Computer User Interfaces in a Multicultural Society

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DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any tertiary institution for a diploma or a degree. I do further declare that the opinions contained herein are my own and not necessarily those of the Technikon.

Signature ..... Date 12/11/97

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ABSTRACT

This research discusses some of the cultural issues that could influence the human-computer encounter in a multicultural community. The results of research to determine differences in computer usage caused by cultural differences when using computer user interfaces in simulated and real-world environments are also discussed.

Various cultural aspects could possibly influence the effectiveness of the user interface in a multicultural society. Language is an important factor and studies have shown that simple translation will increase productivity (Bodley, 1993:23). However all languages do not contain the necessary technical vocabulary. Mothers from a lower social class typically use a limited language code when communicating with their children (Mussen et al.,1984:206). As this causes the children to think in more concrete and less conceptual terms, it may influence the human computer interaction, particularly where a high degree of abstraction, such as in graphical interfaces, is used.

Symbolism is problematic as symbols like light bulbs, recycle bins and VCR controls do not feature in the life of users living in slum and backward rural conditions. Lack of exposure to technology might negatively influence user attitude (Downton, 1991:25) with a corresponding inhibition of learning and performance. An external locus of control is common among disadvantaged groups due to the high degree of rejection, hostile control and criticism they experience. As the sense of being out of control is largely associated with the inclination to avoid stressful situations, users from these groups might prefer to avoid situations where they do not feel in control. The strong differentiation between the roles of the sexes in certain cultures can also influence the encounter with the computer (Downton,

1991:10) It has been shown that the different gender orientations towards problem solving in these cultures can have an important influence on computer usage.

The intracultural factors of social class play a significant role in determining how a person acts and thinks (Baruth & Manning, 1991:9-10). Such differences may sometimes be more pronounced than those resulting from cultural diversity and may influence the orientation of the user towards abstraction and generalization. As each lifespan stage has its own unique developmental characteristics, age as an intracultural factor was found to be a powerful predictor of a user's ability to learn complex computer systems (Egan, 1988:543). It is therefore important to take the age group of expected users into account when designing user interfaces.

Race, being based on the anthropological concept used to classify people according to physical characteristics such as skin and eye colour, provides no culturally relevant information, and can consequently not be considered as an influencing factor.

Owing to the subjective nature of cultural factors, complex test instruments are needed to determine the influence of each factor and even if a factor is found to be an important one, the finding does not necessarily apply to all users of a particular system. Few, if any, studies address the problem of interface design for a wide cultural mix. Existing guidelines mostly assume a specific cultural group as the target and base the design upon this assumption.

As it is important for all users to be able to use simple interfaces like those used for automated banking, the first step was to determine if any significant differences exist between the response times recorded by users from different cultural groups when using a simple text-based interface. Using a simulated interface on a microcomputer network, the time to complete a simple questionnaire in English was measured for a sample of 277 Cape Technikon students representing eight cultural groups and six languages. The students

selected have all been exposed to computers for six months and were at a similar academic level. A marked degree of intergroup difference was found between the response times of users from the different cultural groups.

In a real-life study 2750 students were tested during the annual registration of students at the University of Stellenbosch. Medical, engineering and commercial students were tested for the time they took to complete the interactive registration process. All students were in their second or higher academic year. No significant intercultural differences were found, despite the more complex nature of the registration system.

At the time of testing, the technology to test graphic interfaces was not available, but future tests on this type of interface are expected to show much more cultural differentiation. As symbols may be a way of overcoming low levels of literacy, where even people who cannot read can recognize a graphical image, future research must be aimed at the determination of problem areas in symbol-based interfaces when used by multicultural communities with low literacy levels and little previous exposure to computers.

OPSOMMING

Hierdie navorsing bespreek sommige van die kulturele aspekte wat die mens-rekenaar interaksie in 'n multikulturele gemeenskap kan beinvloed. Die bevindinge van navorsing om die verskille in rekenaargebruik veroorsaak deur kultuurverskille te bepaal wanneer rekenaarkoppelvlakke in gesimuleerde en bedryfsomgewings gebruik word, word ook bespreek.

Verskeie kulturele aspekte kan moontlik die effektiwiteit van die gebruikerskoppelvlak in 'n multikulturele gemeenskap beïnvloed. Taal is 'n belangrike faktor en studies het getoon dat eenvoudige vertaling produktiwiteit verhoog (Bodley, 1993:23). Alle tale bevat egter nie die nodige tegniese woordeskat nie. Moeders van 'n laer sosiale klas gebruik tipies 'n beperkte taalkode wanneer hulle met hul kinders kommunikeer (Mussen et al, 1984:206). Aangesien dit neig om die kinders meer in konkrete en minder in konseptuele terme te laat dink, kan dit die mens-rekenaar interaksie beïnvloed, veral waar 'n hoë mate van abstraksie gebruik word soos in grafiese koppelvlakke.

Simbolisme is problematies aangesien simbole soos gloeilampe, herwinningsdromme en videomasjienkontroles nie voorkom in die lewe van gebruikers wat in plakker en agterlike landelike omgewings bly nie. Gebrek aan blootstelling aan tegnologie kan gebruikershouding negatief beinvloed (Downton, 1991:25) met 'n gevolglike inhibisie van leer en werkverrigting. 'n Eksterne lokus van beheer is algemeen onder agtergeblewe groepe as gevolg van die hoë mate van verwerping, vyandige beheer en kritiek wat hulle ervaar. Aangesien die gevoel van van nie in beheer wees nie grootliks geassosieer word met die neiging om stresvolle situasies te vermy, mag gebruikers uit hierdie groepe verkies om situasies te vermy aar hulle nie in beheer voel nie. Die sterk differensiasie tussen die

geslagsrolle in sekere kulture kan ook die interaksie met die rekenaar beinvloed (Downton, 1991:10) aangesien dit reeds bevind is dat die verskillende benaderings tot probleemoplossing 'n belangrike invloed op rekenaargebruik kan hê.

Die intrakulturele faktore van sosiale klas speel 'n betekenisvolle rol in die bepaling van hoe 'n persoon optree en dink (Baruth & Manning, 1991:9-10). Sulke verskille kan soms meer uitgesproke wees as die wat voortspruit uit kulturele diversiteit en kan die benadering van die gebruiker tot abstraksies en veralgemenings beinvloed. Aangesien elke stadium van die lewensverloop sy eie unieke ontwikkelingseienskappe het, is ouderdom as 'n intrakulturele faktor 'n kragtige voorspeller van 'n gebruiker se vermoë om komplekse rekenaarstelsels aan te leer, bevind (Egan, 1988:543). Dit is daarom belangrik om die ouderdomsgroep van die verwagte gebruikers in ag te neem wanneer gebruikerskoppelvlakke ontwerp word.

Ras, gebasseer op die antropologiese beginsel wat gebruik word om mense volgens fisiese eienskappe soos velkl en oogkleur te klassifiseer, verskaf geen kultureel relevante inligting nie en kan gevolglik nie beskou word as 'n faktor met enige invloed nie.

As gevolg van die subjektiewe aard van kulturele faktore, is komplekse toetsapparaat nodig om die invloed van elke faktor te bepaal en selfs al word 'n faktor as belangrik bevind, dan is dit nie noodwendig van toepassing op alle gebruikers van 'n bepaalde stelsel nie. Min, indien enige, studies spreek die probleem van koppelvlakontwerp vir 'n wye verskeidenheid gebruikers aan. Bestaande riglyne aanvaar meestal 'n spesifieke kulturele groep as die teiken en basseer die ontwerp dan op hierdie aanname.

Aangesien dit belangrik is vir alle gebruikers om in staat te wees om eenvoudige koppelvlakke soos die wat gebruik word vir bankoutomate te gebruik, was die eerste stap om te bepaal of enige betekenisvolle verskille bestaan tussen die reaksietye aangeteken deur gebruikers van verskillende kultuurgroepe wanneer 'n eenvoudige teksgebasseerde

koppelvlak gebruik word. Deur 'n gesimuleerde koppelvak op 'n mikrorekenaarnetwerk te gebruik is die tyd om 'n eenvoudige vraelys in Engels te voltooi bepaal vir 'n monster van 277 studende van die Kaapse Technikon, wat agt kulturele groepe en ses tale verteenwoordig. Die gekose studente was almal vir ses maande blootgestel aan rekenaars en was op 'n vergelykbare akademiese vlak. 'n Opmerklike graad van intergroepverskille is gevind tussen die reaksietye van gebruikers afkomstig uit verskillende kultuurgroepe.

In 'n studie van 'n werklike stelsel is 2750 studente getoets gedurende die jaarlikse registrasie van studente aan die Universiteit van Stellenbosch. Mediese, Ingenieurs en handelstudente is getoets vir die tyd wat hulle geneem het om die interaktiewe registrasieproses te voltooi. Alle studente was in hul tweede of hoër akademiese jaar. Geen betekenisvolle interkulturele verskille is gevind nie, ten spyte van die meer komplekse aard van die registrasiestelsel.

Tydens die toetsing was die tegnologie nie beskikbaar om grafiese koppelvlakke te toets nie, maar dit word verwag dat toekomstige toetse van hierdie aard baie meer kulturele differensiasie sal toon. Aangesien simbole 'n manier kan wees om lae vlakke van geletterdheid te oorkom waar selfs mense wat nie kan lees nie 'n grafiese beeld kan herken, moet toekomstige navorsing daarop gemik wees om die probleme te bepaal by simboolgebasseerde koppelvlakke wanneer dit deur multikulturele gemeenskappe met lae geletterdheidsvlakke en min vorige blootstelling aan rekenaars gebruik word.

