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AN INVESTIGATION OF THE EFFECTS OF MICROCOMPUTERS ON THE WORK OF PROFESSIONAL ACCOUNTANTS

BY

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A THESIS IN FULFILLMENT OF REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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ABSTRACT

Information technology research over the past two decades suggests that the installation and use of computers fundamentally affects the structure and function of organisations and, in particular, the workers in these organisations. Following the release of the IBM Personal Computer in 1982, microcomputers have become an integral part of most work environments. The accounting services industry, in particular, has felt the impact of this 'microcomputer revolution'. In Big Six accounting firms, there is almost one microcomputer for each professional accountant employed. Notwithstanding this, little research has been done on the effect of microcomputers on the work outcomes of professional accountants working in these firms.

This study addresses this issue. It assesses, in an organisational setting, how accountants' perceptions of ease of use and usefulness of microcomputers act on their computer anxieties, microcomputer attitudes and use to affect their job satisfaction and job performance. The research also examines how different types of human-computer interfaces affect the relationships between accountants' beliefs about microcomputer utility and ease of use, computer anxiety, microcomputer attitudes and microcomputer use.

To attain this research objective, a conceptual model was first developed. The model indicates that work outcomes (job satisfaction and job performance) of professional accountants using microcomputers are influenced by users' perceptions of ease of use and usefulness of
microcomputers via paths through (a) the level of computer anxiety experienced by users, (b) the general attitude of users toward using microcomputers, and (c) the extent to which microcomputers are used by individuals. Empirically testable propositions were derived from the model to test the postulated relationships between these constructs. The study also tested whether or not users of different human-computer interfaces reacted differently to the perceptions and anxieties they hold about microcomputers and their use in the workplace. It was argued that users of graphical interfaces, because of the characteristics of those interfaces, react differently to their perceptions and anxieties about microcomputers compared with users of command-line (or textual-based) interfaces.

A passive-observational study in a field setting was used to test the model and the research propositions. Data was collected from 164 professional accountants working in a Big Six accounting firm in a metropolitan city in Australia. Structural equation modelling techniques were used to test the hypothesised causal relationships between the components comprising the general research model. Path analysis and ordinary least squares regression was used to estimate the parameters of the model and analyse the data obtained. Multisample analysis (or stacked model analysis) using EQS was used to test the fit of the model to the data of the different human-computer interface groups and to estimate the parameters for the paths in those different groups.

The results show that the research model is a good description of the data. The job satisfaction of professional accountants is directly affected
by their attitude toward using microcomputers and by microcomputer use itself. However, job performance appears to be only directly affected by microcomputer attitudes. Microcomputer use does not directly affect job performance. Along with perceived ease of use and perceived usefulness, computer anxiety is shown to be an important determinant of attitudes toward using microcomputers - higher levels of computer anxiety negatively affect attitudes toward using microcomputers. Conversely, higher levels of perceived ease of use and perceived usefulness heighten individuals' positive attitudes toward using microcomputers. Perceived ease of use and perceived usefulness also indirectly affect microcomputer attitudes through their effect on computer anxiety. The results show that higher levels of perceived ease of use and perceived usefulness result in lower levels of computer anxiety. A surprising result from the study is that while perceived ease of use is shown to directly affect the level of microcomputer usage, perceived usefulness and attitude toward using microcomputers does not.

The results of the multisample analysis confirm that the research model fits the stacked model and that the stacked model is a significantly better fit if specific parameters are allowed to vary between the two human-computer interface user groups. In general, these results confirm that an interaction exists between the type of human-computer interface (the variable providing the grouping) and the other variables in the model. The results show a clear difference between the two groups in the way in which perceived ease of use and perceived usefulness affect microcomputer attitude. In the case of users of command-line interfaces, these variables appear to affect
microcomputer attitude via an intervening variable, computer anxiety, whereas in the graphical interface user group the effect occurs directly. Related to this, the results show that perceived ease of use and perceived usefulness have a significant direct effect on computer anxiety in command-line interface users, but no effect at all for graphical interface users. Of the two exogenous variables only perceived ease of use, and that in the case of the command-line interface users, has a direct significant effect on extent of use of microcomputers.

In summary, the research has contributed to the development of a theory of individual adjustment to information technology in the workplace. It identifies certain perceptions, anxieties and attitudes about microcomputers and shows how they may affect work outcomes such as job satisfaction and job performance. It also shows that microcomputer-interface types have a differential effect on some of the hypothesised relationships represented in the general model. Future replication studies could sample a broader cross-section of the microcomputer user community.

Finally, the results should help Big Six accounting firms to maximise the benefits of microcomputer use by making them aware of how working with microcomputers affects job satisfaction and job performance.
CHAPTER 1

INTRODUCTION

The acquisition and use of microcomputers by individuals and organisations has increased substantially in recent years\(^1\). By 1997 annual sales of microcomputers in Australia will be approaching one million units (Horey, 1993), suggesting that in the future microcomputers will be increasingly used by organisations and their workers. 'Big Six' accounting firms\(^2\) have also felt the impact of the 'microcomputer revolution'. By the late 1980s most Big Six firms had more than one microcomputer for every two people employed (Reed, 1989). However, little research has been conducted to examine the effects that microcomputers have on accountants working in these accounting firms. The success of an organisation's investment in information

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\(^1\) Schlack (1993) reports that worldwide in 1992 information technology (IT) companies sold $US 46 billion worth of microcomputers. This amounted to a 53 percent increase on sales of equivalent systems in 1988.

\(^2\) Big Six accounting firms are large accounting firms with international affiliations. They include Arthur Andersen, Coopers & Lybrand, Deloitte Ross Tohmatsu, Ernst & Young, KPMG Peat Marwick and Price Waterhouse.
technology depends, in part, upon how well its human resources adapt to and accept the technology. Understanding the relationships between workers' perceptions about microcomputers, their computer anxieties, their attitudes toward using microcomputers, their use of microcomputers and various work outcomes will help organisations adapt to the changing work practices brought about through the use of microcomputers.

1.1 THE PROBLEM ADDRESSED IN THIS THESIS

The problems that users encounter when they interact with computers may be attributed to many factors: differences in levels of computer anxiety, differences in knowledge about, and awareness of, the capabilities of computers, differences in perceptions about, and attitudes toward using computers, and differences in the way in which the human-computer interface is operationalised. A number of these issues have been researched. They include, for example, a study of attitudes toward microcomputers and computer anxiety (Howard, 1986); the prediction and explanation of user acceptance based on users' perceptions of usefulness, ease of use (Davis et al., 1989); an investigation of the determinants of computer anxiety and attitudes toward using computers (Parasuraman and Igbaria, 1989); and an examination of the relationship between computer usage, attitudes toward working with computers and job involvement and organisational commitment (Rafaeli, 1986).

Researchers have also recognised that the nature of work has changed (Ginzberg, 1982), and that this change is linked with the growth and
development of information technology (Giuliano, 1982). Others have argued that the levels of adoption of information technologies (such as microcomputer systems) ' ... have precipitated major structural changes and employment adjustments that, after a period of adaption, should substantially boost both the quality of output and productivity' (Quinn et al., 1987, p. 27). Much of the recent research has focused on the implications and effects these changes in work practices have on organisations and their employees, and include studies of the relationship between extent of use of information technology and task characteristics (Medcof, 1989); the general notion of computer user satisfaction in the workplace (Robey, 1979; Ives et al., 1983; Swanson, 1982; Chin et al., 1988); the quality of worklife of computer users (Lepore et al., 1989; Kraut et al., 1989); the link between computers and the efficiency and effectiveness of users (Pentland, 1989; Turner, 1984); and, the impact of new office information technology on job quality (Long, 1993).

However, while providing useful information, these studies do not focus on microcomputer usage and work outcomes in the accounting services industry. Further, they do not add to our understanding of the relationships between perceptions of ease of use and usefulness of microcomputers, computer anxiety, general attitudes toward using microcomputers, the level of microcomputer usage and individual outcomes in the work environment such as job satisfaction and job performance. As well, this prior research does not examine the role that specific features of microcomputer technology, such as the human-computer interface, play in influencing the extent of the interactions between these beliefs, anxieties and attitudes. Some understanding of
the factors that affect accountants' reactions to microcomputers seems essential to an understanding of the impact of the technology on accounting organisations.

One specific feature of microcomputer technology yet to undergo rigorous research in an organisational setting to test its effect on how people react to working with microcomputers is the human-computer interface. During the 1980s much work has been done to improve the human-computer interface, particularly in the microcomputer field. The graphical user interface is now touted by its developers as the best choice for users of microcomputers because of the benefits which accrue from its use in the work environment (Microsoft Corporation, 1990a). Results of a laboratory experiment by Temple, Barker & Sloane Inc (Microsoft Corporation, 1990b) suggest that users of microcomputers with a graphical interface are more productive and less fatigued than users of microcomputers with a command-line interface. However, because the study was a laboratory experiment, the results may have little external validity. Moreover, the researchers say nothing about how the use of a microcomputer with a graphical interface affects the various relationships between beliefs, anxieties and attitudes people have about microcomputers, and, the relationship between these factors and microcomputer use.

Thus, the purpose of the research described in this thesis is twofold. First, it concentrates on how accountants' perceptions of ease of use and usefulness of microcomputers act on their computer anxieties, microcomputer attitudes and use to affect their job satisfaction and job performance. Second, the research focuses on how different types of
human-computer interfaces affect the relationships between accountants' beliefs about microcomputer utility and ease of use, computer anxiety, microcomputer attitudes and microcomputer use.

1.2 OBJECTIVES OF THE RESEARCH

The main objective of the research described in this thesis is to study the extent to which microcomputers affect accountants working in Big Six accounting firms. Specifically, the research questions investigated are:

1. Are the job satisfaction and job performance of professional accountants affected by their extent of use of, and general attitude toward using, microcomputers?

2. Is the extent to which professional accountants use microcomputers affected by their general attitude toward using microcomputers, and their perceptions of how useful microcomputers are and how easy they are to use?

3. Is the general attitude of professional accountants toward using microcomputers affected by their level of computer anxiety, their perceptions of how useful microcomputers are, and how easy they are to use?

4. Is the level of computer anxiety of professional accountants affected by their perceptions of how useful microcomputers are and how easy they are to use?
5. Do professional accountants react differently to the perceptions they have and anxieties they experience about microcomputers if they use microcomputers with different human-computer interfaces?

A conceptual model describing the interrelationships between perceptions, attitude, anxiety, microcomputer use, and the work outcomes is formulated and applied to help achieve the research objective and answer the research questions. Previously developed information technology models (Nelson, 1990; Thompson et al., 1991; Davis et al., 1989; Miller, 1989) based on expectancy-value models (Triandis, 1980; Fishbein and Ajzen, 1975) form the conceptual basis around which the research model is developed.

Path analysis and ordinary least squares regression are used to determine the extent to which the model describes the proposed interrelationships and to test the propositions derived from the model. Multisample covariance analysis is used to test the fit of the model to the data of the different human-computer interface users and to test for interactions between the type of human-computer interface and the model components.

The research reported in this thesis differs from past research in at least three ways. First, it formulates and tests a model that describes the effects that beliefs about microcomputer utility and ease of use have on job satisfaction and job performance through their effects, either directly or indirectly, on computer anxiety, and on microcomputer attitudes and use. Modelling the components in this way provides a contingency
perspective, thus providing a richer description of the relationships between the components. Contingency models\(^3\) account for the indirect effects of one variable on another, as well as the direct effect.

Second, this study assesses, in an organisational setting, whether the use of different types of human-computer interfaces results in differential relationships between certain components in the model.

Finally, the research focuses on one of the main sectors of the service industry which has been most affected by the changes in information technology in recent years - Big Six accounting firms.

1.3 CONTRIBUTIONS TO KNOWLEDGE

Researchers and practitioners need to understand better the variation in individuals' reactions to using computers so that they may develop practical methods for evaluating systems, predicting how users will respond to them, and improving user acceptance by changing the nature of computer systems and the processes by which they are implemented (Davis et al., 1989). The research described in this thesis contributes to knowledge required for this understanding by its application to accountants using microcomputers in the accounting services industry and specifically, the Big Six firms; and by the further development and refinement of a theory of individual adjustment to information

\(^3\) Although sometimes contrasted with 'intervening variable models' (Chenhall and Brownell, 1988), for the purposes of describing this research contingency models are seen as equivalent to intervening variable models.
technology adoption.

1.3.1 Practical applications

This research contributes to practice by providing information that should improve the deployment and use of microcomputers in Big Six firms, and the training and recruitment of accountants. These firms should obtain the following benefits from the information generated by the research. First, it will provide Big Six firms with a knowledge and understanding of how beliefs, anxieties and attitudes interact to affect microcomputer use and job satisfaction and job performance. Armed with this knowledge, these firms will be better able to develop and refine their professional development and training programs to ensure that they achieve optimum benefit from their investment in microcomputer technology.

Second, individual accountants themselves will become more aware of the process of interacting with microcomputers and how these devices ultimately affect their job satisfaction and job performance. Being aware of the process of microcomputer interaction may enable them to better manage their own dealings with the technology.

Third, knowledge of the extent to which the use of different human-computer interfaces affect the relationships between beliefs about the utility and ease of use of microcomputers, computer anxiety and microcomputer attitude will enable large accounting firms to make more informed decisions about microcomputer hardware and software acquisition and deployment and its impact on the people in their
organisations and the tasks these people carry out.

Other organisations, particularly in the service industry, using similar computing technology also may be able to use the findings of the research to aid them in their planning and deployment of microcomputers in their organisations ensuring the effects of information technology acquisition and deployment on individual work outcomes are optimised.

1.3.2 Theoretical applications

This research aims to provide information that will add to existing theories of individual adjustment to information technology. It will focus on a particular class of information technology, the microcomputer, and will evaluate the impact of this technology on two work outcomes - job satisfaction and job performance. The research will also extend theory by describing how two important beliefs (perceived ease of use and perceived usefulness) can be integrated into a research model along with computer anxiety to describe the impact of microcomputers on the job satisfaction and job performance of those who use them.

Finally, the research will show how the human-microcomputer interface influences the attitudes and behaviours of individuals in technological transition. Earlier research models do not specifically account for the effect of the human-computer interface. By doing so, this research further extends the research done in this field and may add another important dimension to a theory of individual adjustments to
information technology.

1.4 ORGANISATION OF THE THESIS

Chapter 2 of the thesis describes the research model and the components on which it is based. The main purpose of the chapter is to explicate the theoretical foundations for the relationships proposed between the components in the model. The chapter also describes the research propositions developed and articulated for each of the linkages specified in the model.

Chapter 3 describes the research design, environment and procedures including the selection of the study participants and the development of the instruments used to measure the variables investigated in the model. The chapter also discusses the techniques used to test the validity and reliability of the scales forming the basis of the instrument and presents the results of these tests.

Chapter 4 presents the data analysis and the results of the study. It discusses the statistical analysis and interprets the results in terms of the propositions investigated.

Chapter 5 presents the multisample analysis of the research data to establish whether the research model developed in Chapter 2 and evaluated in Chapter 4 can be used to model data partitioned into two groups based on the type of human-computer interface used. The chapter also evaluates whether an interaction exists between the type of
human-computer interface and other variables in the model.

Chapter 6, in concluding the thesis, discusses the limitations of the research and summarises the research findings. It also discusses the implications of the research for theory and practice and makes some suggestions for future research.
CHAPTER 2

THE CONCEPTUAL MODEL

AND

RESEARCH PROPOSITIONS

This chapter presents a conceptual model of the interrelationships between perceptions, attitude, anxiety, microcomputer use, and work outcomes of professional accountants. The model adds to and extends existing theories about individual adjustment to information technology. Previous information technology models (see for example, Davis et al., 1989; Miller, 1989; Thompson et al., 1991) based on expectancy-value models (for example, Fishbein and Ajzen, 1975; Triandis, 1980) have focused on various relationships between constructs similar to those investigated in this study. However, these models have neither accounted for nor integrated specific constructs such as computer anxiety, job satisfaction or job performance. The model developed here extends this research to an information technology environment where users work interactively with microcomputers as part of their everyday work. The model also incorporates measures for computer anxiety, job satisfaction and job performance; and postulates relationships between
these constructs and constructs examined in earlier research. The model also provides a framework for developing empirically testable propositions. These propositions describe the effects of certain perceptions regarding the use of microcomputers on: users' levels of computer anxiety; general attitude toward using microcomputers; and microcomputer usage. The propositions also describe how attitude and usage affect job satisfaction and job performance.

The chapter proceeds in the following manner. Section 1 discusses the theoretical foundations and provides an overview of the conceptual model. Section 2 defines each construct in the model; provides the rationale for the relationships proposed among the constructs in the model; and describes the propositions arising from these relationships. The chapter concludes with a summary in Section 3.

2.1 THE CONCEPTUAL MODEL

2.1.1 Theoretical foundations of the model

The theory of reasoned action developed by Fishbein and Ajzen (1975) forms a conceptual basis around which the model used in this study has been developed. The theory of reasoned action has influenced the research approaches taken in a number of recent studies that examine beliefs, attitudes, intentions and behaviour of users of information technology (for example, Hill et al., 1987; Collins and Mann, 1988; Davis et al., 1989; Miller, 1989; and Pentland, 1989). The theory of reasoned action models a person's actual behaviour as a function of behavioural
intentions. Behavioural intentions, in turn, are determined by a person's attitude toward behaviour and a set of subjective norms about intended behaviour. A person's attitude toward a specific behaviour is a function of beliefs and evaluations; and subjective norms are seen as a function of normative beliefs and motivation to comply.

The model developed in this study does not attempt to directly implement the theory of reasoned action to describe the beliefs, attitudes and behaviours of users of information technology. However, the research model does adopt elements of that theory to develop and build relationships between beliefs, anxieties, attitudes and behaviours of professional accountants who use microcomputers in the workplace. The research model is different from the theory of reasoned action in as much as it links beliefs, as well as attitudes, directly with behaviour. Moreover, unlike that theory, the research model does not terminate with the behaviour construct. Similar to information technology behaviour models developed by Miller (1989) and Nelson (1990), it is extended to describe the consequences of behaviour through linking microcomputer usage with the work outcomes, job satisfaction and job performance.

Advantages accrue through using the theory of reasoned action as a conceptual basis for developing and building a model to describe relationships between behavioural aspects of information technology and users of that technology. Adopting a model conceptually influenced by that theory provides the basis for a contingency or conditional approach to analysing relationships between constructs. A number of
previous studies have examined relationships between attitudes, anxiety, computer use, etc. (for example, Robey, 1979; Kerber, 1983; Howard, 1986; and Nelson and White, 1990). However, these have been primarily correlational studies, i.e., studies that test for zero order relationships between variables. Studies based on contingency models provide a richer explanation of the relationships between variables under examination. Such models do this by describing the total effect\(^1\) of one variable upon another (for example, the extent to which attitude toward using microcomputers affects microcomputer usage). That is, contingency models allow the development of complex models of relationships among variables, by showing the direct effect of one variable upon another as well as effects via one or more intervening variables.

Davis et al. (1989), in particular, saw the benefit of using a model based on the theory of reasoned action saying it enabled them '... to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behaviour across a broad range of end-user computer technologies and user populations, while being parsimonious, and theoretically justified' (p. 985). They also indicated that there was a substantial body of empirical data in support of their technology acceptance model (TAM). Melone (1990) also felt that the theory of reasoned action was appropriate for developing information systems models for testing expectancy-value theories because it has the advantage

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\(^1\) In path analysis terms, total effects comprise direct effects and indirect effects. Section 4.2 in Chapter 4 provides a detailed description of these terms.
of being easily implemented in applied settings.

Using their technology acceptance model, Davis et al. (1989) investigated the extent to which two constructs, perceived usefulness and perceived ease of use, affect user attitudes toward using a computer system, and the resultant effect this has on actual system usage. They found that perceived usefulness, along with perceived ease of use influenced people's behavioural intentions, although the effect of perceived ease of use subsided over time. They concluded that their results suggest simple but powerful models of the determinants of user acceptance. These models may have substantial practical value in evaluating systems and guiding managerial interventions aimed at reducing the problem of underutilised computer technology.

The construct 'computer anxiety' was not built into the technology acceptance model, although it was recognised and its potential utility acknowledged. Davis et al. (1989) suggested that additional constructs such as computer anxiety may be profitably brought into the analysis. The model developed here is conceptually based on the theory of reasoned action, and is influenced by the technology acceptance model research. However, it differs from these antecedent models by describing relationships between beliefs and computer anxiety, beliefs and behaviour, and computer anxiety and attitude. The research model also describes relationships between attitude and work outcomes (job satisfaction and job performance), and behaviour and work outcomes. By incorporating and describing these relationships the research model attempts to provide a more comprehensive description of the impact of
information technology on the users of that technology.

2.1.2 Model overview

Figure 2.1 depicts the research model adopted for this study. The model suggests that the work outcomes (job satisfaction and job performance) of professional accountants using microcomputers are influenced by users' perceptions of ease of use and usefulness of microcomputers via paths through (a) the level of computer anxiety experienced by users, (b) the general attitude of users toward using microcomputers, and (c) the extent to which microcomputers are used by individuals. To this end, perceived ease of use and perceived usefulness appear as exogenous components of the model. In summary, the relationships proposed among the variables in the model are:

(a) job satisfaction and job performance of professional accountants are positively affected by their extent of use of, and general attitude toward using, microcomputers;

(b) the extent to which professional accountants use microcomputers is positively affected by their general attitude toward using microcomputers, and their perceptions of how useful microcomputers are and how easy they are to use;

(c) the general attitude of professional accountants toward using microcomputers is negatively affected by their level of computer anxiety, and positively affected by their perceptions of how
Figure 2.1: Model of effects of microcomputer perceptions, anxieties, attitudes and use on work outcomes
useful microcomputers are and how easy they are to use; and

(d) the level of computer anxiety of professional accountants is negatively affected by their perceptions of how useful microcomputers are and how easy they are to use.

An underlying objective in the development of models of the type forming the basis of this study is the achievement parsimony, simplicity and elegance. Models with these attributes are easily understood and lend themselves to replication and modification, thus advancing their development and refinement. The research model attempts to achieve parsimony by excluding four paths (perceived ease of use -> work outcome, perceived usefulness -> work outcome, computer anxiety -> work outcome and computer anxiety -> extent of use of microcomputers) from the fully identified model. There is no evidence ex ante to suggest, that by excluding these paths, the explanatory power of the research model will be compromised. An ex post evaluation of the model (see Chapter 4, Section 4.1.1) will test this assumption.

2.2 MODEL COMPONENTS: DEFINITION AND PATH LINKAGES

The following subsections define the components and discuss the relationships proposed among the components in the model. The first part in each subsection defines a component, and the second part provides the rationale for the relationship proposed between that component and other components in the model. Table 2.1 lists the
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<td>Proposition 1A</td>
<td>The extent of microcomputer usage has a direct effect on job satisfaction.</td>
<td>Positive</td>
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<td>The extent of microcomputer usage has a direct effect on job performance.</td>
<td>Positive</td>
</tr>
<tr>
<td>Proposition 2A</td>
<td>Attitude toward using microcomputers has a direct effect on job satisfaction.</td>
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<td>Positive</td>
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<td>Computer anxiety has a direct effect on attitude toward using microcomputers.</td>
<td>Inverse</td>
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<td>(a) Perceived ease of use of microcomputers has a direct effect on the extent of microcomputer usage.</td>
<td>Positive</td>
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<td>Positive</td>
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<td>Proposition 6</td>
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<td>(b) Perceived usefulness of microcomputers has a direct effect on attitude toward using microcomputers.</td>
<td>Positive</td>
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<tr>
<td>Proposition 7</td>
<td>(a) Perceived ease of use of microcomputers has a direct effect on computer anxiety.</td>
<td>Inverse</td>
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<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct effect on computer anxiety.</td>
<td>Inverse</td>
</tr>
</tbody>
</table>

Table 2.1: List of research propositions
propositions derived from the model.

2.2.1 Job satisfaction

After his review of the early research into job satisfaction, Vroom (1964) found that job satisfaction was variously described as the '... affective orientations on the part of individuals toward work roles which they are presently occupying' (p. 99). In essence, job satisfaction is the feeling of enjoyment, happiness and contentment a person gets from successfully completing assigned work tasks.

Early research (for example, Herzberg, 1966; and Trist, 1976) suggests that job satisfaction is multi-dimensional and includes both intrinsic and extrinsic satisfaction. Intrinsic satisfaction\(^2\) derives directly from the work a person does, whereas extrinsic satisfaction derives from things external to engaging in the work itself and includes such things as the compensation and rewards received for satisfactorily completing work tasks.

For the purposes of testing the research model and the propositions derived from it, job satisfaction is seen as the feeling of enjoyment, happiness and contentment a person gets from successfully completing

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\(^2\) Intrinsic job satisfaction includes a number of specific work factors. A number of studies (Mumford, 1972; Cooper, 1976; O'Brien and Humphrys, 1982) have identified these factors as, \textit{inter alia}, variety, interest, challenge, autonomy, and skill utilisation.
assigned work tasks, that is, intrinsic satisfaction.

2.2.2 Job performance

Job performance is a work outcome variable. There appears to be no universal definition of job performance in the behavioural science or information systems literature. Job performance is defined differently depending on the nature of the work environment, and the individual completing the work. For example, quality of leadership and efficacy of strategic decision-making may form the basis of assessing, at least in part, the performance of the managing director of a business organisation. However, these two factors are unlikely to be used in assessing the performance of workers on the shop floor of a manufacturing plant. For this group it may be more appropriate to define satisfactory performance as the attainment of production levels set by management, i.e., the number of units produced in a given time.

Professional accountants working in business services divisions of Big Six accounting firms provide a range of services to their clients. These services include the aggregation and analysis of financial data; the preparation of accounting reports; the completion and lodgement of reports to corporate and taxation statutory bodies; and the provision of taxation, management and business consulting. Partners in Big Six firms are not forthcoming publicly on what they regard as a satisfactory performance by their professional staff. However, in assessing the performance of their staff, they are likely to consider their clients' needs as well as those of their firm. If professional accounting staff are
providing timely services to their clients and those services are accurate, valid and complete, then those professional staff would be seen to be satisfactorily performing their professional duties.

For the purposes of this study, a professional accountant's performance is defined as the degree to which work tasks are completed efficiently and effectively, i.e., how quickly a given task is done and how well a given task is done (Pentland, 1989).

2.2.3 Extent of use of microcomputers

2.2.3.1 Definition

Extent of use of microcomputers is defined as the amount of time (in hours per week) spent using microcomputers in the workplace. Use is understood to mean interactively 'driving' the system, i.e., using the keyboard and/or a 'mouse' to issue instructions to the computer to undertake and complete certain tasks. Earlier research, particularly that undertaken prior to the release of personal computers (see for example, Lucas, 1975; Robey, 1979), often defined use by non-computing staff in organisations as participation in the use of the output (e.g., hard-copy reports, etc.) from the computer or management information system. The notion of usage adopted in this study is therefore fundamentally different from those earlier studies.
2.2.3.2 Path linkages

While the nature of work of accountants in public practice is diverse, most work undertaken by accountants could be characterised as one or more of managerial, analytical and technical. Typically, accountants working in Big Six firms, and particularly those in business services divisions, are involved in tax and corporate compliance work, audit, and management advisory services. In this type of work, accountants need to apply high levels of analytical and technical skill. Recent research supports this assertion. For example, Ferguson and Wines (1994), in a study of new partners in Big Six firms, found that the partners ranked technical competence highest of five factors that they considered important if staff are to progress satisfactorily from accountant to senior/supervisor and from senior/supervisor to manager.

Historically, Big Six firms recruit the highest-achieving graduates from universities. Such graduates are highly motivated and have well-developed technical and analytical skills. The Big Six environment provides graduates with the challenge they normally seek.

Big Six firms have invested in the new microcomputer technology because of the tools it offers them. These tools, in the form of spreadsheets, general ledger and financial reporting packages, and word processing software, allow accountants to complete sophisticated analytical and technical tasks they may not otherwise be able to complete.
Microcomputer systems empower professional accountants to use their high level of skills. They also bring another dimension to the accountant's job. The constraints accountants sometimes experience because of the lack of an adequate information technology infrastructure in the firm can be overcome. It seems that the more frequently accountants use these microcomputers in their work environment, the more likely it is that they can use their skills and meet the challenges they set themselves. For example, in a study of the relationship between the extent of use of information technology and job characteristics, Kling (1978) found that extent of use was positively correlated with skill variety. Moreover, the more use accountants make of microcomputers, the less dependent they will be on other staff for providing analytical and technical support. They have more autonomy, and a recent study of determinants of job satisfaction (Agho et al., 1993) found autonomy played a significant role in affecting the level of job satisfaction in workers. Accordingly, it is argued that the availability and use of microcomputers leads professional accountants to increased intrinsic job satisfaction. Thus, this leads to the following proposition:

**Proposition 1A:** The extent of microcomputer usage has a direct positive effect on job satisfaction.

Microcomputer systems enhance a user's ability to perform technical and analytical tasks. For example, spreadsheet software such as EXCEL™ and LOTUS 1-2-3™ allow accountants to develop complex models and associated templates for the efficient and accurate manipulation of financial data. Nevell (1991) argues that spreadsheet users are better able
to perform tasks requiring high level cognitive operators\(^3\) than non-users. Users achieve this by being able to perform complex tasks in a less costly way than if they did not have access to spreadsheets\(^4\). Extending this argument, the more time accountants spend using spreadsheets, the more likely they are to complete complex technical and analytical tasks more quickly and more accurately. That is, in this context they are likely to perform better in their job. This provides benefits in excess of the cost of investment in the technologies.

Much of the output of accounting work needs to be compiled and presented formally through reports, memorandums, etc. Word processors have been described as being ideally suited to writing reports and memos (Pentland, 1989). Microcomputers provide users with the opportunity to use word processors. Therefore, through the use of word processors, microcomputers are also likely to allow accountants to perform better at their jobs because word processed reports are likely to be of higher quality than hand-drafted reports. If the writer is more effective in communicating the information then he/she is performing better in his/her job.

\(^3\) Cognitive operators are information processing resources that comprise the building blocks of decision strategies for individuals. Individuals make decisions by executing cognitive operators from their cognitive-operator repertoire (Nevell, 1991).

\(^4\) Less costly in the sense that a given task (for example, calculations requiring long division) could be completed more quickly and accurately with a spreadsheet.
Recent evidence supports this assertion. For example, in an analysis of the early research into the use of word processors by student writers, Williamson and Pence (1989) conclude that writing on a word processor appears to take some of the drudgery out of writing. This conclusion, combined with their observation that writers enjoy the experience of writing with computers more than writing by hand, led them to the belief that the use of word processors improves the quality of writing. Experimental results showed that writers using word processors ' ... showed significantly greater growth in the quality of their essays than students in the handwriting sections ... ' (p. 108).

While care must be taken in generalising these findings, the results suggest that people using word processors are likely to improve the quality of the reports they write. Moreover, the more time spent using word processors to write reports, the more likely the written quality of those reports will improve.

Microcomputers also provide users with access to networking facilities. These facilities provide a range of services (for example, file transfers and electronic mail) that are likely to enable users to more efficiently and effectively complete their work tasks. Reports, data and other documents in the form of computer files can be quickly transferred among users through file transfer procedures. Communications between users can be quick, accurate and almost instantaneous through the use of electronic mail facilities.Electronic mail allows individuals to manage their communications with colleagues over the work day (Eveland and Bikson, 1987). Electronic mail users are able to choose
when to communicate with a colleague and do not have to rely on that person having to be in a specified place, at a specified time to allow communication to occur (which is the case for personal or telephone communication).

