard & Smith, 1986; Igbaria & Chakrabarti, 1990; Igbaria & Parasuraman, 1989; Parasuraman & Igbaria, 1990; Rafaeli, 1986). Most of these intervening variables have been demographic factors such as gender, age, education, and so forth. An intervening variable which may influence attitudes toward working with computers is an individual's past experience with computers. Fishbein and Ajzen (1975) note that past experience and attitudes can mutually influence one another. Both attitudes and past experience can influence subsequent behaviour, i.e., to use or not to use a computer (Fishbein & Ajzen, 1975). However, previous research has not considered the effect of past experience on attitudes toward working with computers. Hence, the present study considered the effects of past experience on an individual's attitude toward working with computers.

Thus, from the above discussion it is evident that previous research on attitudes toward computers and attitudes toward working with computers used inadequate measuring instruments to measure attitudes toward working with computers, did not fully consider user-system-job characteristics and did not take into account users' past experience. Hence, at this stage the broad aims of the present study need to be stated.

AIMS OF THE PRESENT STUDY

The present study had two broad aims: Firstly, to assess the overall attitude toward working with computers of computer users who differ according to their experience and involvement with computers, their tasks and system characteristics, and their psychological needs; and secondly, to assess differences toward working with computers at each attitude component of computer users who differ according to their experience and involvement with computers, their task and system characteristics, and their psychological needs.

Since the general aims of the study have been outlined, it becomes appropriate to consider the manner in which the measuring instruments were designed to achieve these aims and the procedure of the present study in greater detail.

DEVELOPMENT OF THE MEASURING INSTRUMENTS

Questionnaires of the relevant scales were compiled and once permission had been granted, they were distributed to employees of a banking institution to complete. A covering letter was attached to the questionnaire setting out the purpose of the study and ensuring subjects of their confidentiality (See Appendix 1). In order to ensure confidentiality, subjects were not required to state their names on the questionnaire or provide any other information which might lead to their identification. Subjects were also assured that their responses would be treated in the strictest of confidence and were asked to complete the questionnaire as openly and honestly as possible. In the event of any questions about the research, a contact number was provided so that respondents had access to the researcher. Instructions to the respondents were uniform and confined to the way an answer should be recorded and to procedural directions. The questionnaires consisted of three distinct sections. The first section contained a number of demographic questions which the subjects were required to answer. Only respondents' age, gender, education and tenure were asked of them. Because past experience may effect an individual's attitude toward working with computers (Fishbein & Ajzen, 1975), past experience was included as a variable in the biographical blank (Appendix 2, indicates the biographical questions). The biographical information did not form part of the research aim but was useful in the post hoc analysis.

Once the demographic questions had been completed, the subjects were asked to continue with the following section of the questionnaire which consisted of the checklist items which assessed user, task, system and job characteristics. The checklist items were designed specifically for the purpose of the present study and thus need to be discussed in their own right.

Development of the checklist

Checklists contain items which the respondent understands and which briefly and succinctly express his or her views (Oppenheim, 1966). In the present study, a checklist was developed to classify users into distinct categories according to their experience and involvement with computers, their tasks, system and job characteristics.

In order to assess users' experience and involvement, questions were developed to incorporate the salient issues identified by Fisher and Kaplan (1991), as discussed in Chapter 3 (Attitudes toward working with computers) under the section 'User characteristics.' That is, questions were generated to evaluate the following dimensions of computer experience and involvement: length of use, frequency of use, duration of use, repetitive quality of use, breadth of use and depth of use. With regards to task characteristics, questions were formulated to assess the prominent issues pointed out by Eason (1980) and Eason and Damodaran (1981). In other words, task characteristics were examined by items relating to how often a particular task is performed by the individual (task frequency), the ordering of tasks along the structured-unstructured continuum (task structure) and whether the relevant information that is needed to complete the task(s) is freely available to the individual (information). To evaluate system characteristics, questions were developed to incorporate Eason's (1984) ease of use, ease of learning and task match variables. As discussed in Chapter 3 (Attitudes toward working with computers), system characteristics in the present study were not examined by using explicit dimensions of particular systems but rather a general assessment of these characteristics were made in order to cover the vast range of users and systems. Finally, job characteristics were evaluated from a socio-technical approach to job design. The items formulated to examine job design factors were based on the six psychological job requirements. Hence, items generated included issues relating to meaningfulness, variety, learning, decision-making and recognition. Once the questions had been formulated, a 5-point Likert scale was at-

tached to the questions. The 5-point scale was scored from 1 for strongly disagree to 5 for strongly agree.

Once the checklist was designed, it needed to be piloted as pilot work helps in devising the actual wording of questions, ensures that the terms used are like those the respondents use themselves and that they have roughly similar meanings to most of them (Oppenheim, 1966). The checklist items were piloted on a sample of 16 people who used a computer to perform their job or some aspect of their jobs. Respondents were employed in the banking sector (n = 5), steel industry (n = 8) and at the university (n = 3). The sample consisted of 4 males and 12 females who had an average age of M = 33. Forty-four percent had matriculated, the average tenure was reported at M = 4 months and an average past experience of M = 4 months was found for the pilot sample. Subjects were simply required to state their agreement or disagreement with each of the statements on a 5-point scale and to mark any item which they had difficulty understanding. No respondents had difficulty answering and understanding the items. As a result of the pilot study, no item of the checklist needed to be reworded. Strictly speaking, all one knows is that a given respondent has placed checks in certain columns, why he or she has done so is a matter of interpretation. It depends on what the researcher needs to find out (Oppenheim, 1966). For the purpose of this study, the researcher needed to assess user, task, system and job characteristics. Hence, the discrete, non-overlapping categories (user-system-job combinations) were determined by the checklist items for the present study. Appendix 3, indicates the checklist items generated for the present study.

The final section of the questionnaire which the subjects were required to complete, consisted of questions pertaining to attitudes toward working with computers. These questions too were developed for the purpose of the present study and thus need to be discussed.

Development of the Attitudes toward working with computers scale

In the present study, the development of the attitudes toward working with computers scale was based on the three component theory, i.e., attitudes are composed of three components: the cognitive, affective and behavioural (as discussed in Chapter 2 (Attitudes and attitude measurement)). To generate the initial item pool for the attitude scale, a literature survey was undertaken and pre-

vious scales used to measure attitudes toward working with computers were identified and examined (Igbari. & Chakrabarti, 1990; Igbaria & Parasuraman, 1989; Rafaeli, 1986). The items of each of these scales were found to be unacceptable in assessing attitudes toward working with computers. Criticisms labelled against these scales have already been discussed in Chapter 3 (Attitudes toward working with computers). Further, the way in which these scales had been developed were also considered. As will be recalled from Chapter 3 (Attitudes toward working with computers), Rafaeli (1986) developed his scale by brainstorming twenty potential items to measure attitudes toward working with computers. Items were administered to a pre-test sample of 75 white collar employees and a component analysis was performed on the responses to the twenty items. Igbaria and Parasuraman (1989) constructed their scale by adapting some items from prior research (Howard, 1986; Howard & Smith, 1986; Raub, 1981; Reece & Gable, 1982; Swanson, 1982) and generated some new items to capture issues salient to the use of microcomputers in organisations. Both Rafaeli (1986) and Igbaria and Parasuraman (1989) do not appear to have investigated or scanned the field of attitudes toward computers and attitudes toward working with computers thoroughly before developing their scales.

In the present study, since only a few scales have been developed to assess attitudes toward working with computers and since Igbaria and Parasuramen (1989) based their scales on items from previous general attitudes toward computers scales, it was deemed necessary that these general attitude scales should also be considered. On examination of these scales (Bandalos & Benson, 1990; Bannon, Marshall & Fluegad, 1985; Dambrot et al. 1985; Hatcher & Diebert, 1987; Igbaria & Chakrabarti, 1990; Kerber, 1983; Koslowsky, Lazar & Hoffman, 1988; Lee, 1987; Popovich, Hyde, Zakrajsrek & Blumer, 1987; Rafaeli, 1986; Reece & Gable, 1982; Robey, 1979; Smith, 1981; Wagman, 1983; Williams, Coulombe & Lievrouw, 1983; Zakrajsrek, Waters, Popovich, Craft & Hampton, 1990; Zoltan & Chapanis, 1982) it was found that the following scales had a number of common themes or dimensions. The dimensions are as follows:

Computers are too time consuming (Dambrot et al., 1985; Hatcher & Diebert, 1987; Igbaria & Chakrabarti, 1990; Popovich et al., 1987), enjoy learning about computers (Bandalos & Benson, 1990; Hatcher & Diebert, 1987; Popovich et al., 1987; Rafaeli, 1986; Zoltan & Chapanis, 1990), computers are intimidating and threatening (Bandalos & Benson, 1990; Dambrot et al., 1985; Lee,

1970; Wagman, 1983), computers make mistakes (Bannon et al., 1985; Dambrot et al., 1985; Lee, 1970), computers complicate work (Dambrot et al., 1985; Smith, 1981), computers should be used as much as possible (Bandalos & Benson, 1990; Hatcher & Diebert, 1987; Smith, 1981), computers make better decisions (Igbaria & Chakrabarti, 1990; Lee, 1970), computer courses should be taught in schools (Smith, 1981; Zoltan & Chapanis, 1982), computers handle or simplify complex problems (Smith, 1981; Wagman, 1983; Zoltan & Chapanis, 1982), computers control or run our lives (Dambrot et al., 1985; Lee, 1970; Popovich et al., 1987; Smith, 1981), there is no limit to what computers can do (Lee, 1970; Zoltan & Chapanis, 1982), computers are trustworthy, secure, fascinating, accurate, amazing, fast and exciting (Dambrot et al., 1985; Lee, 1970; Smith, 1981; Wagman, 1983), computers improve productivity (Igbaria & Chakrabarti, 1990; Rafaeli, 1986), computers create unemployment (Bannon et al., 1985; Hatcher & Diebert, 1987; Lee, 1970; Rafaeli, 1986; Smith, 1981), computers are smarter and more intelligent than people (Lee, 1970; Smith, 1981; Wagman, 1983; Zoltan & Chapanis, 1982), computers allow one to be creative and imaginative (Igbaria & Chakrabarti, 1990; Lee, 1970), and computers devalue people's worth (Lee, 1970; Smith, 1982; Wagman, 1983).

The manner in which the above dimensions were used in previous scales however reflected only the affective component. For example, "Would not feel comfortable using a computer instead of a telephone or a letter" (Rafaeli, 1986), "Using a microcomputer improves my productivity on the job" (Igbaria & Chakrabarti, 1990), "The use of microcomputers will cause people to lose jobs" (Hatcher & Diebert, 1987), "I think that computers and other technological advances have helped to improve our lives" (Bannon et al., 1985) and "I don't understand how some people can spend so much time working with computers and seem to enjoy it" (Bandalos & Benson, 1990). Thus, it was clear that the cognitive and behavioural attitude components had rarely been assessed at all in previous attitudes toward computers scales. In order to develop the attitude scale for the present study, an exemplar item for each of the above dimensions was formulated. Once the exemplar item was formulated, three statements (one on each of the three components of an attitude) were developed for each exemplar. For the purpose of the present study, the three attitude components, as stated in Chapter 2 (Attitudes an attitude measurement), were taken to represent the following: cognitive referred to an individual's knowledge of computers; affective denoted an individual's feelings or emotional reactions towards working with computers; and behavioural referred to an

individual's behaviour or action towards computers. By developing the attitude scale in such a manner, it was hoped that it would be possible to assess an individual's overall attitude toward working with computers, as well as the individual's cognitive, affective and behavioural attitude components toward working with computers. Although the method used in the present study to develop the attitude scale was unusual, the interest lied in the comparative assessments between groups to seek differences of attitude components.

Subjects were required to state their agreement or disagreement with each of these statements on a 5-point Likert scale. A 5-point Likert scale was used as, as previously mentioned in Chapter 2 (Attitudes and attitude measurement) under the heading 'Likert scale method of summated ratings', it is easy to construct, provides information about respondents direction and degree of agreement and disagreement, is easy for respondents to complete and is the most widely used in previous studies on attitudes toward computers and attitudes toward working with computers. Since the present study dealt with positive and negative attitudes toward working with computers, the 5-point scale was scored from -2 for strongly disagree to 2 for strongly agree. Given the attempt to isolate the three components of an attitude, the design of questions should lead itself to three contributing subscales. Thus, scores for the items on each dimension were added to represent the subject's overall attitude toward working with computers and the sum of items of each component represented the subject's total score for that particular attitude component. Appendix 4, indicates the questions developed to assess attitudes toward working with computers.

In order for the attitudes toward working with computers scale to be considered a psychometrically acceptable measuring instrument, the reliability and validity of the scale was established on the pilot sample. Reliability of a measuring instrument refers to the accuracy, stability, precision and consistency of the measure (Kerlinger, 1981). Validity refers to the extent to which the measuring instrument measures what it was designed to measure (Oppenheim, 1966). It determines what can be inferred from test scores (Anastasi, 1982). In the present study, the following techniques were used to assess the reliability and validity of the attitudes toward working with computers scale on the pilot sample.

Internal consistency

Internal consistency measures the degree of homogeneity of test items (Ghiselli, Campbell & Zedeck, 1981) and is established by examining the consistency of the responses to all items in a scale. Since a 5-point Likert scale was utilised in the present study, Cronbach's alpha coefficient was used to assess internal consistency. An alpha coefficient of above 0.60 is taken to indicate a satisfactory internal reliability (Carmines & Zeller, 1979). Consequently, 0.60 was adopted as the minimum acceptance alpha level in the present study. Seeing that the pilot sample only consisted of sixteen respondents, it was deemed necessary that only the alpha coefficient for the overall attitude scale be assessed. The alpha coefficient for the overall attitudes toward working with computers scale was found to be 0.63, thus indicating that the scale was effectively operationalised.

Face validity

Face validity reflects the degree to which an instrument appears, on superficial inspection, to resemble the construct under consideration and is therefore considered as acceptable by respondents and users (Cook, Hepworth, Wall & Warr, 1981). If a scale's content appears irrelevant, inappropriate or childish it is likely that cooperation will be poor regardless of the actual validity of the test (Anastasi, 1982). Face validity is established by observing the responses of participants completing a scale in a test situation, and can be improved by merely reformulating test items that appear relevant and plausible in the particular setting in which they will be used (Anastasi, 1982). In the present study, the face validity of the attitudes toward working with computers scale was assessed by observing the pilot sample answering the questionnaires. Respondents were also asked to note the items that they had difficulty understanding. In this way, problematic items could be identified. By observing the respondents completing the attitude scale and based on their comments, the face validity of the attitudes toward working with computers scale was considered satisfactory.

Thus, from the results of the internal consistency measure and the face validation of the pilot sample, it may be concluded that the attitudes toward working with computers scale designed specifically for the purpose of the present study was found to be psychometrically sound.

Once the measuring instruments were designed, subjects needed to be tested. The subjects required for the present study and the procedure of the study are discussed in the following section.

Subjects

Since the focus of the present study was on assessing computer users' attitudes toward working with computers, only subjects who used a computer to perform their work or some aspect of their work were required. Subjects were chosen at random by the information systems manager, who included users from a variety of occupations ranging from managerial to skilled and semi-skilled. Of the 400 questionnaires distributed, 244 were returned representing a response rate of 61%. Eight responses were unusable (as questionnaires were incomplete) thus reducing the response rate to 59%. Hence, the data of 236 subjects was used in the final analysis in the present study. A number of demographic questions were asked in the first section of the questionnaire. The resulting sample comprised of 59% females and 41% males; with an average age of M = 30; 69% had matriculated and 24% had post-matric qualifications. The tenure ranged from 1 to 288 months with the average tenure reported at M = 46 months (i.e., 3 years and 10 months). Because past experience may effect an individual's attitude toward working with computers (Fishbein & Ajzen, 1975), past experience was included as a biographical variable. Past experience was found to range from 0 to 296 months with an average past experience of M = 46 months (i.e., 3 years and 10 months) reported for the sample.

Subjects were also required to complete the other two sections of the questionnaire. The results of their responses on the questionnaire are reported in Chapter 5 (Results).

Procedure

A banking institution agreed to permit access to its employees. The institution proved suitable for the present study due to its interest in computerisation and the vast number and range of computers utilised by its employees. The sample consisted of individuals who were randomly selected by the information systems manager. Questionnaires were only handed out to subjects who used a computer to perform their work or some aspect of their work. Although subjects were randomly chosen careful attention was given to ensure that questionnaires were given to a range of users, i.e., users

with varying levels of computer experience and involvement, who used computers to perform different tasks, who differed according to their system characteristics and psychological needs. As mentioned previously, a covering letter (see Appendix 1) was attached to the questionnaire setting out the purpose of the study and informing subjects that the organisation by whom they were employed would have no access to their responses on the questionnaire whatsoever and that their responses would only be used for research purposes. Further, subjects were not required to write their names on the questionnaire and were thus assured of anonymity.

Subjects were asked to complete the questionnaire as openly and honestly as possible. Subjects were given two days in which to complete the questionnaire and were then required to return it to the information systems manager. Once a fair amount of questionnaires had been returned, they were collected by the researcher. However, six weeks elapsed between questionnaire distribution and the time they were returned to the researcher. Questionnaires were scanned individually to assess if any questionnaires were incomplete or if any respondent had answered systematically. Of the 244 (N = 244) questionnaires, 236 (N = 236) were used in the statistical analysis. The remainder were discarded due to the fact that a large majority of the questions had not been completed. No questionnaire appeared to have been answered systematically. The statistical analysis of the questionnaires were divided into two distinct areas. Cluster analysis was conducted on the user, task, system and job characteristics questions, in order to separate users into distinct groups according to these characteristics. One-way analysis of variance (ANOVA) were then conducted to assess if the differing groups differed on their attitudes toward working with computers. Although ANOVA indicates that the means of the groups are unequal, it does not pinpoint where the differences lie. As a result, Scheffe's test were computed in order to assess between which groups of users differences in attitudes toward working with computers were occurring. The results obtained by the use of these statistical techniques are reported in Chapter 5 (Results).

Summary of chapter

From the relevant literature reviewed it was evident that past studies on attitudes toward working with computers used inadequate measuring scales to assess attitudes toward working with computers. Hence, the present study deemed it necessary that an adequate attitudes toward working

with computers scale be developed and validated. Furthermore, the present study was concerned with the human-computer interaction however previous studies within this field have not considered the fundamental elements of such an interaction. The present study, deemed it necessary that user-task-system characteristics be assessed in order to have a clear understanding of the human-computer interaction. As a result, a checklist was developed in order to assess these characteristics. Furthermore, job characteristics and past experience with a computer are intervening variables that may have an effect on attitudes toward working with computers, however, these have not been considered in past studies and were thus deemed essential to be assessed in the present study. Hence, the aim of the present study was to explore the attitude differences of computer users who differ according to their experience and involvement with computers, their tasks and system characteristics, and their psychological needs. Users' past experience with computers were also considered. Once the measuring instruments had been developed and validated, questionnaires consisting of the instruments were administered to employees of a banking institution to complete.

CHAPTER 5

RESULTS

Once the questionnaires had been collected, coded and rechecked to ascertain whether a coding error had been made, a number of statistical techniques were computed on the data in order to organise and reduce the data set. From the section dealing with the development of the measuring instruments in Chapter 4 (Rationale and procedure), it will be remembered that the questionnaire consisted of three major sections. The first section consisted of a number of demographic questions, the second section contained checklist items assessing user-system-job characteristics and the final section consisted of questions pertaining to attitudes toward working with computers.

In the present study, before any statistical techniques could be conducted on the data the reliability and validity of the measuring instruments needed to be assessed. The principles of psychological theory require that measuring instruments must embody two fundamental qualities: reliability and validity (Anastasi, 1982; Kerlinger, 1981). Meaningful interpretations about the nature of empirical data cannot be inferred unless the reliability and validity of the measuring instruments used are established (Kerlinger, 1981). In the present study, the checklist items did not need to be psychometrically assessed as these items do not represent a scale, i.e., checklist items are not additive. However, the attitude questions did represent a scale and thus the reliability and validity of the attitudes toward working with computers scale needed to be established.

In order to examine the psychological properties of the attitudes toward working with computers scale, internal reliability coefficients were calculated to assess the reliability and factor analysis was calculated to assess the validity of the scale. At this point is was deemed necessary that the results of the statistical techniques utilised to determine the psychometric properties of the scale be discussed.

INTERNAL CONSISTENCY

To assess whether the variable "attitudes toward working with computers" used in the present study was measured accurately, the internal consistency reliability coefficient was calculated for the scale. The internal consistency of the scale was established using Cronbach's alpha formula. As discussed previously from the section dealing with the reliability of the attitude scale for the pilot sample in Chapter 4 (Rationale and procedure) under the heading 'Internal consistency', an alpha of 0.60 and above indicates a satisfactory internal reliability for a particular scale (Carmines & Zeller, 1979). In the present study, the results of the internal consistency tests for the three attitude components and the overall attitude are presented in Table 1. As can be seen from Table 1, the internal consistencies for the affective and behavioural attitude components (α = 0.12 and α = 0.38 respectively) were below the cut-off point of 0.60 and were thus not satisfactory. The internal consistencies for the cognitive component (α = 0.88) and for the overall attitude (α = 0.81) are well above 0.60 and were thus deemed highly satisfactory.