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Chapter 1

NATURE AND EXTENT OF STUDY

1.1 Introduction

This research is concerned with the usability of computer user interfaces (CUIs) in systems used by members of different cultures. Often no training can be given to the users of systems such as automated teller machines (ATMs) and other systems so that the usability of the User Interface becomes a critical factor in the success of such a system. The current moves towards electronic funds transfer, automated banking, computer aided instruction and other lesser known applications will expose more people from different backgrounds to computer technology. It is important for the acceptance of such systems that everyone can understand and use it successfully.

Oppenheim et al (1981:2) has shown that overhead projection significantly influenced the perception of information by meeting participants. This conclusion can be generalised to computer graphics as well, because images are projected on a screen much like ordinary overhead transparencies. It follows that the presentation of computerised information might influence the perceptions of users with different cultural backgrounds.

According to Booch (1994:382) it is highly desirable to allow a variety of user interfaces for computer systems to compensate for the different backgrounds of users and to allow for the likelihood that the system will change over time. Falling hardware costs and improvements in graphic user interfaces have made this a practical possibility. Sommerville (1992:263) points out that the user interface should use terms familiar to the user, and that objects manipulated by the system should have direct analogues to the user's environment.

Multicultural users are defined in this research as users with differences in customs, beliefs, activities and communication patterns including language.

Very little empirical research has been done in this field owing to the great difficulties in collecting comparative data from various cultures. This fact is illustrated by the fact that the majority of CUIs are available only in English though language is probably the most obvious difference between cultures. A recent study by Bodley (1993:23) has proved that by simply translating a user interface into Xhosa, system acceptance is improved and errors are reduced. The reduction in error rates also more than justified the cost of creating the improved interface.

South African business are under great pressure to increase productivity. To achieve this the use of computers is a necessity. Most South African companies employ personnel from different cultural groupings which immediately creates problems since all employees cannot interact effectively with the computer systems if the user interfaces cater for one group only.

1.2 Problem Statement

In a society with mixed cultural backgrounds, poorly designed CUIs can lead to low productivity and high error rates due to a lack of understanding (Bodley, 1993:22). For settings such as automated bank tellers where people only interact briefly and occasionally with the system, lengthy training sessions are impractical and tailoring interactions to what an individual user knows may not be practical. The design of user interfaces to minimise variation in user performance is therefore particularly important for settings where the people who use the system will remain "permanent casual users". The process of re-designing interfaces to accommodate a wide range of users involves three steps (Egan,

1988:559). The first step is to determine user differences to find out which user characteristics predict differences in overall performance. The next step is to isolate the source of variation in a particular task. The final step is to redesign the interface to accommodate the differences among users.

It follows that in a complex society like that of South Africa, it would be advantageous to have a set of guidelines to lead the interface designer attempting to accommodate user differences. The determination of the sources and nature of variation is not an easy task in a multicultural society. Owing to high variation in user characteristics caused by the different cultural backgrounds and the difficulty in finding the right user samples, few studies produced results that can be applied in practice. Egan (1988:543) states the following:

> " When behavioural scientists raise concerns about user capabilities, even they often have little to say about designing for differences among users. Their silence might be traced to a lack of experience with heterogeneous samples of users. Behavioural scientists usually select narrowly defined user samples to minimise experimental error when comparing the mean performance of different systems. Those behavioural studies that have analysed differences among users have often produced descriptive results rather than prescriptions for interface design."

1.3 Objectives of the study

The skills that the user might bring to interface use include: the application of prior knowledge to understand an unfamiliar situation; the linguistic comprehension and expression of ideas; the use of abstract representations of objects for understanding and predicting events, and the solution of complex problems using reasoning skills (Lansdale & Ormerod, 1994:12) . It can be assumed that the experiences of users from different cultural backgrounds will vary considerably and therefore a difference in the underlying knowledge

is to be expected. The usage of graphical displays to represent the important aspects of real-world systems is increasingly common. As the perceived meaning of an icon depends upon the context in which it appears, and the background, knowledge and interests of the viewer (Baecker et al, 1995:415), it can be assumed that the cultural background of the user will influence understanding of the interface.

The hypothesis following from this is that there are significant differences in interface usage by users from different cultural backgrounds.

The objective of this study therefore was to determine empirically if there are significant differences in computer interface usage by users from different cultural backgrounds.

1.4 Benefits of study

The findings of this study will be of use in the design of most computer interfaces. The most obvious value will be for systems used by a variety users where the possibility of prior training is limited. Typical systems would include automated bank tellers, the Internet, computer-based training and systems for the psychometric testing of students. The findings would also be of value for the development of general business systems, used by a variety of non-expert users.

1.5 Research Methodology

The study contains both a descriptive and an empirical component. A literature study was conducted to gain an insight into cultural differences and what influences the cultural differences might have on computer usage. The literature study also covers the usability of user interfaces and general interface concepts.

The empirical part of the study consists of a simulation of an interface that was tested on a number of users under laboratory conditions, and a real-life study where a large number of users were tested while completing a task as part of their normal routine. In the case of the simulation study, demographic details were collected by a computer-based questionnaire. For the real-life study this information was obtained from a linked database with user information. In both instances the time to complete the specific tasks were measured. The data collected was automatically stored in computer files for later analysis by a statistical package.

1.6 Limitations of Study

Owing to the relative difficulty in finding a large enough sample of people with different cultural backgrounds, students from the Cape Technikon will be used for the empirical study. The true profile of all sectors of the population at large will therefore not be reflected in the study. Age differences will also not be reflected. This is a shortcoming of the study as Egan (1988:559) has found age to be strongly correlated to performance. It could however be reasoned that students have a very high potential for computer use later in their

lives and therefore represent an important part of the population. The relative limited age range also helps to level out differences in experience due to age.

It is also not the intention of the literature study to give an exhaustive discussion of the concept of culture, but only to try to indicate points of contact that could influence the human computer encounter.

Chapter 2

CULTURE AND ITS IMPACT

2.1 Introduction

Culture is concerned with the way that people live. Samovar et al (1981:24-25) define culture as follows:

> 'Culture manifests itself in patterns of language and in forms of activity and behavior that acts as models for both the common adaptive acts and the styles of communication that enable us to live in a society within a given geographic environment at a given state of technical development at a particular moment in time. It also specifies and is defined by the nature of material things that play an essential role in common life. Such things as houses, instruments and machines used in industry and agriculture, forms of transportation, and instruments of war provide a material foundation for social life.'

The participants in a communication process thus bring with them differing backgrounds that have been instilled in them by the cultures of which they form a part. In a multicultural society like South Africa these backgrounds are vastly different.

Within a particular culture, there are identifiable subcultures. A subculture can be defined as a racial, ethnic, economic, social or regional community which exhibits characteristic patterns of behaviour that are sufficient to distinguish it from others within an embracing macroculture (Porter & Samovar, 1988:20).

The South African society is a complex one. Under the previous government, constitutionally and juridically, the population was divided into four categories or cultures:

Asians, Blacks, Coloureds and Whites. The Black culture could be divided into subcultures such as Xhosa, Sotho, Zulu. Similar subcultures exist for the other groups. Subcultures could also have subgroups, for example rural workers, urban workers, Moslems and gang cultures.

A further subdivision that must be considered is intracultural or individual differences. It would for instance be wrong to assume that all people with a particular skin colour share the same cultural characteristics. Intracultural differences might include users' educational backgrounds, socio-economic status, acculturation, age, and their urban and rural backgrounds (Baruth & Manning, 1991:7).

Cultures and subcultures can overlap to the point where it could be difficult to decide whether to regard a specific culture as a macroculture or subculture. What is important here is that these various cultures each have their own beliefs, customs and communication patterns that can have an effect on interpersonal, cross-cultural communication.

2.2 GROUP CHARACTERISTICS

Group characteristics are those aspects of culture that apply to groups of people. Aspects such as styles of communication, thinking styles, general locus of control, language and symbols usually affect all individuals in the group.

2.2.1 Communication

Any behaviour to which meaning is given is a message, but for behaviour to be perceived as a message it must be observed by someone, and it must elicit meaning. The meanings and interpretations of these messages depend on how the participants perceive the messages, and this perception is dependent on the participants' cultural backgrounds that provide the framework within which messages are encoded and decoded. Culture therefore plays an important role in communication (Porter & Samovar, 1988:20). The output from a computer can be seen as the behaviour of one participant in a communication process and could elicit perceptions related to the cultural background of the other party. It is therefore important to look at the issues that give shape to the cultural background of the computer user.

Gelatt (1989:252) says that there is no such thing as information without the presence of subjectivity, as most information is changed by the process of sending or receiving it. The sender or the receiver of information is very likely to modify it. In human-computer interaction, this modification only takes place at the human end of the process.

2.2.2 Symbolism

Non-verbal language forms a very important part of communication (Baruth & Manning, 1991:165). Cultures could be seen as systems of shared symbols and meanings. Culture is communicated by symbols that give expression to the specific way in which a particular community sees and understands the world. Erasmus and De Wit define a symbol as a

sensory perceivable sign applied psychologically or mentally by a person to represent an abstract idea or a less perceivable object. As non-verbal behaviour patterns are distinctly different from culture to culture, it follows that screen displays, especially when of a symbolic nature, could be interpreted in many different ways by users of different cultures (Erasmus & de Wit, 1995:38).

The use of icons constitutes an important aspect of computer interfaces, because the graphical representation allows abstract entities to be displayed as "real" objects that can be manipulated by the user. Whereas it is easy to display objects that are visual by nature, such as text or graphic objects, abstract objects, like files or functions like "Copy" or "Delete", are more difficult to portray because there are no universally familiar symbols that correspond to the meaning of the concept.

This may lead to the use of metaphors which map the objects from the interface onto a visual world that is familiar to the user (Ziegler & Fähnrich, 1988:123).

Icons can be classified by their form, type and colour. The form of an icon can portray certain characteristics of the object or suggest some cognitive characteristics of the task. Colour connotations vary strongly among different kinds of users, especially from different cultures (Marcus, 1995:429). The use of colour therefore requires a careful study of the background of users of the system.

