A GUIDE TO IMPROVING THE E-COMMERCE USER INTERFACE DESIGN

by

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APPROVED FOR FINAL SUBMISSION

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DECLARATION OF ORIGINALITY

I, Alveen Singh declare that this dissertation,

“A Guide to Improving the e-Commerce User Interface Design”,

is my own work under the supervision of Mrs D. Heukelman and that all sources I have used or quoted have been indicated and acknowledged by means of complete references.

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ALVEEN SINGH

PREFACE

One paper was presented in completing this study. This paper was presented at the Durban Institute of Technology, Faculty of Commerce Research Day, 26 September 2003, entitled “The Importance of User Interface Design in e-Commerce Web Systems”. This paper focused on the role of the user interface as the critical medium of communication between the e-commerce website and the internet user. It also highlighted design flaws and poor economic viability of current user interfaces implemented in e-commerce websites. Some of this paper formed part of Chapter two of this dissertation.

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ABSTRACT

This study examines the efficiency, ease of use and ease of understanding of user interface designs implemented in current e-commerce websites. Four South African based e-commerce websites formed the test cases of this study. Selection of the test cases was based on the results and conclusions of previous surveys conducted by an independent research institution. The outcome of that survey identified the most popular e-commerce websites among South African internet users.

Thirty participants who tested the websites were selected according to criteria that placed them into one of three groups; novice, intermediate or expert. Each group represented a particular level of user dependant upon their experience with computing and internet usage.

Data collection techniques included evaluation questionnaires, naturalistic observation and unstandardised, focus group interviews. Research methodology texts were consulted before the implementation of these techniques. In some instances data collection techniques were combined and refined before being implemented in a different manner as described in research methodology texts, in an attempt to record more accurate and in dept data.

Participants were required to perform a list of tasks set by the researcher, for each test case. Observation was done during this process and the researcher as well as research assistants recorded data regarding difficulties experienced by participants. Thereafter participants completed evaluation questionnaires, providing their feedback pertaining to the different aspects of each user interface. In the third and final data collection technique

the participants were interviewed by the researcher. The entire data collection phase described above was executed in a controlled environment. A computer laboratory was utilised for this purpose, and one participant group at a time carried out the evaluation process.

The data generated was categorically analysed, depending on the participant group and the test case. The adopted method of analysing data included tabulating, summarizing and drawing conclusions from a triangulated data collection process. The findings from each of the three data collection processes were used to draw the final conclusions regarding user interface design of the e-commerce websites.

Major findings of this study included:

1. Novice and intermediate level participants were not able to utilise the majority of components of the e-commerce websites without assistance.
2. Expert level participants i.e. those participants with the highest amount of experience in computing and internet usage exhibited the ability to interact with the e-commerce websites with little to no assistance.
3. The e-commerce website user interface design facilitated the retention or learning of the sequence of steps toward completing a task among the expert level participants only.
4. Novice and intermediate group participants required repeated assistance in order to complete the same task, even on the same e-commerce website.
5. Participants from all groups completed all pre-defined tasks on one website only.

6. The components of the e-commerce websites that proved to be most difficult in terms of usability were the search engine, new customer registration web page, sign-in or log-in web page and the shopping basket.
7. Other problem areas of the user interface design included recording product details, website navigation, customer account maintenance and the help facility.
8. Participants from the novice and intermediate groups could not complete the evaluation tasks within the allocated time.
9. The user interface design did not promote the understanding of the concept of certain components on the website.
10. The graphical design of the e-commerce website i.e. implementation of colour and themes, did not effect the participants perception of ease of use.

CHAPTER ONE

INTRODUCTION

The growth of information and communication technology is rapidly changing the way businesses conduct their trade. The Internet, in particular, has provided a medium by which a wider customer base may be created and maintained, on a local, national and international scale. However, in order to benefit from these new emerged possibilities, businesses need to be prepared to introduce the necessary changes to develop and adopt new electronic methods of doing business.

The rate and extent of the adoption of electronic business practices have varied in the different business sectors. The fastest growing sector is the business to consumer sector, with more businesses making products and services available online. The South African government has recognised the potential economic benefits of electronic business practices and have subsequently promoted improved legislature for this business systems (South African Department of Communications, 2003). Surveys carried out by independent research institutes have also highlighted the increase in electronic business within the South African economy (NUA Internet Surveys, 2001).

1.1 WHAT IS E-COMMERCE?

There exists no widely acceptable definition of e-commerce. In some instances the term is used as a reference to buying and selling of products and services on the Internet. A more technical definition may be “any form of business interaction conducted with the aid of an electronic communication medium” (Whiteley, 2000:3-6). For the purposes of

this research, e-commerce is defined as any business activity or practice conducted by using the Internet as a medium of communication. This study was also restricted to the e-commerce of the "business-to-consumer" genre. In this form of e-commerce an Internet user would interact and purchase a product or service from some company's online transaction system or e-commerce website.

1.2 WHAT IS THE USER INTERFACE?

A widely accepted definition of the user interface, such as one provided by the Searchwebservices website, is "everything designed into an information device with which a human being may interact. This may include the display screen, keyboard, mouse, light pen, the appearance of a desktop, illuminated character, help messages, and how an application program or a Web site invites interaction and responds to it"(Searchwebservices, 2001). When performing an online transaction such as purchasing a product using an e-commerce website, the Internet user would complete this transaction utilising the user interface. The technical details of performing this task are complex for the user to comprehend, hence the user interface must simplify the task such that it becomes easy to understand and learn while allowing the Internet user complete control of the entire process. The user interface is therefore the only medium of communication between the Internet user and the e-commerce system. This issue is important in the online buyer-seller environment due to the absence of a salesperson and the ability to physically examine a product. With e-commerce, the entire transaction is initiated and completed through the user interface.

1.3 FOCUS OF THIS RESEARCH

Web applications provide business solutions that have the potential to improve the availability of product and services offered by a company. However, many ventures into electronic business fail because the systems represent a complex design. Computer and Internet users, who constitute potential electronic business customers, are often not able to successfully utilise these web based systems, in order to complete an online transaction. Research investigating South African companies that have developed and implemented online business solutions highlighted the inability of some of these initiatives to attract sufficient paying customers to remain economically viable (Manson, 2001).

Usability and website design experts (e.g. Gerdes and Natchwey, 2000) believe that a potential factor leading to poor economic performance of current online businesses is poor user interface design. Their independent research has highlighted the inability of Internet users to adopt this means of trade due to the difficulty experienced in utilising web based application. Inefficient communication between the Internet user and developers of these online business systems is a second contributing factor toward poor user interface design.

The focus of this study was to identify areas of the online system's user interface that represent difficulty in terms of understanding, ease of use and efficiency, in the context of Internet users. The primary objective of this research was to collect, collate and analyse data regarding potential problem areas of the user interface design, implemented in current e-commerce websites. This data was generated by Internet users while interacting

with these user interfaces. This data is representative of feedback which could be analysed and utilised by system developers to design, implement and maintain user interfaces that are more acceptable by Internet users.

1.4 POTENTIAL BENEFITS OF THIS RESEARCH

Obtaining user centered feedback with regard to potential problems with user interface design, may be viewed as a form of requirements analysis. Analysis of this feedback would enable the e-commerce website developer to identify the needs of a website user and consequently provide a more efficient user interface for these users. It is easier and more cost effective to correct an error or potential problem area at the design stage of an e-commerce system compared to during the implementation and maintenance stage. Furthermore, this feedback obtained from Internet users provides precise and correct understanding of the user's requirements.

In context with the above and earlier remarks, user interfaces that are more user centered in terms of usability may be developed by adhering to user defined feedback. This in turn would cause the recursive effect of attracting more users as well as maintaining the already established customer base. There are many economic benefits for both the customer and the business, if e-commerce is more widely accepted. E-commerce has the potential to offer considerable growth and cost saving opportunities. It would also empower a company to expand its economic reach to a worldwide market place, from various sectors of trade.

The next chapter will provide results and comment on the findings and conclusions of past research carried out in the field of user interface design and testing, based on e-commerce systems.

CHAPTER TWO

A REVIEW OF RELATED LITERATURE

In this chapter it is established that this research was aimed at identifying the potential problem areas of e-commerce user interface design. Statistics drawn from previous studies, including studies conducted in South Africa, show that some user interfaces currently used in e-commerce websites are not adequate in terms of ease of use and understandability. This chapter introduces the concept of "feedback" with regard to Internet users, gathered from the insights of website and information system usability experts. Flaws in the methodology used to design and develop e-commerce user interfaces are highlighted. Insights into the reasons for poor user interface design, as elaborated on by researchers in the field of e-commerce, are also provided in this chapter.

2.1 ROLE OF THE USER INTERFACE IN E-COMMERCE

"The success of an e-commerce website depends largely on the quality of the buyer-seller interaction. This occurs exclusively between the user and the e-commerce website user interface. Whether the user makes a purchase and visits the e-commerce site in future, is determined by how easily the user can find her/his way around the different parts of the website" (Egger, 1999). Egger refers directly to the user interface component as a critical point of an e-commerce website. He believes that the overall success of that website depends entirely on the end users ability to interact with it.

In a technology, such as e-commerce, where the only point of access is a user interface, this definition becomes more important for the success of that technology. "Success of

Information Technology has been dependant on the ease of use of that technology" (Benbasat, 2000). In the era of electronic commerce this same notion needs to be applied. E-commerce strategies in South Africa have not been successful due to a number of factors (these insights are provided later in this chapter). This research identifies poor user interface design as one of these factors.

Online retailers allocate a significant portion of resources toward designing and implementing the e-commerce system as a whole (sometimes referred to as an e-commerce strategy). Hardware, Internet programmers, Internet service provider, website hosting costs and graphic design artists are some of the attributes that must be budgeted for while planning an e-commerce strategy. However these resources could be wasted or not be utilised properly if no Internet users visit the website and if no/few purchases are made online. "FutureCompany reported that Liberty shut down its ambitious MyLife portal after spending R23 million on it and then signed up only 50 customers. It also reported that Edgars had spent R12 million on its site, which also failed to attract consumers" (Manson, 2001). The above quote is the conclusion of one survey which highlights the failed attempts of two South African based companies at implementing a successful e-commerce strategy. A separate survey carried out by the University of Pretoria (South Africa) concluded that only forty-seven percent of South African Internet users have actually made purchases online (NUA Internet Surveys, 2001). These statistics firstly highlight the fact that there is a problem with e-commerce systems that the South African user accesses and secondly, the financial resources invested in e-commerce systems are lost as a result.

In a published paper, Kubilus (2000) states that while the number of e-commerce websites have increased over the last three years, the overall satisfaction of users have decreased. He believes that this is due to insufficient attention being paid to the usability factors by the designers of an e-commerce website. These factors affect whether or not an e-commerce website can be used easily, accurately and without loosing user interest. Vatanasombut, Stylianou and Igbaria (2004) conducted a study that investigated strategies on retaining online customers. Their preliminary research pointed out that current e-commerce companies are not successful at maintaining a "loyal" customer base. Their study concluded that e-commerce initiatives should be implemented to help online customers overcome technical barriers which, could ultimately lead to e-commerce companies being more profitable.

2.2 MEASURING THE SUCCESS OF E-COMMERCE

This research recognises the need for measuring the success of using e-commerce as a medium of trade. In terms of e-commerce, one may differentiate between a "good" or "bad" system by asking two questions:

1. How can success be measured? ,
2. What variable must be compared against what scale in order to measure success?

One of the variables that may be measured is the profit obtained or the amount of revenue brought in by an e-commerce strategy. This can be measured against a projected financial figure for profit generated at the onset of the project, which would subsequently form a

scale or a benchmark. Success would then be an e-commerce system that generated a financial income equal to or more than the projected profit.

One factor directly responsible for achieving success is the number of Internet users that visit these e-commerce websites *and* make online purchases. Najjar identifies three critical factors which he believes will lead to successful user interface design:
"E-commerce websites must first grasp the user attention, enable the user to find the product or service that they desire and allow the user to make the purchase efficiently" (Najjar, 2001). Attracting Internet users to the e-commerce website represents the first task for e-commerce website designers. These designers must also ensure that the Internet user, who represents a potential customer, once browsing the website, is able to successfully complete a transaction with little or no aid. Also, a positive experience should exist that would make the customer want to revisit the site in future.

"The Internet is to a large extent about "instant gratification". Users expect to find what they want quickly and with no effort" (Nah and Davis, 2002). Internet users place high demands on the usability of the e-commerce website, and there exists a high number of alternate e-commerce websites that they can turn to if these demands are not satisfied. In their paper the authors also show statistically that e-commerce website designers ignore this fact and as a result loose customers and risk the economic viability of the e-commerce initiative. The authors later highlighted some of the areas of these websites that exhibit errors in usability design. These were listed as poor navigability, confusing content and the user's inability to search for desired information.

The success of an e-commerce website may be defined as a three step process. These three steps are representative of the potential customer being able to manipulate, "trust" and independently negotiate the procedure representing the completion of an online transaction. ("Trust" represents an interrelated field of research in terms of computer-human interaction. This field is discussed briefly later in this chapter.) These steps are attributes regarding the utilisation of the user interface. This research identifies the user interface as one of the problem areas or the cause for the above mentioned attributes not being present in some current e-commerce systems. "What can be done to improve the user-system interaction?" is the key research problem binding together this study. In the next subsection an account is given of how information systems benefited from usability testing and feedback from end-users. This testing and feedback should also be an integral part of the development process in order to improve the success of e-commerce systems.

2.3 CURRENT E-COMMERCE WEBSITE DESIGN METHODOLOGIES

Prior research has been done in the field of human-computer interaction in information systems. Many of the guidelines and principles for designing a user interface was the result of research done in the field of information systems. "The emergence of usability testing and laboratories since the early 1980s is an indicator of the profound shift in attention to users needs." (Shneiderman, 1998:127). The author goes on to state that the success of many information system projects is due to the implementation of some form of testing process which included the end-user in a proactive role. By involving end-users in the development phase of information systems, flaws in the user interface may be more easily identified. Some of these flaws may include the sequential steps necessary to complete a task not being streamlined and procedures for using the system that are

difficult to understand. This may seem trivial to the designers however, in reality may present themselves as difficult tasks for end-users. Similarly, Internet users should play a proactive role during some part of the development process of e-commerce user interfaces. The benefits listed above may also apply to the field of e-commerce provided that the above mentioned method of user interface "feedback" is applied. The following subsection elaborates on how e-commerce website user interfaces are developed and the shortfalls with using these development processes.

Christoph Villaneck, head of an e-commerce solutions firm, stated in an interview that "the technical demands of shop systems are frequently a cause for limitations in human interface design" (Gerdes and Natchwey, 2000:35). The current trend of e-commerce website design is centered upon the development and implementation of the application (normally an interactive website) followed by the addition of a user interface. This design approach involves the technical aspects of the e-commerce system to be developed first, namely the programming code, data base management software and interfaces between the two. The user interface is then "moulded" to best suit the application. This results in a design that is not best suited for the requirements of the users, i.e. ease of understanding, proficient advancement through the sequence of steps and the overall sense of being in control throughout the process. According to the author these are characteristics that are not present in current e-commerce systems. This problem presents itself during the design and development phase of the user interface. An examination of the methodology adopted during this phase needs to be carried out to identify the source of the above mentioned problems with the user interface, hence substantiating the need of a study such as this.

The user interface of e-commerce websites is often developed following guidelines and principles created by researchers in the field of user interface design and usability experts, such as Najjar (2000) and Nielson (1997). These guidelines exist in a variety of forms and are available through a variety of sources such as journals, textbooks, websites and white papers. Published guidelines and principles are the results of field tests and research conducted by scholars in the field of human computer interaction. However, utilising these guidelines and principles do not guarantee user acceptance. The task of designing and developing e-commerce websites that are easy to understand, utilize and manipulate by an Internet user can not be achieved purely by following guidelines and principles set by international usability experts. "Navigation of Web sites tends to provide designers with a major challenge and many users have commented on bad designs and poor usability" (Shackel, 2000). Basing the design and development methodology entirely on guidelines and principles will not necessarily lead to the creation of successful user interfaces in an e-commerce system. In their journal paper, Proctor et. al. (2003) concluded that at present there is inadequate consideration of users throughout the design process. This emphasises that adhering to guidelines will provide sufficient groundwork, but the end product needs to be "fine tuned" by involving Internet users in some form of testing and gaining feedback from them.

Najjar (2000) maintains that user interface designers of e-commerce websites are faced with the following challenges:

1. Design complex Web pages quickly.
2. Make it easy for customers to understand the design, and interact with the website site easily.
3. Get repeated feedback from customers.

4. Based on this feedback, improve the designs.

Najjar identifies four requirements that need to be met when designing e-commerce websites. He first states that these websites need to be developed or upgraded quickly. If the e-commerce site is not available due to maintenance there is a loss of revenue, measured per hour of its unavailability. Secondly the author states that the website user interface should be designed so that it is simple enough to enable novice users to use the site. At the same time the user interface must allow for some degree of flexibility for the more experienced user. The next two points refer to the testing and improvement of the user interface based on "feedback" from users of the system. The author elaborates further by stating that this would allow for easier maintenance of the website, in terms of providing exactly what the users want and that "feedback" represents an important phase during development.

2.4 INCLUSION OF "FEEDBACK" IN E-COMMERCE USER INTERFACE DESIGN

The concept of user "feedback" is also evident on the UsabilityNet website (UsabilityNet, 1999), a website focusing on improved user interface design and development. According to the information available from UsabilityNet, two of the important principles that should be adopted when ensuring efficient user interface design and development are:

1. Involve users in the design process.
2. Refine designs based on user feedback.

The conclusions drawn from the UsabilityNet website indicate that to ensure a usable product that meets the user's needs, the above mentioned principles based on obtaining "feedback" should be adopted.

Shneiderman (1998) defines "feedback" as a "mechanism such as surveys, interviews and conferences that designers may use for testing/evaluating their designs" (Shneiderman 1998:150). This research focuses on gaining feedback from Internet users while interacting with e-commerce websites. This feedback will be obtained from various data collection techniques, which once analysed, may provide e-commerce website designers with information regarding the problem areas of current e-commerce website user interface design.

This research seeks to address the specific problems of lack of ease of use and understandability in e-commerce user interfaces. This may be seen as an important step towards improving online trade, by establishing the specific difficulties that South African Internet users experience when utilising online trade technologies. E-commerce designers and programmers need to know exactly what areas of their websites users or potential customers have difficulty with. Feedback from users of e-commerce systems can be seen as a key concept when investigating the difficulties experienced during interaction. E-commerce programmers and designers need to be provided with this "feedback", generated from actual responses from users while interacting with e-commerce websites.

2.5 "TRUST" IN E-COMMERCE

The South African government released a green paper documenting the proposed legislature for e-commerce in November 2000. This was done because e-commerce at the time was viewed as having financial growth potential. One of the findings of this paper was the identification of four critical factors that need to be addressed in order to sustain the continued development of e-commerce in South Africa. These were listed as being:

1. Legal and regulatory issues.
2. Building trust in the digital economy.
3. Enhancing the information communication infrastructure.
4. Maximising benefits.

(South African Department of Communications, 2000).

The second point introduces the concept of "trust". Egger defines the concept of trust as making the user of an e-commerce system understand that the benefits of this medium of trade outweigh any associated risk. Risk may exist in an e-commerce system when examining the payment, privacy and consumer after-sale service. The author believes that these risks may form a psychological barrier preventing Internet users from adopting e-commerce trade. Egger goes on to state that "although it is not up to interaction designers and usability engineers to solve issues linked to legislation or cryptography[1], it is argued

[1] Cryptography refers to the technique of applying a specific mathematical equation to information that needs to be sent over a computer network. This renders this information unreadable to those unauthorized parties that might intercept this information.

that they can nevertheless play an important role in ensuring that trustworthiness be communicated in user interface design" (Egger, 1999).

With regard to the above mentioned points, a relation can be drawn between the user interface of an e-commerce system and the Internet user's willingness to utilise the system. The user interface should be designed such that the end user feels comfortable with the e-commerce system, and some degree of trust must be made visible through it. This field of research overlaps with psychology in terms of human computer interaction. However the underlying concept does highlight the importance of the user interface design in a successful e-commerce system.

In this chapter an attempt was made to highlight the shortfalls of current e-commerce user interface design. As described earlier in this chapter, these shortfalls exist in the form of inefficient and difficult to understand sequence of steps required to complete a task, overall difficulty in understanding the purpose of various components and a sense of not being in complete control of the website. Improper design and development of e-commerce website components as well as the associated graphical attributes, lead to these shortfalls. This study is aimed at examining e-commerce websites and recording feedback from users regarding these shortfalls. By including feedback from Internet users in the development process, more efficient user interfaces may be developed which may lead to more financially successful e-commerce systems.

This chapter provided insights into the current economic status of e-commerce websites, potential problem areas regarding the design of user interfaces as identified by website design experts and inadequacy of the user interface in terms of ease of use. The next

chapter focuses on the research design and adopted methodologies to be employed in this study.

CHAPTER THREE

RESEARCH DESIGN

This chapter describes the manner in which this study was executed. It outlines what methodology and adaptations were used and the reasons for choosing them. The chapter then expands to include a discussion on the selection of the e-commerce websites that formed the test cases for this study, the process of selecting participants who evaluated these e-commerce websites, hence providing feedback regarding the efficiency of the user interface, and the procedure that was followed to carry out this evaluation. A brief description of the research assistants is also provided. Also in this chapter is a description of the tasks that the participants completed in order to perform the above mentioned evaluation and the constraints that applied to these tasks.

3.1 ADOPTION OF QUALITATIVE RESEARCH FOR THIS STUDY

Qualitative research yields descriptive data, the kind of data required to answer the proposed question of this study. “Descriptive data emanates from observation, participant observation, interviews and questionnaires” (Clarke, 2000). The type of qualitative research carried out for this study was a case study which is discussed in more detail in the next subsection.

This study was conducted using two primary methods. The first method is commonly referred to by research methodology texts (such as Olivier, 1997) as “desktop research” which consists of the examination of previous surveys, case studies, publications and journals. The second method was “field work”. Field work involved the choosing of

participants and consisted of observation, questionnaires and interviews involving participants. The structure and/or technique of the observation, questionnaires and interview that were conducted in order to facilitate this study were based on the information gathered from the first method, desktop research.

3.2 THE CASE STUDY RESEARCH METHOD

This research was representative of a case study. Olivier (1997) describes a case study as a method intended to get a lot of information about one (or a few) members or subjects, and allowing specific cases to be studied in more detail. Another definition derived from the Colorado State University writing guide sees a case study as "a form of qualitative descriptive research that is used to look at individuals, a small group of participants or a group as a whole" (CSU Writing Guide, 2003).

In case study research the researcher collects data about participants using direct observation, interviews, protocols and tests. Blaxter, Hughs and Tight (1996) state that a case study may use a mixture of methods such as personal observations, interviewing and the tracing and studying of related documents. For this case study, data was collected from participants pertaining to four test cases in the form of e-commerce websites. The test cases were e-commerce websites chosen for this study through predefined selection criteria, which is discussed in the next subsection. The case study was the preferred method of study for this research due to it being suitable for the coalition of data from a number of participants. A case study also allows for a diversity of participants, with regard to computer literacy and Internet skill levels. This was relevant to the study since the efficiency of the e-commerce website user-interface needed to be measured while

being used by a diversity of users, which is similar to the "real life" situation. "Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research" (Soy, 1998).

The CSU writing guide identifies several subdivisions or types of case studies that may be used to facilitate a study or form a research method in its entirety. According to this information, this study is representative of "critical instance case study". A critical instance case study may be defined as "examining one or more sites for either the purpose of examining a situation of unique interest with little to no interest in generalisability, or to call into question or challenge a highly generalized or universal assertion. This method is useful for answering cause and effect questions" (CSU Writing Guide, 2003). This research questioned the efficiency of the user interface component of an e-commerce system, thus this component was that of unique interest (seeing that an e-commerce system exists in the form of multiple inter-related components or subsystems), and poses the question of whether or not poor user interface design is the cause for poor usability of e-commerce websites. In order to attempt an answer for this question the research had to be executed as interrelated processes or as a sequence of steps.