In order to improve the internal consistencies of the affective and behavioural components, negative alpha's, inter-item correlations and communality estimates were examined. Any negatively loading alpha item found on the three subscales and the overall scale was eliminated. As a result, items A1, A6, A7, A8, A9, A11, A12 and A13 were eliminated from the affective component; items B1, B2, B8, B10 and B13 were deleted from the behavioural component; and items A2, A4 and B2 were dropped from the overall attitude scale. No items loaded negatively on the cognitive component and hence no item needed to be eliminated. Hence, from the negatively loading alpha items the following sixteen items were removed: A1, A2, A4, A6, A7, A8, A9, A11, A12, A13; B1, B2, B8, B10, B12 and B13. Further, inter-item correlations, using Pearson's correlation coefficients, were conducted on all attitude questions. If a correlation coefficient of 0.60 or higher was found between two items, one of the items was dropped from the variable set. A number of attitude questions were found to correlate with each other and on closer examination of the items the following five items B3, C3, C6, C8 and C13 were deleted from the variable set. Finally, any attitude item that was found to have a communality estimate (see section on Factor analysis, later in this chapter) of below 0.20 was also deleted from the variable set. Only three items (A10, B11 & C17) were

Table 1: Cronbach's alpha coefficients for the Attitudes toward working with computers scale

	Cronbach's alpha
Affective component	0.12
Behavioural component	0.38
Cognitive component	0.88
Overall attitude	0.81

Table 2: Cronbach's alpha coefficients for the reduced Attitudes toward working with computers scale

	Cronbach's alpha
Affective component	0.63
Behavioural component	0.73
Cognitive component	0.82
Overall attitude	0.89

reported as having communality estimates of below 0.20 (i.e., 0.11, 0.01 & 0.19 respectively) and were thus eliminated from the variable set.

Therefore, from the negatively loading alpha's, the inter-item correlations and the communality estimates the following 24 items were eliminated from the attitude scale: A1, A2, A4, A6, A7, A8, A9, A10, A11, A12, A13, B1, B2, B3, B8, B10, B11, B12, B13, C3, C6, C8, C13 and C17. With the elimination of the above items, the attitudes toward working with computers scale consisted of 27 items (6 items: A3, A5, A14, A15, A16 and A17 assessed the affective component; 9 items: B4, B5, B6, B7, B9, B14, B15, B16 and B17 the behavioural component; and 12 items: C1, C2, C4, C5, C7, C9, C10, C11, C12, C14, C15 and C16 the cognitive component). Alpha coefficients were computed for the three attitude components and the overall attitude scale once the above mentioned items were deleted. Satisfactory alpha coefficients were reported for the three components and the overall scale. Table 2, indicates the final alpha coefficients for each attitude component and the overall attitude scale.

Once the reliability of the attitudes toward working with computers scale had been assessed, the validity of the scale was examined using the statistical technique of factor analysis. Factor analysis was deemed the appropriate technique to use in the present study as it has been said to be a measure of the constitutive meaning of constructs or their construct validity (Kerlinger, 1973). Construct validity refers to the extent to which the instrument measures a theoretical construct or trait (Anastasi, 1982). It seeks the "meaning" of a construct through the relations between the construct and other constructs (Kerlinger, 1973). Thus in the present study, factor analysis was used to examine the number of factors underlying the attitudes toward working with computers scale and therefore assessed whether the scale confirms the three component theory of attitudes on which it is based. Hence, by conducting a factor analysis on the attitudes toward working with computers scale it was possible to assess the major controversy of the three component theory, i.e., whether the three components are interrelated or distinct entities. At this juncture, it was deemed necessary that factor analysis be discussed.

FACTOR ANALYSIS

Factor analysis is a generic term given to a class of multivariate statistical methods whose primary purpose is the reduction and summarisation of data from an initial multiplicity of test variables to a few common factors or traits (Anastasi, 1982). Factor analysis addresses the problems of analysing the interrelationships among a large number of variables (e.g., test scores, test items, questionnaire responses) and then explaining these in terms of their common underlying dimensions or factors (Hair, Anderson, Tatham & Grablowsky, 1979). The two main models of factor analysis are exploratory and confirmatory. Exploratory factor analysis is used as a means of exploring the underlying factor structure without prior specification of the number of factors and their loadings (Kim & Mueller, 1978). Confirmatory factor analysis, on the other hand, is used when specific expectations concerning the number of factors and their loadings are tested on the sample data (Kim & Mueller, 1978). In the present study, although a tripartite model consisting of three independent components was hypothesised to be consistent with the conceptual definition of an attitude, exploratory factor analysis was used to assess the number and nature of factors of the data. Exploratory factor analysis was the preferred choice in the present study as the aim was to assess whether the three attitude components, as defined by the tripartite model, would emerge from the data set.

In order to conduct the exploratory factor analysis, the principal factor method was used in the present study. The principal factor method extracts a maximum amount of variance as each factor is calculated (Kerlinger, 1973). That is, the first factor from the correlation matrix consists of that weighted combination of all the variables which will produce the highest squared correlations between the variables and the factor since the squared correlation is a measure of the variance accounted for (Gorsuch, 1974). The second factor is extracted so that it is uncorrelated with the first factor and maximises the amount of variance extracted from the residual matrix after the first factor has been removed. Each succeeding factor is extracted in like manner and results in a given number of factors accounting for as much of the variance as that number possibly could (Gorsuch, 1974). Therefore, the first factor extracts the most variance, the second the next most variance, and so on (Kerlinger, 1973). Principal factors is the simplest and computationally most efficient method of common factor analysis (SAS Manual, 1990). The packaged computer programme of SAS was

utilised in the present study and the "Factor" procedure was chosen. The factor procedure calculates partial correlations, Kaiser's measure of sampling adequacy, prior and final communality estimates, eigenvalues, a scree plot, the unrotated and rotated factor pattern, interfactor correlations, the reference structure, reference axis correlations, the factor structure, the variance explained by each factor both ignoring and eliminating other factors, and plots of both rotated and unrotated factors (SAS Manual, 1990).

In order to conduct a factor analysis five steps need to be considered. The first step involves collecting the relevant data that is to be analysed and the second step involves the intercorrelation of the items to form the covariance matrix (Kim & Mueller, 1978). Choosing the correct number of factors which adequately explain the covariances of the variables is the third step (Kim & Mueller, 1978; Loehlin, 1987). An exact quantitative basis for deciding the number of factors to extract has not been developed but a number of factor extraction rules have been put forward (Hair et al., 1979). These include the measure of sampling adequacy (MSA), communality estimates (h^2), the scree test and eigenvalues. The above mentioned factor extraction rules are discussed below.

Measure of sampling adequacy (MSA)

The measure of sampling adequacy (Cerny & Kaiser, 1977; Kaiser, 1970; Kaiser & Rice, 1974) is a summary of the relationship between the partial correlations and the ordinary correlations of the matrix. An MSA result of 0.80 or greater is considered good while MSA's less than 0.50 are unacceptable and require either deleting the offending variables or including other variables related to the offenders (SAS Manual, 1990). In the present study, any item with an MSA below 0.50 was deleted from the variable set. As can be seen in Table 3, only one item, item B11, had a MSA below 0.50 (i.e., 0.49) and was thus deleted from the variable set. No other item had an MSA below the unacceptability level of 0.50. Further, the overall MSA for the scale was highly satisfactory (0.87).

Table 3: Measure of sampling adequacy (MSA) for items on the Attitudes toward working with computers scale

Item	MSA	Item	MSA	Item	MSA
A3	0.95	B7	0.83	C5	0.91
A5	0.91	B9	0.70	C7	0.87
A10	0.72	B11	0.49	C9	0.63
A14	0.83	B14	0.91	C10	0.85
A15	0.86	B15	0.91	C11	0.88
A16	0.84	B16	0.88	C12	0.88
A17	0.59	B17	0.67	C14	0.83
B4	0.79	C1	0.91	C15	0.89
B5	0.91	C2	0.91	C16	0.89
B6	0.92	C4	0.91	C17	0.81

Overall MSA = 0.87

Communality estimate (h^2)

The essence of factor analysis is the study of the communality of the variable versus its uniqueness (Gorsuch, 1983). Communalities (h^2) are the sums of squares of the factor loadings for any given item (Cattell, 1952; Kerlinger, 1973). The communality of a variable is defined as that part of its variance that overlaps with the factors being extracted (Comrey, 1973). The extreme limits which communalities can take are 0.00 if the variable has no correlation with any other variable in the matrix and 1.00 if the variable is perfectly accounted for by the set of factors underlying the matrix (Gorsuch, 1974). A communality estimate greater than 0.20 is usually specified for retaining an item in the variable set (Cureton & D'Agistino, 1983). For the present study, all items with a communality estimate below 0.20 were eliminated from the variable set. As can be seen in Table 4, three items, items A10, B11 and C17, had a communality estimate lower than 0.20 (i.e., 0.11, 0.01 and 0.19 respectively) and were thus eliminated from the variable set. For each of the remaining items their communality estimates were satisfactory and as a result no further items needed to be eliminated.

Once the items have conformed to the minimum requirements of MSA and communality estimates, one needs to determine the number of factors to be extracted. The two extraction methods, the scree test and eigenvalues, discussed below were used in the present study.

Scree test

The scree test is used to "identify the optimum number of factors which can be extracted before the amount of unique variance starts to dominate the common variance structure" (Hair et al., 1979, p.37). The scree test is derived by plotting the eigenvalues against a number of factors in their order of extraction and the shape of the resulting point is used to evaluate the cutoff point (Hair et al., 1979). Since the principal factor method extracts factors by amount of variance, the substantial factors will be extracted first and the small trivial factors will be removed later (Gorsuch, 1974). The decision based on the number of factors to extract is the point where the eigenvalues begin to level off, forming a straight line with an almost horizontal slope (Kim & Mueller, 1978). Cattell (1965) describes the smooth slope as "factorial litter or scree" - where the term scree denotes the

Table 4: Communality estimates (h^2) for the items on the Attitudes toward working with computers scale

Item	h^2	Item	h^2	Item	h^2
A3	0.32	B7	0.46	C5	0.55
A5	0.29	B9	0.32	C7	0.37
A10	0.11	B11	0.91	C9	0.25
A14	0.26	B14	0.45	C10	0.30
A15	0.27	B15	0.57	C11	0.25
A16	0.33	B16	0.54	C12	0.24
A17	0.33	B17	0.23	C14	0.39
B4	0.20	C1	0.52	C15	0.56
B5	0.54	C2	0.39	C16	0.34
B6	0.52	C4	0.38	C17	0.19

debris which collects on the lower part of a rocky slope. Kaiser (1970) argues that the scree test is often subjective as it is not uncommon to find more than one major break in the root-graph and there is no unambiguous rule to use. On examining the scree plot of eigenvalues for the present study, which can be seen in Figure 13, the eigenvalues begin to level off forming a straight line with an almost horizontal slope after three factors. Hence for the purpose of the present study, three factors should be extracted.

Eigenvalues

Eigenvalues are obtained by extracting the factors within factor analysis (Gorsuch, 1974). Eigenvalues usually explain the uniqueness of the variable by determining how distinct each of the variables is from all the others. The most popular determinant of factor extraction is Kaiser's (1978) criterion, that is, the number of factors retained are those factors with an eigenvalue greater than unity. Consequently, Kaiser's (1978) criterion was utilised in the present study. From the results reported in Table 5, it can be seen that only three factors had an eigenvalue greater than one (i.e., 7.46, 1.64 and 1.43). Therefore, for the present study only three factors should be retained.

Thus, from the results of the MSA and communality estimates in the present study, items A10, B11 and C17 were eliminated from the variable set. Following the results from the scree test and the eigenvalues it was clear that a three factor solution for the variable items emerged.

The fourth stage of a factor analysis involves rotating the factors (Kim & Mueller, 1978). Hence, in the present study only three factors needed to be rotated. Hair et al.(1979) state that factor rotation is desirable as it firstly, improves interpretation by reducing some of the ambiguities which often accompany unrotated factor solutions; secondly, it simplifies the factor structure; and thirdly, it distributes the variance from earlier factors to later factors to achieve a more meaningful solution. During "rotation" the reference axes of the factors are simply turned about the origin until a simpler and more meaningful solution is reached; it does not change the statistical explanatory power of the factors (SAS Manual, 1990). There are a number of factor rotational methods with the two main types of rotations being "orthogonal" and "oblique" (Kerlinger, 1973). Orthogonal rotation is used when "the goal of the research is to reduce the number of original factors; regardless of how

Figure 13: Scree plot of eigenvalues

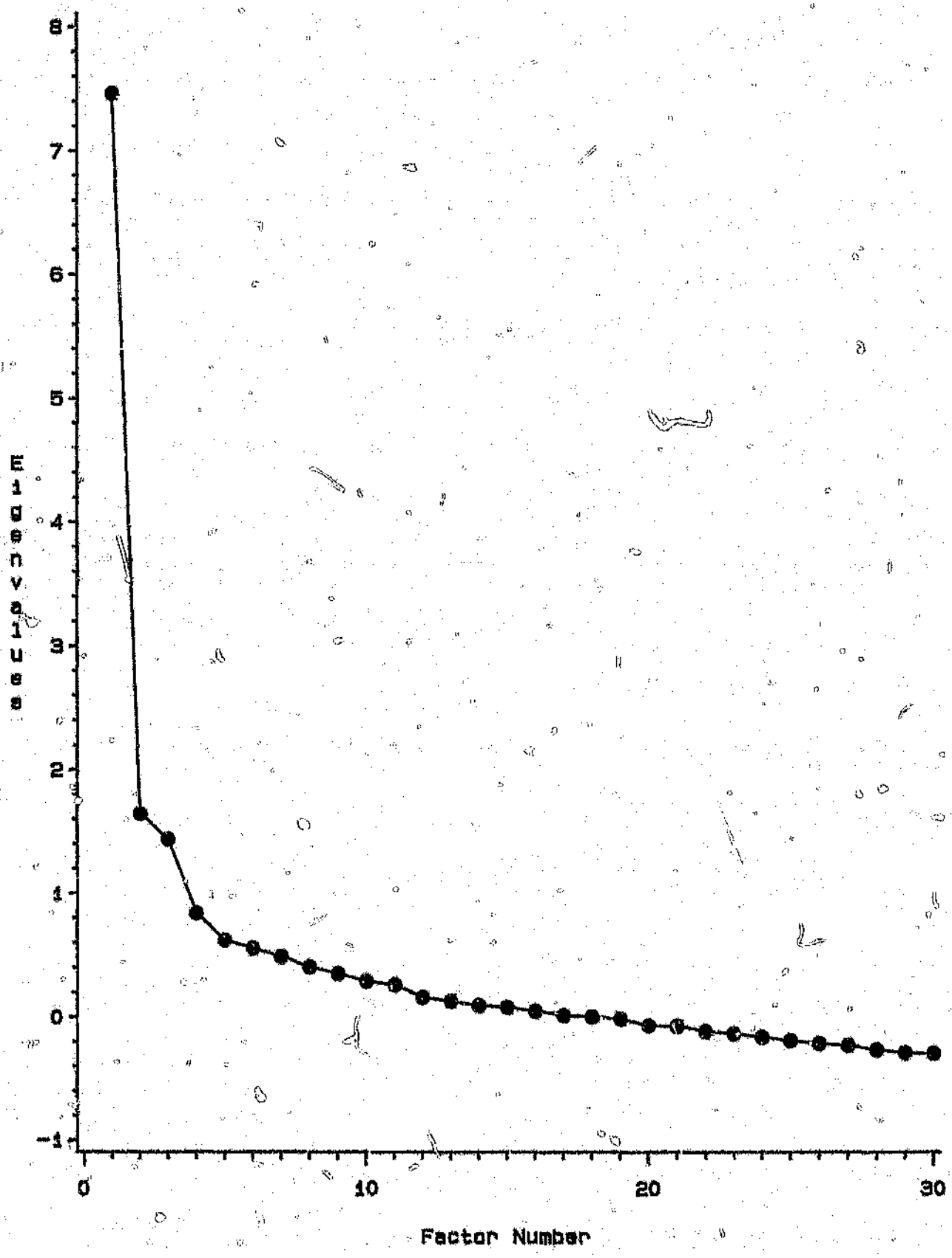


Table 5: Kaiser's eigenvalues for factors of the Attitudes toward working with computers scale

Number of factors	Eigenvalue	Number of factors	Eigenvalue	Number of factors	Eigenvalue
1	7.46	11	0.25	21	-0.08
2	1.64	12	0.15	22	-0.12
3	1.43	13	0.12	23	-0.14
4	0.83	14	0.09	24	-0.17
5	0.61	15	0.07	25	-0.19
6	0.55	16	0.04	26	-0.22
7	0.48	17	0.003	27	-0.24
8	0.39	18	-0.008	28	-0.27
9	0.34	19	-0.03	29	-0.29
10	0.28	20	-0.08	30	-0.30

meaningful factors may be" (Hair et al., 1979, p.32). In this rotation method the axes are maintained at 90 degrees and thus the factors will be uncorrelated. On the other hand, oblique rotation is used when the goal is to obtain several theoretically meaningful constructs (Hair et al., 1979). During rotation the axes are rotated but do not retain the 90 degrees between the reference axes thus producing correlated factors where the degree of correlation is related to the angle between the axes (axes form acute or obtuse angles). From a statistical point of view, one cannot say that any rotation is better than any other rotation. Thus, the choice among different rotations is not based on statistical grounds but rather the preferred rotation is that which is most easily interpretable (SAS Manual, 1990).

In the present study, the preferred technique of promax rotation was used. Promax rotation uses the orthogonal solution as a basis for creating an ideal oblique solution (Gorsuch, 1974). The rationale behind the promax rotation is that the orthogonal solutions are usually close to the oblique solution and by reducing the smaller loadings to near-zero loadings one obtains a reasonably good simple structure target matrix. By finding the best fitting oblique factors by the procrustes procedure (Gorsuch, 1974) for this target matrix, one obtains the desired oblique solution (Kim & Mueller, 1978). While promax can use any orthogonal rotation as a basis for the ideal solution either varimax or quartimax are the usual initial solution (Gorsuch, 1974). Varimax rotation was used in the present study.

Once the factors have been rotated, the final step in factor analysis is the interpretation of the factors. The purpose of the factor interpretation is to name the factor characterised by the variables that load on it (Gorsuch, 1983). For oblique rotations the pattern matrix does not however provide all the necessary information for interpreting the factors and it is necessary to examine the factor and reference structures too (SAS Manual, 1990). The factor structure is the matrix of correlations between variables and common factors (SAS Manual, 1990). The reference structure is the matrix of semipartial correlations (Kerlinger & Pedhazur, 1973) between variables and common factors, removing from each common factor the effects of other common factors (SAS Manual, 1990). When factors are correlated (as in the present study) the contribution of each variable to the interpretation will differ depending upon which of several factor matrices is examined (Gorsuch, 1974). Gorsuch (1974) states that the basic matrix for interpreting factors is the factor structure as by ex-

amining which variables correlate high with the factor and which correlate low it is possible to draw some conclusions as to the nature of the factor. Whereas the reference structure only reflects the distinctive relationship of the factor to the variable, a relationship which is statistically independent of any of the other factors in the analysis (Gorsuch, 1974). Further, factor structure interpretation has the following advantages: firstly, researchers are practised in interpreting correlation coefficients - coefficients have a limited range and researchers gain a feel for what practical importance each part of the range has; secondly, the correlation matrix shows the relationship of the variable to the full factor; thirdly, the correlation matrix gives the relationship of the variables to the factors even if the factors are taken out of a specific context - regardless of what other factors occur in another study, the variables should correlate at the same level with a particular factor (Gorsuch, 1974). Taking the above points into consideration, it was deemed appropriate that the factor structure as opposed to the reference structure be used to interpret the three factors in the present study.

In order to simplify the factor interpretation procedure, Hair et al. (1979) provide the following guidelines. First, examine the factor matrix and second, identify the salient loading (highest factor loading) for each variable on any factor. A salient loading is one which is sufficiently high to assume that a relationship exists between the factor and the variable and that the relationship is high enough so that the variable can aid in interpreting the factor (Gorsuch, 1974). There is no exact way to determine salient loadings used for interpreting factors and only rough guidelines are given; with the factor loading of +/- 0.30 as the minimum loading for interpretation (Gorsuch, 1974). As a result, a minimum loading of 0.30 for factor interpretation was utilised in the present study. Third, variables which do not "load" on any factor can either be ignored or critically evaluated. In the present study, all variables loaded on a factor and thus no variable needed to be ignored or critically evaluated. Fourth, once the factor solution has been obtained one assigns meaning to the pattern of factor loadings. A label is chosen for its appropriateness to represent the underlying dimensions of a particular factor, resulting in a label which represents each of the factors as accurately as possible.

Following Hair et al.'s (1979) factor interpretation guidelines, once the factor structure had been examined and the salient loadings for each variable had been identified, salient loadings for each

variable are presented in Table 6, the following interpretations and labels were assigned to the three factors in the present study.

The first factor accounted for 6,09% of the common variance and consisted of the 9 items shown in Table 7. The items loading on this factor indicated a willingness to use the computer as by using the computer tasks are performed quickly and accurately (items B16, C16 and C1), productivity increases (items A5 and C5), pace of work can be set (item C4) and mistakes made on the computer can be corrected (item C2). Consequently, it was decided to label this factor "Willingness to use a computer." Furthermore, on closer examination of the 9 items loading on factor 1, it was revealed that only one item (A5) assessed the affective attitude component, two items (B14 and B16) the behavioural component and the remaining six items (C1, C2, C4, C5, C14 and C16) assessed the cognitive attitude component. Hence, the majority of the items loading on factor 1 accounted for the cognitive component of an attitude.