Man's background, history and knowledge are embodied in his cognitive schemata and his capacity for metaphorical thinking, and an appropriate choice of pictorial representation can facilitate his understanding of images and his problem-solving ability. The appropriate choice of visual representation is thus a key determinant of the success of a user interface.

2.2.3 Language

The most important function of language is communication. Effective communication requires not only knowledge of the rules of grammar (syntax) and the meanings of words (semantics) but also the ability to use it in the right social context (pragmatics). It was found that the different types of speech used by mothers from different social-class groups have an effect on the linguistic ability of their children. Lower-class mothers typically use a limited code while middle-class mothers use an elaborated code when communicating with their children. The more complex codes could enable older children to be more oriented towards abstractions and generalisation. Lower-class children might think in more concrete and less conceptual terms (Mussen et al, 1984:206). This intracultural difference between users can therefore be expected to have an influence on human-computer interaction, particularly where a high degree of abstraction is used which is more often than not the case in graphical interfaces.

Cultural differences reflected in vocabulary must also be considered. The importance of speaking the user's language is most clear for software that will be used by someone from a completely different language group, but even among English speakers, different people have quite different vocabularies. As the vocabulary of the interface designer is often quite different from the users, care must be taken to prevent a situation where the user cannot understand the interface properly (Siegel, 1991:53).

2.2.4 Locus of control

Locus of control refers to a person's beliefs about control over life events. People who feel personally responsible for the things that happen to them are said to have an internal locus

of control while others who feel that their lives are determined by forces beyond their control are classified as having an external locus of control.

Locus of control can influence the individual's encounter with the computer. It has been found in the United States that certain disadvantaged groups and racial minorities face academic difficulties that are made worse by locus of control factors. An external locus of control is common among these groups due to the high degree of rejection, hostile control and criticism they experience (Baron & Byrne, 1987:515). It may be hypothesized that a user from a cultural group with an external locus of control might have difficulties when using a computer for the first time, due to a fear of failure and rejection.

Users have perceptions of their own ability to execute tasks and also an estimation of the risks and costs of mistakes, which in turn affects their self-esteem and confidence. The sense of being out of control is largely associated with the inclination to avoid such stressful situations. Some potential users may avoid computer systems to avert this stress. Users who do not feel in control of a system are also less likely to learn (Lansdale & Ormerod, 1994:242-248).

It might be argued that a person with an internal locus of control may perceive himself to have more control over the computer and therefore be more willing to experiment. As the most common and most natural way of acquiring computer skills is to turn the machine on and try things (Lansdale & Ormerod, 1994:242-248), experimentation is important as it has been shown that experience is correlated to the effectiveness of the learning process (Baecker et al, 1995:700).

2.3 INDIVIDUAL CHARACTERISTICS

As most episodes of human-computer interaction take place on the level of the individual it is necessary to obtain an understanding of the individual's culture and how the individual relates to his culture. One may assume that a user shares cultural characteristics with other users from the same cultural group, but intracultural or individual differences must also be recognised in interface design. Egan (1988:543) has found that individual differences could account for performance differences in the order of 20:1 for certain computer based tasks.

The main elements of the individual's cultural identity are ethnicity, social class, gender and generational or lifespan differences. Race, however, is based on the anthropological concept used to classify people according to physical characteristics such as skin and eye colour. Cultural groups seldom correspond with racial categories, at least not to the extent necessary to provide information that is culturally relevant. A person's race does for example not reveal his nationality, language or religion (Baruth & Manning, 1991:8). As the physical aspects of computer users fall outside the scope of this study, race will therefore not be considered as an influencing factor. Each user simultaneously has an ethnic identity, a socio-economic class identity, and a gender identity (Baruth & Manning, 1991:7-10).

2.3.1 Ethnicity

Ethnicity refers to group values, beliefs, behaviours, language, culture and ways of thinking (Baruth & Manning, 1991:8). The difference in values and thinking styles between groups

affects what one person finds valuable in an interface and what others do not even notice (Kim, 1995:305).

2.3.2 Social Class

Social class differences play a significant role in determining how a person acts, thinks and relates to others. Such differences may sometimes be more pronounced than those resulting from cultural diversity (Baruth & Manning, 1991:9).

The restricted language code used by mothers from lower classes when talking to their children, might impair the orientation of the child towards abstraction and generalizations (Mussen et al, 1984:206), two important aspects of computer usage.

It can be argued that users from a lower social class might have less experience of technology due to lack of the financial means to acquire such technology. Computers are therefore more likely to be available to affluent users than to poor ones. As experience makes a difference in interface usage (Baecker et al, 1995:575), this will negatively influence the performance of the user from a disadvantaged background.

2.3.3 Gender

The typical organization of the workplace has caused women to play a lesser role in the adoption of computerization. In 1993 less than 30% of American computer workers were women. Even the dramatic improvement in office technologies has not evened out the difference in experience between genders as female computer users are more likely to be

clerks or typists doing simple repetitive work such as payroll, word-processing or airline reservations (Kling, 1995:259).

According to Baruth & Manning (1991:10) males and females also show unique orientations towards problem solving and different behaviour patterns between sexes can have an influence on human-computer dialogue (Downton, 1991:46).

2.3.4 Age

When the age of adult users varies and experiential variables are controlled, age was found a powerful predictor of how difficult users will find it to learn a complex computer system (Egan, 1988:543). A possible cause for this finding is that users differ with respect to their lifespan stage. Each lifespan stage has its unique developmental characteristics that are often closely intertwined with the cultural characteristics of the user (Baruth & Manning, 1991:11).

An example of such a generational difference is the ability to speak the English language. Older generations might have lived in cultures with others speaking native languages, while younger generations who can communicate effectively in English are better able to cope with the use of computers in a predominantly English society.

2.3.5 Paradigms

A paradigm is a set of rules and regulations that establishes boundaries and tells you how to behave inside those boundaries. Each person has his personal paradigms that help to determine his territory and what to do there. Personal paradigms are learned from our

culture, community and experiences. People born into different cultures, living in different communities and having different experiences, will develop different personal paradigms which produce a different set of rules, establish different boundaries and teach them different ways of behaving. The process of paradigm development works well until change sets in. The individual seeking some personal stability may develop paradigm paralysis when he or she becomes incapable of seeing that things are no longer the way they used to be (Gelatt, 1993:9-13). The introduction of computers into the individual's environment always means change and the individual way of handling this change could affect the interaction with the computer. The initial response is often of a negative nature. If the user interface could represent something that is familiar to the user, the negativity of this response might be lessened.

2.3.6 Intelligence

Intelligence is the capacity to learn and to adapt to the requirements for survival in one's culture. In modern Western societies, the ability to use language and mathematical symbols is valued and skill in these areas is used to define intelligence. This is not necessarily a good indication of innate potential for all people, and social-class differences have been found in intelligence. These differences can best be interpreted as showing differences in types of cognitive abilities rather than deficits in cognitive functioning (Mussen et al, 1984:299). Whatever the reasons for these differences, they exist and can influence the individual's encounter with the computer.

2.3.7 Motivation

Motivation to achieve affects the individual's effort and performance. Achievement motivation is manifested in achievement behavior, such as task persistence and attempts to master new challenges. Of the more important factors that influence achievement motivation are expectancies of success and attributions about the reasons for success and failure. Expectancies are at least partly based on attributions about the reasons for past successes or failures. A person with an external locus of control, who does not feel in control of the computer, might for instance experience anxiety that increases the difficulty of learning (Downton, 1991:25), and the lessened expectancies of success will reduce the motivation to use the computer.

2.3.8 Attitude

Attitudes can be defined as lasting, general evaluations of people, objects or issues. Very definite cultural differences in attitude are found as might be seen in, for example, the attitude of American schoolchildren about the Russian government or the role of the woman in certain societies. Attitude has three components: affect, behaviour and cognition. The affect component refers to positive and negative emotions. The behaviour component involves our intentions to act in certain ways that are relevant to our attitudes. The cognition component refers to the thinking and interpreting that goes into forming or using an attitude (Baron & Byrne, 1987:116).

Attitudes are formed by learning during socialization with other people or because of personal experience. The attitude of other people in the user's environment as well as

previous exposure to technology (or the lack thereof), might therefore influence the attitude of the user. Studies of user attitude have shown that a negative attitude towards a system can inhibit both learning and performance (Downton, 1991:25).

The first-time user needs to be persuaded to use the computer. The evaluation of the source of the communication is one of the most critical factors in the success of a persuasion attempt. More attitude changes are likely if the source is viewed as credible, trustworthy and is generally liked by the target (Freedman et al, 1981:401). It follows that an interface (as source of communication) that is liked and understood by the user will help to change the attitude of the first- time user.

Chapter 3

INTERFACES

3.1 USABILITY

Usability is a concept for describing the quality of a user interface (Redmond-Pyle,1995:3). It is a combination of many factors, each of which is often developed independently. Factors such as system performance, support and ease of maintenance are important, but of these only the interaction between the user and the machine falls within the scope of this research.

Software usability has enormous commercial significance. If we can increase the usability, then staff productivity can increase (Redmond-Pyle, 1995:5). A well-designed interface reduces the scope for errors with a corresponding increase in work quality. Interfaces that are easy to learn reduce training time and costs, and enable staff to learn how to use several systems so that they can be moved around between tasks more easily. Staff attitude towards the system is also important as people will tend to avoid using the system if they do not like it, thus undermining the benefits the system was intended to bring.

According to Mynatt (1990:97) the following are five factors that relate to user interface quality:

- Ease of learning. How long it takes the user to learn enough to begin using the system successfully.

- Speed of use. How long it takes to carry out specific tasks.
- Frequency of user errors. How frequently the user makes mistakes in carrying out specified tasks.
- User satisfaction. The user's attitude towards a system. How well the user likes the system.
- Knowledge retention. How easy it is to remember how to use the system after some interval.

