DUAL-METHOD USABILITY EVALUATION OF E-COMMERCE WEBSITES: IN QUEST OF BETTER USER EXPERIENCE

by

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I declare that DUAL-METHOD USABILITY EVALUATION OF E-COMMERCE WEBSITES: IN QUEST OF BETTER USER EXPERIENCE is my own work, and that all sources used or quoted in the study have been indicated and acknowledged by means of complete references.

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Izabela Maria Moczarny Date

Abstract

E-commerce has increased substantially, as e-retailers engage with consumers online. Users require more than products and quality service; they also expect a good user experience. User experience is affected by branding, functionality, navigation, content, aesthetics and usability.

This study investigates the attainment of better user experience on e-commerce websites. A dual-method usability evaluation approach – usability testing with end-users and heuristic evaluation by experts – was employed to obtain a holistic picture of how usability aspects support or hinder the user experience. Usability testing provided insights into detailed interface issues and the type of content and journey that users prefer when making a purchasing decision, while heuristic evaluation was mainly directed at overall user interface and interaction factors. In a complementary way, each method identified a high number of usability problems.

Key findings are summarized, and design guidelines are identified that can facilitate the development of e-commerce websites to promote user experience.

Keywords: E-commerce; heuristic evaluation; Internet usage; online retail; usability evaluation; usability of e-commerce; usability testing; user-centred design; user experience.

Opsomming

E-handel het aansienlik toegeneem, soos e-kleinhandelaars by verbruikers aanlyn betrokke raak. Gebruikers verlang meer as produkte en kwaliteit diens; hulle verwag ook 'n goeie gebruikerservaring. Gebruikerservaring word deur ‘branding’, funksies, navigasie, inhoud, estetika en bruikbaarheid beinvloed.

Hierdie studie ondersoek die bereiking van beter gebruikerservaring op e-handel webwerwe. 'n Dubbelemetode bruikbaarheidsevaluering benadering – bruikbaarheidstoetsing met eindgebruikers en heuristiese evaluering deur kundiges – is gebruik om ‘n holistiese beeld te verkry van hoe bruikbaarheidsaspekte gebruikerservaring ondersteun of verhinder. Bruikbaarheidstoetsing lewer insigte in gedetailleerde koppelvlak kwessies en die tipe inhoud en roete wat gebruikers verkies wanneer hulle 'n aankoop maak, terwyl heuristiese evaluering hoofsaaklik gerig is op algehele gebruikerskoppelvlak en interaksie faktore. Op 'n komplementêre manier, het elke metode' n groot aantal bruikbaarheidsprobleme geïdentifiseer.

Belangrike bevindings word saamgevat, en ontwerp riglyne is voorgestel wat die ontwikkeling van e-handel webwerwe fasiliteer wat gebruikerservaring bevorder.

Sleutelwoorde: E-handel, heuristiese evaluering; Internet gebruik, aanlyn-kleinhandel, bruikbaarheidsevaluering; bruikbaarheid van e-handel; bruikbaarheidstoetsing, gebruikers-gesentreerde ontwerp, gebruikerservaring.

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Acronyms

Acronym	Description
ADSL	Asymmetric digital subscriber line
B2B	Business to business
B2C	Business to consumer
CSFs	Critical success factors
DSTV	Digital satellite television
ECNS	Electronic Communications Network Services
FAQs	Frequently asked questions
GA	Google Analytics
GDP	Gross Domestic Product
HCI	Human-computer interfaces
HE	Heuristic evaluation
ISO	International Organisation for Standardisation
MDWD	Model-driven Web development
N/A	Not applicable
SA	South Africa
TV	Television
UCD	User-centred design
UEM	Usability evaluation methods
UI	User interface
UMUX	Usability metric for user experience

Acronym	Description
UPA	Usability Professionals' Association
UT	Usability testing
UTE	Usability testing eye tracking
UX	User experience
WUEP	Web usability evaluation process
WWW	World Wide Web
8 x 7	Eight by seven
10±2	Between 8 and 12
24–7	24 hours, seven days a week

Chapter 1: Introduction

1.1 Introduction

Companies are expanding their business offerings on the Internet. To be competitive, they should offer more than just good presentations on their websites; they also need to provide a good user experience (Väätäjä, Koponen and Roto 2009). Retail shops have sales consultants who influence customer experience, but in the context of e-commerce, the sales consultant is the website user interface, which provides information and functionality to help users achieve their goals. The interface can either influence a customer to purchase or turn them away, contributing to a decline in the financial performance of the e-business (Chang and Chen 2009). The success of e-commerce is thus influenced by a user's experience in interacting with the website and an awareness on the part of stakeholders of the phenomenon of user experience (UX) in all areas of the business is required to ensure a positive user experience (Martim, Herselman and van Greunen 2009).

The design of websites is becoming a fundamental issue for companies that want to maximize profits in a competitive market (Lee and Koubek 2010). Internet statistics indicate that in 2009 the number of South African Internet users exceeded the 5 million mark, and was expected to grow by 10% in 2010 (Goldstuck and Laschinger 2009). The American International Telecommunication Union and American International Data Group predicted that by 2010, Internet trade would account for 42% of global trade volume (Jing, Yu and Jiang 2008). Therefore, the usability and user experience of e-commerce websites is becoming a competitive requirement (Jinling and Huan 2007; Nielsen 1999).

The goal of this study is to determine means of providing better user experience on e-commerce websites. Usability and user experience of e-commerce websites were investigated by applying two usability evaluation methods, usability testing and heuristic evaluation, to identify what aspects of usability support or hamper users' performance, as well as to identify design guidelines that could facilitate the design, development and re-engineering of e-commerce websites. The study was conducted on South African e-commerce websites.

This chapter provides an overview of the dissertation. It begins by providing the problem statement followed by the research questions. The justification for the study as well as the scope, giving details of the target systems, limitation and assumptions, are discussed. The

research design and methodology is discussed, followed by the steps taken in data collection and analysis. The chapter concludes by providing the structure of the study.

1.2 Problem statement

The phenomenon of user experience (UX) has created interest in academia and industry as researchers have become aware of the limitations of the traditional usability framework, which focuses primarily on user cognition and user performance in interactive products. In contrast, UX shifts the focus to user emotions, sensation, and the meaning as well as value of such interactions in everyday life (Law, Roto, Hassenzahl, Vermeeren and Kort 2009). The focus on users' needs and emotions while interacting with products is a key factor for product success (Sproll, Peissner and Sturm 2010). The International Organisation for Standardisation's current ISO standards 9241-210 on human-centred design describes UX as: 'all aspects of the user's experience when interacting with the product, including all aspects of usability and desirability of a product from the user's perspective' (ISO DIS 9241-210 2008). UX transfers attention from the product itself (i.e. functions, applications, interaction) to human emotions while interacting with the product. Therefore, a good UX on a website or computer application fulfils user needs by resulting in a positive feeling towards the environment (Sproll, Peissner and Sturm 2010).

Good user experience incorporates all aspects of the end user's interaction with the product or service and the organization. These aspects would include marketing, ethnography, design, software engineering, usability, Web analytics and business process analysis (Sward 2006). Rubinoff (2004) defines user experience as involving four independent elements: branding, usability, functionality and content. Furthermore, Porter and Bewer (2010) state that user experience is comprised of all the interactions a person has with the brand, company, or organization. This may include interactions with the software, the website, a call centre, or advertisements. The sum total of these interactions over time culminates in the user experience.

This study describes a comprehensive usability evaluation of e-commerce websites with a focus on how their usability can contribute to a good or bad user experience. The International Organisation for Standardisation (ISO) defines usability as: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context' (ISO 9241-11 1998). User experience, by

contrast, is defined as ‘feelings that the user has while interacting with the company, its services, and its product’ (Nielsen Norman Group, 2008).

User experience differs from usability in that user experience aspects are more subjective qualities and are mainly concerned with users’ emotions regarding a system. They differ from the objective usability goals in that they are concerned with how users experience the product from a personal perspective (Sharp, Rogers and Preece 2007). Nevertheless, viewpoints vary on what usability and user experience respectively encompass and the relationship between them. This is addressed further in Section 3.5.

Furthermore, Sharp et al. (2007) state that designers need to explicitly design for good user experience. A good designer should communicate the intended message to the users in a way that leads to a positive experience. Aspects such as the copy, tone, colours, navigation, visual load, information hierarchy, branding, and satisfaction with content are all part of this communication (Porter and Bewer 2010; Rubinoff 2004).

There are many usability approaches and usability evaluation methods (UEMs). These approaches and methods have become a part of the design and development cycle that cannot be ignored in Web design. The main differences between UEMs are based on whether users will be involved or not, the stage of the product development life cycle, and the place where the evaluation will take place (Ssemugabi and de Villiers 2010).

This study on the user experience provided by e-commerce websites is conducted by using two different evaluation methods: usability testing (UT) and heuristic evaluation (HE). They were selected as complementary approaches, since the former is a user-based method and the latter is conducted by external expert evaluators. Usability testing is scenario-based and relies on the interaction experiences and comments of real users. It is usually conducted in a controlled environment, and the analysis process is complex and time consuming (Tan, Liu and Bishu 2009). Sharp et al. (2007, p. 642) define usability testing as ‘an approach that emphasizes to what extent a system is usable’. It involves measuring typical users’ performance on pre-defined tasks by placing the product in a usability laboratory where users are asked to perform various tasks from a pre-defined list. The testing measures how easy and efficient the product is to use, its visual consistency and load, and users’ overall perception of their experience with the product.

The second method, heuristic evaluation, is a usability inspection technique originated by Nielsen (1992; 1994b) whereby expert evaluators assess whether a system or website complies with standard usability principles, also called heuristics. It is a widely used UEM for computer system interfaces due to its low cost and fast turnaround time.

Clemmensen, Hertzum, Hornbaek, Shi and Yammiyavar (2009) state that interface heuristics and Web standards are presented as universals and not defined per industry or target market. However, each industry has different objectives and goals, and guidelines are required to assist in achieving those unique goals. Furthermore, Barnard and Wesson (2004) state that despite the existence of a large number of Web design guidelines, international research has shown that many websites are still unusable or badly designed. There is little evidence to indicate whether these guidelines have been used in practice (Barnard and Wesson 2004). Väänänen-Vainio-Mattila and Wäljas (2009) mention that the majority of the interface heuristics and standards focus on usability rather than on the more recent concept of user experience.

In this context, the aims of this study are therefore to determine how the usability of e-commerce websites can support the user experience of users, as well as to establish design guidelines that can facilitate the design, development and re-engineering of e-commerce websites with a view to promoting user experience.

Similar studies have been conducted on e-commerce in South Africa. A recent study by Martim, Herselman and van Greunen (2009) addressed ways in which South African online retailers can improve e-commerce usability to enhance growth. Barnard and Wesson (2003; 2004) conducted two studies on e-commerce in South Africa, the former focusing on usability issues for e-commerce in South Africa, while the latter study proposed a trust model for e-commerce in South Africa. The present study aims to determine factors that create a better user experience on e-commerce websites and the role of usability in creating that user experience.

The next section presents the main research question for this study as well as the subquestions.

1.3 Research question

1.3.1 Primary research question

The main research question for this study is:

How can the findings of a dual-method usability evaluation of e-commerce websites contribute to the attainment of better user experience?

1.3.2 Subquestions

The main research question gives rise to the following subquestions:

1. **How can the usability of an e-commerce site be measured?**
2. **How can user experience of an e-commerce site be measured?**
3. **What do the findings of usability evaluation by a dual-method approach indicate about the usability and user experience of four different websites?**
4. **What particular aspects of the usability of an e-commerce site support the user experience offered by that site?**
5. **What design guidelines can facilitate the design, development and re-engineering of e-commerce websites towards promoting user experience?**

These questions will be addressed in the course of the study.

The following section will discuss four sets of beneficiaries that should benefit from this study: designers, retail sector, end users and academics.

1.4 Value of the study

Primary beneficiaries of this study are the designers of e-commerce websites. Website designers will be able to refer to the study to see which usability attributes contribute to a better user experience, and design accordingly. For websites already developed and operational, findings of the study could contribute to improving them.

A secondary beneficiary of this study is the retail sector, for reasons such as the following:

- The emergence of e-commerce as a method of conducting business has highlighted the need to constantly extend the set principles underlying this form of business (Chang and Chen 2009).
- As increasingly more products and services are sold over the Internet, it becomes all the more important to build up a body of knowledge on e-commerce-specific user interface (UI) and user experience (UX) design. Lowry, Spaulding, Wells, Moody,

Moffitt and Madariaga (2006) state that many e-commerce guidelines that exist today have not been validated by empirical evidence, thus making them inapplicable in certain contexts. In South African the majority of designers follow some of these guidelines which do not necessarily provide appropriate levels of website usability. Furthermore, for some designers, the goal of delivering a good user experience might be a lower priority than meeting the website deadline and business requirements (Zhao, Zou, Hawkins and Madapusi 2007). The usability of UIs of e-commerce applications is crucial for the survival of a business and its success. The key to attract users is e-commerce applications with high quality content, ease of use, quick response and frequent updates. However, studies show that many UIs of e-commerce applications suffer from usability problems (Zhao et al. 2007).

- The role of user experience in e-commerce has not been well researched (Väänänen-Vainio-Mattila and Wäljas 2009) and therefore this study could add valuable information.

The third set of beneficiaries is the set of end users. End users will benefit from this study by being able to engage with websites that are user friendly and enjoyable to use.

The fourth set of beneficiaries will be the community of academics. The guidelines for the evaluation of e-commerce website can be added to the scientific body of knowledge.

The next section discusses the scope of the study.

1.5 Scope of the study

This section addresses the domain of the study, target systems used, limitations and delimiters and assumptions.

1.5.1 Domain of the study

This study spans the areas of usability evaluation, user experience, and e-commerce. Existing literature provides background information on retail, e-commerce, usability, user experience and usability evaluation methodologies that forms the foundation of this study. Successful user experience design for e-commerce depends on various factors. With the aim of identifying user experience attributes that contribute to the success of an e-commerce system, this research focuses on retail e-commerce websites that market products and services over the Web.

1.5.2 Target systems

The e-commerce websites selected for this study are within the South African telecommunication sector, namely:

- MTN
- Vodacom
- Virgin Mobile
- Cell C.

1.5.3 Limitations and delimiters

The process of testing and evaluating the e-commerce websites stops short of actual purchases, i.e. there is no study of financial transactions. Furthermore, the inputs are purely for academic use, and will not be used for consulting purposes. The study is not intended to rank the sites or to recommend one above another.

When direct quotes are given from the Web, page numbers are not always provided, because in many cases, pages of a website or a CD, are not numbered.

1.5.4 Assumptions

The study assumed, firstly, that the participants of the system had a fairly strong internet usage background, with at least one year of experience in working with websites. Participants with only one year of experience were considered as novice participants, and participants with more than one year of experience were considered as experts. Secondly, it is assumed that participants had an adequate command of English, since it is the most common medium of instruction in the South African educational system. However, for some of the participants, English is their second language, as their vernacular is Afrikaans or an African Language. In South Africa with its eleven official languages, multilingualism and multiculturalism on the Web are not yet common standards. The reason may be that the translation of a website is expensive and time consuming (Nante and Glaser 2008). Van Iwaarden, van der Wiele, Ball and Millen (2004) state that language, culture and religion may be strong contributors to a user's impression of the website. The consequence of a website not being in a user's official language may be a negative response towards the target system, not because the system is badly designed but because users do not understand the terminology. Thirdly, it is assumed that the information provided by end users (regarding age,

race, Internet usage, etc.) is correct and that analysis of the results will provide correct input into the recommendations.

In this study, it is assumed that heuristic evaluation is inexpensive, easy and fast to perform when compared to other evaluation methods, as discussed in Section 4.5. It is also acknowledged that usability testing, on the other hand, is time-intensive and uses sophisticated technology (see Section 4.4). The issues of cost and time expended on the evaluations are not investigated in this study, since the purpose is to use the two UEMs to obtain supplementary data, and not to conduct a comparative study of UEMs.

For the purpose of this study, the researcher created certain terms that relate to navigation through e-commerce websites, such as ‘product-based’, ‘needs-based’, and ‘user journey’. These terms are defined in Chapter 6.

The following section addresses the research design and methodology used to conduct this study.

1.6 Research design and methodology

Disclaimer: This research study applies usability evaluation methods to four informational e-commerce websites. The work undertaken is for academic and research purposes only, and has no commercial or promotional intentions. The ethical clearance for this study can be found in Appendix D.

As already stated, the International Organisation for Standardisation (ISO) defines usability as: ‘the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context’ (ISO 9241-11 1998). Two different usability evaluation methods (UEMs) were used: usability testing and heuristic evaluation, the former being a user-based method and the latter an inspection method conducted by experts.

Both usability testing and heuristic evaluation methods can provide valuable insights on usability problems at the beginning, during, and at the end of the product development life cycle.

Firstly, criteria appropriate for evaluating the usability and user experience of e-commerce applications were established, to contribute to answering research Subquestions 1 and 2.

- *Literature study*: Criteria for the usability test and heuristic evaluation were identified by conducting a study of existing literature. This provided information on ways to measure usability and user experience.

To answer Subquestion 3 about evaluating e-commerce sites, the material about usability evaluation and the selected criteria were applied in two different ways.

- *Usability testing*: Usability testing (UT) involves formal usability testing and observation sessions in the controlled environment of a usability laboratory with a sample of real end users. Performance measurements were taken of aspects such as the time taken on processes, the number of steps to complete a task, and errors. Questionnaires and interviews were used to determine the problems or preferences identified by participants as they interacted hands-on with the target system, performing specified tasks. UT is known to be an effective method that rapidly identifies weaknesses and strengths, and is particularly used to improve the usability of products (Dumas 2003; Dumas and Redish 1999; Jeffries, Miller, Wharton and Uyeda 1991).
- *Heuristic evaluation*: The defined criteria for usability and user experience evaluation of e-commerce websites were used as heuristics in a heuristic evaluation (HE) of the target websites. HE is conducted by expert evaluators, who review a system using a set of usability principles known as heuristics, to determine whether it complies with these heuristics, and to identify potential usability problems (Ssemugabi and de Villiers 2010). It is the most popular usability evaluation method (UEM) for computer system interfaces, because it is quick, inexpensive, and good at achieving broad coverage of the entire user interface. However, it may miss some complex issues (Barrington 2007). It is advisable to combine HE with a user-based method (Adebesin, Kotzé and Gelderblom 2010).

The differences between UT and HE are as follows:

- The goals are different: HE identifies usability problems while UT focuses on measuring the effectiveness, efficiency and user satisfaction of an application (de Kock, van Biljon and Pretorius 2009).
- Data capturing and processing are different: In HE, the data is gathered from the report by the heuristic evaluator (Jeffries and Desurvire 1992). In UT, the data is captured through objective measures involving the testing the end users' interactions

with the target system and also by subjective measures such as a questionnaire and observations by the evaluator (de Kock, van Biljon and Pretorius 2009).

- There is a difference in the level of information rendered: UT deals mostly with the what and the how information, while HE focuses on a meta-level considering why and when. This is supported by the work of Fu, Salvendy and Turley (2002), who found that UT is more effective in finding usability problems associated with the knowledge-based level of performance, while HE is more effective in identifying usability problems associated with skills-based competencies.

Limitations to UT and HE are as follows:

- Limitations to UT result from the fact that most tests are conducted in a specially designed laboratory with a one-way glass room divider and sophisticated equipment enabling facilitators to interact with the user. This is very expensive to set up, and there can be further costs associated with recruiting users and testers (Gardner 2007).
- Limitations to HE relate to the reliability of the effectiveness measure (Hertzum and Jacobsen 2003), measure of user experience (Law and Hvannberg 2004), the subjective interpretation of the results and the lack of theoretical underpinning (Kasarskis, Stehwien, Hickox and Aretz 2001).

The findings of the two UEMs were combined to answer Subquestion 4, which relates to what usability aspects of an e-commerce site support the user experience offered by that site.

- Consolidation: A study was then undertaken of the correspondence between the usability problems identified using heuristic evaluation and those identified by real end users in usability testing. This study has both depth and breadth. Depth was provided by using two evaluation methods. Breadth was obtained, because four e-commerce websites were evaluated – not to conduct a comparative study of the sites, but to identify generic issues that relate to usability and user experience as encountered by users of e-commerce, and to explore dependencies between usability and user experience. Related aspects of usability aspects and user experience were tabulated against each other.

Finally, the findings were used to generate guidelines as an answer to Subquestion 5.

- Synthesis: Following the identification of generic issues regarding usability and user experience, a set of guidelines was generated to facilitate the design, development and re-engineering of e-commerce sites with a view to creating good user experience.

1.6.1 Usability testing design methodology

The goal of the usability testing process is to measure the degree to which a system is efficient, effective, and if users are satisfied with using the system.

- *Efficiency* entails the extent of effort, for example, time and amount of errors, required to use the system in order to achieve the stated tasks;
- *Effectiveness* deals with the ability of a system to perform tasks comprehensively and accurately, and its ability to support the user in successfully completing the tasks (Genise 2002); and
- *Satisfaction* refers to whether users have a positive response when using the system (Bastien 2010).

Further factors that were tested include: navigation, information architecture, language, aesthetics and visual appeal, and page structure and layout (Gardner 2007). These aspects will be elaborated further in Chapter 5.

In this study, the evaluations were conducted on operational systems.

1.6.1.1 Participants

Twelve representative participants were recruited by the researcher; each was tested on an individual basis. The tests took place at Aqua Online Usability Lab, Hyde Park, in a controlled usability testing environment. Aqua Online is a leading digital agency in South Africa that specialises in usability.

The recruitment characteristics to ensure that participants were representative, are explained in Section 5.3.1 in the chapter on research design.

The duration of the tests was 2 hours, including short breaks between using the four systems, but excluding the orientation, background, pre-test and post-test questionnaires and interviews.

1.6.1.2 Target systems

Participants were asked to perform the same set of tasks on each website. As stated in Section 1.5.2 the target websites used for this study were the main telecommunication websites in South Africa, namely:

- MTN (www.mtn.co.za)
- Vodacom (www.vodacom.co.za)
- Virgin Mobile (www.virginmobile.co.za)
- Cell C (www.cellc.co.za).

1.6.1.3 Tasks

The researcher selected two performance tasks that aim at covering participants' main goals in coming onto e-commerce websites, namely:

- Find a plan that will best suit your needs;
- Find an Internet package.

1.6.1.4 Test structure

The test structure consisted of orientation, background questionnaire, pre-test questionnaire, performance tasks and a post-test user experience questionnaire. These questionnaires will be elaborated in Chapter 5.

1.6.2 Heuristic evaluation methodology

Four expert evaluators were asked to conduct HEs on the target websites, according to the heuristics that emerged from the literature study. Two were so-called 'double experts', i.e. both a usability expert and a domain expert, where the domain in this case is e-commerce.

1.6.2.1 Heuristic evaluation criteria

Three categories of criteria were used for the heuristic evaluation:

- General interface design heuristics;
- E-commerce usability design heuristics; and
- User experience design heuristics.

Each category is briefly described below and will be elaborated in Chapter 5.

The first category of *general interface heuristics* is based on Nielsen's (1994b) and Powals' (1996) heuristic principles. They are: visibility of system status; match between system and the real world; user control and freedom; consistency and standards; error prevention;

recognition rather than recall; flexibility and efficiency of use; aesthetics and minimalism of design; error recovery; help and documentation (Nielsen 1994b). To Nielsen's classic heuristics, Powals (1996) adds automation of unwanted workload and fusion data.

The criteria in the second category, namely, *e-commerce usability design heuristics*, were established by the literature review conducted in Chapters 2 and 3. They are: communication of the intended message; page display; layout and site structure; value of information provided; utility; language and culture; trust and security; effectiveness; efficiency; safety; learnability; memorability; and satisfaction.

The third category, *user experience design heuristics* were established from the literature review conducted in Chapter 3. These heuristics were compiled to form part of a post-test questionnaire to be completed by the expert evaluators once they have interacted with the four systems. These heuristics are: feelings evoked by using the website; personalisation; website quality perception; cross-platform service access; context-aware service; contextually enriched content; general user experience-related issues; visual appeal; and service quality.

The following section presents the steps taken to collect and analyse the data.

1.7 Steps in data collection and analysis

The following steps were taken to collect data and analyse it:

1. Establish criteria for usability evaluation and user experience evaluation of e-commerce websites.
2. Design questionnaires for the usability testing session: pre-test, post-test and performance test interview. Perform a pilot study with one real end user in order to test the documentation and testing process. Carry out the full usability testing evaluation with twelve real end user in order to identify problems and preferences in the e-commerce websites.
3. Design a framework of heuristics for experts to use in the evaluation of e-commerce websites.
4. Analyse the data collected so as to determine answers to another research subquestion, in particular what usability aspects contribute to creating a good user experience on e-commerce websites?
5. Provide design guidelines on good user experience of e-commerce websites.

Where possible, some of these steps were done in parallel.

The following section outlines the structure of this study.

1.8 Structure of the study

The study has three main parts, namely the theoretical part, the practical part, followed by a final section dealing with recommendations and conclusions. They are distinguished as follows:

Part 1: Theory

Chapters 2 to 4 entail literature studies which give background information on e-commerce, usability, user experience and usability evaluation methodologies, with an emphasis on usability testing and heuristic evaluation. These literature studies set the scene and provide the frame of reference for the study. The areas of the study, e-commerce, usability and user experience, are then integrated by the generation of criteria appropriate for evaluation of e-commerce websites.

Part 2: Practical

Chapter 5 describes the development of the usability testing and heuristic evaluation criteria that is used to evaluate the e-commerce websites. Chapter 6 describes the planning and conducting of usability testing on the websites with end users, and the planning and management of the heuristic evaluation by experts. Furthermore it comprehensively presents the results of both studies. As previously stated, the criteria generated in Chapter 5 are used as the basis for the evaluations. The results of both evaluations are recorded, analysed, compared and the main findings are discussed.

Part 3: Recommendations and conclusions

Chapter 7 summarises, draws conclusions and provides guidelines that were derived from the usability test and heuristic evaluation results. The guidelines are designed to aid in creating good user experience for the users when they are looking for products and services on e-commerce websites. Chapter 8 answers the research questions, and summarises the major issues of the study.

Figure 1.1 depicts the various chapters and their interrelationships. The details of these chapters are described in the list following.

- Chapter 1, the introduction, gives a brief overview of the content and structure of the study. This includes the research problem, the value and scope of the study, the research design and methodology used, and the report structure.
- Chapter 2 discusses e-commerce in South Africa, as well as provides an overview of Internet usage and the retail sector.
- Chapter 3 describes the value of usability and user experience to the success of e-commerce websites.
- Chapter 4 names and explains usability evaluation methodologies (UEMs).
- Based on the foundations provided by Chapters 2 to 4, Chapter 5, the research design chapter, combines the application domain of e-commerce websites and the focus area of usability evaluation. The research questions are set out, explaining how and where they are addressed. Usability criteria for evaluation of e-commerce websites are synthesised, focusing on usability issues from the human-computer interaction (HCI) perspective, as well as UX aspects.
- The guidelines and heuristics developed in Chapter 5 are used for the practical evaluations of the websites, described in Chapter 6, where the data collected is presented and analysed.
- Chapter 7 summarises, draws conclusions and provides guidelines.
- Chapter 8 answers the research questions, and summarises the major issues of the study.

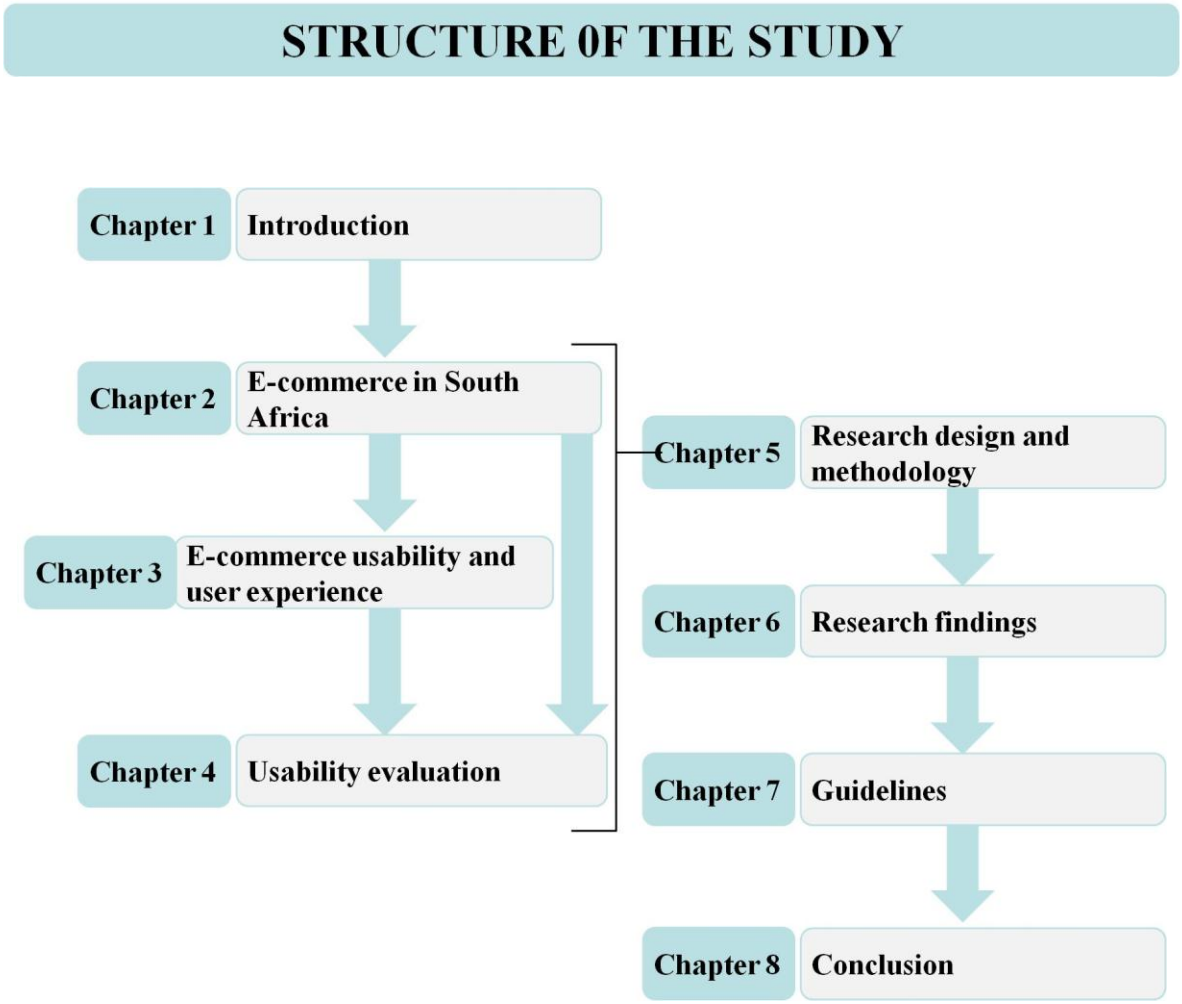


Figure 1.1 Structure of the study

Chapter 2: E-commerce in South Africa

Chapter 2: E-commerce in South Africa

2.1 Introduction

During the 1990s, the media detailed how the Internet was going to revolutionize the way customers shopped, and how online sales would grow. In the past ten years, e-commerce has grown significantly, and become a grounded foundation for driving real business results. Many customers have become comfortable with online shopping, and it is rare to find a customer who does not have access to the Internet at home or at work (McCall 2009).

E-commerce is not limited to direct sales, but extends to influencing offline store sales while building more profitable customer relationships. McCall (2009) reported that 40–50% of all offline retail sales are influenced by customers who research online before heading to the store, and that 70% of online customers state that if the company website is poor, it will negatively affects their overall impression of the brand. Therefore, the Web is a critical brand touchpoint which simultaneously provides the opportunity for a company to engage with consumers and immerse them in their brand.

E-commerce has grown substantially over the past years in South Africa (SA) even though it is still behind in the developed countries (Epnet 2009; World Wide Worx 2010; Internet World Stats 2008). Internet usage in Africa is growing faster than in any other region in the world. In 2009 the number of South African Internet users exceeded the 5 million mark and towards the end of 2010, it grew by 10% (World Wide Worx 2010; Internet World Stats 2008). However, e-commerce has not achieved its full potential (Martim, Herselman and van Greunen 2009), and companies should continuously improve the usability of their e-commerce websites in order to create a positive user experience and increase the success of their marketing efforts.

In SA, the government realized the importance of e-commerce in shaping the performance of domestic enterprises in the global networked economy and have developed policies and regulations to govern e-commerce. Despite the rapid growth of e-commerce, there are prospects and scope for improvements in SA (South Africa Department of Communication 2000).

This chapter discusses e-commerce in SA and provides an overview of Internet usage and the retail sector. The chapter also emphasises the role of good user experience on e-commerce

sites, due to the large number of users researching products over the Internet. The chapter begins by discussing the retail sector in SA in Section 2.2, followed by definitions of e-commerce in Section 2.3. Section 2.4 discusses e-commerce today and the challenges associated with it such as: culture, trust and usability. The chapter concludes by discussing e-commerce guidelines in Section 2.5.