Journals, publications and text books that contain documentation on case studies (e.g. CSU writing guide) list the case study as a sequence of steps that need to be completed if it is to represent a research methodology. This study represented this sequence in that it was completed in six defining steps. Each of these steps is elaborated on in the subsequent sections in this chapter or in later chapters. These steps may be summarised and listed as:

1. Stating the research question and the chosen methodology for completion of this study.
2. Selection of test cases and determination of data gathering and analysis techniques.
3. Preparation for the collection of data.
4. Collection of data.
5. Analysis of data.
6. Publication of findings for this study.

Steps 3 and 4 will be highlighted in chapters four and six respectively, step 5 will be discussed in chapter seven and the final step forms chapter eight.

The findings of this study were more easily achievable because of the execution of this research was determined by the above steps. Soy (1998) states that "the advantages of the case study method are its applicability to real life, contemporary, human situations and its public accessibility through written reports". E-commerce programmers, who were the planned recipients of the findings of this study, have access to the results and conclusions of this study, which was published both in hardcopy and electronic format.

A case study is also known as a triangulated research strategy in that it uses multiple sources of data that aid in ensuring accuracy and that alternative explanations are considered. Yin (1994) identified six primary sources of evidence for case study research, discussed in Swartz (2002):

1. Documentation,
2. archival records,
3. interviews,
4. direct observation,
5. participant observation and
6. physical artifacts

(Swartz, 2002).

When data is obtained from instruments or techniques from those stated above, the reliability and validity of data needs to be tested. According to research methodology texts such as Sapsford and Jupp (1996), reliability refers to measure of the stability of data collection instrument. For example, if a questionnaire is a properly designed one, it should yield the same results when used by different researchers on different occasions, under the same circumstances. Validity in terms of data collection is described as the degree to which the question measured whatever it was designed to measure.

Burns (2000) states that to improve the reliability, the steps and the procedures constituting the case study must be well documented so others involved in the study may accurately duplicate the data collection process. During this case study two types of validity checks (as described in Burns (2000:476)) was consistently checked for:

1. Construct validity, brought about by an insufficient set of measures and/or instruments. This can be countered by using multiple sources of data.

2. Internal validity refers to the accuracy of findings or how closely they match reality. Again the use of multiple sources of data can reduce this negative effect.

The full report on reliability and validity of the data collection methods used in this study is provided in chapter five which is a description of the pilot study carried out before the start of the main study.

Documentation, interviews, and participant observation were also executed during this study in an attempt to ensure accurate data collection through multiple sources of data. Each of these is discussed in detail later in the chapter. The next section is an elaboration on the test cases (e-commerce websites) to be used in this study.

3.3 TEST CASES

Three commercial websites were selected as test cases for this study. These test cases were used by participants who in turn generated data required to draw conclusions for this research. In a published previous study, Sieber (1972) states that surveying techniques help the researcher to select an appropriate sample. The choice of these three e-commerce websites was based on the results of a survey carried out previously. According to a survey carried out by the University of Pretoria, South Africa, the three most frequently visited e-commerce websites by South African Internet users are Amazon.com, Bidorbuy.co.za and Mweb.co.za (NUA Internet Surveys, 2001). An anticipated disadvantage of this selection process was certain participants involved in this study having prior experience with the respective websites. Their previous experience could have impacted on their responses based on their mindset (this became more evident

with the more experienced users). This phenomenon was also evident in research conducted by Lee (2000) and shows that the pre-selection of websites could lead Internet users to a predetermined response, based on their past experiences with website interaction. The tasks set for the participants in Lee's study were designed to reduce any bias[2] in their responses. The same approach was adopted when designing the evaluation questionnaires for this research. (The evaluation questionnaire is discussed in greater detail in the following chapter).

A second approach adopted in an attempt to reduce participant bias, was an increase in the number of test cases. Kalahari.net was the fourth e-commerce website used in this study to cater mainly for the more experienced participant. By providing more test cases, participants were provided with more user interface components to evaluate before deriving their conclusions. As opposed to drawing conclusions from two test cases, any bias that the participants showed toward a particular e-commerce website was reduced once exposed to three or more different websites which in turn provided more accurate conclusions for the study.

"When using multiple cases, each case is treated as a single case. Each case's conclusions can then be used as information contributing to the whole study" (Soy, 1998). This case study was candidate to the above statement. It differed from the norm with regard to case-study research in that "intangible" or "dynamic" items (i.e. e-commerce websites) formed the test cases, as compared to people, companies or geographical elements.

[2] Research methodology texts refer to the term "bias" as a definitive statistical definition. In context of this study, bias will refer to an effect on any one of the participants which leads him/her toward favoritism of a particular test case.

The next subsection is a discussion on the role and selection of participants selected for this study.

3.4 PARTICIPANTS

Zoellick (2000) believes that when evaluating a business's e-commerce web site, it is advantageous to work with groups for the following reasons:

1. It simplifies personalisation: dealing with individual customers is expensive.
2. You can sell more to the individual customer if you understand the needs of the group.

This theory also applied to this research when Internet users were being selected to participate in the case study. The participants were sorted into one of three groups according to their computer and Internet use skill level (this selection process is highlighted below). This aided in shortening the time to complete the case study, as compared to individual participant testing, and secondly the different problems associated with the different computer skill level groups were more easily documented.

According to Burns (2000) the concept of sampling involves:

1. Taking a portion of the population.
2. Making observations with this smaller group.
3. Generalizing the findings to the larger population.

(Burns, 2000:82-84)

Following the above concept, in this study the population consisted of all e-commerce users, the sample frame comprised students and staff members of the Faculty of Commerce, Durban Institute of Technology and the actual sample of this study were thirty participants selected from this sample frame.

Patton (1983) states that participants should be selected based on their ability to increase "sample diversity" as set by the researcher. Also, "participants should be chosen to represent the intended user communities, with attention to background in computing, experience with the task, motivation, education and ability with the natural language used in the interface" (Shneiderman, 1998:129). In an attempt to increase sample diversity, participants were chosen from novice, intermediate and expert computer and Internet literacy levels. This division was achieved by asking the potential participants to complete a short questionnaire (the design and purpose of which is explained in the next chapter). This questionnaire determined the computer and Internet literacy levels of the potential participants. The Faculty of Commerce, Durban Institute of Technology, South Africa, formed the source of the participants. The Faculty of Commerce has a wide variety of students in terms of computer and Internet skill levels. (This became evident while the researcher was involved with lecturing a course called "end-user computing", a course designed to teach the basics of computer functions, providing the students with practical experience in office software (e.g. MS Office) as well as Internet usage). Thirty participants were selected from candidates who volunteered for the case study, with ten participants constituting each of the three literacy levels.

Sampling procedures play an important role when selecting participants for this type of study. “Qualitative research focuses on the depth and richness of data, thus samples should be selected purposefully” (Stead and Struwig, 2001). An important factor pertinent to this research was that although e-commerce websites formed the test cases, data was extracted from the participants involved in this study hence they (the participants) were also selected according to some criteria. Stratified sampling as defined in Burns (2000:90-92) involves dividing the population into layers or strata according to some criterion (in essence of this study, this criterion is Internet and computer literacy levels) and then drawing a random sample from each layer or strata. This research utilised a variation of this technique in that a sample frame was identified and divided into layers.

Once the participants had been selected and sorted into their respective groups they were given a list of predefined tasks to complete while logged onto the e-commerce website. The manner in which the participants carried out these tasks is described in the next subsection.

3.5 PROCEDURE

The participants completed a set of tasks that simulated an online purchase, utilising the e-commerce websites. (These tasks are discussed in the next subsection). The researcher was then engaged with observing the participants while they were performing a list of predetermined tasks. Once the participants completed these tasks or the specified time limit has lapsed (these constraints are fully described in chapter four), they then evaluated the e-commerce website user interfaces by responding to a questionnaire. Lastly,

participants were interviewed by the researcher. This entire procedure was staged in a controlled environment, which was a computer laboratory. Information derived from Shneiderman, an established usability testing expert, states that large software and hardware development companies, such as Microsoft and IBM have conducted usability testing in controlled environments with much success due to advantages such as easier fault logging and participant observation (Shneiderman, 1998:128-130). For reasons documented by usability testing experts, such as Shneiderman, this case study was conducted in a computer laboratory. Each data collection method stated above i.e. observation, questionnaires and interviews will be discussed in greater detail in the next chapter.

Internet Resource Center is a South African based company that offers its services as a consulting agency specialising in research that explores issues that impact on e-business or online trade (IRC, 2000). The IRC lists usability testing as one of the key issues that impact on e-commerce. Website usability testing can be carried out in a number of ways according to the IRC, two of which are "lab-based usability testing" and "focus groups". This research combined these two techniques by carrying out the study in a controlled environment, while utilising a selection of participants, based upon pre-selection criteria. (This pre-selection is elaborated on in the next chapter).

3.6 TASKS

Tasks set for the participants were designed to allow for the examination of the major components of the e-commerce website user interface. Shneiderman (1998:128) states that usability tests are designed to find flaws in user interfaces and he further suggests

that a carefully prepared set of tasks should be used to facilitate this process. The tasks set for the purposes of this study allowed for control over the participants in terms of how they were steered around the user interface, hence certain aspects of the e-commerce website user interface could be tested collectively which in turn easily pointed out common flaws. Also, by maintaining this control over a participant's course of actions, data collection becomes simpler. Participants were handed a list of products to purchase from the e-commerce shop front. Purchasing these products represented the tasks for the participants and is discussed in greater detail in the next subsection.

3.6.1 PRODUCTS

Appendix 1A is a list of the products the participants had to firstly find and secondly purchase. The products selected for purchase for this study ensured that the participants "shop" for different categories of products, hence steering them towards evaluating the navigational aspect of the user interface. Also by having to locate and purchase six products instead of one, the amount of time spent interacting with the user interface was increased giving the researcher more time to observe the participant's actions and behavior.

To serve as proof of the participant locating a product a single page questionnaire (appendix 1B) containing four tables, one for each e-commerce website, was also handed to the participants. They utilised this to record information pertaining to the products they have located and purchased. This information included the price, retailer and delivery time of a specific product. Provision was made for the participant to record the amount of

time spent locating and purchasing the required items, on a particular e-commerce website.

3.6.2 TIME LIMIT

Time limits for the completion of the tasks were approximated at the onset of this study. It was anticipated that the time limit would be sufficient to cater for any technical difficulties experienced with the laboratory equipment or any physical impediments of the participants (e.g. eyesight sensitive to high contrast light). Also the different participant groups (i.e. novice, intermediate and expert) were allocated different time frames for the completion of the task. Novice group participants were allowed 35 to 40 minutes, 25 to 30 minutes for intermediate and 15 to 20 minutes for the more experienced expert group participants. Technical complications (e.g. e-commerce website server gets reset and low bandwidth connections due to an increase in network usage) is one example of a circumstance by which the time limit would have been altered. This time limit was evaluated and adjusted during the pilot study which is fully described in chapter five.

3.6.3 TECHNIQUE FOR CARRYING OUT TASKS

Many surveys carried out previously (e.g. Shneiderman, 1998) required participants to directly evaluate the different components or aspects of the user interface. This is achieved by providing the participant with a questionnaire designed to direct the participant's attention toward a particular component of the user interface and then evaluate that component instantly. This type of testing is not representative of "real life" usage.

For this research a more generalised approach was adopted, one more closely related to the "real life" situation. Instead of pointing or drawing the participant's attention to a portion of the user interface and then answering questions thus related, they were asked to complete all specified tasks. Only upon completion of the tasks did the participants answer the evaluation questionnaires and they were not interrupted while carrying out these tasks. Hence the participants had no premonition of what aspect is currently being evaluated, and this helped to steer participants away from a predetermined response, especially among the more experienced users.

3.7 RESEARCH ASSISTANT TEAM

A team of proficient computer and Internet skilled users was selected to aid in the process of evaluating the e-commerce websites. The selected users formed the research assistant team and their proposed function was to assist in the data collection process and to provide some degree of feedback in terms of efficiency and problematic areas that they might have identified during the execution of the study. Their proposed duties included observing participants during the evaluation process, aiding the participants with any queries that they had and collecting and categorising of documents completed or created during the evaluation process.

This chapter provided a description of how the research was carried out and what methodologies were adopted. The next chapter gives an account of the "tools" used to select and to gather data generated from the participants involved in this study. The different techniques, evaluation materials and methodologies adopted for the collection of data will also be elaborated on in the next chapter.

CHAPTER FOUR

DATA COLLECTION TECHNIQUES

The data collection stage of this study utilised three inter-related methodologies. A detailed discussion on each of the three methods follows in the subsequent subsections of this chapter. The choice of data collection methodologies used for this portion of the study were based on research methodology literature, previously documented case studies and evaluations carried out on current website user interfaces and journal, white, online and other papers relating to the data collection processes. A limitation that may have affected the overall outcome of the data collection process, due to the choice of data collection methods, is discussed towards the end of this chapter. A brief overview of data collection methods that could have been used is also given at the end of this chapter, along with the reasons motivating the exclusion of these methods.

Each data collection method is described using a layout detailed in the
Inuse 6.2 Handbook for User-Centered Design, created by the Networked Electronic Storage and Communication of Telematics Applications Program Results (Nectar) (Nectar, 2003). Nectar is a European based organisation that focuses on bringing together or networking research being carried out in the field of engineering and information and communication technology. The Handbook for User-Centered Design contains information based on the different methodologies that may be employed when evaluating the user interface as well as other components of an information system. Although the methodologies used to collect data in this study are different from those stipulated in the Handbook for User Centered Design, the criteria used to present a detailed description of each methodology was followed during this study. The criteria used to describe data

collection techniques for this research was based on the above mentioned handbook and each is described using the following:

1. What is the method?
2. When is it used in relation to the data collection process?
3. A description of the content of the method.
4. Contribution of this method towards the study.
5. Benefits of using the method.
6. Limitations of the method.
7. How this method will be employed.

The first data collection methodology employed in this study was observation. The next section is a detailed description of this methodology.

4.1 OBSERVATION

Observation entailed taking note of common mistakes made, difficulties experienced and the ease of use of components and facilities, while the selected participants interacted with the user interface component of the selected e-commerce websites.

The type of observational method used, as described in Stead and Struwig (2001:100) was the naturalistic technique. In this technique the participants are given their tasks to be completed at the beginning of the data collection phase. The participants may have asked for assistance by the researcher or any one of the research assistant team members; however apart from this communication they were left alone while interacting with the e-commerce websites. (Selection of the research assistants is described in a later subsection

of this chapter). Even though the researcher or any member of the research assistant team observed a participant committing an error while completing the tasks, she/he did not intervene and disturb the participant's actions. By adopting the naturalistic technique, a more "relaxed" environment was provided and the participants were not under the influence of added pressure. If the participant was under any degree of pressure during any stage of the task completion process, forced errors may have occurred (errors that would normally not occur in a "real-life" situation). It was imperative to this data collection process that the participants fully understood that it was the e-commerce user interface being evaluated and not their own computer or Internet skill levels. This notion was conveyed to them before the onset of the evaluation procedure.

Burns identifies four stances which the researcher may adopt when observing participants. The approach that was taken for this study, as discussed in Burns (2000:405), is "observer-as-participant". In this approach the researcher's identity was known to the participants but remains a "stranger". Observation was carried out by the researcher as well as the research assistants using this approach. This process took place while the participants were carrying out the pre-defined tasks stipulated in chapter three. Information gathered from the User Interface in Advanced Communications Technologies (USINACTS)[3] website states "observation is a research method in itself, which distinguishes itself from others in that it requires that the system is tested in its natural use environment" (USINACTS, 2003). The pre-defined tasks stipulated above were designed to resemble a routine task that an Internet shopper would experience i.e.

[3] USINACTS is an European based research and technological development program dedicated toward providing a systematic approach to usability whenever user trials are an issue. The main objective of USINACTS is to identify, document and disseminate examples of successful application of usability principles from usage trials in industry.

use a number of online shops to get information regarding certain products, such as price and delivery time.

In a study aimed at evaluating usability of business-to-consumer e-commerce systems, carried out by Dawson, et al. (2003), the authors stated that the observational method is good at examining the "front-end" of an e-commerce environment (Dawson, et al., 2003). This "font-end" is a technical term used by programmers and system designers to describe the user interface component of an e-commerce website. The authors of this paper expand their discussion by stating that "observation", post and pre-evaluation interviews are the ideal methods for this type of study where user interface testing is the objective. Observation as a data collection methodology in this study provided the researcher with insights toward the efficiency as well as the problematic areas of the user interface of the e-commerce websites. This methodology also catered for and made known any unforeseen circumstances, which arose while participants were interacting with the user interface, circumstances that may not be recorded by examining the responses on the evaluation questionnaires or during the interview. (The evaluation questionnaires are discussed later in this chapter).

Stead and Struwig (2001:96) state that the observational methodology has the main advantage of not having to rely on the participants to report data accurately. This proved useful when observing the novice user participant group, since they were not anticipated on possessing the technical knowledge to fully express any difficulties experienced. User interface design texts such as Shniederman (1998:128) point out that video recording should be used when observing participants. However video and tape recorders were not planned for utilisation during this study in an attempt to preserve or maintain a

naturalistic environment. Video and other electronic equipment might have caused false, animated or even forced responses by the participants. “Many people feel uncomfortable about having their answers taped and may become inhibited and excessively cautious about what they say” (Burns, 2000:582).

Trustworthiness (as introduced in Stead and Struwig (2001:101)) was an issue associated with this observational methodology, since there was no one who could support the occurrences documented by one person. Hence the research assistants were also involved in the observation process and their documentation was also analysed during the data analysis stage of this research, in an attempt to improve trustworthiness.

USINACTS describes the following disadvantages when adopting observation as a data collection technique:

1. Very costly and really difficult to carry out.
2. It can be biased by using different observers, who may produce different records, thus producing "the observer effect" (there are differences as a function of observers, thus making it difficult to draw conclusions).
3. It can be difficult to know the reasons why particular behaviors are made.

(USINACTS, 2003).

For this study these disadvantages or shortfalls were anticipated, however their overall effects on the result on this study were minimal due to observation being one of two

secondary[4] data collection techniques (interviews constituting the second). By using four observers simultaneously (the researcher and three assistants), the "observer effect" introduced above by USINACTS was reduced.

For this portion of the data collection process no pre-defined criteria was adhered to. There existed no list of errors or mistakes that the participants may commit, that the researcher and the research assistants were informed about nor did they anticipate its occurrence. Documentation was done as the errors, unforeseen circumstances and other anomalies occurred. The researcher and the research assistants identified and recorded trends or patterns pertinent to reaching the conclusions of this study. Burns (2000:471) states that for case studies "conceptual categories" of data may arise i.e. data that does not exist in a category specified by the study. This type of data was also documented during the course of this study in the event that it might have had major influences on the conclusions.

Questionnaires were also employed as data collection agents for this study. Three different questionnaires were designed and developed for different stages and purposes of the data collection phase. The following subsections describe each questionnaire individually.

[4] Research methodology texts view the terms of "primary" and "secondary" sources of data as having precise definitions. Primary data is the original data gathered during a study whereas secondary data is a researcher's interpretation of primary data produced by another study.

4.2 QUESTIONNAIRES

Three different questionnaires were implemented for the purposes of selecting participants, evaluating the e-commerce user interface (completed by the participant) and facilitating the selection of the research assistant team.

4.2.1 SELECTION OF PARTICIPANTS

A short questionnaire was employed to select the participants for this study. Chapter three pointed out the three levels of computer and Internet skill levels that the selected participants were grouped by, in an attempt to increase sample diversity. The main purpose of this questionnaire was to select and sort the potential participants into one of the three above mentioned groups.

Selection of participants was the first task executed before the examination of the e-commerce website user interfaces commenced. The process of short-listing and sorting volunteers into participant groups was done using the questionnaire in appendix 2A.

The questionnaire in appendix 2A consists of questions pertaining to the computer literacy and Internet skill levels of the volunteer or potential participant. Questions used in this questionnaire are of the nominal measures category. Olivier describes nominal measures as “The respondent is requested to select responses from a list of alternatives. No order exists between the alternatives provided” Olivier (1997:109). Responses to these questions enabled the researcher to select, classify and place the volunteer into one of the three participant groups. Placement of the newly selected participant into a particular group (either novice, intermediate or experienced) depended on:

1. Their perception of Internet and computer literacy.
2. The amount of time that individual spends utilising a computer system.
3. The amount of time that individual spends utilising the Internet.
4. A response to their idea of the term “e-commerce”.

Candidates with the most computer and Internet experience were placed in the “experienced” group whereas the candidates with the least amount constituted the “novice” group.

A point system was adopted to select and sort the participants into the relevant groups. For example the first question in appendix 2A stipulates that the participant should rate themselves as a computer user by choosing one of four alternatives (expert, intermediate, beginner or no experience). If the volunteer selected “expert” then 3 points were awarded as opposed to 0 points for choosing “no experience”. The combined score obtained after tallying all four questions was used to place the participant into one of the three groups (beginner, intermediate or expert). The projected points and placement of participants is highlighted in the following table:

Table 4-1: Projected participant score for placement into group.

Score	**Group**
10 /10	Expert
7/10 to 9/10	Intermediate
0/10 to 6/10	Novice

Hence thirty volunteers were chosen, depending on their scores, forming the three participant groups consisting of ten people each. Any remaining completed

questionnaires were filed and that volunteer would have been contacted to act as a participant in the event of one of the existing participants not being able to perform the evaluation.

This questionnaire was designed to shorten the time spent on selecting and sorting participants. Also, when embarking on qualitative research, participants possessing certain criteria need to be selected, as compared to random sampling usually used in quantitative studies. Stead and Struwig (2001:121) state that qualitative researchers must carefully consider the reason for selecting a particular participant and not another. This phase of the research was designed to purposefully select participants based on criteria imperative to this study, i.e. the knowledge and experience of both computer systems and the Internet. Olivier (1997:107) states that questionnaires should be kept as short and as simple as possible. This was important for gaining and keeping the volunteer's attention as opposed to a lengthy questionnaire with difficult to understand questions.

Limitations of this selection technique included the placement of a particular participant into one of the three user groups depending entirely on the participant's perception of his or her own skills and ability. This phenomenon may lead to a certain degree of inaccuracy when forming these groups. The adaptation of a point system based on responses to questions pertaining to different areas of skills curbed this phenomenon to a certain degree, hence yielding more accurate results.

The questionnaire in mind (appendix 2A) was handed out to volunteers wishing to participate in this study. Through the use of posters and notices on bulletin boards, commencement of this study was publicised to the student and staff population of the

faculty of Commerce, Durban Institute of Technology, South Africa. One week was allocated for this task after which the selected participant's names were displayed on the faculty notice boards.

The second questionnaire was implemented to gain responses from the participants pertaining to the e-commerce website user interface, which was later analysed to form feedback. The next section is a discussion of how this was achieved.

4.2.2 USER INTERFACE EVALUATION QUESTIONNAIRE

Appendix 2B is a copy of the questionnaire that was used by the selected participant, for the purpose of evaluating the e-commerce website user interface. This questionnaire represented the most important tool of this study. Conclusions drawn at the completion of this study depended on the responses gained from the participants upon completion of this questionnaire. USINACTS state "questionnaires should be used to assess in a standard way subjective judgements, attitudes, opinions or feelings about the usability of all or part of an existing system" (USINACTS, 2003).