The ideal interface would rate highly in all these categories, but that is not always possible. Low error rates may sometimes only be obtainable through reduced performance or longer learning times. In another case, some user satisfaction may have to be sacrificed for speed.

3.2 USABILITY TESTING

To verify the performance of a user interface against specified user requirements the interface must be tested. Most usability testing is based on the use of prototypes to capture data about the system and user performance. For the outcome of such trials to have validity, it is important that the users tested represent the intended user population and that the tasks they must do are realistic and are treated realistically by the users. Lansdale and Ormerod (1994:242-248) identifies throughput, execution time, accuracy, errors, subjective measures and memory load as discrete measures that can be used as measures of performance. Observation, commentary spoken by the subject, video recording and debriefing can also be used as performance measures, but are more difficult to analyse (Downton, 1991:333).

The performance of the user interface depends equally upon the performance of the computer and of the person. This means that the user must also be evaluated. A variety of user characteristics such as experience, training, education, motivation and technical aptitude can affect interface performance (Downton, 1991:329). Determining the appropriate mix of user characteristics that should be present in the population used for testing is a difficult task with the effect that simplified procedures are often used for practical reasons. Possible objective measures of interface performance are throughput, execution time, accuracy and errors (Downton, 1991:329).

3.2.1 Throughput

Throughput measures productivity. It might test the number of pages read, menus navigated, problems solved or forms completed. Throughput measures are normally used for the comparison of two interfaces that support the same task.

3.2.2 Execution Time

Execution time measures the time taken to complete a specific task. It is usually assumed that longer times reflect poorer design. Although time differences might be small and difficult to measure, it is an important aspect of usability, as a great deal of time and frustration can be saved where the interface is used by a large number of users.

3.2.3 Accuracy

Accuracy refers to performance where the precision, rather than the correctness of inputs, is important. Inaccuracies do not necessarily invalidate the input, but reduce its quality. An example is a drawing package where the user is not able to draw the lines accurately.

3.2.4 Errors

An error is where the action of the user can be classified as either correct or incorrect. This form of measurement is used to indicate interface problems due to a mismatch of interface design and the user's psychological processes.

3.2.5 Subjective Measures

The assessment of a user's subjective responses might be used to determine attitudes to a system, preferences for alternatives and estimations of ease of use. It is normally measured using rating scales or questionnaires. There are two problems with subjective measurements. Questions can be open to biased interpretation and the responses can be misleading, for example what the subject likes is not ultimately the best design for the interface. Users might also be influenced by the novelty of a new type of interface, or where an interface initially appears hard to use.

3.2.6 Memory Load

Difficulties in interface use occur when the user is expected to remember more than what is reasonable. Memory overload can occur when the user is expected to hold too much data in mind. It can also be caused by the complexity of the task that the user must carry out. By grouping information in meaningful units, this overload can be reduced (Lansdale & Ormerod, 1994:246).

Memory load is difficult to measure as errors due to memory failure are not easy to distinguish from other causes. There are also no clear guidelines about when memory problems can be expected as the amount that people can be expected to remember depends on what they already know. This makes it difficult to apply formal measurement techniques to evaluate memory load.

3.3 ENVIRONMENTAL CHARACTERISTICS

The environmental characteristics impacting on usability comprise socio-political and physical factors.

3.3.1 Socio/Political Factors

The socio-political environment of the interface could lead to usability problems. A systems functions within a socio-political or organizational context, and if it does not fulfil its role and expectations within this environment, it could fail. As this study looks at user interfaces in

general and not within a specific socio-political environment, the study of its effect is excluded from this research.

3.3.2 Physical Environmental Factors

The physical environment in which the interaction with the interface takes place has a strong influence on the quality of the process. Influencing factors include display quality, lighting, noise, air quality, the suitability of furniture and user comfort (Bodley, 1993:15).

As the physical environmental factors apply to all groups of users and cannot usually be changed to suit the preferences of certain groups, it is unlikely to play a significant role in intergroup differences.

3.4 COMPUTER USER INTERFACE CONCEPTS

The user interface can be seen as a surface through which data is passed back and forth between the user and computer. Physical aspects of the user interface include display devices, audio devices and input devices such as mouse or keyboard. Data displayed on the work station provides a basis for interaction and gives cues for action by the user. The user formulates a response and takes action. Data then passes back to the computer through the interface.

The quality of the interface, from the user's perspective, depends on what the user sees, what the user must know to understand it, and what actions the user must take to obtain the needed results (Turban, 1993:224). The process of interaction is controlled by the software

being executed on the computer. According to Sprague and McNurlin (1993:456) much of the usability of a computer system is derived from the capabilities of the user interface. To a large extent the usability characteristics of the interface are consequently determined by the software. According to Turban (1993:224) the dialogue between the user and the computer consists of the following components :

- The action language: What the user can do in communicating with the system. It includes such options as the availability of a regular keyboard, function keys, touch panels, etc.

- Knowledge: Knowledge is the information the user must know. The knowledge may be in the user's head, on a reference card, in a user manual or series of "help" messages available upon request.

- User's reaction: The user interprets the display, processes the content, and plans an action.

- Presentation language: The information displayed to the user. It can be shown as display menus, windows, or text. It can be static or dynamic, numeric or symbolic. It can appear on the screen as graphics or text or sound or print.

- Computer: The computer interprets the user's action (input), executes a task and generates a display that acts as the presentation language.

- Dialogue: Dialogue is an observable series of interchanges or interactions between the human and the computer. Dialogue styles determine what the computer system requires as an input and what is provided as outputs.

- User interface: This is the hardware and software that enables a dialogue.

3.5 INTERFACE STYLES

The style of the user interface determines how the system is directed, what it requires as input, and what is provided as outputs. Turban (1993:225) distinguishes six computer user interface styles: Menu Interaction, Command Language, Question and Answer, Form fill-in, Natural Language and Object Manipulation. Multiple Interfaces and Customizable Interfaces are further styles that can be added to this list.

3.5.1 Menu Interaction

The user selects from a list of possible choices the one he or she wants to perform. Menus appear in logical order, starting with a main menu and going on to submenus. The most widely used technique is the hierarchical tree that allows for a relatively small number of options in each menu with few levels. It has been shown that the ideal number of items per menu frame is between four and twelve. This minimizes search time and does not slow down navigation in large menu systems (Downton, 1991:84).

Three selection methods are commonly used for menu selection. An item can be selected by typing the number of the item, or by typing an abbreviation for the item or by pointing at the item, using cursor keys, a mouse, a touch screen or any other pointing device.

The organization of menus in a multiple-menu system is the single factor that has the greatest influence over the user's perception of the interface, since the organization determines the underlying dialogue. Experimental evidence shows that the organization should be in accordance with the user's model of the task as meaningful structures, rather than random structures, reduce error rates and access times (Downton, 1991:85).

If the items on a menu are meaningful to the user then the use of menus can be a rapid and accurate approach. If the items on the menu are hard to understand or appear similar to each other, users can become confused and make errors. Menus decompose a complex situation into a series of smaller steps that eases the user's comprehension of the system. This decomposition process may also be too rigid for advanced users and slow them down. If the system is very rigid and a user decides to change something on a previous menu, it means that the user has to work through all the menus again to make the change (Schneiderman, 1995:402).

3.5.2 Command Language

Command language interfaces require the user to enter a command or command string of syntactically correct words without prompts or help from the system. Most of the advantages of command languages are only true for expert users. For the expert user it offers flexibility and support for initiative. It also allows for the rapid completion of tasks and the automation of repetitive tasks by using macros (Schneiderman, 1995:401).

Command languages have little to offer the novice user, as they require substantial training and regular use to maintain proficiency. The user must also be able to memorize commands. The flexible nature of the input makes the variety of possible errors much

larger than for menu or form-filling style interfaces with a corresponding difficulty in providing meaningful error messages (Downton, 1991:94).

3.5.3 Question and Answer

This mode begins with the computer asking the user a question. The user answers with a phrase or sentence (or by selecting an item from a menu). The computer may then prompt the user for additional input. This dialogue style is mainly used by expert systems where the process is reversed with the user asking the questions and the computer supplying the answers. Menus may be used for the selection of answers (Turban, 1993:226).

3.5.4 Form Fill-in

The user enters data or commands into designated spaces in forms. The field headings serve as a prompt for the input. The computer may then produce some results based on the input or request the user to continue with a further form (Turban, 1993:226).

As this interface style simplifies data entry, little training is needed. All the data in a record is simultaneously visible, giving the user a feeling of control over the interaction with the computer (Downton, 1991:87). The control that the user has over data entry, makes it important to check the data that was entered. This is especially important for novice users. A certain degree of typing skill is also required (Schneiderman, 1995:401)

3.5.5 Natural Language

The ideal user interface would enable the user to communicate with the computer in a language similar to that used in to human-human dialogue. The computer, however cannot simply be equated with a human being as the computer's interpretation of the communication, unlike human communication, is still bound by strict syntactical rules (Downton, 1991:95 ; Schneiderman, 1995:405). No widely used interface of this kind is currently available.

3.5.6 Object Manipulation

Also known as direct manipulation, the user is presented with some kind of direct representation of the task at hand. Objects, usually represented as icons or symbols, are directly manipulated by the user to get the required result. The user points the cursor or mouse at an icon and uses a command to move it, enlarge it or execute the program behind it. The primary advantage of using a metaphor to represent the actual function is that operations and commands can readily be suggested by the computer representation of its real-life equivalent (Schneiderman, 1995:401).

Interfaces of this kind require reduced training and are easily remembered. Direct manipulation also encourages exploration and is visually appealing to the user (Downton, 1991:101). This type of interface requires complex software and high-performance hardware.