The following section discusses the retail sector in SA.

2.2 Retail sector in South Africa

Despite the recent global economic crisis; loss of jobs and change in customer spending behaviour, the performance of SA retail sector has been exceptional over the past 10 years (Seda 2007). The retail sector is one of the strongest sectors in the SA economy and the main contributor to the Gross Domestic Product (GDP). E-commerce contributes 15% to the GDP and accounts for 24% of SA employment (Seda 2007).

For e-commerce to be successful, many factors should be taken into consideration. The user is the most important factor (Lee and Koubek 2010); designers need to study users in order to understand how their preferences are determined. Users may base their preferences on usability, performance, aesthetics, price, information quality and brand of the e-commerce website (Keinonen 1997). E-commerce guidelines are discussed in Section 2.5.

The same 'Internet Retailing in South Africa' study (World Wide Worx 2010) predicts that by 2014 there will be 9 million Internet users in South Africa. The Internet has been available in South Africa for only 15 years, yet, as stated in Section 2.1, there are currently over 5 million users. Goldstuck and Laschinger (2009) state that this growth can be attributed to four driving factors, namely:

1. The Seacom undersea cable, which increases bandwidth dramatically in Southern and East Africa, as well as reducing the cost.
2. The decision made by the Independent Communications Authority of South Africa to issue electronic communications network services licences (ECNS) to Internet service providers, that allow service providers to build their own networks and use their own infrastructure.
3. Many small and medium enterprises (SMEs) are using asymmetric digital subscriber line (ADSL) and abandoning dial-up technology behind. These smaller companies are

currently the major driving force behind Internet access in South Africa. For every SME, up to twenty individuals gain connectivity (Goldstuck and Laschinger 2009).

4. Internet access via mobile phones is growing steadily. Goldstuck and Laschinger state that there will be improvements in both usability and the user's ability to use advanced features on their cell phones (Goldstuck and Laschinger 2009).

Taking the above into consideration, the future of e-commerce in South Africa looks optimistic. To evaluate e-commerce websites, it is necessary to first look at e-commerce as defined in the next section.

2.3 E-commerce defined

Table 2.1 lists various definitions of e-commerce by different authors (Lubbe and van Heerden 2003, p.54).

Table 2.1 Definitions of e-commerce (Lubbe and van Heerden, 2003, p.54).

Author	Definition
McLaren and McLaren 2000	Exchange of information electronically to conduct business.
Greenstein and Feinman 1999	Exchanging of products and services via some form of telecommunication medium from one location to another.
Ford and Baum 1997	An umbrella term that includes automated business transactions, online purchases, electronic forms and industrial inventory control transactions.
Turban, King and Lang 2009	Conducting business online by exchanging products, services and money with the support of computers over a network.
Whitten, Bentley and Dittman 2003	Conducting internal and external business over the Internet, intranet and extranets. This has simplified day-to-day business processes – all through digital communication.
U.S. Department of Commerce 2001	Business processes which transfer transactions to the Internet or some other non-proprietary Web-based system.

From the above definitions, it can be concluded that e-commerce is the exchange of information that requires a prior transaction and that usually involves finance. Despite the many definitions, to the consumer in general, e-commerce means shopping on the part of the Internet called the World Wide Web, generally referred to as WWW or just the Web.

The next section discusses the current challenges facing e-commerce.

2.4 E-commerce and its challenges

In South Africa, designing an e-commerce website may be a greater challenge than in the rest of the world, since the population varies greatly with regard to cultural background and eleven official languages. There are many factors that contribute to the challenges of e-commerce. Three of these factors are: culture (Martim, Dlamini, van Greunen, Eloff and Herselman 2009; Macagnano and Greeff 2007), usability (Barnard and Wesson 2003; 2004) and trust (Egger and Abrazhevich 2001). The following section expands on three challenges that affect e-commerce: culture, trust and usability.

2.4.1 Culture

E-commerce owners that offer their products across national and international borders are continually striving to enhance the usability of their websites in order to attract more visitors (Nante and Glaser 2008). Besides trust and usability, culture is an important aspect to consider in the design of e-commerce sites. Nante and Glaser conducted a study on the impact of language and culture on perceived website usability and found that the perceived usability increases when the website is designed in the native language of the user. In South Africa with eleven official languages, multilingualism or multiculturalism on the Web are not yet common standards. The reason may be that the translation of a website is expensive and time consuming (Nante and Glaser 2008). Van Iwaarden et al. (2004) state that language, culture and religion may be strong contributors to a user's impression of the website. Clemmensen, Hertzum, Hornbaek, Shi and Yammiyavar (2009), however, state that most research on usability evaluation methods is unaffected by cultural issues. For example, the cultural background of users is rarely reported, task scenarios are assumed to be culturally unbiased, interface heuristics and Web standards are presented as universals and not defined per industry or target market. This is surprising, because definitions of usability emphasize the importance of concepts such as the context of use, which includes users' cultural background.

Besides the factors mentioned in the previous paragraph, there are two other important factors influencing users when they are interacting on e-commerce websites, namely: trust and usability. The former is important because the lack of secure payment methods may have a negative influence of the user's perception of the trustworthiness of the site and this can result in users not purchasing anything. The latter is relevant because if the site does not meet the user's goals, they will tend to find another site.

2.4.2 Trust

Trust includes privacy, ease of use and credibility of information on the Web and is as important to users as security (Egger and Abrazhevich 2001). The primary hindrance to continued e-commerce growth is winning public trust (Furnell and Karweni1999; Ott 2000; Bélanger, Hiller and Smith 2002). Hoffman, Novak and Peralta (1999) identified two important factors that hamper the potential growth of e-commerce, namely: lack of standard technologies for secure payments and the lack of profitable business, and state that both of these factors influence the user's perception of the trustworthiness of a site. The Cheskin Research Project conducted on e-commerce trust, states that without trust, e-commerce will not reach its full potential (Cheskin Research 1999). Egger and Abrazhevich (2001) found that average users are probably unable to objectively assess security issues such as encryption algorithms, but the average user is willing to trust a familiar information resource. For example, if a website employs a well-structured marketing effort to enable users to gain trust before transacting, then the users will regard the website as a familiar information resource, and be more likely to purchase from it. Users are more likely to trust companies they have heard about than companies they have not (Cheskin Research 1999; Barnard and Wesson 2003). Word-of-mouth and brand identification are the two issues that keep website vendors going (Barnard and Wesson 2003). Users are more likely to listen to what other users are saying about the product than they are to believe the original source. Several studies have suggested that a large number of Internet users have serious concerns regarding privacy on the Internet.

E-commerce transactions often consist of complex interactions between stakeholders. Trust becomes an important factor in situations that are perceived to be risky, such as e-commerce that exposes users to new vulnerabilities and risks (Joubert and van Belle 2009).

2.4.3 Usability

The first law of e-commerce states that, if users are looking for a product but they cannot find it, they simply cannot buy it (Nielsen 1994a). Thus having a usable website is not a luxury; rather it is a prerequisite for the survival of the website. Barnard and Wesson maintain that the quality of a website is relative to the usability of the site (Barnard and Wesson 2003) and usability can thus play a major role in the success of e-commerce. The aspects of usability are addressed further in Chapter 3.

Despite the collapse of many ‘dot-coms’ in the late 1990s, Business to Consumer (B2C) e-commerce has grown rapidly and has introduced a new shopping medium for users (Turban, King and Lang 2009). Since 1995, there has been a rapid expansion of B2C e-commerce activities and purchasing via the Internet is one of the most rapidly growing forms of shopping (Levy and Weitz 2001). Companies have realised the importance of this, as well as the benefits for their customers, for example: 24 hour, seven day (24–7) access to products and services, latest stock information, and a variety of products and services from one point of access (Chang and Chen 2008; Laudon and Traver 2007; Wang and Emurian 2005). In addition, companies have noted that that they should fine-tune their operations and offer better service to their customers (Becker 2008; Dietel, Dietel and Nieto 2001; Laudon and Traver 2007). Jupiter Research (2003) conducted a review of 239 well-known B2C websites, and found that one in seven B2C websites had major errors on their home pages to such an extent that they caused visitors to abandon the website. E-commerce websites represent the online presence of a company and, if the website reflects low usability, then users may develop a poor image of the company, eventually working against their intention to return to the website (Nielsen 1994a).

Following are examples of the e-commerce situation in South Africa, from a report conducted by World Wide Worx, on ‘Internet Retailing in South Africa’ (2009):

- Amazon.com no longer supplies products to South African users because they have encountered major problems with the postal system in the country as products were not delivered safely to the customer. E-tailors now use couriers in SA.
- Lower disposable income in 2008, due to economic conditions, affected users’ spending on e-commerce. Moreover, there is a mistrust of the South African postal system and users are concerned that they will not receive products purchased online. Majority of the South African population falls into the lower living standards measure (LSM) group and therefore cannot afford internet access. Therefore, the growth of e-commerce in South Africa is limited by the number of users who have access to the internet.
- Kalahari.net is the largest e-commerce retailer in South Africa. The company held a value share of 5% in 2008. Pick 'n Pay and Woolworths have tapped into the e-commerce market in South Africa, but their market shares remain small in comparison to the more established players. South Africans still prefer to go into a store to purchase products.

The following section presents certain e-commerce guidelines.

2.5 E-commerce guidelines

Chang and Chen (2009) state that a good website needs to provide orderly screens, simple search paths, fast and readable presentation of information, and simple navigation; if the website succeeds in these aspects it will, in return, reduce users' switching behaviour. Although there has been little research in this area, it is likely that users keep on using whatever website they perceive as having high interface quality.

There are a number of considerations that designers need to take into account when designing an e-commerce website (Hernández, Jiménez and Martín 2009):

- Users who have no previous experience of e-commerce and those who have purchased before, represent two different types of user-behaviour journeys.
- A design strategy should be identified to attract new e-users or retain their existing ones.
- The target market and needs should be identified, and products should be tailor-made for the needs of each type of user, due to the different perceptions of different target groups.
- E-commerce providers cannot control the level of experience of users, but they can develop websites that aim to create a shopping experience that is confidence-building by making users feel efficient and capable of correctly performing all types of e-transactions.

Camus and Evans (2009) from Forrester Research conducted a study on the complex purchasing decision path of European shoppers, and implemented strategies to convert visiting Web users into buying Web users. They proposed the following guidelines to promote buying transactions:

- **Enable seamless channel transitions:** Companies need to allow users different purchase options in order for them to transact easily in the means of their choice, for example, offering two purchase options: buy online or reserve the option to pick it up in a store.
- **Aim at clear product visualization and information:** The majority of users do most of their product research on the Internet, thus it is important that the website offers a detailed and comprehensive description about the product to assist users in choosing

the right product. There are many ways to achieve this, some examples being: comparison charts; advanced technologies featuring product texture imagery; or online videos of products in use.

- **Promote cross-channel tools like online inventory and store locators:** Having a store locator tool on the website will allow users to see which store is closest to them when doing product research. The online research experience can be enhanced if companies post a clear in-or-out-of-stock message on the websites.

Table 2.2 lists the critical success factors (CSFs) for e-commerce as suggested by different authors (Atchariyachanvanich and Okada 2001, pp. 1-2).

Table 2.2 Critical success factors (CSFs) for e-commerce (Atchariyachanvanich and Okada 2001, pp. 1-2)

Author	Success factors
Sung 2006	Customer relationship, privacy of information, low cost operation, ease of use, e-commerce strategy, technical e-commerce expertise, stability of systems, security of systems, adequate information, variety of goods/services, speed of systems, payment process, services, delivery of goods/services at a low price.
Chen, Gillenson and Sherrell 2004	Product offerings, usability of the website, perceived service quality, and perceived trust.
Turban, King, Lee, Warkentin and Chung 2002	User-friendly website interface, delivery of quality services or products, support of top management, technical infrastructure, level of trust between buyers and sellers, security and control of e-commerce systems and user acceptance.
Dubelaar, Sohal and Savic 2005	Combination of strong user attention, clearly defined performance measures, a clear link between value proposition and measures, and incremental development processes.
Viehland 2000	Creation of a user-centric strategy, acceptance of outsourcing to improve business performance, utilization of information towards management of differentiation of the company's product, becoming part of an e-business community, and the requirement of executive leadership.
Eid, Trueman and Ahmed 2002	Attention to five inter-related factors, namely: marketing strategy factors, website factors, global factors, internal factors, and external factors.
Jennex, Amoroso and Adelakun 2004	Mainly focused on infrastructure factors for setting up business to business (B2B) e-commerce enterprise in developing countries. Namely: people factors, technical infrastructure factors, client interface factors, business infrastructure factors, and regulatory environment factors. The client interface factors are considered the most critical among these five factors.

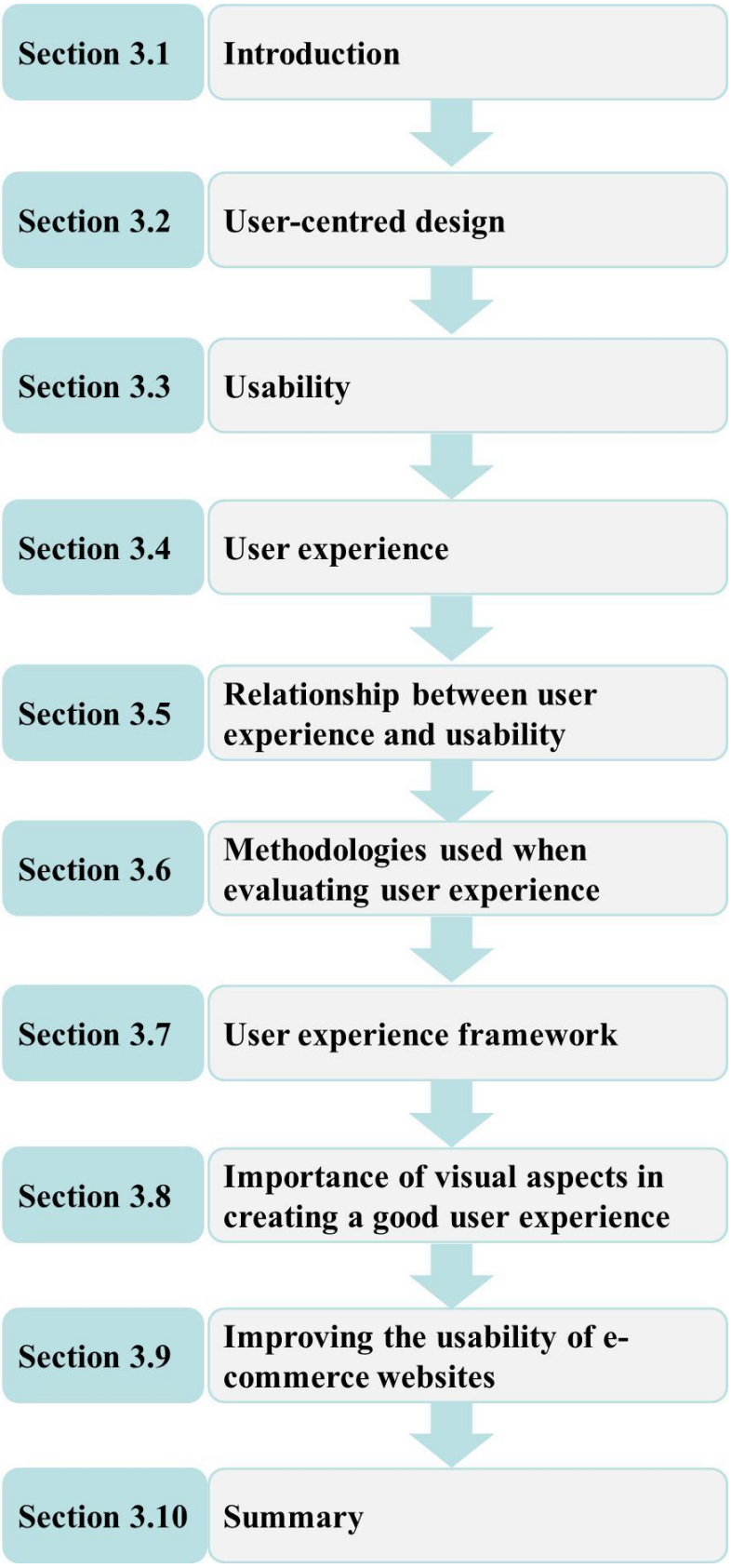
Author	Success factors
Yan and Paradi 1999	Identified five critical success factors for financial institutions to compete in e-commerce market. This involves: e-commerce strategy, innovation, risk tolerance, communication network and size of company assets.
Madeja and Schoder 2003	Identified four success factors including media richness and variety, availability, and ease of use.
Liu and Arnett 2000	Four major factors that are critical to website success in e-commerce, namely: information and service quality, system use, playfulness and system design quality.

From the above list of critical success factors for e-commerce success, it can be concluded that success of e-commerce depends on many factors, some of the most important being: stability of systems, security, variety of high quality goods and services, usability, service quality and the creation of a customer-centric culture.

2.6 Summary

This chapter provided evidence that e-commerce is growing rapidly and there is a need to research and develop guidelines to support its growth. From the list of critical success factors, the following were found to recur: ease of use, user-centric and user-friendly interfaces, and trust. The next chapter will expand on those aspects, focusing on e-commerce usability and user experience.

Chapter 3: E-commerce usability and user experience



Chapter 3: E-commerce usability and user experience

3.1 Introduction

As most companies expand their business offerings on the Internet, design of the websites is becoming a fundamental issue for companies that want to maximize profits in a competitive market (Lee and Koubek 2010). In the context of e-commerce, the user is the most important factor in the attainment of higher profits. Therefore, the website designer needs to connect strongly with the users by understanding how they make their choices and the journey they would like to take. User preference is based on the user's individual opinion that one product is better than another. Preference reflects a user's feelings for the interface design of a website, and influences his or her decision regarding their behaviour on that website (Lee and Koubek 2010).

Problems occur in e-commerce website usability due to inadequate usability testing of the sites (Gabriel 2007). Various procedures and guidelines exist that can be applied to e-commerce website usability, for example: heuristic evaluation, guideline check lists, user evaluation, and satisfaction questionnaires, among others (Sharp, Rogers and Preece 2007; Holzinger 2005; Nielsen 1994b). Clemmensen et al. (2009) point out that interface heuristics and Web standards are presented as universals, rather than being defined per industry or target market. Each sector has different objective and goals and there should be guidelines to support those unique goals. Although a large number of Web design guidelines exist, international research has shown that many websites are still unusable or poorly designed (Barnard and Wesson 2004). Furthermore, Lowry et al. (2006) state that many of these guidelines have not been validated by empirical evidence, thus making them inapplicable in some contexts. In South Africa the majority of designers follow certain guidelines, but they do not necessarily provide appropriate levels of website usability. The usability of user interfaces (UIs) of e-commerce applications is crucial for the survival of a business and its success. The key to attract users is e-commerce applications with high quality content, ease of use, quick response and frequent updates. However, studies show that the majority of the UIs of e-commerce applications suffer from usability problems (Zhao et al. 2007).

This chapter addresses usability and user experience on e-commerce websites and the role they play in its success or lack of success. Section 3.2 provides an overview of user-centred design, where Section 3.3 discusses usability. In Section 3.4 an introduction is provided to

user experience and what it entails. Section 3.5 discusses the relationship between user experience and usability, and Section 3.6 discusses methodologies that can be used when evaluating user experience. User experience frameworks to uncover emotions of websites are presented in Section 3.7. Section 3.8 lists the importance of visual aspects on a user interface in creating a good user experience. This chapter is concluded by Section 3.9 which shows examples of how usability can improve e-commerce websites.

3.2 User-centred design

Abels, White and Hahn (1999, pp. 35–44) define user-centred design (UCD) as 'design that involves the user's input throughout the product development life cycle from the system-information gathering, development, and evaluation, through to implementation'. The Usability Professionals' Association (UPA) website says: 'User-centred design (UCD) is an approach to design the foundation process in information about the people who will use the product'. Users should be the driving force in the product development lifecycle. UCD processes focus on users through the planning, design, and development of a product.

Sharp et al. (2007) investigate the artefact's use and target domain by taking a user-centred approach to development. They advocate seeking the user's opinions and reactions to early designs, and involving users appropriately in the development process itself. This means that users' concerns direct the development, rather than just technical concerns.

Bevan (2009) identified the following usability and user experience aspects in the context of user-centred design:

Usability:

- Designing for and evaluating the effectiveness and efficiency of the system.
- Designing for and evaluating user comfort and satisfaction.
- Designing for and making sure that the product is easy to use.

User experience:

- Understanding and designing the user's experience with a product; how users interact with it over time.
- Identifying and evoking associated emotional responses.

The following section defines usability and discusses its goals and associated questions.

3.3 Usability

According to Sharp et al. (2007), usability is generally regarded as a characteristic that can be obtained by ensuring that interactive products are easy to learn, effective to use, and enjoyable from a user's perspective. More specifically, usability can be broken down into the following goals: effective to use, efficient to use, safe to use, having a good utility, easy to learn, and easy to remember. In the human-computer interaction (HCI), literature research into the success or failure of e-commerce websites has focused primarily on the usability of a website (Petre, Minocha and Roberts 2006). Nielsen (1994a) points out in his book entitled 'Usability engineering' that usability is not a single, one-dimensional property of the user interface. Usability has multiple components and is traditionally measured against these five attributes: learnability, efficiency, memorability, errors and satisfaction (Nielsen 1994a). Head (1999) proposes that the interface of a website should be easy to learn, easy to memorise, user friendly, and should support recovery from errors.

3.3.1 Usability defined

Usability can be defined as the science of solving the problems that exist between users and the interface. The International Standards Organisation (ISO) defines usability as: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context' (ISO 9241-11 1998):

- Efficiency is concerned with the ease of learning and use of a system;
- Effectiveness deals with the ability of a system to perform tasks comprehensively and accurately; and
- Satisfaction refers to the ability of a system to support the user in successfully completing tasks (Genise 2002).

Quesenbery (2003, pp. 1-8) defines usability as 'starting with a philosophy, namely, a belief in designing to meet user needs and to focus on creating an excellent user experience'. He proposes the usability attributes as being 5E's: effectiveness, efficiency, engaging, error tolerant, and easy to learn. In testing systems for usability, usability goals are operationalised as questions.

This approach provides the designer with a way of operationalising goals so as to assess the various aspects of an interactive product and the user experience (Sharp et al. 2007, p. 20).

Table 3.1 provides descriptions of each usability goal and questions associated with each one.

Table 3.1 Usability goals and associated questions (Sharp, Rogers and Preece 2007, p. 20)

Usability goal	Definition	Question
Effectiveness	How good a product is at doing what it is supposed to do.	Can the product support users in learning, in conducting their work efficiently, and accessing the information they need, and in purchasing the goods they want?
Efficiency	The number of steps when carrying out tasks needs to be at a minimum.	Once users have learned how to use a product, can they sustain a high level of productivity to carry out their tasks?
Safety	Involves protecting users from dangerous conditions and undesirable situations, as well as providing users with various methods for recovery, should they make errors.	What possible errors can occur while using the product and what methods are there to allow users to recover easily from them?
Utility	The product's functionality to assist users in what they need or want to do.	Does the product provide a sufficient set of functions that will enable users to carry out all their tasks efficiently?
Learnability	How easy a system is to learn to use.	How easy is it for the user to work out how to use the product by exploring the interface and trying out certain actions?
Memorability	Once learned, how easy is it to remember how to use a product.	What kind of support does the interface provide to assist users in remembering how to carry out tasks, especially for products and operations they use frequently?
Satisfaction	What users think of the product once they have used it?	Did users have confidence in using the system and did the system make users feel efficient and capable of performing all tasks correctly?

The next section discusses user experience.

3.4 User experience

Until recently, traditional HCI has measured the usability of a system in terms of efficiency, utility, effectiveness, safety, learnability and memorability, while overlooking the role played by other aspects of the user experience, such as whether it is aesthetically pleasing and enjoyable. User experience aspects are more subjective qualities and are mainly concerned

with users' emotions towards a system; they differ from the more objective usability goals, in that they are concerned with how users experience the product from their perspective (Sharp et al. 2007). Hassenzahl (2004) states that the UX viewpoint extends the user-centred design approach to cover issues beyond practical functionality and usability. He mentions that UX extends users' motivations and emotions such as stimulation, identification and self-expression. These may include positive or negative expressions. The former option includes users perceiving a system or site as: satisfying, enjoyable, engaging, pleasurable, exciting, entertaining, helpful, motivating, aesthetically pleasing, and rewarding. The latter case includes: boring, frustrating, annoying, and cutesy (Sharp et al. 2007, p. 26).

These personal emotions will influence future interaction with the system and may be communicated to other users with the potential of influencing their subjective experience (Hassenzahl 2005). Creating a positive user experience (UX), is a central design aim for products and services. Increasingly, Web services are developed for both personal computers (PCs) and mobile terminals to support user needs for media content management and social interaction. Even though many UX models have been developed over the last decade, the specific characteristics affecting UX of Web services have not been studied systematically (Väänänen-Vainio-Mattila and Wäljas 2009).

Creating a user experience on websites involves more than one single factor. There are many considerations to which designers should pay attention when creating a user experience. Companies may be aware of user experience (UX), however, the majority of designers do not know how to measure it or design for it, because they do not understand it. Even in the literature, many authors describe their studies of its effects and importance of improving the experience, without actually defining it (Sward 2006).

Some authors suggest that it encompasses all aspects of the end user's interaction with the company and the merging of the contributions of multiple disciplines (Nielsen Norman Group 2008; Kuniavsky 2007; Vredenburg 2002; Sward 2006). According to Sward (2006), user experience incorporates all aspects of the end user's interaction with the product or service and the organization. User experience is the value that is derived from a user's interactions with a product or service and the context of use (i.e. time, location, and user disposition). User value can be actual value (i.e. efficiency and effectiveness), perceived value (i.e. trustworthiness, emotions, satisfaction, aesthetic, social rewards, behaviour, entertainment), or a combination of both.

Rubinoff (2004) describes UX as being made up of four independent factors: branding, usability, functionality and content. Rubinoff points out that, independently, these factors cannot make for a positive user experience but, if combined, they can constitute to the main ingredients for a website's success. Figure 3.1 represents this view, positioning user experience as an umbrella term and displaying elements that play roles in UX.

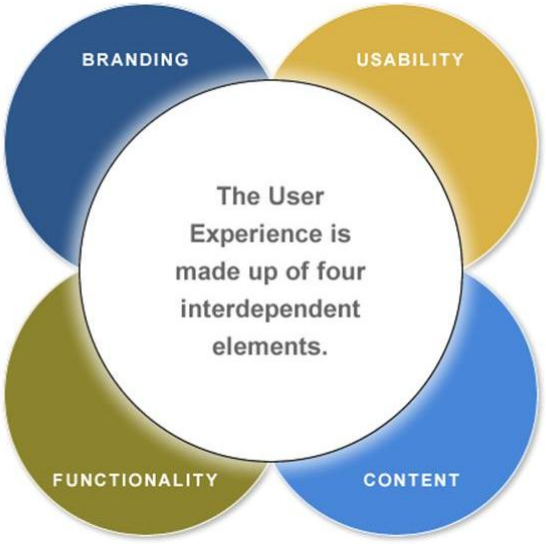


Figure 3.1 Four elements of user experience (Rubinoff 2004)

The viewpoint of Bevan (2008b, pp.1-5) proposes that UX is the users' experience on digital products, of which the key influencing factors are: learnability, usability, usefulness and aesthetic appeal. In this view, UX methods are a broad interpretation of usability (Figure 3.2). Bevan (2008a) refers to a new draft ISO standard which defines 'quality in use' as incorporating usability in use, flexibility in use, and safety. In this context, Figure 3.2 shows the components of usability in use, and the components of satisfaction in use embedded within usability.

Usability

- Effectiveness
- Efficiency
- **Satisfaction (Experience of use)**
  - Likability
  - Pleasure
  - Comfort
  - Trust

Figure 3.2 User experience methods as a broad interpretation of usability (Bevan 2008a)

Bevan 2009, points out the close connection between the satisfaction component of usability and user experience: ‘A person’s perceptions and responses in the definition of user experience are similar to the concept of satisfaction in usability. From this perspective, measures of user experience can be encompassed within the 3-component model of usability, particularly when the satisfaction is task-related’.

The ISO definition, given in Section 3.4.1 immediately following, suggests measures of user experience are similar of satisfaction in usability (ISO DIS 9241-210 2008). The user’s experience with a product or service is ideally the outcome of a user-centred design process; not a design process in itself. Delivering a good experience requires a wide range of UX disciplines, such as marketing, ethnography, graphics design, software engineering, hardware engineering, interaction design, information architecture, information design, accessibility, technical writing, usability, user research, visual design, Web analytics and business process analysis (Sward 2006). The next section provides certain definitions of user experience.

3.4.1 User experience defined

Definitions of user experience vary. The current ISO standard 9241-210 on human-centred design describes UX as: ‘all aspects of the user’s experience when interacting with the product, including all aspects of usability and desirability of a product from the user’s perspective’ (ISO DIS 9241-210 2008). As mentioned in the previous section, Rubinoff’s (2004) broad definition suggests that user experience is includes: branding, usability, functionality and content. He emphasises the relationship of UX to user-centred design.

In April 2008, a special interest group at the conference on human factors in computing systems presented a paper entitled, ‘Towards a Shared Definition of User Experience’ (Law, Roto, Hassenzahl, Vermeeren and Kort 2008, pp. 2395-2398). The authors presented a list of various definitions of UX (Table 3.2) from various individuals and organizations in the field. Moreover, they relate to varying contexts, not just computing systems.

Table 3.2 User experience definitions
(Law, Roto, Hassenzahl, Vermeeren and Kort 2008, pp. 2395-2398)

Author	Definition
Lauralee 1996	Involves all the aspects of how users use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they are using it, and how well it serves their purposes.

Author	Definition
Nielsen Norman Group 2008	User emotions derived when interacting with an institution, its services, and its product
Hassenzahl and Tractinsky 2006	A consequence of a user's internal state (i.e. predispositions, expectations, needs); the characteristics of the designed system (i.e. complexity, purpose, usability); and the context (or the environment) within which the interaction occurs (i.e. organizational/social setting, meaningfulness of the activity, voluntariness of use).

Each of these definitions is notably different from the others. They vary in scope but, from them, it can be established that UX is a sensation related primarily to the emotions a user has while interacting with a device or system, and that the success of a system is related to a positive user experience. User experience is primarily influenced by the user interface and a good user interface design supports users in meeting their goals (van Greunen, van der Merwe and Kotze 2010). In addition, user experience is an attitude towards a system and an emotional bonding with it (Tobias and Spiegel 2009).

Law et al. (2009) state that an experience is something personal 'within' a person. They mention that a group may share an experience, because although people may influence each other's experience before, during, and after interacting with a product, only an individual can have actual feelings and experiences. Furthermore, they state that a group generally forms the social context that affects user experience. This however, occurs together with other contextual factors: physical technology and task context (ISO 13407 1999). A survey gathered the views on UX of 275 researchers and practitioners from academia and industry, and results indicated that the users viewed the concept of UX as dynamic, context-dependent, and subjective (Law et al. 2009). Generally, UX was seen as something new, which must become a part of the HCI domain and be grounded in user centred design (UCD) practices. Law et al. (2009, pp. 719-728) identified three reasons as to why it is hard to get a universal definition of UX:

- 'UX is associated with a variety of dynamic concepts: emotional, affective, experiential, hedonic, and aesthetic variables'.
- 'The unit of analysis for UX is flexible, ranging from a single aspect of an individual interaction with a stand–alone application to all aspects of multiple end users' interactions with the company and its merging of services from multiple disciplines'.

- ‘The landscape of UX research is fragmented and complicated by various theoretical models such as: emotion, experience, value, beauty and hedonic quality’.

If this issue of the scope of UX is resolved, it will resolve a number of problems pertaining to UX. Tobias and Spiegel (2009) also state that until a clear definition of UX is agreed upon, the effort made by designers and developers cannot be fully assessed or appreciated. HCI and UX have traditionally been interested in users’ initial interactions with products (Karapanos, Martens and Hassenzahl 2010). User experience is of a dynamic nature, due to the ever-changing emotional state of a person and due to differences in the circumstances during and after an interaction with a product (Hassenzahl 2008; Law et al. 2009). This statement provides a clear indication that it is essential to look beyond static aspects and to investigate the sequential aspects of UX and how it changes over time (Karapanos, Zimmerman, Forlizzi and Martens 2009; Law et al. 2009).

Furthermore, ‘UX factors need to be mapped to the user’s context of use, which profoundly influences the user interaction with products, resulting in a matrix of factors versus contextual parameters’ (Obrist, Ruyter, Tscheligi and Schmidt 2010, pp. 3197-3200). Hess (2009) provided the following descriptions of what ‘UX is not’ in order to clarify misconceptions.

- UX design is not an outcome of a user interface design. The user interface is just one piece of the total UX.
- UX design is not a single step in the process. It relates to a focus on the user, allowing him/her to be the driving force at all stages of the product/service lifecycle.
- UX design is not only about technology. Users come first, the technology helps to enable a good experience.
- UX design is not just about usability, but also about the emotional aspects that arise from usability.
- UX design is not merely the role of the designer, it is the responsibility of all the stakeholders.
- UX design is not a choice. It is a vital part of the business’s survival.