The evaluation questionnaire consisted of four subsections or divisions of questions with each requiring the participant to rate related aspects of the user interface. Division into these four aspects was derived from the findings of the literature review in chapter two. In that chapter it was established that usability experts identified potential shortfalls with user interface design, arising from graphical and component design. This divisional structure was also based on information documented by Kamel (2002) who describes the context of a website as:

1. Section breakdown, which refers to the manner in which a website is organised into subcomponents.
2. Linking structure, the websites approach to linking alternative sections.
3. Navigational tools, facilitates how the user moves through the website.
4. Colour schemes, the colours used throughout the website.

(Kamel, 2000).

Based on the findings of the literature review and the conclusion of the above mentioned study, the four divisions of the evaluation questionnaire are described below:

1. Section A: component usage and design (components such as search engine and shopping basket).
2. Section B: cosmetic design of the user interface (use of colour, font and graphics).
3. Section C: general or overall difficulties and efficiencies pertaining to each of the four websites used.
4. Section D: general open ended question allowing for comment on any aspect of the user interface or the evaluation procedure itself.

Sections A and B consisted of statements regarding or highlighting some aspect of the user interface. Participants were required to respond to these statements by using the following alternatives:

Poor	☐
Fair	☐
Good	☐
Excellent	☐

The statements are representative of a Linkert scale which Olivier describes as "scales used to specify the degree to which a particular statement applies to the respondent" (Olivier, 1997:111-113). Different components of the user interface were evaluated separately by the participants. Each statement on the questionnaire allowed for the evaluation of one component only. Shneiderman states that "if precise, as opposed to general questions are used, then there is a greater chance that the results will provide useful guidance for taking action" (Shneiderman, 1998:134). Analysis of the responses to the question provided data that aided in drawing the conclusions concerning the different parts of the user interface. These responses pointed out the problematic areas of the user interface in terms of efficiency, ease of understanding and ease of use hence providing the "feedback" necessary to reach conclusions regarding the user interface of these four e-commerce websites.

Sapsford and Jupp differentiate between "open" and "closed" questions. "Open questions specify some criteria but the respondent is free to answer in their own way. Closed questions provide a range of possible solutions to the questions asked and the respondent is forced to choose one" (Sapsford and Jupp, 1996:160-162). Open questions were included in section C and D of this questionnaire which provided for a means of expressing a viewpoint that was not addressed by the Linkert scale statements. Olivier (1997:113) describes an open question as when the format of the response depends

entirely on the respondent. The open question was aimed primarily at the more experienced participant, in that it provides a mechanism for expressing more technical viewpoints. Open questions also allowed for the participant to express which component as well as which task they found the easiest to use and to complete respectively. Krueger (1998:99) feels that the final questions are of particular importance, since these questions determines where participants place priority. Hence, section D, the last question in the evaluation questionnaire, was carefully analysed.

The next subsection is a description of the formation as well as the role of the research assistant team.

4.2.3 RESEARCH ASSISTANT TEAM

Appendix 2C is the questionnaire that was used to select three volunteers to form the research assistant team. Posters were used to communicate the need for a research assistant team. Candidates were chosen from 3rd and 4th year Information Technology students from the department of Information and Communication Technology, Durban Institute of Technology, South Africa. Staff members of the above mentioned department were also given the opportunity to volunteer for becoming a part of the research assistant team. The selection criteria for the team members were the amount of computer, Internet and e-commerce interaction experience, with preference given to those candidates with the highest amount of each. A point system was implemented when selecting research assistants, similar to the system used to select participants. Points were awarded depending on the answer selected on the questionnaire and the volunteers with the three highest scores were selected. Experience as a student tutor or lecturer gave the candidate

an added advantage as this serves as proof of experienced communication skills within a controlled environment.

Involvement of a research assistant team firstly decreased the time required to collect data and secondly, added a higher degree of accuracy to the data gained from the participants (since more assistance was available to deal with any queries the participants might have had). Handing out of evaluation questionnaires, ensuring proper seating arrangements for participants within the laboratory, collection of evaluation questionnaires and ensuring that the responses are correctly and concisely completed by the participants were some of the functions that the research assistant team performed, during the data collection process. This reduced the time needed for this phase. Observation of the participants as they completed the required tasks also formed part of the research assistants' duties. Lastly the research assistant team was given the opportunity to reflect their own thoughts and observations of the data collection process and the study in its entirety, at the end of this phase. Information that the researcher might not have recorded was revealed by providing a means of open expression for the research assistant team.

Interviews made up the final data collection methodology adopted for this study. The next subsection is a detailed account of how this was carried out.

4.3 PARTICIPANT INTERVIEWS

According to information drawn from the Inuse 6.2 Handbook for User-centered design (Nectar, 1993) interviews play an important role in the data collection process. It

provided a means of documenting unexpected viewpoints as well as viewpoints which had been overlooked or not represented by other data collection techniques. The type of interview technique used was a combination of the "focus group" and the "unstandardised" techniques. What follows is an elaboration of each technique.

Krueger views a focus group as a "carefully planned discussion designed to obtain perceptions of a defined area of interest in a permissive, non-threatening environment" (Krueger, 1988:18). Interviews were conducted by the researcher after the participants had completed their predefined tasks and reflected their responses on the questionnaire. Neilson describes focus groups as an "informal technique that can help you (the researcher) to assess users' needs before and after user interface design" (Nielson, 1997). Further, Shneiderman (1998:145) states that focus group interviews would eventually lead to specific, constructive suggestions or opinions with regard to the user interface in question.

Nielson (1997) states that for participants, the focus group session should be free-flowing and relatively unstructured. He also states that the proper role of focus groups is not to assess interaction styles or usability designs, but to discover what users want from the system in question. This is representative of "feedback" from participants, a key concept with regards to this study. Further, Stead and Struwig (2001:7) state that an ideal number of participants in a focus group interview are 6 to 12 participants.

The second technique combined with the focus group interview is the unstructured interview. Stead and Struwig (2001:99) describe the unstructured (some texts refer to this as unstandardised) interview technique as being conducted without subjecting the

participants to a set of pre-determined questions. This method allowed for the participants to express his or her opinions freely, as the interviewer did not impose their viewpoints upon them. Also, by using a set of pre-determined questions participants were steered toward a frame of mind depending on the questions asked by the interviewer. This phenomenon might have prevented certain issues or perceptions of the user interface from being concisely discussed by the participant. USINACTS points out "interviews for usability research are usually much less formal. The sample is small and carefully defined. Interview style is intentionally conversational in order to put the interviewee at ease and encourage as much comment as possible" (USINACTS, 2003).

To ensure that this method was properly implemented i.e. unstructured interviews, the researcher adhered to a set of focus group interview guidelines as discussed in Stead and Struwig:

1. Participants must be made to feel that they are free to disagree with each other.
2. All contributions are worthwhile, no matter how trivial it may seem at the time.
3. Facilitator must be attentive and willing to listen.
4. Facilitator must show interest in what is being said by the participant.
5. Encourage a wide range of opinions and ideas.
6. Assist the participant to explore their opinions further

(Stead and Struwig, 2001:101).

Drawing from the above information, the interview technique adopted for this study was a combination of both the above mentioned techniques in that unstructured interviews

were held with three different groups, with each group constituting a focus group. The benefits of adopting and combining these two interviewing techniques as well as adhering to the above list of guidelines included the provision of a secure environment for the participants, free of criticism, allowing for in depth discussions concerning the user interface and the reduction of time required to complete this phase. Further Burns (2000:466) states that case studies use the unstructured technique for conducting interviews so that the participant is more of an informant than a respondent.

This notion provided more insights toward the study since it provided a mechanism for the collection of conceptual data i.e. "data representing issues that were not initially projected during the early stages of the study, but did arise during the data collection stage" (Burns, 2000:430). This type of data was recorded in the event of it having some bearing on the drawing of conclusions of the study.

Viewpoints, comments and other points of interest relevant to this study were documented using pen and paper. Similar to the point illustrated earlier in the chapter with regard to the observational technique, video and other electronic devices were not used to record data. This may have lead to some level of "nervousness" among the participants and yielded inaccurate data.

The disadvantages of the interview data collection technique was the possibility of participants not disclosing their complete thoughts on the efficiency and other related issues pertaining to the user interface. The researcher was aware of this event and sometimes directed the discussion toward a biased train of thought. "During the group session the moderator has the difficult task of keeping the discussion on track, without inhibiting his own thoughts on the subject matter" (Nielson, 1997). Similarly this method

might have suffered from group influenced biases (as experienced by Dawson et. al., 2003) and the individual personal feelings and/or preferences might have been accidentally ignored. The researcher would have intervened and corrected the flow of the interview if this had transpired.

Another limitation, as pointed out in USINACT, is that interviews depend on human memory which is frequently inaccurate (USINACT, 2003). This was dealt with by submitting the participants to an interview soon after they had completed the evaluation. Sapsford and Jupp (1996:99) identified "acquiescence" as a potential pitfall when interviewing. This is a phenomenon where the respondent always responds favourably to the subject in question. The researcher intervened whenever this event occurred and asked the participant to criticise the user interface.

The data collection process was executed in a computer laboratory. The next subsection provides an account of why this location was chosen as well as technical information describing the computers utilised by the participants.

4.4 LABORATORY PREPARATION

For this study, the data collection stage was carried out in a controlled environment. This allowed for a relaxed and secure work place for the participant to evaluate the e-commerce user interface, with the participant's concentration directed entirely toward completion of the evaluation tasks. The data collection process took place in one of the computer laboratories available at the department of Information and Communication Technology, Durban Institute of Technology, South Africa. Each lab was fitted with fifty

desktop computers. The technical specifications are detailed in the table below. The network speed/bandwidth at the time of this data collection process is averaged at 3.86 Kb/sec.

Table 4-2: Laboratory computer hardware specification.

Desktop computer component	**Specifications**
CPU	Intel Pentium 2, 333 MHz
Memory	64 MB
Hard disk	10 Gb
Monitor	14 inch
Screen resolution	640 x 480
Colour dept	16 bit

The specifications of the desktop machines were found sufficient to view the selected e-commerce websites user interfaces. Each machine was controlled by the Microsoft Windows 98 operating system and Internet Explorer ver 5.0 was used for Internet browsing purposes.

The next section is a short discussion regarding the shortcomings of the elected data collection methodologies.

4.5 LIMITATIONS OF THE EVALUATION PROCEDURE

Limitations of the discussed data collection methods include the users not having to carry out the actual purchase. Participants were not required to use their own finances or credit card details. These factors do not lead to a genuine, self motivated task within an e-

commerce environment. Further, the participants did not have freedom to choose the e-commerce retailers they feel most comfortable with. This is in contrast with the "real life" situation in which a user would be more aware and alert about the task of purchasing an item online, since their finances are at stake, should they choose an incorrect item. Dawson et al., (2003) also conclude that participants should use their own financial details and select their own e-commerce websites in an attempt to add a higher degree of realism. However, the participants used in this study are primarily students, and most of them did not have the financial resources to allow the study to be conducted in the manner described by the above authors.

The next section is a description of methodologies that were not used during the data collection process, although they have been employed in other studies which evaluated the user interface component of both websites and information systems. Methodologies that could have been adopted for this study are "cognitive walkthroughs" and "heuristic evaluations". The following subsection describes what they are and why they were not implemented in this study.

4.6 EXCLUDED METHODOLOGIES

4.6.1 COGNITIVE WALKTHROUGHS

"Cognitive walkthroughs is when the evaluator simulates the user's decision-making process with the user interface, for a particular task" (Dawson et al., 2003). This method is useful for examining the usability problems of the user interface design features. The primary focus of this method is the user's retention of commands over time or the ease of learning of the user interface. This would be accurate for evaluating the user interface of

an information system, seeing that the user will be using the same interface over a long period of time. This method was excluded due to e-commerce website user interfaces being different from each other and the Internet user is by no means required to "learn" the user interface. If the user is not happy with the e-commerce website user interface design, they are free to use another.

4.6.2 HEURISTIC EVALUATIONS

Heuristic evaluations involve an expert usability evaluator carrying out typical task scenarios with the user interface being evaluated. This expert would also examine the user interface's compliance with recognised usability principles (Dawson et al., 2003). This methodology was excluded due to the inability of the usability expert to simulate the multitude of differing characteristics typical users of an e-commerce website represented. The demographics of the users logging onto e-commerce websites is too vast to be evaluated by one or two experts. The second reason for excluding this methodology was the rate of pay for a usability expert being too high in comparison to the allocated budget for this study.

4.7 PILOT STUDY

A pilot study was planned in an attempt to test the chosen data collection techniques before actual data was collected. The above mentioned data collection techniques were tested and refined by subjecting them to a pilot study. Olivier (1997) states that a pilot study is important for identifying misunderstood questions and unexpected responses on the design of the questionnaires as well as other data collection instruments. He also

states that if drastic changes are required then another pilot study should be implemented. Stead and Struwig (2001) also displayed similar reasons for conducting a pilot study. These authors feel that a pilot study is imperative to testing the questionnaire to show problems with understanding instructions.

For the above reasons a pilot study was planned in this research. More so due to the questionnaire being the most important data collection instrument, since it yielded data directly from the participant, directly related to the user interface. There exist pre-developed and tested questionnaires available from usability testing journals and case studies (such as Shneiderman) that could have been employed in this study, however the participants of this study may have had difficulty with understanding the terminology e.g. "shopping cart" as opposed to "shopping basket", use of too many technical terms (computer literacy level of the average American compared to that of an average South African user) and the fact that most of these questionnaires were designed to be completed online. Mouton amplifies the above remarks in his discussion regarding the use of existing instrumentation by stating that "most existing questionnaires, scales and tests were probably developed in the highly industrial countries of Europe and North America and are not suited for our South African skill levels" (Mouton, 2001:102).

This chapter described the techniques that were adapted in an attempt to gain concise data from participants used in this study. A description of the techniques used to implement the different data collection methods was also given. Advantages, limitations and the contribution toward this study of each method were also detailed in this chapter. The importance of conducting a pilot study, especially for this type of research, was also highlighted.

The next chapter is a description on how the pilot study was implemented and a report of the conclusions derived from this.

CHAPTER FIVE

PILOT STUDY

A pilot study refers to a mini-version of the full scale study. It provides a means by which the researcher can test the various attributes constituting the research procedure. Bloor and Frankland argue that a pilot study provides the researcher with a "clear definition of the focus of the study, which in turn helps the researcher with the data collection of the study" (Bloor and Frankland, 1999:154-158). A pilot study was carried out to test the different data collection instruments, to streamline the proposed evaluation tasks, to establish time allocation for the differently skilled participants, to test the efficiency of the sampling technique and to investigate the advantages and disadvantages of executing this study in a computer laboratory. Other issues also scrutinised during this phase of this study were the sequence of implementing the data collection techniques, the procedure proposed for collecting data as well as the reliability and validity of the data collection instruments that were first introduced in chapter three.

The importance of the pilot study is further exaggerated due to the data collection instruments, data collection techniques, sampling methods and procedural design of this study as a whole, being an adaptation and/or modification of existing methodologies.
Existing methodologies could not be directly employed for various reasons, fully described in chapters three and four. These modified techniques, methods and procedures had to be extensively tested before being employed in the main data collection stage of this study in an attempt to ensure the integrity and accuracy of any data collected.
This chapter is a description of how the pilot study was conducted, the potential problems that were identified and an account of how they were rectified. Implementation

of the pilot study followed the same procedure discussed in chapter four. What follows is a summary of this procedure. Thereafter a more detailed description of the pilot study is provided.

5.1 PILOT STUDY METHODOLOGY

Participants volunteered for this pilot study. There existed no skill level division among participants in the pilot study, since the emphasis was on testing the data collection methods. Of the ten volunteers, seven turned up for the evaluation. However these seven participants showed sufficient representation of the different skill levels to be used in the final study. Participants were then asked to purchase a list of pre-selected products from pre-defined e-commerce sites. Observation took place while participants performed these tasks. Evaluation questionnaires were thereafter used by the participants to rate the various components of the e-commerce website. An interview formed the final data collection instrument and this was conducted by the researcher. The researcher was the sole facilitator of the pilot study and this was conducted in a controlled environment which was a computer laboratory at the department of Information Technology, Durban Institute of Technology.

Subsequent subsections of this chapter provide more thorough discussions of the pilot study, the issues or problems that arose as well as how these were addressed before the final data collection phase of this study was carried out.

5.2 QUESTIONNAIRES

The first data collection instrument to be tested was the questionnaire, which was designed to be completed by the participant. Limitations of using questionnaires to draw out responses include inaccuracy, as compared to other data collection methods. There exists the possibility of factors arising that may lead to imprecise responses being given by the participant, for example the participants may not properly understand a statement on the evaluation questionnaire or fully interpret what is required of them as a response. This issue was addressed by implementing more than one data collection technique regarding the same or similar issues and at a later stage examining the responses for similarities.

Information gathered from the USINACTS website (introduced earlier in chapter 4) highlight certain principles that need to be enforced when designing usability testing questionnaires. These may be listed as:

1. Provide clear instructions for completion.
2. Consider choice of words.
3. Consider phrasing of questions.
4. Sequence of questions.
5. Desired form of response.

(USINACTS, 2003).

The above principles were some of the aspects that the questionnaires were tested for during the pilot study. Also, the reliability and validity of the data was also tested (a concept introduced earlier in chapter three).

The above mentioned criteria were tested by having the participant complete questionnaires and then subjecting them to the same or similar line of questioning during some stage of the interview. (Interviews are discussed at a later stage in this chapter).

In their paper describing the importance of pilot studies, van de Teijlingen and Hundley (2001) identify procedures to improve the internal validity of a questionnaire. Their view's have been adopted from the work done by Peat et al. (2001) and lists the procedures as follows:

1. Administer the questionnaires in the pilot study the same way planned in the main study.
2. Ask participants for feedback to identify ambiguities and difficult questions.
3. Record time taken to complete questions.
4. Assess whether each question gives an adequate range of responses.
5. Establish that replies can be interpreted in terms of the information required.
6. Shorten, revise and pilot again if possible

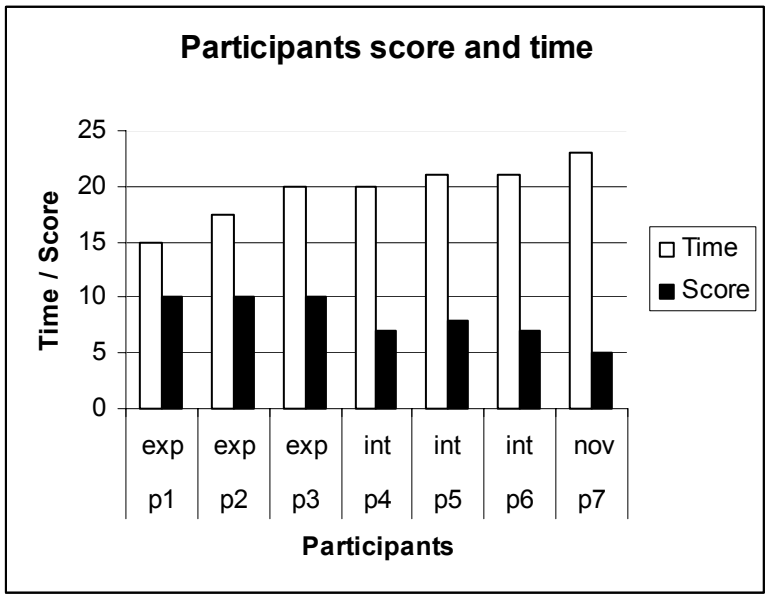
(van de Teijlingen and Hundley, 2001).

The above procedure established by van de Teijlingen and Hundley (2001) formed the basic framework for testing questionnaires during this pilot study. Two questionnaires were employed in this study and the above described procedures were repeatedly tested

for with respect to both the participant selection questionnaire, to be utilised in order to determine their level of computer literacy (appendix 2A) and the evaluation questionnaire, which is planned to be used to evaluate the different e-commerce websites (appendix 2B).

For the purpose of testing the participant selection questionnaire (appendix 2A), ten questionnaires were handed out to volunteers. Volunteers consisted of candidates from the student population as well as staff members from the department of Information Technology. The objective of this exercise was to test the efficiency of the point system to be adopted when short listing and selecting participants for this study. (The point system was discussed in greater detail in chapter four). This was achieved by firstly recording the volunteer's name, their calculated score and later comparing this to the time taken for them to complete the predefined tasks using the e-commerce websites. Consistency between the participant's score and the time taken to complete the tasks should be reflected as an inverse relationship (i.e. the higher a participant's score, the time taken to complete the pre-defined tasks should be shorter when compared to the other participants). Consistency was reflected after analysis, shown below diagrammatically. Hence this data collection technique proved reliable and valid.

The following table and relative chart highlights the inverse relationship between the scores obtained by the participants in the participant selection questionnaire (appendix 2A) and the time taken to complete the predefined tasks on a particular e-commerce website.



Graph 5-1: Inverse relationship between participant's score and time taken to complete tasks.

No potential irregularities arose with respect to the participant questionnaire (appendix 2A) and the same version was used for the data collection phase of this study.

The evaluation questionnaire (appendix 2B) consists of four subsections. What follows is a breakdown of the questionnaire and the results of the pilot study regarding each section.

5.2.1 CONSENT

No errors were present with this portion of the questionnaire. All participants understood their role in the pilot study. This was evident due to no queries being made.

5.2.2 INSTRUCTIONS

Just three instructions were listed. Participants were able to fully understand these instructions, since they were modeled from examination question paper instructions. No queries were made.

5.2.3 SECTION A TO SECTION C

Sections A, B and C contained the questions relating to the different components of the e-commerce website and hence formed the most important portion of the questionnaire. These three sections also constituted the bulk of the questionnaire and were tested for grammatical errors, difficulties arising from the misunderstanding of the questions or misunderstanding the type of response required, structure and layout of the questionnaire and taking note of time utilisation by the participant. The above criteria were checked for by examining the responses to questions and taking note of the queries made by the participants. Time needed to complete the evaluation questionnaire was also recorded and was used at a later stage to develop time allocations (described later in subsection 5.6).

The following issues manifested with regard to the evaluation questionnaire:

1. Four test cases (e-commerce websites) were planned for evaluation by participants. Each website had to be evaluated using separate questionnaires (appendix 2B). However this approach did lead to difficulties with filing and eventually lead to the participants' questionnaires being mismatched. A design change was affected and the result was one questionnaire being designed with a

tabular format. Each table incorporated questions regarding each of the four e-commerce websites (appendix 3A). This modification significantly reduced the amount as well as the collection and management of paperwork during the main study.

2. One spelling error was identified by a staff member.

3. Page numbers were changed in format from a single digit to the "1 of 4" format. This gave the participant a more clear indication of their progress, which is important due to the planned time allocation limitation.

4. Initially one open ended question was included. The researcher later decided that more opportunity should be made available for participant comment. The revised version of the questionnaire (appendix 3A), seven open ended questions were included. Six of which allowed for comment pertaining to the different components of each of the four e-commerce websites, the process of task completion and the amount of assistance required during the evaluation process. The last question provided a mechanism for comment regarding the evaluation procedure as a whole. Responses gained from these open ended questions provided information that had been overlooked or not addressed by the content of the questionnaire.

5. Some participants did show an above average interest in this study and made the remark that they would relate and forward any information they might come across, related to this study. Hence the researcher's contact details were added to

the end of the evaluation questionnaire (appendix 3A) specifically for this purpose.

6. No time limit was specified for the completion of the evaluation questionnaire and an average time of 12 minutes was recorded for the completion of responses to the questionnaire.

5.2.4 SECTION D

This section consisted of one open ended question and provided the participant with a mechanism to express opinions and viewpoints in a more generalised manner. Comments regarding the entire evaluation procedure were anticipated as responses.

Responses made in the questionnaire were compared to the data gathered from a stage of the interview, during which a similar line of questioning to that of the questionnaire was asked of the respondents. This was executed purely to assess the reliability and validity of the questionnaire. The data collected corresponded during both data collection methods i.e. questionnaire and the stage of the interview.

Observation is another data collection techniques enlisted in this study. The next subsection is the elaboration of the effectiveness of this technique.