3.5.7 Multiple Interfaces

One obvious solution to the problem of having to cater for the needs of many different types of users is to provide an interface for each type of user. A recent trend is to separate the construction of the interface from that of the rest of the system. This makes it possible to provide multiple interfaces for a single application. A variation of this interface style is to provide different modes for different levels of user (Siegel, 1991:88). A menu style interface could for instance be used for novice users, while expert users may use command language.

3.5.8 Customizable Interfaces

A customizable interface can be changed by the user. The user may change menu item names or add new items and function keys to invoke some existing command or create new commands. The primary advantage of an interface that allows customization is that users with different vocabularies can coexist because names and messages can be adapted to the particular user's vocabulary (Siegel, 1991:89). User interfaces vary widely in their customizability, but even if an interface is not highly cu' tomizable, the capacity for small adaptations to suit the individual user will contribute towards user satisfaction.

Chapter

4

COLLECTION AND ANALYSIS OF DATA

4.1 EXPERIMENTAL METHODOLOGY

In true experiments, subjects are randomly chosen or randomly assigned to experimental conditions so that comparison groups are equivalent. The experimental conditions differ only with regard to the levels of one or more independent variables, therefore any difference between the groups' performances on the dependent variables can be attributed to a difference in the independent variable.

A correlational study is characterized by less control by the researcher over the independent variable. In some studies groups may be compared, but the independent variable may be a subject variable over which the researcher has no control. For example, males and females may be compared in a study, but clearly the groups do not begin the study as equivalent.

The distinction between a true experiment and a correlational study is not always clear. In many situations, a researcher may be studying a variable th at cannot be manipulated, such as age or gender, but the researcher adds considerable control to the testing environment. These cases resemble true experiments in the amount of control that is used, but they do not involve random assignment of the subjects to the conditions. Such designs lie halfway between a true experiment and a correlational study and are called quasi-experimental designs.

Quasi-experimental designs are conducted when true experiments cannot be carried out, such as in applied settings where, for ethical or practical reasons, subjects cannot be randomly assigned to experimental conditions. With this type of design, causal statements may only be made with caution after efforts have been made to account for all the rival hypotheses (Schweigert, 1994:304).

The main objective of this study was to determine any differences in response times between computer users from different cultures when using a simple computer user interface. As it is not possible to exert any control over a person's cultural group, this study clearly cannot use a true experimental design. It is however possible to control the testing environment to a considerable degree and therefore a quasi-experimental design can be used.

4.2 SUBJECT SELECTION

As previous exposure to computer technology and also literacy plays an extremely important role in the encounter with a computer user interface, a test population with comparable characteristics had to be found. The test population also had to contain sufficient numbers of individuals from each cultural background.

Various methods of data collection were considered. Few opportunities exist for the interactive testing of a multitude of users from different cultural backgrounds, with interactive banking systems virtually the only type of system with a wide enough variety of users for this kind of study. Problems with confidentiality and the accurate determination of the user's cultural group and previous exposure to the system made the use of this option impractical.

The only other available option was to use students in an educational environment. Students are by no means representative of the general population as a much lower level of education can be expected in the general public. It would be senseless to compare someone with hardly any schooling or exposure to computers with somebody of a much higher education as the lack of skills and exposure to technology will probably mask any cultural differences. Students also represents the sector of the population most likely to use computers for work purposes. The influence of age, which is a very important influencing factor, is also minimized as students are usually of a comparable age group. Tests can also be carried out under similar environmental conditions.

4.3 SIMULATION STUDY POPULATION

During the first phase of the study a number of students from the Cape Technikon were tested while using a simple text-based interface (See Appendix A). Only first year students, all with about six months exposure to computers, were used to minimise the influence of training. As a certain level of education is required for entrance to the Technikon, a comparable level of education can be assumed. As other studies have found significant individual differences in performance when complex tasks was performed (Egan, 1988:545), a simple task was chosen to minimise the influence of individual differences.

4.4 REAL-LIFE STUDY POPULATION

As the simplicity of a the simulated interface may have caused a lack of sensitivity, a further study was undertaken. During registration at the University of Stellenbosch, certain groups of students use an interactive system to register for the new academic year. As they receive no help or training, this system can be used to test for possible differences between the users, caused by cultural differences.

A total of 2590 students from the Medical, Engineering and Commerce faculties were tested. All students were in their second or higher year of study. Students used computer terminals placed at strategic positions on campus to register. A text-based interface was used to confirm demographic and personal details and to indicate the subjects the student wished to take during the year. The time taken to complete this process was registered along with free-form comments from the students about their opinion of the system.

4.5 COLLECTION PROCEDURES

The time to complete a specific task was chosen as the prin.ary parameter of performance. This is often used in formal experiments, since it is readily measured either manually or by the system itself as opposed to techniques such as observation and user satisfaction which contain a strong subjective element. (Downton, 1991:331). The task of completing a simple one-page questionnaire was used for the simulated experiment as this is not only a tool for performance measurement, but could also be used to obtain certain demographic information from the users. The task was kept short to prevent boredom on the side of the

respondents and to prevent learning of influencing the results. A respondent can also concentrate for the full duration of the task, thereby minimizing the effect of distractions and loss of attention.

The simulation was run on a microcomputer network and the student responses and times taken were automatically recorded in a central file. During tutorial laboratory sessions students were asked to complete the questionnaire before starting with their practical work for the day. It was felt that students might use more time than necessary to complete the task if there was no other work waiting.

For the real-life study, computer terminals linked to a central mainframe computer, were placed at strategic points on campus. Students could register at any convenient time before a specific cut-off date. Student responses were used to update the university's administrative database. Timing data were also stored along with the administrative data. A large number of students were tested to minimize the effect of differences in computer response times.

4.6 STATISTICAL PROCEDURES

Non parametric procedures are appropriate when the assumption of normality cannot be made for a small data set, or when a large data set is known to be from a non-normal population. Non-parametric procedures are generally based on ranks rather than actual data values. The KWIKSTAT statistical package used for the analysis of the data uses the Mann-Whitney procedure if two independent groups are being compared, and the Kruskal-Wallis procedure if three or more groups are being compared.

The hypotheses tested are:

H_0 : There is no difference in the medians of the groups.

H_a : There is a difference in the medians of the groups.

The Mann-Whitney and Kruskal-Wallis non-parametric procedures the ranks or order of the data for the analysis rather than the data values themselves. The Tukey Multiple Comparisons test is then used to determine which groups are significantly different from each other. A critical range is first calculated for this procedure and then each of the pairs of means is compared against the one critical range. A pair is declared different if the absolute difference in the sample means exceeds this critical range. As shown by Fig 4.1 the distribution of the times taken to complete the questionnaire used in the simulated study is skewed to the right.

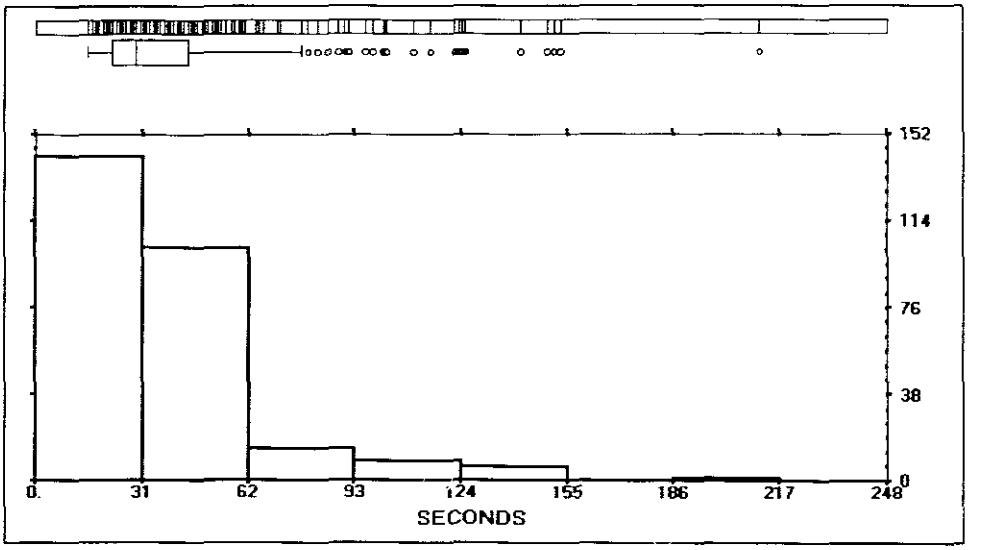

FIG. 4.1 *Time Distribution (simulation study)*

This is also confirmed by the Tukey five number summary:

Minimum	15
Q1	22
Median	29
Q3	44
Maximum	211

This shows that 50% of the data falls between 22 and 44. This means that non-parametric comparison procedures must be used for any intergroup comparisons, as the non-parametric procedures do not assume a normal distribution of the data. Fig. 4.2 shows a similar completion time distribution for the real-life study.