The second factor appeared to reveal a user's knowledge and understanding of computer systems. It accounted for 5.15% of the common variance and included the 10 items depicted in Table 8. These items reflected a user's knowledge of computers (items B9, C9, C15, B15, B6 and A3), knowing how to further one's computer knowledge (items B7 and C7) and an understanding of the socio-economic implications (item C11) and limitations (item C10) of computers. As a result, it was deemed appropriate to label this factor "Knowledge and understanding of computers." Moreover, examining the attitude components of the items of this factor, it was found that only one item (A3) assessed the affective component, four items (B7, B9, B15 and B16) the behavioural component and five items (C7, C9, C10, C11 and C15) the cognitive component. Thus, the major portion of the items consisted of the behavioural and cognitive attitude components for the second factor.

Finally, the third factor accounted for 3,72% of the common variance and consisted of the 8 items shown in Table 9. The items loading on this factor showed specific attributes of computers, i.e., computers are smart (items A15, A17 and B17), fast and accurate (item A16), allow users to achieve more (item B5) and to work at a comfortable pace (item B4), and should thus be used as much as possible (item A14). Consequently, this factor was called "Computer attributes." Finally, the items loading on this factor revealed that four items (A14, A15, A16 and A17) assessed the

Table 6: Factor structure

Item	Factor 1	Factor 2	Factor 3
A3	0.44	0.51*	0.35
A5	0.53*	0.33	0.32
A14	0.35	0.24	0.47*
A15	0.32	0.37	0.47*
A16	0.30	0.28	0.60*
A17	0.01	0.02	0.51*
B4	0.37	0.17	0.39*
B5	0.53	0.45	0.69*
B6	0.49	0.65*	0.50
B7	0.30	0.63*	-0.02
B9	-0.02	0.44*	0.20
B14	0.65*	0.38	0.42
B15	0.60	0.70*	0.37
B16	0.70*	0.23	0.39
B17	0.13	0.04	0.44*
C1	0.71*	0.41	0.40
C2	0.63*	0.38	0.15
C4	0.57*	0.45	0.36
C5	0.64*	0.63	0.45
C7	0.38	0.59*	0.12
C9	-0.05	0.37*	0.14
C10	0.45	0.50*	0.15
C11	0.32	0.50*	0.22
C12	0.39	0.28	0.42*
C14	0.62*	0.25	0.14
C15	0.53	0.71*	0.20
C16	0.60*	0.22	0.18

* Highest factor loading for each item

Table 7: Items loading on the "Willingness to use a computer" factor

I usually perform my tasks quickly and accurately on the computer	B16
I usually know how to complete my tasks quickly and accurately on the computer	C16
I know the quickest way to complete my tasks on the computer	C1
Using the computer does increase my productivity at work	A5
I know how to use the computer to achieve more	C5
I understand how the system works and thus set my own pace of work	C4
When I make mistakes on the computer I know how to correct them	C2
I always know when to use the computer	C14
I use the computer as much as I can	B14

Key:

Attitude components

A = Affective component
B = Behavioural component
C = Cognitive component

Dimensions

1 = Time consuming
2 = Computers make mistakes
4 = Control
5 = Increase productivity
14 = Use as much as possible
16 = Faster and more accurate

Table 8: Items loading on the "Knowledge and understanding of computers" factor

I often rely on my formal training when using the computer	B9
My formal education provided me with a sound knowledge of computers	C9
I know how to simplify complex problems on the computer	C15
I often use the computer to simplify complex problems	B15
I often use the computer creatively to help me in my job	B6
Using the computer improves the quality of my decisions	A3
I often read about computers to further my knowledge of computers	B7
I know exactly what computer course to take to further my knowledge of computers	C7
I know the socio-economic implications of introducing computers at work	C11
I understand the limitations of computers	C10

Key:

Attitude components

A = Affective component
B = Behavioural component
C = Cognitive component

Dimensions

3 = Make better decisions
6 = More creative
7 = Enjoy learning about
9 = Computers should be taught at school
10 = Limitations
11 = Creates unemployment
15 = Simplify complex problems

Table 9: Items loading on the "Computer attributes" factor

The computer can simplify complex problems	A15
In general computers are smarter than people	B17
The computer does things that are cleverer than things I can do	A16
I feel computers are faster and more accurate than people	B5
When using a computer I usually work at a pace that is comfortable	B4
Computers should be used as much as possible	A14
I know that people and computers share the work that is done	C12

Key:

Attitude components

A = Affective component
B = Behavioural component
C = Cognitive component

Dimensions

4 = Control
5 = Increase productivity
12 = Devalues people's worth
14 = Use as much as possible
15 = Simplify complex problems
16 = Faster and more accurate
17 = More intelligent

affective attitude component, three items (B4, B5 and B17) the behavioural component and only one item (C12) assessed the cognitive attitude component. Therefore, 50% of the items loading on factor 3 accounted for the affective component of an attitude.

Thus, from the above interpretation of the factor structure (as the final step in factor analysis), it may be concluded that the three factors were labelled as follows. Factor 1 - Willingness to use a computer, Factor 2 - Knowledge and understanding of computers, and Factor 3 - Computer attributes. All three factors demonstrated items relating to the three attitude components thus each factor was underscored by the three components regardless of whether some factors accounted for more of a particular attitude component than other factors. Hence, the present study did not find three factors pertaining purely to the cognitive, affective and behavioural components. Furthermore, the internal reliability of each factor was calculated using Cronbach's alpha coefficient. As can be seen in Table 10, the three attitude factors and the overall attitude scale exhibited satisfactory reliabilities.

Once the reliability and validity of the attitudes toward working with computers scale had been assessed, cluster analysis was conducted on the checklist items in order to separate computer users into groups according to their experience, involvement, knowledge; task, system and job characteristics. The biographical variables included in the questionnaire did not form part of the clustering but were used once clusters have been formed to describe the age, gender, education, tenure and past experience of the different clusters. Attitude differences between clusters were assessed using one-way analysis of variance (ANOVA) and Scheffes' test were conducted to indicate between which clusters attitude differences were occurring. At this juncture, it was deemed appropriate to consider what is meant by the term cluster analysis.

CLUSTER ANALYSIS

Cluster analysis is the generic name for a wide variety of techniques which seek to separate data into constituent groups (Everitt, 1974). These techniques empirically form classes, types, groups, categories or clusters of highly similar entities (Aldenderfer & Blashfield, 1984; Lorr, 1983). Since the number and nature of such groups are not known in advance the clustering process is actually

Table 10: Cronbach's alpha coefficients for the Attitude toward working with computers factors and the overall attitude

	Cronbach's alpha
Factor 1 "Willingness to use a computer"	0.86
Factor 2 "Knowledge and understanding of computers"	0.84
Factor 3 "Computer attributes"	0.73
Overall attitude	0.90

preclassificatory, i.e., these techniques construct a classification scheme for unclassified data (Lorr, 1983). Although there is no consistent and universally agreed upon definition of the word "cluster" it is by nature a grouping of one's subjects or objects into homogeneous groups, i.e., a "group" is populated by subjects which are very similar or closely related (Aldenderfer & Blashfield, 1984). More specifically, a clustering method "is a multivariate statistical procedure that starts with a data set containing information about a sample of entities and attempts to reorganise these entities into relatively homogeneous groups" (Aldenderfer & Blashfield, 1984, p.7).

Despite the lack of a consistent definition of the term cluster, clusters do have certain properties. Sneath and Sokal (1973) have described a number of these properties. The first is density, by this they mean a cluster is a relatively thick "swarm" of data points in a space (i.e., scores for one's subject on different variables when plotted on a subject or object variable graph) in comparison to other areas of the space. Second, variance is the degree of dispersion of the points in this space from the centre of the cluster or the relative nearness of points to one another in the space. Hence, clusters can be said to be "tight" when all data points are near the centroid or may be "loose" when the data points are dispersed from the centre. Closely related to variance is the property of dimension. Dimension refers to the idea that if one is able to see a cluster then one can measure the radius of it. Fourth, the shape of the cluster denotes the arrangement of the data points in space, i.e., the shape they form. Finally, separation is the degree to which clusters overlap or lie apart from each other in space. Clusters may be relatively close to one another with no clear boundaries or they may be widely separated with large gaps between them. The above five features can be used to describe any type of cluster within a space. Everitt (1980) notes that clusters are continuous regions of space containing a relatively high density of points, separated from other such regions containing a relatively low density of points.

The general objective of cluster analysis is to partition or subdivide a set of objects or individuals into homogeneous subgroups or into a hierarchical arrangement of homogeneous subgroups (Lorr, 1983). More explicitly, these techniques are designed to develop a typology or classification, investigate useful conceptual schemes for grouping entities, hypothesis generation through data exploration and hypothesis testing (Aldenderfer & Blashfield, 1984). The development of classifications accounts for the most frequent use of clustering methods, however many of these

objectives are combined to form the basis of a study (Aldenderfer & Blashfield, 1984). For the purpose of the present study, cluster analysis was used to explore the data, to reduce the data by summarising the information available on the relationships between entities and to ascertain whether the predictions made regarding the groups of subjects are fulfilled. Thus, cluster analysis was deemed an appropriate statistical technique to use in the present study.

The majority of clustering techniques begin with a calculation of a matrix of similarities or distances between entities (Everitt, 1974). A fundamental concept in cluster analysis is that objects or individuals are recognised as similar or dissimilar. The concept of similarity and the procedures used to measure it are far from simple. The problem of similarity does not lie with the simple recognition that objects are alike or not, but in the way in which these concepts are expressed and implemented in scientific research (Aldenderfer & Blashfield, 1984). In order to develop a statistical study of similarity, objects are represented as points in some attribute space such that the observed dissimilarities between objects correspond to the metric distance between the respective points (Lorr, 1983). There are four standard criteria used to determine whether a similarity measure is a true metric. These are symmetry, triangle inequality, distinguishability of nonidenticals and indistinguishability of identicals (Aldenderfer & Blashfield, 1984).

Metrics are by no means the only way to represent the similarity between objects. There are alternatives to the use of these measures that may be appropriate and necessary within the context of research. The choice of a similarity measure is embedded within the design of research which is determined by the theoretical, practical and philosophical context of the classification problem (Aldenderfer & Blashfield, 1984). There are four types of similarity measures: correlation coefficients, distance measures, association coefficients and probabilistic similarity coefficients. All four types of similarity measures have been used by numerical taxonomists and others in the biological sciences, however, only correlation and distance coefficients have been used extensively in the social sciences (Aldenderfer & Blashfield, 1984). Further, due to their mathematical properties both association coefficients and probabilistic similarity coefficients are confined to binary data (Clifford & Stephenson, 1975; Sneath & Sokal, 1973). In the context of the present study neither of these two measures require elaboration. Rather, a brief consideration of correlation coefficients and distance measures is appropriate.

Correlation coefficients

Correlation coefficients are among the most frequently used measures of similarity in the social sciences. The most popular is the product-moment correlation coefficient suggested by Karl Pearson. The correlation coefficient is defined as:

$$r_{jk} = \frac{\sum (x_{ij} - \bar{x}_j)(x_{ik} - \bar{x}_k)}{\sqrt{\sum (x_{ij} - \bar{x}_j)^2 (x_{ik} - \bar{x}_k)^2}}$$

where:

x_{ij} = the value of variable i for case j,

$\bar{x}_j$ = the mean of all values of the variables for case j.

The value of the coefficient ranges from -1 to +1 and a value of zero indicates no relationship between the cases (Aldenderfer & Blashfield, 1984).

One of the major drawbacks of the use of the correlation coefficient is its sensitivity to shape at the expense of the magnitude of differences between the variables (Williams, 1971). This means that two profiles can have a correlation of +1.00 and yet not be identical (i.e., each profile does not pass through the same points). Further, correlation coefficients often fail to satisfy the triangle inequality and furthermore the use of the method to calculate the correlation of cases does not make statistical sense as one obtains the mean value across different variable types rather than across cases (Aldenderfer & Blashfield, 1984). However, the correlation coefficient has been widely used in research applications involving cluster analysis (Aldenderfer & Blashfield, 1984). The correlation coefficient proves to be of value as it is not affected by dispersion and size differences between variables (Fisher, 1988).

Distance measures

Distance measures are best described as dissimilarity measures. Most correlation coefficients show similarity by high values within their ranges, distance measures are however scaled in the reverse (Aldenderfer & Blashfield, 1984). Objects are judged identical if each one is described by variables with the same magnitude, i.e., if the distance between them is zero. One of the more popular representations of distance is Euclidean distance which is defined as:

$$d_{jk} = \sqrt{\sum_{k=1}^{p} (x_{ik} - x_{jk})^2}$$

where:

d_{ij} = the distance between cases i and j,

x_{ik} = the value of the kth variable for the ith case.

The major drawback of the Euclidean and other distance metrics is that the estimation of the similarity between cases is strongly affected by elevation differences. Thus, variables with large size differences and standard deviations effectively swamp the effects of other variables with smaller absolute sizes and standard deviations (Aldenderfer & Blashfield, 1984). Further, distance metrics are also affected by transformations of the scale of measurement of the variables in a profile (Everitt, 1980).

There are many different types of similarity measures, and the choice of which measure to use should be made with careful consideration of the measurement implications inherent in the chosen technique. As stated previously, Aldenderfer and Blashfield (1984, p.19) note that "The choice of similarity measure, then, should be embedded ultimately within the design of research, which is itself determined by the theoretical, practical, and philosophical context of the classification problem." The most commonly applied clustering techniques used in the social sciences are the hierarchical agglomerative techniques (Aldenderfer & Blashfield, 1984). At this point, it is deemed necessary that these techniques be considered in some detail.

Hierarchical agglomerative methods

A hierarchy may be seen as a family of nested multilevel classes. The hierarchical agglomerative methods begin with N individual cases or units and at each stage combines together the two entities or clusters that are closest until all cases are combined into one family or cluster (Lorr, 1983). The hierarchical scheme is commonly represented as a tree or dendrogram beginning at the branches and combining until the trunk is reached, thus indicating the fusions or the partitions made at each successive level. The fusions are fixed permanently thus once assigned to a group the entity or the cluster remains in that group (Lorr, 1983).

A wide range of clustering algorithms have been developed and applied across research disciplines which means that applying different techniques to a single data set could well yield quite different cluster solutions. Selecting a clustering technique involves decisions about the most appropriate algorithm for the theoretical context of the research questions; an inappropriate choice of technique will yield inappropriate clusterings (Aldenderfer & Blashfield, 1984). The four most popular hierarchical agglomerative methods are: single linkage, complete linkage, average linkage and Ward's minimum variance technique (Blashfield, 1976). Although these methods differ primarily in terms of the rules by which entities or clusters are combined or linked, the basic procedures for these four methods is however the same. The process begins with the computation of a distance or a similarity matrix between the possible pairs of entities (Everitt, 1974). The matrix is searched for the closest pairs which are subsequently merged to form a cluster and the matrix entry values are then modified to reflect the change. The matrix is searched again for the closest pair and the two are merged into a new cluster. The process is followed until all entities are in one cluster (Lorr, 1983).

In the present study, the clustering technique utilised was Ward's minimum variance method which needs to be discussed in its own right at this stage.

Ward's minimum variance method

Ward (1963) proposed that at any stage of an analysis the loss of information which results from the grouping of individuals into clusters can be measured by the total sum of squared deviations of every point from the mean of the cluster to which it belongs. At each step in the analysis, union

of every possible pair of clusters is considered and the two clusters whose fusion results in the minimum increase in the error sum of squares are combined (Everitt, 1974). Hence, Ward's method is designed to optimise the minimum variance within clusters (Ward, 1963). The value of the objective function is expressed as the sum of the within-group sum of squares called the error sum of squares, ESS. The formula for the error sum of squares is:

$$ESS = x_i^2 - 1/n\left(\sum x_i\right)^2$$

where:

x_i = the score of the ith case (Aldenderfer & Blashfield, 1984).

At the first step of the clustering process the error sum of squares is zero. The method works by joining those groups that result in the minimum increase in the error sum of squares. Each cluster previously formed is treated as one unit. When the complete hierarchical solution has been obtained, the ESS values may be compared to ascertain the relative homogeneity of the groups formed. A sharp increase in ESS indicates that much of the accuracy has been lost by reducing the number of groups (Lorr, 1983). Ward's method joins clusters to maximise the likelihood at each level of the hierarchy under the following assumptions: multivariate normal mixture, equal spherical covariance matrices and equal sampling probabilities (SAS Manual, 1990). Ward's method has been widely used in many of the social sciences (Blashfield, 1980) however, it has been criticised on the grounds that it tends to join clusters with a small number of observations (SAS Manual, 1990), is strongly biased towards finding clusters with roughly the same number of observations in each cluster (SAS Manual, 1990) and finally, the clusters it finds can be ordered in terms of their overall elevation (Alderdenfer & Blashfield, 1984).

Nevertheless, many simulation studies comparing various methods of cluster analysis have found that the clustering method with the best overall performance is either average linkage or Ward's minimum variance method. However, the results of simulation studies are often inconsistent and confusing (SAS Manual, 1990). In the present study, Ward's method was chosen as it optimises

the minimum variance within clusters and since there is no ground to assume clusters of equal sizes it eliminates undue bias.

Once the clustering method to be utilised in a study has been chosen and computed, one needs to determine the number of clusters that are present in one's results. The nested tree structure of a dendrogram suggests that many different groups may be present in the data. However, the question is where to "cut" the tree so that the optimal number of groups is found (Aldenderfer & Blashfield, 1984). This fundamental step is unfortunately among the unsolved problems of cluster analysis (Everitt, 1979). The lack of a suitable null hypothesis (when do no clusters exist) and the complex nature of multivariate sampling distributions (of unknown structure) are the two most important reasons that so little has been done towards the solution of the problem (Aldenderfer & Blashfield, 1984).

The difficulty in forming a workable null hypothesis is that there is no consistent and comprehensive definition describing the structure and content of a cluster. A possible null hypothesis of "no structure" in the data set has not been clarified and it is not clear what types of tests could be devised to determine whether there is or isn't structure present in the data (Aldenderfer & Blashfield, 1984). Null hypotheses which have been developed include the random graph hypothesis and the random position hypothesis. However, these are extremely limited in scope and have not been applied in practical data analysis (Dubes & Jain, 1980). Dubes and Jain (1980) further note that since a practical and mathematically useful definition of "clustering structure" does not exist, the rejection of the null hypothesis is not particularly significant as meaningful alternative hypotheses have not yet been developed.

In response to the restrictions in determining the number of clusters present in a data set, social scientists have used two basic approaches, i.e., heuristic procedures and formal tests. Heuristic procedures are the most commonly used methods and involve "cutting" the hierarchical tree or dendrogram by looking at the different levels, hence producing different numbers of clusters at different levels. This method is obviously biased by the needs and opinions of the researcher concerning the "correct" structure of the data (Aldenderfer & Blashfield, 1984). A more formal approach to the problem is to graph the number of clusters suggested by the dendrogram against

the fusion or amalgamation coefficient (i.e., the numerical value at which various cases merge to form a cluster). The values of the fusion coefficients are shown along the y-axis in the dendrogram. Where the graph begins to "flatten" an assumption can be made that no new information is depicted by the consequent cluster merges (Aldenderfer & Blashfield, 1984). Another method is to examine the values of the fusion coefficients to discover a significant "jump" in the value of the coefficient. A jump implies that two relatively dissimilar clusters have merged thus the number of clusters prior to the merger is the most probable solution. However, many small jumps in the value of the fusion coefficient can be found and there is no way to tell which of these is the "correct one." In the formal test approach, the most common null hypothesis used in these tests is that the data under consideration is a random sample from a multivariate normal distribution. An alternative hypothesis developed by Lee (1979) is that the data are a random sample of a uniform distribution. However, few of these tests are widely accepted, properly studied and are poorly understood generally.

Thus, there are no satisfactory methods for determining the number of population clusters for any type of cluster analysis (Everitt, 1979, 1980; Hartigan, 1985). The number of clusters problem is more difficult than the number of factors problem (SAS Manual, 1990). Milligan and Cooper (1985) and Cooper and Milligan (1984) however compared thirty methods for estimating the number of population clusters using four hierarchical clustering methods and found that two statistics, the pseudo F and pseudo t**2, were the most effective in estimating the number of population clusters. The pseudo F statistic measures separation amongst all the clusters at the current level while the pseudo t**2 statistic measures the separation amongst the two most recently joined clusters. It is thus advised to look for a consensus among these two statistics, i.e., local peaks of the pseudo F statistic combined with a small value of the pseudo t**2 statistic and a larger pseudo t**2 statistic for the next cluster fusion (SAS Manual, 1990). In the present study, the pseudo F and pseudo t**2 statistics were used to estimate the number of clusters present in the data set. Furthermore, examination of the tree diagram or dendrogram for large changes between fusions are useful in determining the number of clusters present within a data set (Everitt, 1974). In the present study, a tree diagram of the cluster hierarchy was conducted in order to clarify the number of clusters present in the data.