Summarising, spreadsheets, word processors and network facilities allow microcomputer users to act more efficiently and effectively over their work day. The more workers use a microcomputer, the more efficiently and effectively they will complete their work tasks.

These considerations lead to the following proposition:

**Proposition 1B:** The extent of microcomputer usage has a direct positive effect on job performance.

2.2.4 Attitude toward using microcomputers

2.2.4.1 Definition

Allport (1967) regards attitudes as a neuropsychic state of readiness for mental and physical activity. After detailing the history of this concept in social psychology, he offers this broad definition: '... an attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related' (p. 798). He also suggests that an attitude results in behaviour that is acquisitive or avertive, favorable or unfavorable, affirmative or negative toward the
object or class of objects with which it is related.

Allport's views on attitude have been influential. For example, Triandis (1971), reviewing the ideas of attitude theorists and those of Allport in particular, describes attitude as an idea charged with emotion which predisposes a class of actions to a particular class of social situations. Fishbein and Ajzen (1975) adopt a similar view about the concept of attitude. In developing their theory of reasoned action, they define attitude as a person's general feeling of favorableness or unfavorableness toward some stimulus object (p. 216).

These definitions provide a framework for developing a definition for the construct, attitude toward using microcomputers, used in this study. The definitions suggest attitude has three components. The first component, described by Triandis (1971) as a cognitive component, may be seen as an idea, an object or a situation. For the purposes of this study, the idea, object or situation is the microcomputer.

The second component of attitude is an affective or evaluative component. Triandis (1971) describes this as the emotion which charges the idea. This emotive component occurs as a result of thinking about the object, idea or situation; and in this study it is the feeling of favourableness or unfavorableness toward microcomputers.

The third and final component of attitude is the behavioural component, the 'predisposition to action' (Triandis, 1971). In this study
this 'predisposition to action' is using a microcomputer.

A collective description of the three components derived above provides a definition of attitude toward using microcomputers used in this study: a person's general feeling of favourableness or unfavourableness toward using a microcomputer in his or her job.

2.2.4.2 Path linkages

Although attitude toward working with computers has been the focus of substantial research (see for example, Nelson and White, 1988, 1989; Howard, 1986; Rafaeli, 1986; Kerber, 1983), little research has been done on examining the relationship between attitudes toward using microcomputers and job satisfaction. It is proposed in this study that an accountant's general attitude toward using a microcomputer in the work environment positively affects his or her level of job satisfaction. That is, the more positive the accountant's attitude toward using a microcomputer, the higher the level of job satisfaction experienced.

The argument for this is as follows. Information technology acquisition by accounting firms in recent years has increased substantially. By the end of the 1980s, their acquisition and deployment of microcomputers has been such that there is almost one microcomputer per professional staff member in Big Six firms (Reed, 1989). This penetration of microcomputer technology means firms complete many tasks using microcomputer programs such as wordprocessing, spreadsheets and accounting software. Because of this investment in information
technology, accounting firms and their principals expect professional staff to be knowledgeable about microcomputers and to be positive and enthusiastic about using microcomputers in their work. A recent study by Ferguson and Wines (1994) provides support for this: when new Big Six partners were asked, in the context of producing better graduates for accounting practices, what they considered to be an area of undergraduate programs which should be expanded, they ranked information technology first out of a group of eight areas identified as requiring expansion.

If the views of accountants employed in Big Six firms on information technology, and in particular, on microcomputers, are aligned with those of their partners, these accountants are likely to enjoy their work and be happier and more content than those whose views differ. Those accountants who hold positive attitudes toward using microcomputers in their work are more likely to hold views similar to those of the partners of their firm because they are more likely to regard information technology as beneficial to the firm.

Accordingly, one can argue that accountants who have positive attitudes toward using microcomputers in their work are likely to enjoy their work and be happier and more content than those whose attitudes are less positive. That is, an accountant’s general attitude toward using a microcomputer in the work environment positively affects his or her level of job satisfaction. The proposition can more formally be stated as:
**Proposition 2A:** Attitude toward using microcomputers has a direct positive effect on job satisfaction.

The model developed in this study proposes a relationship between attitude toward using a specific form of information technology and job performance. Specifically, it proposes that, independent of the extent of microcomputer use, an accountant's general attitude toward using a microcomputer at work positively affects job performance. That is, the more positive the accountant's attitude toward using a microcomputer, the greater the level of job performance. This proposition is consistent with a general body of research that examines the relationship between employee attitudes and work outcomes (see for example, Locke, 1976; Jackofsky and Peters, 1983; Shore and Martin, 1989). However, little of this research has focussed on the relationship between employee attitude toward using information technology and performance. Results to date which do address this issue have been equivocal (see for example, King and Rodriguez, 1978; Zmud, 1979; Ramamurthy et al., 1992).

Attitude toward using microcomputers is an affective outcome of an evaluative process based on a person's assessment of the extent to which microcomputers and their use will affect the user's utility (Robey, 1979). That is, if an individual concludes that, on balance, the potential benefits of using a microcomputer in the work environment exceed the costs, he or she will be positively disposed toward using microcomputers in the work environment. Conversely, if the individual concludes that the costs outweigh the benefits, he or she will hold a negative attitude toward using microcomputers.
Because microcomputer technology is an integral part of the infrastructure of contemporary accounting firms and is perceived by the partners of these organisations to be beneficial, there is likely to be an expectation on the part of the principals of those firms that more rather than less use of microcomputers by professional accountants employed by them is in the interests of the firms. Those employees holding positive attitudes toward using microcomputers have effectively aligned their views about microcomputers with those of their employers. On the other hand, those employees holding negative attitudes about microcomputers and their use are likely to be in conflict with the views and expectations of their employers. Because their views are not aligned with those of their employer, employees in the latter category are more likely to experience stresses and strains in their jobs brought about through perceived threats to their career prospects and reduced access to the extrinsic and intrinsic rewards the job. Ultimately, stresses and strains experienced by workers reduce job involvement. After evaluating the research into stressful events and job performance, Bhagat (1983) argued that reduced job involvement adversely affects job performance. Following this, it is argued here that attitudes toward using microcomputers in the work environment affect job performance.
This suggests the following proposition:

**Proposition 2B:** Attitude toward using microcomputers has a direct positive effect on job performance.

Research into the relationship between attitudes and user behaviour is not new (see for example, Lucas, 1975; Schewe, 1976; Robey, 1979; Ginzburg, 1981; Ives *et al.*, 1983). Moreover, the results of these studies generally show that attitudes toward various features of a management information system, systems development personnel, and computers in general are related to user behaviour. These studies reported a strong positive correlation between attitude toward using information systems and information systems use. However, these studies focused primarily on large, centralised computer systems. The users of these systems were actually consumers of output from the systems, *i.e.*, they used reports, *etc.* generated by the system. They were not necessarily interactive users.

Unlike these studies, the model developed in this study proposes a relationship between a person's attitude toward using a specific form of information technology, the microcomputer, and the extent to which that person uses\(^5\) that technology. Specifically, it proposes that an accountant's general attitude toward using a microcomputer at work positively affects the extent of use of microcomputers. That is, a more

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\(^5\) As defined earlier, use in the context of this study involves 'hands on' activity where the user directly interacts with the microcomputer. In essence, the user is the 'driver' of the technology, making decisions on what software to run and how to run it; deciding what output to generate and in what format to present it, *etc.*
positive attitude toward using a microcomputer results in a higher level of microcomputer use.

Although little research to date has focused on attitudes and microcomputer use, there is some evidence to suggest that a relationship exists between the two. For example, a study designed to investigate how attitudes affect students' use of microcomputers found that students with a more positive attitude toward computers were more likely to complete assignments on microcomputers (Fann et al., 1989). A study of the attitudes of accounting students to working with computers reported similar results, finding that time spent working with computers was significantly related to positive and negative computer attitudes (Orpen and Ferguson, 1991).

The argument for proposing that attitude toward using microcomputers affects the extent of microcomputer use is as follows. In general, people act and behave in a way that increases and optimises their own utility. That is, they choose to do things or not to do things depending on their assessment of whether or not the actions they undertake will (depending on the context in which the action is taken) make them better off (Collinson Black, 1990). They make a cost/benefit judgement.

Accountants faced with the decision to use a microcomputer, or to

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6 What is regarded as better off is very much a subjective determination, depending on the circumstances in which the decision is made. One measure of being better off or increasing one's utility is the economic one of an increase in purchasing power. Other measures may be those of a psychological nature such as happiness, contentment, etc.
increase their use of a microcomputer, will choose the course of action which they perceive makes them better off. In this case, if they believe, for a given task, that, *ceterus paribus*, microcomputer use will reduce the effort on their part to complete the task, they will see that as making them better off.

Accountants' assessment of the efficacy of microcomputer use is likely to be closely linked with their overall attitude toward using microcomputers in the workplace. For example, if they have a positive attitude toward using microcomputers, they will be predisposed to using them. Therefore, when encountering a work task where the use of a microcomputer is likely to be less costly to them (in terms of effort, *etc.*), accountants are likely to use it. Conversely, if they hold negative attitudes toward using microcomputers, they will not be predisposed toward using them. Therefore, when confronted with a work task which could be completed in a less costly manner using a microcomputer, they are not likely use it.

Following this, it is argued that those accountants who hold positive attitudes toward using microcomputers in their work are likely to use them to complete work tasks. That is, an accountant's general attitude toward using a microcomputer in the work environment positively affects his or her extent of microcomputer use. This leads to the following formal proposition:
Proposition 3: Attitude toward using microcomputers has a direct positive effect on the extent of microcomputer usage.

2.2.5 Computer anxiety

2.2.5.1 Definition

Debate over a robust definition of anxiety has continued across most of this century. Freedman et al. (1976) sees anxiety as '... an uncomfortable feeling of impending danger, accompanied by overwhelming awareness of being powerless, inability to perceive the unreality of the threat, prolonged feeling of tension, and exhaustive readiness for expected danger' (p. 1283). May (1977) defines anxiety as '... the apprehension cued off by a threat to some value that the individual holds essential to his existence as a personality' (p. 191); and Eidelberg (1968) regards anxiety as '... the unpleasure experienced when the object is unknown and the anticipation of being overwhelmed by an internal or external force is present' (p. 37).

Reviewing definitions such as these, Howard (1986) makes two points. First, he observes that a consistent theme running through the definitions advanced is that anxiety refers to a fear about something in the future. He also notes that anxiety may be described within the boundaries of a four-way classification system: normal or neurotic in intensity and permanent or temporary in duration. 'Normal' anxiety occurs when the fear or apprehension is proportionate to the real danger. When the fear or apprehension is disproportionate to the real danger,
the anxiety is regarded as 'neurotic'. Using the 'trait'/ 'state' anxiety taxonomy reported by Spielberger (1966), Howard (1986) identifies the temporal characteristics of anxiety as trait anxiety and state anxiety. He describes trait anxiety as a person's basic tendency to be anxious, i.e., a personality characteristic (trait) that does not change significantly over time; and state anxiety as a transitory condition that varies in intensity, fluctuates over time, and arises in response to a specific situation.

Using Howard's (1986) nomenclature, the present study is concerned primarily with the 'transitory-neurotic' type of anxiety in the specific context of computers, and in particular, microcomputers. Howard (1986) defines such computer anxiety as '... the tendency of a particular person to experience a level of uneasiness over his or her impending use of a computer, that is disproportionate to the actual threat presented by the computer' (p. 18).

Because this study examines the accountant's use of microcomputers, the above definition has been refined to focus on anxiety as it applies specifically to microcomputers. Therefore, for the purposes of this study computer anxiety is defined as the tendency of a particular person to experience a level of uneasiness over his or her impending use of a microcomputer, that is disproportionate to the actual threat presented by the microcomputer.
2.2.5.2 Path linkage

Howard (1986) traces the origin of research into computer anxiety to Weinberg. Weinberg's interest in computer anxiety, or what he called cyberphobia, commenced at the end of the 1970s when he observed among his computer programming students at the University of Connecticut that significant numbers of people actually seemed to be afraid of computers beyond the usual low level anxiety that accompanies any new experience (Howard, 1986). It is unfortunate that much of Weinberg's work on this phenomenon has not found its way into the academic literature, but rather, appears in the pages of the popular press or through interviews in the electronic media.

Apart from Weinberg's research, few other studies have examined the computer anxiety phenomenon. Those that have, concern themselves mainly with attempting to identify correlates of computer anxiety (see for example, Raub, 1981; Morrow et al., 1986; Howard, 1986; Howard and Smith, 1986; Parasuraman and Igbaria, 1990; Ray and Minch, 1990). The results of the research to date have been equivocal. While Raub (1981) and Morrow et al., (1986) found an interaction between gender and computer anxiety, Howard and Smith (1986) and Parasuraman and Igbaria (1990) did not. However, Howard and Smith (1986) found a significant inverse correlation between computer anxiety and attitude toward using microcomputers. They did not look for causation when examining the relationship. However, they reported that the significant inverse correlation strongly suggests that, if computer anxiety can be reduced, attitudes will improve, and increases in computer usage will
follow (p. 614). This assertion is consistent with the findings from a study of managers by Parasuraman and Igbaria (1990) that computer anxiety was the strongest predictor of attitudes toward microcomputers.

This view of the effect of computer anxiety on attitude toward using computers is consistent with the proposition in this study that an accountant's level of computer anxiety inversely affects his or her attitude toward working with microcomputers. That is, the greater the level of computer anxiety, the more negative the attitude toward using microcomputers.

For the purposes of this study, computer anxiety is seen as a transitory-neurotic form of anxiety. That is, it is the feeling of extreme apprehension, disproportionate to the real danger that may exist, in response to the impending use of a microcomputer in the work environment. This apprehension evokes in the individual a painful uneasiness about the object of the fear - the microcomputer. The fear is real to the extent that the individual genuinely believes that some 'value' important to his or her self-esteem is threatened. The 'value' may be that person's perception of his or her work skills, or some other related perception about his or her self. With this perceived threat real and powerful, the individual is likely to view any interaction with the object of his or her fear, the microcomputer, with distaste.

It is therefore argued that if a person identifies microcomputers and their impending use as threatening, he or she will have a general feeling of unfavourableness toward using microcomputers in the work
environment. Further, the greater the perceived threat, the greater the feeling of unfavourableness toward using microcomputers. That is, the level of computer anxiety experienced by an accountant inversely affects his or her general attitude toward using microcomputers in the work environment. More formally stated, the proposition is as follows:

**Proposition 4:** Computer anxiety has a direct inverse effect on attitude toward using microcomputers.

### 2.2.6 Perceived ease of use and perceived usefulness

#### 2.2.6.1 Definitions

Recent research into two constructs associated with computer systems usage, perceived ease of use and perceived usefulness\(^7\), has been motivated by the need to continue to develop and to refine valid constructs for predicting user acceptance of computer systems. Davis (1989), for example, argues that many of the substantive measures used in the user satisfaction research into information technology are largely unvalidated, and their relationship to system usage is unknown. He further argues that even though research into user information systems satisfaction was seen as important, progress has been impeded by the shortage of high quality measures for key determinants of user satisfaction.

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\(^7\) Constructs similar to ease of use and usefulness are examined in other studies but under different appellations, e.g., usefulness and functionality (see for example, Goodwin, 1987).
acceptance.

Motivated by this, Davis (1989) developed and validated the two specific variables mentioned above. He defines perceived ease of use as the degree to which a person believes that using a particular system would be free of effort and perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance. In a study of computer users and various application programs, Davis (1989) confirmed the validity and reliability of the two constructs and, as well, established a relationship between perceived ease of use and usefulness and system usage.

More recent studies by Adams et al. (1992) replicate the work of Davis on the subject of perceived ease of use and perceived usefulness. Their results, inter alia, confirmed the robustness of the psychometric properties of the two constructs. They also found a relationship between ease of use and usefulness and system usage.

The work of Davis (1989) and Adams et al. (1992), primarily aimed at confirming the existence of two statistically distinct dimensions, provides the basis for the development of definitions of perceived ease of use and perceived usefulness of microcomputers used in this study. For the purposes of this study, usefulness is seen as the extent to which a microcomputer contributes to the enhancement of the accountant's performance, where enhanced performance is indicated by a reduction in the time needed to accomplish a given task and, at the same time, producing higher quality work. Ease of use relates to the effort required
by the accountant to take advantage of the microcomputer system.

For the purposes of testing the research model and the propositions
derived from it, perceived ease of use of microcomputers is defined as
the degree to which a person believes that using a microcomputer
system will be free of effort; and perceived usefulness of microcomputers
is defined as the degree to which a person believes that using a
microcomputer system will enhance his or her job performance.

2.2.6.2 Path linkages

In the workplace people's reasons for initially using computers, and once
started, continuing to use them may differ. One reason for using a
computer is because it may be the only way to get a particular job done.
In high-volume, highly structured and system dependent circumstances
(for example, airline reservation systems, catalogue sales, banking, etc.),
high computer usage on the part of workers is likely to occur - reverting
to manual methods is most likely no longer a viable option regardless of
the users' perceptions of the system.

On the other hand, in a work environment where the use of computers
is largely discretionary because work tasks are generally less structured
(the likely case for professional accountants in large accounting firms),
people who do use computers are likely to do so because they believe (a)
their job performance will improve, i.e., they perceive computers to be
useful; and/or (b) the use of computers is relatively free of effort, i.e.,
they perceive computers to be easy to use.

Research to date provides evidence to support the notion that computer use is linked to perceptions of their usefulness and ease of use. A recent study shows that perceived ease of use and perceived usefulness significantly affect intentions to use a word processing system (Davis et al., 1989). Usefulness has also been found to be related to system usage and usage intentions (Davis, 1989). Prior research produced similar results (see for example, Schultz and Slevin, 1975; Robey and Zeller, 1978; Robey, 1979; Hill et al., 1987).

Thus, it is hypothesised that accountants' perceptions of the usefulness of microcomputers in completing work tasks directly affects the extent to which they use microcomputers. That is, a higher level of perceived usefulness of microcomputers results in greater microcomputer use. The argument for this is based on motivation theory, and in particular, the expectancy theory of motivation. This theory refers to the belief that effort will lead to performance, which in turn is perceived to be instrumental in achieving valued outcomes that are separate from the activity itself (Vroom, 1964). Such outcomes, for example, might include rewards which have extrinsic or intrinsic value, eg., increased compensation, promotion, recognition, etc.

Professional accountants working in large accounting firms are subject to performance monitoring by the principals of those firms. This monitoring is used to determine future compensation schemes, promotions, and higher order benefits such as partnership. Therefore,
these accountants are likely to use tools and techniques that they believe will improve their job performance. If they believe microcomputer use results in quicker completion of work tasks, while at the same time maintaining or improving the quality of their work, they will use them. Moreover, the greater the perceived impact of microcomputer use on job performance, the more these accountants are likely to use them.

On the other hand, if accountants believe microcomputer use does not improve (or worse, impedes) job performance, they are likely to use them either rarely or not at all.

It is also hypothesised that accountants' perceptions of the ease of use of microcomputers in completing work tasks directly affects the extent of use of microcomputers. That is, a higher level of perceived ease of use leads to greater microcomputer usage. Davis et al. (1989) argue that a key mechanism by which ease of use directly affects behaviour (in this study, microcomputer usage) is self-efficacy. Bandura (1982) defines self-efficacy as judgements of how well one can execute courses of action required to deal with prospective situations. The easier a microcomputer is to use, the greater should be the user's sense of efficacy and personal control regarding his or her ability to carry out the sequences of behaviour needed to operate the microcomputer. A high sense of efficacy brought about by a user perceiving microcomputers to be easy to use influences his or her attitude toward using microcomputers, effort persistence and motivation to use due to inborn drives for competence and self-determination (Davis et al., 1989).
A further mechanism through which perceived ease of use influences microcomputer use is explained by the cost-benefit paradigm (Davis, 1989). In essence, this approach explains that decision-makers alter their choice strategies when they perceive that the effort required to achieve certain goals may be reduced without prejudicing the output from their actions. If accountants believe that a microcomputer is so easy to use that they can complete work tasks of at least the same quality, in at least the same time with a reduction in effort, then this perception will lead them to using the microcomputer to complete those tasks. Moreover, the greater the perceived positive impact of microcomputer use on work effort, the more they are likely to use them.

Conversely, if accountants believe microcomputer use does not reduce (or for that matter, increases) work effort, they are likely to use them either rarely or not at all. Thus, the above analysis leads to the following formal proposition:

**Proposition 5:**

(a) Perceived usefulness of microcomputers has a direct positive effect on the extent of microcomputer usage.

(b) Perceived ease of use of microcomputers has a direct positive effect on the extent of microcomputer usage.

Recent research not only shows that perceptions of ease of use and usefulness affect computer system usage, it also shows that these perceptions affect attitudes toward using computer systems (Davis *et al.*, 1989). It is proposed in this study that regardless of whether or not they use microcomputers, accountants are likely to hold positive attitudes
toward using them if they perceive them to be useful and easy to use in the work environment. That is, higher levels of perceived usefulness and perceived ease of use result in more positive attitudes toward using microcomputers.

The arguments for this are as follows. As with the perceived ease of use/usage relationship, self-efficacy acts as a basic mechanism by which perceived ease of use influences attitudes. Perceiving microcomputers as easy to use, accountants see themselves as prospectively being competent and capable of 'driving' the microcomputer system if and when they need or want to. That is, the easier they perceive the microcomputer to use, the greater their confidence in their ability to use it. This belief in ones' ability to use microcomputer systems is likely to result in the accountant holding a positive feeling of favourableness toward using microcomputers and a predisposition to use them. That is, an accountant's attitude toward using a microcomputer\textsuperscript{8} will be positively affected.

On the other hand, if accountants perceive microcomputers to be difficult to use, they will see themselves as relatively incapable of 'driving' microcomputer systems. Ultimately, this reduced self-estimate of efficacy will negatively affect the accountant's attitude toward using

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\textsuperscript{8} Recall from Section 2.2.4.1 that the three components of attitude are the cognitive component (the microcomputer), the affective component (the feeling of favourableness or unfavourableness toward microcomputers) and the behavioural component (the predisposition to use a microcomputer).
microcomputers.

It is also argued that perceived usefulness positively affects accountants attitudes toward using microcomputers. If accountants assess microcomputers as being tools which can aid them in achieving valued outcomes (for example, improved performance leading to promotion, increases in salary and conditions, etc.), then they are likely to be favourably disposed toward them. Moreover, this perception of microcomputer utility will also affect prospective individual behaviour associated with them: perceived high levels of utility will predispose the individual toward using microcomputers (conversely, perceived low levels of utility will predispose the individual against microcomputer use). In sum, accountants' perceptions of the usefulness of microcomputers will positively affect their attitude toward using them.

The foregoing analysis leads to the following formal proposition:

**Proposition 6:** (a) Perceived usefulness of microcomputers has a direct positive effect on attitude toward using microcomputers. 
(b) Perceived ease of use of microcomputers has a direct positive effect on attitude toward using microcomputers.

Research into computer anxiety in recent times has primarily focused on identifying correlates of computer anxiety (see for example, Raub, 1981; Morrow et al., 1986; Howard, 1986; Howard and Smith, 1986; Parasuraman and Igbaria, 1990; Ray and Minch, 1990). Although Raub (1981) used regression analysis with computer anxiety as the dependent
variable and correlates such as computer experience, trait anxiety, math anxiety and gender as the independent variables, little research has been undertaken to identify factors that may affect computer anxiety, and little argument has been advanced to identify causal relations of computer anxiety. Davis et al. (1989) did not incorporate computer anxiety into their technology acceptance model. However, they did suggest that additional theoretical constructs such as computer anxiety may be profitably brought into the analysis, suggesting that perceived ease of use and perceived usefulness may be factors which also affect computer anxiety, and that, in turn, computer anxiety may affect such things as attitude and usage.

This study hypothesises that accountants' perceptions of ease of use of microcomputers in completing work tasks directly affect their level of computer anxiety. That is, a higher level of perceived ease of use of microcomputers results in a reduced level of computer anxiety. Similar to the ease of use/attitude linkage, the argument for the relationship between ease of use and computer anxiety is based on the self-efficacy mechanism which is triggered by the individual's perception of ease of use.

Recall that computer anxiety for the purposes of this study is seen as the tendency to experience a level of uneasiness over impending use of a microcomputer that is disproportionate to the actual threat. Given this, and accepting that self-efficacy is a person's judgement of their own ability to behave in a particular way (for example, operate a microcomputer), if a person's self-judgement is that he/she is able to,
with ease, operate a microcomputer when needed or wanted, this in turn is likely to ameliorate any sense of uneasiness or foreboding held about possible microcomputer use. In essence, what this suggests is that perceived ease of use, through the mechanism of self-efficacy, inversely affects the level of computer anxiety experienced.

It is further hypothesised that accountants' perceptions of usefulness of microcomputers in completing work tasks directly affect their level of computer anxiety. That is, a higher level of perceived usefulness of microcomputers results in a reduced level of computer anxiety. As discussed earlier (see Section 2.2.5.1), in this study computer anxiety is seen as a 'transitory-neurotic' type of anxiety. Essentially, this is an anxiety that manifests itself in an 'unrealistic' level of fear and apprehension. It varies in intensity; fluctuates over time; and, arises in response to a specific stimulus (in this study, the thought of impending use of a microcomputer).

It is argued that perceived usefulness, essentially the belief that microcomputers, if used, will enhance job performance, is a powerful enough belief on the part of the individual to induce that person to set aside misgivings and apprehensions he/she may hold about microcomputers. In essence, the motivation induced by the belief that future job rewards are enhanced by the use of microcomputers acts to moderate and dampen any short-term, transitory fear and apprehension invoked by thinking about the impending use of microcomputers.
These arguments suggest the following proposition:

**Proposition 7:**
(a) Perceived usefulness of microcomputers has a direct inverse effect on computer anxiety.
(b) Perceived ease of use of microcomputers has a direct inverse effect on computer anxiety.

### 2.3 CHAPTER SUMMARY

This chapter described the research model and the variables on which this study is based. The main purpose of the chapter has been to explicate the theoretical foundations for the relationships proposed between the components in the model. Essentially, the model attempts to parsimoniously, but fully, describe how two exogenous variables, perceived ease of use and perceived usefulness of microcomputers influence work outcomes (job satisfaction and job performance) through their effect on computer anxiety, attitude toward using microcomputers and microcomputer usage itself.

Specific research propositions were developed and articulated for each of the linkages specified in the research model. These propositions are the basis of detailed testing and analysis in Chapter 4.
CHAPTER 3

RESEARCH METHOD

The previous chapter presented the conceptual model and the propositions derived therefrom. This chapter describes the research method used to investigate these propositions. Section one presents the research design including the rationale for choosing the particular approach used in the research. Section two describes the research environment, including the setting and the participants. Section three describes the processes for constructing the research instrument and discusses the research procedures including a description of the research task and the administration of the research instrument. Section four describes the research instrument used to measure the components investigated in the conceptual model developed in this study. The chapter concludes with a summary in section five.
3.1 RESEARCH DESIGN

A field study\(^1\) was designed to collect the data needed to test the research propositions. Professional accountants, working in a Big Six accounting firm in a metropolitan city in Australia, recorded their attitudes toward using microcomputers in their work environment. They provided information about the extent to which they use microcomputers and different microcomputer software at work. In addition, they reported how satisfied they were with their job and how well they believed they performed their job. In collecting the data, none of the variables in the study was experimentally manipulated. Therefore, the study falls into the nonexperimental-methods category, or what Cook and Campbell (1979) more usefully describe as a passive-observational study.

The field study approach was deliberately chosen for this research because of the realism concomitant with this research method. Kerlinger (1973, pp. 406-407), for example, describes a field study as '... strong in realism, significance, strength of variables, theory orientation, and heuristic quality, ... they are closest to real life'. Also, to date, most research into the impact of different types of microcomputer interfaces on users has generally been restricted to laboratory settings\(^2\). While this

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\(^1\) Kerlinger (1973, p. 405) defines field studies as '... any scientific studies, large or small, that systematically pursue relations and test hypotheses, that are ex post facto, and that are done in life situations like communities, schools, factories, organisations, and institutions.'

\(^2\) For example, see the Temple, Barker & Sloane Inc study (Microsoft, 1990b).
environment is sound for studying '... the precise interrelations of variables and their operation, and to control variance under research conditions that are uncontaminated by operation of extraneous variables' (Kerlinger, 1973, p. 401), the ability to generalise the results of the research to the real world is problematical.

3.2 THE RESEARCH ENVIRONMENT

This section describes the setting in which the field study took place and the people who participated in the study.

3.2.1 The research setting

While the strength of field studies is their real-life setting, potentially they may be flawed because 'the field situation has a plethora of variables and variance' (Kerlinger, 1973, p. 408). That is, it may be difficult to establish whether any variance observed is attributable to between-group variance (systematic variance). Put another way, any variation found in a between-group comparison of dependent variables may be attributable to factors not identified nor controlled for in the study (commonly known as error variance). Therefore, a critical objective in field research is to minimise error variance. In this study, an attempt has been made to achieve this objective by selecting a setting where there is homogeneity among the potential participants in the study except for the type of microcomputer interface used by them. To this end, the research site selected was the business services division of a
large Australian metropolitan international accounting firm - one of the Big Six accounting firms.

The major professional tasks of the business services division of this firm (for a range of business clients) include the accumulation of financial data, the preparation of accounting reports, the preparation of monthly accounts and summary records, the completion and lodgement of forms to statutory bodies such as the Australian Taxation Office and Corporate Affairs Commission, the provision of business and taxation planning advice, and the conduct of audits. It is the nature and size of the client serviced that characterises the work carried out in the business services division. In general, the client and services profile of the business services division is similar to that of the middle group of accounting firms that exist in large metropolitan cities - that is, a wide range of accounting services to clients which, on average, are not 'top 100' companies.

The business services division uses both IBM PC (or compatible) microcomputers\(^3\) and Apple Macintosh microcomputers\(^4\) as aids in carrying out the tasks outlined above. The type of software used on the business services division microcomputers include commercial

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\(^3\) At the time of the study most of these types of microcomputers had the conventional command-line (or textual) user interface, although some were running the Microsoft Windows package, a type of graphical user interface.

\(^4\) These types of microcomputers have a graphical user interface as an integral part of the machine.
spreadsheets, wordprocessing packages, and accounting packages (such as Solution 6 and Great Plains). To a lesser extent, database software, communication packages, and audit packages are used. Table 3.1 shows the use of various types of software (as a percentage of total time spent using a microcomputer) by accountants in the business services division. The table clearly shows that accountants in this division spend most of their time using either spreadsheets (59.9 percent of accountants spend at least 20 percent of their microcomputer time using spreadsheets), accounting packages (57.3 percent of accountants spend at least 20 percent of their microcomputer time using accounting packages) or wordprocessing packages (34.4 percent of accountants spend at least 20 percent of their microcomputer time using wordprocessing software). On the other hand, Table 3.1 shows that use of other microcomputer software by accountants in the business services division is minimal (for example, 92.4 percent of accountants never use database software; 83.4 percent never use auditing software; and, 93.0 percent never use communications software).