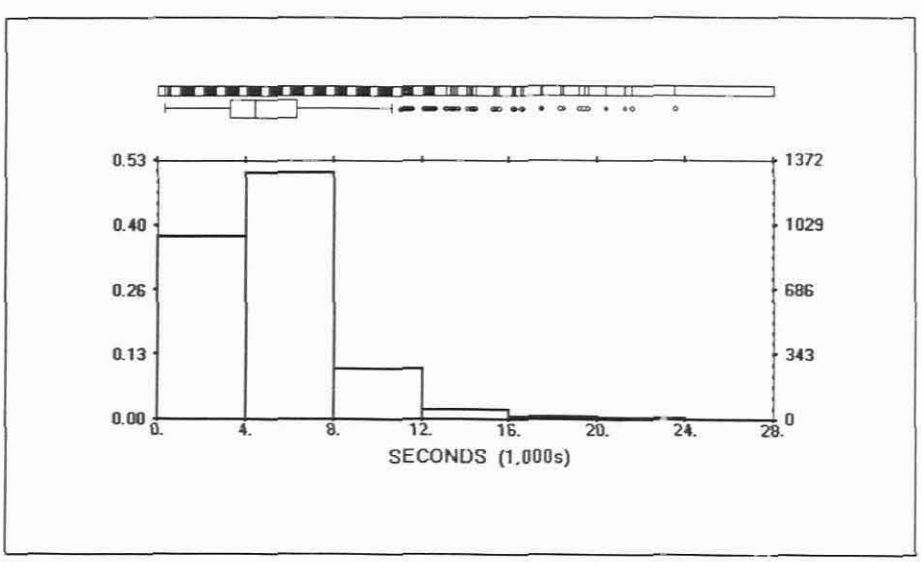

FIG. 4.2 *Time Distribution (real-life study)*

Once again the Tukey five number summary:

Minimum	318
Q1	3279
Median	4380
Q3	6278
Maximum	23531

indicates the use of non-parametric comparison procedures.

4.7 Cultural Groups

4.7.1 Distribution

Users tested during the simulated study had to indicate their cultural groups on the computerised questionnaire. The distribution is portrayed in Fig. 4.3.The imbalance between the Coloured-Afrikaans and Coloured-English groups is probably caused by the fact that a large percentage of students from this group prefer to study in English even though they might have grown up in a predominantly Afrikaans-speaking area.

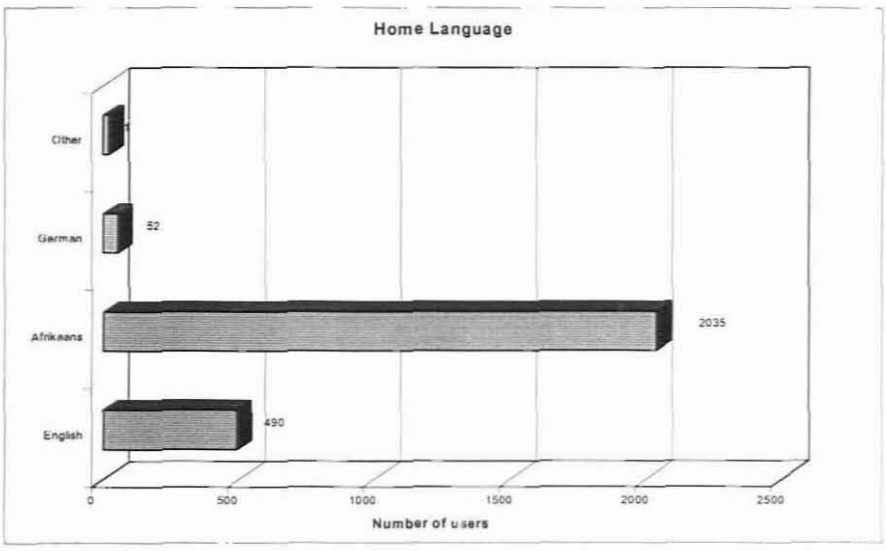

FIG. 4.3 *Cultural Groups (simulation study)*

The real-life study sample shows a large number of white Afrikaans speaking users (Fig. 4.4). This is due to the fact that the study was undertaken at the University of Stellenbosch,

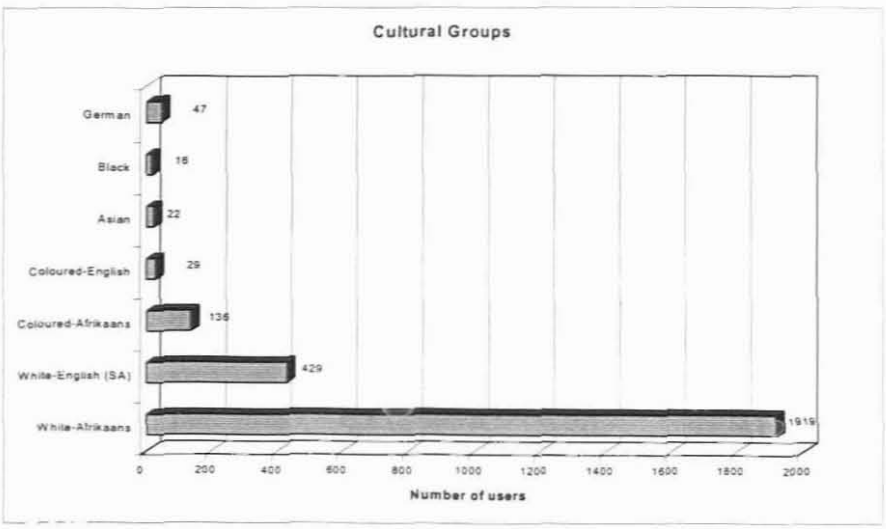

Fig. 4.4 *Cultural Groups (real-life study)*

where Afrikaans is the official teaching language. In the past this university was for the exclusive use of the white population group and therefore the number of students from other population groups is still relatively low.

4.7.2 Intergroup Differences (Simulation Study)

As shown by Table 4.1, the Tukey multiple comparison found a number of differences in the completion times between the different cultural groups that took part in the simulation study.

Cultural Group	Number	Mean Rank	*
Black	33	207	c
Coloured-English	76	138	ab
Coloured-Afrikaans	28	157	bc
White-English	48	111	ab
White-Afrikaans	58	101	a
Other	30	146	ab

Chi-square = 45.4 DF = 5 $p < 0.001$

* Groups with the same letters do not differ at 0.05 significance level

Table 4.1 *Intergroup Differences (simulation study)*

4.7.3 Intergroup Differences (RealHife Study)

As shown by Table 4.2 the Tukey multiple comparison found no difference in completion times between the different cultural groups that took part in the real-life study.

	Number	Mean Rank	*
White-Afrikaans	1919	1265	a
White-English (SA)	429	1402	a
Coloured-Afrikaans	136	1383	a
Coloured-English	29	1230	a
Asian	22	1228	a
Black	16	1676	a
German	47	1452	a

Chi-square = 20.1 DF = 6 p = 0.003

Tukey Multiple Comparison: No difference

* Groups with the same letters do not differ at 0.05 significance level

Table 4.2 *Intergroup Differences (real-life study)*

4.8 Home Language

4.8.1 Distribution

Some users were not included in the analysis of the simulation study as it was not possible to determine their correct home language. The remainder of the users were grouped according to the three main groups represented in the study, namely English, Afrikaans and Black Language groups (Fig. 4.5).

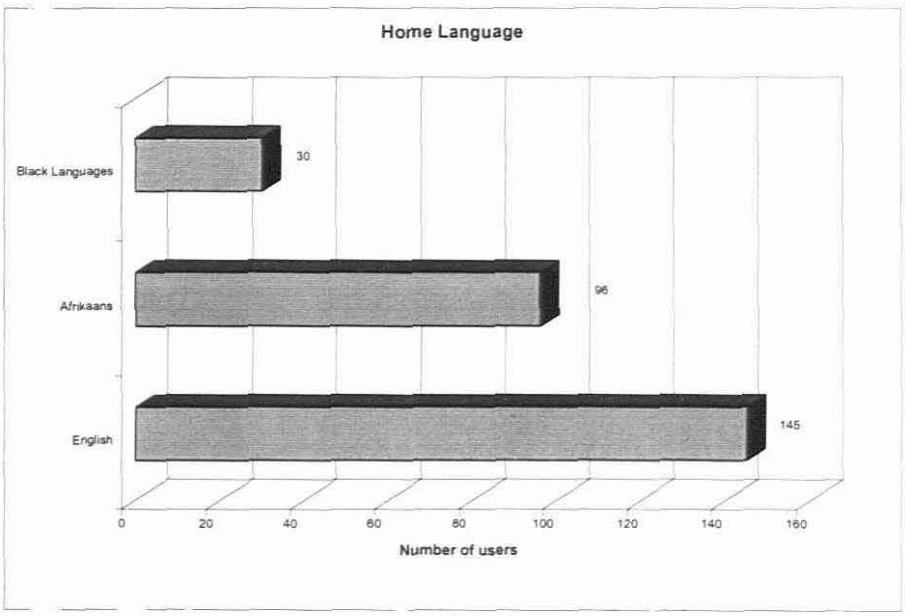

Fig. 4.5 *Home Language Groups (simulation study)*

For the Real-life Study, four significant groups were formed namely English, Afrikaans, German and a group called Other consisting of the rest of the users (Fig 4.6).

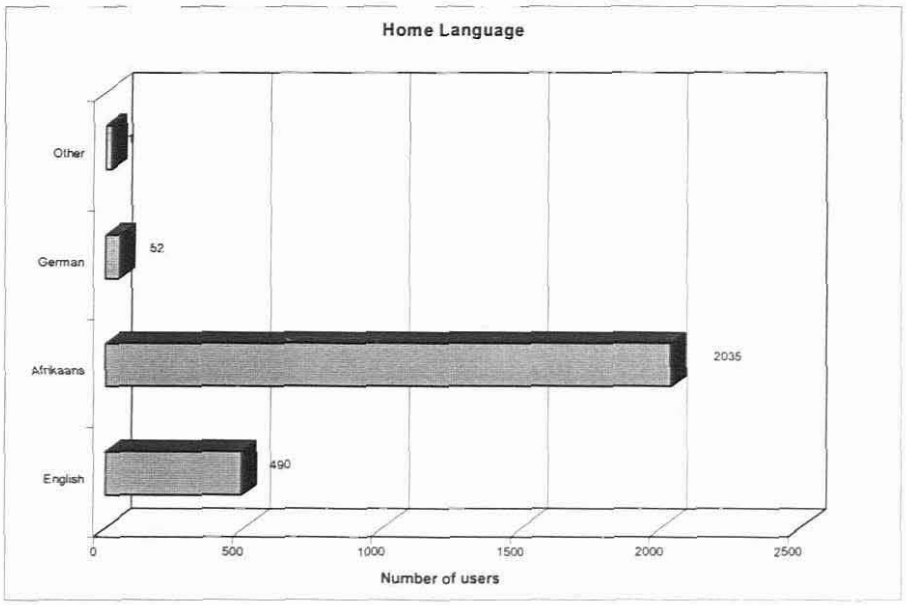

Fig 4.6 *Home Language Groups (real-life study)*

4.8.2 Home Language Group Differences (Simulation Study)

In the simulation study a difference was found between the response times of the Black Language group and that of the other two language groups (Table 4.3).