5.3 OBSERVATION

By implementing this technique during the pilot study, observation was tested for any shortfalls that it may exhibit. As described in chapter four, the type of observation used was “naturalistic”. This form of observation was also tested.

The adopted method for recording data i.e. hand written notes, also had to be tested since past studies, which have employed observation as a data collection technique, recommend using video equipment to record data. (A more detailed elaboration substantiating the exclusion of video and other electronic equipment was given in chapter four).

Observation was implemented while participants were interacting with e-commerce websites. Naturalistic observation requires no intervention from the researcher under normal testing circumstances. The only instance of researcher intervention was when a participant had a query.

The following issues manifested with regard to observation:

1. During this pilot study, observation as a data collection instrument, proved effective when taking note of participants behavioral characteristics, common errors made and tasks that were more easily completed.

2. Hand written transcripts documenting observation proved efficient and cost effective.

3. A difficulty did arise occasionally when a participant had a query. The researcher was distracted from observation momentarily while resolving these queries. It was decided that the research assistant team will facilitate the data collection phase of this study in an attempt to address this shortcoming.

4. E-commerce website components that were more easily utilised, those that were more difficult to utilise, tasks that were easily completed and tasks that took longer to complete were the aspects that were recorded during observation. At the end of the pilot study this data was compared to the participant's responses to the open ended questions. Both sets of data were consistent and this proved the data gathered to be reliable.

5. Peer-to-peer consultation among participants was observed while they were completing the evaluation questionnaire. This notion was not encouraged since bias may affect the participants' responses and hinders their true reflection of the e-commerce website user interfaces. Instead participants were encouraged to ask the researcher for assistance. Easier documentation of common errors or participant queries was made available through this approach.

As applied to the other data collection methods used in this study, the reliability and validity of observation had to be tested. Sapsford and Jupp (1996:90) highlight two ways of asserting reliability as "replication" and "triangulation". In context of this study replication involves the researcher's and the research assistant's extent of agreement on the accuracy of the data collected. After the pilot study the notes made by both above

mentioned parties were in correspondence. Triangulation was asserted by using three different data collection techniques, and then cross checking the recorded data. This data was also consistent and corresponded to a high degree.

Validity, according to Sapsford and Jupp (1996:91), refers to the accuracy of data collected. This was checked for by comparing the data collected using the three adopted techniques, and did prove valid.

The next subsection elaborates on the testing of the interview data collection technique.

5.4 INTERVIEW

Interviews formed the third and final data collection technique planned for this study. "Unstructured, focus group" was the type of interview technique used, which was discussed in chapter four. This data collection method was subjected to testing during the pilot study. Participants elected for the pilot study were required to participate in an interview with the researcher upon completion of the pre-defined tasks and the evaluation questionnaire.

The following issues arose with regard to interviews:

1. The desired method of data collection was hand written transcripts. This alternative was chosen, as compared to electronic equipment such as video recorders, in an attempt to prevent animated responses or inaccurate responses brought on by the presence of electronic equipment (Detailed in chapter four). Natural and unperturbed opinions and viewpoints were expressed by the

participants, which were successfully recorded using the above mentioned method.

2. No time limit was specified for this data collection method. A total time period of 20 minutes was required for the entire interview. This approach was used during the final data collection phase i.e. the absence of a time allocation limit.

3. No pre-defined questions were planned for the interview stage of the final data collection phase of this study. However, for the pilot study a line of questioning similar to the open ended questions present in the evaluation questionnaire was posed to the participants at the end of the interview. This was done in an attempt to test the reliability of interviews as a data collection instrument. Responses to questions in both the evaluation questionnaire and the interview were consistent. Hence the reliability of this method was shown.

4. Another factor that may hinder this type of interview as a data collection agent is the informal manner of conduction. The informal technique may lead to participant input "straying off the topic". This phenomenon did occur among two of the more advanced/experienced participants albeit by a slight degree of variation. This was the only instance of researcher intervention during the interview in an attempt to redirect or streamline their comments more closely towards the topic.

5. The researcher was successfully able to document all comments and remarks accurately and concisely. It was further decided that the research assistant team

will not facilitate in this process for the final data collection process. This would leave them free for the collection and categorising of the questionnaires completed by the participants which in turn will allow the researcher to devote his full attention to the interview.

6. Interviews conducted with participants in a group yielded sufficient data in order to draw new conclusions and to support data already gathered from the primary data collection technique i.e. the evaluation questionnaire. Hence the need for individual participant interviews was relinquished which eventually decreased the amount of time spent executing this process.

Notes recorded by the researcher during the interview were compared to those recorded during the observation and to the responses made in the evaluation questionnaire. This comparison did prove the reliability and validity of the interview as a data collection technique, since the difficulties experienced by the participants were noted as being similar for all three techniques.

Apart from the data collection instruments, the pre-defined tasks to be attempted by the participants were also scrutinised during the pilot study. Issues such as the time required completing the tasks, difficulty level of the tasks and the participant understanding of the requirements had to be tested and the results are discussed next.

5.5 TASKS

In order for the participant to evaluate the selected e-commerce websites, certain tasks had to be completed by the participant before hand, providing him/her with sufficient exposure to the different components. Participants had to find and record product details given to them in list form. This effectively formed the tasks and is present in appendix 3B. Apart from locating these items, the tasks also required the use of the client/customer profile section as well as the help facility. All participants involved in this pilot study had to complete the list of tasks on all four selected e-commerce websites.

The following is a list of the observations made during this pilot study with regard to the tasks:

1. Appendix 3B is a list of the six items that made up the majority of the task list. Participants had difficulty in finding the cellular phone accessory and the tennis racquet. This was mainly due to the discontinuation of these products or in the case of one website the product being continuously out of stock. For the main evaluation process of this study these two items were removed from the list of tasks however the time allocation remained unchanged. Appendix 3C was the task list used in the main study.

2. Product information i.e. retailer, cost and delivery time were required to be recorded using the tables in appendix 3D. Participants expressed neither difficulty in understanding nor filling in the product details. One difficulty that did arise was when the researcher himself had to take note of the time taken by a participant to complete the tasks for each website. This disturbed the participant to some extent

and a degree of inaccuracy of approximately 2 minutes did occur in some instances when more than one participant had finished the tasks on a particular website at the exact time. Thus a mechanism needed to be provided for the final data collection which catered for the participant to record the time utilisation themselves. The revised tables can be viewed in appendix 3E, the layout remained unchanged, two items were removed (as stated above in point number two) and a space for time utilisation included.

3. One additional question was added regarding the time spent on each website. This allowed for the total time taken to complete these tasks to be documented.

4. Reliability of this questionnaire was tested by comparing the participant responses to the "time spent completing tasks" question to that recorded by the researcher. This was done for each participant and the results were consistent.

5. Novice participants did reflect some form of fatigue induced by the length or duration of this process. This could be seen by their body language and presented a potential shortfall since it did lead to some participants completing the questionnaire inaccurately, in an attempt to shorten the evaluation process. The removal of two products from the task list was affected for the final data collection in an attempt to curb this problem.

Limited time will be available to the participants, during which the evaluation tasks will have to be completed. The next section discusses the adequacy of this limitation.

5.6 TIME ALLOCATION/LIMIT

A time limit was set for the completion of tasks. This limit was subject to change during the pilot study, depending on the number of tasks that the participant could complete during this pilot study, in an attempt to cater for the different levels of participants involved in the pilot study i.e. novice, intermediate and expert. A time limit of 1 hour and 20 minutes was initially allocated. What follows is a breakdown of the time allocation established for each participant group.

5.6.1 EXPERT GROUP

Of the seven participants employed in the pilot study, three met the criteria for forming the expert participant group i.e. obtaining a maximum score of 10 in the participant selection questionnaire (appendix 2A). An average time of 17 minutes was recorded for the completion of the predefined tasks on one e-commerce website. Since there are four such websites a total time of 58 minutes was averaged. One anomaly was the fact that the participants forming the expert group were all staff members with high skill levels hence more time (an additional 6 minutes) was allocated in order to cater for other participants in the expert group. For the data collection of this study the expert participant group was allowed 1 hour 4 minutes.

5.6.2 INTERMEDIATE GROUP

Three participants met the criteria for the intermediate group, obtaining a score of between 7 and 9 points in the participant selection questionnaire. An average time of 20

minutes was recorded for the completion of the tasks using each website. Thus a total average time for completion of all tasks was 80 minutes. The intermediate group will be allowed 1 hour 20 minutes.

5.6.3 NOVICE GROUP

One participant formed the novice group and he completed all tasks in 1 hour 30 minutes. This participant did need guidance during the evaluation process and this was administered on three occasions during the pilot study. At this point it was decided by the researcher that the novice group be allowed 1 hour 36 minutes (additional 6 minutes), however this time limitation will not be strictly enforced. Additional time of up to 5 minutes will be allowed for when performing data collection with the novice group. This will allow for more accurate responses when evaluating the e-commerce websites as opposed to inaccuracy induced by added pressure on the participant induced by specifying a strict time limit.

Table 5-2: Participant group time allocation.

Group	**Time allocation**
Novice	1 hour 36 minutes (approx.)
Intermediate	1 hour 20 minutes
Expert	1 hour 4 minutes

5.7 EXPERT REVIEWS

Of the seven participants in this pilot study, three were staff members from the department of Information Technology. Two of these staff members were carrying out research in the field of computer system user interfaces, at the time of writing this dissertation. Staff members were encouraged to make suggestions as to how the evaluation questionnaire could be improved. Typographical, content, ambiguous language and technical hitches were among those identified for improvement.

Three staff members were subjected to the pilot study first and completed the original version as well as two other revised versions of the evaluation questionnaire, based on their suggestions. The final pilot study involving the seven selected participants began only after these modifications were affected.

What follows is a list of the major adjustments made to the evaluation questionnaire, before commencement of the pilot study.

1. Spelling errors were identified and corrected.

2. The idea of including more open ended questions was suggested by one of these patrons.

3. Initially the questionnaire regarded only the positive aspects of the e-commerce websites e.g. “Which task was the easiest to complete?” Another suggestion pointed out that participants should be prompted for the negative aspects as well.

Thus questions such as “Which task was the most difficult to complete?” were also included.

5.8 DATA SORTING

Collection and categorising of documents such as questionnaires and transcripts, was also tested during this pilot study. Participants were required to complete a participant selection questionnaire (appendix 2A), fill out a product information table for each of the four selected e-commerce websites (appendix 3D) as well as an evaluation questionnaire (appendix 2B) which consisted of four pages. Hence six pages of documentation were created for each participant. These documents were stapled together as soon as they were handed in by each participant. Thus seven six page documents were collected and filed into a loose sheet binder after the pilot study. Before analysis of this data began, the documents were sorted into groups according to the scores obtained on the participant selection questionnaire (appendix 2A). For the final data collection process of this study, this sorting into groups was done first i.e. as soon as all participant selection questionnaires were collected. Participants were then be put into groups for the process of website user interface evaluations. This methodology of sorting into groups first was ignored during the pilot study since only one group representing a random sample was used. Documents stored in a loose sheet binder proved efficient to maintain.

5.9 FIELD NOTES

Data gathered from observation and interviews were recorded using pen and paper. According to Burns field notes should exist in three separate files:

1. Transcript file, holds records of interviews observations.
2. Personal file, holds the reflections of the researcher.
3. Analytical file, holds any conceptual issues (described in chapter four as issues that were not initially projected but did arise during the course of the study)

(Burns, 2000:430).

The above described approach was adopted and tested during the pilot study. The layout for recording data during observation and the interviews was also adopted from the technique used by Burns (2000:431) and examples of the transcripts from this study can be viewed in appendix 5I and 5J. This method of sorting field notes proved efficient and was adopted for the main data collection stage of this study.

5.10 SAMPLING TECHNIQUE

Olivier argues that for the purpose of a pilot study, the participant group need not be selected randomly however, the more variety the group shows the greater chance you have of identifying potential problems (Olivier, 1997:112). He goes on to state that "the group may be deliberately picked so it includes as many atypical members of the population as possible (Olivier, 1997:113). Sapsford and Jupp (1996:103) describe this as "purposive sampling" in that the full range of individuals and their possible responses are catered for.

Stratified sampling was the proposed method of selecting participants for this study. This was also the adopted method of selecting participants for the pilot study and ten

participants were selected to represent each of the three groups i.e. novice, intermediate and expert. However, the researcher did "hand pick" three staff members involved in research in a related field, which is in conjunction with purposive sampling. Hence the sampling technique used for the pilot study is a combination of the stratified and purposive techniques. Their insights on both the data collection instruments and the data collection procedure proved valuable (as discussed in the previous section).

Stratified sampling did prove a viable method of selecting participants as participants possessing the skill levels to constitute all three participant groups, were available. Also, there existed an adequate number of volunteers from which to choose participants, even though the advertisement for the need for volunteers was posted on the department notice board for one afternoon only. This method was used for both advertising the need for volunteers and selecting participants for the main study.

5.11 LABORATORY PREPARATION

This pilot study was conducted in a computer laboratory used and serviced by the department of Information Technology at the Durban Institute of Technology. This venue proved technically and physically sufficient for the purposes of the pilot study and was used for the final data collection phase of this study. One minor problem was that of a faulty air conditioner, which was due to be repaired during the course of that week. Due to this problem participants were seated further forward and closer together in the computer lab, where the functional air-conditioners were present. This however did not hinder their performance, but did result in some discomfort among the patrons.

van de Teijlingen and Hundley feel that a pilot study should be executed as a sequence of sequential phases which may be listed as:

1. In-dept interviews or focus groups to establish the issues to be addressed in a large scale questionnaire survey.
2. Pilot the questionnaire itself e.g. wording and order of questions.
3. Test the research process e.g. the different ways of distributing and collecting the questionnaires.
4. Identify potential practical problems in following the research process.

(van de Teijlingen and Hundley, 2001).

This pilot study was done adhering to a framework similar to the one depicted above. However this pilot study did differ from the sequence depicted above in the sense that it was viewed as a repetitive process i.e. if problems were identified it was rectified and subjected to further testing. This testing process was repeated in an attempt to find the most efficient and accurate procedure to adhere to for the data collection process.

The proposed sequence of collecting data for this study, i.e. observation, questionnaire then interviews, was evaluated during this pilot study and proved both efficient and exhibited the potential for obtaining accurate data. Thus the data collection methodology sequence remained unchanged. Due to time and other constraints, other methodologies were not subjected to testing. Instead emphasis of the pilot study rested on identifying

and correcting potential difficulties that may present themselves when using the methods adopted from and after reviewing documentation relating to previous case studies. This was described with more attention in chapter four.

5.13 POTENTIAL SHORTFALLS REGARDING THE PILOT STUDY

van de Teijlingen and Hundley (2001) identify "contamination" as a pitfall, which may arise during the pilot study, but affect the results of the final study. Contamination may occur firstly when data obtained during the pilot study is included in analysis of the main study. The authors identify one obvious reason as when the data collection instrument used during the pilot study had to be changed or modified, in order to correct potential problems. The responses from these instruments are inaccurate and should not be used as final data.

Secondly, contamination may occur by allowing the participants from the pilot study to be included in the final study. The responses gathered from these participants would differ from those experiencing the process for the first time.

Both of the above mentioned pitfalls were catered for by firstly not using data obtained during the pilot study in the final data analysis phase and secondly by not employing participants from the pilot study in the final data collection phase.

This chapter was a detailed description of the pilot study. It provided information regarding the problem areas identified and how they were addressed. Revised versions of the data collection instruments were then created accordingly. This would improve the

accuracy of data collected during the next stage of the study. The next chapter is a description of the data collection phase of this study.

CHAPTER SIX

DATA COLLECTION

This chapter is a description of how the adopted techniques were implemented for the final data collection phase of this study. It describes how data was collected using the techniques introduced and elaborated on in the previous chapters, categorised and stored for analysis. Data analysis will be done in the next stage of this study.

Data collection consisted of participant observation, the use of evaluation questionnaires and participant interviews. Before this was achieved a research team was selected and the need for volunteers publicised. Data collection consisted of two main phases. Phase one consisted of data collection used to facilitate the selection of three participant groups as well as the formation of the research assistant team. Phase two was when data representing user feedback was collected. The data collected during phase two was later analysed to draw conclusions supporting the hypothesis of this study. Phase one is discussed next.

6.1 SELECTING PARTICIPANTS

The execution of this case study was publicised at the Faculty of Commerce by posting notices on the bulletin boards as well as by word of mouth. A total of 54 students volunteered by completing and returning the participation selection questionnaire (appendix 2A). A larger number of volunteers were anticipated, however this task was done one week prior to the main examination and students were reluctant to participate, since this period was their study leave. End of term was chosen to conduct this study due

to students having completed their academic syllabus hence making them more adept in computing and Internet technology. If this study was conducted during the term, participants would have given priority to lecture attendance and would have been reluctant to participate in this study. If this study was conducted after the exam, students would then be on official vacation leave and also reluctant to participate in this study.

Volunteers were instructed by the notices to collect and to complete the participant selection questionnaire, which was obtainable from the researcher and from the secretary of the department of Information Technology. As described in chapter four a point system was used to place participants into one of three groups. The volunteers obtaining the maximum score of 10 were placed into the expert group (Group C), volunteers who scored from 7 and 9 formed the intermediate group (Group B) and scores from 0 and 6 were placed into the beginner group (Group A). The remainder of the completed participant selection questionnaires was kept in a file in the event of one of the chosen participants no longer being available. In this eventuality a participant will be chosen from this pool. The participants were not informed of this grading process. Notices simply informed participants of their involvement by listing their names under one of three groups (A, B, C). The dates and times of the evaluations were also listed on this notice, which was posted on the faculty bulletin boards. A detailed analysis of the data gathered from this questionnaire is presented in the next chapter.

6.2 RESEARCH ASSISTANT TEAM

The following three subsections provide concise information regarding the selection, preparation as well as the function of the research assistant team during the data collection stage of this study.

6.2.1 SELECTING MEMBERS

Notices were also used to publicise the need for research assistance. A greater number of students than anticipated volunteered for this task due to a fee being offered for their services. A total of 15 students volunteered their services by collecting and completing the questionnaire in appendix 2C. A point system was also adopted for this task, which was discussed in detail in chapter four. Three volunteers obtaining the highest scores were selected as members of the research assistant team. The questionnaire required the contact details of the assistant, which enabled the researcher to communicate with the assistant during the data collection phase of this study. Analysis of the data obtained from this questionnaire is given in chapter seven.

6.2.2 ROLE

The role of the research assistant team in this study was to aid the researcher with the process of lab preparation, addressing participant queries during the website evaluation process, observation and providing some feedback on the data collection process in its entirety. Other functions of the research assistant team included the collection and checking for correctness and completion of the evaluation questionnaires. Their

assistance was extensively used while the novice participant group was carrying out their evaluation tasks and to some extent when dealing with the intermediate group, with regard to aiding participants.

6.2.3 PREPARATION

Before data collection was carried out a short lecture and practical session was presented to the three research assistant team members in the computer laboratory. The lecture included topics such as the purpose of this study, a presentation of the terminology commonly used in e-commerce websites, a description of the different components of the user interface and a question and answer session.

The practical module of this presentation demonstrated to the team the sequence of steps that need to be undertaken by the participants, which would eventually lead to the completion of the evaluation tasks. Team members were then asked to complete the tasks themselves, which allowed them to gain greater familiarity with the e-commerce websites nominated as test cases.

The research assistant team was then briefed on techniques for observing participants as they carry out the evaluation tasks. The observational technique adopted for this study is the natural, direct and unobtrusive approach (discussed in chapter four) and the team was told not to intervene unless assistance was requested by the participants. Further, notes had to be taken by the team relating to difficulties experienced, tasks that were more easily completed and components that the participants learned how to manipulate quickly. Notes were taken using pen and paper, which was then handed over to the

researcher for filing. (This process of filing is described in greater detail in a later subsection of this chapter).

The final task of the research assistant team was to participate in an interview with the researcher, which provided an opportunity for their personal reflection of the data collection process. Their thoughts and opinions were recorded using pen and paper by the researcher. Analysis of this as well as the observational data will be described in length in the next chapter.

Completion of the above two objectives i.e. selecting participants and the research assistant team marked the end of the first phase of data collection. Phase two involved the collection of data from participants, data representative of user feedback, a concept introduced in chapter two. The following subsections expand on how this was executed.

6.3 PROCEDURE

One participant group at a time was asked to complete the predefined tasks (these tasks are discussed in a later subsection) and evaluate the e-commerce websites, hence a total of ten students at a time were in the computer laboratory where this process was executed. The research assistant team was present during each evaluation session. Three data collection sessions were held over a period lasting one week. The intermediate participant group (group B) was the first to carry out the evaluation tasks followed by the expert group (group C) and lastly the beginner group (group A). Time allocation within which the participants had to complete the tasks was set at 1 hour 20 minutes for the intermediate group, 1 hour 4 minutes for the expert participant group and 1 hour 36

minutes for the beginner group. These time allocations were set after experimentation done during the pilot study, and are more clearly described in chapter five.

Before the commencement of the evaluation, all participants involved in this study were given a short lecture with insights to the purpose of this study and the role of this evaluation process, an introduction to the researcher and the research assistant team members, a brief introduction to e-commerce and the an explanation of e-commerce website components. A question and answer session was then permitted. This short lecture lasted no longer than 15 minutes.

Thereafter participants were allowed to seat themselves anywhere in the computer laboratory. Restricted communication was allowed between the participants and they were reminded throughout the process to ask the research assistant team for help if required. This allowed for common queries to be documented by the research assistant team and/or by the researcher. Participants were then given the double-faced task sheet, containing the task list and a table for recording the details of each product (appendix 3C and 3E). A brief walkthrough of the steps was then given by the researcher and the time limit specified. Participants were then told to carry out the evaluation tasks and also encouraged to take advantage of the Windows multi-tasking capabilities, to speed up their task completion (i.e. time was not wasted waiting for a particular website to load). Once the time limit for that group had expired, participants were told to complete their last transaction and the evaluation questionnaires were handed out to them. No time limit was specified for the completion of the evaluation questionnaires and on all occasions a duration of 30 minutes was sufficient. Task sheets and evaluation questionnaires were thereafter collected and sorted by the research assistant team. A group interview with the

participants was the last data collection process carried out with each group. This was done in the lab while the research assistant team was collecting and sorting out the documents. Once again no time limit was specified for this process.

6.4 TECHNIQUES

Three techniques were employed as data collection agents i.e. observation, questionnaires and interviews. These techniques formed phase two of the data collection process. The execution of these techniques is elaborated on in the subsequent subsections. Chapter seven contains the detailed analysis of the data collected during these processes.

6.4.1 OBSERVATION

Observation formed the first data collection method. As described in chapter four, unobtrusive and direct observation was carried out while the participants completed the evaluation tasks. The researcher as well as the research assistant team was involved with this process. Observation primarily involved note taking using pen and A4 sized paper. Each instance of the participant making some query was documented. Secondly common mistakes as well as the seemingly easier tasks were documented, for example participants of the beginner group were not utilising the product index e.g. books, CD and Software, before entering a key word for the search engine, and this did not streamline the time taken to locate a product. (A comprehensive analysis of these findings is presented in the next chapter).

At the end of the data collection session, i.e. once the participants had been dismissed, the researcher collected the observational notes completed by him and the research assistant team. These were then filed into the respective loose sheet binder, three binders existed with one designated for each participant level.

6.4.2 QUESTIONNAIRES

A total of 26 evaluation questionnaires (appendix 3A) was collected; ten from the expert and intermediate groups and six from the novice participant group. At the end of each evaluation session, the questionnaires were collected from the participants by the research assistant team, checked for completeness and correctness, loose sheets of the questionnaire stapled and placed into the loose sheet binder for that particular participant group.

There were only two queries with regard to the tabular layout of the evaluation questionnaire. Participants were told that each table required four responses, one for each e-commerce website. The expert level participant group had no queries.