It is significant to note that UX is not only an interaction with services or products but also with the company’s brand. A company’s brand experience is a broader concept than user experience with the company’s products and services, it includes all the information about the company either from the company itself, media, or word of mouth. Therefore, the company’s

brand experience affects the user experience when they interact with the product (Desmet and Hekkert 2007). Until a user has initially used a product, there cannot be a user experience, and once the user interacts with a product, the user experience typically affects the brand experience. Everything before the first-hand encounter with a product just builds up expectations for the user experience or affects the brand experience. Furthermore, Morville (2004) describes seven facets that are relevant to the user experience, and that assist designers in moving beyond usability (Figure 3.3).

Figure 3.3 Seven facets of user experience (Morville 2004)

Morville (2004) explains the model depicted in Figure 3.3 by asking the following questions. Is the interactive system:

- useful to the user and the specified task?
- usable by the user for the specified task?
- desirable for the user and the specified task?
- valuable for the user and the specified task?
- accessible and available to every user, regardless of disability?
- credible for the user and the specified task?
- making the target accessible for the user and the specified task?

In summary, Law et al. (2009, pp. 719-728) recommend that the term user experience should be ‘scoped to products, systems, services, and objects that a person interacts with through a user interface’.

The next section discusses the relationship between user experience and usability.

3.5 Relationship between user experience and usability

Usability and user experience are closely related. There are varying viewpoints on which of the two includes the other, or whether they are separate but overlapping concepts. Figures 3.4 and 3.5 are over-simplifications, but they illustrate the lack of clarity and the varying points of view.

On the one hand, there is a strong perception that UX subsumes usability. Under this point of view, *UX includes usability* (Rubinoff 2004; Sward 2006) and UX evaluation entails the extension of existing methods for usability evaluation (Figure 3.4).

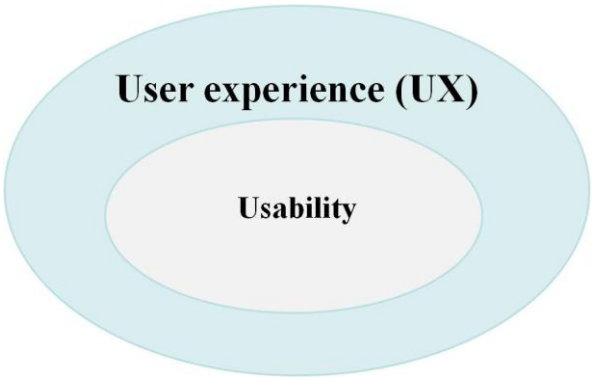


Figure 3.4 User experience includes usability (Rubinoff 2004; Sward 2006)

Other researchers argue that satisfaction is the subjective component of usability (ISO 9241-11 1998) and that user experience is a broader and richer term for satisfaction. In this viewpoint, *usability includes UX* (Bevan 2009). Satisfaction can be seen as part of UX because UX incorporates a range of subjective qualities and determines how a user feels towards a product (Vermeeren, Law, Roto, Obrist, Hoonhout and Väänänen-Vainio-Mattila 2010), (Figure 3.5).

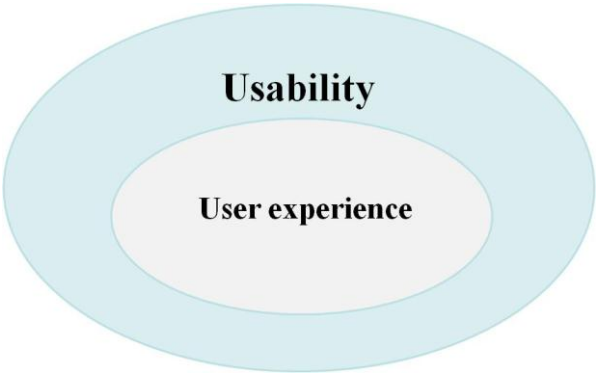


Figure 3.5 Usability includes user experience (Bevan 2009)

A third stance could suggest that usability and user experience are separate, but closely related, concepts. They can be perceived as two intersecting concepts with a common area, but outer features that are distinct to one of the two. This stance is also in harmony with the view of Rubinoff (2004) (see Figure 3.1), who portrays usability as overlapping with user experience, implying that certain aspects of usability lie outside of UX. This study is founded on the above viewpoint and portrayed in Figure 3.6.

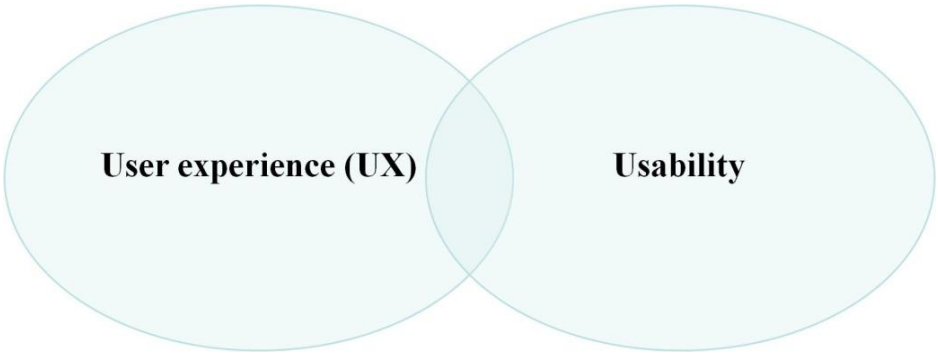


Figure 3.6 Usability and user experience: Closely related concepts

Hassenzahl (2004) distinguishes between two perceptions of quality: pragmatic and hedonic. This distinction supports the stance of the present researcher, and is represented in Figure 3.7, which extends Figure 3.6. *Pragmatism* refers to a product's ability to support the achievement of behavioural goals, i.e. usefulness and ease of use, which are usability goals. *Hedonism*, relates to enjoyment and stimulation, i.e. the product's ability to stimulate and enable personal growth and identification, which are attributes of user experience. Hassenzahl argues that the driver of UX is fulfilment of a person's basic human needs, and that lack of usability might block fulfilment of certain human requirements. If users experience fulfilment through a product, they will attach hedonic attributes to it. Hedonism, therefore, contributes directly to the core of positive experience (Hassenzahl 2008).

Sharp et al (2007) point out the *subjectivity* of user experience goals and their importance from the user's personal perspective. This is in contrast with the more *objective* usability goals, by which an interactive product is assessed from its own perspective, in terms of its usefulness and productivity. This distinction is also shown in Figure 3.7.

In a pragmatic approach, Bevan (2008a) deals with the UX and usability in an integrated way, stating, 'There are two types of UX/usability measures: those that measure the result of using the whole system (usability in use) and measures of the quality of the user interface (interface usability). Furthermore, in Bevan (2009) the varying roles of both are indicated,

‘Although there is no fundamental difference between measures of usability and measures of user experience at a particular point in time, the difference in emphasis between *task performance* and *pleasure* leads to different concerns during development’. These attributes are also shown in Figure 3.7.

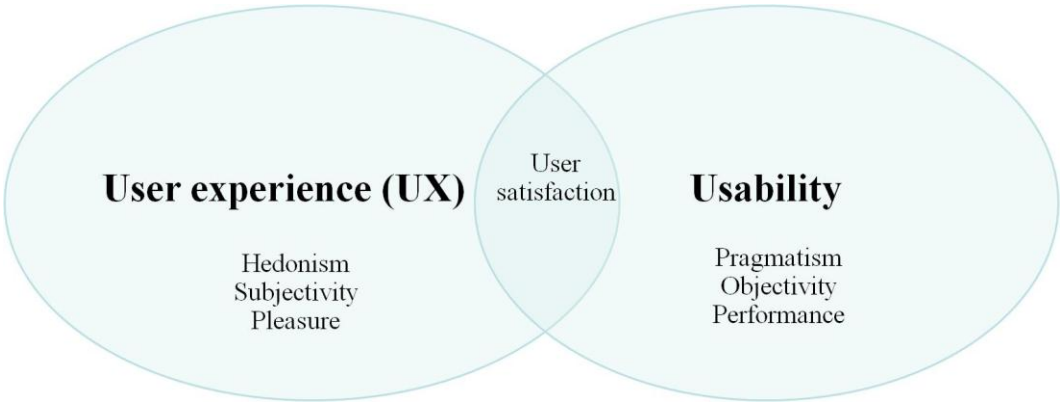


Figure 3.7 Usability and user experience: Some differences

Experts are currently attempting to integrate UX into the next revision of the respective ISO standards (Hassenzahl 2008). (See ISO 9241-210 on human-centred design which defines user experience). Tobias and Spiegel (2009) state that design drives UX which, in turn, affects the user’s mental model, and the lack of design impacts the user psychologically, and directly affects user experience in HCI.

This perspective makes design the central pivot of UX. A positive user experience on a website is essential if users are to return. When users are satisfied with a product they are more likely to recommend it to others, and people are more likely to make purchases from a source that has been personally recommended. Website usability can have a key influence on this experience. Good site usability ensures people are able to use the site and helps ensure the site does what it is intended to do. When users they have finished using a site – successfully or unsuccessfully – and leave it with a positive or negative emotion towards the brand, it relates to user experience (Gray 2009).

Both UX and usability are of great value and impact synergistically on each other. Regardless of containment or overlaps, an aim of the present study (Table 6.33 in Section 6.6) is to show how certain recognised aspects of usability impact on recognised aspects of UX. The study will considers how usability attributes can contribute to a good user experience or, conversely, how the lack thereof can detract from the quality of the experience.

3.5.1 User satisfaction

Based on the stance taken in this study regarding the relationship between usability and UX (Section 3.5 and Figure 3.7), user satisfaction is common to both usability and UX. Chang and Chen (2009, pp.411–417) define customer satisfaction as an 'affective response to a purchase that is an important goal in customer marketing'. They provide two different ways of determining overall customer satisfaction:

- **Transaction-specific approach** - the emotional response by users to their most recent experience with a company.
- **Cumulative customer satisfaction** - the user's overall experience with a particular company over time.

These two forms of satisfaction – the short term and the longer term form – correspond with integral aspects of UX.

Szymanski and Hise (2000) found convenience, site design, and security to be important factors in e-commerce customer satisfaction. Furthermore, Tian, Hou and Yuan (2008, pp. 39-43) defined satisfaction as 'the degree of the users' subjective satisfaction and acceptance in the process of using a product, but the satisfaction is mainly determined qualitatively from five to ten questions asked after a usability testing session'. In line with the approach presented in this section, Bevan (2009) states that user experience can be conceptualised as an elaboration and extension of the satisfaction component of usability.

From this discussion on aspects of user experience, usability and satisfaction, it emerges that satisfaction is an important factor of usability (Travis 2009), and usability intersects with user experience, i.e. we have an overlap. On the other hand, there are notable differences between the three, supporting the intersection-of-circles view and not the usability-includes-UX view. These distinctions indicate that:

- ***User experience*** – relates to subjective emotions triggered within users when interacting with a system or website, i.e. happy, sad, bored, excited. Jensen (2006) believes that UX is about feelings that users get before, during and after they have used a product.
- ***Usability*** – is characterised by objective measurements (efficiency, effectiveness and satisfaction). The product is being studied and tested, not the user.
- ***Satisfaction*** – dependant component of usability, which deals with what the users think of the product once they have used it.

The next section addresses methodologies to investigate user experience.

3.6 Methodologies used when evaluating user experience

The discipline of usability engineering represents user experiences primarily in cognitive or behaviourist terms, but there is a current trend to investigate human emotional experiences by representing users' reactions to designs using verbal and graphic means, as well as by applying heuristics custom-made for evaluating UX (Chang 2006). Many toolkits exist for doing traditional usability evaluations, but user experience evaluation differs considerably from usability evaluation. User experience cannot be evaluated with stopwatches or logging, because UX is subjective (Law et al. 2009). Objective measures such as task execution time and the number of clicks or errors are not reliable measures for UX, but evaluators need to know how the user feels about the system. Users' motivation and expectations affect the experience more than in traditional usability (Mäkelä and Fulton 2001).

A good user experience on a company's external website is crucial for companies to differentiate themselves from the competition and to gain loyalty and trust from users. Therefore, it is impossible to manage an experience on a website without sound methods of evaluating user experience (Väätäjä, Koponen and Roto 2009). As the need for regular user experience evaluation is high both in industry and academia, it is still unclear which are the most appropriate methods for assessing user experience. This is partly due to the fact that there is still not an agreed definition for user experience, although standardization work is ongoing (Benford, Giannachi, Koleva and Rodden 2009). As has been pointed out in this chapter, user experience is largely associated with the emotions that users have whilst engaging with an interactive system. Emotion assessment is not the only way to evaluate user experience; the users' perceptions of the product and their overall evaluative judgments of it should also be ascertained. In order to study attributes of UX, practical tools that support the assessment of user experience are needed (Väätäjä, Koponen and Roto 2009).

The following section describes some methodologies currently used to evaluate UX.

3.6.1 Think-aloud method with user observation

The think-aloud method is discussed in more detail in Chapter 5. It is a technique applied in usability testing when users are observed in a controlled environment. Users describe their thinking processes out loud while they are completing various tasks on the website. The

advantage of thinking aloud is that testees provide valuable information, including details of their cognitive processes and their behavioural patterns (Fang 2008).

3.6.2 Drawing

Massironi (2002) recommends drawing as a manual skill of generating signs to represent what one sees. Drawing can also be viewed as a visual metaphor that shows a user's emotional state of mind much better than verbal descriptions (Diem-Wille 2001). Drawings can be a good way for users to describe their feelings because it is not always easy to use written language to describe an emotion (Chang 2006). Furthermore, Chang (2006) states that drawings provide designers and usability analysts with a communicative method that works on both conscious and unconscious levels. Drawings can depict personality, feelings and different emotions that users have towards a Web interface, this is achieved by asking each user to draw a picture in response to their impression of, and feeling about, their favourite Web interfaces, instead of describing them textually (Chang 2006).

3.6.3 Mood board

A mood board is a combination of images, text, fonts, colour schemes and other graphic elements that is used to depict the structure of the overall look and feel for a design. These designs can be illustrated by collages that portray users' thoughts, emotions, and creative urges, through images (Chang 2006). A collage is an emotionally expressive and dynamic exercise for explaining one's personal character or way of life or illustrating feelings toward certain subjects and events **(**Mattelmäki and Battarbee 2002). A collage can be used by designers and usability analysts as an interactive tool for gathering design ideas and user perspectives in the early stages of the design process. It can also serve as an evaluation tool to measure the user experience through visual and emotional descriptions (Chang 2006).

3.6.4 Heuristics

Väänänen-Vainio-Mattila and Wäljas (2009) developed six heuristics for evaluating user experience on websites:

- **Heuristic 1: Usage and creation of composite services.** Is there functionality for users to add new service components as they become available? This is more applicable to sites such as social networking websites where users can join friends, upload photographs, update their status or post messages.

- **Heuristic 2: Cross-platform service access**. Can users access the service elements they need on their PCs as well as on mobile phones? Currently, most companies, especially in the telecommunication sector, develop a website as well as a mobile site. Users should be able to access the information they require from both of these technologies.
- **Heuristic 3: Social interaction and navigation**. Can users interact with other users, and apply the navigation histories of other users in their interaction with the service?
- **Heuristic 4: Dynamic service features**. Can users identify changes in the user interface and determine how to interact with the modified services?
- **Heuristic 5: Context-aware services and contextually enriched content**. Does the service adapt to the user's context of use and offer meaningful contextual information associated with the contents?
- **Heuristic 6: General user experience-related issues**. Is the user interface usable and aesthetically pleasing, supportive of users' trust and privacy, and other experiential aspects?

Vermeeren, Law, Roto, Obrist, Hoonhout and Väänänen-Vainio-Mattila (2010, pp. 521-530) compiled the examples indicated in Table 3.3, of different types of user experience evaluation methods (UXEM):

Table 3.3 Evaluation methods for user experience (Vermeeren, Law, Roto, Obrist, Hoonhout, and Väänänen-Vainio-Mattila, 2010, pp. 521-530)

UXEM	Description	Authors
Experience sampling method	This method requires users to document their thoughts and feelings outside the laboratory in order to provide insights into variability over time.	Intille, Rondoni, Kukla, Anacona and Bao 2003, pp. 972-973.
Day reconstruction method	The online diary method requires users to describe their feelings in a particular episode. An episode is a reflection after experiencing a product, i.e. playing a game.	Kahneman, Krueger, Schkade, Schwarz and Stone 2004, pp. 306. Karapanos, Martens and Hassenzahl 2009.
iScale	With this method, users sketch their experiences with the aim of minimising retrospective bias.	Karapanos, Martens and Hassenzahl 2009. Karapanos, Martens and Hassenzahl 2010.

UXEM	Description	Authors
AttrakDiff™ questionnaire	This method evaluates hedonic and pragmatic qualities of interactive products in order to evaluate the beauty of the product being experienced.	Hassenzahl and Monk 2010.
Expert evaluation with UX heuristics	This involves use of a predefined set of heuristics by expert evaluators to record positive and negative findings experienced.	Väänänen-Vainio-Mattila and Wäljas 2009. Väänänen-Vainio-Mattila and Wäljas 2010.
Psycho-physiological measurements	User physiological reactions are recorded by attached sensors. This method produces trajectories of the experience over the session.	Mandryk, Inkpen and Calvert 2006, pp. 141-158.
FaceReader	This system allows for real-time analysis of the user's facial expressions. Based on these facial expressions, a calculation of the likeliness of the six basic emotions (joy, anger, sadness, surprise, fear and disgust) can be made at any given time.	Bernhaupt, Boldt, Mirlacher, Wilfinger and Tscheligi 2007.
PrEmo	PrEmo is a non-verbal self-report software instrument that measures 14 emotions elicited by product design. Each emotion is displayed by an animation of dynamic facial, physical or vocal expressions.	Desmet 2005.
Sensual evaluation instrument	This instrument allows users to mould objects in order to describe their emotions.	Isbister, Hook, Sharp and Laaksolahti 2006.
3E (Expressing Experiences and Emotions)	3E is a template that includes a stick figure with an empty face and a speech balloon, on which users are asked to draw and write their experiences and emotions about their interaction.	Tahti and Arhippainen 2004.
Controlled observations	Users test an application or system within a controlled environment (e.g. usability testing, Section 4.3.1.1). This formal type of observation provides detailed insights that would be hard to obtain in real contexts, such as video clips of users' facial expressions.	Jordan 2002.
Emotion Sampling Device (ESD)	Emotion sampling devices (ESD's) provide a series of questions compliant to the emotion the user is experiencing as the result of an event. It investigates the causes of the emotion, rather than about the emotion itself, to avoid the typical problems of verbal assessment of emotions.	Roseman, Antoniou and Jose 1996.

UXEM	Description	Authors
Emocards	At the end of every task, users are asked to pick one of several cartoon faces that identifies how they are about their interaction.	Desmet, Overbeeke and Tax 2001.
Long term diary method	A prototype of the product is given to users for a period of 6 months to a year. Users are required to report their experiences and emotions at short fixed intervals in the form of journal entries.	Bolger, Davis and Rafaeli 2003.
Reaction checklist	Once the system has been evaluated by users, they are given a list of possible reactions to it, i.e. satisfied, frustrated or irritated.	Jordan 2002.

Vermeeren et al. (2010, pp. 521-530) propose the following methods for UX and HCI practitioners and researchers to identify the best UX evaluation method for their specific needs (i.e. development phase, kind of experience addressed, and location of UX evaluation):

- **'Methods for the early phases of development**: Establish how to evaluate UX concept ideas and non-functional prototypes with real users early in the design process'.
- **'Validated measures for UX constructs**: Improve the validity of measure-based methods by providing validated measures for different experience such as cross-cultural studies'.
- **'Methods for social and collaborative UX evaluation**: Identify methods to address experiences of groups of individuals'.
- **'Attention to practicability of methods**: Address issues such as resources and ease of data analysis, applicability of results for the development'.
- **'Effective multi-method approaches**: Identify which methods work well together, as well as how to effectively collect and analyse the data from different sources'.

Creating a user experience on websites does not involve just a single aspect. There are many considerations that designers need to reflect upon when creating a user experience. The most important factor is the user himself or herself (Lee and Koubek 1010). Designers should study the target users in order to understand how they make their preferences. Users may base their preference on usability, performance, aesthetics, price, information quality or brand of the e-commerce website (Keinonen 1997).

The next section discusses user experience frameworks used to uncover emotions on websites.

3.7 User experience frameworks

Human needs and requirements are continually addressed in psychology and in the design of interactive products (Hassenzahl, Diefenbach and Göritz 2010). Hassenzahl (2008) requested users to mention a recent, positive and satisfactory experience with an interactive technology. The results showed distinct experiences based on the fulfilment of users' needs and the close connection between needs and affect. Therefore, the fulfilment of particular psychological needs can be understood as a cause of positive experience.

This section presents some UX frameworks for websites that contribute to creating emotional user reactions with the aim of creating good user experiences:

1. User experience framework (Mahlke and Thüring 2007, pp. 915-918), (Table 3.4);
2. A model of user-experience factors in e-commerce interaction tasks (Mahlke and Thüring 2007, pp. 915-918), (Table 3.5);
3. User experience framework (Kort, Vermeeren and Fokker 2007, pp. 57-64), (Table 3.6);
4. Framework of UX including influencing factors (Schulze and Krömker 2010, pp. 261-264), (Table 3.7).

Table 3.4 User experience framework (Mahlke and Thüring 2007, pp. 915-918)

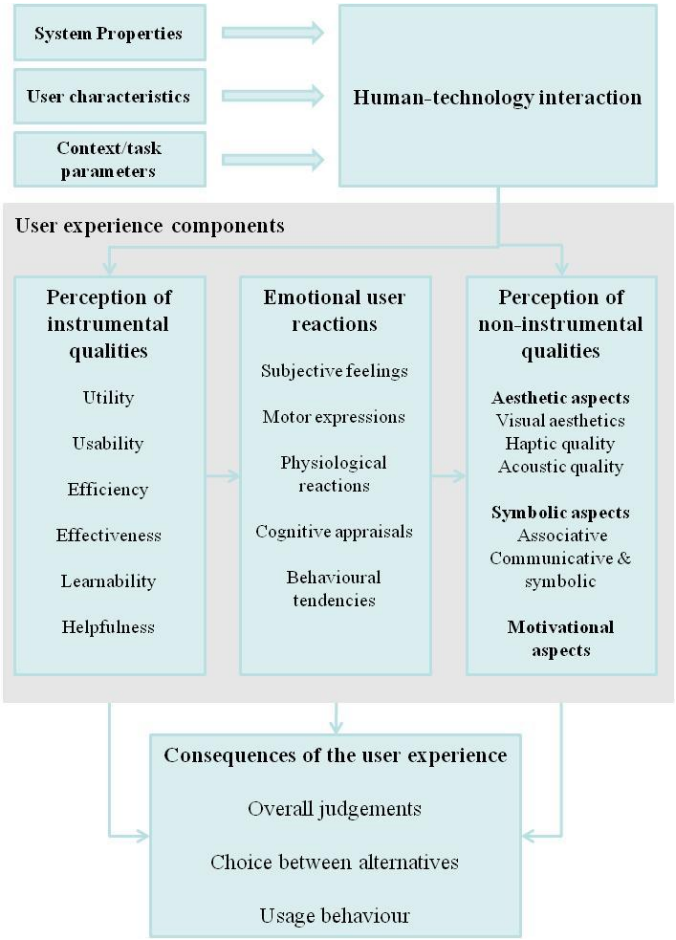
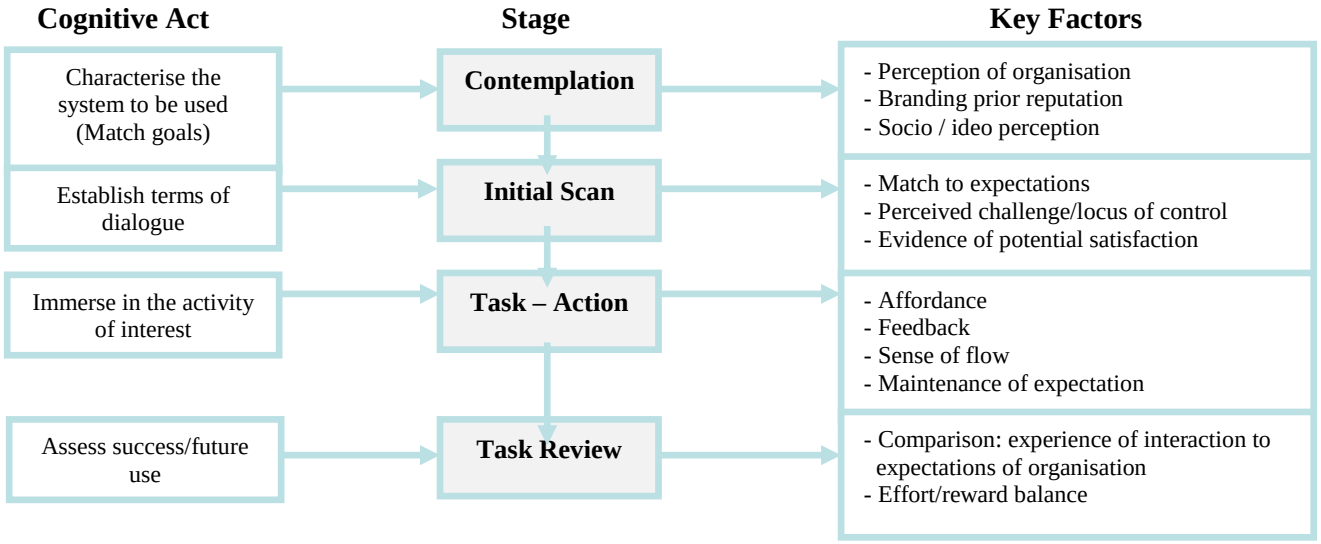
UX framework 1 	Mahlke and Thüring (2007) defined a framework for user experience that illustrates instrumental (usefulness, usability) and non-instrumental (aesthetics, symbolic, motivational) quality perceptions and emotional user reactions (subjective feelings, motor expressions, physiological reactions, cognitive appraisals, behavioural tendencies) as three central components of the user experience. Interaction characteristics depend on system properties, user characteristics and the parameters of the context or task. The outcome of user's interaction with these three components is the overall user experience. Furthermore, Mahlke and Thüring (2007) tested this UX framework with four portable audio players that differed in terms of various design aspects. Thirty individuals participated in the study and were given four tasks for each product. After accomplishing the tasks, users filled in a questionnaire that assessed ratings on different experience criteria (usability as instrumental qualities; visual aesthetics, heptic quality, and symbolic quality as non-instrumental qualities) and emotional user reactions. After using each audio player, users ranked it in relation to the others. The results showed that instrumental quality aspects, i.e. the usability of the system, had a major influence on the emotional user reactions, but also that the non-instrumental aspects play a significant role. All three components had an influence on overall judgments.

Table 3.5 A model of user-experience factors in e-commerce interaction tasks (Mahlke and Thüring 2007, pp. 915-918)

UX framework 2



Mahlke and Thürings (2007) illustrate four stages in e-commerce interaction tasks that contribute to the overall user experience. The first stage is contemplation, within which the user makes an initial judgement of the website prior to any action, for example, looking at the home page of a website. One problem that may occur at this stage is that Web designers fail to create innovative and engaging homepages. The second stage is initial scan; in this stage, the user's first attempts at action tend to be critical, therefore, greeting messages or similar features can be displayed to set the tone of interaction. The third stage is task action, which occurs during interaction. Affordances, feedback and flow are aspects of usability factors while consistency or inconsistency of dialogue tone may be a reference to experience. The fourth stage is task review; a stage which occurs on completion of a task. During interaction that may have an effect on a user's sense of what he or she is dealing with, for example, whether the sense of the organisation's identity formed from awareness of the branding or advertising matches the experience.

Table 3.6 User experience framework (Kort, Vermeeren and Fokker 2007, pp. 57-64)

UX framework 3	Kort, Vermeeren and Fokker's (2007) user experience framework is discussed below: • **Compositional aspects:** Compositional aspects deal with how users interact with the product. These are closely related to usability and the interaction possibilities and results the product will provide. Compositional aspects can result in an understanding of how a product works, what has happened and what will happen next, where the user is, and how satisfied they are with using the product. • **Aesthetic aspects:** Aesthetic experience aspects relate to a product's ability to enhance user sensory modalities (Blythe and Wright 2006). It is the look and feel of the product, colours, font, graphics and sounds used. Aesthetic experience aspects may lead to basic feelings such as excitement or fear when looking at the product. • **Aspects of meaning:** Aspects of meaning are experience aspects a designer creates by identifying user's goals, needs and desires. Desmet and Hekkert (2007) state that this is where cognition comes into play. Through 'cognitive processes, designers are able to recognize metaphors, create personas, and assess the significance of a product' (Desmet and Hekkert 2007, pp. 57-66). Aspects of product meaning and product interaction can result in feelings such as anger, joy, satisfaction and fulfilment. The relationship between compositional aspects, aesthetic aspects and aspects of meaning, is that they each represent aspects of design elements to create an experience at a specific experience level. • Compositional aspects cover the practical and functional properties. • The aesthetic aspects deal with the look and feel of the product. • The aspects of meaning cover the satisfaction of user goals, needs and desires, and relate to properties like expressiveness.

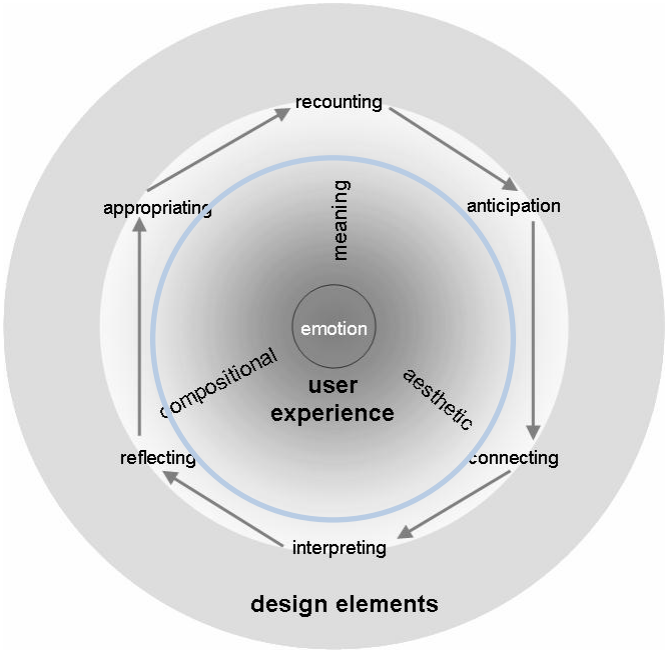
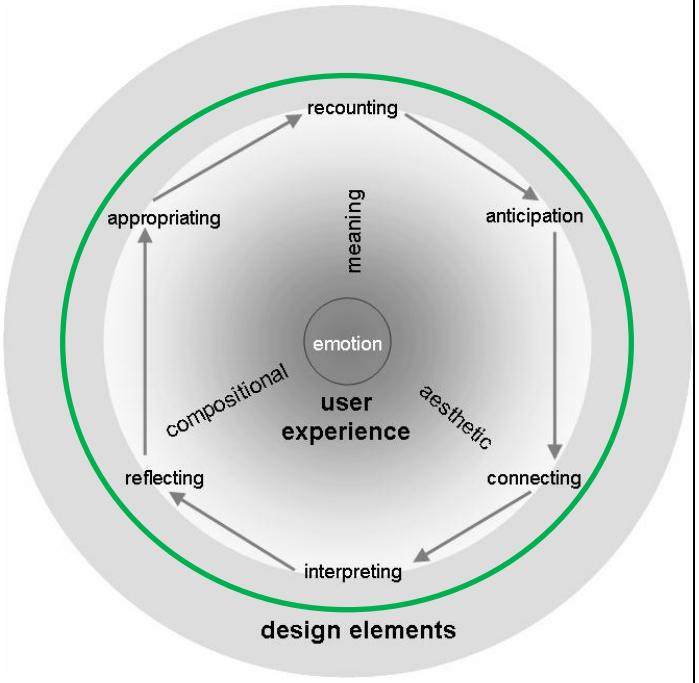
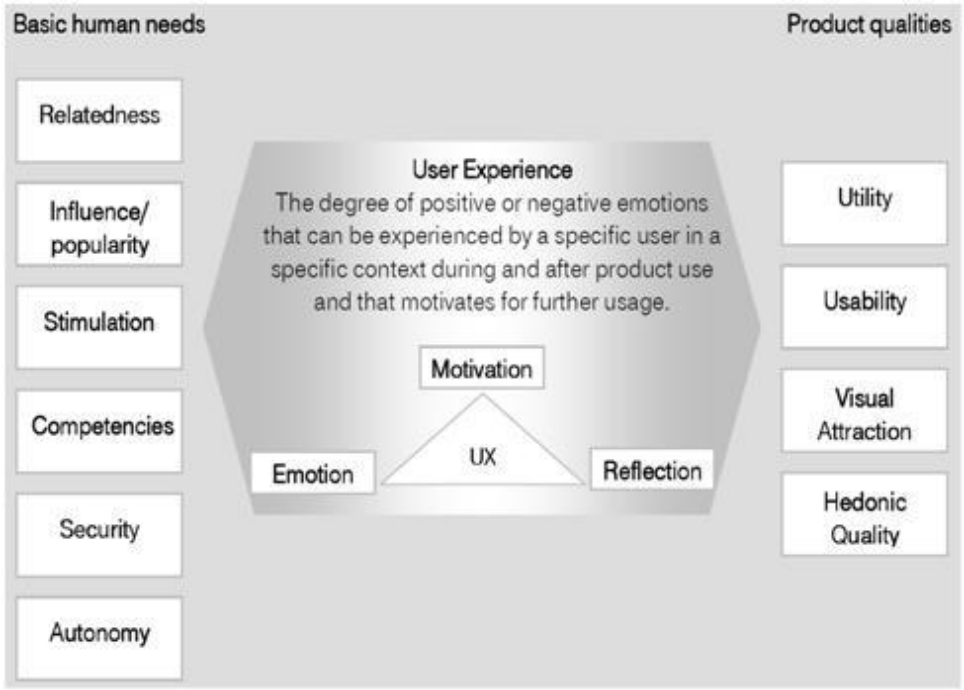


Table 3.6 – continued



- **Connecting:** Wright, McCarthy and Meekison (2005) state that connecting deals with components that may have an impact on users in generating some type of response, but without designers assigning meaning to it. For example, a connecting experience aspect may result in users experiencing a sense of speed or thrill by the aesthetic aspects of a product's design.
- **Interpreting:** Interpretation deals with feelings that arise when users interact with a product, and their expectations when they perform certain actions. Based on those interpretations, users can experience excitement or a feeling of anxiety, leading to emotions such as the desire to remove oneself from the situation or a motivation to continue.
- **Reflecting:** Reflection relates to the judgments about how the user experienced the product while interacting with it, for example, a good experience can lead to feelings such as satisfaction during product interaction or feelings of boredom.
- **Appropriating:** Appropriating compares experiences with previous and future experiences and this comparison may become a benchmark against future experiences.
- **Recounting:** Recounting occurs when users share their experiences with others, thereby reliving the experience and finding new possibilities and meanings. This is how an experience is re-evaluated.
- **Anticipation:** Anticipation means that users do not just experience a situation, but also bring their previous familiarity and sense making of experiences to the current situation.