All clustering techniques involve a large amount of arithmetic and would not be feasible without the aid of modern statistical computational packages. For the present study, the SAS statistical computational package (SAS Institute, 1990) was used and the "CLUSTER" option was chosen. The cluster procedure prints a history of the clustering process and provides statistics useful for estimating the number of clusters in the population from which the data were sampled (SAS Manual, 1990). The cluster procedure hierarchically clusters the observations in a data set using one of eleven methods (SAS Manual, 1990). In the present study, Ward's minimum variance method, one of the eleven methods available under the cluster procedure, was used. In all agglomerative hierarchical clustering procedures each observation begins in a cluster by itself. The two closest clusters are merged to form a new cluster that replaces the two old clusters. Merging of the two closest clusters is repeated until only one cluster is left. The various clustering methods differ in how the distance between two clusters is computed. The distance between two clusters can be defined either directly or combinatorially (Lance & Williams, 1967), i.e., by an equation for updating a distance matrix when two clusters are joined (SAS Manual, 1990). In Ward's method, the distance between two clusters is defined by:

$$D_{KL} = B_{KL} = \frac{||\bar{x}_K - \bar{x}_L||^2}{(1/N_K + 1/N_L)}$$

whilst the combinatorial formula is:

$$D_{JM} = \frac{((N_J + N_K)D_{JK} + (N_J + N_L)D_{JL} - N_J D_{KL})}{(N_J + N_M)}$$

where:

N_k = number of observations in C_k,

$\bar{x}_k$ = mean vector for cluster C_k,

x = Euclidean length of the vector x, i.e., the square root of the sum of the squares of elements of x,

D_{kl} = any distance or dissimilarity measure between clusters C_k & C_l (SAS Manual, 1990).

The cluster procedure calculates the minimum variance within clusters and provides calculations for the pseudo F and pseudo t**2 statistics. Further, the procedure also creates an output data set that can be used by the Tree procedure to draw a tree diagram of the cluster hierarchy or to output the cluster membership at any desired level (SAS Manual, 1990).

In the present study however, before cluster analysis could be conducted on the checklist items, inter-item correlations (using Pearson's correlation coefficient) were performed on all checklist items to see if any item correlated highly with any other. If a correlation coefficient of 0.60 or higher was found between two items, one of the items was eliminated from the variable set. As a result, items 9, 25, 29, 34 and 35 were deleted from the variable set. Further, in order to compute the cluster analysis only items 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 30, 31, 32, 33, 36, 37 and 38 were included in the clustering process as these items had all been scored from 1 to 5. Items 39, 40 and 41 were scored differently (i.e., items 39 and 40 were scored in months, and item 41 from 1 to 3) and assessed more descriptive aspects of the user-task-system interaction. As a result, items 39, 40 and 41 were used to describe the clusters more accurately once clusters had been formed and thus did not form part of the clustering process.

Hence, clustering took place on 33 checklist items which assessed different aspects of the user-task-system interaction and job characteristics. At each level of the clustering algorithm the cluster procedure identifies the pair of clusters with the minimum distance. There may however be two or more pairs of clusters with the same minimum distance. When this occurs it is referred to as "ties." A tie simply means that the level in the cluster history at which the tie occurred and possibly some of the subsequent levels are not uniquely determined. The presence of ties is reported by a "T" in the column of the cluster history labelled "Tie" and a blank indicates the absence of a tie (SAS Manual, 1990). In the present study, the cluster procedure identified a number of ties for the raw data. In order to eliminate the ties the data was standardised (SAS Manual, 1990) and the cluster procedure was recomputed. The cluster procedure revealed no ties for the standardised data. Ties exist for the raw data as the increments between successive values are the same for all of the raw variables but different for the standardised variables. As a result, the remaining statistical techniques utilised in the present study were computed on the standardised data of the cluster analysis.

As can be seen in Table 11, the cluster procedure conducted on the standardised data calculated the minimum variance within clusters and the pseudo F and pseudo t**2 statistics. A closer look at the pseudo F statistic reveals that it peaks at seven clusters (cl 8, cl 7, cl 6, cl 5, cl 4, cl 3 & cl 2). The t**2 statistic for all seven clusters is small, with the t**2 statistic dropping at cluster 6 and the largest value for the next cluster fusion found at cluster 2, hence pointing to a three cluster solution for the data. Further, at cluster 1 there is a "jump" in the minimum variance measured implying the merger of two relatively dissimilar structures. Thus, a three cluster solution would be deemed appropriate for the present study. The tree diagram or dendrogram of the clusters for the present study is shown in Figure 14. It is clear that the tree diagram shows three distinct separations in the data. Thus, from the results of the pseudo F and pseudo t**2 statistics and the dendrogram, it was evident that for the present study a three cluster solution emerged from the data.

In order to determine the distinguishing characteristics of each of the three clusters, frequencies were conducted on the categorical biographical variables (i.e., gender and education) and means were computed on the continuous biographical variables (i.e., age, tenure and past job experience). In the present study, although checklist items were generated to assess user-system-job characteristics, the items pertaining to each of these characteristics did not form four separate subscales. As a result, the mean for each of the four characteristics were calculated to determine on which of these characteristics cluster members differed. The results of the above mentioned statistical procedures revealed the following characteristics for each cluster.

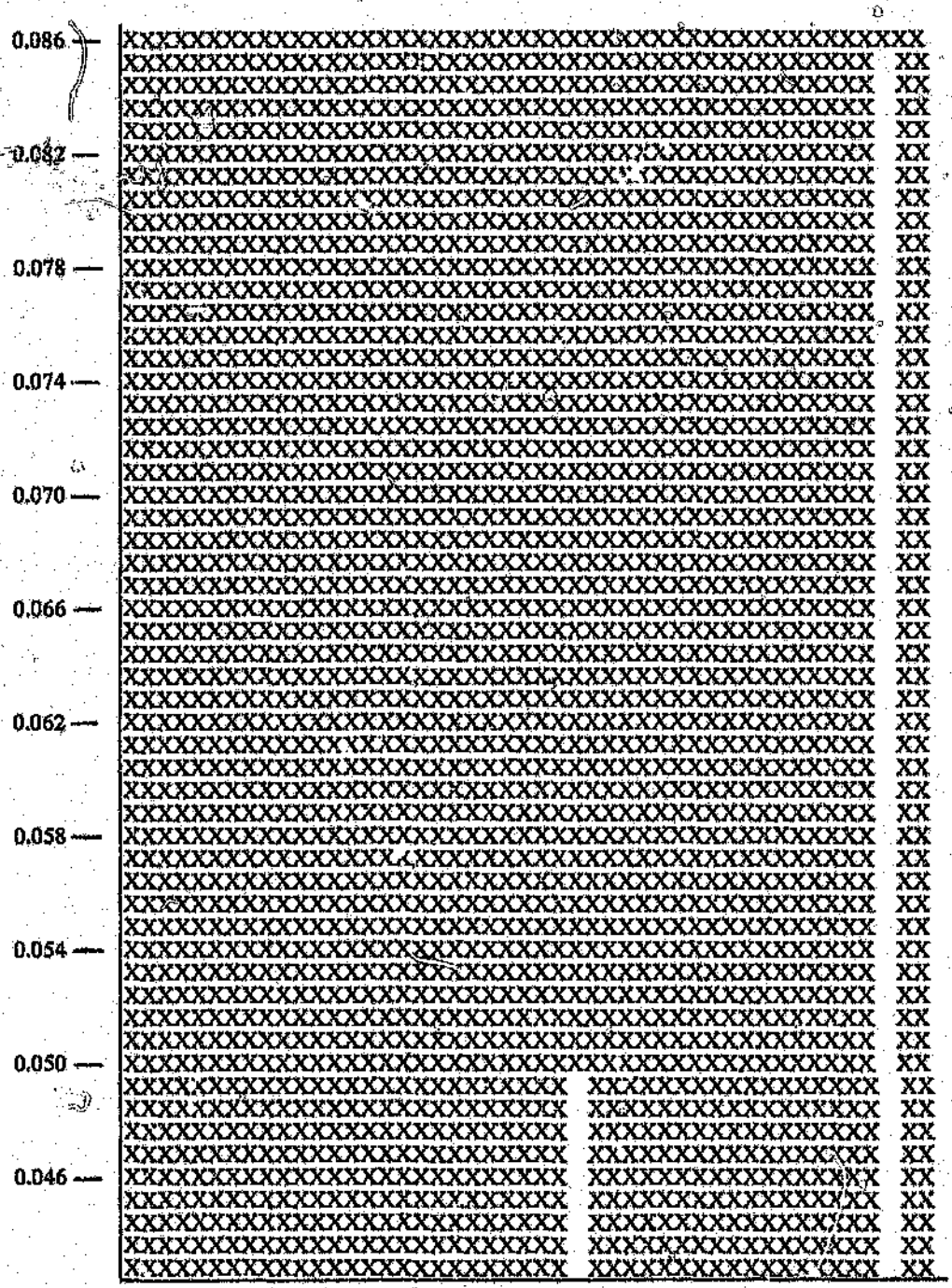
Cluster A, consisted of 113 members and hence formed the largest cluster in the present study. Of the 113 members 62% were female and 38% male, 7% had no matric and 71% had matriculated, 7% had a college or technikon diploma and 10% had a bachelors degree. The average age of the cluster members was reported at M = 31 and tenure ranged from 1 to 248 months with the average tenure being 48 months (i.e., 4 years). Job experience ranged from 0 to 296 months with an average job experience reported at 46 months (i.e., 3 years and 10 months). For cluster A, the mean for task characteristics was reported at M = 26, system characteristics was found to be M = 21, user characteristics was reported at M = 27 and job characteristics was found to be M = 36. Further, examination of the means for items cl 39, cl 40 and cl 41 revealed that for this cluster, members had been using the computer for an average of 68 months (i.e., 5 years and 8

Table 11: Cluster analysis for user-system-job characteristics

Ncl*	Clusters Joined	Frequency of new cluster	Semipartial R-squared	Pseudo F	Pseudo t**2
15	CL39 CL40	14	0.010586	7.88	3.76
14	CL75 CL32	17	0.010589	8.13	3.86
13	CL30 CL34	26	0.011971	8.37	4.97
12	CL29 CL18	45	0.012536	8.64	4.37
11	CL20 CL26	42	0.013304	8.95	4.97
10	CL14 CL24	24	0.013405	9.35	3.73
9	CL13 CL11	68	0.014049	9.82	4.88
8	CL16 CL41	19	0.014259	10.45	3.35
7	CL17 CL15	41	0.017398	11.11	5.64
6	CL8 CL31	25	0.019074	11.97	4.07
5	CL10 CL19	57	0.020131	13.22	5.36
4	CL9 CL12	113	0.023212	15.07	7.58
3	CL7 CL5	98	0.027730	18.24	7.68
2	CL4 CL3	211	0.049213	22.07	13.94
1	CL2 CL6	236	0.086171	-	22.07

Ncl* = Number of clusters

Figure 14: Dendrogram of the three cluster solution



months), a typical task on the computer was completed in 130 minutes (i.e., 2 hours and 10 minutes) and the computer was frequently used during their working day. Cluster B consisted of 98 members of which 53% were female and 47% were male. Examination of the educational level of the cluster members revealed that 68% had matriculated and 6% had not, 13% had obtained a bachelors degree and 11% had a diploma. Cluster members average age was reported at M = 30, and tenure ranged from 1 to 288 months with the average tenure being 48 months (i.e., 4 years). Job experience ranged from 0 to 245 months with the average job experience reported at M = 48 months. The task characteristics mean for cluster B was found to be M = 29, for system characteristics the mean was reported at M = 24, for user characteristics the mean was found to be M = 31 and for job characteristics the mean was reported at M = 39. Furthermore, cluster B members had been working with a computer for an average of 76 months (i.e., 6 years and 4 months), a typical task was completed in 177 minutes (i.e., 2 hours and 57 minutes) and the computer was used all the time.

The final cluster, cluster C, only consisted of 25 members and thus formed the smallest cluster in the present study. Sixty-four percent of the members in this cluster were female and 36% were male. The majority of the cluster members, 64%, had a matric and 8% had no matric, 20% had a bachelor degree and 4% had obtained a diploma at a college or technikon. The average age of the members in this cluster was reported at M = 28 and tenure for the cluster ranged from 6 to 144 months with the average tenure being M = 28 months (i.e., 2 years and 4 months). Job experience ranged from 0 to 180 months with the average job experience reported at M = 41 months (i.e., 3 years and 5 months). The mean for task characteristics for this cluster was reported at M = 25, for system characteristics the mean was found to be M = 21, for user characteristics the mean was reported at M = 28 and for job characteristics the mean was found to be M = 28. Finally, members of cluster C had been using a computer for an average of M = 50 months (i.e., 4 years and 2 months), a typical task on the computer was completed in 146 minutes (i.e., 2 hours and 26 minutes) and the computer was frequently used during the working day.

Thus, from the above description of each cluster it is evident that the three clusters are similar on a number of biographical and user-system-job characteristics but also differ on a number of these

characteristics. It is thus important, at this stage, that these similarities and differences found between the three clusters be discussed.

With regards to gender, all three clusters had a more or less 60% female and 40% male split. More specifically, cluster B consisted of more males than the other two clusters and cluster C had more females than clusters A and B. Although no major differences between the ages existed for the three clusters, it may be said that cluster A had the oldest members (i.e., M = 35 years) and cluster C the youngest (i.e., M = 28 years). In clusters A and B members had been in their present job for 48 months however, in cluster C members tenure was only 28 months. Clusters differed with regards to their job experience with members in cluster B having the most job experience and members in cluster C the least.

Looking at the user-task-system characteristics no major differences were found between the means for each of these characteristics between clusters A and C. However, for cluster B large differences between the means for each of these characteristics were found when compared to the other two clusters. On examination of the individual items that constitute the user-task-system characteristics, it was found that cluster B showed differences in a few items, i.e., for task characteristics members differed on item 2 - thus indicating that the members goals were clearly stated for them; for system characteristics cluster members differed on items 10, 11 and 13 - hence showing that they understood computer instructions, could easily use manuals to solve problems and the computer helped them in their jobs; and for user characteristics a difference on item 18 was found - thus indicating that members of cluster B had received formal training in computers. Although small differences between the means for the user-task-system characteristics existed for clusters A and C it was still deemed necessary that the individual items be examined. It was found that cluster C differed on item 1 for task characteristics - thus showing that members performed the same tasks often, and for user characteristics cluster C members differed on item 16 - hence showing that members used one or more computer programmes. All three clusters differed on item 14 which assessed an aspect of system characteristics. That is, cluster B relied heavily on the computer to perform their work and members of cluster C did not depend so heavily on the computer in order to accomplish their work.

With regards to job characteristics, large differences in the means were found for the three clusters, especially between clusters B and C. On examination of the individual items that constitute job characteristics, it was found that differences occurred on items 26, 28 and 36. This indicated that in cluster C members did not continuously learn new things at work, were not encouraged to fully use their skills and found their work boring. Further, differences in the means were found for items 30 and 32 for the three clusters - hence showing that in cluster C supervisors and co-workers did not provide members with adequate feedback whereas members in cluster B were provided with adequate feedback and members in cluster C did not receive much recognition from others whereas members in cluster B did.

Finally, regarding items 39, 40 and 41 differences were found in the means for these items between the three clusters. For item 39, major differences were found between clusters B and C, i.e., cluster B members had been working with a computer for a longer period than members in cluster C. For item 40, the main difference occurred between clusters A and B - thus indicating that members of cluster B spend more time completing a task on the computer than members in cluster A. Furthermore, looking at item 41 revealed that all members of the clusters used the computer frequently, with members of cluster B using it all the time and members of cluster C using it the least frequent.

Thus, from the above descriptions of the individual clusters and from the discussion of the comparison of the three clusters, it is clear that each cluster in the present study has the following characteristics.

Cluster A

Members in this cluster were the oldest and spend the least time completing a task on the computer. Cluster A can be seen as an "intermediate" cluster falling inbetween cluster B and cluster C.

Cluster B

In cluster B, members had the most job experience and their task goals were clearly stated for them. The computer helped members in their jobs and hence they relied heavily on the computer in order to perform their work. Members in this cluster had received formal training to use the computer

in their job and thus had no difficulty understanding computer instructions or using computer manuals to solve any problem that they were experiencing. Cluster B members had the most experience in computers as they had been working with computers for the longest time. They used the computer all the time and spend the most time completing a task on the computer. Finally, cluster B members received adequate feedback and recognition from their supervisors and co-workers.

Cluster C

Members in cluster C were the youngest, had the lowest tenure and the least job experience. Members often performed the same tasks but did not rely heavily on the computer in order to perform their work. Cluster C members had the least experience in computers as they had been using the computer for the shortest time. They used the computer least frequently but made use of one or more computer programmes. Finally, members in this cluster felt that they did not receive adequate feedback and recognition from their supervisors and co-workers, did not continuously learn new things at work, were not encouraged to fully use their skills and found their work boring.

Thus, in order to concluded on the distinctive characteristics of each cluster in the present study, it may be said that members in cluster B had the most job and computer experience, relied heavily on the computer to perform their job and thus used the computer all the time. They also spend the most time completing a task on the computer. Further, cluster B members received adequate feedback and recognition from their supervisors and co-workers. Cluster C members, on the other hand, had the least job and computer experience, did not rely heavily on the computer to perform their work and hence used the computer the least frequently. Furthermore, members in cluster C did not receive adequate feedback or recognition from their supervisors and co-workers. Finally, members in cluster A spend the least time completing a task on the computer and fall in between cluster B and cluster C.

Once the number of clusters and the distinctive characteristics of each cluster had been identified, the cluster members attitudes toward working with computers needed to be examined. In order to

assess differences in cluster members attitudes toward working with computers, analysis of variance (ANOVA) were computed and Scheffes' test were conducted to examine between which clusters attitude differences were occurring. Before discussing the ANOVA and Scheffes' test results for the present study, it was deemed necessary to briefly discuss the statistical techniques of ANOVA and Scheffe's test.

ANALYSIS OF VARIANCE (ANOVA)

Analysis of variance (ANOVA) is a statistical technique which deals with whether the means of a variable differ from one group of observations to another. ANOVA methods all employ ratios of variances (Iversen & Norpoth, 1976) in order to test statistical hypotheses about the significance of differences between means (Kerlinger, 1973). Thus, the purpose of ANOVA is to determine the "probability that the means of several groups of scores deviate from one another merely by sampling error" (McCall, 1990, p.245). In order to do this ANOVA partitions or divides the variability, within the total sample, into a portion that highlights differences between the means of the sample groups and a portion that is not influenced by those differences in means. This partitioning of variability is performed in such a way that the two estimates of the variance of the scores in the population are calculated. These estimates are known as the between-group variance and the within-group variance. The between-group variance is determined from the deviation of the group means about the grand or total mean (the mean of all the scores in the total analysis) (Emory & Cooper, 1991; McCall, 1990) whereas within-group variance describes the deviation of scores within each group from the sample means (McCall, 1990).

A basic concept in ANOVA is the sum of squares. The sum of squares refers to the deviations from the mean squared and summed. The advantage of the ANOVA technique is that one can partition the total sum of squares into two components, the within-group sum of squares and the between-group sum of squares. To determine variance estimates from between and within-group sum of squares one divides each by the appropriate number of degrees of freedom, i.e., degrees of freedom of the between-group is the number of cells minus 1 and for the within-group the total N minus the number of cells (Runyon & Haber, 1980). Then the F-ratio is calculated to determine whether or not the two variance estimates are drawn from the same population. The F-ratio compares the

between-group variance with the within-group variance and is obtained by dividing the between-group variance estimate by the within-group variance estimate (Runyon & Haber, 1980). If the between-group variance estimate is large (i.e., the difference between means is large) relative to the within-group variance estimate, the F-ratio is large. This suggests that there are large differences among the group means. Conversely, if the between-group variance estimate is small relative to the within-group variance estimate, the F-ratio will be small. The significance of the difference in variance estimates (F-ratio) is obtained by reference to Fisher's F-distribution (Runyon & Haber, 1980). If the obtained F-ratio is as great or greater than the appropriate tabled entry, the differences between the means are statistically significant. In such a case the null hypothesis of no difference between the means is rejected at the chosen level of significance (Kerlinger, 1973). Thus, if the F-ratio is found to be statistically non-significant then the null hypothesis of equal population means can be entertained. On the other hand, if the F-ratio is found to be statistically significant then one may concluded that the group means are not all estimates of a common population mean (Runyon & Haber, 1980).

Before ANOVA can be computed it is necessary that three assumptions are met. These are homogeneity of variance, normality of distribution and the independence of observations.

The first assumption is that of homogeneity of within-group variance. When using ANOVA it is necessary to assume that "the populations from which the groups are drawn have equal variances" (McCall, 1990, p.231). A reason for this assumption to adhered to is that it enables within-group variance to be an appropriate pooling of the variability about each group mean into a single estimate of the population variance. In the absence of this assumption a particular group with high variance may contribute disproportionately to this single estimate of population variance and thus the within-group variance will not be representative of the variability within each group (McCall, 1990). However, random sampling of subjects serves to meet this requirement adequately (Tomarken & Serlin, 1986). In the present study, subjects were randomly sampled and thus the assumption of homogeneity of variance was adequately met.

The second assumption is that of normality of distribution. It is assumed that the distribution of each population must be normal in form and should be reflected in each of the sample groups

(McCall, 1990). This assumption is made so that the two variance estimates are independent and so that the F test may be used. It can be shown that the mean and variance of a normal distribution are independent. The between-group variance is based on the means of the groups whereas the within-group variance is derived from the variability of scores about their respective means. If the means are independent from the variability of scores about these group means then both variance estimates will also be independent (McCall, 1970). Violations of this assumption will not be terribly detrimental to the final results if a sufficient number of cases are sampled and if the "departure from normality is not severe" (McCall, 1990, p.259). If the distributions are decidedly not normal and there are not many cases in each group, a nonparametric analysis may be performed (McCall, 1990). Although it is impossible to validate this equation empirically, such a normal curve ensures that findings may be generalised to the larger population from which the specific sample was drawn (Tomarken & Serlin, 1986).