The business services division was chosen because within that division microcomputers with both graphical user interfaces and command-line user interfaces are used by accountants to complete common work tasks. Also, within the business services division, individual accountants tend toward using either one or other of the two different interfaces for most of their day-to-day work. Participants in the present study therefore can be partitioned into two groups: users of graphical interfaces and users of command-line interfaces.
<table>
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<th>Accounting</th>
<th>Database</th>
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<td>Percentage Use</td>
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Table 3.1: Percentage of microcomputer time spent using application software.
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<td>4.5</td>
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</tr>
<tr>
<td>1-10</td>
<td>14</td>
<td>8.9</td>
<td>16.6</td>
<td>1-10</td>
<td>7</td>
<td>4.5</td>
<td>7.0</td>
<td>1-10</td>
<td>12</td>
<td>7.6</td>
<td>12.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zero</td>
<td>131</td>
<td>83.4</td>
<td>100.0</td>
<td>Zero</td>
<td>146</td>
<td>93.0</td>
<td>100.0</td>
<td>Zero</td>
<td>138</td>
<td>87.9</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.1: Percentage of microcomputer time spent using application software (continued)
The business services division was also chosen because, even though individual accountants almost exclusively use one or other of the interface types, the between-group mix of work carried out on a day-to-day basis is substantially the same regardless of the type of interface used. That is, while different accountants may use different tools, the task environment is substantially the same.

A further reason for choosing the business services division is that accountants working in this division are primarily voluntary users of microcomputers. This is important because any study of relationships between ease of use, usefulness, computer anxiety, microcomputer attitude and usage of information technology must ensure that work activities are of a type which do not mandate the use of that technology. In such cases, factors such as those under investigation in this study may have little influence on overall levels of microcomputer use, even though use levels may be seen to be relatively high.

A related problem to that of mandatory use is "captive use" (see Adams et al., 1992). Captive use describes the situation where, even though usage is not mandatory, there may be no choice but to use the system to complete the task. In such circumstances, the real relationship between the variables under examination may be understated because usage would be high regardless of the levels of the other variables. If captive use exists, the underlying relationships between the variables under study may not be identified. However, captive use is not likely to be an important issue in this study because accountants working in the business services division still have the choice of traditional tools (eg.,
calculators, typewriters, etc.) to complete work tasks apart from those tools available through the use of a microcomputer.

Having decided on using a Big Six accounting firm as the organisational setting for the study, telephone contact was made with the managing partner of the firm selected, requesting his agreement to his firm's participation in the study. The managing partner agreed in principle to the participation of his firm and its staff. Nevertheless, he required the details of the research procedures to be resolved with one of his partners who had daily involvement with information technology matters in the firm.

After initial contact by telephone with the partner, a letter (see Appendix 1.1) was sent indicating the general plan of the study and requesting general information about the operational tasks of the firm. This letter was followed up with a presentation to seven senior staff at the firm. The presentation included a description, by way of an overview, of the objectives of the research and the model being tested by the research. During the presentation, such things as confidentiality of data, anonymity of participants, the number of participants, and the logistics associated with the distribution and collection of the research instrument were discussed. The partner agreed in principle to his firm's participation in the research, provided he and his colleagues viewed the questionnaire in its draft stages. This provision was agreed to.
After completing a draft of the questionnaire based on the results of an earlier exploratory survey, a copy was forwarded to the firm. The firm's initial reactions to the questionnaire were guarded. The firm was concerned with the job evaluation section of the questionnaire. After further assurances about confidentiality and anonymity, the partner agreed to sound out a partner in the business services division. Subsequently, in an interview with a business services division partner, final approval was given for accounting staff in his division to participate in a pilot study, followed by the study proper, after agreeing to a set of guidelines outlined in a letter sent to the partner (see Appendix 1.2). The partner agreed to coordinate the distribution and collection of the primary questionnaire and the distribution of any follow-up questionnaires.

3.2.2 Participants

At the time of the administration of the questionnaire, 214 accounting staff worked in the business services division. This number excluded staff on leave or seconded to other divisions of the firm. The study did not include partners in the firm. From the 214 questionnaires distributed, 164 were returned representing a response rate of 77 percent. Seven of these were unusable because they were not completed and were dropped from the analysis, leaving 157 useable responses (73.3 percent of the original number distributed). Biographical information derived

5 In developing the questionnaire, the researcher completed both an exploratory survey and a pilot study. These are described in detail in Section 3.3.1.
from these questionnaires is shown in Table 3.2.

Table 3.2 shows that just over half (52.2 percent) of the participants were aged between 21 years and 25 years, with almost 80 percent under 30 years. Forty-two percent of participants were female. The business services division has four broad employment categories for professional staff (not including partners). These include manager, supervisor, senior and accountant. The largest group of participants (43.9 percent) were employed in the accountant category, and over half of the participants (59.2 percent) were employed as either seniors or accountants. Almost 90 percent of participants held at least a bachelor degree, while 57 percent were members (or eligible for membership) of either the Australian Society of Certified Practising Accountants or The Institute of Chartered Accountants in Australia.

3.3 RESEARCH PROCEDURE

This section describes the processes for constructing the research instrument and the procedures for the field study. These field study procedures include the steps in planning and organising the administration and collection of the research instrument. The research instrument (see Appendix 1.3) is the primary source of data for the study.
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<thead>
<tr>
<th>Age:</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 21 years</td>
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<td>3.2</td>
</tr>
<tr>
<td>21 - 25 years</td>
<td>82</td>
<td>52.2</td>
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<tr>
<td>26 - 30 years</td>
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</tr>
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<td>46 - 50 years</td>
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<td>Over 50 years</td>
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<table>
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<td>Male</td>
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<table>
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<td>Supervisor</td>
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<td>18.5</td>
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<td>Manager</td>
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<td>22.3</td>
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<tr>
<td><strong>Total</strong></td>
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<table>
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<th>Highest Academic Qualification:</th>
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<th>Percentage</th>
</tr>
</thead>
<tbody>
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<td>TAFE Diploma</td>
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<td>3.2</td>
</tr>
<tr>
<td>Bachelor Degree</td>
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<td>82.8</td>
</tr>
<tr>
<td>PG Diploma</td>
<td>10</td>
<td>6.4</td>
</tr>
<tr>
<td>Masters Degree</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Other</td>
<td>11</td>
<td>7.0</td>
</tr>
<tr>
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<td><strong>157</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Membership of Professional Accounting Body</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member*</td>
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<td>56.7</td>
</tr>
<tr>
<td>Non-Member</td>
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<td>43.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>157</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

*or eligible for membership

Table 3.2: Biographical details of participants
3.3.1 Constructing the research instrument

It is important that the complete research instrument presented to the subjects is set out in such a way to ensure complete, accurate, and timely responses. In an attempt to achieve these objectives, as well as testing the reliability and validity of the scales included in the questionnaire, an exploratory survey and pilot study were carried out. Also, the research instrument at various stages in its development was assessed by individuals with experience in the development and use of such research tools. Figure 3.1 depicts the process followed when building the instrument. This section describes the exploratory survey, the pilot study, and the individual assessments of the research instrument and how they contributed to the refinement of the instrument.

3.3.1.1 The exploratory survey

To assist in the development of items that could be used to estimate the components of the research model, an exploratory survey was carried out. Sixty-five staff from eight faculties and departments of Deakin University were invited to complete and return an instrument that questioned them about their attitudes to, and use of, computers. Fifty-two staff responded. Their responses were used to test the reliability and validity of some of the scales ultimately included in the final research instrument. These scales were used to estimate the following components in the primary study: (i) attitudes toward using microcomputers, (ii) computer anxiety, (iii) perceived ease of use of microcomputers, (iv) perceived usefulness of microcomputers, and (v)
Figure 3.1: Process of research instrument construction
extent of use of microcomputers. The results of the reliability and validity tests are reported in Section 3.4.1.

As well as providing a means for testing the reliability and validity of the scales, the exploratory survey responses were used to assess the adequacy of the structure of the questionnaire and the way in which the questions were framed.

The results of the exploratory survey led to a complete recasting of the items used to estimate the extent of use of microcomputers and software. The exploratory survey used questions that required respondents to choose the most accurate response from a range of six choices indicating frequency of use (never, rarely, occasionally, often, very often, continually) to estimate their extent of use. In attempting to analyse extent of use of microcomputers and software using these responses, the researcher found it difficult to draw meaningful conclusions because of the nature of the measurement scale used - at best the scale could be regarded as ordinal. To overcome this problem in the primary study, the scales used to estimate, in particular, extent of use of microcomputers, and, to a lesser degree, extent of use of software were redesigned.

The scale ultimately adopted in the final study to estimate extent of use of microcomputers captured two important data - the type of interface normally used by the respondent and the number of hours per day in which a microcomputer was used. Inviting respondents to record their microcomputer use in terms of hours per day made it possible for the researcher to use analytical techniques otherwise not available had the
exploratory survey scales been used. The original scales limited the data to ordinal form only.

Rather than invite subjects to respond to the question on extent of use of software by marking their response along a Likert-type scale (ranging from 'never' at one end to 'continually' at the other) as was done in the exploratory survey, the question was redesigned to enable subjects to indicate the spread of their microcomputer time across the various types of software by assigning a percentage.

Further analysis of the exploratory survey results led to other more general changes to the research instrument. For example, the sections on subjects' attitudes and perceptions regarding microcomputers were collapsed into one section, with extent of use of microcomputers and software being separated into a section of its own. The biographical data section was included at the end of the questionnaire rather than at the beginning. The motivation for these changes was to enhance the readability and ease of response of the instrument. Comments written on the completed exploratory survey instruments, and interviews with respondents, were useful indicators as to the form of these changes.

3.3.1.2 The pilot study

The main purpose of the pilot study was (a) to test the reliability of the instrument in the proposed research setting, and (b) to determine the suitability of the overall structure and layout of the instrument to the
potential subjects of the primary study.

The questionnaire was distributed to twenty accountants in the business services division of the accounting firm chosen for the primary study. They were invited to complete the questionnaire and return their responses in a sealed envelope. Fifteen responses were received, and these formed the basis of the analysis. The results of the reliability tests are reported in Section 3.4.1.

The suitability of the overall structure and layout of the instrument to the potential subjects of the primary study was gauged by reviewing the responses to the questions to ensure completeness and by interviewing two of the respondents. All fifteen questionnaires received from the respondents were complete. There was no evidence to suggest the questions were ambiguous or incomprehensible. The two respondents interviewed were asked how difficult the questionnaire was to complete. Each unequivocally said the questionnaire was straightforward to complete. One interviewee offered the opinion that the questionnaire was 'really quite simple' to follow and complete and that the five-point Likert-type scale used for the questions on microcomputer attitudes and perceptions provided the respondent with the opportunity to accurately record the attitude or perception held.

The results of the analysis of the pilot-study responses and the interviews confirmed the layout and structure of the instrument and its suitability for administering to the primary-study participants.
3.3.1.3 Individual evaluation of the research instrument

As well as conducting the exploratory survey and the pilot study as a means of developing and refining the research instrument, a number of individuals, experienced in the development and use of such research tools, were invited to evaluate the instrument at various stages throughout its development. In all, six people provided assistance. Their comments and opinions were also used to further refine the instrument.

The major contribution these evaluators made to the development and refinement of the questionnaire was in advice about, and suggestions on, layout and structure. For example, the layout of the questions on page 4 in Section 2 of the instrument (see Appendix 1.3) was changed to include right-hand pointing horizontal arrows on the suggestion of one of the evaluators. Without them it was thought that respondents may not associate the right-hand boxes with those on the left. By including the arrows, it became clear they were connected. Similarly, after the suggestion of another evaluator, the choices to the questions in Section 4 Biographical Background (see Appendix 1.3), which required the respondents to tick an appropriate box, were aligned using a horizontal line to ensure accurate 'mapping' from the choice to the box. The simple step of incorporating this line guarded against respondents inadvertently ticking the wrong box.

Apart from comments and suggestions of the type indicated above, the evaluators made no substantive negative remarks about the scales and
the scale items included in the questionnaire.

3.3.2 Distribution and collection of the research instrument

Organisationally, the business services division is structured into 9 work groups, with between 12 and 33 accountants in each group. Each group has a secretary. The secretary services the members of the group to which he or she belongs. This structure provided a simple way for distributing and collecting the questionnaire.

The researcher visited each group secretary and provided her with enough questionnaires to distribute one to each professional staff member in her group. In a letter (see Appendix 1.4) from the researcher, that accompanied each questionnaire, respondents were asked to return their completed questionnaire, sealed in the envelope provided, to their group secretary.

A memorandum (see Appendix 1.5) from the business services division partner accompanied the researcher's letter and the questionnaire. This memorandum was a direct request from the firm, via the partner, for each staff member to assist the researcher in his work by completing and returning the questionnaire. It pointed out that the responses would be treated confidentially and anonymously and that only the researcher would have access to the completed questionnaires for study and analysis.
Upon receipt of the completed questionnaire, the secretary was instructed to place a tick on a staff list beside the name of the staff member returning the questionnaire. Staff who had not responded to the questionnaire by the date specified could therefore be identified. Follow-up procedures could then be targeted at non-respondents.

Participants were given two weeks from the receipt of the questionnaire to complete and return it. After two weeks, 136 questionnaires had been completed and returned to the various group secretaries. A few days later, the researcher received directly via mail another completed questionnaire. Seven of those questionnaires returned were incomplete and were excluded from the study. This left 130 questionnaires (64 percent of those originally distributed) available for analysis from the first distribution.

Within a week, group secretaries within the business services division distributed a second copy of the questionnaire with an accompanying letter (see Appendix 1.6), to those staff who had not responded to the earlier distribution. Three weeks later, after receiving a further 27 completed questionnaires from the follow-up procedures, the survey was closed. In all, 164 questionnaires were returned (a response rate of 76.6 percent), 7 of which were excluded from the analysis because they were unusable.
3.3.3 The research task

Participants in the study were required to respond to 82 questions contained in 4 sections within the questionnaire (see Appendix 1.3). The questions contained in section one ask respondents to rate their attitude toward using microcomputers in the workplace. The questions specifically address such issues as general attitude toward using microcomputers, the level of anxiety associated with using microcomputers, and the perceived ease of use and usefulness in using microcomputers, all in the context of the workplace. Section two of the questionnaire asks respondents to provide details of the type of microcomputer interface they use, the amount of time they spend using microcomputers, and the frequency of use of certain types of software. Section three asks a series of questions designed to obtain the respondents' perceptions of their job and their reactions to it. The final section collected biographical information about each respondent. Apart from three questions on age, education level, and home-computer ownership, all questions directly relate to various aspects of the respondent's job.

Seventy-nine of the questions were of a closed nature, requiring the respondents to either circle a number, enter a number, or tick a box, all from a selection, that best describes their response to the question. Three questions were open-ended, requiring respondents to answer using their own words (or more accurately, in this questionnaire, numbers).
Both a covering letter (see Appendix 1.4) and an information and instruction sheet (see Appendix 1.7) accompanied each questionnaire. The covering letter described the nature and purpose of the research, emphasised the confidential and anonymous nature of the study, and provided directions on sealing responses and returning them to group secretaries. The information and instruction sheet described the structure of the questionnaire, provided general instructions on how it should be completed and returned, and invited respondents to complete it anonymously if they wished. The instruction sheet also provided the researcher's telephone number if they needed assistance.

Specific instructions within the questionnaire directed respondents to carefully read the questions and then to respond honestly and frankly, working quickly and without undue reflection through all the questions.

3.4 RESEARCH INSTRUMENT

The data needed to test the conceptual model were collected using the questionnaire (see Appendix 1.3) mentioned above. This section describes the scales used to estimate the variables representing the components of the model and the procedures followed to test the reliability and validity of the scales.
3.4.1 Operationalisation of the model components

The conceptual model developed in Chapter 2 comprises seven components. Table 3.3 provides a list of the components' scales, along with the sources from which the scales were either drawn or developed.

3.4.1.1 Perceived ease of use

The estimate of perceived ease of use of microcomputers was obtained using a scale that included eleven items and employed a five-point Likert-type scale for subjects to record their response (see Appendix 1.3, Section 1, pp. 2-3, questions 18-28). The scores for each item are aggregated to give an estimate of perceived ease of use of microcomputers. Six items were drawn from the scale developed by Davis (1989) to estimate perceived ease of use as part of a study of user acceptance of information technology. The other five were developed by the researcher.

Davis (1989) reported that his six-item scale achieved Cronbach Alpha reliability coefficients\(^6\) of between 0.86 and 0.94 for the two studies in

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\(^6\) All other things being equal, a scale should, if administered to the same survey sample, repeatedly produce the same aggregate score for the scale being estimated, i.e., it should be reliable. The Cronbach Alpha coefficient provides an estimate of the reliability of a scale. A coefficient, that approximates 1.00 indicates the scale to which it has been applied approximates perfect reliability in reporting the responses of the survey sample.
<table>
<thead>
<tr>
<th>Model Component</th>
<th>Instrument Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Usefulness</td>
<td>Davis (1989) scale as modified by the researcher</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>Davis (1989) scale as modified by the researcher</td>
</tr>
<tr>
<td>Computer Anxiety</td>
<td>Scale based on Howard (1986) and items developed by the researcher</td>
</tr>
<tr>
<td>Extent of Use of Microcomputers</td>
<td>Scale developed by the researcher</td>
</tr>
<tr>
<td>Work Outcome - Job Satisfaction</td>
<td>Hackman &amp; Oldham's (1975, 1980) Job Diagnostic Survey</td>
</tr>
<tr>
<td>Work Outcome - Job Performance</td>
<td>Scale developed by the researcher</td>
</tr>
</tbody>
</table>

Table 3.3: Model components and scales used to estimate them
which the scale was used. The eleven-item scale used in this study was tested first in both an exploratory survey and a pilot study. The Cronbach Alpha coefficients achieved in the exploratory survey ranged from 0.93 to 0.97; the pilot study achieved a coefficient of 0.91. The post hoc reliability test for the primary study data confirmed the reliability of the scale, achieving a Cronbach Alpha coefficient of 0.91.

While a scale may be reliable, it may still not estimate the component (or construct) under study because it may be estimating some other entirely unrelated component (or components), that is, it may be invalid. In essence, a scale estimator is valid '...if it measures what it is supposed to measure' (Hatcher and Diebert, 1987, p. 696). To determine the validity of the scale for this study, a further procedure was applied. Fifteen experts\(^7\) were asked to rate the degree to which they thought the eleven-item scale estimates users' perceptions of ease of use of microcomputers (see Appendix 1.8). They were presented with a copy of the scale (including a covering letter), a definition of the construct being estimated by the scale, and an equal-interval scale along which to mark their response. One end of the scale, anchored at "1", was labelled, "Weak Estimate of Attitude toward using Computers", the other end, anchored at "10", "Strong Estimate of Attitude toward using Computers" (see Appendix 1.8). All but one person responded to the request. The mean score from the raters was 8.24 (Standard Deviation - 1.81, Median - 9). This result suggests the experts rated the scale a strong estimator of

\(^7\) These included academics who either taught or researched in the social sciences.
the 'ease of use' component.

The extra five items were added to the Davis (1989) scale so that specific opinions about ease of file handling on microcomputers could be gauged. The ease with which microcomputer users can find, open, save, copy, and print files is likely to affect their overall perceptions of how easy a microcomputer is to use. By including these further five items, the question of whether the scale now forms a distinct construct becomes important. This issue was examined by performing a principal components analysis on the data from the exploratory analysis. If the scale forms a distinct construct, all items will have their highest loading on the first factor in an unrotated factor structure (McCroskey and Young, 1979, p. 380). Table 3.4 shows the results of a principal components analysis of the three sets of data collected in the exploratory survey where two factors have been extracted. For each of the three exploratory survey datasets, each item has its highest loading on the first factor. Even with the addition of the five extra items to the Davis (1989) scale, this result suggests it still forms one distinct construct. A post hoc principal components analysis of the data from the primary study for the 'perceived ease of use' scale produced similar results with each item having its highest loadings on the first factor (see Table 3.4).

The items from the Davis (1989) scale required some modification for use in this study primarily because the Davis study in which the scale was used was evaluating the prospective use of a specific piece of software. For example, where an item in the Davis (1989) scale states, "Learning to operate CHART-MASTER would be easy for me", the term
<table>
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<th>Primary Study Dataset (N=157)</th>
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<td>Factor 2</td>
<td>Factor 1</td>
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<td>59.31</td>
<td>16.57</td>
<td>72.61</td>
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</table>

Table 3.4: Unrotated principal component analysis of perceived ease of use scale
"CHART-MASTER would be" was replaced with "microcomputers is". Similar adjustments were made to the other five items from the Davis (1989) scale.

3.4.1.2 Perceived usefulness

The Davis (1989) scale for estimating 'perceived usefulness' was used in this study for estimating perceived usefulness of microcomputers (see Appendix 1.3, Section 1, p. 3, questions 29-34). The scale comprises six items that were derived psychometrically by Davis (1989) to estimate perceived usefulness in studies of user acceptance of information technology. For this study, each item employs a five-point Likert-type scale for participants to record their response. The scores for each item are aggregated to give an estimate of 'perceived usefulness of microcomputers'.

In developing and testing his perceived usefulness scale, Davis (1989) reported Cronbach Alpha coefficients of 0.97 and 0.98 for the studies in which it was used. In the exploratory survey and the pilot study carried out to test the instrument prior to use in the primary study, reliability coefficients of 0.95 and 0.96 were recorded for the former and 0.88 for the latter. The Cronbach Alpha coefficient for the primary study was 0.91, indicating the scale has a consistently high reliability factor across a range of studies.

In terms of assessing whether the scale is estimating what it is supposed to be estimating, as with the preceding scale, a group of experts were
asked to rate the appropriateness of the scale (see Appendix 1.8). Results from analysis of the raters' responses suggest the scale is a valid estimator of 'perceived usefulness of microcomputers': the mean score of the raters was 8.1 (Standard Deviation - 1.8, Median - 8.1).

As with the 'perceived ease of use' scale, items from the Davis (1989) 'perceived usefulness' scale required adaptation for use in this study. For example, "CHART-MASTER" was replaced with "a microcomputer". Also, each statement was changed from the future tense to the present tense. Similar adjustments were made to the other five items from the Davis (1989) scale.

3.4.1.3 Computer anxiety

The estimate of subjects' computer anxiety was obtained using a scale derived partly from a scale used by Howard (1986) and developed partly by the researcher (see Appendix 1.3, Section 1, p. 2, questions 12-17). The scale comprised six items (three taken from the Howard (1986) scale and three developed by the researcher) and used a five-point Likert-type scale for subjects to record their response. The scores for each item are aggregated to give an estimate of 'computer anxiety'.

Because the resultant scale was effectively a new scale for estimating computer anxiety, steps were taken to test whether the items collectively could estimate this construct prior to the scale being used in the exploratory survey. These involved providing the scale to a number of social science academics for them to provide critical comment on the
items, the way they were constructed, and how well they collectively estimated the construct, 'computer anxiety'.

Feedback from these people led to minor amendments to the syntax of the items; however, no substantial changes were suggested. Once the minor adjustments were made, the scale was incorporated into the instrument to be used in the exploratory survey (and later, the pilot study and primary study).

Scale reliability was assessed by deriving a Cronbach Alpha coefficient for both the exploratory survey and the pilot study. For the exploratory survey, the coefficient was 0.89, while the pilot study recorded a coefficient of 0.86\(^8\). The post hoc reliability coefficient computed from the primary study data was 0.94, confirming the reliability of the scale.

Because the 'computer anxiety' scale was, effectively, a new scale developed specifically for this study, it needed to be assessed to ensure each of its items is measuring the same thing (convergent validity) and that it is clearly measuring one construct (discriminant validity). To validate the scale, an unrotated principal components analysis with a two-factor solution was run on the exploratory survey data. The results summarised and presented in Table 3.5 show there is a single factor solution. That is, except for Item 2 in exploratory survey dataset 1, all of the highest loadings for each item load on the first factor in all three

\(^8\) The scale, from which three of the items for the scale used in this study were derived, reported a coefficient of 0.85 (Howard, 1986).
<table>
<thead>
<tr>
<th></th>
<th>Exploratory Study Dataset 1 (n=40)</th>
<th>Exploratory Study Dataset 2 (n=40)</th>
<th>Exploratory Study Dataset 3 (n=38)</th>
<th>Primary Study Dataset (N=157)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Factor 1: 0.842 Factor 2: 0.197</td>
<td>Factor 1: 0.846 Factor 2: -0.447</td>
<td>Factor 1: 0.932 Factor 2: 0.009</td>
<td>Factor 1: 0.850 Factor 2: 0.360</td>
</tr>
<tr>
<td>Item 2</td>
<td>Factor 1: 0.398 Factor 2: -0.754</td>
<td>Factor 1: 0.761 Factor 2: 0.572</td>
<td>Factor 1: 0.954 Factor 2: -0.153</td>
<td>Factor 1: 0.768 Factor 2: -0.570</td>
</tr>
<tr>
<td>Item 3</td>
<td>Factor 1: 0.776 Factor 2: 0.034</td>
<td>Factor 1: 0.796 Factor 2: 0.261</td>
<td>Factor 1: 0.851 Factor 2: -0.515</td>
<td>Factor 1: 0.854 Factor 2: -0.315</td>
</tr>
<tr>
<td>Item 4</td>
<td>Factor 1: 0.954 Factor 2: 0.117</td>
<td>Factor 1: 0.898 Factor 2: 0.076</td>
<td>Factor 1: 0.949 Factor 2: 0.111</td>
<td>Factor 1: 0.907 Factor 2: 0.227</td>
</tr>
<tr>
<td>Item 5</td>
<td>Factor 1: 0.771 Factor 2: -0.221</td>
<td>Factor 1: 0.898 Factor 2: 0.076</td>
<td>Factor 1: 0.870 Factor 2: 0.246</td>
<td>Factor 1: 0.906 Factor 2: 0.113</td>
</tr>
<tr>
<td>Item 6</td>
<td>Factor 1: 0.868 Factor 2: 0.363</td>
<td>Factor 1: 0.854 Factor 2: -0.469</td>
<td>Factor 1: 0.906 Factor 2: 0.284</td>
<td>Factor 1: 0.927 Factor 2: 0.101</td>
</tr>
<tr>
<td>Eigenvalue:</td>
<td>3.927</td>
<td>4.270</td>
<td>4.978</td>
<td>4.545</td>
</tr>
<tr>
<td>Percentage of total variance explained:</td>
<td>65.45</td>
<td>71.17</td>
<td>82.97</td>
<td>75.75</td>
</tr>
</tbody>
</table>

Table 3.5: Unrotated principal component analysis of computer anxiety scale
exploratory survey datasets. A similar analysis was made using the primary study data. The results, which are also included in Table 3.5, confirm the exploratory survey results, again showing a single-factor solution with the first factor showing the highest loading for each item in the scale. Given this single-factor solution, it is reasonable to conclude each of the items in the 'computer anxiety' scale is estimating the same thing and that the scale is clearly estimating one construct.

To test the face validity of the 'computer anxiety' scale, as with the previously discussed scales used in this study, the scale was rated by a group of experts. Specifically, the raters were asked to rate (on an equal interval 10-point scale) the degree to which they believed the items in the scale collectively estimated the component, 'computer anxiety' (see Appendix 1.8). The mean score from the raters was 7.68 (Standard Deviation - 2.13, Median - 8). This result suggests the experts rated the scale a medium-to-strong estimator of the 'computer anxiety' component.

3.4.1.4 Attitude toward using microcomputers

The Hatcher and Diebert (1987) instrument was used in this study to estimate attitude toward using microcomputers (see Appendix 1.3, Section 1, pp. 1-2, questions 1-11). This scale is a refinement of the Hatcher and Coats' (1984) scale. It comprises eleven items and employs a five-point Likert-type scale. After reversing the scores on four items, the scores for each item are aggregated to give an estimate of attitude toward
using microcomputers.

In twelve sample tests of their instrument, Hatcher and Diebert (1987) reported a Cronbach Alpha coefficient ranging between 0.61 and 0.78, indicating moderate to strong reliability. In the exploratory survey, pilot study, and primary data collection phase of this study, the Cronbach Alpha coefficients were 0.70, 0.45, and 0.66. The pilot-survey coefficient, at 0.45, appears low. This result is at odds with the coefficients reported from both the exploratory survey and the primary survey, which are consistent with those reported by Hatcher and Diebert (1987) suggesting the scale reliability to be moderate to high.

To test the face validity of the 'attitude toward using microcomputers' scale, as with the previously discussed scales used in this study, the scale was rated by a group of experts. Specifically, the raters were asked to rate (on an equal-interval 10-point scale) the degree to which they believed the items in the scale collectively estimated the component, 'computer anxiety' (see Appendix 1.8). The rater's mean score was 7.37 (Standard Deviation - 2.36, Median - 8.00). On the whole, this result suggests the experts rated the scale a moderate-to-strong estimator of the 'attitude' component. This result is consistent with the instrument validity coefficient reported by Hatcher and Diebert (1987)\(^9\).

\(^9\) Hatcher and Diebert (1987), using the Product-Moment formula for the Linear Correlation Coefficient, found their 'attitude' scale had a validity coefficient of 0.83.
3.4.1.5 Extent of use of microcomputers

To gauge the extent to which the subjects used microcomputers in their work and to determine which type of microcomputer interface they mainly used, the respondents were given a choice of four boxes to tick. With each box there was a section in which to record the number of years they had been using microcomputers and the number of hours per week they use them (see Appendix 1.3, Section 2, p. 4, questions 1-4). The respondents were also asked to estimate the percentage of microcomputer time they spent using various types of application software (see Appendix 1.3, Section 2, p. 5, questions 5-7).

These questions in the final version of the research instrument provided categorical data for the type of microcomputer interface used and at least ordinal-scale data for extent of use. Four categories for user-type were employed to enable the respondents to be classified: (i) graphical interface users, (ii) command-line interface users, (iii) graphical interface users who were previously command-line interface users, and (iv) command-line interface users who were previously graphical interface users. Respondents were given the opportunity to apportion their microcomputer time over six specific types of application software (wordprocessing, spreadsheets, databases, accounting packages, audit packages and communication packages) with the option of nominating other software not covered by these types.
3.4.1.6 Work outcome - job satisfaction

The Hackman and Oldham (1975, 1980) scale used in their Job Diagnostic Survey to estimate job satisfaction was used to assess the level of job satisfaction of the business services division accountants. Responses to the five-item scale (see Appendix 1.3, Section 3, Part III, questions 2, 4 and 6 p. 9; Section 3, Part V, questions 2 and 3, pp. 10-11) are aggregated (after reversing the score for question 4, p. 9 and question 3, p. 11) and divided by five to obtain the job-satisfaction estimate. As with all items in the Job Diagnostic Survey, responses are recorded on a seven-point scale by the subjects.

The post hoc reliability coefficient from the primary study data was 0.75, confirming the reliability of the scale.

3.4.1.7 Work outcome - job performance

The operational definition of job performance combines worker efficiency and effectiveness at completing work-related tasks. Pentland (1989, p. 215) defines efficiency as '... quantity (or how quickly a given task is done)' and effectiveness as '... quality (or how well a given task is done)'. Quantity and quality of work completed are generally included.

---

10 Taber and Taylor (1990, p. 468) note that the Job Diagnostic Survey is '... now .. the most frequently cited instrument in the Social Sciences Citation Index for assessing worker perceptions of intrinsic job characteristics.'
as key components in estimations of job performance (see Irving et al., 1986; Stumpf and Dawley, 1981).

In this study, job performance was estimated using a scale developed by the researcher (see Appendix 1.3, Section 3, Part VI, questions 1 and 2, p. 11). The scale comprises two items and uses an eleven-point (zero to ten) equal-interval scale for participants to score their response. The item scores are aggregated to give an estimate of job performance.