6.4.3 INTERVIEWS

Interviews were held with participants at the end of each evaluation session and with the research assistant team at the very end of the data collection portion of this study. Unstructured, group interviews were held and the researcher made notes of the views, opinions, general and overall experiences of the participants. This allowed for in-depth data to be collected, data pertaining to the user interface, which may not have been

addressed by the questionnaires. One example of this phenomenon was that of the e-commerce websites taking variable times to load, which lead to a minor degree of irritation among participants. This issue did not manifest after analysis of the responses made in the questionnaires, and would have been unnoticed were it not for the interview.

Four interviews were held in total. The first round involved the intermediate group. Interviews were held in the computer laboratory soon after the questionnaires had been collected. Issues brought up and discussed during this interview, were recorded on paper. This document was then placed into the respective loose sheet binder for that particular group, for later analysis.

The second round of interviews involved the expert level participant group. Data recorded during this interview was more detailed compared to the other groups, with technical aspects, such as bandwidth and the speed of the switches[5] used in the computer laboratory, being addressed. This round of interviews lasted 17 minutes. The researcher was not required to steer the above mentioned interviews toward a particular topic or issue related to the e-commerce user interface, since the information gained from participants were relevant to the topic in hand.

The next round of interviews involved the novice group. This was the shortest interview with a total of 5 minutes spent discussing general issues. For example most of the participants agreed that Amazon.com was the easiest to use and understand, compared to the other e-commerce websites. This is the only instance of intervention, because the

[5] A switch is a computer hardware device used to allow several desktop machines to link together hence forming a computer network.

researcher had to step in and mention that this study is not intended to compare the e-commerce websites, but to measure the efficiency of the user interface.

The final round of interviews comprised the research assistant team. This was done at the end of the data collection phase. Remarks made by the research assistant team referred mainly to the data collection process as a whole.

A more detailed analysis of the data obtained from the interviews is given in the next chapter.

6.5 TASKS

Observation as well as the completion of the evaluation questionnaires were done during and after the predefined tasks were given to the participants. All three participant groups performed the same set of tasks; a copy of this task list is appendix 3C. The task lists were handed out to the participants as a double sided, single sheet of A4 paper. One side of the page contained the instructions and the tasks in the form of products to be purchased and other functions that needed to be performed using the website. The second side contained a table listing each of the four products (appendix 3E). Details of each product i.e. retailer, delivery time and cost were recorded by the participant as they located it. This served as proof of locating the item.

The most frequent query during this process was the action to be taken when an item was out of stock. Participants were told to write “out of stock” in the appropriate space on the questionnaire.

6.6 DOCUMENTS

Documents were collected during phase one and phase two. During phase one documents existed in the form of questionnaires completed by volunteers for the purpose of selecting participants and secondly to select volunteers to form the research assistant team. For the purpose of selecting participants, the same questionnaire was used by all volunteers. As discussed in chapter 4, a point system was used to firstly select and secondly place a participant into one of three groups. For the research assistant team, a similar point system was also used and participants with the highest scores were selected.

During phase two of data collection, documents consisted of the task list, evaluation questionnaires, observational notes and interview notes. All documents were collected and filed into the corresponding binder depending on the participant group. This was done at the end of each evaluation session. These documents then made up the transcript file. Personal observations regarding the case study in its entirety, was recorded and stored in the personal file at the end of each session. (Both the transcript and the personal file were fully described in chapter five).

The final document to be created was a summary of the laboratory computers. Any problems, technical or other that may have been raised would have been recorded in this summary. However all machines worked flawlessly for the length of the data collection process, and this fault report document was not created.

6.7 DATA SORTING

All documents were collected and filed using loose sheet binders. The participant questionnaires were stapled onto the corresponding evaluation questionnaire, i.e. the one used by the participant in question. The notes taken during observation, by the researcher and the research assistant team, were also stapled. Filing of the documents was done after each session, and by the end of the week three files had been created (one for each participant group). Each file contained the participant questionnaire, task list, evaluation questionnaire, stapled together to form one three page document for each participant. Also enclosed within the file were the observational notes for that session as well as the interview notes.

This chapter was a description of how data was collected for this study. It described how the adopted techniques for collecting data were implemented as well as how data was sorted and stored. Chapter seven will consist of an analysis of the data collected.

CHAPTER SEVEN

DATA ANALYSIS

The data analysis phase of this study encompassed the three data collection techniques used in this study. Evaluation questionnaires formed the primary data collection tool and the data gathered from that was supported by two secondary data collection techniques i.e. participant interviews and observation. This chapter provides the details and the conclusions drawn from the data collected using the above mentioned methodologies, which where employed in the identification of the problematic areas of e-commerce user interfaces. The first subsection is a description of the procedure used to analyse data collected.

7.1 PROCEDURE

Coffey and Atkinson define data analysis as three linked sub-processes:

1. Data reduction, which involves the selection and condensation of data where data is summarized, coded and placed in respective categories.
2. Data display, data is depicted in diagrammatic, pictorial or visual forms. Data displays should be viewed as organized, compressed assembly of information that permits conclusion drawing.
3. Conclusion drawing and verification, this is when data is interpreted and meaning is drawn

(Coffey and Atkinson, 1996:7).

This procedure was used to govern the data analysis stage of this study. This chapter is a reflection of points one and two above i.e. data reduction and display, whereas chapter eight deals with point 3, conclusion drawing and verification.

Sapsford and Jupp (1996:163) state that data analysis involves deriving a good form in which to reproduce data so that it, firstly, provides a fair summary of what has been studied and secondly, can be readily analysed to answer the researcher's questions. For purposes of this study, data was displayed using a structure known as a "data matrix". Research methodology texts, such as Burns (2000), state that a data matrix comprises rows and columns within which data is structured. This structure was extensively used in this chapter to aid in summarizing and drawing conclusions from the data collected earlier in this study.

The next subsection describes the analysis of the questionnaires utilised in selecting the participants for this study.

7.2 PARTICIPANT SELECTION

Three participant groups were formed for this study each representing a particular computer and Internet skilled level. The computer and Internet skill levels are novice, intermediate and expert. A point system was used to select and divide volunteers into one of the above mentioned groups, which depended on their score calculated by examining their responses to a participant selection questionnaire (appendix 2A).

Fifty-four volunteers completed the participant selection questionnaire. Of the 54 volunteers, 10 volunteers out of the 22 scoring a maximum of 10 were selected to form the expert group and 10 out of the 26 scoring between 7 and 9 were selected to constitute the intermediate group. The novice group comprised all volunteers scoring between 0 and 6 which resulted in 6 participants.

The total volunteer scores are tabulated as follows:

Table 7-1: Number of volunteers per group.

Score	Total number of volunteers	Total number selected
From 0 to 6 (novice)	6	6
From 7 to 9 (intermediate)	26	10
Maximum of 10 (expert)	22	10

7.3 PRODUCT DETAILS

Product details (appendix 1B) namely the registered name of the retailer, delivery time and cost of the item were required to be recorded by the participant. This served as proof of the participant finding that predefined product or item. Four e-commerce websites formed the test cases for this study and four predefined products i.e. a novel, DVD, CD and software, had to be purchased from each website, within the specified time allocation. Amazon.com, Bidorbuy.co.za, Kalahari.net and Mweb.co.za formed the test cases. Each e-commerce website was analysed independently by examining the skill level or group of users and the number of items that the specified participant group located and purchased. A conclusion was be established by highlighting the number of participants

that purchased the greater amount of products for e.g. with reference to Amazon.com (see the following subsection), 21 of the 26 participants (i.e. all three groups) located and bought 4 out of 4 predefined items, thus representing a task completion rate of 80.8%. What follows are the results of this analysis in summary and tabular format.

7.3.1 AMAZON.COM

Participants from all three groups found this website the easiest to use. The highest number of participants locating and purchasing all four predefined products was recorded against this test case.

Matrix 7-1a: Number of participants and respective number of products purchased, for Amazon.com.

Group	**Number of Products**				
	Four	***Three***	***Two***	***One***	***Zero***
Expert	9	1			
Intermediate	8	1			1
Novice	4	1	1		
Task completion Rate	21 (80.8%)	3 (11.5%)	1 (3.8%)	0	1 (3.8%)

7.3.2 BIDORBUY.CO.ZA

None of the participants from any of the groups were successful in locating all four items while using this website. The majority of participants from the intermediate and the novice groups did not locate any products.

Matrix 7-1b: Number of participants and respective number of products purchased, for Bidorbuy.co.za.

Group	**Number of Products**				
	Four	***Three***	***Two***	***One***	***Zero***
Expert			1	5	4
Intermediate				2	8
Novice					6
Task completion Rate	0	0	1 (3.8%)	7 (26.9%)	18 (69.2%)

7.3.3 MWEB.CO.ZA

The results of this test case analysis are similar to that of Bidorbuy.co.za (above), none of the participants from any of the groups were successful in locating four items while using this website. The majority of participants from all three groups did not locate any products. This test case had the highest failure rate.

Matrix 7-1c: Number of participants and respective number of products purchased, for Mweb.co.za.

Group	**Number of Products**				
	Four	***Three***	***Two***	***One***	***Zero***
Expert		1	1		8
Intermediate			1		9
Novice				2	4
Task completion Rate	0	1 (3.8%)	2 (7.6%)	2 (7.6%)	21 (80.8%)

7.3.4 KALAHARI.NET

Analysis shows that this test case represents different success rates for the different skill levels. The expert group reflected a wide range of success rates however the majority of

these participants found 2 of the four products. The majority of the intermediate group found no items and all of the participants comprising the novice group found no products.

Matrix 7-1d: Number of participants and respective number of products purchased, for Kalahari.net.

Group	**Number of Products**				
	Four	***Three***	***Two***	***One***	***Zero***
Expert	1	1	4	2	2
Intermediate		2	2	1	5
Novice					6
Task completion Rate	1 (3.8%)	3 (11.5%)	6 (23.1%)	3 (11.5%)	13 (50%)

7.3.5 CONCLUSION: PRODUCT DETAILS

An analysis of the product details reflect that participants, from all three groups, encountered the highest success rate in locating and purchasing all four predefined items from Amazon.com. However for the other three test cases i.e. Bidorbuy.co.za, Mweb.co.za and Kalahari.net, the majority of participants found no products. This points to an overall problem with the participant's ability to properly use the e-commerce website, which could be attributed to poor user interface design. The user interface components of the e-commerce websites will be analysed in greater detail in the following subsection, in an attempt to specifically identify the problematic areas.

7.4 EVALUATION QUESTIONNAIRE

The website evaluation questionnaire (appendix 2B) was used by all participants to record their responses to questions relating to the user interface. This questionnaire was

divided into four different sections, each section pertaining to a different aspect of the user interface. Section A, the first in the evaluation questionnaire, required responses pertaining to the efficiency and the ease at which a particular component of the user interface was utilised. The responses are analysed and reported below, one component at a time.

7.4.1 SECTION A: EASE OF USE

7.4.1.1 NEW CUSTOMER ACCOUNT

Creating a user account was the first task faced by participants involved in this study. In order for a user to make a purchase the participant had to create a customer profile using the website's account creating component. Responses by the different participant groups, relating to the efficiency of this component for each e-commerce system, were recorded as follows:

Matrix Set 7-2: Participant rating for creating a new customer account.

AMAZON.COM

Group	**Sec A Ques. 1: Creating new customer Account**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert			5	5	
Intermediate		3	4	3	
Novice	1		2	3	
Total part rating	1 (3.8%)	3 (11.5%)	11 (42.3%)	11 (42.3%)	0

BIDORBUY.CO.ZA

Group	**Sec A Ques. 1: Creating new customer Account**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	5	3	1	1	
Intermediate	4	2	2		2
Novice	2		1		3
Total part rating	11 (42.3%)	5 (19.2%)	4 (15.4%)	1 (3.8%)	5 (19.2%)

MWEB.CO.ZA

Group	**Sec A Ques. 1: Creating new customer Account**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		2			8
Intermediate	2	1			6
Novice	1	2			3
Total part rating	3 (11.5%)	5 (19.2%)	0	0	17 (65.4%)

KALAHARI.NET

Group	**Sec A Ques. 1: Creating new customer Account**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	3	1	4	1
Intermediate	3	1	6		
Novice	3	1			2
	7 (27%)	5 (19.2%)	7 (27%)	4 (15.4%)	3 (11.5%)

Analysis of this data reflects that Amazon.com had an account creation component that was the most efficient and easiest to both understand and utilise. The majority of participants from all three groups rated the task of customer account creation on Amazon.com as either “good” or “excellent”. Participants agreed that this component was difficult to use in Bidorbuy.co.za. Many participants did not complete this task in the MWeb.co.za e-commerce website. Kalahari.net showed the majority of responses being either “poor” or “good”, which renders this component average in this e-commerce

website. (This phenomenon was based purely on the individual participant perceptions of this task and does not reflect any division of this group due to sampling error).

7.4.1.2 HELP FACILITY

Participants were encouraged to use this feature to gain information on how to go about performing a specific task. Most participants did use the help facility to inquire shipping details such as time and cost for a door to door delivery. Levies added to the total cost of the item for delivery to the different provinces in South Africa or for delivery from another country, were also queried using the help facility.

Matrix Set 7-3: Participant rating for the help facility.

AMAZON.COM

Group	**Sec A Ques. 2: Help Facility**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		4	3	3	
Intermediate		3	2	3	2
Novice	1	2	1	2	
Total part rating	1 (3.8%)	9 (34.6%)	6 (23.1%)	8 (30.8%)	2 (7.7%)

BIDORBUY.CO.ZA

Group	**Sec A Ques. 2: Help Facility**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	5	2	1	
Intermediate	2	2	2		4
Novice	2	1			3
Total part rating	6 (23%)	8 (30.8%)	4 (15.4%)	1 (3.8%)	7 (27%)

MWEB.CO.ZA

Group	**Sec A Ques. 2: Help Facility**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	1			7
Intermediate	1	1	1		7
Novice	2	1			3
Total part rating	5 (19.2%)	3 (11.5%)	1 (3.8%)	0	17 (65.4%)

KALAHARI.NET

Group	**Sec A Ques. 2: Help Facility**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	3	2	5	
Intermediate	1	1	7		1
Novice	3	1			2
Total part rating	6 (23%)	8 (30.8%)	9 (34.6%)	5 (19.2%)	3 (11.5%)

Amazon.com proved to exhibit the most efficient and easiest to use help facility, with the majority of the participants giving it a rating of “fair” and “excellent”. Kalahari.net received a majority response of “good” while Bidorbuy.co.za reflected mostly “fair” and “poor”. The help facility was not extensively used in Mweb.co.za with more than half the participants not providing a response.

7.4.1.3 SEARCH ENGINE

This component was used by every participant involved in this study. The search engine is the only available component on the e-commerce websites that facilitated finding products and the related product details. Participants had to provide product information (such as a book title or author) for the search engine. A list of products matching this information was then displayed on the website. No difficulties were recorded with regard

to participants understanding which products to find. This was due to the precise nature of the details provided in the product list (appendix 1C). This task therefore tested the accuracy of the search engine, from the participant's point of view.

Matrix Set 7-4: Participant rating for product search engine.

AMAZON.COM

Group	**Sec A Ques. 3: Search Engine**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		1	3	6	
Intermediate			4	5	1
Novice		1	1	4	
Total part rating	0	2 (7.7%)	8 (30.8%)	15 (57.7%)	1 (3.8%)

BIDORBUY.CO.ZA

Group	**Sec A Ques. 3: Search Engine**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	3	2	3	1	1
Intermediate	1	4	2		3
Novice	1				5
Total part rating	5 (19%)	6 (23.1%)	5 (19.2%)	1 (3.8%)	9 (34.6%)

MWEB.CO.ZA

Group	**Sec A Ques. 3: Search Engine**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	1	1	6
Intermediate	2	1			7
Novice	1		1		4
Total part rating	4 (15.4%)	2 (7.7%)	2 (7.7%)	1 (3.8%)	17 (65.4%)

KALAHARI.NET

Group	Sec A Ques. 3: Search Engine				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	4	1	4	
Intermediate	1	6	2		1
Novice	2				4
Total part rating	4 (15.4%)	10 (38.5%)	3 (11.5%)	4 (15.4%)	5 (19.2%)

Participants indicated that Amazon.com had the best search capability since 57.7% selected "excellent" as a response. Bidorbuy.co.za reflected an even distribution of responses which renders this search engine as average. The majority of the participants using MWeb.co.za selected "no response". 10 of the 26 participants rated Kalahari.net's search engine as "fair".

7.4.1.4 SHOPPING BASKET

Shopping basket is the component used once the participant has located their desired product. Each time a product was found the participant had to place that product into a virtual shopping basket or shopping cart. The participant would then proceed to purchase all products placed in the shopping basket. In order to use the shopping basket effectively the participant would have to firstly locate it on the website, learn how to add and remove products from it, as well as how to view the contents of the shopping basket (in the form of desired products) at any given time.

Matrix Set 7-5: Participant rating for shopping basket.

AMAZON.COM

Group	**Sec A Ques. 4: Shopping Basket**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	3	5	
Intermediate		1	5	3	1
Novice		1	1	4	
Total part rating	1 (3.8%)	3 (11.5%)	9 (34.6%)	12 (46.2%)	1 (3.8%)

BIDORBUY.CO.ZA

Group	**Sec A Ques. 4: Shopping Basket**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	6	1			3
Intermediate	1	3	2		4
Novice	1		1		4
Total part rating	8 (30.8%)	4 (15.4%)	3 (11.5%)	0	11 (42.3%)

MWEB.CO.ZA

Group	**Sec A Ques. 4: Shopping Basket**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2				8
Intermediate	3				7
Novice	1	1			4
Total part rating	6 (23.1%)	1 (3.8%)	0	0	19 (73.1%)

KALAHARI.NET

Group	**Sec A Ques. 4: Shopping Basket**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	2	5	1
Intermediate	1	3	2	2	2
Novice	1	1	1		3
Total part rating	3 (11.5%)	5 (19.2%)	5 (19.2%)	7 (26.9%)	6 (23.1%)

Participants found the shopping basket component provided in Amazon.com the easiest to understand and use with 46.2% choosing "excellent" and 34.6% choosing "good" as ratings. Kalahari.net had an even distribution of responses for its shopping basket component. Most participants selected "no response" for Bidorbuy.co.za (42.3%) and for Mweb.co.za (73.1%).

7.4.1.5 CUSTOMER ACCOUNT MANAGEMENT

This feature provided the e-commerce customer with a mechanism to change his/her personal details. Information such as postal address and their contact numbers are of vital importance when the e-commerce vendor delivers the products purchased by a particular customer. Participants were asked to change their details using the customer account management feature.

Matrix Set 7-6: Participant rating for customer account maintenance facility.

AMAZON.COM

Group	**Sec A Ques. 5: Customer Account Management**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	3	3	2	
Intermediate	2	2	3	2	1
Novice	1	1	1	3	1
Total part rating	5 (19.2%)	6 (23.1%)	7 (26.9%)	7 (26.9%)	2 (8%)

BIDORBUY.CO.ZA

Group	**Sec A Ques. 5: Customer Account Management**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	4	3	1	2	
Intermediate	2	4	1		3
Novice	1				5
Total part rating	7 (26.9%)	7 (26.9%)	2 (8%)	2 (8%)	8 (30.1%)

MWEB.CO.ZA

Group	**Sec A Ques. 5: Customer Account Management**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1			8
Intermediate	2		1		7
Novice		2			4
Total part rating	3 (11.5%)	3 (11.5%)	1 (3.8%)	0	19 (73.1%)

KALAHARI.NET

Group	**Sec A Ques. 5: Customer Account Management**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	3	2	4	
Intermediate	2	2	3	1	2
Novice	1	1			4
Total part rating	4 (15.4%)	6 (23.1%)	5 (19.2%)	5 (19.2%)	6 (23.1%)

Amazon.com provided the best customer account management with 26.9 % of participants responding with ‘excellent’ and 26.9 % responding with good. Kalahari.net provided an even distribution of responses, again rendering this website as average.

26.9 % of the participants selected poor and 26.9 % selected fair for Bidorbuy.co.za, while 30.1 % were non-responsive. Many participants did not use this facility in Mweb.co.za with 73.1% not responding to this question.

7.4.1.6 LINKS TO OTHER WEBSITES

If a participant found that a particular product was not offered by any of the pre-defined e-commerce vendors or if that product was out of stock, then a link to an e-commerce vendor that might offer that same product had to be provided by the current e-commerce website. Participants were asked to follow these provided links to other sites to establish if they were an effective mechanism in finding the predefined products in alternate e-commerce vendors.

Matrix Set 7-7: Participant rating for links to other/associated e-commerce websites.

AMAZON.COM

Group	**Sec A Ques. 6: Links to other e-commerce websites**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1		5	4	
Intermediate		3	5	1	1
Novice	1	2	1	2	
Total part rating	2 (7.7%)	5 (19.2%)	11 (42.3%)	7 (26.9%)	1 (3.8%)

BIDORBUY.CO.ZA

Group	**Sec A Ques. 6: Links to other e-commerce websites**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	6	2	2		
Intermediate	2	2	2		4
Novice	1				5
Total part rating	9 (34.6%)	4 (15.4%)	4 (15.4%)	0	9 (34.6%)

MWEB.CO.ZA

Group	**Sec A Ques. 6: Links to other e-commerce websites**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1			2	7
Intermediate	1	2			7
Novice	1		1		4
Total part rating	3 (11.5%)	2 (7.7%)	1 (3.8%)	2 (7.7%)	18 (69.2%)

KALAHARI.NET

Group	**Sec A Ques. 6: Links to other e-commerce websites**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	2	5		1
Intermediate	1	2	4		3
Novice	2				4
Total part rating	5 (19.2%)	4 (15.4%)	9 (34.6%)	0	8 (30.8%)

42.5% of participants using Amazon.com gave it a rating of "good". 34.6% of participants using Kalahari.net also selected "good" as a response. For Bidorbuy.co.za 34.6% of participants chose "poor" and 34.6% did not respond to this question. The majority of participants (69.2%) selected "no response" for this question when evaluating MWeb.co.za.

7.4.2 SECTION B: GRAPHICAL DESIGN

Apart from the components of the e-commerce user interface this study also required the elected participants to evaluate the graphical or "cosmetic" design of the user interface under the topics of clarity, mobility, control, colour usage, font design and website layout. Each of these topics was evaluated separately by asking the participants to respond to questions under section B of the evaluation questionnaire. The analysis of

these responses are tabulated and elaborated on in the following subsection, one question at a time.

7.4.2.1 CLARITY (EASE OF UNDERSTANDING)

For this question participants were instructed to evaluate the ease at which components were identified based on the positioning, graphics and naming of that particular component.

Matrix Set 7-8: Participant rating for clarity.

AMAZON.COM

Group	**Sec B Ques. 1: Clarity (Ease of understanding)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		2	4	4	
Intermediate		2	5	2	1
Novice	2		2	2	
Total part rating	2 (7.7%)	4 (15.4%)	11 (42.3%)	8 (30.8%)	1 (3.8%)

BIDORBUY.CO.ZA

Group	**Sec B Ques. 1: Clarity (Ease of understanding)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	4	5	1		
Intermediate	2	1	3		4
Novice	2		1		3
Total part rating	8 (30.8%)	6 (23.1%)	5 (19.2%)	0	7 (26.9%)

MWEB.CO.ZA

Group	**Sec B Ques. 1: Clarity (Ease of understanding)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	2		1	6
Intermediate	1	1		1	7
Novice			2		4
Total part rating	2 (7.7%)	3 (11.5%)	2 (7.7%)	2 (7.7%)	17 (65.4%)

KALAHARI.NET

Group	**Sec B Ques. 1: Clarity (Ease of understanding)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		3	4	2	1
Intermediate	2	4	2	1	1
Novice	1	1	1		3
Total part rating	3 (11.5%)	8 (30.8%)	7 (26.9%)	3 (11.5%)	5 (19.2%)

Amazon.com proved to have the clearest and easiest to understand user interface, with 42.3% of participants selecting “good”. 30.8% of participants found that Kalahari.net provided a “fair” user interface in terms of clarity rating it as second best. The majority of participants (30.8%) selected “poor” as a response for Bidorbuy.co.za. 65.4% of participants did not rate Mweb.co.za which points to unavailability or non evaluation of this website.