Table 3.7 Framework of UX including influencing factors (Schulze and Krömker 2010, pp. 261-264)

UX framework 4  	Schulze and Krömker (2010) state that in order to make user experience (UX) measurable, designers need to identify UX direct and indirect influencing factors. Influencing factors are divided into user's experience during and after product use. Hassenzahl (2008) states that basic human needs such as relatedness, popularity and stimulation are key drivers of product use and quality perception. Satisfaction or frustration of these needs drive users' experience with an interactive product and are mainly influenced by product qualities such as utility, usability, visual attraction and hedonic qualities.

UX framework 5

McCarthy and Wright (2004) propose four core threads that make up a holistic experience:

- **The sensual thread:** The sensual thread is concerned with users' sensory engagement and level of absorption with technology or devices. These can involve fear, happiness, pain or comfort.
- **The emotional thread:** Emotions can be defined as the moving and cementing force. Examples of emotions include: joy, anger, frustration and happiness. With these emotions, users make judgments of value on the technology or device.
- **Compositional thread:** Compositional thread is the narrative part of an experience. It deals with the participant's thought during an experience, for example: What is this about? Where am I? What has happened?
- **The spatio-temporal thread:** Spacio-temporal thread refers to the space and time in which users' experiences take place and their relationship with one another.

The five UX frameworks discussed above highlight a common aspect in the creation of a good user experience, namely, usability. If the usability is good, it will contribute to creating a better user experience for the user. Furthermore, this emphasises the need to empirically investigate how usability can support UX and provide specific guidelines. The visual appeal of a website also plays an important role in creating a good user experience. The next section will discuss the importance of visual interface aspects in creating a good user experience.

3.8 Importance of visual interface aspects in creating a good user experience

The visual impact of a user interface can have a significant influence on the user experience. If designed poorly, it can complicate the communication that the company is trying to convey to the users and make it less effective (Hoffman and Krauss 2004). When users are browsing a website, they asses their experience by two aspects: the usability of the e-commerce site and the service-quality (Petre, Minocha and Roberts 2006). The usability of an e-commerce site is determined by its user interface, visual elements, navigation, information architecture and the way users interact with the website. In addition to the usability of the e-commerce site, a customer has service-quality expectations while browsing e-commerce sites, such as: reliability, responsiveness, empathy, information-quality, fulfilment, privacy of data. The aesthetics of the e-commerce site can also be seen as an aspect of the broader concept of user experience (Hassenzahl and Tractinsky 2006), which can include: usability, beauty, overall quality and hedonic, affective and experiential aspects.

Chang and Chen (2009, pp. 411-417) adopted four components of customer interface quality for e-commerce websites:

- **Convenience** – Is the website user friendly, easy to navigate and does it allow users to get the information they want? About two-thirds of e-commerce transactions are not completed because users cannot find the information they need to complete the purchase quickly.
- **Interactivity** – Does the e-commerce website facilitate a two-way communication with the users? The user interface becomes the salesperson on websites. Therefore, if the interface is of an interactive nature, it will have a positive effect on user response, including a desire to return to the website.
- **Customisation** – Does the website tailor its products and services based on user needs? If it does, it will increase the probability that users will find the product that they are looking for and in return it will create the perception of increased choice by enabling users to focus on what they really want, making the site more appealing.
- **Character** – What kind of overall image or personality does the website depict to users through the use of graphic elements, for example: fonts, pictures and colours? These graphic elements can serve the function of making the visual content easy to read, can create an atmosphere that makes the shopping experience more pleasurable, and can instill a sense of confidence in shopping with a previously unknown online store.

Tobias and Spiegel (2009) state that design directly affects UX as well as usability. They place a strong emphasis on design, stating that design is the major factor that drives UX. Not only does design impact the user psychologically, but it also affects the human's interaction with the computer system, making design the most vital aspect of UX. By leveraging design, an experience can become more engaging, and can influence the user's mental model in a positive way. A good UX design can therefore contribute to a positive attitude and can support emotional bonding towards the product.

Another aspect that can have a major impact on the user experience is the terminology used. Williams (2008) defines eight positive trigger words and five negative trigger words that can influence users interacting with e-commerce websites.

The terms that create positive emotions are: discovery, freedom, guarantee, confidence, novelty, simplicity and proven. Those that create negative emotions are: payment, expense, loss, failure and complexity.

The usability, aesthetics and service-quality of the e-commerce environment together determine the value the user perceives while browsing a e-commerce website. Perceived value is the customer's overall assessment of the user experience based on perceptions of what is received and what is given (Gabbott and Hogg 1998; Shaw and Ivens 2002). For example, Lee and Koubek (2010) attempted to understand the process of users' preference-making based on usability and aesthetics. The results accentuate the importance of considering both perceived usability and perceived aesthetics. Therefore, designers need to utilize the strong interrelationship between perceived usability and perceived aesthetics when designing a website. For example, users may perceive a product or system to be more usable than its actual usability if it is designed with a high aesthetic quality.

The following section discusses different approaches taken in order to improve the usability of e-commerce websites.

3.9 Improving the usability of e-commerce websites

There are various approaches to improving e-commerce usability. Usability testing is discussed in Section 3.9.1, business processes in Section 3.9.2, personalisation in Section 3.9.3, and Web analytics in 3.9.4.

3.9.1 Improving usability by using usability testing

Sharp et al. (2007) define usability testing as an approach that emphasizes to what extent a system is usable. It involves measuring typical users' performance on pre-defined tasks in a controlled environment by placing the product in a usability laboratory where users are asked to perform various tasks from a pre-defined list. The next section overviews three usability studies, showing how usability testing has been used to improve the usability of e-commerce sites.

Usability study example 1

Martim, Herselman and van Greunen (2009) conducted a study on how SA online retailers can improve e-commerce usability to enhance growth. The study found that some SA

retailers were aware of the usability problems on their websites and were in the process of improving them.

Major usability problems facing SA retailers include:

- Search engines do not provide results that meet users' expectations.
- Registration processes take too long, for example: information such as gender, title, middle name, date of birth may be irrelevant.
- Navigation needs to be more efficient.
- Error messages are not sufficiently useful and clear, and users struggle to read and understand them.
- Users are concerned about trust and security issues; SA retailers need to provide the most relevant and current information on their websites.
- The SA cultural background also emerged as a challenge. Results show that needs of SA users differ from international users' needs for example, South Africans prefer colourful, graphic interfaces.

Usability study example 2

Barnard and Wesson (2003) conducted an empirical investigation on the usability issues within e-commerce sites in South Africa. Four well-known sites and one international site were evaluated, involving sixteen participants. The international site was used to determine whether there were differences between South African sites and the international sites. The usability results showed that:

- Exclusive Books was the most efficient site for the task of finding information and Amazon the least.
- World Worth was the most efficient site in terms of purchasing.
- The most effective site with regard to finding information was Amazon, although no users selected items from the site.
- The most frequent comment regarding Amazon was that there was no currency converter, and it should be possible to determine precisely what the rand amount of the final purchase would be.
- From a satisfaction point of view, World Worth was rated the lowest, while Kalahari was rated better than Exclusive Books.

Usability study example 3

Bernard (2002) conducted a study to determine where users expected to find 'common e-commerce objects' on a page. Users used a paper representation of a blank browser window that was divided into an eight by seven (8 x 7) grid. Users were asked to place cards representing the e-commerce objects on the gridded browser in the location where they expected to find that object. Figure 3.8 summarizes the objects included in the study and Bernard's findings.

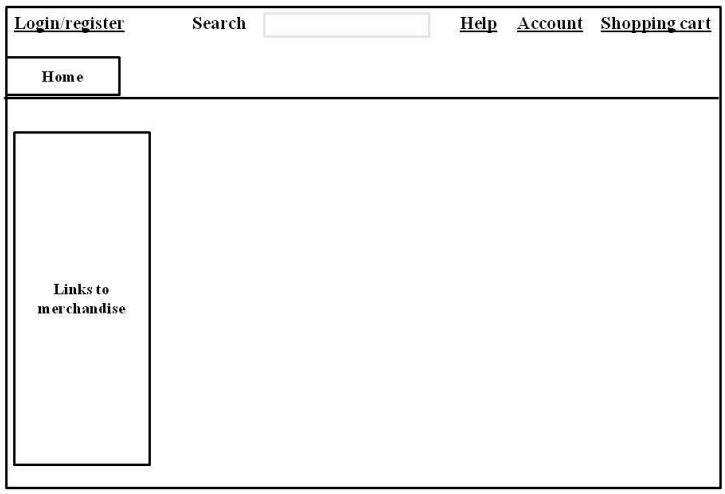


Figure 3.8 Common e-commerce objects (Bernard 2002)

All three usability studies were based only on usability attributes, i.e. efficiency and effectiveness of the websites. Minimal attention was paid to how the users felt after using the websites (user experience).

3.9.2 Improving websites by using business processes

A business process is a sequence of tasks carried out by users to achieve the business objectives of an organization (Zou, Zhang and Zhao 2007). For example, a cellphone purchasing process may consist of several tasks such as selecting a cellphone from a list, making payment with a credit card, and printing or saving a receipt. A process definition specifies the business tasks (for example, selecting a cellphone), roles (for example, users and sales representatives), and data (for example, a cellphone order request) involved in a business process.

E-commerce business is growing. In order to cater for the increasing business requirements and the associated updates of the user interface to reflect the continuous evolution of the underlying business processes, e-commerce websites should provide additional functionality and continuous guidance to users.

Zou, Zhang and Zhao (2007) conducted a study to restructure the user interface (UI) of an existing e-commerce application to improve its usability for users conducting their tasks (business processes). The study shows that the improved UI provides navigational guidance to assist users in accomplishing their tasks (business activities). This was achieved by displaying the UI components relevant to the context of a user's current activities. The findings of the study indicate that improved UI can improve the user experience for novice users by offering more guidance and by reducing the time needed for novices to perform their tasks (business activities).

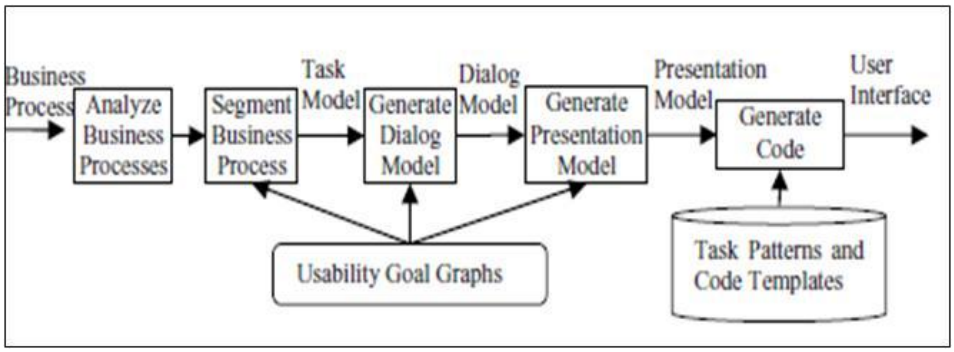


Figure 3.9 User interface generation framework (Zhao, Zou, Hawkins and Madapusi 2007, pp. 256-270)

A study conducted by Zhao, Zou, Hawkins and Madapusi (2007, pp. 256-270) illustrates the overall steps in generating interfaces to support business processes (Figure 3.9). They propose three intermediate models to provide sufficient information to a business process to generate code automatically: task models, dialog models, and presentation models to gather enough detail towards generating the final UI code. Business processes capture the business requirements. The task models are derived from business processes. The UIs are generated using two other intermediate models: the dialog models and the presentation models to ensure that the UIs are easy to use and learn. The transformations between models are guided by UI design principles and tasks. As a result, the generated UI has strong usability supports such as a consistent look and feel and conversion guidance, and if changes occur, they can be automatically added to the UIs by regenerating the code using a prototype tool.

3.9.3 Improving websites through personalisation

Personalisation involves storage of users' information such as preferences (Abbattista, Degemmis, Licchelli, Lops, Semeraro and Zambetta 2002). The more a system knows about users, the better it can serve them effectively, and thus improve UX. Personalisation is mainly done by user modelling which means collecting items of information about each user,

processing that information quickly and providing the results to applications. This is implemented in the back-end of the system. The website collects information such as needs, wishes and interest from every user who logs onto the site.

Abbattista et al. (2002) provide three main advantages of using personalisation in e-commerce:

- Personalisation makes the site more attractive for users by noting their preferences and habits in order to suggest products that reflect their needs on the next occasion they visit the website.
- Personalisation can obtain users' trust and confidence by the fact that they are not constantly requested to insert information about their preferences. In contrast they can participate in the management and updating of their personal profile, which improves customer loyalty.
- Every time a customer interacts with the website, the personalisation mechanism collects new data about his or her preferences, so that a more and more satisfactory service can be offered.

3.9.4 Improving websites through Google Analytics

Despite the importance of good usability in e-commerce websites, there are not many studies that stress the importance of this aspect (Hasan, Morris and Probets 2009). The studies that do exist, cover mainly usability testing or heuristic evaluations in the process of identifying usability problems. Research has shown that there is little literature on Web analytic tools. Web analytic tools provide methods that automatically collect statistics regarding collection, measurement, monitoring, analysis and reporting of Web usage data to understand visitors' experiences. The advantage of this approach is that it can help to optimise websites in order to accomplish business goals and/or assist in optimising customer satisfaction and loyalty **(**Malacinski, Dominick and Hartrick 2001)**.**

Hasan, Morris and Probets (2009) conducted a study to illustrate the value and use of Google Analytics (GA) for evaluating the usability of e-commerce websites by employing advanced Web-metrics. The objectives for this research were:

- To investigate the potential usability problem areas identified by GA software;
- To assess the main usability problem areas in three e-commerce websites using comprehensive heuristic guidelines;

- To compare issues raised by GA software with problems identified by the Web experts who evaluated the sites using heuristics approaches.

The Hasan et al. (2009) study identified specific Web metrics that can provide quick, easy, and cheap indications of general potential usability problem areas on e-commerce websites. However, to get a more in-depth analysis of the usability problems, other usability techniques are more valuable, for example: heuristic evaluation and usability testing. There are two advantages that Web analytical tools can provide that heuristic evaluation cannot: they can provide information regarding the financial performance of the site in terms of its ability to generate revenue, and the results offer a foundation for future research. Usability evaluation methods are further addressed in the next chapter, Chapter 4.

3.10 Summary

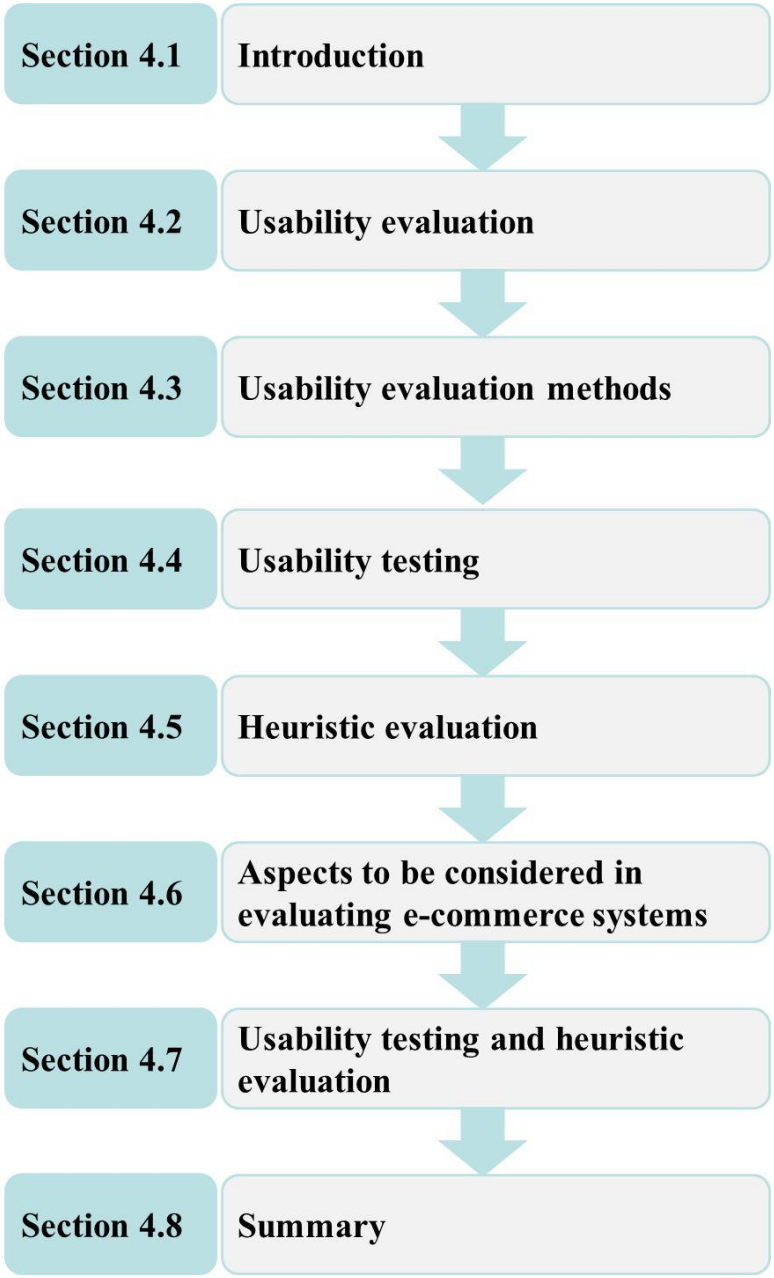
This chapter defined usability and descriptions were given of various factors that are associated with measuring usability, namely: usability goals, user experience goals and user-centred design. The majority of the UIs of e-commerce applications suffer from usability problems (Zhao et al. 2007). Any products, including e-commerce websites, must be usable to ensure that they meet the user's needs, this will be determined by evaluating the website.

This chapter also defined user experience and discussed relationships between user experience, usability and satisfaction. It presented various methodologies for the evaluation of user experience. Frameworks for user experience were discussed. From the literature surveyed, it can be concluded that user experience is a critical factor in customer satisfaction and loyalty.

Designers, product developers and Web services have been researching deeply into how to generate a positive UX (Tobias and Spiegel 2009). UX focuses on well-being, and not performance, as an outcome of human-product interaction, and this is the common denominator of all UX work (Hassenzahl 2008). As products and services are increasingly sold over the Internet, it becomes all the more important to build up knowledge in e-commerce-specific user interface (UI) and user experience (UX) design (Egger 2001).

The next chapter will discuss usability evaluation methodologies with an emphasis on usability testing and heuristic review, as these two evaluation methods will be used to conduct the study.

Chapter 4: Usability evaluation



Chapter 4: Usability evaluation

4.1 Introduction

With a wide-ranging variety of products available, users have become particular in their selections. Users want products to be easy to learn, effective, efficient, safe, and to provide a good user experience. It is also important for the success of a product or a website, that it is engaging, attractive, challenging, and enjoyable. In order to achieve this, the product should be evaluated to identify its strengths and problems (Sharp, Rogers and Preece 2007).

Evaluation is a broad concept. Preece, Rogers, Sharp, Benyon, Holland and Carey (1994, p. 602) defined evaluation as 'gathering data about the usability of a design or product by a specific group of users for a particular activity within a specified group of uses or work context'. In Sharp et al. (2007) this definition is extended, stating that evaluation focuses both on the usability of the system, for, example, how easy it is to learn and to use, and on the users' experience when interacting with the system, for example, how satisfying, enjoyable, or motivating the interaction is. Approaches to evaluation within the discipline of human-computer interaction (HCI) are changing. Poppe, Rienks and van Dijk (2007) identified four main trends in current HCI systems: new sensing possibilities such as automotive speech recognition and video tracking; shift in initiative, users will be more pro-active rather than responsive; diversifying physical interfaces such as billboards and mobile; and shift in application purposes which states that new applications will be more focused on user experience. The following section expands on these trends:

- **New sensing possibilities**. Technology that is beyond the traditional keyboard and mouse, for example: automatic speech recognition and video tracking that not only implement localization of human users, but also detect their actions, identity and facial expressions (Pantic, Pentland, Nijholt and Huang 2007).
- **Shift in initiative**. Traditional HCI supports the concept of user-based evaluation, but in the future of interactive systems, users will become more pro-active rather than just responsive.
- **Diversifying physical interfaces**. Interface designs are becoming larger, such as interactive billboards. In contrast, other interface designs are becoming smaller, due to the increased usage of mobile devices.

- **Shift in application purpose**. Traditional systems are generally task-based, but new applications will be more focused on user experience (UX), (Reidsma, van Welbergen, Poppe, Bos and Nijholt 2006).

Within this context of diversification and novel interface technologies, usability evaluation is vital. In particular, the use of evaluation methods for the assessment of the more common interactive systems such as websites is increasingly becoming a standard and mandatory procedure in the design process.

Following explanations of usability and user experience in the previous chapter, Chapter 4 discusses some of the techniques used most commonly in the HCI discipline for evaluating usability. Section 4.2 provides an introduction to usability evaluation, while Section 4.3 outlines usability evaluation methods in general. The next two sections focus respectively on particular evaluation techniques that are directly relevant to this study. Section 4.4 is an in-depth discussion of usability testing (UT) and Section 4.5 addresses heuristic evaluation (HE) in detail. These are the two usability evaluation methods (UEMs) that will be used to conduct the empirical evaluation studies of this research. In Section 4.6 a set of aspects is given that should be considered in evaluating e-commerce systems. Section 4.7 concludes the chapter by comparing the two methodologies of HE and UT and considering their use in combination.

4.2 Usability evaluation

Usability is defined as: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context' (ISO 9241-11 1998). It is a key aspect in HCI since it contributes to the quality of the user interface when used by the intended target group (Parlangeli, Marchingiani and Bagnara 1999). Usability evaluation is an assessment process concerned with gathering quantitative and qualitative information about the usability or potential usability of a product in order to either enhance its interface or eliminate problems. The standard usability issues are investigated, namely: efficiency, effectiveness and satisfaction, as introduced in Section 3.3.

The aim of evaluation is to determine whether the product can do what it is intended to do and to provide a means of suggesting improvements to it (Preece 1993). Determining whether the product should do what it is supposed to do, means evaluating to check that users can use the product, understand it, and whether they like it, especially if the design concept is new.

Contemporary users look for much more than merely a usable system: they require a pleasing, easy to use, and engaging experience. In the present rapidly-changing environment, particular industry sectors mature and, in the process, usability and technical reliability of products improve and are taken for granted. Users then start to look for products that provide engaging UX (Obrist, Roto and Väänänen-Vainio-Mattila 2009). This development is motivated by the observation that usability alone does not explain users' preferences and overall experience with interactive products (Karapanos et al. 2009).

Christensen and Frokaer (2010) claim that usability evaluation draws heavily on inadequate resources such as: expertise in interaction design, programming, insight into the application being tested and the company's objectives. They also state that usability evaluation can be time consuming, expensive and complex to conduct. Nevertheless, evaluating a product with users or an expert early in the design process will provide valuable feedback, so that major problems or shortcomings can be fixed before the product becomes operational or is placed on sale (Sharp et al. 2007).

The next section discusses usability evaluation methods.

4.3 Usability evaluation methods

There are many usability evaluation methods (UEMs) for software. These methods have become a part of the design and development cycle that cannot be ignored in Web design. The main differences between the various UEMs are usually based on whether users will be involved or not, the stage of the product development life cycle, and the place where the evaluation will take place. The methods can be divided into two main types: user-focused and expert-focused. User-focused methods adopt techniques such as interviews, questionnaires, observation or experiments to examine users' reactions toward interface design to determine problems concerning usability (Hui-Jiun, Jen and Shing-Sheng 2008). Expert-focused approaches include heuristic evaluation done by one or more usability experts on a product interface in order to identify possible problems and make suggestions relating to interface design.

The next subsection overviews some of these UEMs.

4.3.1 User-focused

The main user-focused evaluation methods are usability testing, questionnaires, interviews, focus groups, observations, and eye tracking.

4.3.1.1 Usability testing

Usability testing began in the early 1980s when computer software was first used by end users (Dumas 2003). Usability is currently a key factor in the quality of an application or website (Cockton, Lavery and Woolrych 2002). Sharp et al. (2007, p. 646) define usability testing as 'an approach that emphasizes to what extent a system is usable'. It entails certain quantitative aspects with the goal of measuring the degree to which a system is effective, efficient and satisfying**.** Usability testing involves an empirical study, in which results are derived from observing end users in a controlled environment called a usability laboratory. Data is collected using a combination of methods, for example: keystroke logging; data recording, which includes the researcher taking notes; audio recording; taking photographs and video recording. UT is discussed in detail in Section 4.4, and includes an elaboration of these methods in Table 4.2. The observation of end users in usability testing exposes problems that are difficult to anticipate (Cockton et al. 2002). Usability testing will be discussed in detail in Section 4.4.

4.3.1.2 Questionnaires

Questionnaires are a popular way of gathering information because of the wealth of information that can be gathered quickly. Questionnaires are effective tools for reaching a large number of people. They can be used to gather information in the early stages of designing and can be used to evaluate an existing website (Fang 2008). Dix, Finlay, Gregory, Abowd and Beale (2004) provide a number of styles of questions that can be used in the questionnaire. These include the following:

1 ***General:*** User-profile demographic questions, such as age, gender, occupation, and location, help to establish the background of the user and his/her position within the user population.

2 ***Open-ended:*** Users are asked to provide their own unprompted opinion to a question such as: What do you like most about the interface?

3 ***Scalar:*** Users are asked to judge a specific statement on a numeric scale known as Likert scaling, for example, users may be asked to rate the site based on 'ease of use'

by rating it from -3 (very difficult) to 3 (very easy), or from 1 (very difficult) to 5 (very easy).

4.3.1.3 Interviews

Sharp et al. (2007, p. 298) define an interview as a 'conversation with a purpose'. Interviews depend on the type of method used. Interviews can be effective for high-level evaluation, particularly in eliciting information about user preferences, impressions and attitudes (Dix et al. 2004). There are four main types of interview: open-ended or unstructured; structured; semi-structured; and group interviews (Fontana and Frey 1994). The first three types are named according to how much control the interviewer imposes on the conversation by following a predetermined set of questions. The fourth involves an interview with a small group guided by a facilitator (Sharp et al. 2007). Semi-structured and unstructured interviews are particularly good for obtaining unanticipated information, because the interviewer can probe when unexpected responses are given. Interviews can include both closed and open questions, but effort and skill are needed to ensure that questions are clearly worded and that the data collected can be analysed efficiently (Sharp et al. 2007).

A particular form of group interview, termed a focus group interview, is discussed below.

4.3.1.4 Focus groups

In this technique, usability experts have informal discussions with a group of target users. It is recommended to have more than one interview with several different groups, so the result will be more representative (Fang 2008). Normally three to ten people are involved; the users are selected to provide a representative sample of the target audience (Sharp et al. 2007). One advantage of focus groups is that a great deal of information can be obtained, including useful information from the type of users who are vulnerable to being neglected (Fang 2008). Furthermore, Sharp et al. (2007) state that focus groups allow diverse or sensitive issues to be raised that might otherwise be missed. Planning a focus group involves, firstly, an outline of the objectives and target audience and secondly, the development of user and facilitator documents that include the set of questions to be asked. Questions may be open or closed. Under the former option, the user is not prompted and the goal of the question is exploratory. A disadvantage of this type of question is that answers may be influenced by the stronger users in the group. In the case of closed questions, a list of possible answers is required as options; these options are based on the responses that frequently occur, so that the facilitator knows the possible answers in advance (Sharp et al. 2007).

4.3.1.5 Observation

Sharp et al. (2007, p. 321) define observation as a useful data gathering technique at any stage during product development. They also set out the benefits of using observation in the design process. For example, if observation is used early in the design process, it assists designers in understanding the users' context, tasks and goals. Observations conducted later in development may be useful in order to investigate how well the developing prototype supports these tasks and goals. Users are observed directly by the investigator as they perform their activities. Observations are conducted in two different ways, namely:

- ***Field***: Individuals are observed as they go about their day to day tasks in their natural setting. This is also called naturalistic observation.
- ***Controlled environment***: Observation in a usability laboratory environment, where individuals are observed performing specified tasks. See Section 4.4, where usability testing is discussed in more detail, since it is one of the methods applied in this study.

4.3.1.6 Eye tracking

Pool and Ball (2006) defined eye tracking as a method to determine eye movement and eye-fixation patterns. Eye tracking has existed as an evaluation technology for many years, but recent improvements in hardware have made it more viable as an approach to measuring usability. Eye tracking is associated with usability testing since it is usually conducted in a usability laboratory. Eye movements are believed to reflect the amount of cognitive processing that a display, or certain regions of it, require and, therefore, how easy or difficult it is to process the information. Measuring not only where people look, but also their patterns of eye movement, may indicate to the tester which areas of a screen users find easy or difficult to understand (Dix et al. 2004). Various kinds of measurements are used, including fixations and gaze that will now be discussed:

- **Fixations**

  Fixations can be interpreted quite differently depending on the situation. For example, when the user is browsing a Web page, higher fixation frequency on a particular area can indicate that the user is interested in that section such as news articles or promotional banners, or it can indicate that the user is confused (Jacob and Karn 2003; Just and Carpenter 1976). However, these interpretations may be reversed in a search task where a higher number of single fixations, or clusters of fixations, are often an index of greater uncertainty in recognising a target item (Jacob and Karn 2003). Fixation scenarios are listed below:

- ***Number of fixations:*** the more fixations the less efficient the search strategy.
- ***Fixation duration:*** longer fixations may indicate difficulty with a display.
- ***Scan path:*** indicating areas of interest, search strategy and cognitive load.

- **Gaze**

  Gaze is usually the sum of all fixation durations within a given area. It is best used to compare attention distributed between the different areas. It can also be used as a 'measure of anticipation in situation awareness in cases of longer gazes on an area of interest before a possible event occurring' (Mello-Thoms, Nodine and Kundel 2002, pp. 111-117; Pool and Ball 2006, pp. 211-219).

In HCI, eye tracking has been used to determine the usability of websites. It provides useful information on aspects such as navigation, information architecture and layout searching (Jacob and Karn 2003; Aula, Majaranta and Raiha 2005). Eye tracking requires advanced equipment that can unobtrusively measure eye movement without interfering with users' mental processing (Pool and Ball 2006) and without requiring users to articulate their opinion (Bednarik and Tukiainen 2006; Bojko and Stephenson 2005). Eye tracking provides insights into what attracts the eye in website design and where problems areas occur (Dix et al. 2004). Problems associated with the use of eye tracking are infrastructure and cost (Ssemugabi and de Villiers 2007).

4.3.2 Expert-focused

The following two UEMs, namely: heuristic evaluation and cognitive walkthroughs, are examples of expert-focused evaluations.