The final assumption is that of the independence of observations across populations. It is assumed that the groups involved in a particular study are comprised of randomly sampled subjects which are also independent from one another. Independence is usually secured by selecting different subjects for the several groups in the analysis and not matching them on any particular basis (McCall, 1990). Nonindependence can seriously affect probability statements concerning Type I and Type II errors and treatment effects may be claimed where none exist (Hopkins & Glass, 1978). Whenever the treatment is individually administered, as in the present study, independence presents no problem (Hopkins & Glass, 1978).

From the above discussion it is clear that the present study met the three fundamental assumptions of ANOVA. However, in addition to adhering to the above mentioned assumptions one is required to select a parametric or nonparametric test on the basis of the data involved in the study. ANOVA requires nominal scaling for the independent variable and interval scaling for the dependent variable (Elifson, Runyon & Haber, 1982). In the present study, the allocation of the letters A, B and C to the three clusters represents a nominal scale. However, the dependent variable, attitudes toward working with computers, represents an ordinal and not interval scale. As discussed in Chapter 2 (Attitudes and attitude measurement) under the section 'Likert's scale method of summated ratings', ordinal scales require the use of nonparametric, distribution-free statistical techniques.

Nevertheless, these restrictions are almost universally disregarded as statistical research findings indicate that violations of the underlying assumptions of the use of parametric techniques do not lead to serious distortions of their results (Oskamp, 1977). Thus, it was deemed appropriate that ANOVA be conducted on the attitude scale results in the present study. Thus, the present study met all the necessary ANOVA assumptions.

Finding an overall significant F-value demonstrates a significant difference between groups but it does not specify between which of these groups these differences occur. To investigate specific hypotheses concerning population parameters a large number of tests have been developed (Runyon & Haber, 1980). The two broad classes of such tests are: a priori or planned comparisons - comparisons planned in advance to investigate specific hypotheses concerning population parameters; and posteriori comparisons - comparisons not planned in advance to investigate specific hypotheses concerning population parameters (Runyon & Haber, 1980). The present study was concerned with a posteriori comparisons - after ANOVA had produced significant results. In addition, a posteriori comparisons are designed for cases in which all possible means are to be compared (McCall, 1990). Various posteriori tests exist for making comparisons among means (e.g., Tukey's test and Scheffe's test). Such tests are appropriate as they determine which means are not equal without confounding the alpha error which would occur if one were to use t-tests (McCall, 1990). For the purpose of the present study, if and only if a significant F-ratio was found, Scheffe's test would be used to compare the means across the groups. Scheffe's test allows one to test all differences between means, to test the combined mean of two or more groups against the mean of one other group or to select any combination of means against any other combination (Kerlinger, 1973). Although, Scheffe's test is very useful it is also quite conservative. To attain significance, differences have to be rather substantial. However, the main point is that comparison tests can be done mainly for exploratory and interpretative purposes (Kerlinger, 1973).

In the present study, the SAS statistical computational package (SAS Institute, 1990) was used and the most general analysis-of-variance procedure, the General Linear Model (GLM), was chosen. The GLM procedure uses the method of least squares to fit the general linear models. The GLM procedure, as opposed to the ANOVA procedure, was preferred in the present study as the number of members varied for each cluster (SAS Manual, 1990). Thus using the GLM procedure, one-way

analysis of variance were conducted on the three factors. As can be seen in Table 12, significant associations were found on factor 1, factor 2, factor 3 and the overall attitude. Although ANOVA demonstrated significant differences on all three factors, it did not specify between which of the three clusters these differences occurred. For this reason Scheffes' test were used to compare the means across the three clusters. Scheffe's test revealed that clusters A and B, and clusters B and C differed on factor 1; clusters A and B, and clusters B and C differed on factor 2; clusters B and C differed on factor 3; and finally clusters A and B, and clusters B and C differed on the overall attitudes toward working with computers. The differences between clusters for each factor are depicted in Tables 13, 14, 15 and 16.

Thus, significant differences between clusters A and B, and clusters B and C were found for the factors. No significant differences between clusters A and C were demonstrated. Further, factors 1, 2 and the overall attitudes toward working with computers differed significantly across clusters A and B, and clusters B and C. Factor 3 however, only differed significantly across clusters B and C.

On examination of the factor means for each cluster, as shown in Table 17, it was found that cluster B members had the highest mean for all three factors and the overall attitude, and cluster C members indicated the lowest means for all factors and the overall attitude. Thus, it may be concluded that users characterised by more job and computer experience, who use the computer extensively, and who receive adequate feedback and recognition from others are more willing to use a computer, have a greater knowledge and understanding of computers, score the highest on the computer attribute factor and have a generally more favourable attitude toward working with computers. On the other hand, users characterised by low job and computer experience, who use the computer frequently and who do not receive adequate feedback and recognition from others are less willing to use a computer, have less knowledge and understanding of computers, score the lowest on the computer attribute factor and have an unfavourable attitude toward working with computers.

Table 12: One-way analysis of variance of the factors and the overall attitude

	F-value	*df*
Factor 1	31.66**	2/235
Factor 2	30.17**	2/235
Factor 3	5.50*	2/235
Overall attitude	32.57**	2/235

*p < .05

**p < .01

Table 13: Scheffe's test for the clusters and factor 1

Cluster comparison	Difference between means
A - B	4.33*
A - C	0.20
B - C	4.52*

*p < .05

Table 14: Scheffe's test for the clusters and factor 2

Cluster comparison	Difference between means
A - B	5.01*
A - C	2.93
B - C	7.94*

*p < .05

Table 15: Scheffe's test for the clusters and factor 3

Cluster comparison	Difference between means
A - B	1.13
A - C	1.49
B - C	2.63*

*p < .05

Table 16: Scheffe's test for the clusters and the overall attitude

Cluster comparison	Difference between means
A - B	10.48*
A - C	4.62
B - C	15.10*

*p < .05

Table 17: Factor means for clusters A, B and C

FACTORS	CLUSTERS		
	A	B	C
1	6.83	11.16	6.64
2	1.85	6.86	1.08
3	4.65	5.79	3.16
Overall Attitude	13.34	23.81	8.72

CHAPTER 6

DISCUSSION

In the present study, a checklist and an attitude scale were developed in order to assess users' attitudes toward working with computers. The items of the checklist and attitude scale were tailored to fit conceptual models and partialised to suit methodological constraints. Attitudes toward computers has been of interest for a number of years however, attitudes toward working with computers, i.e., users feelings towards actually working with or interacting with a computer at work, has only recently gained concern. The aim of the present study was thus to assess users' attitudes toward working with computers. Since the present study was concerned with the human-computer interaction it was deemed necessary that user, task, system and job characteristics be considered. These characteristics were measured by means of a checklist. Further, an attitude scale which measured attitudes toward working with computers was developed and validated for the purpose of the present study and was based on the three component or tripartite model of attitudes. The attitude scale was factor analysed and a three factor solution was found. Cluster analysis was computed on the checklist items which revealed three separate clusters differentiating users on their user-system-job characteristics. Furthermore, Anovas' and Scheffes' test were calculated and it was found that the clusters differed on the three attitude factors as well as on their overall attitudes toward working with computers. The results of the present study are discussed in relation to the literature in the following section. Theoretical and practical implications of the findings, directions for future research as well as limitations of the present study are considered thereafter.

ATTITUDES TOWARD WORKING WITH COMPUTERS

Past studies on attitudes toward computers and attitudes toward working with computers have based their attitude scales on the three component or tripartite model of attitudes. However, these scales have been criticised for dealing vaguely with the three attitude components, for being extremely superficial and for not capturing the essence of actually interacting with a computer at work. Hence, one of the aims of the present study was to develop a scale which assessed specifically attitudes toward working with computers and thus it was deemed appropriate that the attitude scale be based on the three component model. According to this model (discussed in detail in Chapter

2 (Attitudes and attitude measurement)), an attitude consists of three components, i.e., the cognitive, affective and behavioural. The main criticism labelled against the three component model is whether the three components are interrelated and measure the same concept or whether they are independent and measure separate entities. Since the present study's attitudes toward working with computers scale was based on the three component model it was necessary that this controversy be assessed. Using the statistical technique of exploratory factor analysis it was found that three factors emerged. On closer examination of the items loading on each factor it was evident that each factor demonstrated items pertaining to the three attitude components, i.e., each factor was underscored by the three attitude components regardless of whether some factors accounted for more of a particular attitude component than other factors. Thus, the present study did not find factors purely pertaining to the cognitive, affective and behavioural components but rather three factors emerged each consisting of a combination of the three components of an attitude. The present study hence supports the view that the three components are interrelated and measure the same concept. This finding is consistent with Mann's (1959) finding of a positive intercorrelation between the three components of racial prejudice for black subjects; and Ostrom's (1969) finding of a high intercorrelation among the three components for students attitudes toward the church. Furthermore, the present study's finding is consistent with Woodmansee and Cook's (1967) finding that the three components are not identifiable as cognitive, affective and behavioural. Woodmansee and Cook (1967) identified subgroups of items related to racial attitude. The items formed subgroups with each having its focus on a common content or substance. Woodmansee and Cook (1967) "content-defined" dimensions can be applied to the present study's factor solution. That is, the present study identified three factors with each focusing on a common content.

Hence, the present study's finding appears to warrant the following conclusions regarding the organisation of items related to attitudes toward working with computers. Firstly, the items may be classified as cognitive, affective or behavioural but their classification does not correspond to the three component model. On the contrary, the factors contain two or more types of items while items of the same type separate into two or more factors. Thus, the results suggest that attitudes toward working with computers is a simple concept that can be used to describe the same attitudes in users with different characteristics. There seems to be a single attitude factor which is tapped regardless of which aspect of attitude is measured. As a result, the hypothesis that users with

varying characteristics would differ on the three attitude components could not be assessed in the present study. Secondly, items formed into three factors with each factor focusing on a common content.

In the present study, before the attitudes toward working with computers scale was developed the limitations of past studies which assessed the three component model's validity (as discussed in Chapter 2 (Attitudes and attitude measurement) were taken into account and controlled for. In particular, a controversial topic was studied: a wide range of users were tested who differed according to their user-system-job characteristics (Kothandapani, 1971; Ostrom, 1969), the three attitude components were clearly defined and measures for each followed the definitions (Mann, 1959) and all three components were scaled on an evaluative continuum (Mann, 1959). Hence, it was believed that by accounting for these limitations the present study would have a better chance of supporting the distinguishability of the three components of an attitude. Surprisingly however, as discussed previously, the components were not found to be distinguishable from each other but intercorrelated. Perhaps a possible explanation for this finding is the way in which the attitude scale was developed for the present study. As discussed in detail in Chapter 4 (Rationale and procedure) under the section 'Development of the Attitude toward working with computers' scale, three items or statements (one on each of the three attitude components) were developed for each dimension (common theme identified from previous studies scales). On closer examination of the items developed for the present study however, it appears as if items of some of the dimensions can not be easily differentiated into the respective attitude components. That is, there is confusion as to whether an item of a particular dimension refers to the cognitive or affective; cognitive or behavioural; or affective or behavioural component. For example, for the dimension "time consuming" it may be difficult for one to separate the items "Using a computer is too time consuming" , id "It takes me a long time to coraplete my work on the computer" into the affective and behavioural components respectively. It is thus possible that items on some of the dimensions reflected great similarity to one another and were therefore difficult to separate into the three respective attitude components clearly.

Although, the present study did not find the three components of an attitude to be distinguishable from each other, factor analysis revealed three factors which consisted of a combination of the three

components. As will be remembered from Chapter 5 (Results) under the section 'Factor analysis', the first factor was termed "Willingness to use the computer", the second factor was labelled "Knowledge and understanding of computers" and the third factor was called "Computer attributes." All three factors reflected a positive attitude toward working with computers.

A comparison of the present study's factor solution with the factors found in Rafaeli's (1986) study indicates that the existence of positive and negative factors has changed to only positive factors emerging. That is, Rafaeli's (1986) first factor referred to positive attitudes toward working with computers and his second factor addressed negative attitudes or concerns. However in the present study, all three factors reflected positive attitudes toward working with computers. Furthermore, since only one previous study on attitudes toward working with computers reported on their factor analysis solution (Igbaria & Parasuraman (1989) and Parasuraman & Igbaria (1990) used factor analysis but do not discuss it), it was deemed necessary that the present study's factor solution be discussed and compared to general attitudes toward computers studies which used factor analysis.

Previous studies have emphasised the existence of positive and negative factors but in a different order of importance (Finne, 1987; Gardner et al., 1989; Lee, 1970; Morrison, 1983; Smith, 1981 and Zoltan & Chapanis, 1982). Three studies, for example, show a gradual shift in importance of factors from those regarding computers in an awesome light to those regarding computers in a negative light. Lee's (1970) study emphasised the benefits of the computer (factor 1) along with the awesome and sometimes fearful aspect of the machine (factor 2). Zoltan and Chapanis (1982) also highlight the efficiency of the computer (factor 1) and the desirability of the machine (factor 3) yet the respondents also see the machine as depersonalising (factor 2). The factor which explains the greatest variance in Morrison's (1983) study reflects the belief that computers are dehumanising (factor 1) although the awesome factors (factors 2 and 3) and the beneficial factors (factor 4) remain important. These findings are inconsistent with the present study's finding as all three factors were found to reflect positive attitudes and no negative, hence the fearful aspect of the computer was not found.

Gardner et al. (1989) in a more recent study found their first and second factors emphasised the pleasure and improved quality of life attributable to the computer whereas the fear (factor 3) and

anxiety (factor 4) the computer creates follow as less important factors. Gardner et al. (1989) conclude by stating that the shift of attitudes seems to indicate a realisation in individuals that computers are an aid rather than a threat. The relative position of the positive factors in their study indicates the greater importance of the beneficial aspects of the computer than the fear inducing factors which were highly prominent in the previous studies (Gardner et al., 1989). The present study's findings can indeed confirm Gardner et al.'s (1989) contention that feelings of awe are disappearing and positive factors are dominating. In fact, it can be said that as the years go by and as individuals are getting more accustomed to computers, negative feelings towards computers are disappearing and only positive factors are emerging. Thus, the present study found only positive attitudes toward working with computers with no sign of any negative factors. Thus, there is a clear indication that people have overcome their fear of computers and are viewing the computer as an aid which can benefit them in their lives. Computers do not antagonise individuals as much as might have been expected. On the contrary, computers are being supported (Smith, 1981). This is further evident as the most prominent factor in the present study was willingness to use a computer. Users are willing to use the computer as they understand what the computer can do for him or her, i.e., tasks are performed quickly and accurately, productivity increases, and so on. The second and third factors also point to this as users have knowledge and understanding of computers and attribute positive characteristics to computers such as smart, fast, accurate, and so forth. Thus, the present study confirms the importance of the beneficial aspects of the computer rather than the fear inducing aspects. Table 18, tabulates previous attitudes toward computers studies' factor solutions.

The second aim of the present study was to ascertain whether subjects differed with regards to their attitudes toward working with computers. Since the present study dealt with the human-computer interaction, it was deemed essential that user-task-system characteristics be considered in order to have a clear understanding of the interaction. Further, a user's attitude toward working with computers is largely established by his or her job design (Eason, 1988) and hence job characteristics were deemed necessary to take into account. As a result, cluster analysis was computed

Table 18: Previous Attitudes toward computers studies' factor solutions

Attitude study	Factor	Positive (+) or Negative (-) factor
Lee (1970)	1 2	+ −
Zoltan and Chapanis (1980)	1 2 3 4 5 6	+ − + − + −
Morrison (1983)	1 2 3 4	− − − +
Rafaeli (1986)	1 2	+ −
Gardner et al. (1989)	1 2 3 4 5	+ + − − +
Present study	1 2 3	+ + +

in order to separate users into groups according to these characteristics. The cluster analysis revealed three clusters for the present data. Attitude differences between clusters were assessed using one-way analysis of variance (ANOVA) and Scheffes' test were conducted to indicate between which clusters attitude differences were occurring. At this stage, it was deemed necessary to simply restate the differing characteristics and attitudes toward working with computers of the three clusters before discussing the findings.

Cluster A consisted of the oldest members who spend the least time completing a task on the computer. Cluster A members can be seen as an "intermediate" cluster falling inbetween clusters B and C. Cluster A members indicated a favourable or positive attitude toward willingness to use a computer, knowledge and understanding of computers and computer attributes. They also indicated a favourable overall attitude toward working with computers.

Cluster B members had the most job experience and their task goals were clearly stated for them. They found the computer helpful and relied heavily on the computer in order to perform their work. Cluster B members had received formal training to use the computer and thus had a sound understanding and knowledge of computers. They had the most experience with computers, used them all the time and spend the most time completing a task on the computer. Finally, they received adequate feedback and recognition from their supervisors and co-workers. For this cluster, members indicated the most favourable attitude toward willingness to use the computer, knowledge and understanding of computers and computer attributes. Furthermore, they indicated the most favourable overall attitude toward working with computers.

Cluster C members, on the other hand, were the youngest and had the lowest tenure and the least job experience. They often performed the same tasks but did not rely heavily on the computer in order to perform their work. Cluster C members had the least computer experience, used the computer least frequently but made use of one or two programmes. Finally they did not receive adequate feedback and recognition from their supervisors and co-workers, did not continuously learn new things at work, were not encouraged to fully use their skills and found their work boring. Cluster C members indicated the least favourable but not negative attitude toward willingness to

use the computer, knowledge and understanding of computers and computer attributes. They further showed the least favourable overall attitude toward working with computers.

In discussing these findings it was deemed necessary that the major differences between clusters be discussed in relation to the literature as opposed to discussing each cluster individually. The findings of each factor for the three clusters will be discussed thereafter.

The first major difference that was found between the cluster members was that computer users with the most computer experience had the most favourable attitude toward working with computers and users with the least or lowest computer experience had the least favourable attitude toward working with computers. This finding is consistent with Zoltan and Chapanis's (1982) finding that experienced users had a more positive attitude toward computers than inexperienced users; Smith's (1981) finding that highly experienced users had a positive attitude toward computers and users with no direct experience with computers had a negative attitude toward computers; Kerber's (1983) finding and Dambrot et al.'s (1985) finding that computer experience is positively correlated to attitudes toward computers; and Rafaeli's (1986) finding that the more experience a user has with working with a computer the more positive the user's attitude toward the computer.

In addition, it was found that users who had received formal training to use the computer and who used the computer all the time showed the most favourable attitudes toward working with computers; and users who used the computer the least frequently showed the least favourable attitudes toward working with computers. This finding is consistent with Igbaria and Chakrabarti's (1990) finding that computer experience and training are positively related to attitudes toward working with computers; and Stone's (1990) finding that experience in using computers, training and frequency of use all have positive associations with attitudes toward computers. It is also consistent with Smith's (1981) finding that users who have a positive attitude toward computers are regular users who use the computer as much as possible whereas negative attitudes toward computers are associated with users who have no direct experience with computers and rarely use computers. Moreover, the findings of the present study are consistent with Igbaria et al.'s (1989) findings that users with more computer experience and training use the computer more often and for a longer period of time.

Hence, the present study confirms the importance of individual difference variables in influencing attitudes toward working with computers. In particular, the present study found that computer users who have more experience, more formal computer training and who use the computer all the time showed the most favourable attitudes toward working with computers. A possible explanation for the relationship between experience, frequency of use and attitudes toward working with computers is that the more involved a user is with a computer the more familiar the user will be with the computer and the more favourable the user's attitude toward working with the computer. As Zajonc (1968) notes the more familiar an individual is with the attitude object the more pleasant the individual will rate that object. Familiarity has been found to be positively associated with attitudes toward information equipment. In particular Arndt et al. (1983) showed that familiarity with information equipment reduced anxiety in two different ways. First, users who had previous experience with word processors were less anxious about them; and second, frequency of use proved to be positively related to anxiety reduction and more positive evaluations of the equipment's effect on work capabilities. They conclude by stating that use of a word processor leads to positive attitudes toward the equipment (Arndt et al., 1983) and that training procedures should include early and extensive utilisation of the word processor in order to reduce unfavourable attitudes and promote the idea that it is a valuable instrument (Arndt et al., 1983). Oborne (1985) notes that ignorance of technology encourages fear and thus resistance whereas familiarity with the system leads to more positive attitudes and less anxiety. Therefore well-exposed, trained and informed personnel have less resistance to and greater acceptance of the technology (Apex, 1984).

Moreover, the finding that users who have more computer training have more positive attitudes toward working with computers obtained in the present study, supports Igbaria and Parasuraman's (1989) and Igbaria and Chakrabarti's (1990) belief that increases in training programmes may foster feelings of "self-efficacy" (Gist, 1987), i.e., the belief that one can develop the skills necessary to use computers and strengthen confidence in one's ability to master and use them in one's work (Igbaria & Chakrabarti, 1990; Igbaria & Parasuraman, 1989). This suggests that training programmes designed to increase individual's knowledge about computers and their operations may be beneficial in alleviating unfavourable attitudes toward working with computers (Igbaria & Parasuraman, 1989). Furthermore, the provision of opportunities for successful interactions with computers may strengthen a user's perceptions of self-efficacy. Recent research (Gist, Schwoerer & Rosen, 1987,

Nelson & Cheney, 1987) provides evidence that the type of computer training provided influences subsequent task performance and the users' beliefs that they can develop the skills necessary to use computers (Igbaria & Chakrabarti, 1990; Igbaria & Parasuraman, 1989). Additionally, the provision of opportunities to gain experience in using computers would be beneficial in improving users' attitudes toward the system (Igbaria & Chakrabarti, 1990).