7.4.2.2 MOBILITY

This question refers to the user’s ability to navigate between the different parts of the user interface while carrying out specific tasks. Participants tested this particular aspect of the user interface design while carrying out the predefined tasks since this required the usage of different components accessible at different locations of the website user interface.

Matrix Set 7-9: Participant rating for navigation.

AMAZON.COM

Group	**Sec B Ques. 2: Mobility (Ease of Navigation)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		1	5	4	
Intermediate		3	5	1	1
Novice	1		1	3	1
Total part rating	1 (3.8%)	4 (15.4%)	11 (42.3%)	8 (30.8%)	2 (7.7%)

BIDORBUY.CO.ZA

Group	**Sec B Ques. 2: Mobility (Ease of Navigation)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	4	5		1	
Intermediate	2	1	3		4
Novice	1				5
Total part rating	7 (26.9%)	6 (23.1%)	3 (11.5%)	1 (3.8%)	9 (34.6%)

MWEB.CO.ZA

Group	**Sec B Ques. 2: Mobility (Ease of Navigation)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	1		1	6
Intermediate	1	1	1		7
Novice	1	1			4
Total part rating	4 (15.4%)	3 (11.5%)	1 (3.8%)	1 (3.8%)	17 (65.4%)

KALAHARI.NET

Group	**Sec B Ques. 2: Mobility (Ease of Navigation)**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2		4	4	
Intermediate	1	4	4		1
Novice	2				4
Total part rating	5 (19.2%)	4 (15.4%)	8 (30.8%)	4 (15.4%)	5 (19.2%)

Forty-two point three percent of participants indicated that Amazon.com delivered "good" mobility. Most participants 30.8% found that Kalahari.net also had good mobility. 34.6% of participants did not respond for Bidorbuy.co.za, but 26.9% agreed that this website exhibited "poor" mobility. The majority of participants (65.4%) using Mweb.co.za did not respond.

7.4.2.3 USER CONTROL

This question refers to the participant's perception of the e-commerce website's user friendliness. The instruction given to participants prior to answering this question was to evaluate the degree of comfort and confidence experienced while performing tasks on a particular website and/or if they felt uncertain of their actions.

Matrix Set 7-10: Participant rating for user control.

AMAZON.COM

Group	**Sec B Ques. 3: Control**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		3	4	3	
Intermediate		2	6	2	
Novice	1		2	2	1
Total part rating	1 (3.8%)	5 (19.2%)	12 (46.2%)	7 (26.9%)	1 (3.8%)

BIDORBUY.CO.ZA

Group	**Sec B Ques. 3: Control**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	4	5			1
Intermediate	3	2	3		2
Novice	1	1			4
Total part rating	8 (30.8%)	8 (30.8%)	3 (11.5%)	0	7 (26.9%)

MWEB.CO.ZA

Group	**Sec B Ques. 3: Control**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	1		7
Intermediate	3				7
Novice		2			4
Total part rating	4 (15.4%)	3 (11.5%)	1 (3.8%)		18 (69.2%)

KALAHARI.NET

Group	**Sec B Ques. 3: Control**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		2	4	3	1
Intermediate	2	3	4	1	
Novice	1	1			4
Total part rating	3 (11.5%)	6 (23.1%)	8 (30.8%)	4 (15.4%)	5 (19.2%)

The majority of participants (46.2%) indicated the most confidence when performing the evaluation tasks on Amazon.com and responded with "good". 30.8% reflected that Kalahari.net had also provided a "good" degree of user friendliness. According to the above analysis Bidorbuy.co.za had poor control with 30.8% of participants each responding with "poor" and "fair". 69.2% of participants did not respond for Mweb.co.za.

7.4.2.4 COLOUR USAGE

Participants were asked to evaluate the use of colour in highlighting certain components, instructions, procedures and shortcuts on the website. Bright colours, colours that were difficult to see and colour coordination were some of the aspects being evaluated in this question.

Matrix Set 7-11: Participant rating for colour usage.

AMAZON.COM

Group	**Sec B Ques. 4: Colour Usage**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	3	1	4	
Intermediate		2	5	3	
Novice			4	2	
Total part rating	2 (7.7%)	5 (19.2%)	10 (38.5%)	9 (34.6%)	0

BIDORBUY.CO.ZA

Group	**Sec B Ques. 4: Colour Usage**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	4	4		
Intermediate		4	4		2
Novice	2	1			3
Total part rating	4 (15.4%)	9 (34.6%)	8 (30.8%)	0	5 (19.2%)

MWEB.CO.ZA

Group	**Sec B Ques. 4: Colour Usage**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		3		1	6
Intermediate		2	1		7
Novice			2		4
Total part rating	0	5 (19.2%)	3 (11.5%)	1 (3.8%)	17 (65.4%)

KALAHARI.NET

Group	**Sec B Ques. 4: Colour Usage**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	2	6	1	
Intermediate	1	4	3	2	
Novice	1	1	1		3
Total part rating	3 (11.5%)	7 (26.9%)	10 (38.5%)	3 (11.5%)	3 (11.5%)

38.5% of participants agreed that both Amazon.com and Kalahari.net exhibited "good" usage of colour on their user interfaces. 34.6% of participants agreed that Bidorbuy.co.za had "fair" utilisation of colour. The majority of participants (65.4%) did not respond for Mweb.co.za.

7.4.2.5 FONTS

This question was designed for the participant to evaluate the legibility of the information displayed on the website. Font type, size and colour used on icons, website links, help and other information were evaluated.

Matrix Set 7-12: Participant rating for font design.

AMAZON.COM

Group	**Sec B Ques. 5: Font**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	5	3	
Intermediate		3	4	3	
Novice			3	3	
Total part rating	1 (3.8%)	4 (15.4%)	12 (46.2%)	9 (34.6%)	0

BIDORBUY.CO.ZA

Group	**Sec B Ques. 5: Font**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		6	2	2	
Intermediate		5	2	1	2
Novice	2		1		3
Total part rating	2 (7.7%)	11 (42.3%)	5 (19.2%)	3 (11.5%)	5 (19.2%)

MWEB.CO.ZA

Group	**Sec B Ques. 5: Font**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		2	1	1	6
Intermediate		2	1		7
Novice			2		4
Total part rating	0	4 (15.4%)	4 (15.4%)	1 (3.8%)	17 (65.4%)

KALAHARI.NET

Group	**Sec B Ques. 5: Font**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	2		7	
Intermediate	1	2	5	2	
Novice	1		2		3
Total part rating	3 (11.5%)	4 (15.4%)	7 (26.9%)	9 (34.6%)	3 (11.5%)

The majority of participants (34.6%) indicated that Kalahari.net offered "excellent" usage of font. Amazon.com had "good" font design according to 46.2% of its participants. 42.3% indicated that Bidorbuy.co.za had a "fair" font design while 65.4% did not supply a response for Mweb.co.za.

7.4.2.6 LAYOUT OF WEBSITE CONTROLS

This question required the participant to rate the layout of components or controls of the user interface. These included such items as buttons, links and menu controls. This aspect was important to this evaluation since it affected both the speed and the ability to become familiar with the e-commerce website user interface.

Matrix Set 7-13: Participant rating for layout of controls.

AMAZON.COM

Group	**Sec B Ques. 6: Layout of Controls**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1	1	6	2	
Intermediate	1	1	6	2	
Novice	1	2	2	1	
Total part rating	3 (11.5%)	4 (15.4%)	14 (53.8%)	5 (19.2%)	0

BIDORBUY.CO.ZA

Group	**Sec B Ques. 6: Layout of Controls**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	2	6		1	1
Intermediate		4	4		2
Novice	3				3
Total part rating	5 (19.2%)	10 (38.5%)	4 (15.4%)	1 (3.8%)	6 (23.1%)

MWEB.CO.ZA

Group	**Sec B Ques. 6: Layout of Controls**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert	1		1	1	7
Intermediate		3			7
Novice		1	1		4
Total part rating	1 (3.8%)	4 (15.4%)	2 (7.7%)	1 (3.8%)	18 (69.2%)

KALAHARI.NET

Group	**Sec B Ques. 6: Layout of Controls**				
	Poor	***Fair***	***Good***	***Excellent***	***No Response***
Expert		4	4	2	
Intermediate	3	4	3		
Novice	2		1		3
Total part rating	5 (19.2%)	8 (30.8%)	8 (30.8%)	2 (7.7%)	3 (11.5%)

53.8% of participants agreed that Amazon.com had “good” website layout. Most (30.8%) reported that Kalahari.net also had “good” website layout, however the same number of participants responded by stating that it was “fair”. BidorBuy.co.za received a response of “fair” from 38.5% of participants. Majority of participants (69.2%) did not respond for Mweb.co.za.

7.4.3 CONCLUSION: SECTION A AND SECTION B

Due to individualism and personal preference associated with rating an e-commerce website, gauging the efficiency is not possible by the use of a comparative model and quantitative data. Instead participants were required to carry out predefined tasks on all four e-commerce websites and only after this procedure, did they evaluate the various aspects of the user interface.

Amazon.com proved to be the most favoured with Kalahari.net the second most favoured website in this study. For Mweb.co.za and Bidorbuy.co.za the majority of participants selected “no response” when evaluating the components of the user interface. This occurrence was anticipated since technical problems such as those experienced when trying to access the website due to network, hardware or the unavailability of the retailer’s e-commerce system are a reality, which might easily occur outside the controlled environment of this study. This phenomenon had to be taken into consideration because of the realism of this study. Even in everyday usage a potential customer may experience difficulties gaining entry to an e-commerce website which would cause him/her to abandon this website and visit another. Sapsford and Jupp (1996:49) state that non-response by a participant must not be overlooked and that further

attempts must be made to follow-up e.g. distribute questionnaires again. With regards to this study, the evaluation questionnaire was one of three data collection instruments. Also, four e-commerce websites were used as test cases to cater for the unavailability of one or more e-commerce websites during any on the three evaluation sessions held. This was done in an attempt to deter non-response.

Although two test cases, Amazon.com and Kalahari.net received better ratings per component compared to Mweb.co.za and Bidorbuy.co.za, the data collected proved sufficient. Further, observation and the participant interview did provide sufficient data for analysis, which is done later in this chapter.

Analysis of sections A and B highlighted the fact that there is a problem with current user interface design evidently shown by the participant's responses to the different components and graphical design. The findings of this analysis will be revisited in the next chapter, when the problematic areas of the e-commerce website components and cosmetic aspects of the user interface will be identified. The following subsection is a detailed analysis of the most frequent potential problems, difficulties and lack of understanding of specific components as well as procedures of the user interface.

7.4.4 SECTION C

Section C of the evaluation questionnaire (appendix 3A) required open ended responses regarding the difficulties experienced while utilising any of the website components or during completion of a required task. Sapsford and Jupp feel that "information from open ended questions has to be structured and transformed into a form suitable for analysis"

(Sapsford and Jupp, 1996:160). This stage of the data analysis was executed by categorising the responses according to the three participant groups. A tabular format was used to record every response made by the participants for the open ended question, for each of the four test cases, even if only one participant responded.

The tables that are presented in the following subsections are a summary of the above mentioned responses made by the participants, as they related to the different e-commerce websites, arranged in alphabetical order. The numerical value recorded in the table refers to the number of participants that reported an experienced difficulty or flaw for that e-commerce website.

7.4.4.1 EXPERT GROUP

Table 7-2: Number of expert group participants that recorded an experienced difficulty with a particular component on a website.

Component/Procedure	Amazon	BidorBuy	MWeb	Kalahari	total
Acc maintenance		1			1
Getting prod info					0
Help facility		1			1
Registration	2	2	2	2	8
Search capability	1	3		3	7
Shopping basket	3	2	2	2	9
Sign in		5		1	6
Site navigation					0

The shopping basket component and the registration procedure represented the most problematic areas of the user interface. Search capability and the sign in process also proved difficult for this group.

7.4.4.2 INTERMEDIATE GROUP

Table 7-3: Number of intermediate group participants that recorded an experienced difficulty with a particular component on a website.

Component/Procedure	Amazon	BidorBuy	MWeb	Kalahari	total
Acc maintenance					0
Getting prod info	2	2	2	1	7
Help facility		1			1
Registration	4	4	6	3	10
Search capability	2	3	3	3	10
Shopping basket		3	1	2	6
Sign in	2	1	2	4	9
Site navigation		2	2	1	5

Analysis shows that for the intermediate group the registration procedure required to become a bona fide customer and the website product search engine presented the highest degree of difficulty. Signing-in as a customer was also difficult to perform.

7.4.4.3 NOVICE GROUP

Table 7-4: Number of novice group participants that recorded an experienced difficulty with a particular component on a website.

Component/Procedure	Amazon	BidorBuy	MWeb	Kalahari	total
Acc maintenance	1				1
Getting prod info			2		2
Help facility					0
Registration		2			2
Search capability	3		2		5
Shopping basket	1		1		2
Sign in			1	2	3
Site navigation	1				1

Analysis of the above recorded data reveals that most participants experienced difficulty with the search engine and the sign in procedure. Gathering product information and the registration procedure also proved to be cumbersome for the participants.

A higher response rate was anticipated from this group for this part of the evaluation questionnaire. Poor responses to section C reflect a lack of understanding of the concepts used in e-commerce user interfaces. It was projected during the data collection phase of this study that the novice should have learnt or become better accustomed to the different components of the user interface. This evidently did not transpire, which was further proved by the queries made by the participants while completing this part of the questionnaire. This proves the difficulty experienced in learning and becoming accustomed to the use of e-commerce website as a result of difficult to understand user interface design. This group also provided very broad feedback since the responses lacked reference to technical aspects and detail.

The following table is a representation of the components that participants experienced problems with. All three groups are represented here to provide overall results, as opposed to the previous tables which depicted one participant group at a time. It shows the total number of participants that had difficulties with utilising a particular component or carrying out some task. These e-commerce website tasks or components are ranked according to the frequency of complaints, from highest to lowest.

Table 7-5: Total number of participants that recorded experienced difficulties with a particular component.

Component/Procedure	Novice	Intermediate	Expert	total
Search capability	5	10	7	22
Registration	2	10	7	19
Sign in	3	9	6	18
Shopping basket	2	6	9	17
Getting prod info	2	7	0	9
Site navigation	1	5	0	9
Acc maintenance	1	0	1	2
Help facility	0	1	1	2

7.4.4.4 CONCLUSION: SECTION C

The search engine, shopping basket components, registration and sign-in processes represented the most difficulty in using and/or completing. However participants reported experienced difficulties with all components and procedures of the e-commerce websites. It is important to note that not a single component or procedure had zero negative criticisms. Reasons for this phenomenon will be presented later in this chapter and in more detail in chapter eight. The following subsections are an analysis of section D.

7.4.5 SECTION D

Section D of the evaluation questionnaire consisted of a single open ended question in which participants were encouraged to voice their opinions of the evaluation procedure in its entirety. Responses encountered included remarks pertaining to the overall impression of the e-commerce websites user interface, the research procedure and problems

associated with time allocation, network speed and performance of the computers in the laboratory. This section of the evaluation questionnaire was not mandatory hence, not all participants completed this section. Participants that did complete this section, especially the expert group, provided detailed data which was imperative for drawing conclusions in this type of study involving qualitative data.

The following points represent the transcription of the responses to the open ended question, categorised by the three participant groups. Both the positive and the negative viewpoints of each of the three participant groups are illustrated below, categorized by the e-commerce website.

7.4.5.1 EXPERT GROUP

AMAZON.COM

Positive aspects listed were:

1. Easy to use.
2. Best designed of the four websites.
3. Best sign-in and search facilities.

Negative aspects:

1. Shopping cart component difficult to understand.

BIDORBUY.CO.ZA

Positive aspects:

None were recorded.

Negative aspects:

1. Search engine difficult to understand.
2. Difficult to register as a new customer.
3. Did not allow the user to browse or use the shopping cart without first entering credit card details, if the user had a free hosting e-mail address e.g. Yahoo.com.

MWEB.CO.ZA

Positive aspects:

1. None were recorded.

Negative aspects:

1. Overall, this website was the most difficult to use.

KALAHARI.NET

Positive aspects:

1. Overall, this website was the easiest to use.

Negative aspects:

1. Difficult to register as a new user.
2. Could not find the new customer registration component.
3. Website took a long time to load.
4. Difficult to locate shopping cart.

Since the expert level participants had experience with both utilising a computer and the Internet, their responses had a greater impact on the analysis. This was due to the data

obtained from them being more accurate and unambiguous. Hence every negative comment made was taken into account for analysis.

The main components or aspects of the websites that were highlighted as problematic were the shopping cart and the registration process (both location of component and the procedure itself). There was one negative response regarding the search engine of Bidorbuy.co.za. The only component shown as a potential problem in Amazon.com by this group was the shopping cart.

7.4.5.2 INTERMEDIATE GROUP

AMAZON.COM

Positive aspects listed were:

1. Overall, this website was the easiest to use.

Negative aspects:

1. Difficult to locate shopping cart.
2. Changing details in customer account information.
3. Difficult to identify and differentiate between components.

BIDORBUY.CO.ZA

Positive aspects:

1. None were recorded.

Negative aspects:

1. Assistance was required for the use of the search engine.

MWEB.CO.ZA

Positive aspects:

1. None were recorded.

Negative aspects:

1. Time allocated to find all items was to short.

KALAHARI.NET

Positive aspects:

1. None were recorded.

Negative aspects:

1. Search engine not extensive in providing detail.

With this group the search engine was reflected as problematic, with three websites receiving this criticism. There was one complaint against the shopping cart component. There were two recorded responses regarding the network speed, where participants agreed that a faster network would have improved their task completion rate within the given time.

For Amazon.com the shopping cart and the customer maintenance were the components reported as being difficult to use. Website design was also negatively mentioned by one participant who found the components difficult to locate.

7.4.5.3 NOVICE GROUP

This group recorded the lowest number of responses. This may be attributed to the lack of technical knowledge and understanding of the working of the underlying computer and Internet systems in place. This phenomenon was taken note of when collecting the questionnaire after the evaluation session and as a result more time was spent on interviewing this group at the end of the data collection stage, in an attempt to extract more information from them.

The responses made reflected a much broader scope than the previous two groups and the responses lacked technical feedback. They can be listed as:

1. Allocated time to complete tasks was insufficient.
2. Difficult to understand website controls.
3. Computers were too slow (poor network speed).
4. Most participants could not access Bidorbuy.co.za.

7.4.5.4 CONCLUSION: SECTION D

The analysis of the responses from both the expert and intermediate groups highlighted the shopping cart, search engine, customer account, website navigation, layout of components and user account maintenance as the problematic areas of the websites.

The novice group provided responses relating to the evaluation process as a whole. The fact that they frequently indicated that the allocated time was insufficient, points out that they could not complete all the predefined tasks. Later analysis will show that this was

the result of the individual components and procedures that make up the e-commerce system being difficult to comprehend and utilise. This point is further substantiated by responses which stated that the website controls were difficult to understand. The responses made by the novice group did not refer to a particular e-commerce website; instead they were aimed at all four test cases, further highlighting the generality of their responses.

7.4.6 CONCLUSION: EVALUATION QUESTIONNAIRE

This section categorised and analysed the responses made in the evaluation questionnaire. These responses were grouped according to the participant group and one of the four e-commerce websites. The conclusions drawn from each section of the evaluation questionnaire will be further analysed in the next chapter, along with the conclusions drawn from the analysis of the other adopted data collection techniques namely participant interview and participant observation. Each section's response was separately, further elaborated on due to the nature of the feedback. For example section C and D responses were more general and hence broader in scope compared to section A and B, which limited participants to predefined and measured responses. The next subsection is an analysis of the interviews held with the participant groups.

7.5 PARTICIPANT INTERVIEWS

Analysis done in the previous sections of this chapter identified the problems experienced by the participants pertaining to the components and procedures of the e-commerce websites (sections A and C) and to the design of the user interface (section B). During the

interview potential problems were also identified, however this method extended data collection by also identifying the reasons for an experienced difficulty. For example if a participant stated during the interview that the search engine was difficult to use, the researcher then "probed" to pin-point what made the search engine difficult to use.

Participant interviews were held after a particular group completed the evaluation process. The researcher was the sole facilitator of the interview and the feedback gathered from participants was recorded using pen and paper. What follows is the transcribed version of this feedback, categorised according to the participant groups.

This process of analysing data from an unstructured interview was modeled against the procedure detailed in Sapsford and Jupp (1996:170). The procedure involves sorting the data into themes, topics or categories due to this data being central to the objectives of this research. Any data that had no bearing on this study was cast aside. Unexpected categories (or conceptual categories) were examined more closely if the researcher felt that they might have an impact on the research topic and ultimately the conclusions of this study.

In the following subsections, data collected was categorised according to the major components of the user interface e.g. search engine or shopping cart. Responses pertaining to these components were recorded, as well as any other response that seemed relevant to this study.

7.6.1 EXPERT GROUP

AMZON.COM

Positive feedback:

1. A large number of retailers were available.
2. Overall, this website was the most efficient to use.

Negative feedback:

1. Search results displayed too many products on a page, information was "cluttered".
2. Not enough details about a particular product were provided. For example Bidorbuy.co.za displayed a picture of the item for greater clarity.
3. Website components were not well laid out, and it was often difficult to locate them.

BIDORBUY.CO.ZA

Positive feedback:

1. Descriptive product details were provided, including a picture of the item.

Negative feedback:

1. Website took too long to load, thus a bid could not be placed on time, which resulted in the item being sold to another user.
2. All free e-mail account holders were not allowed access to Bidorbuy.co.za, only certain e-mail providers are recognised. Thus a recognised e-mail account had to be created before accessing this website.
3. Lengthy registration procedure. Too much of detail was required off the user.

4. Difficult for a new user to grasp the concept of "bidding", insufficient information was provided concerning the usage of this website.
5. Free e-mail account users had to provide credit card details before being allowed access. A sense of uneasiness and insecurity were experienced by users.

MWEB.CO.ZA

Positive feedback:

1. There was an option available to change the screen text to Afrikaans.

Negative feedback:

1. Difficult to understand progressive steps to purchasing a product.
2. Could not easily find links to other e-commerce websites.
3. This website is a portal or a directory that points the user to other websites that do the actual sale. However, MWeb.co.za does not have enough links that lead users to these alternative e-commerce websites.

KALAHARI.NET

Positive feedback:

1. Good product description and details was given.
2. Best shopping cart component compared to other websites, this was due to ease of understanding and usage.

Negative feedback:

1. Help facility was difficult to read, small font size.
2. Initially difficult to locate the shopping basket at the top, left corner of the screen.

3. Displayed too many alternative products, which confuses the user.
4. Sense of uneasiness was experienced when entering personal details such as address and contact numbers; this website did not do enough to inform the user of the safety mechanisms and standards in place.
5. Lengthy registration process, most of the mandatory information was too extensive.
6. Mandatory fields were not clearly demarcated.
7. The web page containing registration details took a long period of time to submit.
8. There was an option to change the language of the user interface, but to Afrikaans only. More languages should be included.

CONCEPTUAL FEEDBACK (ALL FOUR TEST CASES)

1. Some participants suggested that some form of a virtual map should be part of the website. This would allow for the user to constantly be aware of what area is being used. This feature would be beneficial if the website is a large one, similar to those employed in this study.
2. The four test cases did not cater for experienced users. Users that know exactly what they require should be provided with a means of purchasing that item in a short sequence of steps.
3. The entire evaluation procedure was done using Microsoft Internet Explorer. The question of what these websites might look like when viewed using a different browser e.g. Netscape, was asked by a few participants.