4.3.2.1 Heuristic evaluation

Heuristic evaluation (HE) is a method that involves the evaluation of an interface against 'rules of thumb' or heuristics. These rules, or criteria, are often derived from collections of interface guidelines (Cockton, Lavery and Woolrych 2002). The most widely used heuristics for evaluation are Nielsen's (1994b) set of ten classic heuristic principles. Nielsen derived these from a database of 249 usability problems obtained from evaluations of eleven interactive systems. See Table 4.3 in Section 4.5 for the complete list of Nielsen's heuristics.

Heuristic evaluation is conducted mainly during the development phase, but can also be effective when used on operational systems (Nielsen 1992; Peng Ramaiach and Foo 2004).

Heuristic evaluation is discussed in more detail in Section 4.5, since it is one of the methods used in this study.

4.3.2.2 Cognitive walkthroughs

This technique involves a team of evaluators stepping through the defined tasks of a website to uncover the processes and workflow flaws and inconsistencies (Wei-siong, Liu and Ram 2009). Walkthroughs require a detailed review of a sequence of actions, but do not involve interaction with an actual operational system. In a code walkthrough, the sequence represents a segment of the computer programming code that is stepped through by the reviewers to check certain characteristics. The evaluators then step through the associated action sequence to check it for potential usability problems in user interactions. The main focus of the cognitive walkthrough is usually to establish how easy a system is to learn (Dix et al. 2004).

Dix et al. (2004) state that in order to conduct a cognitive walkthrough, the evaluator needs four items of information, namely:

1 A specification or prototype of the system.
2 A description of the task/s that users are to perform on the system.
3 A comprehensive list of the actions needed to complete the task with the proposed system.
4 An indication of who the users are, and what kind of experience and knowledge the evaluators can expect them to have.

The results from cognitive walkthroughs are documented and a record is kept of what is satisfactory and what needs improvement.

The following sections discuss in detail the two evaluation methods that will be used to conduct this study, namely, usability testing – a user-based method, and heuristic evaluation – an expert method.

4.4 Usability testing

Usability testing (UT), which is briefly outlined in Section 4.3.1, is described in detail here as one of the two methods applied in the research design of this study. UT is one way of making sure that the intended product or system is appropriate for the actual users and their goals, and that no negative outcomes result from using it (Bastien 2010). The UT approach measures: how easy a product is to use; its visual consistency and load; and the users' overall

perception of their experience with the products (ISO 9241-11 1998). Sharp et al. (2007, p. 646) define usability testing as 'an approach that emphasizes to what extent a system is usable'.

It entails certain quantitative aspects with the goal of measuring the degree to which a system is effective, efficient and satisfying:

- Effective: does the system do the tasks for which it was designed?
- Efficient: how much effort is required to use the system in order to achieve those tasks?
- Satisfaction: do users have a positive response when using the system? (Bastien 2010).

Factors that may affect website usability include: navigation, information architecture, language, aesthetics and visual appeal, and page structure and layout (Gardner 2007). Furthermore, designers need to take into consideration that users are from different disciplines and may have very different needs when it comes to the information they expect from the website (Du Toit and Bothma 2009).

Deciding how many users to recruit as participants in a study has practical, economic, and scientific implications. The aim of inviting users to a usability test is to find the most design flaws on a user interface at the lowest possible cost (cost of users, cost of observers, cost of laboratory facilities) (Lewis 2006). In the nineties, the view was held that with four or five users, 80–85% of the usability problems of an interface could be uncovered (Nielsen and Landauer 1993; Virzi 1990; Virzi 1992). However, a study conducted by Spool and Schroeder (2001) on an extensive website showed that they would need considerably more than five users to find 85% of the usability problems. Another study conducted by Hwang and Salvendy (2010) claims that 10±2 (between 8 and 12) evaluators are needed to find around 80% of the usability problems.

4.4.1 What does usability testing involve?

Usability testing involves measuring typical users' performance on pre-defined tasks in a controlled environment by placing the product in a usability laboratory where users are asked to perform various tasks from a pre-defined list. Users' performance while doing these tasks are observed and measured by a researcher, but users are assured that it is the system that is being judged, not them. A useful method that can be used when observing users in a

controlled environment, is the thinking-aloud method. This involves users stating their thinking process out loud as they undertake various tasks on the system or website. The advantage of thinking aloud is that testees may offer a lot of information, including the details of their cognitive processes and behaviour patterns, as well as reasons why they do what they do (Fang 2008). Data is collected using a combination of methods, for example, data recording which includes taking notes, audio recording, taking photographs and video recording.

4.4.2 Steps taken in a usability test

Lewis (2006) states that planning a usability test requires the following steps:

1. Define the test objectives.
2. Recruit users who represent the target market.
3. Select the tasks to be conducted.
4. Create task scenarios.
5. Decide how tasks will be measured and recorded.
6. Prepare the test plan, satisfaction questionnaire, data analysis procedure and the usability laboratory.
7. Conduct the usability test with users from the target group.
8. Capture and analyse the results.
9. Present and communicate the test results.

This section will discuss the usability steps in more detail:

1. **Define the test objectives**

   Usability testing is conducted by companies and other organisations for a number of reasons such as benchmarking the performance of users on their websites, and comparing the system to its competitors. In order to achieve these objectives, usability engineers need to gather two types of data, quantitative and qualitative. In the former case, the time is recorded that it takes users to complete the task, as well as aspects such as the number of errors and the time users take to recover from errors. In the latter case, the kinds of errors they make are noted (Rubin 1994).

   Quantitative objectives

   - Are the users able to complete the tasks successfully?
   - Number of errors made during tasks.
   - Time taken to complete tasks.

- Number of clicks made in order to access particular products or functionality.
- How easy is it for users to find what they are looking for?

Qualitative objectives

With regards to navigating the system:

- Does the navigation structure support users in finding the content they are seeking?
- Establish how users navigate in order to:
  - Complete tasks.
  - Discover the system.
- Does the system provide alternative navigation options?
- Is it easy for users to manoeuvre between related pages and between different sections?
- What kinds of mistakes do users make?
- Are the links within the content area obvious to the user and is the colour of the links standard throughout?
  - Is the language and terminology of the navigational headings easy to understand?

2. Recruit representative users

The sample of users recruited must be a heterogeneous group, representing the user population for which the product is targeted. They should have a range of age levels, experience, and should come from different cultural groups (Sharp et al. 2007). Table 4.1 lists factors that distinguish the users of an e-commerce system (Rubin 1994, p.120).

Table 4.1 User factor table for an e-commerce system (Rubin 1994, p.120), (customised to the South African situation by the researcher)

Factor	Grading and Related Characteristics
Age	**Group A:** 16 –24 **Group B:** 25–34 **Group C:** 35 and older

Factor	Grading and Related Characteristics
E-commerce Experience	**Low:** User browses and purchases once in a while. **Medium:** User browses frequently and makes purchases two or more times annually. **High:** User frequently makes purchases over the internet (weekly shopping, presents, etc).

Internet Experience	**Novice**
	• Makes use of the Internet less than twice a week.
	• Makes use of the Internet for no more than:
	  ○ browsing;
	  ○ e-mail.
	Expert
	• Makes use of the Internet more than twice a week.
	• Makes use of the Internet for:
	  ○ browsing,
	  ○ e-mail,
	  ○ shopping,
	  ○ downloading and
	  ○ banking.

Language	**English** **Afrikaans** **African languages**

3. **Select tasks**

   The tasks selected need to represent the objective of the project (Rubin 1994), for example, in order to evaluate the efficiency of an e-commerce website, tasks may include:

   - Task 1: Find a product
   - Task 2: Compare certain products
   - Task 3: Purchase the product
   - Task 4: Investigate after-sale support
   - Task 5: Complete a satisfaction questionnaire.

4. **Create task scenarios**

   Task scenarios need to represent real life scenarios and must not prompt the users or guide him/her directly to the correct route (Rubin 1994). Following are two examples of task scenarios:

- Find a book: The evaluator can commence a session by asking the users where their interest lies, and then the users explore the site to access the book that they require.
- Find a cell phone contract, assuming that a certain user makes most of his/her calls during the day.

5. **Decide how tasks will be measured and recorded**

   There are three common data recording techniques: observing and taking notes, audio recording, and video recording. Table 4.2 below describes and compares these techniques (Sharp et al. 2007, p. 297).

Table 4.2 Data gathering techniques (Sharp, Rogers and Preece 2007:297)

Data recording technique	Equipment and description	Advantage	Disadvantage
Notes	Pen, paper. Least technical means of recording the data.	Inexpensive and very flexible. Rich feedback can be produced.	Captures only the notes that the evaluator thinks are important.
Audio recording	Handheld recorder. Better than taking notes and less intrusive than video.	Allows the evaluator to concentrate on the users' performance rather than trying to take notes.	Transcribing of the data is time consuming.
Video recording	Video. Most complete technique of collecting data.	Captures both visual and audio data.	If the camera is not positioned properly, it is easy to miss aspects situated beyond the camera view.

6. **Prepare the test plan, satisfaction questionnaire, data analysis procedure and the usability laboratory**

   Test scripts need to be prepared for every user. This documentation should include all the instructions and tasks to be completed (Rubin 1994). The list below presents the standard sequence of a test plan:

   - **Background questionnaire**: involves questions on demographic issues to ensure that users represent the target audience.
   - **Pre-test questionnaire**: captures users' previous experiences with the system (if any), their likes and dislikes and expectations.

- **Performance tasks**: in this step, users are required to undertake and complete the tasks.
- **Post-test user experience questionnaire**: usually involves a satisfaction questionnaire to capture users' overall thoughts when interacting with the system.

7. Conduct the usability test with appropriate ethical procedures

Most usability tests conducted in a laboratory have a two-hour duration. Longer tests are not recommended, because users may get bored and tired; they may tend to say things merely for the sake of getting the test over. Before conducting a usability test, it is important to inform users that it is the system that is being tested and not them personally (Rubin 1994). Furthermore, it does not matter if they make mistakes; in fact, when users make errors, it helps the researcher in evaluating the system. Sharp et al. (2007) provide ethical guidelines to protect users' rights:

- Users need to be told the goal of the study.
- Users should be informed that their personal information is confidential and will not be disclosed.
- Users may withdraw from the session at any time.
- Token incentives are often provided, such as small financial gifts or meal vouchers or gift tokens.
- Evaluators must request users' permission to quote them, or quotations must be anonymous to preserve privacy.
- Informed consent forms should be signed by users prior to the test sessions.

8. Capture and analyse the results

As explained, two kinds of data are captured and analysed: quantitative and qualitative data. A common capturing tool is an electronic spreadsheet, in which the answers can be captured in rows and columns. Before capturing the data, it must be decided how the data will be presented. The spreadsheet should consist of all the answers, as well as the averages and percentages. There are three types of averages: mean, median and mode. Mean refers to the commonly understood arithmetic average; median is the middle value of the data when the numbers are ranked; and the mode is the number that occurs the most (Sharp et al. 2007). Once all the data has been captured, graphic representations can be created using diagrams and graphs. In order to confirm data, the video recordings can be re-viewed.

9. **Present and communicate the test results**

   Common methods of presenting results are PowerPoint presentations or reports. PowerPoint presentations generally include a summary of the results highlighting the key findings. The report should contain a detailed description of all the tasks.

4.4.3 Advantages of usability testing

Usability testing is good for investigating issues such as the following (Barrington 2007; Kantner and Rosenbaum 1997):

- Obtaining users' preferences on which designs they prefer and why.
- Determining what problems users encounter when performing tasks.
- Identifying problems or mistakes in the system or website.
- Discovering how long it takes users to complete tasks.
- Comparing the performances of a user on different products.

Moreover:

- By observing end users, usability testing exposes problems that are difficult to anticipate (Cockton et al. 2002).
- Usability testing can be used throughout the product development life-cycle. Of all the evaluation methods, the findings of UT have the most credibility with developers (Dumas 2003).

4.4.4 Disadvantages of usability testing

- Usability tests are very expensive to set up because they are conducted in specialised laboratories, using sophisticated equipment that enables facilitators to log user activities, video-record sessions, and interact with users (Gardner 2007).
- Most usability tests are conducted at the end of the product development life cycle. Changing a website or software system based on the usability testing results, may have an impact on the budget and timeframes of the project (Gardner 2007).
- Usability testing is a lengthy procedure because of the need to recruit users with profiles that match the target audience for the website (Kantner and Rosenbaum 1997).
- Processing and analysing the data is complex and time-consuming. It is very difficult to gain reliable data from laboratory test sessions within less than three weeks from the date of sessions and, in fact, the time before the results of many laboratory tests

are available is often considerably longer than three weeks (Kantner and Rosenbaum 1997).

4.5 Heuristic evaluation

Heuristic evaluation is undertaken by expert evaluators who review a system based on a set of usability principles or criteria known as heuristics, in order to determine whether the system complies with those heuristics, and to identify possible usability problems in the system (Ssemugabi and de Villiers 2007). Heuristic evaluation (HE), which is briefly outlined in Section 4.3.2, is described in detail here as one of the two methods applied in the research design of this study. HE is a commonly used UEM for computer system interfaces because it is quick, inexpensive, and good at achieving broad coverage of a whole user interface, although it may miss some complex issues (Ssemugabi and de Villiers 2007; Barrington 2007). Delice and Gungor 2009 define heuristic evaluation as a process in which a small set of evaluators judge whether each task element in a system conforms to established usability principles. For each evaluation, it must be decided how many evaluators to recruit. Albion (1999) recommends the use of 3 to 5 evaluators to ensure identification of about 75% of usability problems in a project. Nielsen and Molich (1990), found that 3 to 5 evaluators in an aggregate would be able to detect about two third of the usability problems. Furthermore, Nielson (1994b) recommends the use of five evaluators, but not less than three.

Heuristic evaluation is mainly conducted during the development phase, but can also be very effective when used on real, operational systems (Nielsen 1992; Peng, Ramaiach and Foo 2004).

4.5.1 Heuristics

This section presents two examples of classic sets of heuristics. Table 4.3 provides Nielsen's recommended ten heuristic principles from 249 usability questions (Nielsen 1994b, p.686). In Table 4.4, following immediately after Table 4.3, ten research-based heuristics by Powals (1996) are given. The ten heuristic principles recommended by Nielsen are the most well-known and frequently applied heuristics for software product evaluation. Powals' ten research-based heuristics are similar to those of Nielsen, but take a more holistic approach to evaluation (Powals 1996, pp.189-211).

Table 4.3 Nielsen's ten classic heuristic principles (Nielsen 1994b, p.686)

	Heuristic	Description	Observation
1	Visibility of system status	The system should keep users continually informed on where they are in the environment. In all situations, appropriate feedback should be provided to users within a reasonable timeframe.	Users performing tasks should know exactly where they are and where they can go next. The branding and labelling should be obvious to indicate to users which section they are in.
2	Match between system and the real world	The terms, phrases, analogies and concepts used, should be familiar to the user, and appear in logical order.	In cases where English is not the first language of many users, different language options should be provided.
3	User control and freedom	There should be clearly marked and highly visible exit points, so that users can choose to leave the unwanted state without working through extensive dialogue. This should also permit early exit without completing a task.	Exit buttons should be clear, and the application should support user control. There should be some freedom, allowing users to conduct certain activities in ways they prefer.
4	Consistency and standards	Words, situations and action need to be consistent throughout the application.	Wording, navigation menus and icons should be used consistently throughout the site.
5	Error prevention	The design should prevent a predicament from occurring.	In case of predicaments, the application should prevent users from making errors.
6	Recognition rather than recall	Objects, actions, options and instructions should be visible or easily retrievable whenever appropriate.	Users need to recognize where they are in the application by looking at the current page.
7	Flexibility and efficiency of use	The system needs to cater for both inexperienced and experienced users, as well as provide functionality in order to speed up interaction.	There should be quick links to frequently-used information.
8	Aesthetic and minimalist design	Dialogues should not contain information which is irrelevant or rarely needed.	Irrelevant information on the application that may distract the user, should be avoided.
9	Help users recognize, diagnose, and recover from errors	Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	Every error message should offer a solution that is clearly written in language that is familiar to the user.

	Heuristic	Description	Observation
10	Help and documentation	Information should be easy to search, indicate to users the number of steps to be carried out if it is a wizard or a form, and not be too long.	If the task is complex in nature, the application should offer sufficient information to assist users in achieving their goals.

Table 4.4 Ten research-based heuristics (Powals, 1996, pp.189-211)

	Heuristic	Description
1	Automate unwanted workload	• Free cognitive resources for high-level tasks. • Eliminate unnecessary thinking, i.e. mental calculations, estimations and comparisons.
2	Reduce uncertainty	• The data that is displayed should be clear and consistent.
3	Fuse data	• Reduce cognitive load by integrating lower-level data in a higher-level summation.
4	Present new information with meaningful aids to interpretation	• Use a familiar framework that makes it easier to absorb information. • Use everyday terms, metaphors, etc.
5	Use names that are conceptually related to function	• Provide aids that facilitate recall and recognition
6	Group data in consistently meaningful ways to decrease search time	
7	Limit data-driven tasks	• Reduce the time spent assimilating raw data. • Make appropriate use of colour and graphics.
8	Include in the displays only that information which is needed by the user at a given time.	
9	Provide multiple coding of data when appropriate.	
10	Practise judicious redundancy.	

4.5.2 What does heuristic evaluation involve?

HE's are generally conducted independently by the experts; each evaluator inspects the interface and interaction alone to identify usability problems. After the evaluation session, each evaluator can be provided with a severity rating questionnaire, on which is listed the complete set of usability problems that were discovered. All the evaluators can then rate the severity of each problem (Delice and Gungor 2009). In the majority of usability evaluation projects, the budget does not always permit fixing of all the problems. Hence the concept arose of a severity rating list for usability problems, which can help developers to determine the major needs and to set relative priorities for problems to be fixed within a stated budget and timeframe (Nielsen 1994b). The severity rating of a usability problem is determined by a number of factors (Delice and Gungor 2009). Nielsen defined the severity of a usability problem as a combination of three factors: frequency, impact and persistence (Nielsen 1994b).

- **Frequency** with which the problem occurs: Is it common or rare?
- **Impact** of the problem on the system if it occurs: Will it be easy or difficult for the users to overcome?
- **Persistence** of the problem: Is it a one-time problem that users can overcome once they know about it or will users repeatedly be bothered by the problem?

Severity rating is not undertaken in every HE. However, when severity ratings are obtained from all the evaluators, it increases the reliability of the results. The following 0–4 rating scale can be used to rate the severity of usability problems (Nielsen, 1994b).

- 0 Not a usability problem at all;
- 1 Cosmetic problem only: need not be fixed unless extra time is available;
- 2 Minor usability problem: fixing this should be given a low priority;
- 3 Major usability problem: important to fix: it should be given a high priority; and
- 4 Usability catastrophe: imperative to fix before product can be released.

4.5.3 Advantages of heuristic evaluation

- HE's are a quick, inexpensive method and feedback can be obtained early in the design process (Nielsen 1994b).
- Expert evaluators can produce high-quality results in a fairly short time, because the method does not involve detailed reporting or time-consuming recruitment of users (Kantner and Rosenbaum 1997).

- HE can enable usability improvements and enhancements before the release of a project and can be an excellent investment of usability resources (Kantner and Rosenbaum 1997).
- Without prior heuristic evaluation, end users may spend considerable time struggling with a usability problem while some other usability problem may be 'masked' by the first problem and not found during the usability test. This can be addressed by a two-phase approach that is consistent with current iterative software development practices. For example, an HE can take place on an early prototype, while laboratory testing can follow at a later stage (Kantner and Rosenbaum 1997).

4.5.4 Disadvantages of heuristic evaluation

- Factors such as: evaluator training on the system, task coverage, problem extraction and description may have an effect on the evaluation because HE relies strongly on the skills and experience of the evaluators (Hvannberg, Law and Larusdottir 2007).
- Even though the evaluators are experts they remain surrogate users and not typical users of the website (Kantner and Rosenbaum 1997).
- Real users often experience problems that are unexpected, therefore heuristic evaluation should not replace studies involving actual users, since HE does not necessarily indicate which problems users will encounter most frequently (Kantner and Rosenbaum 1997).
- Nielsen (1994b) states that using this type of evaluation to identify usability problems can be difficult. Research shows that it may result in only a 50% hit rate, and a 20% miss rate, because results are not based on observations of user behaviour. An HE can result in the making of recommendations to the system that are not actually required.
- Cockton et al. (2002) state that HE is limited in its support for analyst preparation and recommendation generation.

Väänänen-Vainio-Mattila and Wäljas (2009) state that specific and additional heuristics appear to be needed for the following areas of service:

- Usability: service navigation and presentation.
- Safety, trust and privacy.
- Content creation for user's own consumption.
- Support for cost-awareness.
- Unobtrusive presentation of advertisements.

The following section discusses aspects to be considered in evaluating e-commerce systems.

4.6 Aspects to be considered in evaluating e-commerce systems

Finstad (2010, pp. 323-327) conducted a study on what he termed the 'usability metric for user experience (UMUX) for the subjective assessment of an application's perceived usability'. Although this is a proposed way of measuring UX, the metrics were organized around the International Organisation for Standardisation (ISO) that defines usability as: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context' (ISO 9241-11 1998).

Criteria embodied in UMUX to measure user experience include the following questions:

- Do the site or system capabilities meet my goals?
- Is using this site or system a frustrating experience?
- Is this site or system easy to use?
- Does the site or system require users to spend a lot of time completing tasks?

Results from applying UMUX indicate that this usability metric for user experience is a reliable and valid metric, and adequate as a standalone subjective usability metric to measure user experience effectively and efficiently (Finstad 2010, pp. 323-327). This again raises the issue of the uncertain relationship between usability and UX as shown in Figures 3.4 and 3.5. Nevertheless UMUX is highly relevant to the present study and is in harmony with the researcher's stance portrayed in Figures 3.6 and 3.7, which show usability and UX as overlapping concepts.

Evaluations are characterised by two primary top-level attributes, namely, the evaluation method and the evaluation criteria. The two methods selected for use in this evaluation study have been described in Sections 4.4 and 4.5.

This section presents lists of attributes that have bearing both on the usability testing (UT) and heuristic evaluation (HE), and can be considered when determining criteria to be used by the experts undertaking HEs and in designing the post-test questionnaire for users in the UT. Apart from the distinction between qualitative and quantitative aspects, there are numerous other usability attributes that impact on websites.

Table 4.5 following, lists attributes related to usability, namely: information architecture; value of content; structure of content; user experience; and aesthetics and consistency.

Table 4.5 Usability attribute that characterise websites (synthesised by the researcher)

Information Architecture	• Is the grouping of information on the system logical and does it make sense to the user? • Is information located where users would expect it to be? • Does the intra-page navigation work effectively and logically?
Value of Content offered	• Does the content support the user's goals and objectives? • What stands out within the content areas? • Is the content of value to the user? • Are the categories over-complex, requiring simplification?
Structure and layout of the content	• How well does the structure of the content support users in what they are trying to achieve? • Does the content design and functionality, such as scrolling and drop-downs, hinder usage in any way?
User satisfaction	• Do users enjoy using the product or system? • Are users satisfied with the overall offering, layout and functionality?
Aesthetics and consistency	• What are users' thoughts with regard to the branding on the pages? • Are there particular aspects that users like or dislike with regard to the look and feel of the pages? • What are users' perceptions regarding the tone, use of graphics, colour, graphical intensity and readability on pages?

This section has discussed the usability evaluation methodologies to be applied in this study. The next section compares the two evaluation methodologies and provides examples of previous studies that have combined these two evaluation methods.

4.7 Usability testing and heuristic evaluation

Usability and user experience play a vital role in the context of application usage. They should be emphasized in evaluations and become an inherent design characteristic and requirement (Rexfelt and Rosenblad 2006; Latorella and Prabhu 2000; Gramopadhye and Drury 2000). The questions facing usability engineers are to determine what constitutes a

well-designed site, and how e-commerce sites should be evaluated. This chapter has described various usability evaluation methods that have been developed and applied in the design and development of computing systems and websites. Among these techniques, user testing and heuristic analysis are two of the most common (Tan, Liu and Bishu 2009). Using both usability testing and heuristic evaluation in tandem is an optimal cost effective and practical approach to usability evaluation. As stated in this chapter, expert evaluation using heuristics is quick, inexpensive, and good at achieving broad coverage of the entire user interface, but may miss some complex issues. Usability testing is good for identifying problems that emerge in detailed aspects of system use (Barrington 2007).

4.7.1 Comparison and combination of usability testing and heuristic evaluation

Both usability testing and heuristic evaluation methods provide valuable insight on usability problems in the early stages, during, and at the end of the product development life cycle. UT is scenario-based and relies on the experience and comments of real users. It is usually conducted in a controlled environment. The analysis process is complex and time-consuming. UT is used more to evaluate finished products than to investigate potential problematic issues (Tan, Liu and Bishu 2009). HE, on the other hand, is a usability inspection technique originated by Nielsen (1992; 1994b), which relies on expert evaluators to assess whether a website complies with standard usability principles or heuristics. It is a widely used UEM for computer system interfaces due to its low cost and fast turnaround time (Ssemugabi and de Villiers 2007).

Several studies combine two evaluation methods, HE and a user-based method such as UT, and compare the results. Very few studies indicate that UT should be used as the only evaluation method. Most of the findings indicate that both UT and HE should be used in a usability study, because they have different strengths.

This section will discuss these strengths.

UT strengths:

- Usability testing involves the actual users of a system and identifies the problems they encounter (Cockton et al. 2002).
- Usability testing is appropriate as the main evaluation method for usability evaluations, because it addresses the difficulties, or likelihood of making errors, as aspects of overall usability (Liljegren 2006).

HE strengths:

- Ssemugabi and de Villiers (2007) conducted a study on an educational website, which involved four experts in a heuristic evaluation and 61 learners as end users in a questionnaire survey. The findings indicated that the results of the experts' evaluation were better than the user-based survey results, although they were produced by only four experts compared to 61 learners. In total, the experts identified 58 problems compared to the learners' 55. These findings indicate that heuristic evaluation, if conducted by a competent and complementary group of experts, is an efficient, and highly effective UEM.
- Adebesin, Kotzé and Gelderblom (2010) undertook a study using the two evaluation methods: heuristic evaluation and a field usability study among end users. The results indicate that the heuristic evaluation exposed a large number of usability and accessibility problems, some of which could be classified as low-severity problems. The field study showed additional problems that affected the successful completion of user tasks. Therefore, the heuristic evaluation method can be optimized by combining it with another method that involves user participation.
- Nielsen and Mack (1994) conducted a study to uncover usability problems in a complex telephone company application. They combined HE with UT and the study showed that seventeen common problems were found. HE, however, found further twenty three unique problems while UT identified four unique problems.
- De Kock, van Biljon and Pretorius (2009) investigated the application of HE and UT, supported by eye tracking (UTE), to the website of a learning management system with the intent of discovering the difference in the usability information yielded. HE identified 53 problems in comparison to the 25 identified by UTE. Considering Law and Hvannberg's (2004) criteria of validity and thoroughness, it appeared that HE was more thorough in terms of covering all problems at a meta-level. On the other hand, UTE performed better on evaluating the surface level and page-level problems and in proving validity by triangulation of the objective and subjective measures.

Findings of the two approaches do not always correspond. Thompson and Kemp (2009) used both UT and HE to evaluate three Web 2.0 sites. The aim of their study was to determine whether the results of the HE accurately reflected the experiences and opinions of actual end users. The results from the HE showed that the three sites failed in some aspects. However, the UT results indicated that users found the sites easy and logical to use and believed that

their needs had been taken into account during the design process. Overall, the results from this study show that findings of heuristic evaluations do not always reflect the opinions of the users. An explanation for this is that highly sensitive experts may notice issues that, although they are potential problems, do not actually disturb end users, who learn to work around them.

Fernandez, Abrahão and Insfran (2010) found that there is a lack of empirically validated usability evaluation methods that can be utilized during the early stages of Web development processes and have proposed a Web usability evaluation process (WUEP) which can be integrated into model-driven Web development processes (MDWD). This was designed in order to evaluate the effectiveness, efficiency, perceived ease of use, and satisfaction with WUEP in comparison with the widely-used inspection method of heuristic evaluation. Results showed that WUEP was more effective and efficient than HE in the detection of usability problems in artefacts obtained from a model-driven Web development process.

Combined evaluation methods strengths: UT and HE:

- ***Timing of evaluation***:

  Tan, Liu and Bishu (2009) compared the quantity, severity, and type of usability problems discovered by both methods and suggest that it is appropriate to use both user testing and heuristic analysis in a usability study, because they have different strengths. Heuristic evaluation should be used early in the product development process where feedback can be used to create a design standard for the rest of the development, while UT should be conducted at a later stage to directly assess the usability issues most relevant to users.

- ***Combinations of UEMS***:

  The best evaluations of a user interface come from applying multiple evaluation techniques (Jeffries et al. 1991; Desurvire, Kondziela and Atwood 1992). Both these groups of researchers, 20 years ago, established that the best possible approach is to conduct UT and HE in different stages of the user interface design process because the two methods tend to identify very different and specific types of problems. Martim, Herselman and van Greunen (2009) found that the expert reviews combined with usability testing results assisted in the design of guidelines for developing usable e-commerce websites.

- ***Types of problems identified***:

  With the foundation of prior HEs, usability testing can focus on detecting potential new usability problems resulting from the revised design, paying attention to basic problems as well (Kantner and Rosenbaum 1997). Overall, the study suggests that HE identifies more problems than UT and confirms that laboratory testing should be preceded by heuristic evaluation. As stated previously in this section (de Kock, van Biljon and Pretorius 2009), HE covers all problems at a meta-level, whereas UT evaluates problems at surface level and page-level.

- ***Scope of the evaluation***:

  Finally, it should be noted that HE provides the freedom to explore an entire user interface, whereas UT is based on a well-developed but restricted test plan, and is conducted in a controlled environment (Sharp et al. 2007).

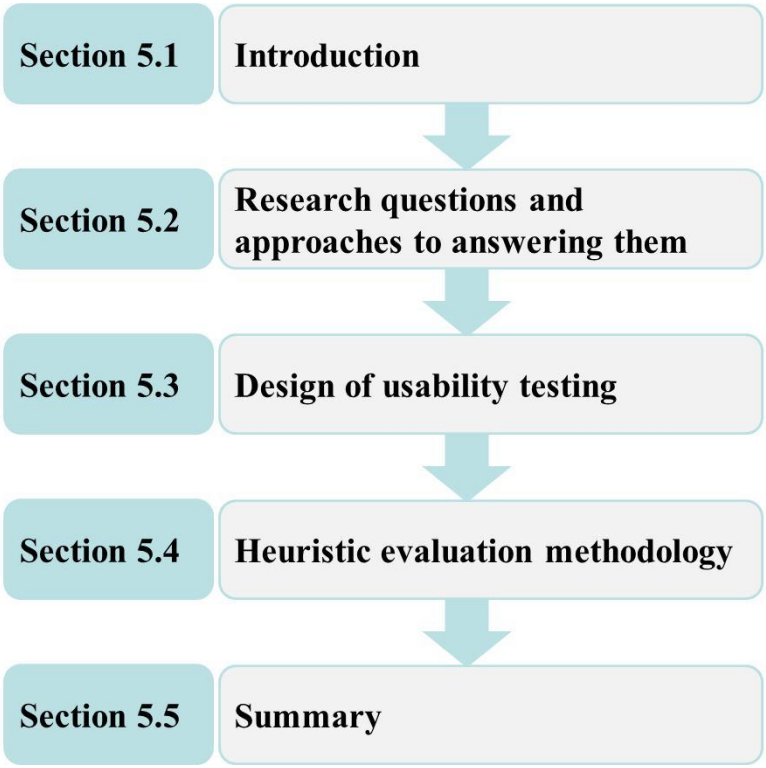
4.8 Summary

Any computing products, including e-commerce websites, must be usable to ensure that they meet the user's needs. The attainment of sound usability and good user experiences can be supported by evaluating websites and other software products. The role of evaluation is to enhance understanding of particular needs during the development and use of the product, where evaluation is the process of systematically collecting and analysing data to establish the experiences and likely problems of the target users in using a product. This chapter overviewed various usability evaluation methods, focusing in particular on those used in this study, namely heuristic evaluation and usability testing.

In order to maximise the value of usability evaluation studies, a dual approach can be used combining two UEMs, as was done in the present study which applied UT and HE (see Chapters 5 and 6). The two methods are complementary in identifying different kinds of problems. Moreover, this approach obtains the expertise of both expert evaluators and end users. Together UT and HE can provide in-depth analysis of websites and other software applications. UT is recommended at the end of the product development lifecycle on a fully operational system, while HE is recommended early in the development lifecycle as well as at the end.

The next chapter, Chapter 5, discusses the research design and methodology used for this study.

Chapter 5: Research design and methodology



Chapter 5: Research design and methodology

5.1 Introduction

This chapter details the research design and methodology used to conduct the present study, which aims to determine how the usability of e-commerce websites supports the user experience of users. To implement an evaluative study, *research methods* and *evaluation criteria* are required. In this study the usability evaluation methods applied are usability testing (UT) and heuristic evaluation (HE) for which ethical clearance was obtained. The ethical clearance document is provided in Appendix D. The evaluation criteria are extracted from literature studies in Chapters 2 and 3.