As Brownell and Dunk (1991) report, self-rating measures of job performance can be criticised because of uncertainty about their objectivity. Nevertheless, they acknowledge that there is little evidence to support suggestions of inaccuracy or bias in information derived from the analysis of data collected using self-rating techniques.

Prior to its use in the primary study, the scale was reviewed by four academics with backgrounds in behavioural and social research methods. These critics agreed the structure and content of the items were appropriate for the purposes of the study. Perusal of the completed questionnaires from the pilot study by the researcher indicated that the respondents had no problems understanding and completing the job-performance questions. There were insufficient cases (fifteen) in the pilot study to use principal components analysis to test whether the items in the scale were estimating the same unitary construct. Given the positive results of the review by the behavioural research academics, however, the researcher considered the scale satisfactory for use in the primary study. A post hoc analysis of the primary data using a two-
factor, unrotated principal components analysis vindicated this decision. It showed clearly that the highest loadings for each item were on factor one, with this factor explaining 78.7 percent of the total variance.

The Cronbach Alpha reliability coefficient for the pilot study was 0.74 indicating a sound level of scale reliability. The post hoc reliability coefficient from the primary study data was 0.72, confirming the reliability of the scale.

3.5 CHAPTER SUMMARY

This chapter described the research design used including the research setting and the study participants. In addition, it discussed the construction and testing of the research instrument, the research procedures used, along with a description of the research task and the procedures for distributing and collecting the research instrument. The chapter concluded with a description of the scales used to estimate the variables representing the components of the model.
CHAPTER 4

DATA ANALYSIS AND RESULTS

The previous chapter described the research method used to select the research sample and to collect the data for analysis. This chapter describes the statistical characteristics of the scales used to estimate the variables representing the components of the model and the results obtained from path analysis that was used to test the propositions detailed in Chapter 2. Section 1 describes the statistical characteristics of the scale scores. Section 2 describes the statistical model used to analyse the research data and the test of whether the model fits the data. Section 3 presents and discusses the results of the analyses used to test the propositions. The chapter concludes with a summary in Section 4.

4.1 STATISTICAL CHARACTERISTICS OF THE SCALE SCORES

The conceptual model developed in Chapter 2 contains seven components. This section describes the statistical characteristics of each of the variables used to estimate these components.
Table 4.1 lists the components and the characteristics of the scale variables used to estimate them. For perceived ease of use, perceived usefulness, computer anxiety, attitude toward using microcomputers, and job performance, the score used is the aggregate of the responses to each item in the scale after reversing individual items where required. For job satisfaction, the mean score for the items making up the scale is the score used for the scale.

The distribution of the actual scores for each variable is an important consideration when deciding which statistical tools to choose to analyse the data. As a general rule, parametric statistical techniques assume the data to be normally distributed. To assess whether or not the data are normally distributed, normal probability plots were created from the data for each variable\(^1\). These plots are included in Figure 4.1. The plots show the distributions are normal or nearly normal, with the possible exception of plots 4.1(d) and 4.1(e) (computer anxiety and extent of use of microcomputers respectively). The skewness and kurtosis coefficients reported in Table 4.1 support this view and suggest that the distributions for computer anxiety and extent of use of microcomputers are, to some extent, positively skewed. The data for these two variables were transformed using the natural logarithmic function. However, the resultant distribution is similar to that for the raw data; therefore, as

\(^1\) 'A Normal probability plot provides a simple way to tell whether or not the numbers in a variable are approximately Normally distributed' (Velleman, 1989, p. 8/21). The probability plot graphs the normal score against the observed value. Velleman (1989, p. 8/22) says, 'If the plot is straight or nearly straight, then the distribution of the variable is nearly Normal ...'. 
<table>
<thead>
<tr>
<th>Component</th>
<th>Number of items</th>
<th>Possible range of numerical scores</th>
<th>Actual range of numerical scores</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Median</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude toward using microcomputers</td>
<td>11</td>
<td>0 to 55</td>
<td>30 to 52</td>
<td>42.53</td>
<td>4.33</td>
<td>43.00</td>
<td>-0.301</td>
<td>-0.007</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>11</td>
<td>0 to 55</td>
<td>19 to 55</td>
<td>42.15</td>
<td>6.27</td>
<td>43.00</td>
<td>-0.418</td>
<td>0.868</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>6</td>
<td>0 to 30</td>
<td>12 to 30</td>
<td>24.25</td>
<td>3.33</td>
<td>24.00</td>
<td>-0.350</td>
<td>1.152</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>6</td>
<td>0 to 30</td>
<td>6 to 26</td>
<td>10.27</td>
<td>4.33</td>
<td>10.00</td>
<td>1.249</td>
<td>1.659</td>
</tr>
<tr>
<td>Extent of use of microcomputers</td>
<td>1</td>
<td>*</td>
<td>0 to 8</td>
<td>2.37</td>
<td>1.48</td>
<td>2.00</td>
<td>1.180</td>
<td>1.758</td>
</tr>
<tr>
<td>Work outcome - job satisfaction</td>
<td>5</td>
<td>0 to 7</td>
<td>1.60 to 6.60</td>
<td>4.48</td>
<td>1.12</td>
<td>4.60</td>
<td>-0.728</td>
<td>0.874</td>
</tr>
<tr>
<td>Work outcome - job performance</td>
<td>2</td>
<td>0 to 20</td>
<td>5 to 20</td>
<td>13.94</td>
<td>2.55</td>
<td>14.00</td>
<td>-0.728</td>
<td>0.874</td>
</tr>
</tbody>
</table>

*Theoretically this could range between 0 and 24

Table 4.1: Statistical characteristics of the scale scores
Figure 4.1: Normal probability plot of scale scores
Figure 4.1 (cont.): Normal probability plot of scale scores
with the other variables the raw data were used in the analysis.

To overcome any problems that may arise because of the marginal skewness of two of the variables, tests of significance used in the analysis of the data are based primarily on a technique that does not assume the data are normally distributed. Appendix 2 describes the technique and how it is applied.

4.2 THE STATISTICAL MODEL

To analyse the data obtained in this research, a linear recursive model using path analysis and ordinary least squares regression was used. Path analysis modelling techniques, originally developed by Wright (1934), have been pioneered in sociology research (see for example, Blalock, 1972; Duncan et al., 1972; and Alwin and Hauser, 1975). These path analysis techniques are used to fit models (incorporating observed variables only) to data, where the data are in standard form and the model linkages are recursive. Path analysis techniques, or techniques derived from them, have been used recently to test a number of information systems theories; for example, the communication behaviours of systems analysts (Tan, 1989), determinants of MIS employees' turnover intentions (Igbaria and Greenhaus, 1992), factors affecting software developers' performance (Rasch and Tosi, 1992) and an information systems planning model (Hann and Weber, 1992).

The path analysis technique used here to test the model and the research propositions derives directly from Duncan et al. (1972), Alwin and Hauser (1975) and Fedhazur (1982). A path model, through path
coefficients, interprets the quantitative information contained in the zero order correlations of the linkages between the theoretical constructs of the model. The zero order correlation describes the total association between two variables. Total association comprises total effects and spurious effects (Alwin and Hauser, 1975). The total effect of one variable on another includes both direct effects\(^2\) and indirect effects\(^3\). The effects not accounted for by either direct or indirect effects, and equal to the difference between total association and total effects, is the spurious effect (or common cause effect) resulting from the common antecedents of directly linked variables in the model (Chenhall and Brownell, 1988, p. 229; Stumpf and Hartman, 1984, p. 320).

Figure 4.2 represents the research model developed in Chapter 2 using conventional path model form (Duncan et al., 1972). The path coefficients and residuals needed to test whether the model fits the data and whether the propositions can be supported are derived by solving a set of four structural equations. These equations are solved using ordinary least squares regression analysis with the data in standard form (Alwin and Hauser, 1975, p. 38). The beta-coefficients in the regression

\(^2\) A path coefficient represents the direct effect and indicates '... the amount of expected change in the dependent variable as a result of a unit change in the independent variable' (Pedhazur, 1982, p. 583).

\(^3\) Alwin and Hauser (1975, p. 39) describe indirect effects as '... those parts of a variable's total effect which are transmitted or mediated by variables specified as intervening between the cause and effect of interest in a model.'
Figure 4.2: Path model of effects of microcomputer perceptions, anxieties, attitudes and use on work outcomes
equations are the path coefficients for the path model\(^4\).

The four regression equations (each representing one of the structural equations) are:

\[
X_1 = \beta_{1a}X_a + \beta_{1b}X_b + \varepsilon_1 \tag{4.1}
\]

\[
X_2 = \beta_{2a}X_a + \beta_{2b}X_b + \beta_{21}X_b + \varepsilon_2 \tag{4.2}
\]

\[
X_3 = \beta_{3a}X_a + \beta_{3b}X_b + \beta_{31}X_b + \varepsilon_3 \tag{4.3}
\]

\[
X_4 = \beta_{42}X_2 + \beta_{43}X_3 + \varepsilon_4^i; \quad i = 1 \ldots 2 \tag{4.4}\]

4.2.1 Goodness of fit of the model

Figure 4.2 and the structural equations\(^6\) derived from it show that not all variables are interconnected. That is, the research model hypothesises that the model of 'best fit' for the relationships between the variables is one which assumes that four of the path coefficients (direct effects) from

---

4 Each path coefficient in this study is tested for significance using the computer intensive bootstrap technique described by Noreen (1988) and Bollen and Stine (1990). Appendix 2 describes the application of this technique to the data in this study.

5 Equation 4.4 calculates the path coefficients for the work outcome variables. The equation is solved twice to obtain the coefficients firstly, for the job satisfaction variable, and then for the job performance variable.

6 Operationalised through the four regression equations (4.1) to (4.4).
a fully recursive\textsuperscript{7} (or 'saturated') model are equal to zero. This research model needs to be assessed to establish how well it fits the data, \textit{i.e.}, whether it fits the data as well (or almost as well) as the fully recursive model.

Given that the observed variables in the research sample are assumed to have a multivariate normal distribution and that the sample size is relatively large (n=157), a $\chi^2$ statistic (with degrees of freedom equal to the number of paths whose coefficients are hypothesised as equal to zero) may be used to gauge the extent to which the model fits the data (Pedhazur, 1982, p. 618). The larger the probability associated with the $\chi^2$ statistic, the better the model fits the data.

Following Specht (1975), an approximate $\chi^2$ statistic is computed by using the estimates of the residual path coefficients\textsuperscript{8} with the following equations:

---

\textsuperscript{7} A fully recursive model is one where all the variables are interconnected.

\textsuperscript{8} The residual path coefficients are calculated using the general form $p = \sqrt{1 - r^2}$ (Pedhazur, 1982, p. 585).
Firstly, for the fully recursive model -

\[ R_m^2 = 1 - (1 - R_1^2) (1 - R_2^2) \ldots (1 - R_p^2) \quad (4.5) \]

where \( R_m^2 \) is the ordinary squared multiple correlation and each item in parenthesis is a squared residual path.

For the research model -

\[ M = 1 - (1 - R_1^2) (1 - R_2^2) \ldots (1 - R_p^2) \quad (4.6) \]

where \( M \) is the research model equivalent of \( R_m^2 \).

The nearer \( M \) is to \( R_m^2 \), the better the fit of the research model. Specht (1975, p. 123) provides a specific measure of goodness of fit, \( Q \), where

\[ Q = \frac{(1 - R_m^2)}{(1 - M)} \quad (4.7) \]

\( Q \) is tested for significance using \( W \) (which has an approximate \( \chi^2 \) distribution for large samples (Specht, 1975, p. 124)), where

\[ W = -(N - d) \log_Q Q \quad (4.8) \]

and \( N \) is the sample size with \( d \) being the number of path coefficients hypothesised to be equal to zero.
The research model of this study includes two work outcome variables - job satisfaction and job performance. In testing the propositions derived from the overall model, two separate statistical models are evaluated, one for each of the work outcome variables. Therefore, two tests were carried out using the technique described above to establish how well each statistical model fitted the data\(^9\).

Table 4.2 shows the results of the tests. It reports values for \( R^2 \), \( M \), \( Q \) and \( W \) (the \( \chi^2 \) approximation). The results reported show that each work outcome model fits the data (job satisfaction: \( W = 2.590, df = 4, p > 0.70 \); job performance: \( W = 6.403, df = 4, p > 0.20 \)). That is, in each case, the research model explains approximately the same (or almost the same) amount of the variance as the fully recursive model but with a more parsimonious structure.

### 4.3 RESULTS FOR TESTS OF PROPOSITIONS

Table 4.3 reports the zero order correlations among the variables used in the path model. Table 4.4 demonstrates how the observed correlations between the variables in the model are decomposed into direct, indirect and spurious effects; and Table 4.5 reports the decomposition effects in the model. Tables 4.6 to 4.10 summarise the results of fitting the regression equations to the data. They report the coefficient of determination for each equation, the standardised regression coefficients

---

\(^9\) All variables and paths are the same for each statistical model except that the work outcome variable is different in each case.
<table>
<thead>
<tr>
<th>Research model</th>
<th>$R_m^2$</th>
<th>M</th>
<th>Q</th>
<th>W</th>
<th>$df$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Satisfaction</td>
<td>0.723</td>
<td>0.718</td>
<td>0.984</td>
<td>2.590</td>
<td>4</td>
<td>&gt;0.70</td>
</tr>
<tr>
<td>Job Performance</td>
<td>0.719</td>
<td>0.707</td>
<td>0.960</td>
<td>6.403</td>
<td>4</td>
<td>&gt;0.20</td>
</tr>
</tbody>
</table>

Table 4.2: Measures of goodness of fit of research model
<table>
<thead>
<tr>
<th></th>
<th>Perceived usefulness</th>
<th>Perceived ease of use</th>
<th>Computer anxiety</th>
<th>Microcomputer attitude</th>
<th>Extent of use</th>
<th>Job satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use</td>
<td>0.547 ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>-0.528 ***</td>
<td>-0.602 ***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microcomputer attitude</td>
<td>0.558 ***</td>
<td>0.574 ***</td>
<td>-0.536 ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extent of use</td>
<td>0.221 **</td>
<td>0.267 ***</td>
<td>-0.241 **</td>
<td>0.186 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>0.240 **</td>
<td>0.319 ***</td>
<td>-0.250 **</td>
<td>0.269 ***</td>
<td>0.197 *</td>
<td>0.173 *</td>
</tr>
<tr>
<td>Job performance</td>
<td>0.228 **</td>
<td>0.238 **</td>
<td>-0.330 ***</td>
<td>0.240 **</td>
<td>0.098 ns</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05  
** p<0.01  
*** p<0.001  

Table 4.3: Zero order correlations between research model variables
<table>
<thead>
<tr>
<th>Variable associations</th>
<th>Observed correlation</th>
<th>Direct effect</th>
<th>Indirect effect</th>
<th>Spurious effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use / perceived usefulness</td>
<td>$r_{ab}$</td>
<td>$\gamma_{ab}$</td>
<td>$\gamma_{ab}$</td>
<td>$\gamma_{ab}$</td>
</tr>
<tr>
<td>Perceived ease of use / Computer anxiety</td>
<td>$r_{a1}$</td>
<td>$\beta_{1a}$</td>
<td>$\beta_{1a}$</td>
<td>$\beta_{1a}$</td>
</tr>
<tr>
<td>Perceived ease of use / microcomputer attitude</td>
<td>$r_{b2}$</td>
<td>$\beta_{2a}$</td>
<td>$\beta_{2a}$</td>
<td>$\beta_{2a}$</td>
</tr>
<tr>
<td>Perceived ease of use / Extent of use</td>
<td>$r_{b3}$</td>
<td>$\beta_{3a}$</td>
<td>$\beta_{3a}$</td>
<td>$\beta_{3a}$</td>
</tr>
<tr>
<td>Perceived usefulness / Computer anxiety</td>
<td>$\gamma_{b1}$</td>
<td>$\gamma_{b1}$</td>
<td>$\gamma_{b1}$</td>
<td>$\gamma_{b1}$</td>
</tr>
<tr>
<td>Perceived usefulness / Microcomputer attitude</td>
<td>$\gamma_{b2}$</td>
<td>$\gamma_{b2}$</td>
<td>$\gamma_{b2}$</td>
<td>$\gamma_{b2}$</td>
</tr>
<tr>
<td>Perceived usefulness / Extent of use</td>
<td>$\gamma_{b3}$</td>
<td>$\gamma_{b3}$</td>
<td>$\gamma_{b3}$</td>
<td>$\gamma_{b3}$</td>
</tr>
<tr>
<td>Computer anxiety / microcomputer attitude</td>
<td>$\tau_{12}$</td>
<td>$\tau_{12}$</td>
<td>$\tau_{12}$</td>
<td>$\tau_{12}$</td>
</tr>
<tr>
<td>Microcomputer attitude / Extent of use</td>
<td>$\tau_{23}$</td>
<td>$\tau_{23}$</td>
<td>$\tau_{23}$</td>
<td>$\tau_{23}$</td>
</tr>
<tr>
<td>Microcomputer attitude / Work outcome*</td>
<td>$\tau_{24}$</td>
<td>$\tau_{24}$</td>
<td>$\tau_{24}$</td>
<td>$\tau_{24}$</td>
</tr>
<tr>
<td>Extent of use / Work outcome*</td>
<td>$\tau_{44}$</td>
<td>$\tau_{44}$</td>
<td>$\tau_{44}$</td>
<td>$\tau_{44}$</td>
</tr>
</tbody>
</table>

$*$The work outcome variables include job satisfaction and job performance.

Table 4.4: Decomposition of observed correlations
<table>
<thead>
<tr>
<th>Linkage</th>
<th>Direct effect ($p_{ij}$)</th>
<th>$\beta$</th>
<th>Indirect effect</th>
<th>Spurious effect</th>
<th>Total association ($r_{ij}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use / perceived usefulness</td>
<td>$p_{1a}$</td>
<td>-0.446</td>
<td></td>
<td>-0.156</td>
<td>0.547</td>
</tr>
<tr>
<td>Perceived ease of use / Computer anxiety</td>
<td>$p_{1b}$</td>
<td>-0.284</td>
<td></td>
<td>-0.244</td>
<td>-0.602</td>
</tr>
<tr>
<td>Perceived usefulness / Computer anxiety</td>
<td>$p_{2a}$</td>
<td>0.290</td>
<td>0.094</td>
<td>0.190</td>
<td>0.574</td>
</tr>
<tr>
<td>Perceived usefulness / Microcomputer attitude</td>
<td>$p_{2b}$</td>
<td>0.288</td>
<td>0.060</td>
<td>0.210</td>
<td>0.558</td>
</tr>
<tr>
<td>Computer anxiety / Microcomputer attitude</td>
<td>$p_{2c}$</td>
<td>-0.210</td>
<td></td>
<td>-0.326</td>
<td>-0.536</td>
</tr>
<tr>
<td>Perceived ease of use / Extent of use</td>
<td>$p_{3a}$</td>
<td>0.205</td>
<td>0.003</td>
<td>0.059</td>
<td>0.267</td>
</tr>
<tr>
<td>Perceived usefulness / Extent of use</td>
<td>$p_{3b}$</td>
<td>0.102</td>
<td>0.004</td>
<td>0.115</td>
<td>0.221</td>
</tr>
<tr>
<td>Microcomputer attitude / Extent of use</td>
<td>$p_{3c}$</td>
<td>0.011</td>
<td></td>
<td>0.175</td>
<td>0.186</td>
</tr>
<tr>
<td>Microcomputer attitude / Job satisfaction</td>
<td>$p_{4a}$</td>
<td>0.240</td>
<td>0.002</td>
<td>0.027</td>
<td>0.269</td>
</tr>
<tr>
<td>Microcomputer attitude / Job performance</td>
<td>$p_{4b}$</td>
<td>0.230</td>
<td>0.001</td>
<td>0.009</td>
<td>0.240</td>
</tr>
<tr>
<td>Extent of use / Job satisfaction</td>
<td>$p_{4c}$</td>
<td>0.152</td>
<td></td>
<td>0.045</td>
<td>0.197</td>
</tr>
<tr>
<td>Extent of use / Job performance</td>
<td>$p_{4d}$</td>
<td>0.055</td>
<td></td>
<td>0.043</td>
<td>0.098</td>
</tr>
</tbody>
</table>

Table 4.5: Decomposition of effects in the model
(i.e., the path coefficients) and their level of statistical significance. Table 4.11 provides a summary of the specific propositions and the extent to which they are supported. The following subsections provide a description and discussion of the results obtained from testing the propositions developed in Chapter 2 and summarised in Table 2.1.

4.3.1 Microcomputer usage and work outcomes

The first proposition predicts that the extent of use of microcomputers has a direct positive effect on both the job satisfaction (Proposition 1A) and job performance (Proposition 1B) of professional accountants. That is, when an accountant’s use of microcomputers increases, the extent to which that person will be satisfied with, and perform well in, his/her job also increases. This proposition was tested by calculating path coefficients for the paths $p_{43}^{(1)}$ and $p_{43}^{(2)}$ as depicted in Figure 4.2 and then testing them for significance. Tables 4.6 and 4.7 show variability in the results of tests on these linkage. The effect of microcomputer usage on job satisfaction (i.e., path $p_{43}^{(1)}$) is positive and significant ($\beta = 0.152$, $p<0.05$). However, the effect of microcomputer usage on job performance (i.e., path $p_{43}^{(2)}$) is not significant ($\beta = 0.055$). This latter result is not surprising given that the test of total association (i.e., zero order correlation) between extent of use and job performance shows a weak nonsignificant relationship ($r = 0.098$).

Interestingly, while the path coefficient, $p_{43}^{(1)}$, suggests only a moderate (but significant) effect of microcomputer usage on job satisfaction, it does
Model: \( X_4^{\text{out}} = \beta_{42.1}^{(i)} X_2 + \beta_{43.2}^{(o)} X_3 + \epsilon_4^{(o)} \)

<table>
<thead>
<tr>
<th>Paths</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>*Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{42}^{(i)} )</td>
<td>0.240</td>
<td>0.078</td>
<td>( p &lt; 0.05 )</td>
</tr>
<tr>
<td>( p_{43}^{(o)} )</td>
<td>0.152</td>
<td>0.078</td>
<td>( p &lt; 0.05 )</td>
</tr>
</tbody>
</table>

\[ R^2(\text{adj.}) = 0.089 \]
\[ F_{2,155} = 8.098 \]
\[ p < 0.001 \]

*Path coefficients tested for significance using the bootstrap technique (Noreen, 1988; Bollen and Stine, 1990)*

Table 4.6: Research model path coefficients for paths \( p_{4.2}^{(i)} \) and \( p_{4.3}^{(o)} \)
Model: \[ X_4^{(0)} = \beta_{42.1}^{(0)} X_2 + \beta_{43.2}^{(0)} X_3 + \varepsilon_{4}^{(0)} \]

<table>
<thead>
<tr>
<th>Paths</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{42}^{(0)} )</td>
<td>0.230</td>
<td>0.079</td>
<td>( p &lt; 0.05 )</td>
</tr>
<tr>
<td>( p_{43}^{(0)} )</td>
<td>0.055</td>
<td>0.079</td>
<td>ns</td>
</tr>
</tbody>
</table>

\[ R^2(\text{adj.}) = 0.055 \quad F_{2,155} = 5.003 \quad p < 0.01 \]

*Path coefficients tested for significance using the bootstrap technique (Noreen, 1988; Bollen and Stine, 1990)*

**Table 4.7**: Research model path coefficients for paths \( p_{42}^{(0)} \) and \( p_{43}^{(0)} \)
nonetheless represent 77 percent\textsuperscript{10} of the total association between the two variables. This indicates that common antecedent variables play little part in inflating the overall relationship between microcomputer usage and job satisfaction.

In sum, the results reported in Tables 4.5, 4.6 and 4.7 show that while Proposition 1A is only partially supported, Proposition 1B is not supported. Microcomputer usage does directly effect the level of job satisfaction of professional accountants. However, there is no support for the proposition that microcomputer usage also influences the level of job performance that professional accountants may achieve.

4.3.2 Attitude toward using microcomputers and work outcomes

The second proposition states that attitude toward using microcomputers has a direct positive effect on both the job satisfaction (Proposition 2A) and job performance (Proposition 2B) of professional accountants. That is, when an accountant's general feeling of favourableness toward using microcomputers increases (or alternatively, the accountant's general feeling of unfavourableness toward using microcomputers diminishes), the extent to which that person will be satisfied with, and perform well in, his/her job also increases. The two parts to this proposition were evaluated by testing the significance of path $p_{42}^{(1)}$ for job satisfaction and path $p_{42}^{(2)}$ for job performance shown in Figure 4.1. Tables 4.6 and 4.7 show that in both instances the paths

\textsuperscript{10} Calculated by taking the direct effect coefficient as a percentage of the correlation coefficient.
(p^{(1)}_{42} and p^{(2)}_{42}) between microcomputer attitude and work outcomes are positive and significant with the attitude-job satisfaction linkage having a path coefficient of 0.240 (p<0.05) and the attitude-job performance linkage a path coefficient of 0.230 (p<0.05).

Apart from providing support for the research proposition that attitude toward using microcomputers directly affects work outcomes, these results are interesting because they show that almost all of the total association (i.e., zero order correlation) between attitude toward using microcomputers and both job satisfaction and job performance is accounted for by this direct affect (89 percent in the case of job satisfaction and 96 percent in the case of job performance). The results in Table 4.5 indicate that microcomputer usage plays almost no part as a moderating influence on the extent to which attitude toward using microcomputers affects either job satisfaction (0.029) or job performance (0.010). In the case of job satisfaction in particular, this is in spite of the fact that Table 4.3 shows there is a significant (r = 0.197, p < 0.05) relationship between microcomputer usage and job satisfaction. As Section 4.3.3 shows, it is the weak nonsignificant linkage between attitude toward using microcomputers and extent of use that explains the negligible role extent of use plays as a moderating influence between attitude toward using microcomputers and both job satisfaction and job performance.

To summarise, the results reported above support Proposition 2. If professional accountants have a positive attitude toward using microcomputers this will have the effect of increasing their level of job satisfaction and the level at which they perform at their job.
4.3.3 Attitude toward using microcomputers and level of microcomputer usage

Proposition 3 states that accountants' attitudes toward using microcomputers have a direct positive effect on the extent to which they use them on a day-to-day basis in their work environment. That is, when an accountant's general feeling of favourableness toward using microcomputers increases (or alternatively, the accountant's general feeling of unfavourableness toward using microcomputers diminishes), the extent to which that person will use a microcomputer in carrying out day-to-day work activities will also increase. This proposition was evaluated by testing the significance of path $p_{32}$ shown in Figure 4.2. Table 4.8 shows that the path $p_{32}$ between microcomputer attitude and microcomputer usage is positive but small in magnitude and nonsignificant ($\beta = 0.011$). This suggests that the proposition does not hold and the results are at odds with findings in studies examining the effects computer attitudes may have on the extent of use of computers (see for example, Lucas, 1975; Robey, 1979; Davis et al., 1989; Fann et al., 1989; Thompson et al., 1991).

The most likely reason for the divergent results between this study and earlier studies is the way in which computer usage is operationalised. This study measures microcomputer use using the actual interactive time spent with microcomputers. In earlier studies computer usage (or MIS usage) was measured using various surrogates. For example, Lucas (1975) used the level of use of hard copy output from computer systems
Model: \( X_3 = \beta_{3a} X_a + \beta_{3b} X_b + \beta_{32} X_2 + \varepsilon_3 \)

<table>
<thead>
<tr>
<th>Paths</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>*Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P_{3a} )</td>
<td>0.205</td>
<td>0.100</td>
<td>( p &lt; 0.05 )</td>
</tr>
<tr>
<td>( P_{3b} )</td>
<td>0.102</td>
<td>0.099</td>
<td>( p &lt; 0.10 )</td>
</tr>
<tr>
<td>( P_{32} )</td>
<td>0.011</td>
<td>0.101</td>
<td>( n.s )</td>
</tr>
</tbody>
</table>

\( R^2(\text{adj.}) = 0.068 \quad F_{2,155} = 4.433 \quad p < 0.01 \)

*Path coefficients tested for significance using the bootstrap technique (Noreen, 1988; Bollen and Stine, 1990)*

Table 4.8: Research model path coefficients for paths \( P_{3a}, P_{3b} \) and \( P_{32} \)
as a measure of computer use, while Robey (1979) used record maintenance levels to proxy for levels of computer use.

This suggests that these earlier studies were investigating a different form of computer use. This is understandable because the incidence of interactive computer use by non-computing staff in organisations was very low before the release of the IBM personal computer in 1982. To this extent, past studies and their results regarding attitudes and computer usage are not directly comparable with this study's results.

Given that the total association (i.e., zero order correlation) between microcomputer attitude and microcomputer usage is sizeable ($r = 0.186$) and moderately significant ($p<0.10$), the decomposition effects were examined in an attempt to explain the lack of a sizeable, significant direct effect. The decompositions shown in Table 4.5 suggest the reason for little direct effect of microcomputer attitude on microcomputer usage is because most of the total association (94 percent) is inflated by spurious effects\textsuperscript{11}. Figure 4.2 shows that these spurious effects (i.e., effects caused by common antecedent variables) occur via paths through perceived usefulness and perceived ease of use.

In sum, the results reported above do not support the proposition that attitude toward using microcomputers directly affects actual microcomputer usage. However, they are instructive because they show that it may be a dangerous practice to rely on simple bivariate

\textsuperscript{11} Calculated by taking the spurious effect coefficient as a percentage of the correlation coefficient.
relationships to explain microcomputer usage.

4.3.4 Computer anxiety and attitude toward using microcomputers

The fourth proposition states that computer anxiety has a direct inverse effect on the general attitude an individual has toward using microcomputers. That is, when levels of computer anxiety increase, an accountant's general feeling of favourableness toward using microcomputers will diminish (or alternatively, the accountant's general feeling of unfavourableness toward using microcomputers will increase). Path p_{21} shown in Figure 4.2 was tested to assess this proposition. Table 4.9 shows that the path (p_{21}) between computer anxiety and microcomputer attitude is negative and significant (β = -0.210; p<0.05).

An examination of the decomposition of effects in the model reported in Table 4.5 shows that part of the effect of computer anxiety on attitude toward using microcomputers in the workplace is attributable to the direct effects of perceived ease of use and perceived usefulness on computer anxiety. That is, there is an indirect effect of 0.094 and 0.060 by perceived ease of use and perceived usefulness via computer anxiety respectively on attitude toward using microcomputers.

The results in Table 4.5 further indicate that over 60 percent of the total association (i.e., zero order correlation) between the two variables is spurious. Figure 4.2 and Table 4.4 show that this spurious effect is due to perceived ease of use and perceived usefulness which are both common antecedent variables for computer anxiety and attitude toward using
Model: \( X_2 = \beta_{2a} X_a + \beta_{2b} X_b + \beta_{21} X_1 + \varepsilon_2 \)

<table>
<thead>
<tr>
<th>Paths</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>*Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{2a} )</td>
<td>0.290</td>
<td>0.080</td>
<td>( p &lt; 0.05 )</td>
</tr>
<tr>
<td>( p_{2b} )</td>
<td>0.288</td>
<td>0.075</td>
<td>( p &lt; 0.05 )</td>
</tr>
<tr>
<td>( p_{21} )</td>
<td>-0.210</td>
<td>0.079</td>
<td>( p &lt; 0.05 )</td>
</tr>
</tbody>
</table>

\( R^2(\text{adj}) = 0.432 \)

\( F_{2,155} = 40.250 \)

\( p < 0.001 \)

*Path coefficients tested for significance using the bootstrap technique (Noren, 1988; Bollen and Stine, 1990)*

**Table 4.9:** Research model path coefficients for paths \( p_{2a} \), \( p_{2b} \) and \( p_{21} \)
microcomputers in the research model. However, notwithstanding this relatively large spurious effect, the direct effect between computer anxiety and attitude toward using microcomputers is still significant.