Home Language	Number	Mean Rank	*
English	145	133.31	a
Afrikaans	96	117.03	a
Black Languages	30	209.72	b

* Groups with the same letters do not differ at 0.05 significance level

Tukey Multiple comparison: The Black Language Group is different at the 0.05 significance

Table 4.3 *Language Group Differences (simulation study)*

4.8.3 Home Language Group Differences (Real-life Study)

The real-life study did not show any significant differences (Table 4.4).

Home Language	Number	Mean Rank	*
English	467	1387.53	a
Afrikaans	2010	1259.25	a
German	52	1404.81	a
Other	40	1226.43	a

* Groups with the same letters do not differ at 0.05 significance level

Chi-square = 13 DF = 3 p = 0.005
Tukey Multiple Comparison: No difference

Table 4.4 *Language Group Differences (real-life study)*

4.9 Gender

No significant difference in the response times of users from different gender groups was shown in any of the two studies. Fig. 4.7 shows the distribution for the simulation study.

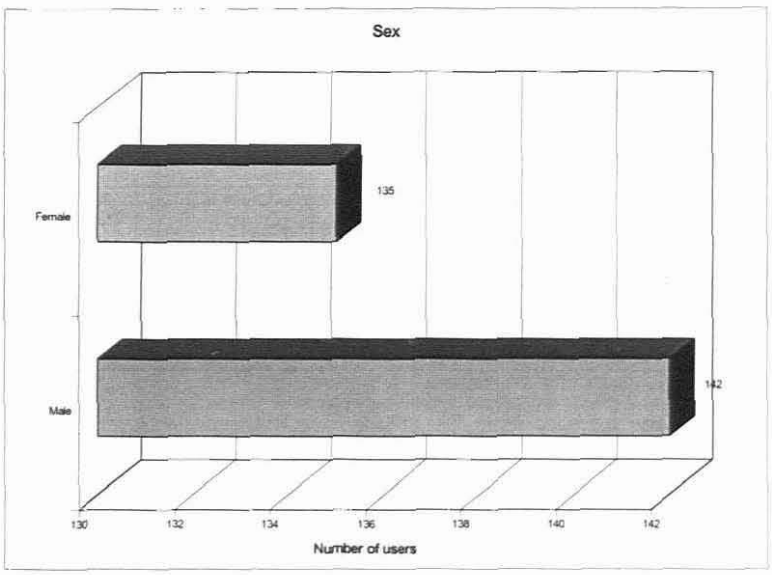

Fig 4.7 Gender *Groups (simulation study)*

The real-life study had a higher percentage of male students as the study had to be structured round specific courses using online registration (Fig. 4.8). Some of these courses traditionally attract a higher number of male students.

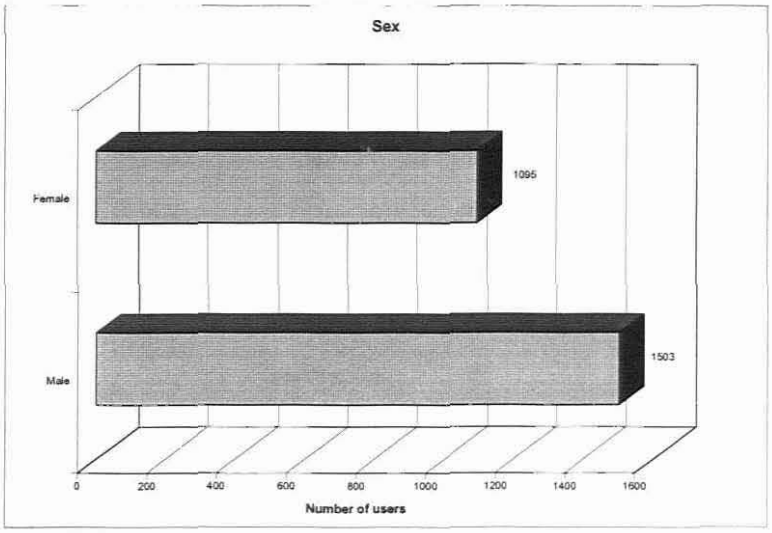

Fig 4.8 Gender *Groups (real-life study)*

4.10 Age

The age distribution for both studies peaks close to the twenty year mark. No correlation between the age of the users and their response times could be shown for any of the studies.

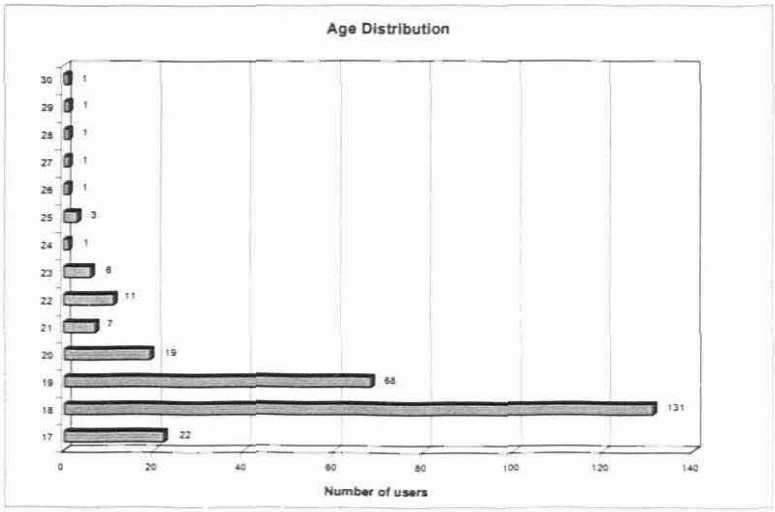

Fig 4.9 *Age Groups (simulation study)*

The age distribution for the simulation study is given in Fig. 4.9 and the distribution for the real-life study in Fig. 4.10

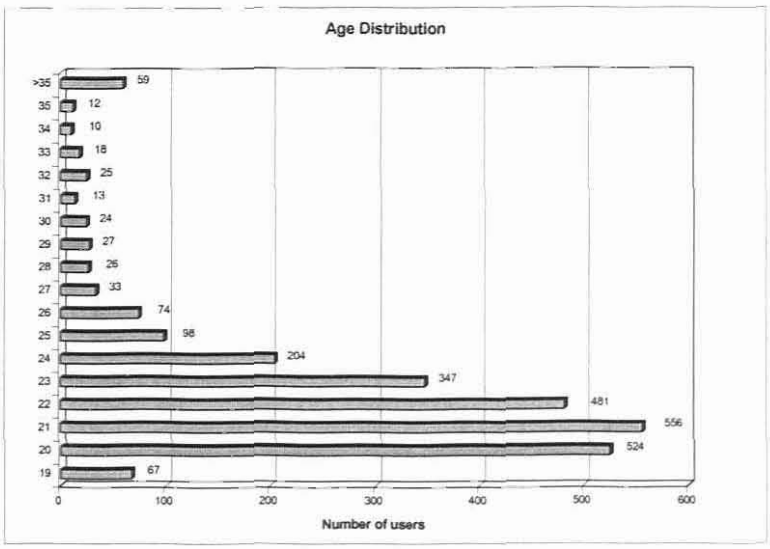

Fig 4.10 *Age Groups (real-life study)*

Chapter
5

RESULTS AND CONCLUSIONS

5.1 INTRODUCTION

This research project has provided some interesting insights into the use of computer user interfaces by users from different cultural backgrounds. The culture of the user manifests *itself in patterns of language, forms of activity and behaviour that enables him or her to live* in a society with a given environment and given state of technical development at a particular moment in time (Samovar et al, 1981 : 24-25). As the user's way of communication is also shaped by his cultural background, it is most likely that culture will have at least some influence on the communication process between the user and a computer user interface.

The complex nature of culture makes the accurate measurement of cultural influences very difficult. Not only are there the intercultural aspects such as styles of communication, thinking styles, general locus of control, language and symbols that differentiate groups, but there also exists certain individual characteristics such as social class, gender, age, intelligence, attitude and motivation that can give rise to intracultural differences within a particular group.

The scope of this study only allowed testing for general differences between groups as each of the specific cultural aspects would need a study of its own. This would also

necessitate the use of highly specialised test instruments and study subjects which were not available for this study.

5.2 INTERPRETATION OF RESULTS

5.2.1 Cultural Group Differences

A large number of different cultural aspects can possibly influence the encounter between the user and the computer. Group characteristics such as symbolism, language, locus of control and the individual aspects of ethnicity, social class, gender and age are just a few of the possible influencing factors. As it is not possible to determine the contribution of every factor in a single study, separate studies will have to be undertaken to determine the influence of the individual cultural aspects.

The first and main objective of this study was to determine if the cultural group of a user has any effect on the user's interaction with the computer while using a simple user interface. A simple interface was used, as it is firstly necessary to establish whether there are any differences between the cultures when using simple text-based interfaces, as this type of interface is still used by many computer systems. This will also allow the gradual addition of more complex elements to the interface by further studies to determine the effect of these elements.

The simulation study showed a marked difference in the response times recorded by the Black cultural groups and most of the other cultural groups. Many factors are involved in the human-computer interaction process and specialized studies will be necessary to determine the reasons for this result.