Feedback obtained from this group was detailed, thus each participant's input was discussed in length with the other group members during the interview. Responses recorded were technical in nature due to the participants understanding of e-commerce components and concepts, as well as their underlying knowledge of the internal workings of an e-commerce system and the computer system sustaining it e.g. network type and speed, processing capability of a computer affecting the colour and other visual aspects of the websites.

The expert participant group also provided general or overall feedback relating to all four test cases. Their experience in usage of both the Internet and computer systems allowed this group to provide insights into the areas in which the websites could be improved. Their recorded responses formed the conceptual feedback section (discussed above), since the issues raised by these participants were not anticipated during the initial stages of this study but had to be analysed due to the impact it might inflict on the conclusions. Also due to this study being qualitative in nature, every response that might influence the outcome had to be recorded.

7.5.2 INTERMEDIATE GROUP

As projected before the interview process, a mixture of technical and generalised feedback was recorded for the intermediate group.

AMAZON.COM

Positive feedback:

1. Overall, this website was the easiest for first time usage.

2. “Frequently asked questions” section in the help facility was relevant and easy to understand information.
3. Additional product detail may be displayed if requested e.g. book reviews were available for the novel.
4. This website offers more variations of the required product e.g. the novel can be obtained in hardcover, paperback, new or used.

Negative feedback:

1. The link for creating a new customer account was difficult to locate.
2. Difficult to find prices of items. Prices are displayed in dollars only.
3. In order to add a product to the shopping basket, the user had to view two screens. The other websites allowed for the user to purchase a product from just one screen.
4. Removing an item was also a two screen process which proved to be a lengthy process and sometimes confusing to the participant.
5. Changing account details was difficult. Too much text was displayed on the screen.

MWEB.CO.ZA

Positive feedback:

1. None was recorded.

Negative feedback:

1. Lengthy registration process.
2. Requirements for registration of a new user were not clear.

KALAHARI.NET

Positive feedback:

1. None was recorded.

Negative feedback:

1. Registration process was not clear in understanding.
2. Displaying of search results was not clear and difficult to understand.

MWEB.CO.ZA

Positive feedback:

1. None was recorded.

Negative feedback:

1. This website took too long to process registration information.

A potential problem that recurred among the intermediate group was the registration procedure, across all test cases. Users had negative responses regarding almost all components and procedures facilitating the registration process.

A more general aspect (one that reflects a response pertaining to all test cases) was the time taken for the e-commerce website to load progressive web pages. One comment made referred to the amount of graphics being used in relation to the time taken for the Internet browser to load that page. Another general aspect concerned the displaying of the price of the desired item. Participants agreed that the user should have a choice of

selecting the required currency and the e-commerce system should perform the necessary conversion.

7.5.3 NOVICE GROUP

For this group generalised comments pertaining to all e-commerce websites used in the evaluation and the evaluation procedure itself were made.

1. The time allocation was insufficient to complete all tasks.
2. Computers were too slow.
3. Registration procedure took too long due to the amount of information required from the user.
4. Much assistance was required to find the listed products.
5. E-commerce websites took too long to load.

The registration procedure proved a problem area for this group as well. The general consensus with this group was that the evaluation tasks were difficult to complete, which was a consequence of various difficulties experienced while using the websites, brought on by poor user interface design. When asked about specifics this group responded by stating that it was difficult for a first time user to understand the concepts used in e-commerce websites, for e.g. the ideology of the shopping basket and the incorporated product search engine. The novice group had to be assisted to a great extent before being able to efficiently utilise components such as these. In the real life situation, this assistance may not be readily available, causing novice users to abandon the website.

Lack of understanding the e-commerce computing system also played a part in this group's poor performance. One comment made during the interview was that "help was required for the help facility", which points out that the information provided by the help facility and the text on the website itself is too technical for an entry level user to comprehend.

7.5.4 CONCLUSION: INTERVIEW

The data recorded during the interview provided data that was overlooked by the other data collection techniques, for e.g. the questionnaire did not reveal that the novice group participants experienced difficulty in understanding the concepts being used by the user interface to describe the various components. Only when the researcher spoke first hand to the participants, and realised their inability to concisely describe the e-commerce components, did this issue manifest itself. Therefore the interview as a data collection methodology proved a viable mechanism by which the participants could more adequately and more concisely express their views. These conclusions will be revisited in the next chapter to clearly state the problem areas with the e-commerce user interfaces, categorised by the major components.

The next subsection is an analysis of the observation held during the evaluation process.

7.6 OBSERVATION

Unobtrusive, natural observation was carried out by the researcher and the research assistant team while the participants were completing the predefined tasks. Observational

notes were recorded using pen and paper. The analysis of this data was categorised according to the participant groups and the researcher and/or research assistant team notes were transcribed for that particular group[6]. The observational notes refer to observations made regarding a potential shortcoming, of any of the four e-commerce websites used in this study.

7.6.1 EXPERT GROUP

7.6.1.1 RESEARCHER'S OBSERVATIONAL NOTES

1. Participants were "agitated" at the time required to gain access to a particular e-commerce website due to low network speed. This was visible through their body language.
2. The above point was more pronounced for MWeb.co.za.
3. Participants were willing to experiment and explore the various components of the e-commerce website. They were not concerned with making an irreversible mistake or an error of some sort.
4. Participants seemed very comfortable with using the interface of the website. Their intended actions were completed at a very brisk pace. Their experience with using the Internet and computing systems was clearly evident when watching participants complete their tasks.
5. Queries were made regarding the course of action to be taken (in terms of the evaluation procedure) when a particular item is out of stock.

[6] Three research assistants were involved in this study. Their observational notes were combined and then transcribed to alleviate the repetition of observed difficulties.

7.6.1.2 RESEARCH ASSISTANT TEAM'S OBSERVATIONAL NOTES

1. Participants were relatively quick to learn the workings of the websites. The shopping basket was the component that took the longest to get used to.
2. Participants seemed unafraid to experiment with the website. Some participants found shorter methods to completing the tasks e.g. use of "short-cuts" provided by the user interface.

7.6.2 INTERMEDIATE GROUP

7.6.2.1 RESEARCHER'S OBSERVATIONAL NOTES

1. Participants (7 out of 10) required some form of assistance with the search facility. For e.g. when searching for the novel, participants entered "novel" as the search argument and not "Wilbur Smith" or "Birds of Prey".
2. Queries were made regarding the use of the shopping basket component. Participants were told that they should place the item into the shopping basket, which lead to an even higher degree of confusion among some participants, with some of them trying to "drag-and-drop" the product into the shopping basket. Participants were then shown the "add to shopping basket" button or icon when they asked for assistance.
3. Removing items from the shopping basket was difficult. Confirmation of a completed task would have been beneficial to participant understanding e.g. provide a message when item removed from shopping basket. Some websites required two web pages to be loaded in order to complete a single task. This lengthened the time taken to purchase an item.

4. Difficulty was experienced in identifying and recording details of the desired products, details such as price and delivery time. Participants exhibited difficulty in locating the required details among those presented for each item. Possibly too much information was shown initially.
5. Participants from this group were not as comfortable and confidant with using the e-commerce websites when compared to the expert group participants. This trend was noticed from the degree of uncertainty shown by their body language such as peering into a fellow participant's computer screen or confirming certain actions among themselves during the task completion process.
6. Some participants asked the same question or made the same query two or more times while working with the same e-commerce website. This highlighted their inability to quickly learn how to complete a certain procedure using a particular website due to poor user interface design.

7.6.2.2 RESEARCH ASSISTANT TEAM'S OBSERVATIONAL NOTES

1. The intermediate group was not comfortable with experimenting with the e-commerce websites. They were concerned with making some form of irreversible mistake while carrying out the pre-defined tasks.
2. Every participant in this group had at least one query with regards to locating and recording details of products, carrying out a certain task and locating different components of the e-commerce website.
3. Questions pertaining to recording the details of products were the most frequently asked question on all four websites.

4. A few participants required assistance while using the search engine facility, namely how to use this component and some clarification on what a "search key" was and how it relates to the search engine.
5. Some participants did not purchase all products within specified time limit.

7.6.3 NOVICE GROUP

7.6.3.1 RESEARCHER'S OBSERVATIONAL NOTES

1. Most participants from this group did not complete all the tasks within the given time allocation. This was due to lack of confidence, difficulty in understanding the concepts and the methods used to effectively negotiate the user interface.
2. Difficulties were experienced while using most of the components that were being evaluated, such as the search engine, product details and shopping basket. Difficulties attributed to poor user interface design ranged from lack of understanding how a component works and exactly what they were required to do using that component.
3. Participants could not distinguish between plain text and links on the web page.
4. In some cases the available options displayed on the user interface were not easily interpreted for example on Kalahari.net a new customer had to activate a link called "Create a profile". The majority of participants did not understand exactly what was meant by "profile".
5. There was an overall difficulty experienced in the initial location of the components. The user interface did not clearly point out or highlight the different components. This is necessary for novice users and some option should be made available especially for novice users.

6. Assistance was most frequently provided for the utilisation of the search engine and the identifying and recording of product details.
7. A clearer definition and brief purpose of the shopping basket component was verbally given to these participants by a research assistant team member. The user interface should make this clearer.
8. Most participants took a long time to get accustomed to the layout of the user interface as well as movement between the various components.
9. Even in the last fifteen minutes of the task completion process, participants did not display any improvement in their degree of confidence when interacting with the user interface.
10. In some instances too much information was displayed on the same web page. This intimidated the novice user. The user interface design should incorporate the use of expandable menus that would gradually display information.

7.6.3.2 RESEARCH ASSISTANT TEAM'S OBSERVATIONAL NOTES

1. This group had the highest number of queries.
2. Frequent assistance was given before the participants were able to carry out their tasks.
3. Participants used the image or picture of the product to confirm that the correct item was found.
4. The concept of a multi-key search or Boolean search had to be carefully explained. Participants were told that a Boolean search would allow the search engine to find the precise item.
5. Assistance regarding all components was provided.

6. With regard to Bidorbuy.co.za, participants from the novice group and the majority of the intermediate group experienced difficulty in understanding the concept of having to bid for an item.
7. A similar problem with understanding the underlying concepts was noted with Mweb.co.za. Participants had to be told that this website is a portal to other e-commerce websites that make the actual sale e.g. there exists a link to Kalahari.net. With reference to this point and to point six above, the user interface should provide easy to understand and concise information regarding these underlying concepts. This becomes more important with the case in point i.e. novice users.

7.6.4 OBSERVATION CONCLUSION

Analysis of the data recorded during observation revealed information that was not recorded by the interview or the questionnaire data collection methods. Factors such as body language, facial expressions and signs of agitation or fatigue brought to attention difficulties being experienced among the participants, which could subsequently be noted by the researcher or the research assistant team. This data collection method also allowed for concise and accurate data to be recorded due to note taking being executed by the researcher himself. Observation also provided a vantage point in that actual problems experienced during use of the websites could be noted, similar to a "real-life" situation. Observation therefore proved a viable data collection technique.

This chapter analysed the data collected during the evaluation process of this study. It included analysis of the primary data collection technique, i.e. questionnaires and two

secondary data collection techniques i.e. interviews and observation. Analysis of this data then provided proof of problematic areas with the e-commerce websites as experienced by the different levels of participants. These problematic areas spanned attributes such as components, procedures and recording relevant information. The conclusions reached here will also be revisited in the next chapter in an attempt to provide concise information elaborating on the problems experienced by participants. The next chapter will draw the conclusions for this data collection by combining and re-analysing the conclusions drawn in this chapter.

CHAPTER EIGHT

DATA ANALYSIS CONCLUSION

This chapter draws the final conclusions for the data collection of this study. The findings of each of the data collection techniques, elaborated on in the previous chapter, are now summarised and discussed.

E-commerce websites formed the test cases for this study and various aspects of their user interface design were evaluated by participants. These aspects can be divided into two categories, namely e-commerce website components and the graphical (or cosmetic) design of the user interface. Website components are those essential elements that an e-commerce website must provide for its users, in order for it to be deemed as a commercial website. Examples of these elements include the search engine, user sign-in or log-in and a shopping basket. Graphical design refers to user interface attributes such as the physical screen layout of the components, legibility of the inter-related web pages and the ease of understanding the sequential procedure for performing a transaction. The conclusions that follow are grouped according to these categories, in that they relate to some component or graphical design constraint.

8.1 E-COMMERCE WEBSITE COMPONENTS

8.1.1 REGISTERING AS A NEW CUSTOMER

This was the first task to be completed by the participant involved in this study. Before the participant could gain entry to the web page that facilitates locating and purchasing products, a customer profile had to be created by and for each of the participants. This

was done by the e-commerce website by providing a mechanism that allowed the participant to enter relevant details as a customer. This information included examples such as customer name, shipping address and certain bank account details. Participants agreed that the amount of information required initially was too great both in detail and quantity, which ultimately lead to a lengthy registration process.

Once this information had been entered by the user, the waiting period during which these details are being processed by the e-commerce website, was too lengthy. Often the website had to be refreshed[7] which lead to confusion and agitation among the participants who often queried the whereabouts of the web page that they were currently viewing.

However the quantity of information required did not pose a vital potential problem since this process had to be completed once in a customer's lifetime. Instead a more significant problem was in understanding exactly what information was required of them. Some of the requirements were not clearly stated, which lead to confusion as to what exactly was required, for example the word "zip code" has the more preferred term of "area code" among the novice users.

8.1.2 SIGN-IN AS A CUSTOMER

Once the participants had registered and created a new customer account, the next step was to sign-in (or log-in) to the e-commerce website as a potential customer. A problem specifically regarding Bidorbuy.co.za was that the website did not allow all users with a

[7] This is when the webpage being viewed has been displayed in exactly the same way for too long. The webpage has to be reloaded or refreshed since the computer system that contains this webpage, sees this long wait as an error.

free e-mail account to sign-in. Only certain free e-mail account holders (such as Yahoo.com) were allowed access to this e-commerce website. This restriction forced participants to create a Yahoo.com e-mail account before they could use this website. This created an overall negative attitude among the participants, which affected the remainder of the evaluation to a certain degree.

A positive aspect of the sign-in procedure on all test cases was the storing of customer information. Each time a user signed-in, his/her details did not have to be re-entered.

8.1.3 SEARCH ENGINE

The next step taken by participants, once they had signed-in as a customer, was to locate the predefined products. The first major difficulty experienced by participants was in understanding the purpose of the search engine. This was more pronounced among the participants that did not have prior experience with searching for items located on the World Wide Web. When searching for items on the Internet, for example information regarding a particular subject for the purposes of research, users would have to utilise an Internet search engine. Participants forming the expert group, who had the most experience in Internet use, did understand the concept of the search engine, both in purpose and usage. The novice and intermediate groups were the participants that queried the purpose of the search engine during the evaluation procedure. Participants who had this query were told by the researcher and the research assistant team that they need to employ the search engine to locate the items that they desired, in this case a list of predefined products.

This then lead to the second experienced problem based on the usage of the search engine. In order for the search engine to locate a desired item, a "search argument" needed to be typed into a space provided on the web page. A search argument comprises certain key words that the search engine would use to locate a particular product. For example, if the user was looking for a novel, then the name of the novel and/or the name of the author would be typed in. The search engine would then use this information provided by the user and display a summary of details regarding that novel which may include the price, abstract and basic shipping details.

The novice and intermediate participant groups experienced difficulty in understanding what a search argument was. The researcher and the research assistants had to provide assistance to the majority of participants, in some cases assist the same participant more than twice, before they could effectively use search arguments. Expert participants did not require assistance and were using advanced features of the search engine such as Boolean or multiple key-word search arguments e.g. Birds of Prey + Wilbur Smith. This would instruct the search engine to find the novel called "Birds of Prey" written by the author "Wilbur Smith".

Evidently, not enough help is provided by the website for the novice and intermediate computer and Internet skilled users. Some of these group members would not have succeeded in using the search engine if they did not have assistance at hand. Participants indicated that the results of the search engine were not adequately displayed on the website. The majority of participants from all groups indicated that the information was "cluttered" i.e. too much information was displayed within too small an area. It was

difficult for participants to identify precise details of the purchase, such as shipping costs and time required for delivery.

8.1.4 RECORDING PRODUCT INFORMATION

Bidorbuy.co.za provided a picture of the item with the product information. Participants considered the displaying of an image of the product in a positive light. However, the pitfall with this approach was that the website took a longer time to load, due to the high graphic content brought on by the advent of the image. The more experienced participants stated that had they been accessing these e-commerce websites from a network with greater bandwidth, then the inclusion of images would have been beneficial since a higher bandwidth would reduce the time needed to load these images. However the user interface should be designed to cater for various computer network types and speeds e.g. the Internet user should be given the option of determining, to some extent, the content being displayed by the website.

Participants also indicated that the e-commerce websites displayed too much information regarding the product. The majority of participants indicated that it was difficult for them to identify the required product details, for the purposes of this evaluation. The concentration of product details displayed in the designated area on the webpage was too high. Once the participants did manage to identify the required information from that being displayed, the information provided was descriptive and easy to understand. The only two irregularities arose with regard to product pricing, with some e-commerce websites displaying prices in Dollars. The second irregularity was that of the delivery time which had to be estimated on some websites. Delivery time may in some instances

might be a critical factor, not necessarily in terms of a shorter time, but in providing an exact date and time of when the product may be received.

8.1.5 SHOPPING BASKET

Novice and intermediate participant groups had to be informed of the concept of a shopping basket. Once this was done by the researcher and the research assistants, the problem of using the shopping basket still persisted. The most frequent error made by this group of participants was to attempt to "drag-and-drop" the desired products into the shopping basket. Participants were subsequently told to click on the button at the bottom of the webpage entitled "add to shopping basket", which pointed out the difficulty in identifying this control. There was a slight degree of confusion when some websites used the terminology of "shopping cart" in place of "shopping basket", this transpired mainly on the Amazon.com website. Participants were told that they were in fact one and the same.

One of the tasks of the evaluation instructed the participant to remove an item from the shopping basket. This was not easily completed and the intermediate and novice users had to be aided in completing this task. Removing items should be a simple procedure since customers will use this component to compare the total price, including vat, before making a purchase. Also participants should have been provided with feedback letting them know that they have just added or removed an item from the shopping basket. This should be done by means of a message.

Some participants had difficulty in locating the shopping basket icon on the web page. This however is a minor difficulty since it only occurred during some participant's first encounter with the component.

8.1.6 WEBSITE NAVIGATION

For the participant to perform the required tasks for the evaluation procedure, different components of the e-commerce website had to be identified and then utilised. These components existed in a number of different forms such as buttons, icons and menu items. Part of the evaluation procedure was to measure the effectiveness of identifying the different components in what ever form they might have existed. Website designers refer to these buttons, icons and menu items as website controls.

The majority of participants agreed that it was difficult to find the website controls. This was further highlighted by the time taken for participants to learn the layout of the controls on the websites, even after having purchased two products. Novice and intermediate group participants did not reflect "fluent" use of the site controls, and often asked for assistance from the research assistants or sometimes from other participants seated nearby.

There was insufficient clarity with regard to the progressive steps toward purchasing a product. Participants were often unsure and required assistance throughout the process of locating, recording details and placing items into the shopping basket. The sequential steps involved in this procedure were not clearly displayed and participants suggested that additional aid should be available if the user requires it.

Users of the e-commerce websites were provided with the ability to move from one webpage to any other webpage. This lateral movement should be limited since too much choice has the potential to lead the novice and intermediate participant to confusion. This was observed when participants were unsure of a course of action and tried to reverse their previous steps. Within the same context, the expert participant group suggested the introduction of a "website map". Further research identified that some commercial websites make use of a collapsible menu providing a "you are here" type of reference point. This may be useful on an e-commerce website that provides limited products and/or services hence the website in its entirety is not a large one. For larger e-commerce websites like the ones adopted in this study, a point of reference may be too complex and add to an already existing degree of confusion. However it is a facility that should be designed, implemented and tested in larger websites such as e-commerce websites.

Research team assistants noticed that the novice and intermediate participant made frequent use of the "back" button provided by the Internet browser. This control allowed for the previously displayed webpage to be reloaded and shown again. Reasons for this may be the result of the webpage taking too long to load causing technical problems such as "freezing" or stalling of the loading process. A second reason may have been the lengthy period of time taken by these participants to complete a required task on that webpage, which caused it to eventually stall. A third and final reason may be the participant loosing track or direction of what they were currently doing and what needs to be done next. In an attempt to regain their sense of direction and course of action, the previous webpage was reloaded and examined.

One participant from the expert group did comment on the speed at which a particular product could be purchased. He referred specifically to the situation where the customer knows exactly what they require and is attempting to locate and purchase that product in the shortest possible time. Further research into user interface guidelines state that website designers often refer to the "3-click rule" which stipulates that a user should obtain the required information or item in a maximum of three steps. This rule can apply to commercial websites with limited offerings in terms of products and services. However when examining larger e-commerce websites similar to the four used in this study, this 3-click rule may be difficult to enforce. However, this is another feature that should be designed, implemented and tested on e-commerce websites.

8.1.7 CUSTOMER ACCOUNT MAINTENANCE

A customer's personal details such as bank account numbers, credit card numbers and contact information e.g. e-mail and home addresses, may change over time. E-commerce websites provide the user or customer with a mechanism to update their personal details. Participants involved in this study were asked to make changes to their contact details in an attempt to test this component.

Participants that did attempt to change their personal details (mainly from the expert group) indicated that the task was not difficult to understand but the process was a lengthy one. The time taken to load the subsequent web pages of this component was too long, and sometimes the pages had to be refreshed and details re-entered by participants. However, this is not a major concern since it is not performed frequently.

Identifying and gaining access to this component did not prove to be difficult to the limited number of participants who did perform this task. Once this component was activated the sequential process was easy to understand and complete.

8.1.8 HELP FACILITY

Participants indicated that the help facility was “confusing” to utilise on the Mweb.co.za and Kalahari.net websites. Most agreed that the controls for this component were not properly labeled and were difficult to identify. The second potential problem was with the time taken by the website to display the information regarded as “help”.

The e-commerce websites did provide a “frequently asked questions” option which provided assistance for most of the frequently performed tasks, such as adding products to the shopping basket. There were some participant responses that pointed out the complexity of the help facility due to a high number of features being displayed on the same web page, in the form of links. A collapsible menu should be used instead of numerous links as this would not discourage the novice or intermediate level user due to the large content and number of options.

8.1.9 CONCEPTUAL ISSUES REGARDING WEBSITE COMPONENTS

Certain potential problems that were not catered for during the onset of this study did arise during the evaluation process. These shortcomings had to be listed and analysed since they did have a direct bearing on the conclusions of this study.

Time allocation for task completion was not sufficient, especially for the novice and intermediate groups. This does not indicate an improper measurement done during the pilot study. Instead it is traced back to the experienced difficulty in the participant's learning and subsequent understanding of the user interface, which highlights an overall problem with the e-commerce website design. Further evidence supporting the above remark was the participant's incapability to perform basic tasks (such as purchasing an item), even after continuous exposure to the user interface. This also highlights the lengthy period of time required to get acquainted with the user interface.

Participants found the task of accessing alternative e-commerce websites through the use of links, difficult. Many of them commented on not being able to locate these links. Not being able to understand the purpose of a website link is the more probable explanation for this phenomenon. Participants were told that if a particular product could not be found on an e-commerce website then that website should provide a link to another that may possibly have the desired item.

Insufficient assurance was provided in terms of security and privacy of personal details. Participants, especially the expert group, agreed that the e-commerce websites should have provided more information on the security features in place with the function of providing a safe medium of trade. Users' confidence when using e-commerce websites needs to be increased by informing them or at least reminding them of the security features in place on an e-commerce website.

For Bidorbuy.co.za, participants did not easily understand the concept of bidding. This e-commerce website was representative of an online auction, and the user that places the

highest offering for a product would eventually be able to purchase it. By examining the website, participants were not clear on this concept, which was more pronounced among the novice group. This website did not provide meaningful, initial information in the above light.