Overall, even taking into account the large spurious effect in the total association between computer anxiety and attitude toward using microcomputers, the results suggest that a person's general feeling of favourableness or unfavourableness toward using a microcomputer is affected by that person's level of computer anxiety. That is, if people are experiencing increasing levels of uneasiness toward the impending use of computers, this will in all likelihood lead to them feeling less favourable toward using microcomputers to complete their work tasks. These results about the relationship between computer anxiety and attitude toward using microcomputers are generally consistent with the findings of Parasuraman and Igbaria (1990) and with Howard's (1986) findings in his study of managers in the United States.

4.3.5 Perceived ease of use, perceived usefulness of microcomputers and level of microcomputer usage

Proposition 5 states that perceived ease of use and perceived usefulness of microcomputers has a direct positive effect on the extent to which accountants use microcomputers on a day-to-day basis in their work environment. That is, the easier and more useful accountants perceive microcomputer systems to be, the more they will use those systems in their work environment. Paths p_{3a} and p_{3b}, depicted in Figure 4.2 were tested to evaluate this proposition. Table 4.8 reports that while the path (p_{3a}) between perceived ease of use and microcomputer usage is positive
and significant ($\beta = 0.205; p<0.05$), the path ($p_{3b}$) between perceived usefulness and microcomputer usage is at best only marginally significant ($\beta = 0.102; p<0.10$). These results appear to be at odds with recent research which found that the perceived usefulness-usage linkage was significant and, as well, much stronger than the perceived ease of use-usage linkage. For example, Davis (1989, p. 333) in two studies involving four application programs found that 'in both studies usefulness was significantly more strongly linked to usage than was ease of use.' Similarly, Adams et al. (1992, p. 227) in the first of the two studies they report that deals with messaging technology found usefulness to be '... an important determinant of system use', while ease of use had no significant relationship with usage. The second study that examined three software applications, on the whole, found both ease of use and usefulness to be significantly linked to usage. On balance, the results of these studies suggest that it is likely that both ease of use and usefulness are significantly linked to usage, or at worst, usefulness only is the significant link with usage. Either way, the results from these earlier studies are at odds with the findings of this study.

A possible explanation for the findings in the study reported here is that, unlike the Davis (1989) and Adams et al. (1992) studies that assessed the relationship between perceived ease of use and perceived usefulness in the context of the level of use of individual software programs, the respondents in this study were assessed as to the relationship between their perceptions of ease of use and usefulness and the overall use of microcomputer systems. Therefore, they are being asked for a more generalised assessment about perceived ease of use and usefulness and usage. Their affective responses regarding ease of use are likely to be
based on an evaluation of the ergonomic characteristics, the operating system environment, and the various software applications they use on the microcomputer systems. In this context, it could be argued that relative to the perceived usefulness-microcomputer usage linkage, the perceived ease of use-microcomputer usage linkage is more 'elastic' because if users see the overall microcomputer system as a complex, difficult environment in which to work, they are likely to perceive a greater cost (in terms of effort required on the part of the user to meaningfully and productively use the system) associated with actual system use.

An examination of the decomposition effects reported in Table 4.5 also provides a possible explanation for perceived usefulness having only a moderate direct effect on microcomputer usage even though the total association between the two variables is sizeable and significant ($r = 0.221, p < 0.01$). Table 4.5 shows that while there is almost no indirect effect (i.e., $p_{32}p_{2b} + p_{32}p_{21}p_{1b} = 0.002$), there is a sizeable spurious effect (i.e., $p_{3a}r_{ab} + p_{32}p_{21}p_{1a}r_{ab} + p_{32}p_{2a}r_{ab} = 0.117$) accounting for 53 percent of the total association between perceived ease of use and microcomputer usage. A breakdown of this shows that perceived ease of use, an antecedent variable common to perceived usefulness and microcomputer usage is contributing 98 percent of this spurious effect.

In sum, the results suggest that the extent to which accountants use microcomputers in their workplace appears to be affected by their

---

'elastic' in the sense that, all other things being equal, the effect of ease of use on usage is greater than the effect of usefulness on usage.
perceptions of how easy they are to use. That is, if people believe they find microcomputers easy to use, they are likely to use them more in carrying out their day-to-day work activities. However, accountants' perceptions of microcomputer utility do not appear to have a strong significant effect on the extent to which they use microcomputers.

4.3.6 Perceived ease of use, perceived usefulness of microcomputers and attitude toward using microcomputers

The sixth proposition states that perceived ease of use and perceived usefulness of microcomputers both have a direct positive effect on the general attitude an individual has toward using microcomputers. That is, when levels of perceived ease of use and perceived usefulness increase, so too does the accountant's general feeling of favourableness toward using microcomputers. This proposition was evaluated by testing the significance of the paths $p_{2a}$ and $p_{2b}$ in the model shown in Figure 4.2.

Table 4.9 shows that the path $p_{2a}$ between perceived ease of use and microcomputer attitude is significant ($\beta = 0.290; p<0.05$). Likewise, the path $p_{2b}$ between perceived usefulness and microcomputer attitude is significant ($\beta = 0.288; p<0.05$).

Unlike their direct effects on computer anxiety (where perceived ease of use had a greater effect than did perceived usefulness), however, the magnitude of the effect of each variable on microcomputer attitude was approximately the same. Moreover, Table 4.5 shows that the total effect (i.e., the direct effect plus the indirect effect via computer anxiety) of
perceived ease of use (0.384) is only marginally different from the
equivalent effect of perceived usefulness (0.348). The total effects of
perceived ease of use and perceived usefulness on microcomputer
attitude account for approximately 67 percent and 62 percent respectively
of total association (i.e., the zero order correlations). These results
suggest that perceptions about how easy microcomputers are to use have
much the same impact on users' general attitudes toward using
microcomputers as do their perceptions about how useful
microcomputers are in the workplace.

Interestingly, Table 4.5 shows that in the case of both perceived ease of
use and perceived usefulness, there is a sizeable spurious effect (0.190
and 0.210 respectively) accounting for approximately 33 percent of the
total association between perceived ease of use and general
microcomputer attitude, and approximately 38 percent in the case of
perceived usefulness. This indicates that the common antecedents of
perceived ease of use and general microcomputer attitude, and perceived
usefulness and general microcomputer attitude described in Table 4.4 do
inflate the observed correlations ($r_{a2}$ and $r_{b2}$), although not by an
amount that results in the direct effects being nonsignificant.

In sum, attitude toward using microcomputers, described in Chapter 2 as
a person's general feeling of favourableness or unfavourableness toward
using a microcomputer in his or her job, is affected by accountants'
perceptions of how easy to use and how useful microcomputers may be
in their work environment. Moreover, it appears that each perception
contributes approximately the same effect on this general feeling toward
using microcomputers. Therefore, these results suggest that two
important factors in influencing how positively disposed accountants are toward using microcomputers in their workplace are the degree to which they perceive these types of computers as being easy to master and the degree to which they perceive them to be useful in completing their work tasks.

4.3.7 Perceived ease of use, perceived usefulness of microcomputers and computer anxiety

Proposition 7 states that perceived ease of use and perceived usefulness of microcomputers have a direct inverse effect on an individual's computer anxiety. That is, when levels of perceived ease of use and perceived usefulness increase, computer anxiety decreases. The results obtained and reported in Table 4.10 support this. The path ($p_{1a}$) between perceived ease of use and computer anxiety is significant ($\beta = -0.446; p < 0.05$) and, as well, the path ($p_{1b}$) between perceived usefulness and computer anxiety is significant also ($\beta = -0.284; p < 0.05$).

The results show that, even though both paths have a significant effect on computer anxiety, the magnitude of the effect of perceived ease of use is greater than that of perceived usefulness. This suggests that perceptions about how easy microcomputers are to use have a greater impact on users' anxiety levels toward computers than do perceptions about their usefulness. Moreover, an analysis of the spurious effects for each relationship (i.e., $p_{1a}^f_{ab}$ and $p_{1b}^f_{ab}$) provides further support for this assertion. Table 4.5 reports the various effects in the model based on the
Model: $X_1 = \beta_{1a}X_a + \beta_{1b}X_b + \epsilon_1$

<table>
<thead>
<tr>
<th>Paths</th>
<th>Coefficients</th>
<th>Standard error</th>
<th>*Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_{1a}$</td>
<td>-0.446</td>
<td>0.073</td>
<td>$p &lt; 0.05$</td>
</tr>
<tr>
<td>$p_{1b}$</td>
<td>0.284</td>
<td>0.073</td>
<td>$p &lt; 0.05$</td>
</tr>
</tbody>
</table>

$R^2_{(adj.)} = 0.415$  
$F_{2,155} = 55.728$  
$p < 0.001$

*Path coefficients tested for significance using the bootstrap technique (Norsen, 1988; Bollen and Stine, 1990)

Table 4.10: Research model path coefficients for paths $p_{1a}$ and $p_{1b}$
decomposition of observed correlations reported in Table 4.4. It shows that for \( p_{1a}r_{ab} \) and \( p_{1b}r_{ab} \) the spurious effects are -0.156 and -0.244 respectively. These effects indicate that 46 percent of the overall relationship between perceived usefulness and computer anxiety is due to the effect of perceived ease of use on perceived usefulness. On the other hand, only 25 percent of the overall relationship between perceived ease of use and computer anxiety is due to the effect perceived usefulness has on perceived ease of use.

To summarise, computer anxiety, earlier described as the tendency of an individual to experience a level of uneasiness over impending use of a computer that is disproportionate to the actual threat presented by the computer, appears to be affected by that person's perceptions of how easy to use and how useful microcomputers may be, with ease of use being the dominant influence. Therefore, these results suggest that perceptions about usefulness, and in particular, ease of use of microcomputers are important factors in moderating the level of uneasiness accountants often experience when they are faced with the prospect of using, or having to use, microcomputers in their work environment.

4.4 CHAPTER SUMMARY

This chapter presented the results of the analyses completed to test the propositions derived in Chapter 2. Section 1 reports the statistical characteristics of the scale scores. Section 2 described the tests undertaken to establish if the model expounded in Chapter 2 fitted the
data. Section 3 details the results of the tests of the propositions.

Figure 4.3 and Table 4.11 show that in tests of the paths shown in Figure 4.2, with job satisfaction as the work outcome variable, eight out of the ten paths were statistically significant, and all of these in the hypothesised direction. Figure 4.3 and Table 4.11 also show that for paths tested with job performance as the work outcome variable, seven of the ten were statistically significant and in the hypothesised direction.

Conclusions drawn from these results and implications for further research are discussed in Chapter 6.
(a) **Job satisfaction model**

(b) **Job performance model**

* Significant at the p<0.05 level

**Figure 4.3: Path model showing path coefficients**
<table>
<thead>
<tr>
<th>Propositions</th>
<th>Relationships of model components</th>
<th>Direction</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposition 1A</td>
<td>The extent of microcomputer usage has a direct effect on job satisfaction.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td>Proposition 1B</td>
<td>The extent of microcomputer usage has a direct effect on job performance.</td>
<td>Positive</td>
<td>Not supported</td>
</tr>
<tr>
<td>Proposition 2A</td>
<td>Attitude toward using microcomputers has a direct effect on job satisfaction.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td>Proposition 2B</td>
<td>Attitude toward using microcomputers has a direct effect on job performance.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td>Proposition 3</td>
<td>Attitude toward using microcomputers has a direct effect on the extent of microcomputer usage.</td>
<td>Positive</td>
<td>Not supported</td>
</tr>
<tr>
<td>Proposition 4</td>
<td>Computer anxiety has a direct effect on attitude toward using microcomputers.</td>
<td>Inverse</td>
<td>Supported</td>
</tr>
<tr>
<td>Proposition 5</td>
<td>(a) Perceived ease of use of microcomputers has a direct effect on the extent of microcomputer usage.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct effect on the extent of microcomputer usage.</td>
<td>Positive</td>
<td>Weakly supported</td>
</tr>
<tr>
<td>Proposition 6</td>
<td>(a) Perceived ease of use of microcomputers has a direct effect on attitude toward using microcomputers.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct effect on attitude toward using microcomputers.</td>
<td>Positive</td>
<td>Supported</td>
</tr>
<tr>
<td>Proposition 7</td>
<td>(a) Perceived ease of use of microcomputers has a direct effect on computer anxiety.</td>
<td>Inverse</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct effect on computer anxiety.</td>
<td>Inverse</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table 4.11: List of research propositions and the extent to which they are supported
CHAPTER 5

MULTISAMPLE ANALYSIS
OF
THE RESEARCH DATA

The previous chapter presented the results of an evaluation and analysis of the research model and the propositions derived from it. The model fitted the data. This chapter extends the analysis to determine whether or not the research model may be extended to describe two discrete groups of data drawn from the original research sample. The two groups represent people using two different types of human-computer interfaces when interacting with microcomputers in their work environment. These human-computer interfaces are the command line user interface (CLUI) and the graphical user interface (GUI).

The chapter is structured as follows. Section 1 describes the multisample covariance structure (or stacked model) approach to the analysis of group data. Section 2 derives a stacked model appropriate for the two groups under investigation. This model is evaluated in Section 3 to determine whether it fits the data. Section 4 analyses in detail the stacked model coefficients to establish whether or not users belonging to
the two different groups react differently to the perceptions they have and anxieties they experience about microcomputers in the workplace. Section 5 summarises the chapter.

5.1 MULTISAMPLE COVARIANCE STRUCTURES

Often research data that are partitioned into groups and then analysed, provides the researcher with more information than if analysed as a single data set. Groupings may be based on specific variables in the data set. For example, data about people could be partitioned into older people and younger people, males and females, blacks and whites, etc. In instances where subgroups can be identified, it may be appropriate to establish 'whether there are multiple populations rather than single populations, and multiple structural models rather than a single model' (Bentler, 1992, p. 149). Multiple structural models are identified if the covariance matrices of the various groups identified from the originally collected data differ. Conversely, if the covariance matrices from these groups are identical, then the single structural model for the general set of data is appropriate to model the relationships between the variables in the multiple groups identified in that data.

Multisample analysis (or stacked model analysis) is a technique that analyses data from the subgroups of the data set simultaneously and estimates the extent to which one general structural model fits the data from each of the subgroups. However, even though one structural model may be found to fit the data from subgroups, it is possible that there are differential affects between some of the variables across the subgroups. To test whether this is the case, some parameters can be
constrained to be equal between the groups (constrained parameters),
while other parameters may be free to vary between the groups (free
parameters).

Entering constraints between the groups reflects the ways in which the
groups are expected to behave similarly. The free parameters reflect the
ways in which the groups are expected to behave differently (Hayduk,
1987). If the structural model fits the data of the groups when certain
parameters remain free to vary (as compared to the case where all
parameters are assumed to be identical across groups), then the fit of the
model has been improved and an interaction exists based on the
criterion used to partition the data into the subgroups for these
particular parameters.

5.2 THE MULTISAMPLE RESEARCH MODEL

A unique aspect of the sample data used to evaluate and analyse the
research model and propositions of this study is that the respondents
can be categorised as being either GUI users or CLUI users1. The GUI

---

1 A GUI is a human-computer interface which presents the user with icons on the
microcomputer screen in an attempt to simulate a real working environment.
For example, the Macintosh microcomputer, which implements a GUI, provides
the user with a 'Desktop'. The 'Desktop' is a physical-office
metaphor where such things as documents and folders are represented by small
pictorial representations or icons. The idea behind the 'Desktop' and its icons
is to induce users to intuitively work with the computer system by immediately
relating the icons to real world physical objects. The CLUI, on the other hand,
is a human-computer interface that enables the microcomputer user to interact
with the computer using a series of alphanumeric characters in the form of
individual characters or words, or a 'string' of words. The user either directly
provides its users with the propensity for direct manipulation\(^2\) when using the microcomputer. Schneiderman (1987) suggests that direct manipulation interfaces, because they are likely to lead to direct engagement\(^3\) by the user, are a preferred form of interfacing the physical computer system with computer users.

Differential perception and anxiety effects may arise in the research model because GUI users are more likely to experience direct engagement when interacting with microcomputers than are CLUI users. Using a GUI may enhance the effects perceived ease of use and perceived usefulness have on computer anxiety, microcomputer attitude and microcomputer use because GUI users are likely to experience a feeling of direct involvement with the activities and

cnters these commands using a keyboard when prompted, or selects alphanumerical commands from a menu which is displayed on the computer monitor connected to the computer. For a more detailed discussion of recent developments in human-computer interfaces see Appendix 3.

2 Direct manipulation allows (a) users to experience less anxiety because the system is comprehensible and because actions are easily reversible; (b) knowledgeable intermittent users to retain operational concepts; (c) users to immediately see if their actions are furthering their goals and, if not, to simply change the direction of their activity; (d) novices to learn basic functionality quickly, usually through demonstration by a more experienced user; and (e) experts to work rapidly to carry out a wide range of tasks, even defining new functions and features (Schneiderman, 1987).

3 Hutchins et al. (1986, p. 114) believe direct engagement occurs 'when the user experiences direct interaction with the objects in the domain'. They describe it as a 'feeling of involvement directly with a world of objects rather than of communicating with an intermediary' (p. 114).
problems they are attempting to solve. Similarly, GUI users may experience an enhanced inverse effect of computer anxiety on their attitude toward using microcomputers compared with their CLUI counterparts, again because of the feeling of direct engagement they are likely to experience.

The possibility of the human-computer interface conditioning several effects among the variables in the model suggests that separate models be created for the GUI user and CLUI user cases in the research sample. However, building two completely separate models would not allow for the belief that effects between other variables in the model should be the same for the two groups. For example, there is no reason to believe that the effect of general attitude toward using microcomputers on microcomputer usage, job satisfaction and job performance differs between the two groups. Nor is there any evidence to suggest that microcomputer usage has a differential effect on job satisfaction and job performance between the two groups. The solution is to stack the GUI and CLUI models together and, taking account of the constrained parameters, estimate the models simultaneously with those constraints operative.

Table 5.1 reports the descriptive statistics for the GUI and CLUI groups, and Table 5.2 reports the zero order correlations between the research model variables for the two groups. Table 5.3 identifies the parameters to be constrained in the model, and those that are to remain free. Figure 5.1 shows the stacked model developed taking account of the constraints described above.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLUI GROUP (n=50)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>42.240</td>
<td>6.342</td>
<td>43.000</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>24.300</td>
<td>3.564</td>
<td>24.000</td>
</tr>
<tr>
<td>Microcomputer attitude</td>
<td>42.220</td>
<td>4.816</td>
<td>43.500</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>10.080</td>
<td>4.606</td>
<td>9.000</td>
</tr>
<tr>
<td>Extent of use</td>
<td>2.540</td>
<td>1.600</td>
<td>2.000</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>4.676</td>
<td>1.054</td>
<td>4.800</td>
</tr>
<tr>
<td>Job performance</td>
<td>14.580</td>
<td>2.500</td>
<td>15.000</td>
</tr>
<tr>
<td><strong>GUI GROUP (n=107)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>42.112</td>
<td>6.267</td>
<td>42.000</td>
</tr>
<tr>
<td>Perceived usefulness</td>
<td>24.224</td>
<td>3.234</td>
<td>24.000</td>
</tr>
<tr>
<td>Microcomputer attitude</td>
<td>42.673</td>
<td>4.093</td>
<td>43.000</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>10.355</td>
<td>4.221</td>
<td>11.000</td>
</tr>
<tr>
<td>Extent of use</td>
<td>2.286</td>
<td>1.429</td>
<td>2.000</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>4.391</td>
<td>1.139</td>
<td>4.400</td>
</tr>
<tr>
<td>Job performance</td>
<td>13.636</td>
<td>2.527</td>
<td>14.000</td>
</tr>
</tbody>
</table>

Table 5.1: Descriptive statistics for the GUI and CLUI groups
<table>
<thead>
<tr>
<th></th>
<th>Perceived usefulness</th>
<th>Perceived ease of use</th>
<th>Computer anxiety</th>
<th>Microcomputer attitude</th>
<th>Extent of use</th>
<th>Job satisfaction</th>
<th>Job performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived usefulness</td>
<td>-</td>
<td>0.546 ***</td>
<td>-0.488 ***</td>
<td>0.552 ***</td>
<td>0.204 **</td>
<td>0.209 **</td>
<td>0.265 **</td>
</tr>
<tr>
<td>Perceived ease of use</td>
<td>0.550 ***</td>
<td>-</td>
<td>-0.563 ***</td>
<td>0.546 ***</td>
<td>0.207 **</td>
<td>0.219 **</td>
<td>0.285 ***</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>-0.601 ***</td>
<td>-0.678 ***</td>
<td>-</td>
<td>-0.430 ***</td>
<td>-0.177 *</td>
<td>-0.155</td>
<td>-0.324 ***</td>
</tr>
<tr>
<td>Microcomputer attitude</td>
<td>0.570 ***</td>
<td>0.631 ***</td>
<td>-0.724 **</td>
<td>-</td>
<td>0.188 **</td>
<td>0.210 **</td>
<td>0.330 ***</td>
</tr>
<tr>
<td>Extent of use</td>
<td>0.250 **</td>
<td>0.384 ***</td>
<td>-0.351 **</td>
<td>0.195</td>
<td>-</td>
<td>0.127</td>
<td>0.075</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>0.311 *</td>
<td>0.555 ***</td>
<td>-0.449 ***</td>
<td>0.415 ***</td>
<td>0.322 **</td>
<td>-</td>
<td>0.195 **</td>
</tr>
<tr>
<td>Job performance</td>
<td>0.159</td>
<td>0.144</td>
<td>-0.343 **</td>
<td>0.106</td>
<td>0.106</td>
<td>0.063</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: Correlation coefficients above the diagonal are for the GUI data. Correlation coefficients below the diagonal are for the CLUI data.

* p<0.10
** p<0.05
*** p<0.01

Table 5.2: Zero order correlations between research model variables
<table>
<thead>
<tr>
<th>Linkage</th>
<th>Parameter ((p_{ij}))</th>
<th>Constrained parameter</th>
<th>Free parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived ease of use - Computer anxiety</td>
<td>(p_{1a})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Perceived usefulness - Computer anxiety</td>
<td>(p_{1b})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Perceived ease of use - Microcomputer attitude</td>
<td>(p_{2a})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Perceived usefulness - Microcomputer attitude</td>
<td>(p_{2b})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Computer anxiety - Microcomputer attitude</td>
<td>(p_{21})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Perceived ease of use - Extent of use</td>
<td>(p_{3a})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Perceived usefulness - Extent of use</td>
<td>(p_{3b})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Microcomputer attitude - Extent of use</td>
<td>(p_{32})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Microcomputer attitude - Job satisfaction</td>
<td>(p_{42})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Microcomputer attitude - Job performance</td>
<td>(p_{42}')</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Extent of use - Job satisfaction</td>
<td>(p_{43})</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Extent of use - Job performance</td>
<td>(p_{43}')</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 5.3: The constrained and free parameters in the stacked model
(a) Submodel for the CLUI group

(b) Submodel for the GUI group

Note: Parameters allowed to differ between the CLUI and GUI groups are indicated by heavy arrows. The light arrows indicate those parameters which have been constrained to be equal.

Figure 5.1: The stacked model
5.3 EVALUATION OF THE MODEL FIT

Once specified, the stacked model was evaluated and analysed using the EQS\textsuperscript{4} software package. In EQS, the model being evaluated is specified in a program control input file. The program control input file used to evaluate the stacked model developed here is included as Appendix 4. The stacked model analysis is done by fitting an ordinary EQS model in each sample, but doing this in a single run simultaneously for all groups, taking into account that some parameters are the same in each of the samples (using equality constraints across groups) while others are allowed to be different (Bentler, 1992, p.150). Output from EQS provides unstandardized and standardized coefficients and statistical tests that indicate (a) the extent to which the stacked model fits the data of the two groups; and (b) the extent to which individual parameters are significantly different from zero.

5.3.1 The general fit of the stacked model

EQS provides a single goodness of fit $\chi^2$ test to describe the adequacy of the stacked model in representing the data of the groups. The $\chi^2$ test evaluates the joint hypothesis (5.1)-(5.2) shown below. The first part of the hypothesis (5.1) tests whether or not the covariance matrices of each of the groups in the stacked model are the same. If the covariance

\textsuperscript{4} Eqs is a structural equation modelling program developed by Peter M. Bentler and distributed by BMDP Statistical Software Inc. The version used to evaluate and analyse the stacked model developed in this research is Eqs/Mac 3.0: Release Version 21.0 Floating Point math coprocessor version, 1991.
matrices are the same, the samples constituting each group are in all likelihood from the same population. Specifically, the test involves estimating the model parameters for each of the groups, then evaluating whether or not the model with these parameters adequately accounts for the sample covariances in each of the samples (groups). This test is specified as follows

\[ \sigma_1 = \sigma(\theta_1), \sigma_2 = \sigma(\theta_2), \ldots, \sigma_m = \sigma(\theta_m), \]  

(5.1)

where \( \sigma_m \) is a nonredundant element vector of the covariance matrix of sample \( m \); and \( \theta_m \) are a set of parameters derived from the model using data from sample \( m \).

Because (5.1) may contain constraints on certain parameters across all the groups in the stacked model, a complete test of the fit of the model requires the following test as well

\[ \theta_{1(l)} = \theta_{2(l)} = \ldots = \theta_{m(k)}, \]  

(5.2)

that specifies the constraints of particular parameters across the groups in the stacked model, specifically, the equality of the \( i^{th} \) parameter in the first group with the \( j^{th} \) parameter in the second group, and so on.

The results of the stacked model evaluation by EQS report a goodness of fit \( \chi^2 \) of 18.396 with 11 d.f. and a probability of 0.073 for the job performance model, and a \( \chi^2 \) of 12.913 with 11 d.f. and a probability of 0.299 for the job satisfaction model. These results indicate that the research model fits both the GUI and CLUI user groups for both the job
performance and job satisfaction models.

5.3.2 The difference $\chi^2$ procedure

The goodness of fit $\chi^2$ test reported above indicates that the covariance matrices of the GUI and CLUI are substantially the same, that is, the one model adequately fits both sets of data. The question as to whether or not the specific parameters allowed to be freely estimated in the stacked model are significantly different between the GUI and CLUI groups now arises. To test for this, the difference $\chi^2$ procedure can be used (Hayduk, 1987). Using this procedure, a stacked model with all parameters between the groups constrained to be equal is estimated producing a goodness of fit $\chi^2$ statistic. Following this, the model is reestimated with only the specific parameters originally nominated for constraint across the groups constrained. A goodness of fit $\chi^2$ statistic is estimated for this model, as well. The difference between the $\chi^2$'s and the difference between the degrees of freedom provide a test of whether the freeing of the parameters gives a significant improvement in fit.

Table 5.4 reports the results of the difference $\chi^2$ test for the job satisfaction model and the job performance model. The results show that in both models the data would have been significantly less well fit had the seven parameters (listed in Table 5.3) not been allowed to differ between the groups.
<table>
<thead>
<tr>
<th>Research model</th>
<th>Model with all parameters constrained to be equal between groups</th>
<th>Model with selected parameters free to vary between groups (research model)</th>
<th>Difference $\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2$</td>
<td>d.f.</td>
<td>$\chi^2$</td>
</tr>
<tr>
<td>Job Satisfaction</td>
<td>2924.62</td>
<td>18</td>
<td>12.91</td>
</tr>
<tr>
<td>Job Performance</td>
<td>3919.84</td>
<td>18</td>
<td>18.40</td>
</tr>
</tbody>
</table>

Table 5.4: Measures of goodness of fit of multisample research model
5.4 ANALYSIS OF THE MODEL PARAMETER ESTIMATES

Table 5.5 reports the unstandardized coefficients for the stacked model derived in Section 5.2 and evaluated for fit in Section 5.3. Table 5.6 and Figure 5.2 report the standardized solution. Both the unstandardized and standardized coefficients can be used to interpret the stacked model. The unstandardized coefficients are best used to interpret differences across the GUI and CLUI groups for specific parameters ' ... since they are immune to the effects of different variances in the same variable that may arise due to subsetting' (Asher, 1976, p. 47). On the other hand, standardized coefficients provide the best means of interpreting the relative effect of variables within a particular group ' ... since [the standardized coefficient] adjusts for the different scales of measurement of the variables' (Asher, 1976, p. 48).

5.4.1 Interpretation of the unstandardized coefficients

The results reported in Table 5.5 show that perceived ease of use and perceived usefulness for both the GUI and CLUI users have a strong significant\(^5\) effect on the level of computer anxiety, with the stronger effect occurring in the CLUI group. This is inconsistent with the prediction that perceived ease of use and perceived usefulness play a more important role in moderating computer anxiety in GUI users than

---

\(^5\) Table 5.5 reports a z-test statistic for each parameter estimated. The standard normal critical value of 1.96 associated with a 0.05 probability level is used to assess the significance of the reported coefficients. Therefore, any coefficient with a z-value of 1.96 or greater is treated as significant.
<table>
<thead>
<tr>
<th></th>
<th>Perceived usefulness</th>
<th>Perceived ease of use</th>
<th>Computer anxiety</th>
<th>Microcomputer attitude</th>
<th>Extent of use</th>
<th>Job satisfaction</th>
<th>Job performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CLUI GROUP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microcomputer attitude</td>
<td>0.221^\dagger</td>
<td>0.164</td>
<td>-0.501</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.162^\dagger</td>
<td>0.099</td>
<td>0.142</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1.304^\dagger</td>
<td>1.660</td>
<td>-3.519</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>-0.422</td>
<td>-0.362</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.131</td>
<td>0.085</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-2.797</td>
<td>-4.251</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Extent of use</td>
<td>0.023</td>
<td>0.088</td>
<td>-</td>
<td>0.004</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.072</td>
<td>0.042</td>
<td>-</td>
<td>0.035</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>0.322</td>
<td>2.114</td>
<td>-</td>
<td>0.109</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.066</td>
<td>0.114</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.020</td>
<td>0.057</td>
<td>-</td>
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<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.404</td>
<td>1.993</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Job performance</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.147</td>
<td>0.063</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.046</td>
<td>0.134</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.182</td>
<td>0.465</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Squared multiple correlations</td>
<td>-</td>
<td>0.534</td>
<td>0.576</td>
<td>0.150</td>
<td>0.159</td>
<td>0.078</td>
<td></td>
</tr>
</tbody>
</table>

| **GUI GROUP**       |                      |                       |                  |                        |               |                  |                 |
| Microcomputer attitude | 0.429               | 0.203                 | -0.086           | -                      | -             | -                | -               |
|                     | 0.118                | 0.064                 | 0.092            | -                      | -             | -                | -               |
|                     | 3.631                | 3.150                 | -0.942           | -                      | -             | -                | -               |
| Computer anxiety    | -0.235               | -0.285                | -                | -                      | -             | -                | -               |
|                     | 0.121                | 0.062                 | -                | -                      | -             | -                | -               |
|                     | -2.772               | -4.574                | -                | -                      | -             | -                | -               |
| Extent of use       | 0.055                | 0.030                 | -                | 0.004                  | -             | -                | -               |
|                     | 0.052                | 0.027                 | -                | 0.035                  | -             | -                | -               |
|                     | 1.062                | 1.123                 | -                | 0.109                  | -             | -                | -               |
| Job satisfaction    | -                    | -                     | -                | 0.066                  | 0.114         | -                | -               |
|                     | -                    | -                     | -                | 0.020                  | 0.057         | -                | -               |
|                     | -                    | -                     | -                | 3.404                  | 1.993         | -                | -               |
| Job performance     | -                    | -                     | -                | 0.147                  | 0.063         | -                | -               |
|                     | -                    | -                     | -                | 0.046                  | 0.134         | -                | -               |
|                     | -                    | -                     | -                | 3.182                  | 0.465         | -                | -               |
| Squared multiple correlations | - | 0.363 | 0.395 | 0.055 | 0.084 | 0.063 |

Goodness of fit summary: χ² = 12.306, df = 11, p = 0.075 (Job performance model)
χ² = 12.943, df = 11, p = 0.059 (Job satisfaction model)

^\dagger: coefficient estimates
^\circ: standard errors
^*: test statistics

**TABLE 5.5**: EQS estimates for the stacked model allowing for differences between the CLUI and GUI groups (including standard errors and test statistics)
in CLUI users.