A large percentage of the Black cultural groups come from communities that are severely disadvantaged in terms of the available schooling facilities and access to technology. The nature of Black cultures is also markedly different from the cultures of the other groups tested, which all contain a strong western element. This could lead to differences in group cultural characteristics such as symbolism, language and locus of control aspects.

Poverty which often prevails in Black communities may also lead to a lower social class with related problems such as low literacy and a reduced ability for abstract thinking.

The real-life study showed no difference in the intergroup response times during the use of the interfaces. This is probably due to the fact that there were relatively small numbers of users from some of the cultural groups. The users from this study were also at least in their second year of study and therefore had more previous exposure to computers. To show differences in this case, a more sensitive test instrument would probably be necessary.

5.2.2 Home Language Differences

Without the ability to understand the language used in a communication process, the user cannot take part in the process. It follows that it is essential that the user have an adequate understanding of the language used by the computer user interface to be able to use it effectively.

Bodley (1993:23.) has found that simply changing the language of the user interface can greatly enchance the efficiency of computer usage. It was also found by Mussen (1984:206) that social class might have an influence on the language ability of the child. This in turn can have an effect on the abstract thinking ability of the person who grew up in a social environment where the language code was simple and more oriented towards

concrete than conceptual terms. It is therefore to be expected that there will be differences between cultural groups when using computer interfaces, particularly where a high degree of abstraction is used by the interface. Cultural differences in vocabulary can also influence the encounter with the user interface as even among English speakers, there may be considerable differences in the vocabularies of the users.

The simulation study showed a difference between the Black language groups and the Afrikaans and English language groups. This finding may be the result of the language difference, but could also be the effect of other unidentified cultural aspects unique to the cultural groups that use Black languages.

The real-life study found no difference in the response times recorded by the different language groups. This is probably due to the fact that there were small numbers of users from some language groups and all the users that took part in the study were already studying at tertiary level and therefore already had a good command of the English language. Since the questions asked by both questionnaires made use of simple English it cannot be expected that they would have been sensitive enough to measure differences of such small magnitude.

5.2.3 Gender Differences

According to Baruth & Manning (1991:10) males and females show unique orientations towards problem solving. This could arguably have an effect on the way the two sexes experience the human-computer encounter. If the task is not overly complex, there will probably be very little difference in the way that the task is accomplished by the two sexes.

As the interfaces used in the two studies was of a simple nature, very little problem solving skills were necessary to complete the relevant tasks and as expected, no difference in the response times of the two groups was found.

5.2.4 Age Group differences

Egan (1988:543) has found age to be a powerful predictor of how difficult a user it will find to learn complex computer systems. This is probably due to the fact that users differ with respect to their lifespan stage. Each lifespan stage has unique characteristics that are often closely intertwined with the cultural characteristics of the user. One such a characteristic is the ability of the user to speak the English language that is used for most computer user interfaces. Another factor that could have an influence is the previous exposure to technology that the user might have had. Younger users are more likely to have some experience of computer technology as this often forms part of their schooling. Older users might therefore find it more difficult to use computers.

Both studies showed no correlation between the recorded response times and the age of the users. As all the users tested are from groups with very little difference in age, this result is to be expected.

5.3 FURTHER RESEARCH

Due to limitations in the availability of suitable equipment, this study had to limit its investigations to text-based interfaces. Most new computer systems currently make use of

graphical user interfaces, which make extensive use of icons to represent abstract concepts such as the deletion and creation of files. Culture is communicated by symbols that give expression to the specific way in which a particular community sees and understands the world. As the understanding of the symbolic representation of abstract ideas is very important for the effective use of user interfaces, it will be necessary to determine ways to represent such ideas in a way that all user communities can understand the meaning of these ideas as intended by the interface designer. This is particularly important in the case of cultures that tend to think more in concrete than in abstract terms.

Locus of control is another aspect of culture that needs investigation. If a person does not feel in control of the user interface, then it is likely that the efficiency of the interaction will be negatively influenced. By designing computer user interfaces that do not hide details from the user, and to keep him or her informed at all times the user's feeling of being in control can be enhanced. Further research, particularly into the design of menu structures, which in the case of graphical user interfaces often tend to hide a major portion of the functionality of the system, could help to improve the feeling of being in control experienced by the user. This in turn could possibly lead to lessened anxiety and an improved willingness and confidence to use the system as the user feels that his or her self-esteem is not at risk.

Paradigms are sets of rules and regulations that establish boundaries and tell a person how to behave inside those boundaries. Each person has his personal paradigms that help to determine his territory and what to do there (Gelatt, 1993:9-13). The paradigms are learned from our culture, community and experiences. The introduction of computers into the individual's environment always means change and could possibly threaten the individual's accustomed behaviour, therefore the initial response is often of a negative nature. As the user interface is usually the first line of contact with the user, it is very important in shaping the response of the user towards the computer system. If the user interface could represent something that is familiar to the user it might help the user to fit the experience into his or

her set of personal paradigms and so lessen the perceived threat to his or her zone of comfort. Research about how user interfaces can be tailored to use concepts that are familiar to particular users could contribute considerably towards the efficient use of computers where computerization is new to the users. This type of customization will obviously be easier where a specific group of users can be targeted.

5.4 CONCLUSIONS

With the rapidly expanding availability of computer technology many new opportunities for business and education have opened up in communities that previously had very little exposure to technology. Just like books need to be translated for different language groups, it is also necessary to take into account the group and personal cultural aspects of computer users to encourage and help them to use the available computer systems.

The precise cultural characteristics of a computer user are not easy to determine and the design of computer user interfaces for use by diverse groups poses a unique challenge to the designers of such systems. If this is done properly it may provide many business and educational opportunities, particularly in developing countries.

In conclusion, the results reported in this research provide a clearer understanding of the conceptual basis of cultural factors that might contribute to the success of computer systems in multicultural communities. Further research needs to be undertaken to determine the influence of specific cultural aspects, and to explore the integration of these into the design of user interfaces for developing multicultural communities. It is hoped that the insights gained will lead towards the increased availability and ease of use of computer systems in communities previously deprived of such facilities.

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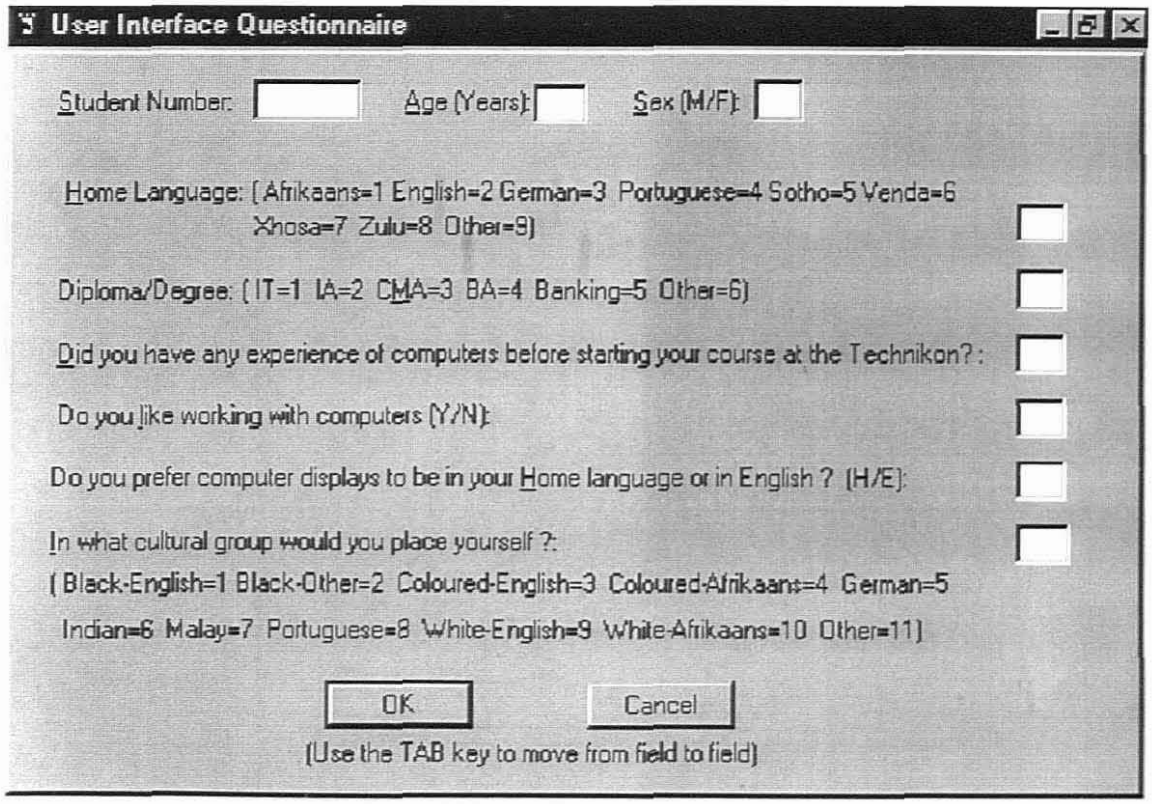
APPENDIX A


User Interface Questionnaire
Student Number:
Age (Years):
Sex (M/F):
Home Language: (Afrikaans=1 English=2 German=3 Portuguese=4 Sotho=5 Venda=6
Xhosa=7 Zulu=8 Other=9)
Diploma/Degree: (IT=1 IA=2 CMA=3 BA=4 Banking=5 Other=6)
Did you have any experience of computers before starting your course at the Technikon? :
Do you like working with computers (Y/N):
Do you prefer computer displays to be in your Home language or in English ? (H/E):
In what cultural group would you place yourself ?:
(Black-English=1 Black-Other=2 Coloured-English=3 Coloured-Afrikaans=4 German=5
Indian=6 Malay=7 Portuguese=8 White-English=9 White-Afrikaans=10 Other=11)
OK
Cancel
(Use the TAB key to move from field to field)