In the present study, factor 1 accounted for 6,09% of the common variance and was labelled "Willingness to use a computer." For this factor, it was found that cluster B members were the most willing to use the computer and cluster C members were the least willing to use the computer. Attitudes toward information systems have been found to be associated with information system usage (Lucas, 1975; Robey, 1979). Cluster B members had the most favourable attitudes toward working with computers and showed the most willingness to use a computer. Cluster C members had the least favourable attitudes toward working with computers and showed the least willingness to use a computer. These findings are thus consistent with Lucas's (1975) finding that positive attitudes toward computers leads to high levels of use; and with Robey's (1979) finding that users' attitudes are significant correlates of system use. Taking this finding a step further, the present study found that users who had greatest knowledge, experience, involvement and understanding of computers were the most willing to use the computer and users with the lowest knowledge, experience, involvement and understanding of computers were the least willing to use the computer. This finding reflects a commonsense interpretation that users who have a greater knowledge and understanding of computers are more likely to be more willing to use them as they understand what the computer can do for him or her and their respective tasks. Further, these users relied heavily on the computer in order to perform their work and hence it seems reasonable to assume that they needed the computer in order to perform their tasks which may thus explain why they showed the most willingness to use the computer. On the other hand, for users with the lowest job and computer experience and who did not rely heavily on the computer in order to perform their work, it is not surprising that they showed the least willingness to use the computer. These users' knowledge and understanding of computers was the lowest which perhaps explains why they showed the least willingness to use a computer as they may not fully comprehend the benefits of using one or may not know exactly how to use it to achieve more.

With regards to factor 2 "Knowledge and understanding of computers" which accounted for 5,15% of the common variance, it was found that cluster B members had the most knowledge and understanding of computers and cluster C members had the least. Since cluster B members were characterised by the most experience and training in computers, relied heavily on the computer to complete their work, used them all the time and spend the most time completing a task on the computer, it seems logical that these users would have the most knowledge and understanding of computers. Cluster C members, on the other hand, would have the least knowledge and understanding of computers as they had the least experience and training in computers, did not rely heavily on the computer to perform their work and used the computer the least frequently. Hence, it seems logical to assume that the more a user uses a computer and the more training the user has in using the computer, the greater the user's knowledge and understanding of computers.

Finally, the third factor found in the present study accounted for 3,72% of the common variance and was labelled "Computer attributes." For this factor it was found that members from all three clusters associated only positive aspects to the computer. In particular, users in the present study attributed aspects such as smart, fast, accurate, comfortable, and so on, to computers. However, it was found that members in cluster B scored the highest on this factor and members in cluster C scored the lowest. In other words, users characterised by more computer experience attributed positive aspects to the computer but had a higher score on the factor than users who had little experience with computers. This finding is consistent with Zoltan and Chapanis's (1982) finding that experienced users perceive the computer positively and attribute aspects such as easy to use, powerful, unthreatening, helpful and welcomed in their homes, to the computer. However, the present study's finding is inconsistent with Zoltan and Chapanis's (1982) finding that inexperienced users placed greater emphasis on negatively toned items and attributed aspects such as impersonal, intelligent, costly and need to know a computer language in order to use, to computers. Gamble (1988) also found that experienced users described computers in mainly positive terms. Gamble (1988) found that users perceived computers as systematic, precise, organised, efficient and fast. Gamble (1988) compared his findings to Zoltan and Chapanis's (1982) findings and found that the attributes were almost the same but in a slightly different sequence. Smith (1981) also found that users who have a positive attitude toward computers and who have computer experience attribute only positive aspects to computers and no negative implications. However, Smith (1981) found

inexperienced u were extremely concerned about the effects of computers on people at both an individual and social level. Thus, the present study's finding is consistent with Gamble's (1988) and Smith's (1981) findings that experienced users attribute positive aspects to computers but inconsistent with Smith's (1981) finding for inexperienced users. Taking this finding a step further, two of the attributes found in the present study, i.e., fast and accurate, are consistent with two of Gamble's (1988), i.e., precise and fast, although the place or position of the attribute "fast" varies with it being seen as more important by users in the present study and less so by users in Gamble's (1988) study.

Hence, the present study found that experienced and inexperienced users attributed only positive aspects to computers and no negative aspects were expressed. However, experienced users' score was the highest for the computer attributes factor and inexperienced users' score was the lowest. A possible explanation for this finding is that as Gardner et al. (1989) state, people are getting more accustomed to computers and are realising their benefits, hence feelings of awe are disappearing and positive factors are dominating. Thus, even individuals who have little or no computer experience realise the potential benefits of computers and are viewing them more positively as opposed to negatively. Furthermore, Zoltan and Chapanis (1982) note that users who have little or no experience with computers may attribute some inaccurate perceptions about computers due to their lack or limited experience with computers. This can definitely be applied to the present study as users who had little computer experience scored the lowest on the computer attribute factor but did not have inaccurate perceptions about computers.

With regards to job characteristics, the present study found that users who received adequate feedback and recognition from their supervisors and co-workers had the most favourable attitudes toward working with computers whereas users who did not receive adequate feedback and recognition from their supervisors and co-workers had the least favourable attitudes toward working with computers. Moreover, in the present study users who received adequate feedback and recognition and who had the most favourable attitudes toward working with computers were also found to use the computer all the time, spend the most time completing a task on the computer and relied heavily on the computer in order to perform their work. Hence, cluster B members are in permanent contact with the computer and thus the computer is an important part of their working lives

and as such it becomes involved in the individual's efforts to meet his or her psychological needs. In short, cluster B members have a strong job-system identification and treat the computer as an important source of satisfaction or dissatisfaction at work which affects their attitudes toward the computer (Eason & Damodaran, 1981). In the present study, cluster B members had the most favourable attitudes toward working with computers on all factors which indicates their satisfaction with the system which in turn influences their attitudes toward working with computers. Furthermore, the job design characteristic of "adequate feedback and recognition from supervisors and co-workers" was a distinguishing factor in the cluster solution in the present study. Since cluster B members received adequate feedback and recognition from their supervisors and co-workers, they are provided with all the necessary resources (goods and services) and information required for coping with or solving problems that they may be facing, as well as information relevant to their self-evaluation and sense of personal worth. It is thus reasonable to assume that for a user provided with such information the greater will be the impact of the information on the user's attitude toward working with computers.

On the other hand, cluster C members did not receive adequate feedback and recognition from their supervisors and co-workers, had the least favourable attitudes toward working with computers, were found to use the computer infrequently and did not rely on the computer in order to perform their work. Hence, cluster C members' job was peripheral to the computer system. For cluster C members, the computer was one of the many tools that they used to do their job. Moreover, cluster C members' main concern perhaps is that the computer serves his or her task needs and demands less from him or her in terms of effort and time than other ways of accomplishing the task. If this is so the user can devote his or her energies to pursuing tasks which she considers to be of central relevance to his or her job and which answer his or her psychological needs (Eason & Damodaran, 1981). In the present study, it was found that for cluster C members their psychological needs were not meet through the use of the computer system. That is, not only did they not receive adequate feedback and recognition from their supervisors and co-workers but they found that they did not continuously learn new things at work, were not encouraged to fully use their skills and found their work boring. Perhaps, a possible explanation for this finding is that these users did not have much experience in working with computers, used the computer infrequently and for repetitive tasks, thus their knowledge and understanding of computers is likely to

be extremely limited. It is hence logical to assume that users characterised by such job design factors would have the least favourable attitudes toward working with computers. Furthermore, they received inadequate feedback and recognition from their supervisors and co-workers which largely impinges on their least favourable attitudes toward working with computers as they are not provided with the necessary resources and information required for coping with or solving problems that they may be experiencing, nor are they receiving the information relevant to their self-evaluation and sense of personal worth.

Thus, from the above discussion it is possible to conclude that firstly, the organisation of items relating to attitudes toward working with computers formed three factors with each factor focusing on a common content. The items loading on each factor may be classified as "cognitive", "affective" and "behavioural" although their classification does not correspond to the three component theory of attitudes. Hence, attitudes toward working with computers was found to be a simple concept. Secondly, the present study highlights the existence of a highly favourable (or positive) to a less favourable but not negative continuum of attitudes toward working with computers among tertiary sector users in South Africa. Hence, there is a clear indication that individuals are viewing the computer positively, as an aid which can enhance their working lives. The present study confirms the importance of the beneficial aspects of the computer rather than the fear inducing aspects. Thirdly, the present study offers a tentative answer to the basic question of what is meant by a highly favourable and less favourable view of working with computers. Individuals with a highly positive attitude toward working with computers are likely to have the most job and computer experience, rely heavily on the computer in order to perform their job and thus use the computer all the time. They spend alot of time completing a task on the computer and receive adequate feedback and recognition from their supervisors and co-workers. They are the most willing to use a computer, score the highest on the computer attribute factor and have a sound knowledge and understanding of computers. Individuals with the least favourable attitudes toward working with computers are likely to have the least job and computer experience, do not rely heavily on the computer to perform their work and thus do not use the computer so often. They do not receive adequate feedback or recognition from their supervisors and co-workers. They are the least willing to use a computer, score the lowest on the computer attribute factor and have a low knowledge and understanding of computers. Individuals falling inbetween the "most favourable - least favourable"

attitude continuum are characterised by spending the least time completing a task on the computer and may be said to have a "balanced" view of computers. That is, they are willing to use a computer, attribute positive aspects to the computer and have a knowledge and understanding of computers.

Furthermore, the present study has a number of theoretical and practical implications as well as directions for future research which are discussed in the following section.

THEORETICAL IMPLICATIONS AND FUTURE RESEARCH

The main theoretical implication of the present study is that successful integration of computers into the work environment calls for increased sensitivity to individual differences that might have an impact on their receptivity to and potential use of computers. Hence, the present study supports Igbaria and Chakrabarti's (1990) contention that individual difference variables are important in influencing attitudes toward working with computers. More specifically, the present study indicated that users characterised by more computer experience and training, who used the computer all the time and who received adequate feedback and recognition from supervisors and co-workers showed the most willingness to use computers, most knowledge and understanding of computers, had the highest score on the computer attributes factor and had the most favourable overall attitudes toward working with computers. Users characterised by the least computer experience and training, who used the computer the least frequently and who did not receive adequate feedback and recognition from supervisors and co-workers were the least willingness to use the computer, had the least or lowest knowledge and understanding of computers, scored the lowest on the computer attributes factor and had the least favourable overall attitudes toward working with computers. Although in the present study individual differences were found to influence attitudes toward working with computers, further research is required to explore the influence of these individual differences on attitudes toward working with computers in greater detail.

Perhaps, additional factors not included in the present study may impact on an individual's attitude toward working with computers. Variables that may be considered include the type and size of an organisation, the manner in which computers are installed in the organisation, the way in which

employees are introduced to and trained on the facilities, the industrial relations within the organisation (Gattiker & Nelligan, 1988; Morieux & Sutherland, 1988; van der Merwe, 1986; van der Veer et al., 1988), the type of training, and factors such as software characteristics and hardware alternatives. Future research can also examine individual difference variables in conjunction with organisational characteristics that may serve to inhibit or promote more favourable attitudes toward working with computers. The present study thus provides implications for further model building. The present study provides evidence to suggest that, within the industrial environment, attitudes toward working with computers are important to be examined. Furthermore, research on attitudes toward working with computers has been conducted primarily within the attitudes toward computer paradigm. That is, the interaction between humans and computers has not previously been assessed. Therefore, the present research adds to the body of knowledge of attitudes toward computers by examining user-system-job characteristics previously not considered by other studies on attitudes toward computers and attitudes toward working with computers.

PRACTICAL IMPLICATIONS OF THE PRESENT RESEARCH

The major practical implication of the present study concerns the potential for motivating and managing by supervisors and managers. Supervisors and managers can be taught to identify users' attitudes toward working with computers. The assessment of users' attitudes toward working with computers will allow supervisors and managers to allocate their time more effectively by providing users with the relevant attention depending on their degree of favourability or unfavourability towards working with computers. That is, users who have a more favourable attitude toward working with computers can be offered advanced instructional courses about the computer in addition to training on each software package (Hatcher & Diebert, 1987). Users who have a less favourable attitude toward working with computers can be provided with basic assistance and training in order to eliminate the fear of the unknown (i.e., offer information about the computer, its purpose and functions), eliminate the fear of loss of security (i.e., assure employees that the computer will help them in the short and long run) and proper introduction to the equipment and software is needed with the user having available time to use the software and hardware (Hatcher & Diebert, 1987). It is essential that training does not antagonise the user but conversely it should produce a more

favourable attitude toward working with computers at the end of the training sessions (Kennedy, 1975).

Furthermore, careful management planning is necessary if computers are to achieve their intended benefits such as increased productivity and quality of output. Management should also play a key role to assist users in exploring applications for the computer and to ensure the existence of an effective structure to assist users within the organisation. This will enable users with varying degrees of favourability towards working with computers to utilise more fully the potential of the computer more effectively. As Schewe (1976) notes trainers must provide their users with the necessary training to effectively interact with a computer system. If users are not reckoned with the behavioural problems of the system, with no matter how technically competent an information system is developed, its true potential will never be realised. Guidance is the single most important factor in building up a user's confidence in his or her ability to use the system since it changes the human-computer relationship from that where the computer is an aloof observer of the human to that where the computer is involved with him or her in the task (Kennedy, 1975). Nonetheless, the role that computer systems play in our working lives today makes it desirable that more effort be placed on the education and training of end-users.

Moreover, system developers and designers who have control over the quality of the system must have a clear understanding of users' requirements and needs. More careful selection of computer systems with regard to system capabilities and user-friendliness as well as attention to improved system maintenance and repair may generate more positive user attitudes. Hence, system developers and designers should consider including more user research in the development of information systems. Important variables need to be measured before a system is designed. Results should suggest what type of flexibility is needed and what information should be provided for users under differing conditions and with differing needs.

Attitudes toward working with computers may also be useful as a selection device for many specific jobs and settings. When organisational demands require employees to work with a computer for most of the working day, users with a more favourable attitude toward working with computers would be more appropriate; and when the requirement is for employees to work with a computer

infrequently and not sophisticatedly, users with a less favourable attitude toward working with computers would be more suitable. It is important that an employer determines the attitudes of those selected to work with computers both for the benefit of the organisation (such as increased productivity, decreased alienation and absenteeism, and so on) and for the benefit of the employees (such as increased satisfaction, self-fulfilment, and so forth). Furthermore, since attitudes are often associated with successful implementation of technology (Lucas, 1979) one may suspect that given the positive attitudes of users toward working with computers in the present study, the usual problems of implementation are likely to be less. In fact, attitudes toward working with computers should be addressed during implementation but in some cases it may be too late by then. A system that does not help individuals perform their jobs is not likely to be received favourably in spite of careful implementation efforts. A system that reduces rewards for users is likely to meet with disaster. As stated previously, an often recommended approach to system design is to involve users in the design effort (Robey, 1979). This appears to be a valid method of addressing users' attitudes toward working with computers before irretrievable investments are made in design efforts. System designers and implementation teams would be well advised to find some means of addressing attitudes toward working with computers during computer system development (Robey, 1979).

Finally, a number of limitations relevant to the present study can be identified. These limitations are discussed in terms of the sample and measurement used in the section below.

LIMITATIONS OF THE PRESENT STUDY

One of the limitations of the present study concerns the choice of the sample. Because the sample was selected from a single banking institution in the Transvaal, the results may not be applicable to other organisational sectors. However, the diversity of users in the banking institution and the user-system-job characteristics surveyed enhance the generalisability potential of the study. Future research is however required to assess the generalisability of the findings in other organisational sectors. Second, participation was voluntary and suggests a volunteer sample which may have biased the responses obtained (Rosnow & Rosenthal, 1976).

Examining the measurement of the present study, three limitations, i.e., language, the attitudes toward working with computers scale developed specifically for the present study and the method of data collection, can be identified. First, prior consultation with the information systems manager of the banking institution used in the present study revealed that the majority of users were either English speaking or bilingual. Covering letters and the actual questionnaires were administered in English and not necessarily in the home language of the subject (i.e., Afrikaans). Consequently, the chances of subjects misunderstanding the questions were increased thus possibly biasing the sample. The translation of questionnaires causes problems of distorted meaning in translating, specifically idiomatic expressions (Bluen, 1986). Consequently, questionnaires were not translated and used in the original language in which they had been constructed.

Second, the present study relied on questionnaires as the means of data collection. Data collection by self-report measures has been criticised on the grounds that "objective" conditions may not be reported (Kruger, 1987). Self-report inventories are also subject to response bias (social desirability and acquiescence) defensive tactics (rationalisation or denial), inaccurate answers and faking (Anastasi, 1982). Future research could benefit from using a multiple-level strategy or multimethod approach where a variety of techniques such as interviews and naturalistic observations are used as a means of data collection (Anastasi, 1982). Moreover, the present study focused on the computer user as the source of data collection. Future research may benefit from obtaining data from additional sources such as independent observers (i.e., supervisors or peers). A further criticism labelled against the use of self-report measures is that results may be influenced by expectations of research outcomes by participants. This criticism is especially appropriate when participants know the aim of the research. However, the covering letter of the questionnaire used in the present study, did not specify the nature of the research beyond that it assessed how employees feel towards working with computers.

The attitudes toward working with computers scale was developed specifically for the purpose of the present study. It was based on the three component theory and once factor analysed was found not to support the three component theory. Instead three factors emerged with each consisting of a combination of the three attitude components. As a result, the attitudes toward working with computers scale measured the three components of an attitude but not as distinct "cognitive",

"affective" and "behavioural" components. The hypothesis that users with varying user-system-job characteristics would differ on the three components could thus not be tested. Future research needs to be undertaken in order to ascertain whether attitudes toward working with computers can be divided into three distinct "cognitive", "affective" and "behavioural" attitude components and if so whether users differ on each of these components.

REFERENCES

Abraham, S. (1981). The impact of automated systems on the productivity of managers and professionals. Proceedings of the 1981 Office Automation Conference, Houston, March.

Adorno, T.W.; Frenkel-Brunswick, E.; Levinson, D.J. & Sanford, R.N. (1950). The Authoritarian Personality. Harper: New York.

Ahl, D.H. (1975). Survey of public attitudes toward computers in society. Creative Computing, 1, 49-51.

Ajzen, I. & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour. Prentice-Hall: Englewoods Cliffs, New Jersey.

Aldenderfer, M.S. & Blashfield, R.K. (1984). Cluster analysis. Sage Publications Inc.: Beverly Hills.

Allport, G.W. (1935). Attitudes. In C.A. Murchison (Ed.). A handbook of social psychology. Clark University Press: Worcester, Massachusetts.

Allport, G.W. (1954). The nature of prejudice. Addison-Wesley: Cambridge.

Allwood, C.M. (1986). Novices on the computer: A review of the literature. International Journal of Man-Machine Studies, 25, 633-658.

Anastasi, A. (1982). Psychological testing (3rd ed.). Collier MacMillan: New York.

Apex (1984). A trade union strategy for new technology. In T. Forester (Ed.). The microelectronics revolution. Blackwell: Oxford.

Arndt, S.; Feltes, J. & Hanak, J. (1983). Secretarial attitudes towards word processors as a function of familiarity and locus of control. Behavior and Information Technology, 2 (1), 17-22.

Ayerst, P.W. (1984). Computer assistance in the teaching of Biology in South African schools. Unpublished Masters Thesis, University of Natal.

Back, K.W. (1977). Social psychology. John Wiley & Sons: New York.

Bagozzi, R.P. (1978). The construct validity of the affective, behavioral and cognitive components of attitude by analysis of covariance structures. Multivariate Behavioral Research, 13, 9-31.

Bailey, J. (1983). Job design and work organisation - matching people and technology for productivity and employee involvement. Prentice-Hall: Englewood Cliffs, New Jersey.

Bandalos, D. & Benson, J. (1990). Testing the factor structure invariance of a computer attitude scale over two grouping conditions. Educational and Psychological Measurement, 50, 49-60.

Bannon, S.H.; Marshall, J.C. & Fluegad, S. (1985). Cognitive and affective computer attitude scales: A validity study. Educational and Psychological Measurement, 45, 679-681.

Barnes, R.M. (1980). Motion and time study: design and measurement of work (7th ed.). Wiley: New York.

Benson, D.H. (1983). A field study of end user computing: findings and issues. MIS Quarterly, 7, 35-45.

Bergmark, R.E. (1980). Computers and persons. In W.M. Mathews (ed.). Monster or Messiah? The computer's impact on society. University of Mississippi Press: Jackson, Mississippi.

Bjorn-Andersen, N.; Eason, K. & Robey, D. (1986). Managing computer impact. Ablex: Norwood, New Jersey.

Blashfield, R.K. (1976). Mixture model tests of cluster analysis: accuracy of four agglomerative hierarchical methods. Psychological Bulletin, 83, 377-388.

Blashfield, R.K. (1980). The growth of cluster analysis: Tryon, Ward, & Johnson. Multivariate Behavioral Research, 15, 439-458.

Bloom, A.J. (1985). An anxiety management approach to computerphobia. Training and Development Journal, 39, 90-92.