Likewise, the results showing the effect of computer anxiety on microcomputer attitude across the two groups are not consistent with the prediction that there would be an enhanced negative effect of computer anxiety on microcomputer attitude in the GUI group. Table 5.5 shows that whereas there is no significant effect of computer anxiety on microcomputer attitudes for GUI users, there is a strong significant effect among CLUI users.

Although there is no obvious reason why perceived ease of use and perceived usefulness do not have a stronger effect on computer anxiety among the GUI users, or why computer anxiety has a significant effect on microcomputer attitudes among the CLUI users but not GUI users, it may be that the relationships between the variables in the model are more complex than originally envisaged. The results in Table 5.5 reporting that perceived ease of use and perceived usefulness have a significant direct effect on GUI users' microcomputer attitudes but not on CLUI users' microcomputer attitudes suggest this might be the case. What these results suggest is that perceptions about ease of use and usefulness of microcomputers affect the microcomputer attitudes of both GUI users and CLUI users, but in different ways.

In the case of GUI users, these perceptions play a direct role in affecting microcomputer attitudes, whereas these same perceptions, in the case of CLUI users, affect microcomputer attitudes but in an indirect way through their effect on computer anxiety. An examination and comparison of the unstandardized coefficients across the two groups
confirms this. Table 5.5 shows that the unstandardized coefficients for $b_{1a}$, $b_{1b}$, $b_{2a}$, $b_{2b}$ and $b_{21}$ are -0.285, -0.335, 0.203, 0.429 and -0.086 respectively for the GUI group, and -0.362, -0.422, 0.164, 0.221 and -0.501 for the CLUI group$^6$. The GUI coefficients $b_{2a}$ and $b_{2b}$ are larger than the CLUI equivalents and, unlike the CLUI coefficients, are significant; and, the CLUI coefficients $b_{1a}$, $b_{1b}$ and $b_{21}$ are larger than the GUI equivalents and, unlike the GUI coefficients, are significant. From this it could be concluded that perceived ease of use and perceived usefulness directly affect microcomputer attitudes in GUI users but indirectly affect (via computer anxiety) microcomputer attitudes in CLUI users.

The prediction that perceived ease of use and perceived usefulness would have a greater effect on microcomputer use in the GUI group than in the CLUI group is not borne out by the results reported in Table 5.5. The results show that only perceived ease of use has a significant effect on microcomputer use, and this for the CLUI group and not the GUI group as one would have anticipated. There appears to be no obvious explanation for these results. Moreover, because microcomputer attitude has no significant direct effect on microcomputer usage, any notion that perceived ease of use and perceived usefulness may affect microcomputer usage via microcomputer attitude in the case of GUI users does not warrant examination.

---

$^6$ The character 'b' is used to denote an unstandardized coefficient, just as the character 'β' is used to denote a standardized coefficient.
The five remaining coefficients in the model were constrained to be equal across the two groups and do not warrant examination save to report that, of these, the coefficients that are significant in the stacked model are the same as those that are significant in the general model evaluated in Chapter 4

5.4.2 Interpretation of the standardized coefficients

In this section, the relative effects of variables within each human-computer interface group are analysed by examining the direct effects (the standardized coefficient estimates), the indirect effects and the spurious effects for those parameters allowed to be free across the groups in the stacked model. The constrained parameters are assumed to have identical coefficient estimates across the groups\(^7\). The direct, indirect and spurious effects for the stacked model are reported in Table 5.6 and the direct effects are shown in Figure 5.2.

5.4.2.1 Direct effects

Table 5.6 shows that in the GUI group, perceived ease of use has a greater effect on computer anxiety ($b_{10} = -0.423$) than does perceived usefulness

---

\(^7\) Almost always, the standardized coefficients for the constrained parameters are not exactly equal across groups. In personal correspondence with the researcher, Bentler (1993) explains why this is the case. He says that 'In general, equality constraints imposed will only work for the unstandardized solution, and will not remain in the standardized solution ... unless it happens that relevant F, E, D (and I think V) variances and regression coefficients are equal across groups'.
<table>
<thead>
<tr>
<th>Linkage</th>
<th>Direct effect* (β)</th>
<th>Indirect effect</th>
<th>Spurious effect</th>
<th>Total association (η)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CUIG GROUP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use - Perceived usefulness</td>
<td>p1a -0.404</td>
<td></td>
<td>-0.180</td>
<td>-0.550</td>
</tr>
<tr>
<td>Perceived ease of use - Computer anxiety</td>
<td>p1b -0.277</td>
<td></td>
<td>-0.674</td>
<td></td>
</tr>
<tr>
<td>Perceived usefulness - Computer anxiety</td>
<td>p2a 0.216</td>
<td>0.238</td>
<td>0.177</td>
<td>0.631</td>
</tr>
<tr>
<td>Perceived usefulness - Microcomputer attitude</td>
<td>p2b 0.164</td>
<td>0.157</td>
<td>0.249</td>
<td>0.570</td>
</tr>
<tr>
<td>Computer anxiety - Microcomputer attitude</td>
<td>p31 -0.479</td>
<td></td>
<td>-0.245</td>
<td>-0.724</td>
</tr>
<tr>
<td>Perceived ease of use - Extent of use</td>
<td>p3a 0.348</td>
<td>0.005</td>
<td>0.031</td>
<td>0.384</td>
</tr>
<tr>
<td>Perceived usefulness - Extent of use</td>
<td>p3b 0.052</td>
<td>0.004</td>
<td>0.194</td>
<td>0.250</td>
</tr>
<tr>
<td>Microcomputer attitude - Extent of use</td>
<td>p32 0.011</td>
<td></td>
<td>0.184</td>
<td>0.195</td>
</tr>
<tr>
<td>Microcomputer attitude - Job satisfaction</td>
<td>p41 0.314</td>
<td>0.002</td>
<td>0.099</td>
<td>0.415</td>
</tr>
<tr>
<td>Microcomputer attitude - Job performance</td>
<td>p42 0.269</td>
<td>0.009</td>
<td>-0.163</td>
<td>0.106</td>
</tr>
<tr>
<td>Extent of use - job satisfaction</td>
<td>p43 0.179</td>
<td></td>
<td>0.145</td>
<td>0.522</td>
</tr>
<tr>
<td>Extent of use - Job performance</td>
<td>p44 0.038</td>
<td></td>
<td>0.068</td>
<td>0.106</td>
</tr>
<tr>
<td><strong>GUI GROUP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived ease of use - Perceived usefulness</td>
<td>p5a -0.423</td>
<td></td>
<td>-0.113</td>
<td>-0.536</td>
</tr>
<tr>
<td>Perceived usefulness - Computer anxiety</td>
<td>p51 -0.250</td>
<td></td>
<td>-0.232</td>
<td>-0.468</td>
</tr>
<tr>
<td>Perceived ease of use - Microcomputer attitude</td>
<td>p52 0.339</td>
<td>0.038</td>
<td>0.169</td>
<td>0.546</td>
</tr>
<tr>
<td>Perceived usefulness - Microcomputer attitude</td>
<td>p53 0.311</td>
<td>0.023</td>
<td>0.218</td>
<td>0.552</td>
</tr>
<tr>
<td>Computer anxiety - Microcomputer attitude</td>
<td>p54 0.069</td>
<td></td>
<td>-0.341</td>
<td>-0.430</td>
</tr>
<tr>
<td>Perceived ease of use - Extent of use</td>
<td>p55 0.132</td>
<td>0.004</td>
<td>0.071</td>
<td>0.207</td>
</tr>
<tr>
<td>Perceived usefulness - Extent of use</td>
<td>p56 0.126</td>
<td>0.004</td>
<td>0.074</td>
<td>0.204</td>
</tr>
<tr>
<td>Microcomputer attitude - Extent of use</td>
<td>p57 0.011</td>
<td></td>
<td>0.177</td>
<td>0.188</td>
</tr>
<tr>
<td>Microcomputer attitude - Job satisfaction</td>
<td>p58 0.234</td>
<td>0.002</td>
<td>-0.026</td>
<td>0.210</td>
</tr>
<tr>
<td>Microcomputer attitude - Job performance</td>
<td>p59 0.243</td>
<td>0.000</td>
<td>0.087</td>
<td>0.330</td>
</tr>
<tr>
<td>Extent of use - job satisfaction</td>
<td>p50 0.149</td>
<td></td>
<td>-0.013</td>
<td>0.127</td>
</tr>
<tr>
<td>Extent of use - Job performance</td>
<td>p51 0.036</td>
<td></td>
<td>0.039</td>
<td>0.075</td>
</tr>
</tbody>
</table>

* Outline box indicates coefficient is significant at p<0.05 (two-tailed)

Table 5.6: The EQS standardized solution (decomposed) for the stacked model
(a) Submodel for the CLUI group

(b) Submodel for GUI group

Note: For the two paths on the right hand side of the model, the coefficients above the path are for the Job Satisfaction model; the coefficients below the path are for the Job Performance model.

* Coefficient is significant at p<0.05 (two-tailed)

Figure 5.2: The stacked model path coefficients
(b_{1b}=-0.256). A similar relationship exists between the same coefficients in the CLUI group (b_{1a}=-0.498; b_{1b}=-0.327). Because of this, it is not surprising that the equivalent coefficients in the general model reported in Figure 4.2 show a similar relationship to those in the two groups in the stacked model. These results suggest that human-computer interface type is not an interacting force on the extent to which perceived ease of use and perceived usefulness affect computer anxiety.

The relationship between the coefficients describing the effects of perceived ease of use, perceived usefulness and computer anxiety on microcomputer attitude are distinctly different between the GUI and CLUI groups. For the GUI group, perceived ease of use and perceived usefulness have approximately the same effect on microcomputer attitude, with computer anxiety having no significant effect (β_{2a}=0.339; β_{2b}=0.311; β_{21}=0.089). On the other hand, the coefficients for the CLUI group indicate that computer anxiety has a very strong effect on microcomputer attitude relative to perceived ease of use and perceived usefulness, that are shown to have no significant effect (β_{2a}=0.216; β_{2b}=0.164; β_{21}=0.479). These marked differences in relative effects between the two human-computer interface user groups help explain why, in the general model, the relative effects of the same variables on microcomputer attitude are approximately the same (β_{2a}=0.290; β_{2b}=0.288; β_{21}=0.210).

Results for the general model reported in Figure 4.2 show that perceived ease of use has a significant direct effect on extent of use (β_{3a}=0.205) but perceived usefulness does not (β_{3b}=0.102). The stacked model shows that, for the CLUI group, there is a similar pattern of effects among these
variables, with perceived ease of use having a strong significant effect on extent of use ($\beta_{3a}=0.348$) and perceived usefulness having no significant effect ($\beta_{3b}=0.052$). However, for the GUI group, neither perceived ease of use nor perceived usefulness have a direct significant effect on extent of use ($\beta_{3a}=0.132; \beta_{3b}=0.126$).

5.4.2.2 Indirect effects

Table 5.6 shows that, for the free parameters under investigation in the stacked model, there are four possible indirect effects for the two exogenous variables (perceived ease of use, perceived usefulness) on two endogenous variables (microcomputer attitude, extent of use).

The results in Table 5.6 also show that, for the GUI group, these indirect effects appear to be almost nonexistent. That is, computer anxiety plays no role in moderating the effects of perceived ease of use and perceived usefulness on microcomputer attitude ($\beta_{21}\beta_{1a}=0.038; \beta_{21}\beta_{1b}=0.023$). Equally, microcomputer attitude plays no role in moderating the effects of perceived ease of use and perceived usefulness on extent of use ($\beta_{32}\beta_{2a}=0.004; \beta_{32}\beta_{2b}=0.004$).

However, the equivalent indirect effects for the CLUI group show that while microcomputer attitude plays no role in moderating the effects of perceived ease of use and perceived usefulness on extent of use ($\beta_{32}\beta_{2a}=0.005; \beta_{32}\beta_{2b}=0.004$), computer anxiety does appear to act to moderate the effects of perceived ease of use and perceived usefulness on microcomputer attitude ($\beta_{21}\beta_{1a}=0.238; \beta_{21}\beta_{1b}=0.157$).
Taken together with the results reported in Section 5.4.2.1, the results reported above show a clear difference across the two human-computer interface user groups in the way in which microcomputer attitude is affected by perceived ease of use and perceived usefulness. For GUI users, perceived ease of use and perceived usefulness directly influence users' attitudes toward using microcomputers, whereas in the case of CLUI users, perceived ease of use and perceived usefulness appear only to affect microcomputer attitude through their effect on computer anxiety.

5.4.2.3 Spurious effects

Table 5.6 shows that the zero order correlations (total association) for the seven free parameters estimated using the stacked model generally contain sizeable spurious effects. These sizeable spurious effects most likely account for the nonsignificant weak direct effect in some of the linkages. For example, Table 5.2 reports a significant correlation between perceived usefulness and extent of use in the CLUI group (0.250) but there is no significant direct effect. The spurious effect in this relationship is approximately 78 percent\(^8\) of the total association. Similarly, spurious effects account for approximately 79 percent of the total association between computer anxiety and microcomputer attitude in the GUI group, where the direct effect of computer anxiety is both small and nonsignificant.

\(8\) Calculated by taking the spurious effect coefficient as a percentage of the correlation coefficient.
5.5 CHAPTER SUMMARY

This chapter presented a multisample analysis of the research data. The aim of this analysis was to establish whether or not the research model developed in Chapter 2 and evaluated in Chapter 4 could be used to model the data once it was split into two groups (making a stacked model) with particular parameters constrained and others remaining free. The data grouping was based on the type of human-computer interface used.

The results of the multisample analysis confirm that the research model fitted the stacked model and that the stacked model was a significantly better fit if specific parameters were allowed to vary between the two human-computer interface user groups. In general, these results confirm that an interaction exists between the type of human-computer interface (the variable providing the grouping) and the other variables in the model.

The unstandardized and standardized coefficients generated from fitting the stacked model to the data were analysed to establish the extent of the differential effects between the two groups. The results show a clear difference between the two groups in the way in which perceived ease of use and perceived usefulness affect microcomputer attitude. In the case of CLUI users, these variables appear to affect microcomputer attitude via an intervening variable, computer anxiety, whereas in the GUI group the effect occurs directly. Related to this, the results show that the exogenous variables (perceived ease of use and perceived usefulness) have a strong significant direct effect on computer anxiety in CLUI users,
but no effect at all for GUI users.

Finally, of the two exogenous variables only perceived ease of use, and that in the case of the CLUI group, has a direct significant effect on extent of use of microcomputers. This is difficult to explain given that there is a significant relationship (as estimated by the zero order correlations) between perceived ease of use and usefulness and extent of use in both groups. However, examination of the spurious effects in these relationships provides, at least in part, an explanation for this. This examination shows that in each of the relationships where there is no significant direct effect, spurious effects are a sizeable part of the overall total association between the variables.
CHAPTER 6

CONCLUSIONS

This chapter concludes the thesis. It is organised into five sections. Section 1 summarises the research motivation and objectives, the theoretical foundations, the research model and propositions, and the methodology. Section 2 summarises the conclusions obtained from analysis of the results of the research. Section 3 discusses the limitations of the research and appraises their impact on the research conclusions. Section 4 discusses the practical and theoretical implications of the research and suggests directions for future research. Section 5 summarises the chapter.

6.1 SUMMARY OF THE RESEARCH

The research reported in this thesis was motivated by the researcher's belief that past research had not adequately developed techniques for modelling the impact of microcomputer technology on the work outcomes of professional accountants. Because the accounting services industry has embraced this relatively new technology, it is important that the acquirers of that technology have the means to investigate how
microcomputers and their use affect such things as the job satisfaction and job performance of professional accountants.

Job satisfaction and job performance are, *inter alia*, precursors of the ultimate economic impact of information technology acquisition and implementation on organisations. One of the motivations for organisations to invest in information technology is the belief that the investment will produce economic benefits to the organisation. If the acquisition and use of microcomputer technology is having a deleterious effect on job satisfaction and job performance of professional accountants, then organisations need to understand how and why this occurs so they may develop strategies to eliminate or, at the very least, minimise these effects.

To facilitate explanations and predictions of the impact of microcomputers and their use on the work outcomes of professional accountants, a model was developed incorporating constructs for perceived ease of use and perceived usefulness of microcomputers, computer anxiety, attitude toward using microcomputers and microcomputer usage. The model proposes that the job satisfaction and the job performance of professional accountants using microcomputers are influenced by the perceptions of these accountants. These perceptions include ease of use and usefulness of microcomputers. They affect job satisfaction and job performance through their influence on (a) the level of computer anxiety experienced by users, (b) the general attitude of users toward using microcomputers, and (c) the extent of use of microcomputers. Propositions that could be tested empirically were derived from the research model. These propositions related to
fundamental constructs in several ways.

As well as testing the general research model, the study also tested whether specific types of human-computer interfaces had a significant effect on the perceptions and anxieties that users have about microcomputers and their use in the workplace. It was argued that users of graphical interfaces, because of the characteristics of those interfaces, react differently to their perceptions and anxieties about microcomputers than do users of command-line (or textual-based) interfaces.

A passive-observational study in a field setting was used to test the model and the research propositions. One hundred and sixty-four professional accountants working in a Big Six accounting firm in a metropolitan city in Australia participated in the main study by completing a specific-purpose questionnaire. Seven incomplete questionnaires were dropped from the analysis. The questionnaire, developed specifically for this study and trialed in a pilot study, contained scales for estimating the components of the research model. The scales were tested for reliability and validity at each stage in the questionnaire development process, as well as in post hoc analysis of the primary study data. The scales were found to meet normal standards of reliability and validity.

Structural equation modelling techniques were used to test the hypothesised relationships between the components comprising the general research model. Path analysis and ordinary least squares regression were used to analyse the data and estimate the parameters of the model. Multisample analysis (or stacked model analysis) using EQS
was used to test the fit of the model to the data of the different human-computer interface groups and to estimate the parameters for the paths in those groups.

6.2 SUMMARY OF THE RESEARCH CONCLUSIONS

6.2.1 The research model and propositions

The results show that the model fitted the data for both the job satisfaction outcome variable and the job performance outcome variable. Table 6.1 summarises the results of the tests of whether the specific propositions were supported. All but two of the propositions were supported. Of these two, Proposition 4 was supported only weakly. The following paragraphs discuss the results of the test of the general model and the test of each proposition.

Tests of the general model showed that it described the data and that there was no significant difference in its explanatory power compared with that of the fully saturated model (i.e., a model where all endogenous variables are linked to all antecedent variables). Overall, the model explains nine percent of the variance for the job satisfaction data and six percent of the variance for job performance. Clearly, there are many other factors that influence job satisfaction and job performance in an organisation. Apart from individual beliefs, attitudes and behaviour, Nelson (1990) also identifies organisational context and work group factors, and job and individual characteristics as elements that affect work outcomes. However, a major objective of this study was to identify and examine the extent to which certain factors associated
<table>
<thead>
<tr>
<th>Propositions</th>
<th>Research proposition</th>
<th>Empirical indicators</th>
<th>Summary of results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposition 1A</td>
<td>The extent of microcomputer usage has a direct positive effect on job satisfaction.</td>
<td>extent of use of microcomputers - job satisfaction</td>
<td>Proposition supported</td>
</tr>
<tr>
<td>Proposition 1B</td>
<td>The extent of microcomputer usage has a direct positive effect on job performance.</td>
<td>extent of use of microcomputers - job performance</td>
<td>Proposition not supported</td>
</tr>
<tr>
<td>Proposition 2A</td>
<td>Attitude toward using microcomputers has a direct positive effect on job satisfaction.</td>
<td>attitude toward using microcomputers - job satisfaction</td>
<td>Proposition supported</td>
</tr>
<tr>
<td>Proposition 2B</td>
<td>Attitude toward using microcomputers has a direct positive effect on job performance.</td>
<td>attitude toward using microcomputers - job performance</td>
<td>Proposition supported</td>
</tr>
<tr>
<td>Proposition 3</td>
<td>Attitude toward using microcomputers has a direct positive effect on the extent of microcomputer usage.</td>
<td>attitude toward using microcomputers - extent of use of microcomputers</td>
<td>Proposition not supported</td>
</tr>
<tr>
<td>Proposition 4</td>
<td>Computer anxiety has a direct inverse effect on attitude toward using microcomputers.</td>
<td>computer anxiety - attitude toward using microcomputers</td>
<td>Proposition supported</td>
</tr>
<tr>
<td>Proposition 5</td>
<td>(a) Perceived ease of use of microcomputers has a direct positive effect on the extent of microcomputer usage.</td>
<td>perceived ease of use of microcomputers - extent of use of microcomputers</td>
<td>Proposition supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct positive effect on the extent of microcomputer usage.</td>
<td>perceived usefulness of microcomputers - extent of use of microcomputers</td>
<td>Proposition weakly supported</td>
</tr>
<tr>
<td>Proposition 6</td>
<td>(a) Perceived ease of use of microcomputers has a direct positive effect on attitude toward using microcomputers.</td>
<td>perceived ease of use of microcomputers - attitude toward using microcomputers</td>
<td>Proposition supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct positive effect on attitude toward using microcomputers.</td>
<td>perceived usefulness of microcomputers - attitude toward using microcomputers</td>
<td>Proposition supported</td>
</tr>
<tr>
<td>Proposition 7</td>
<td>(a) Perceived ease of use of microcomputers has a direct inverse effect on computer anxiety.</td>
<td>perceived ease of use of microcomputers - computer anxiety</td>
<td>Proposition supported</td>
</tr>
<tr>
<td></td>
<td>(b) Perceived usefulness of microcomputers has a direct inverse effect on computer anxiety.</td>
<td>perceived usefulness of microcomputers - computer anxiety</td>
<td>Proposition supported</td>
</tr>
</tbody>
</table>

Table 6.1: Summary of results of testing research propositions
with the use of microcomputers affect accountants' work outcomes. The results assessing the overall fit of the model confirm that the research model does play a role in describing how beliefs about microcomputers, computer anxiety, microcomputer attitudes and use affect job satisfaction and job performance. The individual linkages in the model were evaluated by testing the specific propositions derived in Section 2.2 of Chapter 2.

The first proposition tested in the study was that the use of microcomputers by professional accountants directly affects their work outcomes. Proposition 1A, which stated that the extent of microcomputer usage has a direct positive effect on job satisfaction, was supported. This means that an increase in the use of microcomputers by accountants leads to an increase in their job satisfaction. However, Proposition 1B, which stated that the extent of microcomputer usage has a direct positive effect on job performance, was not supported. One concludes, therefore, that microcomputer use is not directly associated with improved job performance. The test of total association between microcomputer usage and job performance (i.e., the zero order correlation) shows there is no significant relationship. There is neither a direct nor indirect effect of microcomputer usage on job performance.

The second proposition tested the effect that attitude toward using microcomputers has on the work outcomes of professional accountants. Proposition 2A, which stated that attitude toward using microcomputers has a direct positive effect on job satisfaction, was supported. Similarly, Proposition 2B, which stated that attitude toward using microcomputers has a direct positive effect on job performance, was also supported. If
accountants' attitudes toward the use of microcomputers becomes more positive, there is a resultant increase in their job satisfaction and job performance.

Proposition 3 propounded a directional relationship between attitude toward using microcomputers and the extent of microcomputer usage. This proposition was not supported. The extent to which accountants use microcomputers in their work is independent of their feelings of favourableness or unfavourableness towards the use of microcomputers in the workplace. Superficially, this appears to be at odds with the results of previous studies that examined the relationship between attitudes and computer use. However, many of those earlier studies did not measure computer usage directly but, rather, used derived variables for actual computer use. Typically, these derived variables included hard copy output from computer systems (Lucas, 1975), or record maintenance levels (Robey, 1979).

Proposition 4 - that computer anxiety has a direct inverse effect on attitude toward using microcomputers - was supported. This result indicates that if professional accountants are at all anxious about their impending use of microcomputers, this anxiety translates into feelings of unfavourableness about their use in the workplace. Although this result seems to be intuitive, it need not necessarily be the case. For example, it is possible that, in certain circumstances, even though individuals may be anxious about computers, they may still feel favourably disposed towards their use. This result confirms that in the case of accountants and microcomputers, anxieties about microcomputers do translate into
more negative attitudes about their use.

The fifth proposition tested whether perceptions of ease of use and usefulness regarding microcomputers lead to greater use of microcomputers. Proposition 5(a), which stated that perceived ease of use of microcomputers has a direct positive effect on the extent of microcomputer usage, was supported. On the other hand, Proposition 5(b), which stated that perceived usefulness of microcomputers has a direct positive effect on the extent of microcomputer usage, was weakly supported.

These results suggest that while the overall perceptions of ease of use concerning microcomputers directly affect accountants' level of use, this does not necessarily hold for their perceptions regarding usefulness. It may be that in terms of usefulness, the perceptions are more focussed, i.e., increased usage of microcomputers may be dependent more on a specific assessment of the utility of individual software programs rather than a general assessment of microcomputer utility. Recent research results suggest this might be the case. For example, a study of messaging technology that investigated perceptions and use of electronic mail software found usefulness to be an important determinant of system use (Adams et al., 1992).

The sixth proposition tested in the study is the assertion that perceived ease of use and perceived usefulness of microcomputers directly affects accountants' attitudes toward using computers in the workplace. Proposition 6(a), which stated that perceived ease of use of microcomputers has a direct positive effect on attitude toward using
microcomputers, was supported. Equally, Proposition 6(b), which stated that perceived usefulness of microcomputers has a direct positive effect on attitude toward using microcomputers, was also supported. These results suggest that general beliefs about microcomputer ease-of-use and utility are important determinants of accountants' attitudes toward using microcomputers regardless of accountants' beliefs about the ease-of-use and utility of specific software packages to which they have been exposed.

The seventh proposition tested whether perceptions of ease of use and usefulness regarding microcomputers reduce computer anxiety. Proposition 7(a), which stated that perceived ease of use of microcomputers has a direct inverse effect on computer anxiety, was supported. Similarly, Proposition 7(b), which stated that perceived usefulness of microcomputers has a direct inverse effect on computer anxiety, was also supported. From these results, it can be concluded that, as with microcomputer attitudes, general perceptions regarding microcomputer ease-of-use and utility are important determinants of accountants' computer anxieties. Heightened beliefs in the utility and ease of use of microcomputers leads to a reduction in the anxiety that accountants experience when faced with the impending use of computers.

To summarise, the results of this research show that the job satisfaction of accountants working in Big Six accounting firms is affected by their attitude toward using, and their use, of microcomputers. Job performance, while not appearing to be affected by microcomputer use, is influenced by microcomputer attitudes. These results are important to
organisations and their management because they indicate that work outcome variables are affected by factors associated with the adoption and use of microcomputers.

The results also highlight the importance of accountants' general beliefs about microcomputers. If accountants believe microcomputers are easy to use and are useful to them in their work, they are less anxious about using them, and their general attitude to microcomputer use in the workplace is more positive. However, while the results show that general perceptions about ease of use of microcomputers lead directly to increased use of microcomputers by accountants, the same is not the case for general perceptions of microcomputer utility. This result suggests that, in terms of utility, accountants may need to see specific 'payoffs' through the use of certain software before they start using microcomputers, or for that matter, increase their use of microcomputers. A general feeling by accountants that microcomputers will help them become more efficient and effective in their job does not appear to be sufficient motivation for accountants to make greater use of microcomputers.

These findings are also important to organisations and their management because they identify factors that are important in the process of information technology adoption and adaptation. When policies and strategies are being developed for the acquisition and deployment of microcomputer technology by organisations, management can at the same time develop programs that ensure factors identified in the research model as affecting attitudes and use are addressed in training programs. For example, because beliefs about ease
of use and usefulness of microcomputers have been found to reduce accountants' anxiety levels and enhance microcomputer attitudes, training programs instigated by organisations should incorporate strategies for maximising these perceptions.

Finally, the results confirm that computer anxiety is an important component in any model developed to describe behaviour associated with the use of microcomputers. The findings of the study indicate that computer anxiety not only directly affects accountants' attitudes toward the use of microcomputers in the workplace, it also appears to be an important intervening variable in translating the effect of perceived ease of use and perceived usefulness on those attitudes.

6.2.2 The stacked model

The results of a multisample analysis, where the data were partitioned into two groups (users of graphical interfaces and users of command-line or textual interfaces) representing a stacked model, show that the research model fitted the stacked model. These results suggest that an interaction exists between the type of human-computer interface and the variable linkages between perceptions, anxiety, attitudes and use. The key findings highlight the differential effects perceived ease of use and perceived usefulness have on microcomputer attitude. For command-line interface users, the effect of these beliefs on attitude appears to occur only through the moderating effect they have on computer anxiety. For this command-line interface group beliefs about perceived ease of use and usefulness have no direct impact on microcomputer attitude. However, for graphical interface users these beliefs directly affect
attitude, with little mediation by computer anxiety.

These results also show that, while perceived ease of use and perceived usefulness both have a direct significant effect on computer anxiety in both groups, it appears that only in the case of the command-line interface users does computer anxiety have any significant direct effect on microcomputer attitude. The decomposition of total effects reported in Table 5.6 show that the significant relationship between computer anxiety and microcomputer attitude for the graphical interface group is due to spurious effects.

Finally, the results show that perceived usefulness appears to have no significant direct effect on microcomputer usage in both groups, indicating that the interface-type has no interactive effect. However, perceived ease of use has a significant direct effect on microcomputer usage in the case of command-line interface users, but not for graphical interface users. This suggests that the interface type has an interactive effect on the relationship between the ease of use belief and usage.

In summary, the results of the stacked model analysis show that the research model can be used to describe the two-group interface model, and that there are clear differences in the direct relationships between beliefs, anxiety, attitude and use across the two groups.

6.3 LIMITATIONS OF THE RESEARCH

Cook and Campbell (1979) identify and describe the potential threats to validity of conclusions based on research in field settings. This section
investigates limitations of the study and assesses the impact these threats have on the research conclusions based on the validity framework posited by Cook and Campbell (1979). Using the Cook and Campbell (1979) taxonomy, four potential threats to the validity of the research are identified and discussed. These threats include (a) statistical conclusion validity, (b) internal validity, (c) construct validity of putative causes and effects, and (d) external validity. The following subsections deal with each of these in turn.

6.3.1 Threats to statistical conclusion validity

Statistical conclusion validity refers to '... inferences about whether it is reasonable to presume covariation given a specified \( \alpha \) level and the obtained variances' (Cook and Campbell, 1979, p. 41). Table 6.2 describes and discusses the main types of statistical conclusion validity threats. These threats are interpreted against the research methods used in this study and comments are made on the extent to which each type of threat may compromise the research findings.