A limitation to UT is that most usability tests use sophisticated equipment in specialised labs, which can be expensive (Gardner 2007). However in the present study such facilities were available to the researcher at her workplace at no cost. A limitation to HE is that it relies strongly on the skills and experience of the evaluators, who may require training (Hvannberg, Law and Larusdottir 2007). It is important to recruit appropriate experts for the system or site being evaluated. In this study, the researcher had appropriate contacts and experienced no difficulty in recruiting competent expert evaluators. Both UT and HE methods can provide valuable insight on usability problems at the beginning, during, and at the end of the product development life cycle, but in this study, the evaluations were conducted on operational systems.

Section 5.2 presents the research questions introduced in Section 1.3, but elaborates by outlining how the answers will be obtained. Table 5.1 maps each research subquestion to the chapter in which it is addressed, and explains the way in which it will be answered. Sections 5.3 and 5.4 respectively describe how UT and HE are implemented in this study. Both sections list the evaluation criteria used and provide references to the literature sources from which the criteria were extracted.

5.2 Research questions and approaches to answering them

The goal of this study was to determine how the usability of e-commerce websites supports user experience of e-commerce by users, as well as what design guidelines can facilitate the design, development and re-engineering of e-commerce websites towards promoting user experience.

The main research question for this study was:

How can the findings of a dual-method usability evaluation of e-commerce websites contribute to the attainment of better user experience?

This main research question gave rise to the subquestions that are outlined in Table 5.1. Table 5.1 maps each research subquestion to the chapter in which it was addressed, and explains the way in which it was answered

Table 5.1 Mapping of subquestions to location and methods

	Subquestion	Location in dissertation	How this was achieved?
1	**How can the usability of an e-commerce site be measured?**	Literature study (Chapters 2, 3) Criteria presented (Chapter 5)	Criteria were identified by conducting a study of existing literature. This provided information on ways to measure usability.
2	**How can user experience of an e-commerce site be measured?**	Literature study (Chapters 2, 3) Criteria presented (Chapter 5)	Criteria were identified by conducting a study of existing literature. This provided information on ways to measure user experience.
3	**What do the findings of usability evaluation by a dual-method approach indicate about the usability and user experience of four different websites?**	Usability testing (Usability testing is explained in Chapter 4.)	Some of the criteria from the literature, established in answers to Questions 1 and 2, were used in questionnaires and interviews with a sample of end user participants, as part of the usability testing (UT) sessions. Other information from Chapter 4 was used to define the specific performance measurements for the formal testing procedures in the controlled laboratory environment.
		Findings of an evaluation by UT (Chapter 6, Section 6.2)	The purpose of UT and the associated UT questionnaire was particularly to determine the problems and preferences identified by users as they interacted hands-on with the target system, performing specified tasks.
		Findings of a post-test UX (Chapter 6, Section 6.3)	Once the users had performed the required tasks in the UT, a post-test user experience questionnaire was used to capture their feelings and perceptions, with a view to identifying negative or positive emotions participants encountered while performing tasks on the websites.

	Subquestion	Location in dissertation	How this was achieved?
		Heuristic evaluation (Heuristic evaluation is explained in Chapter 4) Findings of an evaluation by HE (Chapter 6 Section 6.4)	Criteria from the literature were used as heuristics in the evaluation of the target websites. The HE was conducted by expert evaluators, who reviewed the sites using a set of usability principles known as heuristics, to determine whether it complied with these heuristics, and to identify possible usability problems. HE is the most popular UEM for computer system interfaces, because it is quick, inexpensive, and good at achieving broad coverage of a whole user interface. However, it may miss certain issues, and is best when it is combined with a user-based method. Three categories of heuristics were employed in the HE: • General interface design heuristics; • E-commerce design heuristics; and • User experience design heuristics.
		Comparison between findings of UT and HE (Chapter 6, Section 6.5, Tables 6.31, 6.32)	A study was undertaken of the correspondence between usability problems identified by end user participants in the UT and by experts in the HE.
4	**What aspects of the usability of an e-commerce site impact the user experience offered by that site?**	Consolidation of usability testing and heuristic review findings (Chapter 6, Section 6.6, Table 6.33)	The study has both breadth and depth – breadth due to evaluating four e-commerce sites and depth, because two different evaluation methods were used. The purpose of this research question was to identify issues that relate to usability and user experience as encountered by participants in this study. Moreover, relationships between usability and user experience are explored, in particular, identifying aspects of usability that either support the experience of the user or that degrade the user experience.
5	**What design guidelines can facilitate the design, development and re-engineering of e-commerce websites towards promoting a good user experience?**	Synthesis (Chapter 7)	Following the identification of generic issues regarding usability and user experience, a set of guidelines was generated to facilitate the design, development and re-engineering of e-commerce sites in order to promote user experience.

5.3 Design of usability testing

Usability testing was described in detail in Chapter 4. This section explains how it is applied in this study. Dumas (2003) defines six characteristics of usability tests as listed below, while the seventh and eighth are obtained from Dumas and Redish (1999):

1. The focus is usability.
2. Participants are end users or potential end users.
3. There is an artifact to evaluate, which may be a product design, a system or prototype.
4. The participants think aloud as they progress through tasks.
5. Data is recorded and analysed.
6. The results are communicated to appropriate stakeholders.
7. Testing should cover the main features of the product.
8. Each participant should spend approximately two hours doing the given tasks.

The methodology and test plan were based on general methodologies for formal usability testing (Pretorius, Calitz and van Greunen 2005; Rubin 1994; van Greunen and Wesson 2002). The broad methodology involves the following steps:

- Set up objectives in line with research questions.
- Determine the aspects to be measured and the criteria.
- Formulate documents.

5.3.1 Participants

Twelve representative participants were recruited by the researcher. Each was tested on an individual basis in the usability laboratory at Aqua Online Usability Lab, Hyde Park, in a controlled environment. Aqua Online is a leading digital agency in South Africa that specialises in usability.

The participants were selected so as to be a representative sample of the target users in terms of the following characteristics:

- ***Gender:*** *50% split across the sample;*
- ***Language:*** *33% split across the sample - English, Afrikaans and African Language;*
- ***User type:*** *equal split across pre-paid, contract and small and medium enterprises (SME);*
- ***Network:*** *equal split across MTN, Vodacom, Virgin Mobile, and Cell C; and*
- ***Internet experience:*** *both novice and expert participants were recruited.*

Usability testing and particularly the analysis of the data are demanding and time-intensive processes. For this reason, usability studies are usually conducted with low numbers of participants. In line with the recommendation of Hwang and Salvendy's (2010), (see Section 4.4), 12 participants were recruited for this study, which is a relatively high number. UT is viewed as a qualitative approach, more than a quantitative approach. Because the e-commerce sites used for this study are the main telecommunication websites in SA, all dealing with the use of cellular phones, the participants were also chosen according to the different packages they used. The tables following present the user recruitment characteristics (Table 5.2), and the user classification table (Table 5.3), with a row for each of the twelve participants.

Table 5.2 User factor table

Factor	Participants	Grading and related characteristics
Age	3 3 3 3	**Group A:** Age = 18–24 **Group B:** Age = 25–34 **Group C:** Age = 35–45 **Group D:** Age = 46+
User Type	4 4 4	**Pre-paid:** The user is a pre-paid or top-up user (top-up is a contract that is capped, requiring users to purchase airtime once the contract amount is reached). **Contract:** Pays a monthly subscription **Small and medium enterprises (SME):** May be contract or pre-paid
Network	3 3 3 3	• MTN users • Vodacom users • Virgin Mobile users • Cell C users
Internet Experience	6 6	**Novice** • Has used the Internet for a year or less • Uses Internet less than twice a week • Uses Internet for no more than: browsing; e-mailing; gaming; chatting **Expert** • Has used the Internet for more than a year • Uses Internet more than twice a week • Uses Internet for: browsing, e-mailing, gaming, chatting, shopping, downloading and banking

Table 5.3 User classification table

Participant	Age	User Type	Internet Experience
1	Group A	Pre-paid	Novice
2	Group A	Contract	Novice
3	Group A	SME	Expert
4	Group B	Pre-paid	Novice
5	Group B	Contract	Expert
6	Group B	SME	Expert
7	Group C	Pre-paid	Novice
8	Group C	Contract	Expert
9	Group C	SME	Expert
10	Group D	Pre-paid	Novice
11	Group D	Contract	Expert
12	Group D	SME	Novice

Time frame

The duration of the test was two hours, including short breaks between the websites. The two hours excluded the orientation, background, pre-test and post-test questionnaires and interviews.

Ethical aspects

All participants in the usability testing sessions and heuristic evaluation were asked to complete a consent form indicating their willingness to take part and acknowledging that the results from this evaluation will be used for research purposes only. They also indicated their awareness that findings might be published in articles in research journals or papers in conference proceedings. It was made clear to participants that their identity and affiliation would not be disclosed.

5.3.2 Target systems

Participants were asked to perform the same set of tasks on each website. As stated in Chapter 1, the target websites used for this study were the main telecommunication websites in South Africa, namely:

- MTN (www.mtn.co.za)
- Vodacom (www.vodacom.co.za)
- Virgin Mobile (www.virginmobile.co.za)
- Cell C (www.cellc.co.za).

5.3.3 Test structure

The test structure consisted of the following main sessions:

- **Orientation**
  - Participants were familiarised with the test structure and the environment in which they were tested. The purpose of orientation was to help participants relax and to prepare them for the test session.
- **Background questionnaire**
  - Participants were required to fill in personal information, to ensure that they meet the criteria of their testing category. This ensures that the results are based on the correct characteristics for each user group (Table 5.2 User factor table).
- **Pre-test questionnaire**
  - Before participants were exposed to concepts within the test, their initial impressions and expectations of various concepts were assessed. This captured their uninfluenced benchmark impressions of the websites and companies, allowing for a measurement of changing impression.
    - **Task 1: Homepage assessment**
- **Performance tasks**
  - These tasks served as the core area of testing. Within this phase, participants were required to complete several tasks, involving the navigation, information architecture, structure and layout, content and overall interaction and perception of the site. User experience (UX) was measured by observing participants' performance, comments and facial expression, in order to identify any positive or negative emotions that they may have experienced while performing the required tasks, and what aspects of the website contributed to participants feeling those

emotions. Contributing factors to participants' performance may be good navigation, page layout, interactivity or supporting content.

- The specified tasks aimed to cover participants' main goals in coming onto an e-commerce website, namely:
  - **Task 2: Find a plan that will best suit your needs;**
  - **Task 3: Find an Internet package.**

- **Post-test user experience questionnaire**
  - After participants completed the tasks: 'Find a plan' and 'Find an Internet package', they were asked to complete a user experience questionnaire that captured their overall perceptions. Participants were asked to select and list the positive and negative emotions they had experienced while using each of the target systems. This recorded the participants' subjective feelings, and serves as a benchmark of impression (user experience questionnaire and interview). After completing the UX questionnaire, each participant was informally interviewed by the researcher regarding the reasons for the emotions that they had selected.

The relevant documentation for the data collection methods can be found in Appendix A and Appendix B.

5.3.4 Evaluation criteria

Participants' performances on the specified tasks were measured against the following aspects of usability (Table 5.4):

Table 5.4 Usability testing criteria

	Criteria	References
1	**Navigation** • Investigate users' interaction with the navigation structures. (Efficiency) • Establish whether it is convenient for users to manoeuvre among related pages, and between different sections? (Efficiency) • How quickly do users find what they are seeking? (Efficiency) • Test whether users can find the content that they are looking for. (Effectiveness) • Investigate the language and terminology of the navigational headings. (Efficiency) • Are the links within the content area obvious to the user and is the colour of the links standard throughout? (Efficiency) • Test the alternate navigation, finding out if users can navigate to the correct area if they get lost. (Efficiency) • Are hyperlinks clear or misleading? (Effectiveness)	ISO 9241-11 1998; Sharp, Rogers and Preece 2007; Nielsen 1994a; Chang and Chen 2009; Gardner 2007; Hassenzahl and Tractinsky 2006

	Criteria	References
2	**Information Architecture** • Determine whether the current navigational paradigm is logically structured and makes sense to the users. (Efficiency) • Test how quickly users find what they are looking for. (Efficiency) • Is information situated in the categories and sections that users expect it to be? (Effectiveness) • Does the site structure and layout hinder usage in any way? (Safety) • Does the intra-page navigation work effectively and logically? (Effectiveness)	Chang and Chen 2009; Gardner 2007; Martim, Herselman and van Greunen 2009; Hassenzahl and Tractinsky 2006
3	**Value of Content offered** • Does the content support the users' goals and objectives when they are coming to the website? (Satisfaction) • What are users expecting to see when they go onto the websites? (Satisfaction) • What stands out within the content areas? (Effectiveness) • Is the content of value to the user? (Satisfaction)	Zhao, Zou, Hawkins and Madapusi 2007; Sung 2006; Camus and Evans 2009
4	**Structure and layout** • Analyse the effectiveness of page layout, testing the way users read the page. (Effectiveness) • Investigate the performance of the content structure, how well does the content structure support the users' goals that they are trying to achieve. (Effectiveness)	Chang and Chen 2009; Gardner 2007
5	**User satisfaction** • Test user's perception of the websites. (Satisfaction and UX) • Understand what the user is experiencing when on the websites. (Satisfaction and UX) • Establish whether users enjoy being on the websites. (Satisfaction) • Determine whether they get satisfaction from what is available. (Satisfaction)	ISO 9241-11 1998; Sharp et al. 2007; Nielsen 1994a; Quesenbery 2003; Szymanski and Hise 2000
6	**Aesthetics and consistency** • Investigate brand effectiveness. • Establish the readability of pages. (Effectiveness) • Test the tone, use of graphics and colour and graphic intensity. (Effectiveness) • Investigate various standard aesthetic measures (balance, visual load, etc.). (Effectiveness and UX)	Sward 2006; Sharp et al. 2007; Blythe and Wright 2006; Hoffman and Krauss 2004; Hassenzahl and Tractinsky 2006
7	**Functionality** • Are the users able to locate the required functionality that is offered to them? (Effectiveness) • Test if the users can use the functionality offered to them. (Effectiveness)	Camus and Evans 2009; Zou, Zhang and Zhao 2007; Sharp et al. 2007

5.4 Heuristic evaluation methodology

Heuristic evaluation was described in detail in Chapter 4. This section explains how it is applied in this study.

5.4.1 Participants

In line with the approach advocated by Albion (1999) of using four evaluators (see Section 4.5), four expert evaluators were asked to participate in this study (see Table 5.5). They were required to conduct HEs on the target websites, according to the heuristics that emerged from the literature, listed in Section 5.4.2 above. Two were so-called 'double experts', i.e. both a usability expert and a domain expert, where the domain in this case was e-commerce. Of the other two, both were usability experts (see Table 5.5).

Table 5.5 Expert evaluator profiles

Expert	Gender	Qualifications and experience	Nature of expertise
Expert 1	M	MSc and Certified Usability Analyst 6 years experience as a professional usability evaluator and consultant	Usability expert and domain expert (in numerous domains)
Expert 2	F	MSc 5 years experience as a usability researcher	Usability expert
Expert 3	F	BSc Hons 20 years experience as multimedia programmer	Multimedia designer Usability evaluator (qualified in both computer science and psychology)
Expert 4	F	B-Tech 10 years experience as a usability consultant. Owner of a user experience company.	User experience expert and domain expert (in the domain of e-commerce)

5.4.2 Heuristic evaluation criteria

Three categories of criteria were used for the heuristic evaluation:

1. General interface design heuristics (Table 5.6);
2. E-commerce usability design heuristics (Table 5.7); and
3. User experience design heuristics (Table 5.8).

Table 5.6 Category 1: General interface design heuristics (Nielsen 1994b; Powals 1996)

	Criteria	References
1	**Visibility of system status** • The system should always keep users informed on where they are, as well as provide appropriate feedback within a reasonable time.	Nielsen 1994b
2	**Match between system and the real world** • Words, phrases and concepts need to be familiar to the user; information should appear in a natural and logical order. • Use a familiar framework, making it easier to absorb. • Use everyday terms, metaphors, etc.	Nielsen 1994b; Powals 1996
3	**User control and freedom** • Clearly marked 'emergency exits' need to be visible. Users often choose to leave the unwanted state without having to go through an extended dialogue.	Nielsen 1994b
4	**Consistency and standards** • Words, situations and action need to be consistent throughout the application. • Data needs to be displayed that is clear and consistent. • Group data displayed in consistently meaningful ways to decrease search time	Nielsen 1994b; Powals 1996
5	**Error prevention** • The design should help to prevent errors.	Nielsen 1994b
6	**Recognition rather than recall** • Objects, actions, options and instructions should be visible or easily retrievable whenever appropriate. • Use names that are conceptually related to functions.	Nielsen 1994b; Powals 1996
7	**Flexibility and efficiency of use** • The system needs to cater for both inexperienced and experienced users, as well as provide functionality in order to speed up interaction.	Nielsen 1994b
8	**Aesthetic and minimalist design** • Dialogues should not contain information which is irrelevant or rarely needed. • Make appropriate use of colour and graphics. • Include in the displays only that information needed by the user at a given time.	Nielsen 1994b; Powals 1996
9	**Help users recognize, diagnose, and recover from errors** • Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	Nielsen 1994b

	Criteria	References
10	**Help and documentation** • Information should be easy to search out, and should indicate to users the number of steps to be carried out if it is a wizard or a form, and not be too long.	Nielsen 1994b
11	**Automate unwanted workload** • Free cognitive resources for high-level tasks. • Eliminate unnecessary thinking, i.e. mental calculations, estimations and comparisons.	Nielsen 1994b
12	**Fuse data** • Reduce cognitive load by bringing together lower-level data into a higher-level summation.	Nielsen 1994b

Table 5.7 Category 2: E-commerce usability design heuristics

	Criteria	References
1	**Communicate the intended message** • The intended message should be communicated in a way that leads to a positive user experience. Aspects such as the copy, tone, colour of font, navigation, visual load and information hierarchy are part of this communication.	Porter and Bewer 2010
2	**Page display, layout and site structure** • A good website should provide orderly screens, simple search paths, fast and readable presentation of information, and navigation that is simple and efficient. • Relevant factors include: navigation, information architecture, language, aesthetics and visual appeal, page structure and layout. • The usability of an e-commerce site is determined by its user interface, visual elements, navigation, information architecture and the design of interaction with the website.	Chang and Chen 2009; Gardner 2007; Martim, Herselman and van Greunen 2009; Hassenzahl and Tractinsky 2006
3	**Value of information should provide all that is required** • Many users do most of their product research on the Internet. The website should offer detailed and comprehensive product descriptions to support choices, using, for example: comparison charts, advanced technologies featuring product texture imagery, or online videos of products in use.	Sung 2006; Camus and Evans 2009
4	**Utility** • A store locator tool on the website will allow users to see which store is closest. Clear in- or out-of-stock messages should be posted and kept current. • E-commerce websites should provide functionality for additional guidance to users, and information about products' functionality to assist decision making, for example, a comparison tool.	Camus and Evans 2009; Zou, Zhang and Zhao 2007; Sharp et al. 2007

	Criteria	References
5	**Language and culture** • Language and culture impact on perceived website usability, which increases when a website is designed in the native language of the user. • Cultural backgrounds in SA present a challenge. Results of other studies show that the needs of SA users differ from those of international community. For example, SA users prefer colourful, graphic interfaces.	Nante and Glaser 2008; Martim, Herselman and van Greunen 2009
6	**Trust and Security** • Two important factors may hamper growth of e-commerce: lack of standard technologies for secure payments, and the lack of profitable business. Both of these factors influence the customer's perception of the trustworthiness of a site. • Users are concerned about issues of trust and security. Retailers should provide relevant and current information on their websites.	Hoffman, Novak and Peralta1999; Martim, Herselman and van Greunen 2009
7	**Effectiveness** • How good is the product at doing what it is intended to do? • Does the system do the tasks for which it was designed?	Sharp et al. 2007; Bastien 2010
8	**Efficiency** • The number of steps taken when conducting a task, should be at a minimum. • How much effort is required to use the system in order to achieve those tasks?	Sharp et al. 2007; Bastien 2010
9	**Safety** • Users should be protected from dangerous conditions and undesirable situations. Various methods of recovery should be available, should the user make errors.	Sharp et al. 2007
10	**Learnability** • Learnability deals with how easy a system is to learn to use?	Sharp et al. 2007
11	**Memorability** • Once learned, how easy is it to remember how to use a product?	Sharp et al. 2007
12	**Satisfaction** • Usability is generally regarded as ensuring that interactive products are easy to learn, effective to use and enjoyable from a user's perspective. • Do users have a positive response when using the system? • Does the system support confidence on the part of users?	Sharp et al. 2007; Bastien 2010; Hernández, Jiménez and Martín 2009; Martim, Herselman and van Greunen 2009; Szymanski and Hise 2000

Table 5.8 Category 3: User experience design heuristics

	Criteria	References
1	**Feelings evoked from using the website** • How do users experience the product from their personal perspective? • UX involves all aspects of use of an interactive product: the way it feels in the users' hands; how well they understand how it works; how they feel about it while using it; how well it serves their purposes; and how well it fits into the context of use. • Feelings evoked from a consequence of a user's internal state might include expectations, needs, motivation and mood.	Sharp et al. 2007; Lauralee 1996; Hassenzahl and Tractinsky 2006
2	**Personalisation** • Personalisation occurs when the website stores users' information such as preferences. • For a good user experience, the more a system 'knows' about users, the better it can serve them effectively.	Abbattista et al. 2002
3	**Website quality perceptions** • Does the product's ability support the achievement of behavioural goals (usability goals), i.e. usefulness and ease of use? • How well do the products stimulate and enable personal growth, and identification?	Hassenzahl 2005
4	**Cross-platform service access** • Can users access the service elements they need on their PCs as well as on mobile phones?	Väänänen-Vainio-Mattila and Wäljas 2009
5	**Context-aware services and contextually enriched content** • Are the services adaptable to the user's context of use? • Do they offer meaningful contextual information associated with the media contents?	Väänänen-Vainio-Mattila and Wäljas 2009
6	**General user experience-related issues** • Is the user interface usable and aesthetically pleasing: does it support users' trust and privacy, and other experiential aspects?	Väänänen-Vainio-Mattila and Wäljas 2009
7	**Four stages in e-commerce interaction tasks that contribute to the overall user experience.** • Contemplation stage: the user makes an initial judgement of the website prior to any action, for example, looking at the home page of a website. • Initial scan: the user's first attempts at action are critical; greeting messages should be displayed in order to set the tone of interaction. • Task action takes place during interaction: affordances, feedback and flow are references to usability factors; consistency or inconsistency of dialogue tone may be a reference to experience. • Task review: this stage occurs on completion of a task. Events occur during interaction and may have an effect on users' sense of who they are dealing with and whether the sense of the organisation's identity, formed from awareness of the branding or advertising, matches the experience.	Mahlke and Thüring 2007

	Criteria	References
8	**Visual appeal** • Aesthetic experience aspects relate to a product's ability to enhance user sensory modalities, such as: look and feel of the product, colours, font, graphics and sounds used. Can users evoke basic feelings such as excitement or fear when looking at the product? • The visual impact of a user interface can have a significant influence on the user experience. If designed badly, it can result in complications of the effective communication that the company is trying to convey to the users. • The aesthetics of the e-commerce site can also be seen as an aspect of the broader concept of user experience, which can include: usability, beauty, overall quality and hedonic, affective and experiential aspects.	Blythe and Wright 2006; Hoffman and Krauss 2004; Hassenzahl and Tractinsky 2006
9	**Service Quality** • **Convenience** – is the website easy to navigate, user friendly and can users get the information they want? • **Interactivity** – does the e-commerce website facilitate a two-way communication with the users? • **Customisation** – does the website tailor its products and services, and the transactional environment to individual users? • **Character** – what kind of overall image or personality does the website depict to users through the use of graphic elements, for example: fonts, graphics, colours, and background patterns?	Petre, Minocha and Roberts 2006; Chang and Chen 2009
10	**Brand** • Brand entails the website's projection of the desired organizational image and promise. This may be articulated though aesthetic and design-related elements within a website, as well as graphics and themes.	Rubinoff 2004
11	**User satisfaction** User satisfaction is viewed as a component both of usability and UX – see Figure 3.7. The sub-criteria are not re-listed here, since they are presented under Point 5 of Table 5.5, which relates to usability.	

5.4.3 Heuristic evaluation rating criteria

The expert evaluators were provided with three sets of heuristics: general interface design heuristics, e-commerce usability design heuristics and user experience design heuristics (see Appendix B).

All heuristics were written in the form of questions, and evaluators were required to rate each on a rating scale of 1 to 5 (1, if they strongly disagreed with the question and 5, if they strongly agreed with the question). This process was conducted on all four target sites.

5.4.4 Capturing the results

The results were captured using Microsoft Excel and appropriate formulas in order to cross-correlate. The results were captured according to tasks: background questionnaire, pre-test questionnaire, performance tasks, user experience and post-test questionnaire. Different question types were captured, consisting of single-select questions, open-ended questions and ratings. Once the results were captured, graphs were generated to highlight and summarise key findings. These graphs are presented in the findings chapter (see Chapter 6).

5.5 Analysis of the data

Steps taken to analyse the usability test (UT) results:

- As stated in Section 5.3.1, for each of the twelve users, their comments and performance per task were captured in an electronic spreadsheet.
- Results were electronically analysed, tallying numbers of each type of response.
- All results were viewed, key findings were extracted.
- Summaries of findings were compiled and relevant graphs were created.

Steps taken to analyse the heuristic evaluation (HE) results:

- As stated in Section 5.4.1, the ratings of the four experts and their comments per task were captured in an electronic spreadsheet.
- The HE results were reviewed to identify violations that led to usability problems.
- Key findings were extracted.
- A summary of findings was completed and relevant graphs were created

Triangulation of findings:

Cohen, Manion and Morrison (2005) define triangulation as using two or more different data collection methods when studying matters related to human behaviour. In the present study, the results from evaluation by UT and HE were summarized and compared. Similarities and differences were identified.

The data is triangulated by presenting the problems and positive aspects *in each of the four websites* as identified by both UT and HE (i.e. common problems and positive aspects) and matters identified by one of the two methods on its own (i.e. UT-specific and HE-specific problems and positive aspects).

Moreover, the general types of problems and the positive aspects are presented with respect to *each category of criteria* that UT identified on its own, both HE & UT identified, and HE identified on its own.

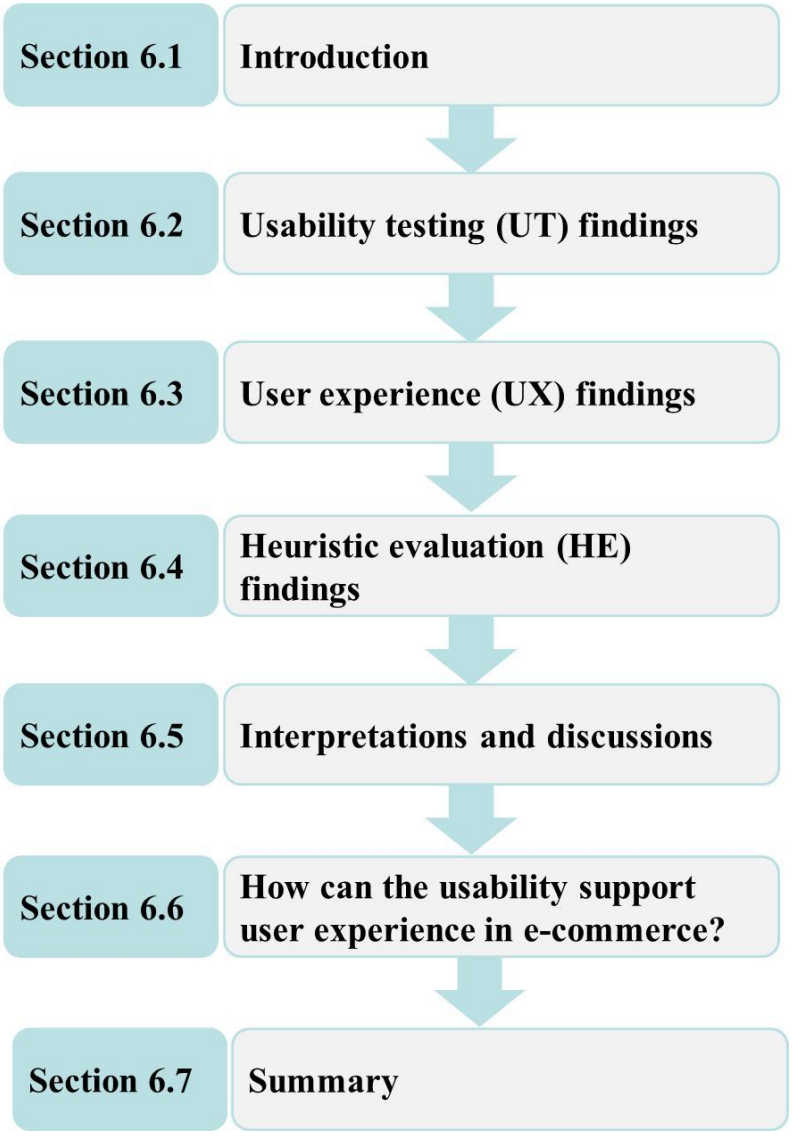
Strengths of using both HE and UT evaluation methods are also discussed

5.6 Summary

This chapter explained the research design of the study, namely, application of two different usability evaluation methods (UEMs), usability testing and heuristic evaluation. The research questions introduced in Chapter 1, were tabulated against the chapters where they were addressed, along with explanations of the ways in which they were answered. The categories and criteria that were used to conduct this study, were set out. Some of the criteria identified were used with the end user participants in the usability testing sessions, and others were considered by the experts conducting heuristic evaluations of the four target systems.

Chapter 5 has explained the evaluation methods and the evaluation criteria used in this research. It lays the foundation for Chapter 6 which describes their implementation and the findings.

Chapter 6: Research findings



Chapter 6: Research findings

6.1 Introduction

This study aims to determine how the usability of e-commerce websites supports the user experience of users. The International Organisation for Standardisation (ISO) defines usability as: 'the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context' (ISO 9241-11 1998). User experience (UX) on the other hand incorporates all aspects of the end user's interaction with the product or service and the organization (Sward 2006).

Two different usability evaluation methods (UEMs) were used: usability testing (UT) and heuristic evaluation (HE). HE is an inspection method conducted by experts. It is a popular UEM for computer system interfaces because it is quick, inexpensive, and good at achieving broad coverage of a whole user interface, although it may miss some complex issues (Ssemugabi and de Villiers 2007; Barrington 2007). UT is a user-based method and is useful for establishing detailed issues, such as: preferences, what problems participants encounter, and how long it takes to complete tasks (Barrington 2007; Kantner and Rosenbaum 1997).
Evaluation criteria were extracted from the literature studies. Some of the criteria identified were used with the end user participants in the usability testing sessions, while others were considered by the experts conducting heuristic evaluations of the four target systems, and some were used with both groups.

Twelve representative participants were recruited by the researcher for the UT on the target websites: MTN, Vodacom, Virgin Mobile and Cell C. Due its time-intensive nature, UT is characterised by low number of participants. The 12 used in this study is a relatively high number. Each participant was tested on an individual basis. Participants' performances on the specified tasks were measured against the identified criteria for UT (see Chapter 5: Section 5.3.4). Four expert evaluators were asked to conduct HEs on the target websites, according to the heuristics that emerged in the study (see Chapter 5: Section 5.4.2).

In order to investigate a possible relationship between usability and UX, the usability of the target websites was first established, followed by investigation of user experience. This chapter discusses the research findings from usability testing, as well as from the heuristic evaluation. Section 6.2 presents the findings of usability testing, while Section 6.3 discusses the user experience findings among the same participants. For heuristic evaluation, the

usability study and the user experience study are described in the same section, namely Section 6.4. In Section 6.5, the findings of the studies are discussed and compared with similar studies. Furthermore, the problems identified, are tabulated to indicate whether they were identified by UT, HE or by both.

Disclaimer: This research study applies usability evaluation methods to four informational e-commerce websites. The work undertaken is for academic and research purposes only, and has no commercial or promotional intentions.

6.2 Usability testing (UT) findings

Twelve participants, representative of the user population were recruited to participate in the usability test (UT), each was tested on an individual basis. Participants' performances was measured against the framework of criteria defined in Section 5.3.4, presented in Table 5.4.

Before undergoing the UT session, participants were familiarised with the test structure, and the environment in which they would be tested. This was to help them relax and prepare them for the test session. Furthermore, participants were required to fill in personal information, to ensure that they met the requirements of their testing category.

This ensures that the results are based on the correct characteristics for each user group (Section 5.3.1: Table 5.2). Participants were required to sign a consent form acknowledging that their inputs are purely for academic use, and would not be used for consulting purposes (see Appendix A1). They understood that participant names and affiliations would not be published or disclosed.

After signing the consent form, participants completed a background questionnaire to establish their profile (Appendix A2), and then a pre-test questionnaire (Appendix A3). Next they investigated the home page (Appendix A4). Their interactions with the tasks 'Find a plan' and 'Find an Internet package' were then studied with the usability technology in the laboratory (Appendix A5 and A6). Findings from the pre-test questionnaire follow.