Bluen, S.D. (1986). Consequences and moderators of industrial relations stressors. Unpublished Ph.D. Thesis, University of Witwatersrand, Johannesburg.

Bolweg, J.F. (1976). Job design and industrial democracy. International series on the quality of working life (Vol.3). Martinus Nijhoff Social Sciences Division: Leiden, Netherlands.

Borgardus, E.S. (1925). Measuring social distance. Journal of Applied Psychology, 9, 299-308.

Breckler, S.J. (1984). Empirical validation of affect, behaviour, and cognition as distinct components of attitude. Journal of Personality and Social Psychology, 47 (6), 1191-1205.

Brod, C. (1982). Managing technostress: Optimising the use of computer technology. Personnel Journal, 61 (10), 753-757.

Bruner, J.S. (1958). Social psychology and perception. In E. Maccoby, T.M. Newcomb and E.L. Hartley (Eds.). Readings in social psychology. Henry Holt & Company: New York.

Campbell, D.T. & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56, 81-105.

Carlson, E.R. (1956). Attitude change through modification of attitude structure. Journal of Abnormal and Social Psychology, 52, 256-261.

Carmines, E.G. & Zeller, R.A. (1979). Reliability and validity assessment. Sage Publications Inc.: Beverly Hills, CA.

Cattell, R.B. (1952). Factor Analysis. Harper & Brothers: New York.

Cattell, R.B. (1965). Factor analysis: An introduction to essentials (I) the purpose and underlying models, (II) the role of factor analysis in research. Biometrics, 21, 190-215; 405-435.

Cerny, B.A. & Kaiser, H.F. (1977). A study of a measure of sampling adequacy for factor-analyptic correlation matrices. Multivariate Behavioural Research, 12, 43-47.

Chein, I. (1948). Behavior theory and the behavior of attitudes: some critical comments. Psychological Review, 55, 175-188.

Clegg, C. (1989). 'The dark side' of I.T.: A personal comment. Behaviour and Information Technology, 8 (5), 399-402.

Clifford, H. & Stephenson, W. (1975). An introduction to numerical taxonomy. Academic Press: New York.

Companion, M.A. & Corso, G.M. (1982). Task taxonomies: A general review and evaluation. International Journal of Man-Machine Studies, 17, 459-472.

Comrey, A.L. (1973). A first course in Factor Analysis. Academic Press Inc.: New York.

Cook, J.D.; Hepworth, S.J.; Wall, T.D. & Warr, P.B. (1981). The experience of work: A compendium and review of 249 measures and their use. Academic Press: London.

Coombs, M.J. & Alty, J.L. (1981). Computing skills and the user interface. Academic Press Inc.: London.

Cooper, M.C. & Milligan, G.W. (1984). The effect of error on determining the number of clusters. College of Administrative Science Working Paper Series 84-2, Ohio State University: Columbus.

Coovert, M.D. & Goldstein, M. (1980). Locus of control as a predictor of users' attitude toward computers. Psychological Reports, 47, 1167-1173.

Criswell, J.H. (1937). Racial cleavage in negro-white groups. Sociometry, 1, 81-89.

Cureton, E.E. & D'Agistino, R.B. (1983). Factor Analysis: An applied approach. Lawrence Erlbaum: Hillsdale, New Jersey.

Curley, K.F. (1989). Computer technology and knowledge workers: a pilot study of job impact. The Interdisciplinary Journal of Human-Computer Interaction, 1 (2), 171-182.

Dambrot, F.H.; Watkins-Malek, M.A.; Silling, S.M.; Marshall, R.S. & Garver, J.A. (1985). Correlates of sex differences in attitudes toward and involvement with computers. Journal of Vocational Behaviour, 27, 71-86.

Damodaran, L. (1986). User support. In N. Bjorn-Andersen; K.D. Eason and D. Robey (Eds.). Managing computer impact. Ablex: Norwood, New Jersey.

Damodaran, L. & Eason, K.D. (1981). Design procedures for user involvement and user support. In M.J. Coombs and J.L. Alty (Eds.). Computing skills and the user interface. Academic Press Inc. Ltd.: London.

Davies, D.S. (1984). The computer revolution, industry and people. In T. Forester (Ed.). The microelectronics revolution. Blackwell: Oxford.

Davis, L.E. (1957). Toward a theory of job design. Journal of Industrial Engineering, 8 (5), 305-309.

Davis, L.E. (1979). Design of jobs (2nd ed.). Goodyear Publishing Company Inc.: California.

Davis, W.S. (1989). Computing fundamentals: Concepts (2nd ed). Addison-Wesley Publishing Company, Inc.: Reading Massachusetts.

Davis, L.E. & Canter, R.R. (1955). Job design. Journal of Industrial Engineering, 6 (1), 3-6.

Davis, L.E. & Trist, E. (1979). Improving the qual' y of working life: Sociotechnical case studies. In L.E. Davis. Design of jobs (2nd ed.). Goodyear Publishing Company, Inc.: California.

Doob, L.W. (1947). The behaviour of attitudes. Psychological Review, 54, 135-156.

Dowell, J. & Long, J. (1989). Towards a conception for an engineering disciple of human factors. Ergonomics, 32 (11), 1513-1535.

Downing, H. (1984). Wordprocessors in the oppression of women. In T. Forester (Ed.). The microelectronics revolution. Blackwell: Oxford.

Dubes, R. & Jain, A. (1980). Clustering methodologies in exploratory data analysis. Advances in Computers, 19, 113-228.

Duckitt, J.H. (1990). A social psychological investigation of racial prejudice among white South Africans. Unpublished Ph.D. Thesis: University of Witwatersrand, Johannesburg.

Drury, C.G. (1983). Task analysis methods in industry. Applied Ergonomics, 14 (1), 19-28.

Eason, K.D. (1976). A task-tool analysis of manager-computer interaction. Proceedings of the NATO ASI on 'Man-Computer Interaction.'

Eason, K.D. (1980). Dialogue design implications of task allocation between man and computer. Ergonomics, 23 (9), 881-891.

Eason, K. (1984). Towards the experimental study of usability. Behaviour and Information Technology, 3 (2), 133-143.

Eason, K. (1988). Information technology and organisational change. Taylor & Francis, Ltd.: London.

Eason, K.D. (1991). Ergonomic perspectives on advances in human-computer interaction. Ergonomics, 34 (6), 721-741.

Eason, K.D. & Damodaran, L. (1981). The needs of the commercial user. In M.J. Coombs and J.L. Alty (Eds.). Computing skills and the user interface. Academic Press Inc.: London.

Eason, K.D.; Damodaran, L. & Stewart, T.F.M. (1974). A survey of man-computer interaction in commercial applications. LUTERC no. 144, HUSAT Research Centre: University of Technology, Loughborough.

Eiser, R. & van der Pligt, J. (1988). Attitudes and decisions. Routledge: London.

Elifson, K.W.; Runyon, R.P. & Haber, A. (1982). Fundamentals of social statistics. Random House: New York.

Emery, F.E. (1959). Characteristics of socio-technical systems. Tavistock Institute, doc. 527.

Emory, C.W. & Cooper, D.R. (1991). Business Research Methods (4th ed.). Richard D. Irwin: Boston.

Everitt, B. (1974). Cluster analysis. Heinemann Educational Books, Ltd.: London.

Everitt, B. (1979). Unsolved problems in cluster analysis. Biometrics, 35, 169-181.

Everitt, B. (1980). Cluster analysis. Halsted: New York.

Fazio, R.H. & Zanna, M.P. (1981). Direct experience and attitude behavior consistency. In L. Berkowitz (Ed.). Advances in experimental social psychology. Academic Press: New York.

Finne, G.R. (1987). Novice attitude changes during a first course in computing: A case study. Questiones informaticae, 5 (2), 56-62.

Fishbein, M. (1965). A consideration of beliefs, attitudes and their relationships. In I.D. Steiner and M. Fishbein (Eds.). Current studies in social psychology. Holt, Rinehart & Winston: New York.

Fishbein, M. & Ajzen, I. (1975). Belief, attitude, intention and behaviour: An introduction to theory and reading. Addison-Wesley: Reading Massachusetts.

Fisher, J.A. (1988). Individual differences and functional architecture in cognitive representations of objects and space. Unpublished Ph.D. Theses: University of Witwatersrand, Johannesburg.

Fisher, J. (1991). Defining the novice user. Behaviour and Information Technology, 10 (5), 437-441.

Fisher, J. & Currin, R.A. (1986). Evaluating interactive menu driven systems. ESA 1986. A.P. Golding and B.K. Hill: Design Institute, Pretoria.

Fisher, J. & Kaplan, I. (1990). Representation of computer processes and command words. In L. Berlinguet & D. Berthelette (Eds.). Work with display units 89 Amsterdam: North Holland.

Fleishman, E.A. (1975). Toward a taxonomy of human performance. American Psychologist, 30, 1127-1149.

Fleishman, E.A. (1978). Relating individual differences to the dimensions of human tasks. Ergonomics, 21 (12), 1007-1019.

Galagan, P. (1983). Treating computer anxiety with training. Training and Development Journal, 37, 57-60.

Gamble, P.R. (1988). Attitudes to computers of managers in the hospitality industry. Behavior and Information Technology, 7 (3), 305-321.

Gardner, E.P.; Young, P. & Ruth, S.R. (1989). Evolution of attitudes toward computers: a retrospective view. Behaviour and Technology, 8 (2), 89-98.

Gassman, H-P. (1981). Information, computers and communications policies for the 80's. North Holland Publishing Company: Amsterdam.

Gattiker, U.E. & Larwood, L. (1986). Career success and organisational position. Journal of Business and Psychology, 1, 77-87.

Gattiker, U.E. (1988). Technological adaption: A typology for strategic human resource management. Behaviour and Information Technology, 7 (4), 345-359.

Gattiker, U.E. & Nelligan, T.W. (1988). Computerised offices in Canada and the USA: Investigating dispositional similarities and differences. Journal of Organisational Behaviour, 9, 77-96.

Gerstberger, P.C. & Allen, T.J. (1968). Criteria used by research and development engineers in the selection of an information source. Journal of Applied Psychology, 52 (4), 272-279.

Ghiselli, E.E.; Campbell, J.P. & Zedeck, S. (1981). Measurement theory for the behavioural sciences. W.H. Freeman & Company: San Francisco.

Gilroy, F.D. & Desai, H.B. ('986). Computer anxiety: sex, race and age. International Journal of Man-Machine Studies, 25, 711-719.

Gist, M.E. (1987). Self-efficacy: Implications for organizational behavior and human resource management. Academy of Management Review, 12 (3), 472-485.

Gist, M.E., Schwoerer, C.E. & Rosen, B. (1987). Modelling vs. non-modelling: The impact on self-efficacy and performance in computer training for managers. Academy of Management Best Papers Proceedings 122-126, 47th Annual Meeting: New Orleans, LA.

Gorsuch, R.L. (1974). Factor Analysis. W.B. Saunders Company: Philadelphia.

Gorsuch, R.L. (1983). Factor Analysis (2nd. ed.). Lawrence Erlbaum: Hillsdale, New Jersey.

Gough, H.G. & Heilbrun, A. (1965). The Adjective Checklist Manual. Consulting Psychologists Press: Palo Alto.

Gower, J.C. & Eason, K.D. (1989). The introduction of information technology in a city firm. In S.D.P. Harker and K.D. Eason (eds.). The Application of Information Technology. Taylor & Francis: London.

Greenwald, A.G. (1968). On defining attitudes and attitude theory. In A.G. Greenwald; T.C. Brock & T.M. Ostrom (Eds.). Psychological foundations of attitudes. Academic Press: New York.

Greenwald, A.G. (1982). Is anyone in charge? Personalysis versus the principle of personal unity. In J. Suls (Ed.). Psychological perspectives on the self (Vol. 1). Hillsdale, Erlbaum: New Jersey.

Guimaraes, T. & Ramanujam, V. (1986). Personal computing trends and problems: An empirical study. MIS Quarterly, 10 (June), 179-187.

Gutek, B.A. & Bikson, T.K. (1985). Differential experiences of men and women in computerised offices. Sex Roles, 13, 123-136.

Guttman, L.L. (1944). A basis for scaling qualitative data. American Sociclogical Review, 9, 139-150.

Hair, J.F.; Anderson, R.E.; Tatham, R.L. & Grablowsky, B.J. (1979). Multivariate data analysis. Petroleum Publishing Company: Tulsa.

Halloran, J.D. (1970). Attitude formation and change. Leicester University Press: New York.

Hammond, N.; Jorgenson, A.; Maclean, A.; Barnard, P. & Long, J. (1983). Design practice and interface usability: Evidence from interviews with designers. IBM UK Laboratories Report HF 082, August.

Hannigan, S. & Herring, V. (1987). Human factors in office product design - European practice, 2nd International Conference on Human-Computer Interaction: Hawaii.

Hannigan, S. & Kerswell, B. (1986). Towards user friendly terminals. Proceedings of the ISSLS 1986 Conference, Tokyo: Japan.

Harker, S.D.P. & Eason, K.D. (1980). An open systems approach to task analysis. HUSAT Memo No. 194 (HUSAT, University of Technology: Loughborough).

Hartigan, J.A. (1985). Statistical theory in clustering. Journal of Classification, 2, 63-76.

Hartley, E.L. & Hartley, R.E. (1952). Fundamentals of social psychology. Alfred A. Knopf: New York.

Hatcher, M.E. & Diebert, T.R. (1987). Predicting end-user acceptance of microcomputers in the workplace. International Journal of Man-Machine Studies, 26, 693-705.

Hirschheim, R.A. (1985). Office automation: A social and organisational perspective. John Wiley and Sons Ltd.: Chichester.

Hirschowitz, R. (1990). Technological change and employment. IPM Journal, 8 (8), 11-15.

Hopkins, K.D. & Glass, G.V. (1978). Basic statistics for behavioral sciences. Prentice-Hall Inc.: Englewoods Cliffs, New Jersey.

Howard, G.S. (1986). Computer anxiety and the use of microcomputers in management. UMI Research Press: Ann Arbor.

Howard, G.S. & Smith, R. (1986). Computer anxiety in management: myth or reality? Communications of the ACM, 29, 611-615.

Igbaria, M. & Chakrabarti, A. (1990). Computer anxiety and attitudes towards microcomputer use. Behaviour and Information Technology, 9 (3), 229-241.

Igbaria, M. & Parasuraman, S. (1989). A path analytic study of individual characteristics, computer anxiety and attitudes toward microcomputers. Journal of Management, 15, 373-388.

Igbaria, M.; Pavri, F.N. & Huff, S.L. (1989). Microcomputer applications: An empirical look at usage. Information and Management, 16, 187-196.

Iversen, G.R. & Norpoth, H. (1976). Analysis of variance. Sage Publications Inc.: California.

Jardine, N. & Sibson, R. (1971). Mathematical taxonomy. John Wiley: New York.

Jaspars, J.M.F. (1978). The nature and measurement of attitudes. In H. Tajfel and C. Fraser (Eds.). Introducing social psychology. Penguin Books Ltd.: England

Johnson, H. & Johnson, P. (1989). Integrating task analysis into system design: surveying designers' needs. Ergonomics, 32 (11), 1451-1467.

Kaiser, H.F. (1970). A second genera ion Little Jiffy. Psychometrika, 35 (4), 401-415.

Kaiser, H.F. & Rice, J. (1974). Little Jiffy, Mark IV. Educational and Psychological Measurement, 34, 111-117.

Katz, D. & Stotland, E. (1959). A preliminary statement to theory of attitude structure and change. In S. Koch (ed.). Psychology: A study of a science. McGraw-Hill: New York.

Kennedy, T.C.S. (1975). Some behavioural factors affecting the training of naive users of an interactive computer system. International Journal of Man-Machine Studies, 7, 817-834.

Kerber, K.W. (1983). Attitudes towards specific uses of the computer. Quantitative, decision-making and record-keeping applications. Behavior and Information Technology, 2 (3), 197-209.

Kerlinger, F.N. (1973). Foundations of behavioral research (2nd ed.). Holt, Rinehart & Winston Inc.: New York.

Kerlinger, F.N. (1981). Foundations of Behavioural Research (2nd ed.). Holt-Saunders: Tokyo, Japan.

Kerlinger, F.N. & Pedhazur, E.J. (1973). Multiple regression in behavioural research. Holt, Rinehart & Winston Inc.: New York.

Kim, J-O & Mueller, C.W. (1978). Introduction to factor analysis: What it is and how to do it. Sage Publications Inc.: Beverly Hills.

Kim, J-O & Mueller, C.W. (1978). Factor analysis: statistical methods and practical issues. Sage Publications Inc.: Beverly Hills.

Klineberg, O. (1954). Social Psychology. Henry Holt & Company Inc.: New York.

Koslowsky, M.; Lazar, A. & Hoffman, M. (1988). Validating an attitude toward computer scale. Educational and Psychological Measurement, 48, 517-521.

Kothandapani, V. (1971). Validation of feeling, belief, and intention to act as three components of attitude and their contribution to prediction of contraceptive behavior. Journal of Personality and Social Psychology, 19, 321-333.

Krech, D. & Crutchfield, R.S. (1948). Theory and problems of social psychology. McGraw-Hill: New York.

Krech, D., Crutchfield, R.S. & Ballachey, E.L. (1962). Individual in society. McGraw-Hill: New York.

Kruger, D. (1987). Work stress and marital quality. Unpublished Masters Thesis: University of Witwatersrand, Johannesburg.

Lance, G. & Williams, W. (1967). A general theory of classificatory sorting strategies. Computer Journal, 9, 373-380.

LaPiere, R.T. (1934). Attitudes versus actions. Social Forces, 13, 230-237.

Lee, R.S. (1970). Social attitudes and the computer revolution. Public Opinion Quarterly, 34, 53-59.

Lee, K. (1979). Multivariate tests for clusters. Journal of the American Statistical Association, 74, 708-714.

Licklider, J.C.R. (1960). Man-computer symbiosis. Institute of Radio Engineers, Transactions on Human Factors in Electronics, 1, 4-11.

Likert, R. (1931). A technique for the measurement of attitudes. Columbia University Press: New York.

Lodahl, T. (1980). Cost-benefit concepts and applications for office automation. Proceedings of the 1980 Office Automation Conference: Atlanta.

Loehlin, J.C. (1987). Latent variable models: An introduction to factor, path and structural analysis. Erlbaum Associates: Hillsdale, New Jersey.

Long, J.B. (1989). Cognitive ergonomics and human-computer interaction: An introduction. In J.B. Long and A.D. Whitefield (Eds.). Cognitive ergonomics and human-computer interaction. Cambridge University Press: Cambridge.

Lorr, M. (1983). Cluster analysis for social scientists. Jossey-Bass Publishers: San Francisco.

Lucas, H.C. (1975). Performance and the use of an information system. Management Science, 21 (8), 908-919.

Lucas, H.C. (1979). The implementation of an operations research model in the brokerage industry. Studies in the Management Sciences, 13, 139-154.

Mann, J.H. (1959). The relationship between cognitive, affective, and behavioral aspects of racial prejudice. Journal of Social Psychology, 49, 223-228.

March, J.G. & Simon, H.A. (1958). Organisations. Wiley: New York.

Martin, J. & Norman, A.R.D. (1973). The Computerized Society. Penguin: London.

Mayer, S.R. (1967). Computer-based subsystems for training the users of computer systems. IEEE Transactions on Human Factors in Electronics, 8 (2), 70-75.

McCall, R.B. (1970). Fundamental statistics for psychology. Harcourt, Brace & World Inc.: New York.

McCall, R.B. (1990). Fundamental statistics for behavioral sciences (5th ed.). Harcourt Jonanovish Publishers: New York.

McGuire, W.J. (1960). A syllogistic analysis of cognitive relationships. In M.J. Rosenberg; C.I. Hovland; McGuire, W.J.; R.P. Abelson & J.W. Brehm. Attitude organization and change: An analysis of consistency among attitude components. Yale University Press: New Haven, Conn.

McGuire, W.J. (1985). Attitudes and attitude change. In G. Lindzey and E. Aronson. Handbook of social psychology Vol. 2 (3rd ed). Random House: New York.

Miller, R.B. (1966). Task taxonomy: Science or technology? IBM: Poughkeepsie, New York.

Milligan, G.W. & Cooper, M.C. (1985). An examination of procedures for determining the number of clusters in a data set. Psychometrika, 50 (2), 159-179.

Minard, R.D. (1946). Race relationships in the Pocahontas coal fields. Journal of Social issues, 8, 29-44.

Morieux, Y.V.H. & Sutherland, E. (1988). The interaction between the use of information technology and organisational culture. Behavior and Information Technology, 7 (2), 205-213.

Morrison, P.R. (1983). A survey of attitudes toward computers. Communications of the ACM, 26 (12), 1051-1057.

Morrow, P.C.; Prell, E.R. & McK-y, J.C. (1986). Attitudinal and behavioural correlates of computer anxiety. Psychological Reports, 59, 1199-1204.

Nelson, R. & Cheney, P. (1987). Training end users: An exploratory study. MIS Quarterly, 11, 547-559.

Newcomb, T.M.; Turner, R.H. & Converse, P.E. (1965). Social psychology. Holt, Rinehart & Winston Inc.: New York.

Nickerson, R.S. (1981). Why interactive computer systems are sometimes not used by people who might benefit from them. International Journal of Man-Machine Studies, 15, 460-483.

Northway, M.L. & Quarrington, B. (1946). Depicting inter-cultural relations. Sociometry, 9, 334-339.