Table 6.2 identifies two potential threats to statistical conclusion validity in this study. The first of these threats deals with the random irrelevancies that may exist in the research environment that can act to inflate error variance. Field studies make it difficult to control for extraneous sources of variation. For this study, it was not possible to negotiate with the firm participating in the study to provide the means that would enable the researcher to increase control over these extraneous sources. It was only through considerable negotiation over a period of twelve months that the partners of the firm agreed to allow
<table>
<thead>
<tr>
<th>Threats to statistical conclusion validity</th>
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<tbody>
<tr>
<td>Low statistical power</td>
<td>Low statistical power is normally a product of small sample sizes. Low statistical power increases the risk of accepting the null hypothesis (i.e., Type II error). This study has a sample size of 157. It is unlikely that the research conclusions are threatened by low statistical power.</td>
</tr>
<tr>
<td>Violated assumptions of statistical tests</td>
<td>Normal probability plots (see Chapter 4, Section 4.1) suggest that the data for two variables may not be normally distributed. Because of this, bootstrap techniques were used to test the statistical significance of the coefficients derived for the general research model (see Appendix 4.1). These bootstrap techniques do not require the data to be normally distributed.</td>
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EQS, used to test the fit of the stacked model and to test the significance of the model parameters, computes test statistics using procedures that do not assume the data is normally distributed.

It is unlikely that the results of this research are threatened by assumption violations regarding statistical tests.

Table 6.2: Threats to statistical conclusion validity
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<th>Threats to statistical conclusion validity</th>
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<tbody>
<tr>
<td>Fishing and the error rate problem</td>
<td>The probability that one or more erroneous conclusions have been drawn from the results in this research is small because only twelve tests were conducted to confirm or reject the specific research propositions. Moreover, the results are consistent with the researchers' expectations based on the theory underpinning the propositions.</td>
</tr>
<tr>
<td>The reliability of measures</td>
<td>Multiple-item scales were used to measure each variable in the research model. An exploratory survey and a pilot study were completed using the research instrument containing the scales. Reliability tests (Cronbach Alpha) on these preliminary studies, as well as the primary study, indicated that the scales were reliable.</td>
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<tr>
<td></td>
<td>There is no reason to believe that the research conclusions are threatened through low reliability of measures.</td>
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<tr>
<td>The reliability of treatment implementation</td>
<td>Lack of standardisation of treatment implementation may inflate error variance and decrease the chance of obtaining true differences. Unreliability of treatment implementation is likely to be a more serious threat in field experiments than field studies of the nature undertaken for this research. Nonetheless, care was taken to ensure that the procedures for, and timing of, the distribution and collection of the research questionnaire were standardised. Any threat to statistical conclusion validity through unreliability of treatment implementation is minimal.</td>
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Table 6.2: Threats to statistical conclusion validity (continued)
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<th>Threats to statistical conclusion validity</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Random irrelevancies in the experimental setting</td>
<td>Participants in the study were asked to complete and return the research questionnaire as quickly as possible. Adherence to this procedure helped to minimise the impact that environmental factors may have had on the responses of the participants. Feedback from participants in the exploratory survey and pilot study suggested that the questionnaire was simple and quick (approx. 15 mins.) to complete. This ease, and speed, of completion helps ensure that extraneous sources of variation can be minimised. It is not obvious from the research results that random irrelevancies have affected variance. However, because of the nature of field studies, the possibility exists for error variance to be inflated by extraneous sources.</td>
</tr>
<tr>
<td>Random heterogeneity of respondents</td>
<td>Random heterogeneity of respondents may have inflated error variance in the results. The researcher attempted to control this by selecting a homogenous respondent sample (see discussion in Chapter 3, Section 3.2.1). Notwithstanding this, Cook and Campbell (1979, p. 44) note that &quot;... respondents in any treatment group can differ on factors that are correlated with the major dependent variables.&quot;</td>
</tr>
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Table 6.2: Threats to statistical conclusion validity (continued)
their employees to participate in the study - and then only if disruption to their normal work routines was kept to a minimum.

Notwithstanding this constraint, in administering the research questionnaire steps were taken to reduce the potential effects of extraneous sources of variation. Participants in the study were asked to complete and return the questionnaire as quickly as possible. The questionnaire was distributed during a period in which work pressures and deadlines were likely to be at a minimum (i.e., outside tax and corporate compliance deadlines). While not eliminating all possible extraneous sources of variation, it was believed that by careful selection of the timing of the administration of the questionnaire, and by ensuring respondents completed and returned the questionnaire quickly, the influence of these sources of error variance could be minimised.

In surveys and field studies, random heterogeneity of respondents presents a similar, and associated threat, to that of random irrelevancies. To minimise the potential threat of heterogeneity, care was taken to select participants so that the respondent population was homogenous. However, total homogeneity of respondents is difficult to achieve in field studies. Again, the researcher in this study was constrained by the conditions imposed by the partners of the firm participating in the research. However, notwithstanding these constraints, the sample population appears to be homogenous on relevant professional characteristics. Any heterogeneity in the sample population is most likely due to non-professional characteristics of respondents and is unlikely to contribute to error variance in this study.
6.3.2 Threats to internal validity

Cook and Campbell (1979, p. 38) describe internal validity as '... the validity with which statements can be made about whether there is a causal relationship from one variable to another in the form in which the variables were manipulated or measured'. Circumstances or events that lead to the questioning of hypothesised causal relationships can be categorised as threats to the internal validity of the research. A number of the threats identified by Cook and Campbell (1979) are not relevant in this research study. These include maturation, testing, instrumentation, statistical regression, selection, mortality, compensatory equalisation, compensatory rivalry, and resentful demoralisation of respondents. However, two potential threats to internal validity have been identified. These are described, and their threat to the research conclusions are discussed in Table 6.3.

The first of these threat types described in Table 6.3 identifies the cross-sectional nature of the data as being a potential threat to this study. Cross-sectional data were collected rather than longitudinal data because of conditions imposed by the partners of the participating firm. The partners agreed to the participation of their staff provided there was minimum interference to their normal work routines. Essentially, this meant that the researcher could take only one 'snapshot' of the data, i.e., have only one opportunity to collect data to estimate the parameters of the model. However, the use of cross-sectional data in testing path models is not unusual (see for example, Brownell and McInnes, 1986; Chenhall and Brownell, 1988; Tan, 1989; Kren, 1992). Asher (1979) argues that a '... temporal ordering can be imposed on substantive grounds
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<th>Threats to internal validity</th>
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<td>Ambiguity about the direction of causal inference</td>
<td>This particular threat is not important in experiments, where the order of temporal precedence between variables being measured is clear. Moreover, it is not a threat when the alternative direction of causality between two variables is implausible. Nor is it a threat in studies of association when the data are longitudinal. However, in studies where the data are cross-sectional, the question of whether A causes B is not necessarily obvious from the results of quantitative analysis. Because the data collected in this study are cross-sectional, the validity of the research conclusions drawn about the causal direction of the effects may be threatened.</td>
</tr>
<tr>
<td>Diffusion or imitation of treatments</td>
<td>In field research, it is possible that respondents may be physically close and able to communicate during an experiment or during the completion of a research questionnaire. This may be a particular problem if an objective of the research is to test for differences between groups or classes of people drawn from the sample population. Communication between respondents from different groups about the research task may lead to an alignment of views about matters affecting the research possibly resulting in a failure to identify any underlying differences between groups. Equally, in correlational studies, communication between respondents about the nature and content of questionnaires elicitng information may result in spurious relationships being reported. In this study, the opportunity existed for respondents to communicate with each other. Given this, it is possible that research conclusions about the direction of causal relationships may be threatened.</td>
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Table 6.3: Threats to internal validity
even though a single time point cross-sectional design was used to obtain the measurements'. Ultimately, the causal direction of effects in a path model are supported by the theory explicating the linkages in the model.

The second threat type reported in Table 6.3 identifies communication between participants during the time allowed for the completion of the questionnaire as a threat to the internal validity of the research. The researcher, aware of this potential threat, instructed participants when distributing the questionnaire on the importance of answering the questions frankly. Also, the amount of time allowed for the completion and mailing of the questionnaire was kept as short as possible to minimise the opportunity for participants to communicate with each other about the contents of the questionnaire. Given these steps were taken, the threat to the internal validity of the research that may arise because of the potential for participants to discuss the contents of the research instrument is likely to be minimal.

6.3.3 Threats to construct validity of putative causes and effects

When researchers are concerned with 'confounding', they are addressing threats to construct validity. Cook and Campbell (1979, p. 59) describe confounding as '... the possibility that the operations which are meant to represent a particular cause or effect construct can be construed in terms of more than one construct, each of which is stated at the same level of reduction'. Carmines and Zeller (1979, p. 23) similarly describe construct validity as being concerned with '... the extent to which a particular measure relates to other measures consistent with theoretically derived
hypotheses concerning the concepts (or constructs) that are being measured. Table 6.4 identifies the threats to construct validity in this research and comments on the extent to which these threats may affect the construct validity of the research.

Table 6.4 indicates that, while four specific threats to construct validity have been identified, there is no major threat to construct validity in the research reported in this thesis.

6.3.4 Threats to external validity

External validity is concerned with '... (1) generalizing to particular target persons, settings, and times, and (2) generalizing across types of persons, settings, and times' (Cook and Campbell, 1979, p. 71). Generally, research of the type conducted here (i.e., a passive-observational study in a field setting) mitigates threats to external validity. Nonetheless, two potential threats to external validity are identified. These threats are described in Table 6.5. Comments are made about the extent to which they threaten external validity.

Table 6.5 suggests that the results of the research may be generalisable to all professional accountants working in Australian Big Six accounting firms. Table 6.5 also identifies a number of potential threats to the external validity of the research. Any generalising to this target group should be done in the context of these potential threats.
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<th>Threats to construct validity</th>
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<tr>
<td>Inadequate preoperational explication of constructs</td>
<td>The constructs used in the research are conceptually derived from the literature and theory upon which the research model is based. Chapter 2 describes the explication of the constructs used in the research. Because the research is testing a new theoretical model, it is possible that the constructs as defined may not totally capture the constructs as conceived. Notwithstanding this, it is believed that the threat to construct validity of inadequate explication of constructs is minimal.</td>
</tr>
<tr>
<td>Mono-operation bias</td>
<td>All but one of the constructs in the research model is multiply operationalised. Multiple indicators for each construct enhance construct validity (Carmine and Zeller, 1979). For these constructs, there is no threat to their construct validity from mono-operation bias. The one construct using a single exemplar, microcomputer usage, uses a ratio scale measure. Microcomputer usage, for the study was defined simply as the amount of time spent using a microcomputer. This data for each respondent was elicited by requesting the number of hours spent per week using a microcomputer. Because this construct is simple and unambiguous, it is unlikely that its construct validity is threatened by mono-operation bias.</td>
</tr>
<tr>
<td>Mono-method bias</td>
<td>Mono-method bias is unlikely to threaten construct validity in the research. During the development of the research instrument, steps were taken to counteract the threat of mono-method bias. For example, during the exploratory study a random selection of respondents were interviewed and their responses compared with their ‘paper-and-pencil’ responses. Interview responses correlated highly with the ‘paper-and-pencil’ responses. Also, in the final draft of the instrument, items making up scales were negatively as well as positively stated.</td>
</tr>
<tr>
<td>Confounding constructs and levels of constructs</td>
<td>Construct validity is threatened when variables in a hypothesised relationship are not linearly related along the whole continuum of the independent variable. Preliminary data analysis, prior to the main analysis, using ANOVA suggests that confounding constructs and levels of constructs are unlikely to threaten the construct validity of the research.</td>
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Table 6.4: Threats to construct validity of putative causes and effects
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<th>Threats to external validity</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Interaction of selection and treatment</td>
<td>The results of the research in this study should be generalised with care. It is unlikely that the results can be generalised to all classes of microcomputer users. However, because care was taken in selecting the participants, generalising to members of the target class of interest (i.e., professional accountants) should be acceptable. There are two reasons for this. First, almost 77 percent of those accountants invited to participate accepted the invitation. The results are unlikely to be affected by non-response bias. Second, all accountants (excepting partners) in the chosen setting were invited to participate.</td>
</tr>
<tr>
<td>Interaction of setting and treatment</td>
<td>The setting chosen for the study was an Australian Big Six accounting firm. Although it is unlikely that the results can be generalised to all accounting firms, they should be generalisable to all Australian Big Six accounting firms. Nevertheless, at least two threats are apparent. First, is the firm chosen for the setting for the study typical of all Big Six firms? The organisational structure of Big Six firms appears to be similar. Equally, the profiles of accountants employed at various levels appears to be similar across Big Six firms. However, there is no definitive research to confirm these views. Second, is the information technology policy and practice of the participant firm similar to that of other Big Six firms? Again, there is no firm empirical evidence to the contrary, and the belief that the policies are similar relies largely on anecdotal evidence.</td>
</tr>
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Table 6.5: Threats to external validity
6.4 IMPLICATIONS OF THE RESEARCH

Prior to this study, little research had been conducted into the effect microcomputers have on the work of professional accountants. This study tests a model that attempts to describe the effects that beliefs and anxieties have on microcomputer attitudes and usage; and, in turn, the effects that these attitudes and usage have on job satisfaction and job performance.

The results of the research confirm the notion that one can construct a general model representing the interrelationships among these factors. As well, the study confirms that accountants' perceptions about ease of use and usefulness of microcomputers play an important role in influencing computer anxiety and microcomputer attitudes. It also confirms that perceived ease of use is a significant factor in affecting the extent to which accountants use microcomputers, and that computer anxiety affects microcomputer attitudes. The study also shows job satisfaction is affected by microcomputer attitudes and usage, whereas job performance is only affected by microcomputer attitudes. In addition, the findings of this study have theoretical and practical implications. Moreover, these findings suggest directions for future research. These implications and future research directions are discussed in the following subsections.

6.4.1 Theoretical implications

This thesis has made a theoretical contribution to the collective knowledge and thinking about person-machine interactions. It has done
this by drawing together earlier research and using it to develop a model that describes the impact of information technology on individuals in the workplace. The thesis, through the research model, integrates recent developments in the 'theory of individual adjustment to information technology' literature to extend the theory by specifying a class of information technology, the microcomputer, and by evaluating the impact of this technology on two key work outcomes - job satisfaction and job performance. The thesis also adds to current theory by focusing the research on a specific group of persons identified as users of microcomputer technology - professional accountants in Big Six accounting firms.

The research also extends the theory by showing that constructs earlier identified as important antecedents to user attitudes and system use (perceived ease of use and perceived usefulness) can be successfully integrated into research models that take a narrower focus than the models developed to test the importance and significance of these constructs in the theory of individual adjustment to information technology (see for example, Davis et al., 1989; Adams et al., 1992).

An important finding is that perceived ease of use is a factor that significantly affects computer anxiety, microcomputer attitude and microcomputer usage. Perceived usefulness, while significantly affecting computer anxiety and microcomputer attitude, does not affect the extent to which accountants use microcomputers. Prior research identified perceived usefulness as playing the major role of the two beliefs in affecting system usage (see for example, Davis et al., 1989; Adams et al., 1992). The results reported in this thesis are important because
(considered in the light of this earlier research) they suggest that the role each of these beliefs plays in any model of information technology adjustment may be a function of the persons and the setting under study.

The research model incorporates computer anxiety as a structural-functional component. Prior research associates computer anxiety with computer attitudes and usage (Howard, 1986) and speculates that it may enrich models of information technology impact (Bagozzi et al., 1992). The results reported in this thesis confirm this speculation and indicate that computer anxiety is an important determinant of microcomputer attitudes and a key component in the overall research model. These findings suggest that future development of theories of information technology adjustment should incorporate a computer anxiety component.

This thesis makes a methodological contribution to the research on individual adjustment to information technology by demonstrating that multisample covariance analysis techniques can be fruitfully introduced into the analysis of path models to test for the existence of interactive effects based on grouping variables. The research findings show that, using human-computer-interface-type as a grouping variable, the multisample analysis provides a richer explanation of the relationships between beliefs, anxiety and attitude.

Apart from the methodological aspect, an important finding from the multisample analysis is that the extent to which beliefs affect anxiety and attitude can be explained, in large part, by the interface used. Although suggested in prior research (Davis et al., 1989), interface-type has not been
used to test for differential effects between perceived ease of use/perceived usefulness and such factors as attitude and behaviour.

6.4.2 Practical implications

The research has a number of implications for Big Six accounting firms and their partners. These organisations, in recent years, have made substantial investments in microcomputer technology. An understanding of how beliefs, anxieties and attitudes toward microcomputers, and microcomputer use itself, affect work outcomes would guide organisations in their attempts to maximise the benefits of microcomputer use. Specifically, the research could assist these firms, their partners and employees in four ways. First, it highlights the dynamics between perceptions of ease of use and usefulness of microcomputers, computer anxiety, microcomputer attitudes and use, and job satisfaction and job performance. By being aware of these relationships, individual accountants may be able to increase their job satisfaction and improve their job performance.

Second, professional development programs and training programs can be designed to incorporate the research findings so that future work with microcomputers leads to increased job satisfaction and improved job performance.

Third, if determinants of perceived ease of use and perceived usefulness of microcomputers cannot be easily identified and incorporated into training programs, accounting firms could develop special recruiting strategies. Recruitment programs could be developed which identify key
microcomputer beliefs, anxieties and attitudes of potential employee accountants.

Fourth, the research findings provide Big Six firms and their partners with information about how the use of different human-computer interfaces affects the relationship between perceived ease of use/usefulness, computer anxiety and microcomputer attitudes. A knowledge of these differential affects will assist the firms in tailoring their microcomputer training programs, their recruitment programs for accounting staff, and their planning for future development of their information technology infrastructure.

6.4.3 Future research implications

The results of this study suggest several areas for future research. First, although steps were taken to allow for the results to be generalised to all professional accountants working in all Big Six accounting firms, Table 6.5 identifies two potential threats to the external validity of the results. These threats could be ameliorated through studies replicating this research using samples drawn from another Big Six firm or a number of other Big Six firms. Moreover, to test the generalisability of the findings to all users of microcomputer systems, replication studies could sample a broader cross-section of the microcomputer user community.

Second, the results show that there appears to be no significant relationship between attitude toward using microcomputers and microcomputer use, even though microcomputer attitude significantly affects both job satisfaction and job performance. This result is difficult
to understand in the context of prior research that reports strong links between attitudes and use. Despite the care taken to counteract threats to construct validity in this research (see comments in Table 6.4), it is possible that a nonlinear relationship exists between the two measures representing attitude and use. The existence of this relationship could explain the nonsignificant result for the attitude-usage linkage. Future research should focus on microcomputer attitudes and usage and test for the existence of nonlinear relationships and levels of constructs. Results from research of this nature would refine this attitude-usage linkage in the model developed in this thesis and add to the theory of individual adjustment to information technology.

Third, the research model assumes perceived ease of use and perceived usefulness as exogenous variables. The research does not attempt to identify and analyse factors that affect these two constructs. The results of this research show that perceived ease of use and perceived usefulness are important variables in the research model. Future research is needed to identify the factors that influence these two variables. Knowledge of these factors, and the extent to which they affect perceived ease of use and perceived usefulness of microcomputers, should be useful for evaluating and developing training strategies, software, and systems and implementation policies. Future research along these lines would also extend the development of the research model to provide a much richer description of the effect that microcomputers have on work.

Fourth, this research restricted the model to examining the effects of microcomputers on two work outcomes - job satisfaction and job performance. Future research might investigate the effect that beliefs,
anxieties and attitudes associated with the use of microcomputers might have on the work motivation of microcomputer users. Work motivation is an important factor in the quality of work life of individuals (Vroom, 1964; Brownell and McInnes, 1986; Lepore et al., 1989). Knowledge of the extent to which work motivation is affected by the introduction and use of microcomputers into the work environment is important because it will add to the theory of individual adjustment to information technology.

Fifth, the research model is evaluated using cross-sectional data (a cost of being allowed access to accountants in the field). In studies of the type reported in this thesis, the internal validity of the research may be threatened by the use of cross-sectional data. Two future research directions should be pursued in an attempt to replicate the results found in this study and overcome the internal validity threats associated with the use of cross-sectional data. These research directions include longitudinal studies in field settings; and field experiments which provide better control over confounding variables.

6.5 CHAPTER SUMMARY

This chapter summarised and discussed the results of the research reported in this thesis in terms of the implications for the theory of individual adjustment to information technology. It also indicated the practical implications of the findings of the study. The chapter identified and commented on threats to the validity of the research results. The chapter concluded with suggestions for future research directions that
could confirm the research findings and, extend and expand the research model introduced in this thesis.
APPENDIX 1.1
29 May 1990

Mr xxxxxx xxxxxxxx
Partner
xxxx xxxx xxxxxxxx
xxx xxxx Sucet
Melbourne 3000

Dear xxxxxx,

Firstly, this is by way of a formal 'thank you' to you and your firm for agreeing to participate in a study which will form the basis of my PhD research. Your help and enthusiasm has been a motivating force in my work to date.

As I indicated to you in our telephone conversation of April 30, I am currently working on a questionnaire which I hope to use as the basis for data gathering in your firm. Within the next couple of weeks I intend administering it to a group of employees at Deakin with a view to using the responses as a means of testing the validity and reliability of the questions. At the completion of this stage, I hope to have an instrument which I can then administer to your staff. However, between now and then, I shall contact you and arrange a time to visit so I may provide you with a more detailed background to the nature of my research, including the objectives and the model which forms the basis of the study.

Also, I need to obtain some detail about your organization, including information on its structure and main operational tasks. I am aware of your need to maintain as confidential certain aspects of your firm's operations. I don't wish to seek, nor do I expect to be given, any information which may threaten this confidentiality.

Again, thank for your assistance to date. Please pass on my best wishes to xxx xxxxxxx.

Yours Sincerely,

Colin Ferguson
Senior Lecturer in Accounting and Information Systems
APPENDIX 1.2
20 May 1991

Mr xxxx xxxxxx
Partner
xxxx xxxx xxxxxx
xx xxxxxxx Street
Melbourne Vic 3000

Dear xxxx,

Thank you for meeting with me last Thursday. I appreciate the time and co-operation both you and xxxxx have given me. As you know, I agreed to provide you with a brief description of how we agreed to distribute and collect the questionnaire, generally how the results will be reported in the thesis and how the confidentiality of the collected data will be maintained.

1. The questionnaire will be tested on a pilot group of 20 professional accountants in the PBS division. Following the analysis of this pilot survey by CF, the main survey will be completed. The main survey group will include all professional accountants (not including partners) working in the PBS division in the Melbourne office. GB will co-ordinate the distribution and collection of the questionnaires, and re-distribute, after a reasonable time, the questionnaire to those people who have not notified their section that they have completed the questionnaire. A sample of those staff who agreed to be interviewed will be interviewed as soon as practicable after the completion of the questionnaire.

2. The completed questionnaires will be forwarded to CF (in their sealed envelopes) once collected from the participants. CF undertakes to retain custody of, and exclusive access to, the questionnaires and any data files created from them.

3. Results from the analysis of the data will be reported in the context of the objectives of the research and the hypotheses derived from these, that is, reporting of the results from the job evaluation section of the questionnaire and discussion of those results will be limited to the relative differences between the different groups of human-computer interface users.

4. xxxx xxxx xxxxxxxx reserves the right to be specifically identified and acknowledged in any theses and reports emanating from the research.

I believe the above four points cover the main aspects of the research associated with your firm. If I’ve not included something you consider important, or if I’ve not accurately reflected our agreement, please write or phone immediately and tell me.

On more practical matters, you will have found enclosed the twenty questionnaires for the members of the pilot group to complete (and one spare one for your file). I’ve asked
them to complete and return them to xxxx xxxxxxx by Friday May 31st. If you think this deadline is unreasonable, adjust it accordingly.

Again, thank you for enthusiastically (and practically) supporting my research, particularly when there is no immediate or obvious tangible benefit to either you or your firm.

Yours Sincerely

Colin Ferguson
Senior Lecturer in Accounting and Information Systems
APPENDIX 1.3
Section 1
Attitudes toward using microcomputers in the workplace

This section of the questionnaire asks you to rate your attitudes toward using microcomputers in the workplace. Each of the statements is something that a person might say about using a microcomputer in his or her job. Please be honest and frank in making your ratings. The following is an example of how you should record your response to each of the statements in this section of the questionnaire:

1. I feel apprehensive about using a microcomputer.  
   Strongly Disagree Disagree Uncertain Agree Strongly Agree  
   1 2 3 4 5

The rating given above indicates that the person responding in no way feels apprehensive about using a microcomputer. You are to respond to all the statements in this section by circling the number which best describes your attitude to the idea contained in each statement.

1. Using microcomputers saves time and money for my department.  
   Strongly Disagree Disagree Uncertain Agree Strongly Agree  
   1 2 3 4 5

2. The use of microcomputers causes people to lose jobs.  
   1 2 3 4 5

3. Using a microcomputer for daily work is fun.  
   1 2 3 4 5

4. Microcomputers take too much time and effort to learn how to use.  
   1 2 3 4 5

5. Using microcomputers leads to upper management wanting more and more reports, some which may be unnecessary.  
   1 2 3 4 5

6. Even if a microcomputer saves me time, I prefer to do my work by hand.  
   1 2 3 4 5

7. I like to do as much of my work as possible on a microcomputer.  
   1 2 3 4 5
<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Uncertain</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>The use of microcomputers in my department allows new work to be done which is valuable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Using microcomputers in my job causes my friends and family to consider my position less important.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Learning to use microcomputers in my work is time-consuming but fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>If training courses for microcomputers are available, I am interested in taking them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>I feel apprehensive about using a microcomputer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>If given the opportunity to use a microcomputer, I'm afraid that I might damage it in some way.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>I hesitate to use a microcomputer for fear of making mistakes I cannot correct.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15</td>
<td>I find using a microcomputer a daunting task.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>Using a microcomputer intimidates me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>17</td>
<td>I don't feel confident when using a microcomputer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>I find microcomputers provide straightforward steps for -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Finding files</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Opening files</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>20</td>
<td>Saving files</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Copying files</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>Printing files</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Uncertain</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>----------</td>
<td>-----------</td>
<td>-------</td>
<td>----------------</td>
</tr>
<tr>
<td>23. Learning to operate microcomputers is easy for me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. I find it easy to get a microcomputer to do what I want it to do.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. My interaction with a microcomputer is clear and understandable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. I find a microcomputer flexible to interact with.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>27. It is easy for me to become skilful at using a microcomputer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>28. I find a microcomputer easy to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>29. Using a microcomputer in my job enables me to accomplish tasks more quickly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>30. Using a microcomputer improves my job performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>31. Using a microcomputer in my job increases my productivity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>32. Using a microcomputer enhances my effectiveness on the job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>33. Using a microcomputer makes it easier to do my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>34. I find a microcomputer useful in my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
This section of the questionnaire asks you about your use of two types of microcomputers and microcomputer software - those with command-line user interface (CLUI) characteristics and those with graphical user interface (GUI) characteristics.

Microcomputers and microcomputer software operated using the MS DOS operating system are regarded as CLUI microcomputer systems.

Macintosh microcomputers and their software and/or IBM PC microcomputers and their software operated using MS Windows (or OS/2 and Presentation Manager) are regarded as GUI microcomputer systems.

Of the following four statements, respond to the one which best describes your use of a microcomputer system.

1. When using microcomputers systems in my job, I have almost always used CLUI microcomputer systems; or

2. When using microcomputer systems in my job, I have almost always used GUI microcomputer systems; or

3. Previously, when using microcomputer systems in my job, I almost always used GUI microcomputer systems, but now I almost always use CLUI microcomputer systems; or

4. Previously, when using microcomputer systems in my job, I almost always used CLUI microcomputer systems, but now I almost always use GUI microcomputer systems.
Answer Question 5 only if you answered Question 1 or Question 2.

If you answered Question 3 go directly to Question 6.

If you answered Question 4 go directly to Question 7.

5. Currently, what percentage of the total time working with microcomputers do you spend using the following software:

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Databases</td>
<td></td>
</tr>
<tr>
<td>Accounting Packages</td>
<td></td>
</tr>
<tr>
<td>Audit Packages</td>
<td></td>
</tr>
<tr>
<td>Communication Packages</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

Now go directly to Section 3.

6. (a) Previously, what percentage of the total time working with GUI microcomputers did you spend using the following software:

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Databases</td>
<td></td>
</tr>
<tr>
<td>Accounting Packages</td>
<td></td>
</tr>
<tr>
<td>Audit Packages</td>
<td></td>
</tr>
<tr>
<td>Communication Packages</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

(b) Currently, what percentage of the total time working with CLUI microcomputers do you spend using the following software:

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Databases</td>
<td></td>
</tr>
<tr>
<td>Accounting Packages</td>
<td></td>
</tr>
<tr>
<td>Audit Packages</td>
<td></td>
</tr>
<tr>
<td>Communication Packages</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

Now go directly to Section 3.

7. (a) Previously, what percentage of the total time working with CLUI microcomputers did you spend using the following software:

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Databases</td>
<td></td>
</tr>
<tr>
<td>Accounting Packages</td>
<td></td>
</tr>
<tr>
<td>Audit Packages</td>
<td></td>
</tr>
<tr>
<td>Communication Packages</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

(b) Currently, what percentage of the total time working with GUI microcomputers do you spend using the following software:

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wordprocessing</td>
<td></td>
</tr>
<tr>
<td>Spreadsheets</td>
<td></td>
</tr>
<tr>
<td>Databases</td>
<td></td>
</tr>
<tr>
<td>Accounting Packages</td>
<td></td>
</tr>
<tr>
<td>Audit Packages</td>
<td></td>
</tr>
<tr>
<td>Communication Packages</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>
In this section you will find several different kinds of questions about your job. Specific instructions are given at the start of each part. Please read them carefully. Please move through the questions quickly.

The questions are designed to obtain your perceptions of your job and your reactions to it.

There are no trick questions. Please answer each item as honestly and frankly as possible.

Section 3: Part I

This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1--------2--------3--------4--------5--------6--------7

Very little; the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much; the job requires almost constant work with mechanical equipment.

You are to circle the number which is the most accurate description of your job.

If for example, your job requires you to work with mechanical equipment a good deal of the time - but also requires some paperwork - you might circle the number six, as was done in the example above.

If you do not understand these instructions, please ring me on (055) 618287 for assistance. If you do understand them, turn the page and begin.
1. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1----------------2----------------3----------------4----------------5----------------6----------------7

Very little: the job gives me almost no personal "say" about how and when the work is done. Moderate autonomy: many things are standardised and not under my control, but I can make some decisions about the work. Very much: the job gives me almost complete responsibility for deciding how and when the work is done.

2. To what extent does your job involve doing a "whole and identifiable piece of work". That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1----------------2----------------3----------------4----------------5----------------6----------------7

My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service. My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome. My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service.

3. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1----------------2----------------3----------------4----------------5----------------6----------------7

Very little, the job requires me to do the same routine things over and over again. Moderate variety. Very much: the job requires me to do many different things, using a number of different skills and talents.

4. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1----------------2----------------3----------------4----------------5----------------6----------------7

Not very significant; the outcomes of my work are not likely to have important effects on other people. Moderately significant. Highly significant; the outcomes of my work can affect other people in very important ways.
5. To what extent does *doing the job itself* provide you with information about your work performance? That is does the actual *work itself* provide clues about how well you are doing - aside from any "feedback" co-workers or supervisors may provide?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very little; the job itself is set up so I could work forever without finding out how well I am doing.</td>
<td>Moderately; sometimes doing the job provides &quot;feedback&quot; to me; sometimes it does not.</td>
<td>Very much; the job is set up so that I get almost constant &quot;feedback&quot; as I work about how well I am doing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Section 3: Part II**

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or an inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job - regardless of whether you like or dislike your job.