Participants often complained about the time taken for a webpage to load. This was due to the high graphic content of the website i.e. large quantity of images, pictures and photographs. Participants commented on some websites by stating that if this were not a controlled evaluation (i.e. if they were actually looking for items) they would have abandoned the search and moved onto other e-commerce retailer's websites. The web pages of these e-commerce websites need to be streamlined to provide a faster service, even on computer networks with moderate to lesser speeds.

Participants involved in this study were required to evaluate the four e-commerce websites under such topics as clarity, user control and graphical design such as font type and colour usage. The next subsection is a discussion of the second category of this study's e-commerce website evaluation, namely the graphical design or cosmetic design of the user interface.

8.2 E-COMMERCE WEBSITE GRAPHICAL DESIGN

8.2.1 WEBSITE CLARITY

Website clarity refers to the ease with which participants were able to distinguish between the different components of the user interface. Buttons, icons, links and menu items are the different controls by which a particular component may be identified and

utilised. Participants were asked to evaluate these different controls with regard to how clearly distinguishable and usable they were.

A wide variety of responses for all test cases were obtained for this test which makes it difficult to identify the gray areas. Participants from all groups indicated that Amazon.com had the most easily distinguishable user interface, with clearly marked controls. The only complaint pertained to some web pages being too rich in information, which resulted in them being cluttered and sometimes confusing. However, good graphical design of the website controls across all test cases was the response that the majority of participants made.

8.2.2 MOBILITY

This aspect refers to the level of "fluidity" when moving between the different controls or components of the website. As participants gained experience with the websites, the movement between the different web pages and controls should have become easier. However this was not the case, highlighting the fact that the user interface design did not promote efficient movement across the webpage. For example the research assistant team members and the researcher took note of frequent diagonal movement across the webpage when purchasing an item. The controls should be more closely situated to aid in movement and ultimately better interaction between the user and the website.

8.2.3 CONTROL

This section regarded the participant's perception of being in control of the website and any process that they were carrying out. It could also be referred to the user friendliness of the user interface. A well designed user interface as listed in texts such as (Shneiderman, 1998) should be "transparent" i.e. the user must not feel as if they are controlling an interface to complete a task, instead they should be concentrating on the just completing the task.

This transparency mentioned above was not present on two of the four e-commerce websites evaluated. Remarks made by the participants pointed out that they blamed the user interface for any difficulty experienced when attempting some task, even though the task in hand was a complex one. The expert participant group, however did not exhibit this behavior due to their confidence and willingness to explore the different avenues of the user interface. They were not afraid of making mistakes since they were aware of the reversibility of their actions if required.

8.2.4 COLOUR USAGE

This section required responses that pointed out flaws with the adaptation of colour on the e-commerce websites. There was only one recorded suggestion made by a participant. He suggested that critical functions such as the "remove-item" button that is utilised when you want to remove an item from the shopping basket should be in an "aggressive" colour such as red or yellow. This would aid in gaining the attention of the participant.

Other than this the participants gave the usage of colour on the user interface an overall rating of "good".

Amazon.com made use of colour as an identification mechanism. The different categories of items that were available on that e-commerce website were identified by the different colour schemes. This contributed towards user friendliness and it did help participants to gain familiarity with the user interface. This website made good use of different colours while maintaining the same theme throughout. In some cases it helped the participant to identify the presence of the same website.

Comments regarding the use of images saw this design feature in a positive light. Participants were in favour of the idea of being able to identify and clarify that the correct item had been placed in the shopping basket by being presented with some picture or image beforehand. This feature does require a high bandwidth network otherwise the loading time required is too long, which in turn leads to a negative attitude among participants.

Another advantage of using pictures or images was that it helped novice customers or customers with poor literacy levels to identify products. This was observed among the novice participant group who used the image of the product as a means of confirmation.

8.2.5 FONT DESIGN

Participants were also required to evaluate the font or text design used on the e-commerce websites. Attributes such as legibility, efficiency in highlighting components and

concentration of text within some area of the webpage, were evaluated. Similar to colour usage there were only a few complaints with regards to this aspect. One of them was a complaint regarding the high concentration of text within the product details web page. Participants agreed that too much information was being displayed in too small an area. Some participants did complain about the small text size used in some areas of the webpage.

8.2.6 LAYOUT OF WEBSITE CONTROLS

The placement of website controls such as icons, buttons, links and menu items played an important part in improving the efficiency or speed at which a participant could complete a task. Provided that the controls were adequately placed i.e. the layout promoted speed and understanding when completing the predefined tasks, participants were noted as being more susceptible to improving their time utilised in finding and placing items in the shopping basket. This phenomenon was further proven by closer examination of the relationship between the responses recorded for Amazon.com and Kalahari.net as well as the time taken to complete tasks on these websites. Amazon.com and Kalahari.net received the best responses for layout of the user interface controls and participants completed the predefined tasks in the shortest time using the same two websites.

However, the same did not occur for Bidorbuy.co.za and Mweb.co.za. For example it was anticipated that participants would have purchased the fourth item quicker than they would have purchased the first item, on the same e-commerce website. This did not transpire, and the research assistant team and the researcher did not record an

improvement in the time taken by the majority of participants to complete the predefined tasks on these two test cases.

User interface experts (e.g. Nielson) state that designing an efficient layout for controls on an e-commerce website is a difficult task since the only way to improve on this is to repeatedly design, develop and test the adopted layout until acceptable results are obtained. Amazon.com and Kalahari.net were favoured for their layout designs due to their controls being easily identified, activated and tasks being completed faster due to less movement between the component controls.

8.3 CONCLUSION: COMPONENT VERSUS GRAPHICAL DESIGN OF THE USER INTERFACE

Through observation and the interviews held with the different participant groups, evidence showed that the graphical design of an e-commerce website did not have great bearing on the effectiveness of that user interface. Aspects such as background colours, patterns, themes, number of controls on a webpage and the consistency of layout, did not feature in the majority of the participant's responses. When the researcher did question the lack of feedback regarding the graphical aspects of the user interface during the participant interviews, most participants agreed that the designs were good to excellent. The design of the components such as search engine and navigational features were the priority concern among participants and this study proved that the functionality and ease of understanding of these features lead to a good rating for that user interface. The overall presentation of the information on the e-commerce website was not as vital when compared to the design of navigational features and components.

Just two of the four featured e-commerce websites provided an option for a multi-lingual user interface. By clicking on a website control, the user had the choice of English or Afrikaans text. This ideology received positive feedback from participants however, the majority of participants agreed that more user interface options that included more of the eleven official South African languages would have been beneficial to user acceptance of the e-commerce websites. This point was further personified when examining the educational background, in terms of both literacy and computing, of the users that make up the novice participant group. These participants find it difficult to comprehend technical terms and details used in the user interfaces. Couple this with the understanding of the concepts required for purchasing items online and a very steep learning curve is formed for these novice users. Presenting this novice users with a user interface that features a language that they are comfortable with and understand will increase the user acceptance and hence increase the economic success of e-commerce systems.

Expert level participants that exhibited confidence and experience in both computing and Internet usage, offered the most input for this study in terms of technical details and evaluation information. It is the finding of this study that expert level computer and Internet users are more inclined toward successfully negotiating e-commerce websites. Their high degree of confidence and exploratory abilities enabled them to efficiently and systematically manipulate the user interface and complete the required tasks within the time constraints. Novice and intermediate level participants required much assistance in understanding the concepts and methods of the majority of components on the e-commerce websites. Their retention of the sequential procedures by which the required tasks had to be completed was poor, even though several similar tasks had to be completed using the same website's user interface. This highlights a significantly steep

learning curve for novice users with reference to gaining experience and eventually using e-commerce user interfaces. The majority of participants did later go on record as stating that if it were not for assistance provided by the research assistant team and the researcher, they would have abandoned the search and purchase of the required products. The user interface needs to be designed and tested to evolve into a more acceptable and usable for the novice user, who represents a significant portion of the Internet users in South Africa (shown in chapter three when participants were selected for this study).

This chapter provided a detailed summary of the problematic areas of the user interface. The next chapter will provide the final conclusions regarding this study.

CHAPTER NINE

9.1 OBJECTIVES AND MAJOR FINDINGS OF THIS STUDY

Insights into research conducted by usability and website design experts show that poor user interface design is one of the leading factors towards poor economic success of e-commerce systems. Chapter two provided an elaboration on this phenomenon. Building from the conclusions of those studies and surveys, the aim of this research was to systematically identify potential problem areas of user interface design implemented in current e-commerce websites. This was achieved through carrying out the objectives of collecting, sorting, collating and analysing data generated by differently skilled participants, while interacting with selected e-commerce websites.

The major finding of this study was the inability of novice and intermediate skilled computer and Internet participants to efficiently utilise the selected e-commerce websites. Analysis of the responses by participants indicated that the above phenomenon was due to difficulties experienced in understanding the different components of the user interface, in terms of both learning and functionality. Chapter eight provided a more detailed discussion on the various problems experienced by participants regarding the different aspects of the user interface. These problem areas pertained mainly to the component design and not the graphical design of the user interface.

Other findings drawn from chapter eight shows that the majority of the participants involved with this study, who were selected to represent South African Internet users, are not capable of utilising e-commerce websites without assistance. Often repeated assistance was required by the same participant to perform a similar task, both on the

same or on a different e-commerce website. The poor computer and Internet literacy levels exhibited by the majority of participants adversely influenced their performance. This was due to the technical terminology used on the different areas of the user interface which made them difficult to understand and to the user interface not being designed with the needs of the novice user being catered for. The researcher often had to explain some of the user interface components in terms of concept and usage, before they were successfully utilised.

This study was successful in identifying potential problem areas associated with the user interface design of current e-commerce websites. The detailed discussion of these highlighted problematic areas presented in chapter eight, provided a more precise and accurate understanding of the end user's needs from an e-commerce website. Website designers and developers may now address these problematic areas and provide a user interface that may be more acceptable by intended users. This phenomenon may ultimately improve the economic success of e-commerce strategies implemented by South African companies.

9.2 RECOMMENDATIONS FOR FURTHER STUDY

1. The problem areas of user interface design highlighted in chapter eight needs to be rectified. A prototype user interface that addresses these shortcomings should be designed and subjected to further testing, using the sequence of techniques implemented in this study. Based on these results, the prototype user interface should be improved and implemented. Further testing should be performed once the user interface is operational.

2. Novice and experienced users of an e-commerce website have different needs in terms of the design of the user interface. Novice users must be able to easily and efficiently browse the e-commerce website until they locate the product that they require. The more experienced user, who knows precisely what he needs and where this product or service can be found on the website, should be provided with a mechanism that allows for the comparison of products and services. Also the expert user should be provided with advanced features that speed up the time taken to complete a transaction. The different needs of different skilled Internet users should be identified and more accurately researched.

3. One participant did comment on one of the e-commerce website's ability to switch between an English and Afrikaans user interface. A study should be implemented to improve this facility to include user interface options for other mainstream languages used within South Africa, such as IsiZulu and IsiXhosa. This may improve the learning, understanding and acceptance of e-commerce among the novice Internet users.

9.3 LIMITATIONS OF THIS STUDY

1. Financial resources allocated for this study only allowed for a small sample frame to be selected. Thirty participants were selected to represent the South African Internet user population. A larger sample would have improved the accuracy of the results by providing more feedback for the purposes of analysis.

2. Four e-commerce websites were chosen as the test cases for this study. Each of these e-commerce websites represented online retailers that offered a wide variety of products. A greater number of e-commerce websites e.g. eight to ten, would have provided the participants with more exposure to different websites hence improving the amount of feedback regarding the user interface design. Further more, different types of e-commerce websites e.g. those specialising in few products or services, would have been tested as well. This approach would have ultimately improved the accuracy of the overall conclusions of this study since a greater variety of e-commerce websites would have been examined and responded to by participants.

3. The tasks set for this study required the participant to locate an item or product and then place this into the shopping basket. Participants were not required to purchase these items. An added sense of realism would have been achieved if the participants were told to purchase these items using bank account information or credit card details. This would have allowed for participant responses regarding their sense of security and trust.

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APPENDIX 1A: PRODUCT LIST

The list of products that need to be located and purchased during the evaluation process.

1. Cellular phone accessories (battery, covers etc.) for Nokia 3310.
2. Novel by Wilbur Smith titled Birds of Prey.
3. DVD Movie. Gone in Sixty Seconds. (1974). Starring H.B. Halicki.
4. Tennis racquet. Dunlop. Grip size ¾.
5. Music CD. Blink 182: enema of the state.
6. Software. Adobe Photoshop Digital Video Collection ver. 8.0.

APPENDIX 1B: PRODUCT INFORMATION TABLE

Product information table was used by the participant to record details of each located product. Information recorded on this table served as proof of the participant finding the product.

	Retailer	**Delivery Time**	**Cost**
Cellular phone acc			
Novel			
DVD Movie			
Tennis Racquet			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

APPENDIX 1C: PRODUCT LIST (REVISED)

Products that need to be located during the evaluation process, with two products removed after results from pilot study.

1. Novel by Wilbur Smith titled Birds of Prey.
2. DVD Movie. Gone in Sixty Seconds. (1974). Starring H.B. Halicki.
3. Music CD. Blink 182: enema of the state.
4. Software. Adobe Photoshop Digital Video Collection ver. 8.0.

APPENDIX 1D: PRODUCT INFORMATION TABLE (REVISED)

Product information table used by the participant to record details of each required product. Revision includes removal of two products after results from pilot study.

	Retailer	**Delivery Time**	**Cost**
Novel			
DVD Movie			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

APPENDIX 2A: PARTICIPANT SELECTION QUESTIONNAIRE

Case Study Participation

Thank you for taking time off to complete this questionnaire. Please tick the appropriate block for each question.

Name:_____

Date: _____

Contact No. _____

1. What level of computer user would you consider yourself?
   Expert ☐
   Intermediate ☐
   Beginner ☐
   Never used one ☐

2. How often do you make use of a personal computer?
   Every Day ☐
   Four times a week ☐
   Twice a week ☐
   Less than once a week ☐

3. How often do you access the Internet?
   Every Day ☐
   Four times a week ☐
   Twice a week ☐
   Never have ☐

4. What do you understand by the term “e-commerce”?
   No idea ☐
   Something dealing with computers ☐
   Trading over the Internet ☐
   The name of a new computer store ☐

For official use: ☐

APPENDIX 2B: WEBSITE EVALUATION QUESTIONNAIRE

e-Commerce Web Site Evaluation

Date _____ Time _____

Your Name _____ Group (a,b or c) _____

1. Answer this questionnaire only after you have completed the tasks.
2. Please write your answer to each question in the space provided or tick the appropriate block.
3. The research staff member will specify your time limit.
4. If required, please ask for assistance during any stage of this process.

Which e-commerce web site are you currently using?

Amazon ☐

BidorBuy ☐

MWeb ☐

Kalahari ☐

SECTION A

Rate the following components of the e-commerce web site.

1. Login procedure
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐
2. Help facility
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐
3. Search Engine
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐

4. Links to other sites (if your desired product can not be found)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐

Rate the following features of the user interface.

5. Clarity (Ease of understanding)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐
6. Mobility (Ease at which you can navigate the website)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐
7. Control (Do you feel that you are controlling the website, and not the website controlling you)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐

SECTION B

8. Use of colour (Not harsh, too bright, hurtful toward the eye)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐
9. Fonts (Easy to read information off the website)
   - Poor ☐
   - Fair ☐
   - Good ☐
   - Excellent ☐

10. Layout of site controls (e.g. buttons, links and menus)
    - Poor ☐
    - Fair ☐
    - Good ☐
    - Excellent ☐

SECTION C
State which component of the website you found difficult to use. Please state reason/s for this.

_____

_____

_____

SECTION D
If you have any comments please write them here.

_____

_____

_____

_____

APPENDIX 2C: RESEARCH ASSISTANT TEAM SELECTION QUESTIONNAIRE

Research Assistant Team

Thank you for taking time off to complete this questionnaire. Please tick the appropriate block for each question.

Name:_____

Date: _____

Contact No.: _____

Year of study:_____ ($3^{rd}/4^{th}$)

Are you currently a staff member:_____ (yes/no)

1. What level of computer user would you consider yourself?
   Expert ☐
   Intermediate ☐
   Beginner ☐
   Never used one ☐

2. How often do you make use of a personal computer?
   Every Day ☐
   Four times a week ☐
   Twice a week ☐
   Less than once a week ☐

3. How often do you access the Internet?
   Every Day ☐
   Four times a week ☐
   Twice a week ☐
   Never have ☐

4. How often do you purchase/browse for products and or services using e-commerce websies?
   Every Day ☐
   Four times a week ☐
   Twice a week ☐
   Never have ☐

5. Have you ever been employed as a tutor or lecturer by your respective department?
   Yes ☐
   No ☐

For official use:

e-Commerce Web Site Evaluation

Consent:

1. My participation is voluntary and I have the right to withdraw consent and discontinue participation at any time.
2. I have been informed in advance what my tasks will be and what procedures will be followed.
3. My signature below may be taken as affirmation of all the above mentioned statements.

Participant Name _____

Signature _____

Date _____ Group _____ (a,b or c)

Department _____

If you are staff member please state designation_____

Instructions:

1. Please tick the most appropriate answer.
2. The research staff member will specify your time limit.
3. If required, please ask for assistance during any stage of this process.

Sec A. Rate the following components of the e-commerce web site.

1. Creating a new account

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

2. Information provided by the help facility

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

3. Search engine

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

4. Shopping basket

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

5. User account information

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

6. Links to other sites

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

Sec B. Rate the following features of the user interface.

1. Clarity (ease of understanding)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

2. Mobility (ease at which you can navigate the website)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

3. Control (do you feel in complete control of the website)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

4. Use of colour (not harsh, too bright, hurtful toward the eye)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

5. Fonts (easy to read text, size, style)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

6. Layout of site controls (eg. links, buttons and menu items)

	Amazon		Bidorbuy		Mweb		Kalahari
Poor							
Fair							
Good							
Excellent							

Sec C. Overall user satisfaction

1. What component do you think was easy and efficient to use?

   A_____

   B_____

   M_____

   K_____

2. What component was difficult to use?

   A_____

   B_____

   M_____

K_____

3. Which task was the easiest to complete?

   A_____

   B_____

   M_____

   K_____

4. Which task was difficult to complete?

   A_____

   B_____

   M_____

   K_____

5. Did you complete the tasks with assistance (yes/no)?

   _____

6. If above is yes, for which task did you require the most assistance?

   _____

Sec D. If you have any comments please write them here.

_____

_____

_____

_____

Thank you for your participation
The Research Team.
The research team may be contacted via e-mail: alveens@dit.ac.za

APPENDIX 3B: EVALUATION TASKS (OLD)

e-Commerce Web Site Evaluation Tasks

Instructions:

1. Complete the following tasks within the time limit specified by the research staff member.
2. For **each** website i.e. Amazon, BidorBuy, Mweb and Kalahari complete the tasks listed below.
3. Upon completion of the tasks for a particular e-commerce website, rate the web site using the evaluation questionnaire. (Hence this process must be done three times).
4. If assistance is required during this process please ask the research team member.

1. Your first task is to create a user account. This may be achieved by selecting new customer or new member. Fill out the online registration form. You will need to fill in your e-mail address. (Ask for assistance if you don't have one).

2. Now that you are a registered customer (at no financial or other obligation) you may purchase products from the e-commerce website. Use the search engine to aid in your search for the products specified below. Remember that all products are sorted categorically eg. the novel will be found under books. Once the product is found please record the details on the single page questionnaire. Finally place the product in the shopping cart or shopping basket.

The products are:

2.1 Cellular phone accessories (battery, covers etc.) for Nokia 3310
2.2 Novel by Wilbur Smith titled Birds of Prey
2.3 DVD Movie. Gone in Sixty Seconds. (1974). Starring H.B. Halicki.
2.4 Tennis Racquet. Dunlop. Grip Size ¾.
2.5 Music CD. Blink 182: enema of the state
2.6 Software. Adobe Photoshop Digital Video Collection ver. 8.0.

3. Now that you have selected the products and placed them in the shopping basket, you now need to record the total cost of these products. This is done by selecting the shopping basket or the shopping cart option. Write the total cost in the space provided in the one page questionnaire.

4. Remove the tennis racquet from the list of items.

5. Access your account details and change your member name or customer name to a name of your choice.

6. Access the help facility and enquire about shipping details eg. cost, time, insurance.

- You have now completed all tasks required for this website.
  Fill out the evaluation questionnaire.
- Now do the same tasks for the next e-commerce website.

e-Commerce Web Site Evaluation Tasks

Instructions:

2. Complete the following tasks within the time limit specified by the research staff member.
5. For **each** website i.e. Amazon.com, BidorBuy.co.za, Mweb.co.za and Kalahari.net complete the tasks listed below.
6. Upon completion of the tasks for a particular e-commerce website, rate the web site using the evaluation questionnaire. (Hence this process must be done three times).
7. If assistance is required during this process please ask the research team member.

1. Your first task is to create a user account. This may be achieved by selecting new customer or new member. Fill out the online registration form. You will need to fill in your e-mail address. (Ask for assistance if you don't have one).

2. Now that you are a registered customer (at no financial or other obligation) you may purchase products from the e-commerce website. Use the search engine to aid in your search for the products specified below. Remember that all products are sorted categorically eg. the novel will be found under books. Once the product is found please record the details on the single page questionnaire. Finally place the product in the shopping cart or shopping basket.

The products are:

2.1 Novel by Wilbur Smith titled Birds of Prey
2.2 DVD Movie. Gone in Sixty Seconds. (1974). Starring H.B. Halicki.
2.3 Music CD. Blink 182: enema of the state
2.4 Software. Adobe Photoshop Digital Video Collection ver. 8.0.

3. Now that you have selected the products and placed them in the shopping basket, you now need to record the total cost of these products. This is done by selecting the shopping basket or the shopping cart option. Write the total cost in the space provided in the one page questionnaire.

4. Remove the music CD from the list of items.

5. Access your account details and change your member name or customer name to a name of your choice.

6. Access the help facility and enquire about shipping details eg. cost, time, insurance.

- You have now completed all tasks required for this website.
  Fill out the evaluation questionnaire.
- Now do the same tasks for the next e-commerce website.

APPENDIX 3D: PRODUCT INFORMATION TABLE

e-Commerce Web Site Evaluation

Single Page Questionnaire

Amazon.com

	Retailer	Delivery Time	Cost
Cellular phone accessories			
Novel			
DVD Movie			
Tennis racquet			
Music CD			
Software			
		Total Cost:	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Bidorbuy.co.za

	Retailer	Delivery Time	Cost
Cellular phone accessories			
Novel			
DVD Movie			
Tennis racquet			
Music CD			
Software			
		Total Cost:	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Mweb.co.za

	Retailer	Delivery Time	Cost
Cellular phone accessories			
Novel			
DVD Movie			
Tennis racquet			
Music CD			
Software			
		Total Cost:	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Kalahari.net

	Retailer	Delivery Time	Cost
Cellular phone accessories			
Novel			
DVD Movie			
Tennis racquet			
Music CD			
Software			
		Total Cost:	

This task is now complete. Next fill out the evaluation questionnaires for each of the websites.

APPENDIX 3E: PRODUCT INFORMATION TABLE (REVISED)

e-Commerce Web Site Evaluation

Single Page Questionnaire

Amazon.com

	Retailer	Delivery Time	Cost
Novel			
DVD Movie			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Bidorbuy.co.za

	Retailer	Delivery Time	Cost
Novel			
DVD Movie			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Mweb.co.za

	Retailer	Delivery Time	Cost
Novel			
DVD Movie			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

This task is now complete. Next fill out the evaluation questionnaires for this website.

Kalahari.net

	Retailer	Delivery Time	Cost
Novel			
DVD Movie			
Music CD			
Software			
Time taken to complete tasks:		**Total Cost:**	

This task is now complete. Next fill out the evaluation questionnaires for each of the websites.