Oborne, D.J. (1985). Computers at work. A behavioural approach. John Wiley & Sons Ltd.: Chichester.

Olson, M.H. (1982). Statement of concern office. Technology and People, 1, 37-40.

Oppenheim, A.N. (1966). Questionnaire design and attitude measurement. Heinemann Educational Books Ltd.: London.

Orcutt, J.D. & Anderson, R.E. (1974). Human-computer relationships: interactions and attitudes. Behavior Research Methods and Instrumentation, 6 (2), 219-222.

Oskamp, S. (1977). Attitudes and opinions. Prentice-Hall: Englewood Cliffs, New Jersey.

Ostrom, T.M. (1968). The emergence of attitude theory: 1930-1950. In A.G. Greenwald, T.C. Brock & T.M. Ostrom (Eds.). Psychological foundations of attitudes. Academic Press: New York.

Ostrom, T.M. (1969). The relationship between the affective, behavioral and cognitive components of attitude. Journal of Experimental Social Psychology, 5, 12-30.

Packard, V. (1978). The People shapers. Nelson: Melbourne.

Parasuraman, S. & Igbaria, M. (1990). An examination of gender differences in the determinants of computer anxiety and attitudes toward microcomputers among managers. International Journal of Man-Machine Studies, 32, 327-340.

Pavri, F.N. (1988). An empirical study of the factors contributing to microcomputer usage. Dissertation Abstracts International, 49/05-A, 1200.

Paxton, A.L. & Turner, E.J. (1984). The application of human factors to the needs of the novice computer user. International Journal of Man-Machine Studies, 20, 137-156.

Peak, H. (1955). Attitude and motivation. In M.R. Jones (Ed). Nebraska symposium on motivation. University of Nebraska Press: Lincoln.

Popovich, P.M.; Hyde, K.R.; Zakrajsek, T. & Blumer, C. (1987). The development of the attitudes toward computer usage scale. Educational and Psychological Measurement, 47, 261-269.

Price, S. (1979). Introducing the electronic office. NCC Publications: Manchester.

Quintanar, L.R.; Crowell, C.R. & Pryor, J.B. (1982). Human-computer interaction: A preliminary social psychological analysis. Behavior Research Methods and Instrumentation, 14 (2), 210-220.

Rafaeli, A. (1986). Employee attitudes toward working with computers. Journal of Occupational Behaviour, 7, 89-106.

Rafaeli, A. & Sutton, R.I. (1986). Wordprocessing technology and perceptions of control among office workers. Behaviour and Information Technology, 5 (1), 31-37.

Raub, A.C. (1981). Correlates of computer anxiety in college students. Unpublished Ph.D. Thesis: University of Pennsylvania.

Reece, M.J. & Gable, R.K. (1982). The development and validation of a measure of general attitude toward computers. Educational and Psychological Measurement, 42 (3), 913-916.

Rice, A.K. (1958). Productivity and social organisation: the Ahmedabad experiment. Tavistock: London.

Rivizzigho, X.R. (1980). Overcoming the fear of using the computer and basic statistical methods. Journal of Geography, 79, 263-268.

Robey, D. (1979). User attitudes and management information systems use. Academy of Management Journal, 22, 527-538.

Rokeach, M. (1967). Attitude change and behavioral change. Public Opinion Quarterly, 30, 529-550.

Rokeach, M. (1968). Beliefs, attitudes and values. Jossey-Bass: San Francisco.

Rosenberg, M.J. (1956). Cognitive structure and attitudinal affect. Journal of Abnormal and Social Psychology, 53, 367-372.

Rosenberg, M.J. & Hovland, C.I. (1960). Cognitive, affective and behavioural components of attitudes. In M.J. Rosenberg; C.I Hovland; W.J. McGuire; R.P. Abelson and J.W. Brehm (Eds.). Attitude organisation and change. Yale University: New Haven.

Rosnow, R. & Rosenthal, R. (1976). The volunteer subject revisited. Australian Journal of Psychology, 28, 97-108.

Runyon, R.P. & Haber, A. (1980). Fundamentals of behavioral statistics (4th ed.). Addison-Wesley Publishing Company Inc.: Reading, Massachusetts.

Salvendy, G. (1984). Research issues in the ergonomics, behaviour and organisational and behavioural aspects of office automation. In B. Cohen (Ed.). Human aspects in office automation. Elsevier Science Publishers: Amsterdam.

SAS Manual (1990). SAS/STAT User's guide Volume 1, Acceclus-Freq. Version 6 (4th ed.). SAS Institute Inc.: Cary NC, USA.

Schachter, S. (1964). The interaction of cognitive and physiological determinants of emotional state. In L. Berkowitz (Ed.). Advances in experimental social psychology Vol 1. Academic Press: New York.

Schermerhorn, J.R.; Hunt, J.G. & Osborn, R.N. (1985). Managing organisational behaviour (2nd ed.). John Wiley & Sons Inc.: New York.

Schewe, C.D. (1976). The management information system user: An exploratory behavioural analysis. Academy of Management Journal, 19 (4), 577-590.

Sherif, C.W.; Sherif, M. & Nebergall, R.E. (1965). Attitude and attitude change. Saunders: Philadelphia.

Sherif, M. & Sherif, C.W. (1969). Social Psychology. Harper and Row: New York.

Shneiderman, B. (1976). Exploratory experiments in programmers behaviour. International Journal of Computer and Information Sciences, 5, 123-143.

Smith, H.T. (1980). Human-computer communication. In H.T. Smith and T.R.G. Green (Eds). Human interaction with computers. Academic Press: London.

Smith, A.G. (1981). Attitudes toward computers: A survey of diverse persons. The Australian Computer Journal, 13 (3), 87-92.

Sneath, P. & Sokal, R. (1973). Numerical Taxonomy. San W.H. Freeman: San Francisco..

Stewart, T.F.M. (1986). Task fit, ease-of-use and computer facilities. In N m-Andersen; K.D. Eason and D. Robey (Eds.). Managing computer impact. Ablex: Norwood, New Jersey.

Stone, R.A. (1990). Leadership style and managers' attitudes toward using personal computers: A field study. Psychological Reports, 67, 915-922.

Swanson, E.B. (1982). Measuring user attitudes in MIS research: A review. Omega International Journal of Management Science, 10 (2), 157-165.

Tayl , T.R. (1984). Attitude measurement and behaviour prediction. Part 1: Literature survey (CSIR Special Report PERS 363). NIPR: Johannesburg, South Africa.

Thibaut, J. & Kelly, H.H. (1959). The social psychology of groups. John Wiley and Sons: New York.

Thomas, W.I. & Znaniecki, F. (1918). The Polish peasant in Europe and America (Vol.1). Badger: Boston.

Thorsrud, E. (1973). The industrial democracy project in Norway. In R. Dubin (Ed.). The handbook of work, organisation, and society. Rand McNally: Chicago.

Thurstone, L.L. & Chave, E.J. (1929). The measurement of attitude. University of Chicago Press: Chicago.

Triandis, H.C. (1971). Attitude and attitude change. John Wiley and Sons: New York.

Triandis, H.C.; Vassiliou, V. & Nassiakou, M. (1968). The cross-cultural studies of subjective culture. Journal of Personality and Social Psychology, monograph supplement, 8 (4), 1-42.

Trist, E.L. & Bamforth, K.W. (1951). Some social and psychological consequences of the Longwall method of goal-setting. Human Relations, 4, 3-38.

Van der Merwe, D.P. (1986). Computers and the law. Juta and Co. Ltd.: Cape Town

Van der Veer, G.C.; Green, T.R.G.; Hoc, J-M. & Murray, D.M. (1988). Working with computers: Theory versus outcome. Academic Press: London.

Wagman, M. (1983). A factor analytic study of the psychological implications of the computer for the individual and society. Behavior Research Methods and Instrumentation, 15 (4), 413-419.

Walsh, P.A.; Lim, K.Y.; Long, J.B. & Carver, M.K. (1988). Integrating human factors with system development In N. Heaton & M. Sinclair (Eds). Designing end-user interfaces. Pergamon Infotech: Oxford.

Walsh, P.A.; Lim, K.Y. & Long, J.B. (1989). JSD and the design of user interface software. Ergonomics, 32 (11), 1483-1498.

Wang, Z.M. (1989). The human-computer interface hierarchy model and strategies in system development. Ergonomics, 32 (11), 1391-1400.

Ward, J. (1963). Hierarchical grouping to optimize an objective function. Journal of the American Statistical Association, 58, 236-244.

Williams, W. (1971). Principles of clustering. Annual review of Ecology and Systematics, 2, 303-326.

Williams, F.; Coulombe, J. & Lievrouw, L. (1983). Children's attitudes toward small computers: A preliminary study. ECTJ, 31 (1), 3-7.

Wilner, D.M.; Walkley, R.P. & Cook, S.W. (1952). Residential proximity and intergroup relations in public housing projects. Journal of Social issues, 8, 45-69.

Woodmansee, J.J. & Cook, S.W. (1967). Dimensions of verbal racial attitudes: Their identification and measurement. Journal of Personality and Social Psychology, 7, 240-250.

Zajonc, R.B. (1968). The attitudinal effects of mere exposure. Journal of Personality and Social Psychology, monograph supplement, part 2, 1-27.

Zajonc, R.B. (1980). Feeling and thinking: Preferences need no inferences. American Psychologist, 35, 151-175.

Zakrajsek, T.D.; Waters, L.K.; Popovich, P.M.; Craft, S. & Hampton, W.T. (1990). Convergent validity of scales measuring computer-related attitudes. Educational and Psychological Measurement, 50, 343-349.

Zipf, G.F. (1965). Human behaviour and the principle of least effort; an introduction to human ecology (2nd ed.). Hafner: New York.

Zoltan, E. & Chapanis, A. (1982). Experience with and attitudes toward computers: accountants vs. lawyers vs. pharmacists vs. physicians. Behavior and Information Technology, 1 (1), 55-68.

APPENDIX 1

Covering letter

Department of Psychology

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3, WITS 2050, South Africa • Telegrams 'Uniwits' • Telex 4-27125SA • Telephone (011) 716-1111

Dear Sir / Madam

At present I am conducting a Postgraduate research study in Industrial Psychology, at the University of Witwatersrand. The aim of the study is to assess employees attitudes towards working with computers.

I would be most grateful if you would assist me with my research by completing the attached questionnaire as openly and honestly as possible, within the next two days. You will notice that your name is not required anywhere on the questionnaire. This is to ensure your complete confidentiality. Your responses to the questions shall be treated in the strictest confidence and scores will be used solely for research purposes. Further, the organisation by whom you are employed will have no access to your responses on the questionnaire whatsoever.

This questionnaire should only be completed by individuals who use a computer to perform their work or some aspect of their work. Although, some items on the questionnaire may appear repetitive they do assess different aspects, thus please ensure that you answer all items.

If you would like more information about this study, please contact me at (011) 716-2407.

Thank you for your time and co-operation.

Yours faithfully

Argirys.....

LOURIA ARGIRYS

APPENDIX 2

Biographical data

Biographical data

To assist this research, certain biographical information is needed.

Please could you provide the following:

Age : .....

Gender : Male / Female

Education (highest level passed) : .....

How long have you been in your present job?

..... years ..... months

How long have you been in a similar job?

..... years ..... months

APPENDIX 3

Checklist items

The following questions examine aspects of your job and the degree to which a computer is used in your daily work. The term 'computer' used in the statements below denotes micro-computers, data processors, word-processors, and large computer systems.

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about the statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. In my job I am required to perform the same tasks over and over.					
2. My goals are closely stated for me.					
3. I am expected to follow instructions and procedures closely.					
4. I am required to complete my tasks within a time limit.					
5. I set my own pace of work.					
6. I am given much freedom to decide how to perform my tasks.					
7. In my job I hardly perform the same task twice.					
8. The relevant information that I need to complete my tasks is freely available to me.					
9. I find the computer easy to use.					
10. When the computer gives me instructions I understand them.					
11. When using the computer if I get stuck I can easily solve my problems using manuals.					

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
12. When using the computer if I get stuck I always know who to ask for help.					
13. The computer helps me do my job.					
14. I rely heavily on the computer in order to perform my job.					
15. If I choose to, I could do my work without the computer.					
16. When I use the computer I use one or two programmes.					
17. I understand how I am required to use the computer but not how others use it.					
18. I received formal training to use the computer.					
19. I understand the concepts and operating details involved when using the computer.					
20. When I use a computer I use many different programmes.					
21. I have completed a computer science course at school, college, or university.					
22. I received informal training to use the computer.					
23. Most of my knowledge about computers comes from on-the-job experience.					
24. I am proficient in one or more computer languages.					

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
25. My work is challenging.					
26. My work allows me to continually learn new things.					
27. In my job I have a variety of tasks to perform.					
28. At work I am encouraged to fully use my skills.					
29. My work gives me a sense of accomplishment.					
30. My supervisor and co-workers provide adequate feedback about how well I am doing on my job.					
31. I am involved in decisions relating to my work.					
32. I often receive recognition from others in my job.					
33. My job requires that I use my initiative.					
34. I feel my work is meaningful and worthwhile.					
35. I find my work interesting.					
36. On the whole I find my work boring.					
37. I always finish off the work I begin.					
38. When I need help in my job my supervisor and co-workers are always willing to assist.					

Please complete the following:

39. I have been using or working with a computer for:

    ..... years ..... months

40. During my working day a typical task on the computer is completed in:

    ..... hours ..... minutes

41. During my working day I use the computer:

    infrequently / frequently / all the time

APPENDIX 4

Attitudes toward working with computers scale

The set of items below deal with your knowledge of computers, and your feelings and behaviour towards working with computers. The term computer denotes micro-computers, data processors, word-processors, and large computer systems.

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. Using the computer is too time consuming. A1					
2. I often read about computers to further my knowledge of computers. B7					
3. I understand what goes on within a computer system. C13					
4. Computers make too many mistakes. A2					
5. I often get stuck and need to ask for help when using the computer. B8					
6. I always know when to use the computer. C14					
7. Using the computer improves the quality of my decisions. A3					
8. I often rely on my formal training when using the computer at work. B9					
9. I know how to simplify complex problems on the computer. C15					
10. I do not feel I have control over what I do when using the computer. A4					
11. I usually find the computer limits the scope of my work. B10					
12. I usually know how to complete my tasks quickly and accurately on the computer. C16					

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13. Using the computer does increase my productivity at work. A5					
14. I have seen lots of people being redundant at work. B11					
15. The computer does only what people instruct or programme it to do. C17					
16. Using computers at work reduces people's creativity. A6					
17. I only feed the computer, it does the work. B12					
18. I know the quickest way to complete my tasks on the computer. C1					
19. I enjoy learning about computers and their abilities. A7					
20. I only use the computer when I have to. B13					
21. When I make mistakes on the computer I know how to correct them. C2					
22. I feel the computer only complicates my job. A8					
23. I use the computer as much as I can. B14					
24. I know how to use the computer to make better decisions. C3					
25. Educating people to use computers is a waste of time. A9					
26. I often use the computer to simplify complex problems. B15					

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
27. I understand how the system works and thus set my own pace of work. C4					
28. There is no limit to what computers can do. A10					
29. I usually perform my tasks quickly and accurately on the computer. B16					
30. I know how to use the computer to achieve more. C5					
31. Using computers at work helps create unemployment. A11					
32. The computer does things that are cleverer than things that I can do. B17					
33. I know how to use the computer creatively to help me in my job. C6					
34. The more computers are used the more they will devalue people's worth. A12					
35. It takes me a long time to complete my work on the computer. B1					
36. I know exactly what computer courses to take to further my knowledge of computers. C7					
37. I find computers intimidating. A13					
38. I often make mistakes when using the computer. B2					
39. I know how to use the computer to make my job easier. C8					

Please read each statement carefully and place a cross (x), in the adjacent columns, under the words that describe most clearly how you feel about that statement.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
40. Computers should be used as much as possible. A14					
41. I often use the computer to make better decisions. B3					
42. My formal education provided me with a sound knowledge of computers. C9					
43. The computer can simplify complex problems. A15					
44. When using a computer I usually work at a pace that is comfortable. B4					
45. I understand the limitations of computers. C10					
46. I feel computers are faster and more accurate than people. A16					
47. When I use the computer at work I seem to achieve more. B5					
48. I know the socio-economic implications of introducing computers at work. C11					
49. In general computers are smarter than people. A17					
50. I often use the computer creatively to help me in my job. B6					
51. I know that people and computers share the work that is done. C12					

Key for the Attitudes toward working with computers scale appears on the next page.

KEY:

Attitude components

A = Affective component

B = Behavioural component

C = Cognitive component

Dimensions

1 = Time consuming

2 = Computers make mistakes

3 = Make better decisions

4 = Control

5 = Increase productivity

6 = More creative

7 = Enjoy learning about

8 = Complicates my job

9 = Computers should be taught at school

10 = Limitations

11 = Creates unemployment

12 = Devalues people's worth

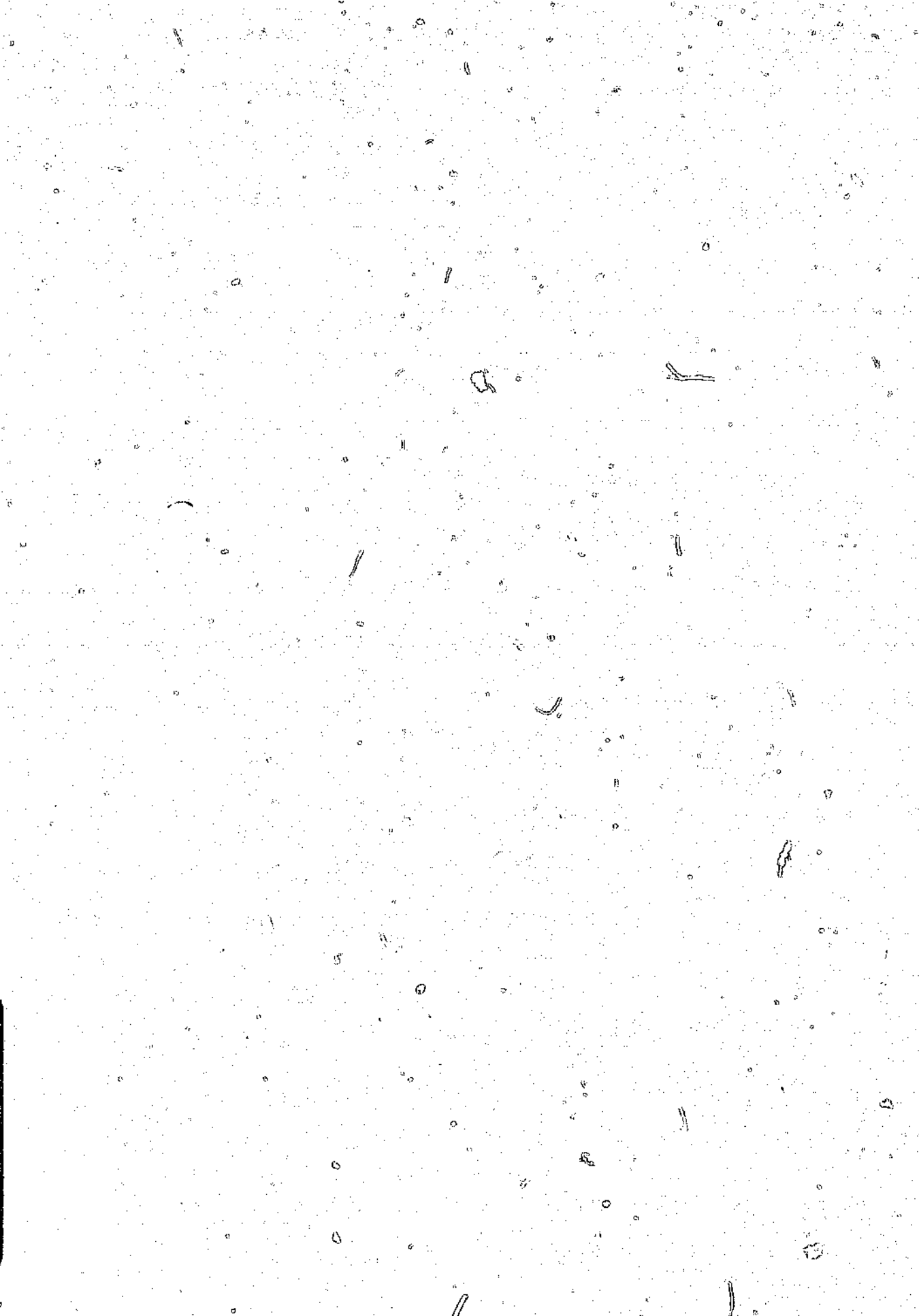
13 = Intimidating

14 = Use as much as possible

15 = Simplify complex problems

16 = Faster and more accurate

17 = More intelligent



Author: Argirys Loukia.
Name of thesis: Attitudes toward working with computers amongst South African tertiary sector users.

PUBLISHER:
University of the Witwatersrand, Johannesburg
©2015

LEGALNOTICES:

Copyright Notice: All materials on the University of the Witwatersrand, Johannesburg Library website are protected by South African copyright law and may not be distributed, transmitted, displayed or otherwise published in any format, without the prior written permission of the copyright owner.

Disclaimer and Terms of Use: Provided that you maintain all copyright and other notices contained therein, you may download material (one machine readable copy and one print copy per page)for your personal and/or educational non-commercial use only.

The University of the Witwatersrand, Johannesburg, is not responsible for any errors or omissions and excludes any and all liability for any errors in or omissions from the information on the Library website.