Enter a number in the blank space beside each statement, based on the following scale:

*How accurate is the statement in describing your job?*

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Inaccurate</td>
<td>Mostly Inaccurate</td>
<td>Slightly Inaccurate</td>
<td>Uncertain</td>
<td>Slightly Accurate</td>
<td>Mostly Accurate</td>
<td>Very Accurate</td>
</tr>
</tbody>
</table>

1. The job requires me to use a number of complex or high-level skills.

2. The job is arranged so that I do *not* have the chance to do an entire piece of work from beginning to end.

3. Just doing the work required by the job provides many chances for me to figure out how well I am doing.

4. The job is quite simple and receptive.

5. This job is one where a lot of other people can be affected by how well the work gets done.

6. The job provides me the chance to completely finish the pieces of work I begin.

7. The job itself provides very few clues about whether or not I am performing well.

8. The job gives me considerable opportunity for independence and freedom in how I do the work.
9. The job itself is not very significant or important in the broader scheme of things.

10. The job denies me any chance to use my personal initiative or judgement in carrying out the work.

Section 3: Part III

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank space for each statement, based on this scale:

How much do you agree with this statement?

<table>
<thead>
<tr>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
</tbody>
</table>

Very Inaccurate    Mostly Inaccurate    Slightly Inaccurate    Uncertain    Slightly Accurate    Mostly Accurate    Very Accurate

1. My opinion of myself goes up when I do this job well.

2. Generally speaking, I am very satisfied with this job.

3. I feel a great sense of personal satisfaction when I do this job well.

4. I frequently think of quitting this job.

5. I feel bad and unhappy when I discover that I have performed poorly on this job.

6. I am generally satisfied with the kind of work I do in this job.

7. My own feelings generally are not affected much one way or the other by how well I do on this job.
Section 3: Part IV

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank space beside each statement.

How satisfied are you with this aspect of your job?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extremely Dissatisfied</td>
<td>Slightly Dissatisfied</td>
<td>Neutral</td>
<td>Slightly Satisfied</td>
<td>Satisfied</td>
<td>Extremely Satisfied</td>
<td></td>
</tr>
</tbody>
</table>

_____ 1. The amount of personal growth and development I get in doing my job.

_____ 2. The feeling of worthwhile accomplishment I get from doing my job.

_____ 3. The amount of independent thought and action I can exercise in my job.

_____ 4. The amount of challenge in my job.

Section 3: Part V

Now please think of the other people in your organisation who hold the same job you do. If no one has exactly the same job as you, think of the job which is most similar to yours.

Please think about how accurately each of the statements describes the feelings of those people about the job.

It is quite all right if your answers here are different from when you described your own reactions to the job. Often different people feel quite differently about the same job.

How much do you agree with the statement?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Inaccurate</td>
<td>Mostly Inaccurate</td>
<td>Slightly Inaccurate</td>
<td>Uncertain</td>
<td>Slightly Accurate</td>
<td>Mostly Accurate</td>
<td>Very Accurate</td>
</tr>
</tbody>
</table>

______ 1. Most people on this job feel a great sense of personal satisfaction when they do the job well.

______ 2. Most people on this job are very satisfied with the job.
3. People on this job often think of quitting.

4. Most people on this job feel bad or unhappy when they find that they have performed the work poorly.

Section 3: Part VI

This part of the questionnaire asks you to rate your work effectiveness.

Please answer each question as honestly and as frankly as possible. To answer the question you are to circle the number which most accurately describes your assessment.

1. How efficient are you at completing assigned work tasks? That is, on the whole, how quickly do you complete assigned work tasks?

   0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10

   Completes tasks extremely slowly. Moderately quickly Completes tasks extremely quickly.

2. How well do you complete assigned work tasks? That is, on the whole, what is the quality of the work you completed?

   0-----1-----2-----3-----4-----5-----6-----7-----8-----9-----10

   Quality of work completed is extremely low. Moderate quality Quality of work completed is extremely high.
Section 4
Biographical Background

(For Questions 1 to 7 and Question 9 place a tick in the box which best answers the question)

1. How old are you?

   Less than 21 .................. 1
   Between 21 and 25 ........... 2
   Between 26 and 30 .......... 3
   Between 31 and 35 .......... 4
   Between 36 and 40 .......... 5
   Between 41 and 45 .......... 6
   Between 46 and 50 .......... 7
   Between 51 and 55 .......... 8
   More than 55 ................. 9

2. What is your gender?  Female 1  Male 2

3. Which of the following best describes your position?

   Partner ...................... 1
   Director ..................... 2
   Senior Consultant .......... 3
   Senior Manager ............. 4
   Manager II .................. 5
   Manager I ................... 6
   Supervisor II ............... 7
   Supervisor I ............... 8
   Senior II .................... 9
   Senior I .................... 10
   Accountant III ............. 11
   Accountant II .............. 12
   Accountant I ............... 13
   Undergraduate .............. 14

4. What is the highest level of education you have attained?

   Secondary ..................... 1
   TAFE certificate ............. 2
   TAFE diploma ................ 3
   Bachelor degree ............. 4
   Postgraduate diploma ....... 5
   Masters degree .............. 6
   PhD .......................... 7
   Other ........................ 8
   Specify ........................

Deakin University
5. Are you (or are you eligible to be) either an Associate or Fellow of The Institute of Chartered Accountants in Australia or a Certified Practising Accountant?

Yes [ ] No [ ]

6. Have you either completed formal studies in the computing field or do you have a professional computing qualification (e.g., MACS)?

Yes [ ] No [ ]

7. Do you have a computer at home?

Yes [ ] No [ ]

8. By placing a mark along the lines shown below, indicate what level of computer expertise you believe you have attained with microcomputer systems.

Low Level of Expertise

0 1 2 3 4 5 6 7 8 9 10

High Level of Expertise

9. By placing a mark along the line shown below, indicate the extent to which you believe the nature and type of work you do with a computer in your job has changed over the past two years.

No change

0 1 2 3 4 5 6 7 8 9 10

Total change

10. Within the next few weeks I wish to interview a small number of questionnaire respondents. Are you willing to participate in this follow-up interview?

Yes [ ] No [ ]

If you ticked Yes to the above question, please write your name in the following space:

..............................

Thank you for participating in the survey.

Now place the completed questionnaire in the envelope supplied, seal it and return it to .........................

Deakin University
APPENDIX 1.4
A Questionnaire on Microcomputer Attitudes and Microcomputer Usage

The last few years has seen a marked increase in the presence of computers in the work environment. Recent research in the field of information systems attempts to provide a conceptual framework for analyzing the impact of computers on organizations. In particular, one body of work has examined peoples' attitudes and concerns about computerized work and how they adjust to the introduction and use of computers in the workplace.

I am interested in extending this research to examine the effect different human-computer interfaces may have on peoples' job characteristics and work outcomes.

By completing the accompanying questionnaire, you can help me in this line of research. The data gathered using this questionnaire will be used to study professional accountants' attitudes toward using microcomputers, the level of microcomputer usage and, in turn, the effect of these on job characteristics and work outcomes.

Responses to the questionnaire will be completely confidential, and, unless respondents elect otherwise, they will remain anonymous.

It is important to note that the information obtained about such things as work effectiveness, job satisfaction and work motivation will be analyzed solely in the context of the effect different computer attributes may have on them. This study is not one which is looking at these work outcomes in isolation, that is, it is not a job evaluation study but rather a study of the effects certain computer attributes may have on work outcomes.

If you are willing to participate in this study, please answer the questions contained in the questionnaire, seal your responses in the attached envelope addressed to me and return it to your group secretary.

Also, if you have difficulty with any part of the questionnaire and need assistance, please don't hesitate to ring me on (055) 618 287.

Thank you,

Colin Ferguson
Senior Lecturer in Accounting & Information Systems

July 1st, 1991
APPENDIX 1.5
Mr Colin Ferguson, a senior lecturer in the Faculty of Commerce at Deakin University, is involved in accounting and information technology research. He is particularly interested in how different aspects of IT impacts accountants in the work environment. Part of his current research requires accountants to complete a questionnaire about microcomputer use and attitudes toward using them. xxxxxxx has agreed to help Mr Ferguson in the administration of his questionnaire by allowing him to distribute it to accounting staff in our PBS division.

Whilst there is no direct benefit to the firm from this study, we fully support research into this important aspect of IT and accounting. The questionnaire should only take you a few minutes to complete, so I urge you to spend a little of your time to complete it and then return it to your group secretary. Your responses will be treated confidentially and anonymously. Only Mr Ferguson will have access to your completed questionnaires for analysis.
A Questionnaire on Microcomputer Attitudes and Microcomputer Usage

Earlier this month, I sent you a questionnaire which asks you questions relating to attitudes toward using microcomputers and other questions about such things as work effectiveness, job satisfaction and work motivation. To date, I’ve not received a response from you.

The purpose of this letter is to follow up on my request. Your response is crucial to the success of this research and I hope that you will complete the attached questionnaire and return it to me in the self-addressed envelope provided.

Responses to the questionnaire will be completely confidential, and, unless respondents elect otherwise, they will remain anonymous.

It is important to note that the information obtained about such things as work effectiveness, job satisfaction and work motivation will be analyzed solely in the context of the effect different computer attributes may have on them. This study is not one which is looking at these work outcomes in isolation, that is, it is not a job evaluation study but rather a study of the effects certain computer attributes may have on work outcomes.

Please return the completed questionnaire by Friday 16th August. If you have already returned your response, please disregard this follow-up request.

If you have difficulty with any part of the questionnaire and need assistance, please don’t hesitate to ring me on (055) 618 287.

Thank you,

Colin Ferguson
Senior Lecturer in Accounting & Information Systems

August 2nd, 1991
APPENDIX 1.7
Microcomputer Attitudes and Microcomputer Usage
Questionnaire

Information and Instructions:

1. The questionnaire contains four sections. Please complete all sections.

2. You answer each question in each section by either circling a number, ticking a box or writing a number in a box.

3. You will complete the questionnaire anonymously unless you elect otherwise.

4. The completed questionnaire is to be sealed in the accompanying envelope by you and returned to your group secretary by Friday July 19 1991. All sealed envelopes will be forwarded directly to me. They will not be opened by anyone but me.

5. Specific instructions on how you are to answer the questions in each section are included at the start of each section. Please read these instructions carefully.

6. If you do not understand the instructions, you can ring me on (055) 618287 (reverse charge) for assistance.

Colin Ferguson
July 1 1991
APPENDIX 1.8
Research on Computer Attitudes and Computer Usage

The last few years has seen a marked increase in the presence of computers in the work environment. Recent research in the field of information systems attempts to provide a conceptual framework for analyzing the impact of computers on organizations. In particular, one body of work has examined peoples' attitudes and concerns about computerised work.

I am interested in extending this research to examine the effect different computer attributes may have on peoples' perceptions of how easy computers are to use, how useful they are, and the extent to which these perceptions moderate the level of computer usage in the work environment.

I am currently developing a questionnaire which will be used to gather data from people using computers in the workplace. The data gathered using the questionnaire will be used to empirically evaluate a model that I have developed which attempts to describe the role certain constructs play in moderating the effect a specific computer attribute, the human computer interface, has on computer usage and certain job attributes such as job motivation and job satisfaction.

One of the tasks I must complete involves validation of the instrument. In particular, I am keen to ensure that the instrument is measuring what I think it is measuring. To this end, I need independent confirmation that the questions do evoke responses which can be used to measure such things as attitude toward using computers, perceived ease of use and usefulness of specific computers, and the degree to which people feel anxious about using particular types of computers.

To this end, I'm asking for your assistance. Specifically, what I want you to do is read through the groups of statements shown in the boxes on the following pages and then gauge the degree to which you think responses to these statements, taken as a whole, estimate the respondents' attitudes and perceptions by placing a mark along the line provided. A definition of each construct being estimated is included on the page along with the group of statements. You are not required to respond to the statements themselves.

If you have any queries about completing the task asked of you, please don't hesitate to contact me.

Thank you,

Colin Ferguson
June 26, 1990
Attitude Toward Using a Computer

Definition: An attitude is a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object (in the case in question - using a particular type of computer).

By placing a mark along the line shown below, please indicate the extent to which you believe the group of statements below, if answered by a respondent to the questionnaire, estimate that persons' attitude toward using computers.

(Note: Before placing a mark along the line, carefully read through each of the statements.)

<table>
<thead>
<tr>
<th>Weak Estimate of Attitude toward using Computers</th>
<th>Strong Estimate of Attitude toward using Computers</th>
</tr>
</thead>
</table>

(Strongly Disagree - SD, Disagree - D, Uncertain - U, Agree - A, Strongly Agree - SA)

<table>
<thead>
<tr>
<th>(Circle the appropriate number)</th>
<th>SD</th>
<th>D</th>
<th>U</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using computers saves time and money for my department.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The use of computers causes people to lose jobs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using a computer for daily work is fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Computers take too much time and effort to learn how to use.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using computers leads to upper management wanting more and more reports, some of which may be unnecessary.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Even if a computer saves me time, I prefer to do my work by hand.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I like to do as much as my work as possible on a computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The use of computers in my department allows new work to be done which is valuable.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>My using computers in my job causes my friends and family to consider my position less important.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Learning to use computers in my work is time-consuming but fun.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>If training courses for computers are available, I am interested in taking them.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Perceived Ease of Use

Definition: Perceived ease of use of a particular type of computer is the degree to which a person believes that using that computer will be free of effort.

[Davis, 1989]

By placing a mark along the line shown below, please indicate the extent to which you believe the group of statements below, if answered by a respondent to the questionnaire, estimate that persons' perceived ease of use of a particular type of computer.

(Note: Before placing a mark along the line, carefully read through each of the statements.)

Weak Estimate of Perceived Ease of Use

Strong Estimate of Perceived Ease of Use

<table>
<thead>
<tr>
<th>(Strongly Disagree - SD, Disagree - D, Uncertain - U, Agree - A, Strongly Agree - SA)</th>
<th>(Circle the appropriate number)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em><em>I find ...........</em> computers provide straight</em>*</td>
<td>SD</td>
</tr>
<tr>
<td><strong>forward steps for</strong></td>
<td></td>
</tr>
<tr>
<td>Finding files</td>
<td>1</td>
</tr>
<tr>
<td>Opening files</td>
<td>1</td>
</tr>
<tr>
<td>Saving files</td>
<td>1</td>
</tr>
<tr>
<td>Copying files</td>
<td>1</td>
</tr>
<tr>
<td>Printing files</td>
<td>1</td>
</tr>
<tr>
<td><strong>Learning to operate ...... computers is easy for me.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>I find it easy to get ........... computers to do what</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>I want them to do.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>My interaction with ........... computers is clear</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>and understandable.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>I find ........... computers flexible to interact with.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>It is easy for me to become skilful at using</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>......... computers.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>I find ........... computers easy to use.</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

* - In the questionnaire the type of computer would be inserted here, eg. large, IBM PC (or compatible or Macintosh.)
Perceived Usefulness

Definition: Perceived usefulness of a particular type of computer is the degree to which a person believes that computer will enhance his or her job performance. [Davis, 1989]

By placing a mark along the line shown below, please indicate the extent to which you believe the group of statements below, if answered by a respondent to the questionnaire, estimate that persons' perceived usefulness of a particular type of computer.

(Note: Before placing a mark along the line, carefully read through each of the statements.)

<table>
<thead>
<tr>
<th>Weak Estimate of Perceived Usefulness</th>
<th>Strong Estimate of Perceived Usefulness</th>
</tr>
</thead>
</table>

(Strongly Disagree - SD, Disagree - D, Uncertain - U, Agree - A, Strongly Agree - SA)

<table>
<thead>
<tr>
<th></th>
<th>SD</th>
<th>D</th>
<th>U</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using ........ computers in my job enables me to accomplish tasks more quickly.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using ........ computers improves my job performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using ........ computers in my job increases my productivity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using ........ computers enhances my effectiveness on the job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using ........ computers makes it easier to do my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I find ........ computers useful in my job.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Computer Anxiety

Definition: Computer anxiety is the tendency of a particular person to experience a level of uneasiness over his or her impending use of a computer, that is disproportionate to the actual threat presented by the computer.

[Howard, 1986]

By placing a mark along the line shown below, please indicate the extent to which you believe the group of statements below, if answered by a respondent to the questionnaire, estimate that persons' level of anxiety about using a particular type of computer.

(Note: Before placing a mark along the line, carefully read through each of the statements.)

<table>
<thead>
<tr>
<th>Weak Estimate of Computer Anxiety</th>
<th>Strong Estimate of Computer Anxiety</th>
</tr>
</thead>
</table>

(Circle the appropriate number)

<table>
<thead>
<tr>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>U</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel apprehensive about using ........ computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>If given the opportunity to use a ........ computer, I'm afraid that I might damage it in some way.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I hesitate to use a ........ computer for fear of making mistakes I cannot correct.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I find using a ........ computer a daunting task.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Using a ........ computer intimidates me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I don't feel confident when using a ........ computer.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Thank you for your help. Please return the completed questionnaire to me in the Faculty of Business.

Colin Ferguson
APPENDIX 2
APPENDIX 2

THE COMPUTER INTENSIVE BOOTSTRAP TECHNIQUE FOR TESTS OF SIGNIFICANCE OF THE BETA COEFFICIENTS

Bollen and Stine (1990) describe the bootstrap technique as an approach to estimating properties of estimators based on samples drawn from the original observations. Noreen (1988) also discusses the bootstrap technique and provides a description of the steps involved in using computer technology to implement the technique. The method outlined by Bollen and Stine (1990) and Noreen (1988) is used to test the significance of the parameters derived for the research model. The technique is nonparametric and it is used because it does not make assumptions about the particular type of distribution function for the data under analysis.

The following steps were taken to apply the bootstrap technique to the research data to test the significance of the parameters. This procedure represented a two-tailed test with a level of significance, $\alpha$ set at 0.05. The nonparametric bootstrap confidence interval (the percentile interval) was then used to test the hypothesis, $H_0: \beta = 0$, for each
parameter.

First, 100 files were created by randomly sampling (with replacement) the original file 157 times. Each random file is a bootstrap sample.¹

Second, each bootstrap was then used to compute the regression coefficient estimates. Four hundred regression equations are solved (100 bootstrap samples and 4 structural equations) to obtain the required coefficient estimates to test the hypothesis, $H_0: \beta = 0$, for each parameter in the path model.

Third, the 100 sample regression coefficients for each parameter in the path model were placed in order.

Finally, the ordered bootstrap sample regression coefficients were examined to determine whether a coefficient with a zero value could fall within the 95 percent bootstrap percentile interval. If it could, then $H_0: \beta = 0$ cannot be rejected; if it could not then the alternative hypothesis, $H_1: 0 < \beta > 0$, holds.

In practical terms, the bootstrap testing of the significance of the model parameters was achieved using a number of microcomputer applications. The random sampling with replacement procedure was achieved by constructing programs (using the programming language, Microsoft GW BASIC) that were then used to select the vectors from the data file and write them to new files. The regression equations

¹ There are no firm rules on setting the number of bootstrap samples to be drawn. However, Bollen and Stines (1990) make reference to a sample of 100 as being reasonable for conducting bootstrap testing.
were solved using these files of randomly selected data and the statistical program, SYSTAT for the Macintosh, Version 5.2. The output files from SYSTAT were converted to simple text files using a program written in Microsoft GW BASIC. Microsoft EXCEL, Version 4, a spreadsheet program, was used with these text files to order the bootstrap estimators prior to examination of the bootstrap percentile intervals.

The Microsoft GW BASIC programs used to generate the files of random data are available on request from the researcher.
APPENDIX 3

THE HUMAN-COMPUTER INTERFACE
(a brief description of recent developments)

Over the past two decades computer scientists and cognitive psychologists increasingly have researched human-computer interaction and, in particular, how best to interface computer systems with the users of those systems (Card et al., 1983). This has been particularly the case since the mid-1970s when the developments in integrated circuits allowed for the design, construction and commercial release of personal computers. Personal computers (or microcomputers) as the name suggests opened up computing to direct personal interaction. Prior to this, most users interacted with computers in an indirect way via punched cards, paper tape, etc. Those that had direct access to computer systems via computer terminals were, in the most part, experienced computer users. These microcomputers also re-defined the market for computer users so that interactive computer use was now the domain (at least potentially, if not actually) of a group of people with a diverse range of computing skills and experiences. At this time, it became important not only to deliver computing power into the hands of these people but also to
provide them with an interface mechanism that would enable them to use it successfully.

Until this time, the conventional interface for interaction with computers had been command-line based, that is, a command-line user interface. The minimal research done at this time during the mid-1970s on human-computer interaction indicated that the command language nature of computer interfaces was a major reason why non-computer specialists, in particular, had difficulties learning to use computer systems effectively (Mann, 1975). With limitations like this in mind, the Xerox Corporation in Palo Alto, California, in the late 1970s and early 1980s, worked at developing a human-computer interface that would make the computer system 'seem familiar and friendly by simplifying the human-machine interface' (Smith et al., 1982, p. 242). The result of this work was the development of the 8010 Star Information System. The results of the pioneering work on the design of the Star interface now manifest themselves in the key attributes of what is termed a graphical user interface. Microsoft Corporation, seen as one of the leading developers of graphical user interface software in the 1980s, believes a true graphical user interface satisfies six requirements (Seymour, 1989, p. 98). These include bitmapped displays enabling 'what-you-see-is-what-you-get' (WYSIWYG) screen representation of printed output; a graphical-based interface using icons; good screen aesthetics; direct manipulation of on-screen elements; use of the object-action paradigm; and, provision of standard elements to provide consistency across applications.
WYSIWYG refers to the way in which the computer monitor displays an accurate image of the printed page. This attribute enables users to literally compose their documents on the screen. It facilitates experimentation with page layouts where users can quickly and directly substitute fonts and font sizes to 'see how they look' before finally printing the document.

The use of icons allows the computer to simulate a real working environment. For example, in the case of the Macintosh computer, the user operates the system using the 'Desktop'. The 'Desktop' is a physical-office metaphor where such things as documents and folders are represented by small pictorial representations or icons. The idea behind the 'Desktop' and its' icons is to induce users to intuitively work with the computer system by immediately relating the icons to real world physical objects. This direct manipulation of on-screen elements purports to reduce the overhead of using the computer\(^1\), thus, enabling users to maximize their problem-solving activities rather than having them dissipated by continually recalling and executing sequences of commands.

An integral part of achieving this 'direct manipulation' using icons is the use of the object-action. Objects (for example, documents) are understood purely in terms of their physical characteristics, and actions (WYSIWYG) with the corresponding.

\(^1\) Time and effort is needed on the part of users to learn, recall and execute the correct set of commands to cause the computer to complete the set of procedures to achieve their goal. Other things being equal, the more time and effort consumed in 'driving' a computer, the less time and effort there is directed at the primary task of goal satisfaction.
are understood in terms of their effects on the screen (Smith et al., 1982, p. 260). For example, if users wish to delete a file (document) then, using a selecting and pointing device (a 'mouse'), they select the picture representing the document and drag it across the screen to the picture of a trash can.

Underlying and supporting this graphical user interaction is a simple, standard set of generic commands such as COPY, CUT, PASTE, UNDO and PRINT. Along with this set of commands are the standard window elements and dialog control boxes. These are provided to ensure total consistency across applications (computer programs) so that users may transport their computing knowledge from one application to another within the microcomputing environment.

The first commercial hardware/software system that used a graphical user interface appeared in 1984 with the release of Apple's Macintosh computer. Although by today's standards a small (in terms of memory size) and limited (in terms of software availability) system, the 128K machine running a simple\(^2\) wordprocessor (MacWrite) and graphics package (MacPaint) had an immediate impact on the microcomputer market\(^3\).

\(^2\) Simple in the sense that they contained none of the sophisticated features found in the wordprocessing and graphics programs available today.

\(^3\) In the United States 60,000 Macintosh computers were sold within the first 100 days of release; it took seven and a half months to sell the equivalent number of IBM PCs when they were first released (Bunnell, 1984, p. 11).
Microcomputer software manufacturers who provide the bulk of the market with the command-line interface systems based on the operating system developed by Microsoft and known as MS DOS immediately responded to the impact of the Macintosh system. In November 1985, Microsoft released a program, Windows, which attempted to emulate the graphical user interface environment implemented on the Macintosh. However, Windows met with little success because most application programs were not written with a graphical user interface in mind. They still retained the old command and interface structure.

By 1989 Microsoft had released upgraded versions of Windows. These were aimed at the newer range of IBM PC microcomputers based on the 80286 and 80386 microprocessors. However, these still met with little success - again because software developers were slow in producing application programs compatible with the graphical user interface characteristics delivered by the Windows software. Nonetheless, there were notable exceptions; for example, the spreadsheet program, EXCEL, written with a built-in, runtime module of Windows became very successful, challenging LOTUS 1-2-3. Until EXCEL's release, LOTUS 1-2-3, a layered-menu-driven command-line interface package, dominated the spreadsheet market.

In 1990 Microsoft launched Windows 3.0. Previous versions of Windows were, by and large, application launchers and not, as with the Macintosh operating system, complete working environments using the desktop metaphor as the interface between file management procedures and the user. However, Windows 3.0 has changed that,
offering the user a Macintosh-like desktop environment to interact with the microcomputer.

Following the initial attempts by Microsoft to create a graphical user interface environment for the IBM PC (or compatible) running MS DOS, the IBM company, in 1988, released a new microcomputer, the PS/2, to run a graphical user interface. The PS/2, with its Microsoft OS/2 operating system and graphical user interface (Presentation Manager), was IBM's attempt to provide a complete graphical user interface microcomputing environment. Although slow in gaining market acceptance in their early years, OS/2 and Presentation Manager appear to be gaining support - in 1990 there are about 600 applications available for running under OS/2, most of which are designed to take advantage of the graphical user interface features offered by Presentation Manager (Microsoft Corporation, 1990a).

While MS DOS is still the basis for running most application programs on microcomputers, graphical user interface-based systems, or systems which support graphical user interface application programs are growing rapidly. For example, by the early 1990s, there were over three thousand applications available to run on the Macintosh. Windows users have approximately one thousand applications available (Microsoft Corporation, 1990a). Along with the six hundred OS/2 applications, the microcomputer user has a wide choice of graphical user interface-based applications.
APPENDIX 4
APPENDIX 4

COMMAND FILES FOR MULTISAMPLE COVARIANCE ANALYSIS IN EQS

/TITLE
PATH ANALYSES OF ACCOUNTANTS' DATA -
PARTIALLY CONSTRAINED MODEL (JOB PERFORMANCE)
THE TWO GROUP MODEL: GROUP 1
/SPECIFICATIONS
CASES = 50; VARIABLES = 8; GROUPS = 2; ME = ML;
MA = RAW; DATA='MODEL.DAT';
/LABELS
V1 = CPMAIT; V2 = PCVEOU; V3 = PCUVUL;
V4 = CMPANX; V5 = USEXTENT; V6 = JOBSATFN;
V7 = JOBPINMC; V8 = USERTYPE;
/EQUATIONS
V7 = 1*V1 + 1*V5 + E7;
V5 = 1*V1 + 1*V2 + 1*V3 + E5;
V1 = 1*V2 + 1*V3 - 1*V4 + E1;
V4 = -1*V2 - 1*V3 + E4;
/VARIANCES
V2 = 40.227; V3 = 12.704;
E1 = 2*; E4 = 2*; E5 = 2*; E7 = 2*;
/COVARIANCES
V2, V3 = 12.437;
/PRINT
EFFECT=NO; COR=YES;
/END

/TITLE
PATH ANALYSES OF ACCOUNTANTS' DATA -
THE TWO GROUP MODEL: GROUP 2
/SPECIFICATIONS
CASES = 107; VARIABLES = 8; ME = ML;
MA = RAW;
/LABELS
V1 = CPMAIT; V2 = PCVEOU; V3 = PCUVUL;
V4 = CMPANX; V5 = USEXTENT; V6 = JOBSATFN;
V7 = JOBPINMC; V8 = USERTYPE;
/EQUATIONS
V7 = 1*V1 + 1*V5 + E7;
V5 = 1*V1 + 1*V2 + 1*V3 + E5;
V1 = 1*V2 + 1*V3 - 1*V4 + E1;
V4 = -1*V2 - 1*V3 + E4;
/VARIANCES
V2 = 39.270; V3 = 10.4b9;
E1 = 2*; E4 = 2*; E5 = 2*; E7 = 2*;
/COVARIANCES
V2, V3 = 11.069;
/CONSTRAINTS
(1,V5,V1)=(2,V5,V1);
(1,V7,V1)=(2,V7,V1);
(1,V7,V8)=(2,V7,V8);
/PRINT
EFFECT=NO; COR=YES;
/END
TITLE
PATH ANALYSIS OF ACCOUNTANTS' DATA -
PARTIALLY CONSTRAINED MODEL (JOB SATISFACTION)
THE TWO GROUP MODEL: GROUP 1
/SPECIFICATIONS
CASES = 50; VARIABLES = 8; GROUPS = 2; ME = ML;
MA = RAW; DATA='MODEL.DAT';
/LABELS
V1 = CMPATT; V2 = PCVEOU; V3 = PCVUFUL;
V4 = CMPANX; V5 = USEXTENT; V6 = JOBSATFN;
V7 = JGBPMNC; V8 = USERTYPE;
/EQUATIONS
V6 = 1*V1 + 1*V5 + E6;
V5 = 1*V1 + 1*V2+ 1*V3 + E5;
V1 = 1*V2 + 1*V3 - 1*V4 + E1;
V4 = -1*V2 - 1*V3 + E4;
/VARIANCES
V2 = 9*; V3 = 9*;
E1 = 2*; E4 = 2*; E5 = 2*; E6 = 2*;
/COVARIANCES
V2, V3 = .5*;
/PRINT
EFFECT=YES; COR=YES;
/LEND
/TITLE
PATH ANALYSIS OF ACCOUNTANTS' DATA -
THE TWO GROUP MODEL: GROUP 2
/SPECIFICATIONS
CASES = 107; VARIABLES = 8; ME = ML;
MA = RAW;
/LABELS
V1 = CMPATT; V2 = PCVEOU; V3 = PCVUFUL;
V4 = CMPANX; V5 = USEXTENT; V6 = JOBSATFN;
V7 = JGBPMNC; V8 = USERTYPE;
/EQUATIONS
V6 = 1*V1 + 1*V5 + E6;
V5 = 1*V1 + 1*V2+ 1*V3 + E5;
V1 = 1*V2 + 1*V3 - 1*V4 + E1;
V4 = -1*V2 - 1*V3 + E4;
/VARIANCES
V2 = 9*; V3 = 9*;
E1 = 2*; E4 = 2*; E5 = 2*; E6 = 2*;
/COVARIANCES
V2, V3 = .5*;
/CONSTRAINTS
(1,V5,V1)=(2,V5,V1);
(1,V6,V1)=(2,V6,V1);
(1,V6,V5)=(2,V6,V5);
/MIST
/PRINT
EFFECT=YES; COR=YES;
/FIND
BIBLIOGRAPHY


Mann, W. C. (1975). "Why things are so bad for the computer-naive user". *Information Sciences Institute, ISI/RR(March), 75-82.