6.2.1 Pre-test questionnaire findings

Prior to the formal UT sessions, participants completed a questionnaire (Appendix A5) to establish their initial perceptions of e-commerce in general and the user experience it generated. In this pre-test questionnaire, they were asked if they had used e-commerce websites before and, if so, for how long.

Considering the 12 participants, it turned out that 11 (92%) were users, seven of whom (58%) had used e-commerce sites for more than two years, three (25%) for between one and two years, and only one (8%) for less than a year.

When asked about the features and functionality they used most, it was found that the *Compare* feature was the most popular for eight (67%) and *Product reviews* for seven (58%). *Social networking* (33%) and *Sharing content* (25%) had about the same popularity, followed by the *Help me choose* facility and other features such as *Podcasts*, V*ideos* and *Picture uploads*.

Given the focus in this study on user experience (UX), participants were asked what aspects were important in order to create UX on e-commerce websites. This open-ended question generated responses that the researcher classified under the following categories:

- **User interface**: interface aspects that contribute to the mood and experience of the website.
- **Functionality**: tools and applications that assist them in completing their tasks.
- **Content**: the type of content that mostly engaged them.

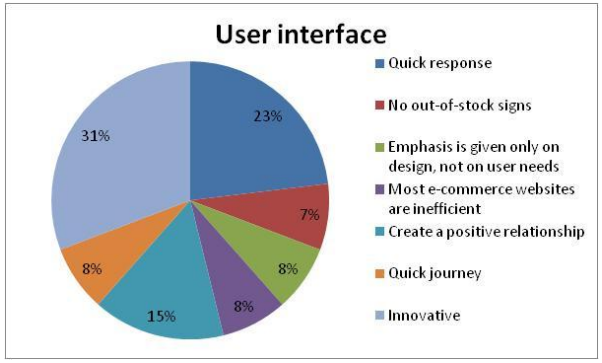
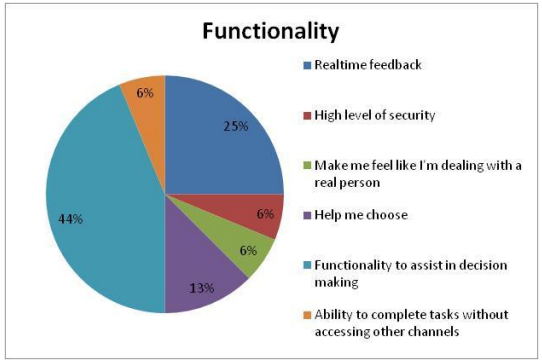
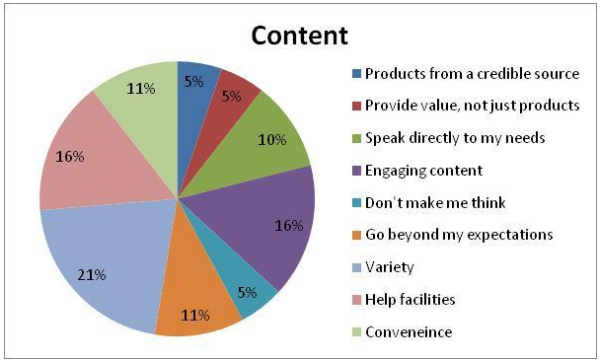
The structure of the sites and responses in this section (as well as subsequent sections) indicated the existence of two diverse approaches to the presentation of product offerings. These approaches can be categorised as ‘product-based’, and ‘needs-based’.

- The concept of **‘product-based’** refers to presenting product offerings in a catalogue according to the way the business defines it.
- Whereas a **‘needs-based’** paradigm, is when the organisation firstly defines the needs of their users and matches the associated product to those needs. This paradigm allows the business to design products around the needs of the user rather than the business.

Table 6.1 following, elaborates and discusses the e-commerce user experience enhancement aspects that were generated from the three categories above, based on the pre-test questionnaire (Appendix A3). Overall, participants mentioned that the majority of current websites are static, text-heavy and provide little value. Two of the sites most preferred by participants in terms of good user experience are Google and Amazon. Key contributing factors may be the simplicity and efficiency of completing tasks on those websites.

The results gave insights into participants' initial feelings and perceptions with regard to e-commerce user experience. The findings indicate that participants are looking for content that is specific to their needs; adequate tools and functionality to assist them in choosing the right product; simple and efficient response time; and innovative designs that are engaging and appealing.

Table 6.1 E-commerce user experience enhancement aspects

User Interface	Functionality	Content
		
Innovative designs (31%) and quick response time (23%) were the most mentioned interface aspects for creating a good user experience. Innovative designs add to the mood and experience when browsing, and encourage participants to browse further.	Participants are not keen on working hard to satisfy their goals; they require supporting tools and applications to help them in making correct decisions (44%), as well as rapid feedback when requesting a product (25%). Participants require the sensation of being virtually 'in front of' a sales consultant when looking for a product. High security was found to be vital for novice participants.	Product-based paradigms cause frustration and are no longer accepted. Participants require customer-centric designs based on their personal needs rather than on product features.

Results follow of participants' initial impressions on the four homepages: MTN, Vodacom, Virgin Mobile and Cell C.

6.2.2 Task 1: Homepage assessment

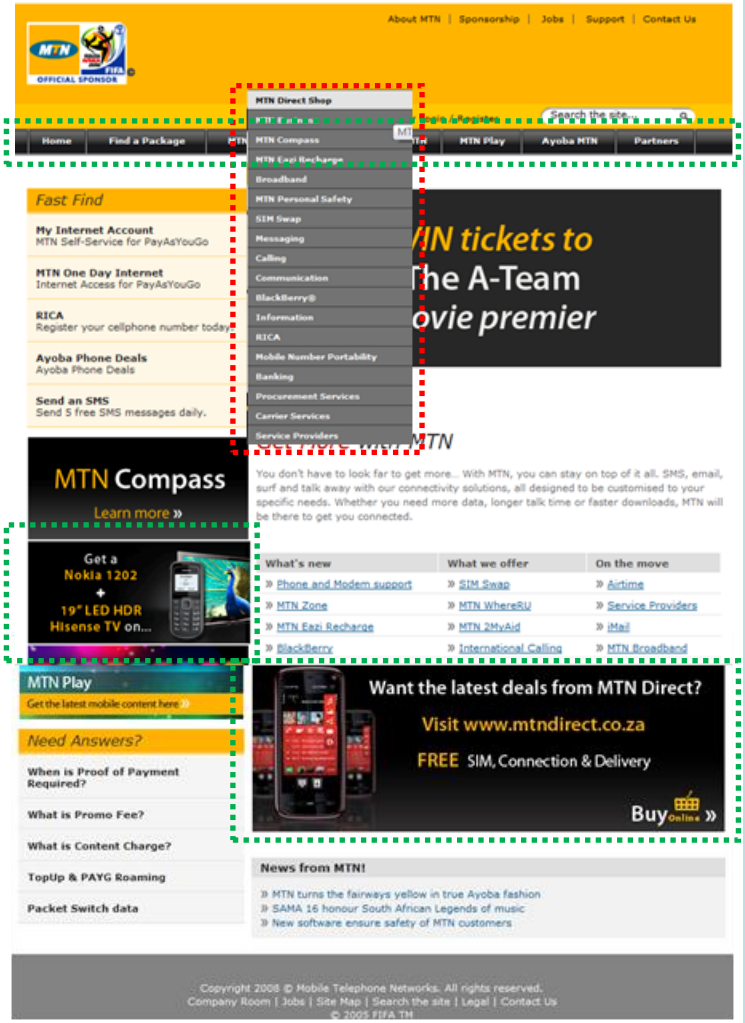
Participants were asked questions (see Appendix A4) to establish their initial perceptions of the four homepages: MTN, Vodacom, Cell C and Virgin Mobile.

In the discussions of the homepage assessment, positive comments are presented before negative. Both positive and negative aspects are subdivided into comments regarding structure and comments regarding content offered. The results are presented in the tables that follow. The tables relate respectively to the homepages of MTN, Vodacom, Virgin Mobile and Cell C:

1. MTN homepage positive and negative factors (Table 6.2);
2. Vodacom homepage positive and negative factors (Table 6.3);
3. Virgin Mobile homepage positive and negative factors (Table 6.4); and
4. Cell C homepage positive and negative factors (Table 6.5).

Table 6.2 MTN homepage positive and negative factors

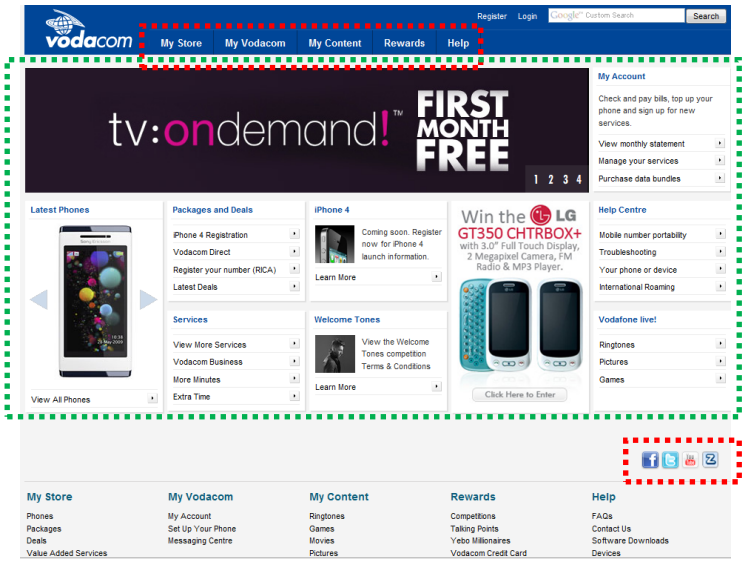
MTN homepage



Positive factors	Negative factors
Three major positive factors regarding structure: • *Quick and easy to see where you want to go* • *Good content categorisation* • *Pictures are eye catching* **There were no major positive factors regarding the content offered.**	**Three major negative factors regarding structure:** • *Site is too busy with no balance* • *Too many banners* • *Navigation menus are too long and jumpy (sometimes they were above or underneath)* **Three major negative factors regarding content:** • *'Seems like MTN is trying to place every department on the homepage'* • *Confusing to understand the offering* • *'There is no option to choose a phone once I have selected a contract plan'*
Discussions	
Key positive findings about structure: • Participants appreciated clear and easily understandable navigation links that allowed them to efficiently satisfy their goals. • Most of the positive feedback was aimed at MTN's entry points to products and services, as well as the look and feel of the homepage.	**Key negative findings about structure:** • Participants did not relate the banners to products and commented that banners made the page look too busy and cluttered. • Participants preferred a simple clean layout that briefly highlights what the company offers. • Participants found there to be too much information on the homepage as well as in the navigation menus. **Key negative findings about content:** • Participants felt that MTN placed too many offerings on the homepage, which caused them to feel overwhelmed when trying to find the product that met their needs. • Participants found it difficult to understand the MTN offering by just looking at the product names.

Table 6.3 Vodacom homepage positive and negative factors

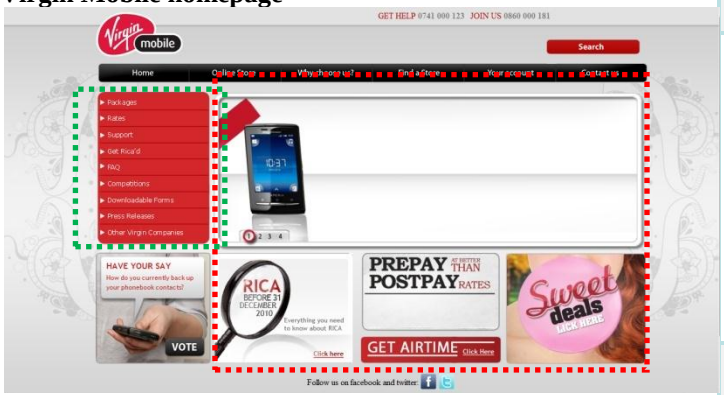
Vodacom homepage



Positive factors	Negative factors
Three major positive factors regarding structure: • *Innovative* • *Clean layout* • *Structure clearly differentiates the different sections* **Three major positive factors regarding content:** • *'Addresses my primary need'* • *Social networking aspects* • *Phones and deals*	**Three major negative factors regarding structure:** • *Social networking* • *Too clinical* • *Navigation is aimed at current users* **There were no major negative factors regarding the content offered.**
Discussions	
Key positive findings about structure: • Participants liked the structure and found it to be an innovative design with terminology that is familiar to the user. • This type of structure and terminology put their minds at ease. It was not difficult to search for, or to identify, products and services. **Key positive findings about content:** • Expert participants who keep up to date with website trends made positive comments with regard to the social networking aspects, stating that Vodacom aims for more than merely selling products, and creates an environment that engaged them over and above the product offering. This created a sense of trust and a positive customer experience with the brand. • Some participants felt at first glance that the Vodacom site was need-based and addressed their primary need when viewing a cellular website i.e. phones and packages.	**Key negative findings about structure:** • In contrast to the statement on the left with regard to social networking, novice participants who do not engage in social networking could not relate to the excitement about these aspects. They do not understand the purpose of social networking and could not see the connection between Vodacom and Facebook. • Participants were disturbed by Vodacom's primary navigation, due to every navigation link beginning with the word 'My'. This made them feel that the site was only targeting current users and not enticing new users.

Table 6.4 Virgin Mobile homepage positive and negative

Virgin Mobile homepage



Positive factors	Negative factors
Three major positive factors regarding structure: • *Simple navigation* • *Different look and feel* • *Trendy and innovative* **Three major positive factors regarding content:** • *Social networking* • *Perception of saving* • *'Content offering is not complicated'*	**One major negative factor regarding structure:** • *'Design does not portray a South African culture'* **Two major negative factors regarding content:** • *Promotions focused* • *'Telecommunication terminology is difficult to understand, i.e. Rica'*

Discussions

Key positive findings about structure: • Participants were able to meet their needs quickly and easily due to the simple and easily understandable navigation menus. • Participants found the Virgin Mobile's structure to be novel and different from most other websites that they browse. **Key positive findings about content:** • The Virgin Mobile site created the perception of a 'sales store', reinforced by the words 'sweet deals' as a navigational menu. This terminology is more approachable and less intimidating than heavy telecommunication language. The graphic depicted cellular instruments and packages. • Participants found Virgin Mobile's content offering less complex, but lacking in variety. They wanted different options to choose from, with sufficient functionality to assist them in making decisions.	**Key negative findings about structure:** • Participants felt that the Virgin Mobile's structure followed the company's international corporate identity and believed that Virgin Mobile is not doing enough to localise their structure for the South African target audience. **Key negative findings about content:** • Participants did not relate the banners to products and commented that banners made the page look too busy and cluttered. • Most of the time, if the homepage was busy with banners, participants would navigate directly to the primary navigation menus to search for products and services that met their needs. • Participants for whom English was not their first language found words such as 'RICA' difficult to understand, with no supporting content to assist them in understanding it.

Table 6.5 Cell C homepage positive and negative factors

Cell C homepage

Positive factors	Negative factors
Three major positive factors regarding structure: • *Categorisation and naming of the navigational menus* • *Visually appealing* **One major positive factor regarding content:** • *'Content meets my needs'*	**Three major negative factors regarding structure:** • *'No innovation, all the websites look the same'* • *'Too many banners make the pages take too long to load'* • *Promotions focused* **Three major negative factors regarding content:** • *Product focused* • *Nothing to entice participants to purchase* • *Brand focused, rather than selling products that meet consumer needs*
Discussions	
Key positive findings about structure: • Most participants felt that Cell C's navigational menus were the simplest to use and understand compared to MTN, Vodacom and Virgin Mobile. **Key positive findings about content:** • Participants stated that at first glance, it is easy to see which product name will meet their needs, i.e. Casual Chat. • The product name 'Gospel offering' appealed strongly to the African market. This type of structure allows participants to be able to choose a product-based on their needs as well as lifestyle.	**Key negative findings about structure:** • The Cell C's homepage structure consists of too many banners which makes the pages slow to download. When the page download took longer than two minutes, participants would abort and go to another website to satisfy their needs. • Participants also stated that the homepage was too focused on promotions, making it difficult to find something specific. Majority of users glanced past the homepage content and went into the primary navigation menus to find out what Cell C offers. **Key negative findings about content:** • Participants indicated that the homepage content was too product focused and lacked in directly addressing their primary cellphone needs, i.e. phones. • Participants did not relate banners to products and immediately assumed that Cell C wanted to sell them something other than what they were looking for.

6.2.2.1 Consolidation of homepage assessment

The findings from the homepage analysis indicate that participants are attracted to a homepage structure that looks different, and is simple and clean with product offerings that are easy to identify at first glance. Participants' appreciated the nature of Vodacom's homepage structure, which they found to be an innovative design with familiar terminology. This type of structure and terminology put their minds at ease and did not require much effort when looking for products and services.

Terminology should be selected to support comprehension. If the terms are selected to resonate with a theme, this should not be at the expense of clarity. For example, in Vodacom's primary navigation, every navigation link commences with 'My'. This gave participants the impression that it targeted only current users who are accustomed to it, and it did not aim to entice new users to browse the categories. They found clean, simple homepage layouts attractive, such as those of Virgin Mobile and Cell C. Minimalist screen layouts are less intimidating when one is looking for products and services. A major contributing factor was the choice of intuitive and easily understandable product names. An example is 'Casual Chat' on the Cell C site; this type of terminology allows participants to know at first glance what the plan is about, just by looking at the product name. Regarding Virgin Mobile, participants found the product structure to be simple, i.e. four plan options, but some stated that it lacked variety for a user looking for a specific plan such as a business package.

Participants became frustrated when a website contained too many banners, stating that it makes the pages slow to download. If it took longer than two minutes, they would abort and go to another website to satisfy their needs. This finding was similar across all the suppliers. Participants also found it overwhelming when the homepage and navigation menus were overloaded with information. An example of this type of structure was the MTN website.

From the above task results, it can be deduced that the primary reason why participants come onto cellular websites is to find plans, deals and phones. Participants felt that the Vodacom website was the only website that catered for users' primary needs on the homepage. With regard to the social networking aspects, the more experienced internet participants were positive, stating that cellular companies are not in business merely to sell products but particularly to create an engagement with participants outside of the product offering. This can create a feeling of trust and a positive customer experience with the brand. In contrast, novice participants did not understand the purpose of having social network icons on a

cellular website, finding it difficult to combine the concept of socialising with friends and looking for a cellphone plan. Users require an adequate amount of information about functionality to assist them in making the right choice. Of the four websites browsed, participants experienced Virgin Mobile's content offering as the least complicated, but they also suggested that the website lacked variety. This indicates a contradiction in terms, in that while addition of products and services contributes to variety, it also adds to the complexity of a site. With regard to Cell C, they felt that the homepage content was too product-focused and lacked content that matched their cellphone needs. Participants did not relate to the banners that provide navigation to products and services, and tended to believe that Cell C was aiming to market products other than what they required.

The next section provides results from the 'Find a plan' task.

6.2.3 Task 2: Find a plan

Participants completed a task that required them to identify a plan that was best suited to their cellphone needs. A plan is a product offered by cellular network companies that allows users to communicate via their mobile phones. Both quantitative and qualitative data was gathered via the questionnaire and interview in Appendix A5. The results across the four websites, MTN, Vodacom, Virgin Mobile and Cell C are discussed in the following sections. Firstly, the quantitative results are discussed, subdivided into: success rate, route taken, number of errors made, time and number of clicks taken to complete the task. Secondly, the qualitative measures are considered, subdivided into: ease of use, content satisfaction, structure, terminology and visual appeal.

6.2.3.1 Quantitative measures findings

6.2.3.1.1 Success rate across the four websites

The first task was for participants to find a cellphone plan. All 12 participants completed the task successfully for each of the four suppliers. This was due to the intuitive and easy-to-understand headings and the good navigational headings on all four sites.

6.2.3.1.2 Route taken by participants

Most participants navigated by using the navigation menus/links in the primary navigation. The main finding was that if a homepage was too busy, participants avoided it and looked for terms that related to their cellphone needs. Overall, key findings include the following: participants avoid busy sections of the website and look for content items that speak directly

to their needs. According to feedback from the participants, Vodacom was the only website that included product links on the homepage that they could relate to.

6.2.3.1.3 Errors

No errors were encountered while participants performed the task 'Find a plan'.

6.2.3.1.4 Time taken and number of clicks

The average time duration in minutes taken to complete the task and the average number of clicks are depicted in Figure 6.1. The data in its complete form for the time duration in minutes, and number of clicks for all 12 participants across the four sites is depicted in Table 6.6.

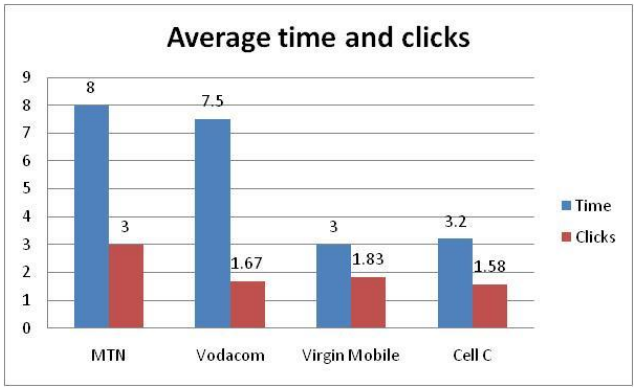


Figure 6.1 Average time and clicks taken to complete tasks

Table 6.6 Time and clicks taken to complete task

	MTN		Vodacom		Virgin Mobile		Cell C	
	Time	**Clicks**	**Time**	**Clicks**	**Time**	**Clicks**	**Time**	**Clicks**
1	**8**	3	**9.5**	3	**3**	2	**2**	1
2	**9**	3	**5.5**	1	**3**	1	**4**	2
3	**7.5**	3	**4.5**	1	**3**	1	**2**	1
4	**6**	2	**10**	3	**4**	3	**3**	2
5	**12**	3	**9**	1	**2**	1	**4**	2
6	**9**	3	**5.5**	1	**5.5**	5	**3**	2
7	**7**	3	**6.5**	1	**3**	1	**3**	2
8	**6**	3	**6.5**	1	**3**	1	**3**	2
9	**4.5**	2	**9**	2	**3**	1	**3**	2
10	**7**	3	**9**	2	**3**	1	**3**	2
11	**10**	4	**8**	2	**3**	1	**3**	2
12	**10**	4	**6.5**	2	**3**	1	**3**	2
Ave:	**8**	**3**	**7.5**	**1.67**	**3.2**	**1.58**	**3**	**1.83**

On average the participants needed three clicks and eight minutes. The most clicks and the longest time occurred in finding a plan on the MTN site. Two contributing factors to this duration of eight minutes were: the *Plan overview* page that summarises all the plans and the

level of product detail provided. With regard to Vodacom, even though the average number of clicks is low (1.67 clicks), participants needed considerable time (average 7.5 minutes) to discover how to use the functionality of the *Deals/Package* section. The participants needed an average of 1.83 clicks on the Virgin Mobile and 1.58 clicks to find a plan on the Cell C site and websites and no major performance-hampering aspects were identified.

6.2.3.2 Qualitative measures findings

The qualitative measures were ease of use, content satisfaction, structure, terminology and visual appeal. The results for ease of use, content satisfaction and structure are depicted in Figure 6.2. Following, Table 6.7 lists the major positive and negative factors with regard to content satisfaction across the four websites. Table 6.8 lists the major positive and negative factors with regard to the structure of the four websites, and Table 6.9 lists participants' ratings and comments about how easy they found the terminology to understand.

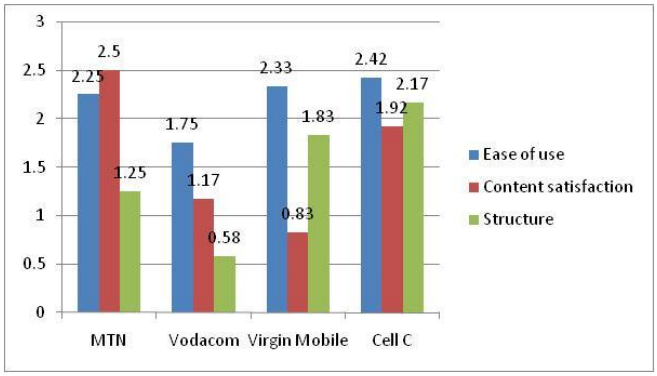


Figure 6.2 Ease of use, content satisfaction and structure

6.2.3.2.1 Ease of use

The ease of use results indicate that participants could complete the task efficiently due to clear and intuitive navigational headings. Good examples were the Cell C and Virgin Mobile sites, which participants found the easiest and quickest to navigate because of the intuitive naming of the navigational headings. Other findings were that participants became frustrated and despondent if they had to click a great deal to satisfy their goals. This occurred when they used a structure that was not aligned with their intended purchase flow. Users intended purchase flow was to first find a plan, secondly, discover what phones are associated with that plan, thirdly, users wanted to see if the phone and plan offers services such as email or Internet connection, and finally a clear call to action, for example, purchase online, or the nearest store locator).

An example of this type of structure was the MTN site. Twelve participants found that navigating the site involved too many clicks and too much reading with a content structure that did not follow the intended purchase flow (choose your airtime, phone and service). Users are able to make better decisions if the product names are associated with the different cellular requirements they may have, i.e. a user who only wishes to make calls after hours, would like a header or link entitled *Only make calls at night*. This would result in a clear and intuitive path for what to do next. An example of this was the Vodacom website, where participants found it quick and easy to get to the plans from the homepage, but once on the *Plan page*, it was difficult to determine what to do next. Another key insight regarding Vodacom was that its navigation is based on a product-paradigm (Talk 100) and not needs-based, making it difficult to choose products.

6.2.3.2.2 Content satisfaction

Participants were most satisfied with product names that are easy to interpret without clicking into the product name, and they also appreciated a comprehensive product description that does not force them to consult other channels in order to satisfy their goals. According to the feedback from 10 participants, the MTN site was a good example with regard to a comprehensive product description and the Cell C site a good example for product names to which they could easily relate. Regarding Virgin Mobile, all 12 participants found that it lacked product variety on the website and they would have to consult other suppliers in order to satisfy goals. Table 6.7 lists the major positive and negative factors with regard to content satisfaction across the four websites

6.2.3.2.3 Structure

It was clear that all participants appreciated simplicity in navigational headings and minimalism in the amount of information provided on product pages. A good example was the Cell C site. Table 6.8 lists the major positive and negative factors with regard to the structure of the four websites. It became increasingly clear that the participants preferred a needs-based approach rather than a product-based structure. A style that addresses needs on a high level, can facilitate searches by presenting offerings in a way that focuses on users' context of use. No site achieved this effectively.

6.2.3.2.4 Terminology and visual appeal

Table 6.9 lists participants' ratings and comments about understanding the terminology used. The table also addresses the look and feel of the four websites.

Table 6.7 Content satisfaction expressed in terms of positive and negative factors

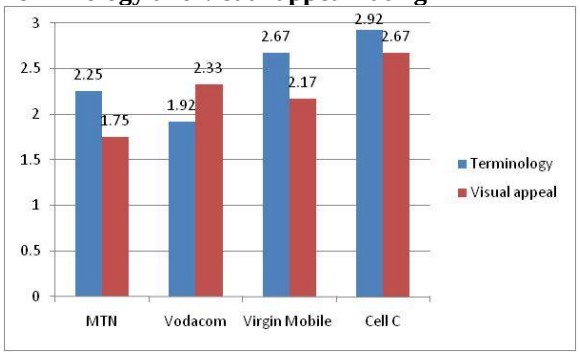
	MTN	Vodacom	Virgin Mobile	Cell C
Positive factors	Participants found the content to be simple, with key decision-making information (price) up front to support their decisions, as well as sufficient functionality to assist them in making the right decisions. • '*Best Package advisor'* • *'Money is a key contributing factor and MTN clearly bases their content on my needs'* • *'I like the filter functionality'* • *'Money and peak speak to my needs'*	Vodacom's content is similar to the advertised content in print, TV and billboards media. This consistency and sound branding allows users to see an advert and then access the site in order to make a purchase decision.	Participants felt that Virgin Mobile does not provide sufficient plan options in order to help them make decisions, and they would have to consult other suppliers in order to satisfy goals.	Clear and intuitive user journey: • Product names are easy to understand and relate to. – *'Talked to my needs'* – *'The name 'All week' appealed to me'* • The process of looking for a product was in line with participants' mental model of a product search. – *'Good purchase model'*
Negative factors	• Content does not relate to all target segments. – '*No business packages'* – *'No corporate packages'* • Content is product focused and does not relate to user needs. – *'I would prefer something that prompts me (SMS a lot, night caller)'* – *'Driver is price and what I get for that price'* • Requires a lot of reading in order to satisfy goals. – *'A lot of irrelevant information'* – *'Why have information on old packages that don't even exist anymore?'* • Related content to complete purchasing decision is lacking. – *'Missing phone information'* – *'What services come with these plans?'*	• Content does not relate to all target segments. – *'Does not talk to me about business calls'* • Important information to complete decision making is missing. – *'Call to action is difficult to find'* – *'No price, cannot make my decision'* – *'Missing decision-making info'* • Tone of content is business-centric and does not relate to user needs. – *'Descriptions are too business-centric'* – *'Needs are addressed but you have to look hard'* • Lack of context around social networking. – *'Social networking links – I do not see the point of following them, no benefit to me'*	• Lack of content to complete decision making. – *'Not enough info to make a decision'* – *'Too generic'* – *'Price is not easily available'* – *'Too many content description items'* – *'Looks like there are only pre-paid plans'* – *'Not enough plan options'* – *'Not a great offering'* – *'Content does not speak to me, I want a contract'* • Content is product-focused and does not relate to user needs. – *'Product-based - does not talk to my needs'*	• Participants want to see the content that speaks directly to their needs, higher up on the page. • Important information to complete decision making is missing. • Content is product focused and does not relate to user needs. – *'Package names do not relate to my needs, only to my creativity'* – *'Fine line between being innovative and meeting my needs'* • Deceptive content: – *'Nothing about cellular on this site, there's handbags and birds'* – *'Too campaign focused'*

Table 6.8 Website structure expressed in terms of positive and negative factors

	MTN	Vodacom	Virgin Mobile	Cell C
Positive factors	None mentioned.	Most participants provided positive comments with regards to Vodacom's product search functionality. The main aspect was that the results are displayed on the same page that the participants search from. • '*Awesome search functionality'*	In the section 'content satisfaction', participants stated that Virgin Mobile does not provide sufficient plan options to make a decision, however, participants did state that Virgin Mobile's content structure does provide the impression that there is more on offer: • '*Virgin Mobile provides the impression that there is more on offer'* • *'Content is better displayed'*	Most of participants commented on the simplicity of the content structure, stating that it does not require a lot of reading and not too many click to get to products.
Negative factors	• Inconsistent navigation links. – '*Ordering of the tabs in the plan section is confusing'* – *'Navigation changes - duplication of links'* • No intuitive transition between MTN's digital properties. – *'No transition between all of MTN's websites'* – *'The shop and the brochure site is confusing, how do I get back?'*	The homepage sets a high expectation with regard to the structure, this expectation is not carried through to the rest of the website. Participants found it tedious to find out more about a certain product and had to click through each and every product, read long lists of features with no support such as a comparison chart. • '*Homepage is deceiving'* • *'Have to click into all plans to see what they are about, no quick comparison link'* • *'Long list of features, too much reading'*	• Participants that wore glasses found the content difficult to read due to the inconsistent font sizes. – *'Hyperlinks are too small'* – *'Struggle to read uppercase'* – *'Feels like the website is shouting at me'* – *'Five different font styles in one offering'* • Important decision making information (price) is at the bottom of the product descriptions – *'Price needs to be more prominent'*	Participants felt that the website should improve on its journey by providing an overview page to summarise each plan. • *'No overview page, requires a lot of clicking to see what each plan is about'* Currently, Cell C only compares the category that the user is browsing, i.e. Casual chat. There is no option to select other plans out of the category (i.e. All week 100) in order to compare the plans against each other.

Table 6.9 Terminology and visual appeal

Terminology and visual appeal rating



Terminology	
Cell C and Virgin Mobile	**MTN and Vodacom**
Participants found Cell C and Virgin Mobile package names to be the most user-centric. Participants could relate easily to the product offering just by looking at the product names, with no need to click into each product and read its description.	Vodacom and MTN were rated lower. Participants found that understanding the content offering required a good knowledge of telecommunication terms and they would need to contact a call centre in order to fully understand the offering. **Terms** that were mainly unfamiliar to the participants include: • MTN: Music bundles, MTN Anytime. (MTN Anytime is the term used for MTN's contract plans, and participants found it difficult to relate it to a contract plan.) • Vodacom: Blackberry 100 BES

Visual appeal		
Cell C	**Vodacom**	**MTN and Virgin Mobile**
Participants rated Cell C highest with regards to the visual appeal of the website. This was due to the simplicity of the content layout, good balance between the content and banners, with no distraction that might delay participants in getting to their task efficiently.	Vodacom's homepage was the main contributing factor to Vodacom being rated second-highest. Participants found the content categories to be clearly laid out and the product offering easily visible without the need to click into the navigation menus.	MTN and Virgin Mobile were rated the lowest in terms of the look and feel for the following reasons: • MTN: participants found it to be too textual with no balance, stating that they would have to do a lot of reading in order to satisfy their goals. • Virgin Mobile: participants found it difficult to read the different font styles and felt that Virgin Mobile is copying the layout of other popular websites, such as the Apple website.

6.2.3.3 Consolidation of the 'Find a plan' task

Overall, the websites performed within acceptable limits. The following are the key factors identified as hampering participants while performing the 'Find a plan' task:

Participants' mental models:

There are three major steps in the purchasing process of a typical participant:

1. Participants want to see the price and a product description that is easy to understand;
2. They would like to see phones and additional services that come with the plan; and
3. Participants want to be able to purchase online.

No supplier site allowed participants to follow their intended purchase flow through to completion. There was no continued user journey (plan, phone, service and call to action) once the user had found a plan.

Lack of attention to needs-based paradigm

Most navigation structures follow a product-based paradigm. On the other hand, participants may have a specific need such as: *I SMS a lot* or *only make calls at night*. No supplier structure provided alternative search options for participants to seek out such products.

Requirements regarding banners

Banners need to be more representative, rather than just displaying pictures or graphics. In general, participants ignore banners and do not relate them to products and services. They tend to view banners as objects that contribute to the look and feel of the website and advertisements that they generally ignore. No user clicked on any of the banners across the suppliers.

Lack of eye-catching objects

The content across all the suppliers was not sufficiently focused or eye-catching to direct participants on what to do next. There was content overload and a lack of focus points to attract the participants.

Telecommunication terminology that was difficult to understand

In many cases, participants did not understand the terminology in the content and navigation area. The Cell C and Virgin Mobile sites are good examples of appropriate choices of terms. The MTN and Vodacom sites, on the other hand, illustrate less effective use of terminology.

Content structure does not assist participants in finding the right plan

No supplier site provided supportive product-summary pages. Participants were forced to read the details of each product and, even though introductory paragraphs may give good descriptions, by the time participants have read the details of a third product, they had forgotten the facts about the first two.

Following are the results from the 'Find an Internet package' task.

6.2.4 Task 3: Find an Internet package

Participants completed a task that required them to identify the Internet package that was best suited to their needs. An Internet package allows participants to be able to browse the Internet on their phone or laptop wirelessly. Both quantitative and qualitative data was gathered via the questionnaire and interview in Appendix A6. The results across the four websites, MTN, Vodacom, Virgin Mobile and Cell C, are discussed in the following sections. Firstly, the quantitative results are discussed. The quantitative measures are subdivided into: success rate, route taken, number of errors made, time taken and number of clicks to complete the task. Secondly, the qualitative measures are discussed. The qualitative measures are subdivided into: ease of use, content satisfaction, structure, terminology and visual appeal.

The findings only represent three of the cellular websites: MTN, Vodacom and Cell C, since Virgin Mobile does not offer Internet packages.

6.2.4.1 Quantitative measures findings

6.2.4.1.1 Success rate across the three websites

The third task was for participants to 'Find an Internet package'. Participants did not perform as well as in the 'Find a plan' task due to a disconnect in terminology. Cellular companies refer to internet packages as 'data', and users do not relate to the term data when looking for an Internet plan for their laptop or phone. Participants' understanding of data is a collection of facts, such as information, values or measurements. Cellular companies define data as a concept including plans that allow participants to browse the internet on their phones or laptops. From the representation of information on the websites, all participants were unsure which data product would be suitable for them and would need to speak to someone personally for more information. In this respect, the Vodacom and MTN sites performed less well. Eleven participants stated that searching for an Internet plan on the Vodacom and MTN

sites was tedious and text heavy. Cell C was the only website with a 100% success rate, the contributing factor being the clear navigational heading *Internet*.

6.2.4.1.2 Route taken and errors made

Browsing to find an Internet package was not intuitive and most user strategies involved some guessing. It is notable that participants gained the impression that cellular companies did not want to promote Internet access as their core offering, despite the promotions on TV and billboards. It appears that cellphone companies assume that participants fully understand the product offering and hence give insufficient support and assistance. Table 6.10 discusses the routes and errors made by participants on three of the target sites. There are no Virgin Mobile findings in the table, because Virgin Mobile does not offer Internet packages.

Table 6.10 Route taken and errors made

	Route	**Errors**
MTN	**Internet package placement on the MTN site** • Internet packages are situated within the *Service* navigation menu. **Route taken by the user** • Participants found MTN to be slightly more intuitive than Vodacom due to the placement of the term *Broadband* under the navigation name *Services*. However, they would have preferred to find it within *Find a package*, due to the fact that it is a contract plan and not a service.	Out of 12, three participants made errors: • Participants found the word *Internet*. However, this category did not relate to packages, but to managing internet accounts online. • Users could not relate the word *Data* to *Internet* and gave up searching. • Users searched *Internet* and no decision-making results came up.
Vodacom	**Internet package placement on the Vodacom site** • Internet packages are situated within the *Value Added Services* navigation menu. **Route taken by the user** • Most of participants took a guess and stated that they did not expect to find *Internet* within the *Value Added Services* navigation menu. One user searched 'Internet packages' and received no results.	• Three out of 12 participants abandoned the task. • Participants did not relate *Internet* to *Value Added Services*.
Cell C	**Internet package placement on the Cell C site** • Internet packages are situated within the *Internet* navigation menu. **Route taken by the user** • All 12 participants clicked on the *Internet* link in the primary navigation.	

Table 6.10 indicates the routes taken and errors made by participants. The average time durations in minutes taken to complete the task and the average number of clicks are depicted in Figure 6.3. The data in its complete form for the number of clicks, and time duration in minutes for all 12 participants across the three sites is depicted in Table 6.11.

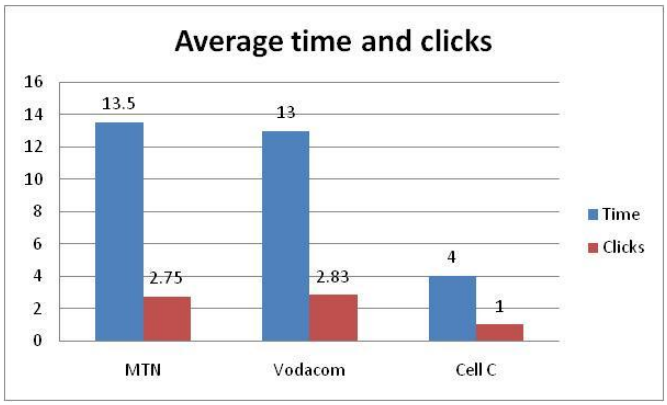


Figure 6.3 Average time and clicks taken to complete task

Table 6.11 Time and clicks taken to complete task

	MTN		Vodacom		Cell C	
	Time	**Click**	**Time**	**Click**	**Time**	**Click**
1	14.5	2	11.5	4	4.5	1
2	12.5	2	14	4	4.5	1
3	11	1	17	4	4	1
4	16	3	17.5	5	3	1
5	10	1	12	1	3.5	1
6	16	5	15	4	4	1
7	16.5	7	10	1	4.5	1
8	15.5	4	15.5	4	4	1
9	13.5	2	9	1	3.5	1
10	10.5	2	9.5	1	4	1
11	13.5	2	12.5	4	4.5	1
12	12.5	2	12.5	1	4	1
Ave:	**13.5**	**2.75**	**13**	**2.83**	**4**	**1**

Participants took much longer to complete the task for ‘Find an Internet package’ compared to ‘Find a plan’. Contributing factors were the non-intuitive navigation menus to guide users where they should go. In many situations, there was too much to choose from with no guidance to help participants find the right product. In this respect, the MTN and Vodacom sites performed less well. Participants needed an average of 2.75 clicks to find an Internet package on the MTN site and 2.83 clicks on the Vodacom site compared to the single click on the Cell C site.

6.2.4.2 Qualitative measures findings

The qualitative measures were: ease of use, content satisfaction, structure, terminology and visual appeal. The results for: ease of use, content satisfaction and structure are depicted in Figure 6.4. Table 6.12. which follows, discusses the ease of use, content satisfaction and structure expressed in terms of positive and negative factors. With regard to MTN and Vodacom, the participants' comments were all negative. Given this outcome, only negative factors are shown for ease of use, content satisfaction and structure of MTN and Vodacom in Table 6.12. In contrast to this, only positive factors are indicated for the Cell C site, due to the fact that Cell C was the only website on which participants could complete the task successfully and intuitively. Table 6.13 following, lists participants' ratings and comments regarding ease of understanding the terminology, as well as the visual appeal of the three suppliers' websites.

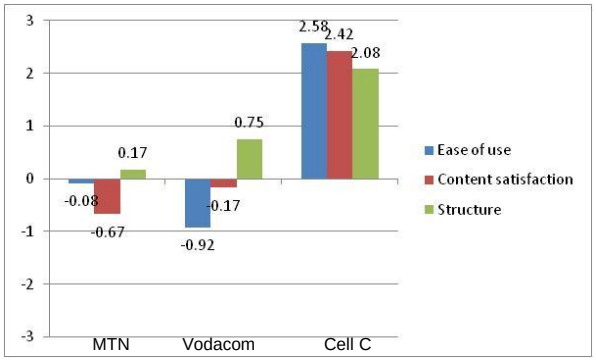


Figure 6.4 Ease of use, content satisfaction and structure

The ease of use findings (see Figure 6.4) indicate that all participants get frustrated or even despondent if the naming convention on the navigation menu is not a good representation of the offerings presented. This occurs when the cellular companies do not logically group their product offering and when they choose a naming convention that non-intuitively represents the entire product offering.

Examples of this type of structure occurred with the MTN and Vodacom sites. The average rating for ease of use on the MTN site was –0.08. All the participants found that there was no clear link to Internet packages. They did not expect to find it within the *Services* navigational menu. Regarding Vodacom, the average rating for ease of use was –0.92; nine participants could not relate the word *Internet* to *Value Added Services*. This type of naming convention prevented participants from satisfying their goals.

Participants are able to make better decisions if the navigation menu naming convention is a good representation of the content provided within that section. A good example was the Cell C site, where the intuitive and logical navigation and the naming of the menu as *Internet*, allowed all 12 participants to complete the task successfully.

The content satisfaction finding (see Figure 6.4) indicated that all participants became frustrated when they had to click a great deal to understand the entire offering. Furthermore, they were frustrated if, on reaching product detail, there was insufficient description of the product to support them in making a decision. Examples of this type of structure occurred on the MTN and Vodacom websites. The average rating for content satisfaction on the MTN site was –0.67 and –0.17 on the Vodacom site.

The structure finding (see Figure 6.4) shows that eight participants appreciate it when the entire product offering is provided in a summary page, thus eliminating click fatigue in attempting to understand the product offering. Users get frustrated when product pages are lengthy with no bullets or tables summarising the most important decision-making information (price and benefits).

Table 6.12. which follows, discusses the ease of use, content satisfaction and structure with regards to finding an Internet package, expressed in terms of positive and negative factors.

Table 6.12 Ease of use, content satisfaction and structure expressed in terms of positive and negative factors

	Ease of use	Content satisfaction	Structure
Cell C positive factors	Participants found the Cell C website the easiest to use for the task 'Find an Internet package'. The main contributing factor was the intuitive term *Internet*.	Cell C provides the right type of information and functionality in order to make a decision, such as brief product description, cost and call to action. This type of information allowed participants to complete the task efficiently without experiencing any frustration. A typical comment with regard to the content satisfaction was: • '*Provides all the information that I need'*	Does not require a lot of reading. The most important information is situated at the top of the page: • '*Structure of the page is easy to read'* • *'Clearly see what the content includes'* • *'Too textual at the bottom of the page'*
MTN negative factors	• No clear links to the Internet packages; participants did not expect to find it under the *Services* navigational heading. • Navigating and finding an 'Internet plan' requires a good knowledge of cellular terms. • There is no clear indication on what the difference is between *Broadband* and *SMS & Data* on the MTN website. Both these sections provide information on *Internet* connectivity. Participants were confused by the entire offering and would have to consult other channels for more information.	MTN received the lowest rating due to the long and difficult-to-relate-to product descriptions. Participants felt they had to click into up to twenty links to understand the entire offering. Overall, they realised they would need to visit a physical store or phone the call centre for more assistance. • *'I do not understand the product offering'* • *'No summary on what I can do with it'* • *'No clear call to action'* • *'Readability is terrible'* • *'Disconnect in the user journey - a lot of irrelevant info'*	No summary of the most important content, forcing participants to click through each and every link to find out the purpose of each product: • *'Need to click through all the products to try and understand them'* • *'No structure or engagement, very static'* • *'Too much reading'* • *'Content is not summarised/graphic in terms of tables/pictures'* • *'Does not highlight specific important information'*
Vodacom negative factors	• Grouping of content in the navigational headings is not intuitive and participants believed that Vodacom bundles irrelevant information together. • Navigating to the Internet packages is not obvious; the participants did not expect to find it within *Value Added Services*.	Participants felt that there was not enough information around the Internet product offering in order to make a decision. This was due to the fact that participants thought that Vodacom only offered one Internet plan. • '*No help me choose functionality'* • *'Not enough detail around the contract'* • *'No call to action'* • *'Not intuitive'* • *'Not for a novice user'* • *'Only one package available, not as advertised'* • *'Obviously, broadband is not a key offering'*	Participants indicated that they had to work much harder to achieve their goals on the Vodacom site due to the pages being lengthy. • '*Too much scrolling'* • *'Too much reading'* • *'Readability is terrible'* • *'Wizard, very lengthy'*

6.2.4.2.1 Terminology and visual appeal

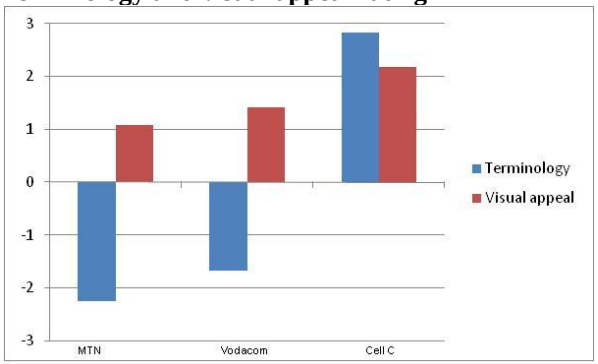
Table 6.13 following, lists participants' ratings and comments regarding ease of understanding the terminology, as well as the visual appeal of the three suppliers' websites in the process of searching for an Internet package.

The terminology findings indicate that all the participants appreciate it if suppliers do not assume that users understand the product offering as well as they do. A good example of this type of structure was the Cell C site. Cell C provided rich product descriptions that explained what the offering *Internet* is and named the entire product offering *Internet*.

The visual appeal findings indicate that all participants are attracted to a layout that includes a good balance between text, tables and pictures, as well as a layout that provides clear and easy product pathways to enable participants to satisfy their goals. Good examples of this type of structure were the Vodacom homepage and the entire Cell C site.

Table 6.13 Terminology and visual appeal comments

Terminology and visual appeal rating



Terminology		
Cell C	**MTN**	**Vodacom**
Participants found that Cell C did not take it for granted that they understood the meaning of the term *data*. Cell C included descriptions explaining what *Mobile Internet* is, as well as naming the entire product offering *Internet*. • '*Like that they explain what Mobile Internet is about'* • *'Good depth of knowledge'*	Participants found the product offering description to be too technical, with no supporting content such as a glossary to help them understand the products. Participants also believed that the term *data* means information, and they could not relate to it referring to Internet on a phone or laptop. • '*Data is information not Internet'* • *'Nothing obvious that states Internet'* • *'No glossary of terms'* • *'Technical, assumes that I understand all these terms'* • *'Best data advisor should be called Best broadband / Internet Advisor'* • *'Extended data makes no sense to me'* • *'MB/GB what is the difference'*	The major negative comment with regard to the terminology used on Vodacom, was that it differs from what is used to advertise on other channels such as: print, billboards and TV, where terms such a *GPRS* and *3G* are used. The website does not include those products in the navigation menus. • '*Value added services do not relate to Broadband'* • *'Terminology is not user friendly'* • *'Not as advertised, i.e. GPRS, 3G'*
Visual appeal		
Cell C	**MTN & Vodacom**	
Overall, participants rated Cell C the highest in terms of visual appeal. The major contributing factors include: good balance between text, tables and pictures, and the fact that it was clear and easy to find what they were looking for.	Vodacom was rated the second highest. The responses were similar for Vodacom and the MTN site with regard to the visual appeal. Participants found the websites to be too textual. Too much reading and scrolling was required, and there was a lack of pictures to create a good balance.	

6.2.4.3 Consolidation of the 'Find an Internet package' task

In each case, participants felt that the journey was not well designed. The frustration of trying to find an Internet package left a negative impression of the brand image. User strategies frequently involved guesses. Three major frustrations identified were:

- Participants became despondent when the navigation menu naming conventions were not a good representation of the offerings.
- The need to click a great deal to understand the entire offering, is frustrating. It is made worse if, once they reach the product detail, there is not sufficient product description to help them make a decision.
- Due to non-intuitive terminology, such as the word *Data*, participants could not relate this term to *Internet* access on their phone or laptop.

These frustrations reduce the likelihood of user engagement and there is no continuation or drive for the user to continue. Potential users are forced to consider other channels (retail) or other suppliers to satisfy their goals. Cell C was the only supplier that achieved positive responses with regard to the above three frustrations. Following are the user experience findings.

6.3 User Experience (UX) findings

The same 12 participants who took part in the usability testing process, were also the participants in the user experience study. After they had completed the tasks: 'Find a plan' and 'Find an Internet package', they were asked to complete a user experience questionnaire that captured their overall perceptions. The user experience questionnaire, which is provided in Appendix A7, presented, as options, various possible positive and negative impressions. Participants were asked to select and list the positive and negative emotions they had experienced while using each of the target systems.

The user experience findings across the four websites, MTN, Vodacom, Virgin Mobile and Cell C, are discussed as follows: firstly, the positive and negative emotions, and secondly, comments relating to aesthetics. The list of positive emotions considered include ease of use, enjoyable, appealing, useful, comprehensive, friendly and engaging. The negative emotions experienced include boring, frustrating, business like, time consuming, overwhelming and annoying. The aesthetics findings are subdivided into: use of colour, use of pictures, clear and easy to read, visual load, text size, text colour, strength of branding, overall visual appeal and

compared to other sites that participants have interacted with. The user experience findings are concluded by considering the overall ratings for features and functionality, content offered, navigation, homepage layout, other page layouts, interactivity, customisation, tone of content, use of graphics, level of relevance and excitement.

6.3.1 Positive and negative emotions

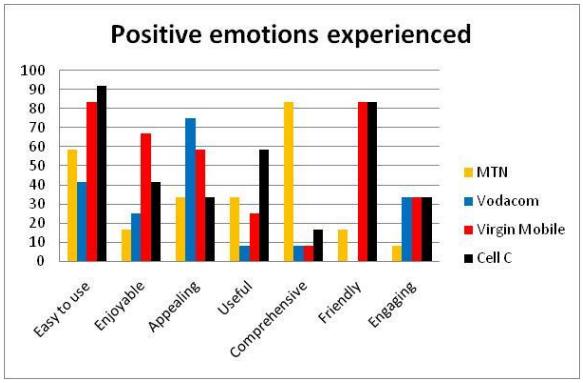


Figure 6.5 Positive emotions (UT)

Figure 6.5 displays positive emotions experienced. If a site has a score of, say 80%, for a particular emotion, it means that 80% of participants chose that adjective to describe it. For example, Cell C and Virgin Mobile were described as 'easy to use' and 'friendly' from high percentages of participants. All participants appreciate it when suppliers provide clear and easy-to-understand menus and navigation paths in order to satisfy goals. Examples were the Cell C and Virgin Mobile sites, on which most participants took one click only to access what they were looking for. These sites also obtained positive responses with regard to the product naming conventions, for example: *Internet.*

Furthermore, participants were required to motivate why they chose the various emotions. After they had filled in the questionnaire (Appendix A7), the researcher browsed through the completed questionnaires. In informal interviews, she asked the participants to motivate the positive emotions they had selected. Following are the key contributing factors that generated the positive experiences, as explained by the participants:

Ease of use

- All participants found the key factors determining ease of use were: simplicity of the content and easily-understandable product offerings. Virgin Mobile and Cell C provide good examples.

Enjoyable

- The expert internet users stated that they enjoy a website if the look and feel is innovative and the tone of the content is easy to read. A good example was the Virgin Mobile site. None of the participants enjoy using websites that are difficult to understand and have a business tone, examples being MTN and Vodacom.

Appealing

- All of the participants find a website to be appealing when the content offered on the homepage speaks directly to their cellphone needs such as *phones* and *deals*. Eight participants indicated that a site is also more attractive when the structure is uncluttered and clearly differentiates the different product categories. The Vodacom homepage achieved this effectively.

Useful

- All participants agreed that websites offer a better experience when the product names are easy to relate to and support them in making the right decision. The Cell C site is a good example, as it provides intuitive navigational menus and product names.

Comprehensive

- Ten participants appreciate depth of product detail, but would prefer it if the most important decision-making aspects were summarised in tables or bullets. A good example was the MTN website. Even though all the participants found its content to be the most comprehensive, they also experienced it as pedestrian and laborious for a user busy looking for a product.

Friendly

- The websites should not presume that users understand the cellular business and terminology as easily as staff working with products. All the participants were unanimous on this point. The Virgin Mobile and Cell C sites were positive examples.

Engaging

- All participants found that the information on the supplier sites was product-focused and lacking in content such as: *new product information* or *reviews* that would entice them to return on a regular basis. No supplier received a high rating with regard to engagement. Participants stated that they would only return if they were looking for information on a specific product or a service.

The next section will discuss the negative emotions experienced (see Figure 6.6). As stated previously, the researcher held informal interviews after the participants had completed the questionnaire, and asked them to motivate negative emotions they had experienced.

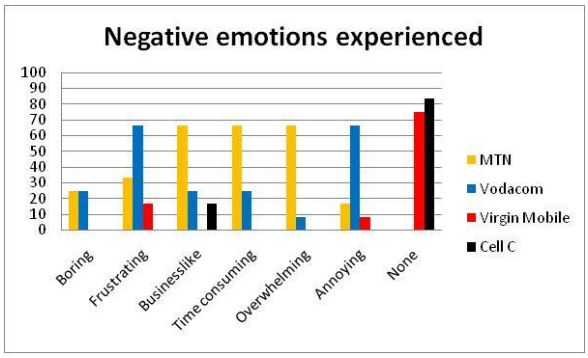


Figure 6.6 Negative emotions (UT)

Novice internet users were irritated when suppliers included technical product descriptions with no assistance to support them in choosing an appropriate product-based on particular cellphone needs such as *phones* and *deals*. In this respect, the Vodacom and MTN sites performed less well. With regard to the Vodacom site, most participants could not understand how to use the functionality provided and most participants found MTN to be businesslike, time consuming and overwhelming to browse (see Figure 6.6).

Overall, across the four suppliers, participants found the journey to find products unenticing. Instead, it was pedestrian and tedious.

Section 6.3.1 introduced the positive and negative emotions experienced across the four suppliers. The next section discusses comments relating to aesthetics across the four suppliers (see Figure 6.7).

6.3.2 Aesthetics findings

Participants were asked to rate the use of colour, use of pictures, clarity and ease of reading, visual load, text size, text colour, strength of the branding, overall visual appeal and compared to other sites on the four suppliers (see Figure 6.7), (Question 4.3, Appendix A7).

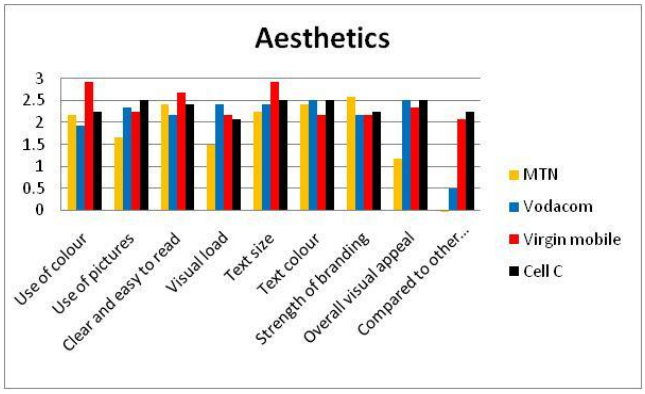


Figure 6.7 Aesthetics ratings across the suppliers

Use of colour

- The participants in general have a clear preference for a 'fun' and informal look and feel, rather than a conservative and formal approach. For example, participants felt that the Virgin Mobile and Cell C sites had associations with play, and did not look as formal as MTN and Vodacom. Even though participants preferred the Vodacom homepage, seven felt there was too much use of blue. Although they understood that blue related to corporate identity, they would have preferred Vodacom to include other colours in their colour palette and be a bit more pioneering.

Use of pictures

- Ten of the participants prefer a layout with photographs and diagrams that grab their attention. Such pictures should be less cellular focused and with more of a lifestyle association. All participants relate better to visuals, and find them to be a key contributing factor when making a purchasing decision. Good examples were the Cell C and Vodacom sites.

Clarity and ease of reading

- Overall, all participants found readability to be satisfactory across the suppliers. Two participants who wore glasses stated that the Virgin Mobile site achieved this by making the font size much larger compared to the other suppliers.

Visual load

- All participants appreciate a good balance between banners and text. Vodacom was considered best in this regard, but lacked in providing participants with sufficient information to satisfy their goals.

Text size

- Two participants who wore glasses, found it difficult to read capital and lower case at the same time. An example of this type of structure was the Virgin Mobile site. Overall, the text size is functionally acceptable across the suppliers.

Text colour

- All participants found the links to be clear and easy to distinguish from the content. Overall, participants provided similar ratings with regard to the text colour across all four suppliers.

Strength of branding

- Nine participants found that in some instances the corporate identity colours tended to be overwhelming and too strong as a website colour. Two poor examples are the red used on the Virgin Mobile site and the blue on the Vodacom site.

Overall visual appeal

- All participants prefer to read through a minimal amount of information in order to satisfy their goals, with a content structure that includes a good balance between banners and text. Good examples were the Virgin Mobile, Cell C and Vodacom sites, while the MTN site was a poor example.

Compared to other sites

- Expert internet users preferred an innovative, distinctive website that does not look like a brochure site. The Cell C and Virgin Mobile sites were good examples:
  - '*Fresh, went the extra mile'*
  - *'They wanted to be different and they succeeded'*

MTN was a poor example; participants felt that the website was too 'brochure-like' and lacked visual appeal.

The next section discusses participants' overall experience findings across the four suppliers.

6.3.3 Overall experience findings

Participants were asked to rate the features and functionality, content offered, navigation structure, home page layout, other page layouts, interactivity (does the e-commerce website facilitate a two-way communication with the users?), customisation (does the website tailor its products and services?), tone of the content, use of graphics, level of relevance and the level of excitement on the four suppliers (Question 4.4, Appendix A7).

Features and functionality

- The participants in general were frustrated with the features and functionality offered across the four suppliers, stating that, even though the functionality was efficient in assisting them to find products, there was not enough product feature information to help them make a purchasing decision.
- A poor example was the MTN *Best Package Advisor*; participants felt that it only assists those users that are migrating from MTN's old packages to MTN's new packages and does not assist prospective users in finding a package based on their current cellphone needs.

Content offered

- The response with regard to the content offered was varied. Participants either felt that there was too little or too much content. Cell C was a good example, due to the simplicity of the content offered, and even though some key information such as: price and call to action was hard to find, the simplicity of the user journey to the product is less intimidating and more inviting. Eight participants felt that although the Virgin Mobile site provided the impression that it offers price-saving deals, it was disappointing to realise that it provided only one savings offer.
- Products were too focused on product features, rather than on needs regarding cellphones. All the participants were unanimous on this point and stated that this made it difficult to find a product that spoke directly to their cellphone needs. A poor example was the MTN site. Even though MTN provided the most comprehensive detail about the product, all participants were frustrated by the large amount of content they had to read to satisfy their goals.

Navigation

- The product-naming conventions used in the navigation menus, were found by all the participants to hamper performance. This occurred particularly in the 'Find an Internet package' task. Poor examples were the MTN and Vodacom sites due to the non-intuitive naming conventions.
- Overall however, all the suppliers received good ratings with regard to the navigation involved in finding the right product.

Homepage layout

Following are the key attributes that all participants identified as being missing from the suppliers' homepages:

- ***Brand proposition****: 'Include a brand promise, what does brand stand for?'*
- ***Reason to believe****: 'Why should I choose them?', 'What can they do for me?'*
- ***Value proposition****: 'Give me value, not just sell products'*
- ***Engaging and compelling designs****: 'More innovations and be different'*
- ***Companies should not take for granted that participants understand the product offering as well as they do:*** *'Design novice websites'*

Six participants found the Vodacom homepage to be enticing and engaging. It made them want to look further, but they found that the homepage strategy was not carried through to the rest of the website. For Virgin Mobile, all participants felt that the category names were up front and obvious, and stated that it was an innovative layout, but lacked engagement. With regard to Cell C, nine participants found it to be an admirable design that lacked substance for decision making. Lastly, with regard to MTN, all participants felt that they needed to work hard in order to satisfy their goals.

Other page layouts

- None of the participants appreciate large amounts of content to read, extensive scrolling, or layout designs that do not help them find the information they need efficiently and effectively. The Cell C and Virgin Mobile sites were successful in achieving this by the simplicity of the content offered, the user-friendly terminology, and the overall visual appeal. Vodacom and MTN were poor examples; seven participants found that there was too much white space on the detail pages.

Interactivity

- In the pre-test questionnaire, participants were asked to list the most commonly used functionality on e-commerce sites (see Section 6.2.1). They mentioned *Help me choose*, *Product reviews*, *Product tips* and *Recommendation*s. None of the four suppliers provided any of these frequently used features named by participants, making it difficult for the participants to choose products online.
- Overall, participants in general felt that the content was static, there was too much scrolling, and content was not engaging. Five participants found that the flash used on the Vodacom site made the page download slowly, and if it took longer than two minutes to download, they would abort the website and go somewhere else.

Customisation

- Customisation was the weakest category; no suppliers allowed participants to customise their own package or to add a product to a favourite/wish list.

Tone of content

- All participants preferred content that is conversational with user-friendly terminology. The Virgin Mobile and Cell C sites are good examples. With regard to MTN and Vodacom, all participants felt that they needed a good knowledge of cellular terms in order to understand the content offering.

Use of graphics

- Generally, users do not relate banners on a website to products, but rather as aesthetics that make the websites look more visually appealing. All the participants were unanimous on this point. Most stated that they were satisfied with the look and feel across the four suppliers, apart from MTN. Eight participants felt that MTN needs to include more graphics and make the website less textual.

Level of relevance

- All participants would like the option to be able to convert online. For example, having chosen the website as a purchase channel, it should provide them with an opportunity to be able to convert online to another method of purchase, by giving purchase options, store locations as well as a stock list. Participants found the overall content offering to be relevant, but they would still have to visit an actual retail store to make the purchase.

Level of excitement

- Across all suppliers, participants in general did not give high ratings to ‘level of excitement’. This was due to the lack of interactivity and engagement the content offered. African language participants stated that it would be to the suppliers’ advantage if websites included cultural aspects such as different language options in order to help them understand complex information. Overall, participants found Virgin Mobile and Cell C to present better experiences than MTN and Vodacom to users looking for products and services.

6.3.4 Consolidation of user experience findings

Overall, participants found that, even though functionality may be efficient in assisting them to find the right product, there was not enough product information to make a purchasing decision, for example: content offered was varied; products were structured around the business rather than user cellphone needs. Most importantly, participants require the facility to be able to convert online, for example: they require information on purchase options, store locations, and stock lists.

The next section will discuss the results of the heuristic evaluation conducted by expert evaluators.

6.4 Heuristic evaluation (HE) findings

Four expert evaluators were asked to conduct a heuristic evaluation of the four websites:

- MTN (www.mtn.co.za)
- Vodacom (www.vodacom.co.za)
- Virgin Mobile (www.virginmobile.co.za)
- Cell C (www.cellc.co.za).

They were presented with an information document and requested to sign a consent form, agreeing to participate and acknowledging that their inputs were purely for academic use, and would not be used for consulting purposes. They were aware that no evaluator names or affiliations would be published or disclosed. The information document and the consent form are in Appendix B2**.**

The primary purpose of an HE is to identify problems within the interface and the interaction sequence. To do this, the evaluators completed an evaluation form based on the three categories of criteria identified in Section 5.4.2 and listed in Tables 5.6, 5.7 and 5.8 respectively:

- General interface design heuristics (Appendix B3);
- E-commerce usability design heuristics (Appendix B4); and
- User experience design heuristics (Appendix B5).

The form and the data and ratings in totality are in Appendix C. Whereas the criteria in Tables 5.6 to 5.8 were phrased in a conceptual way, the criteria in the evaluation forms, are translated into simple and specific evaluation statements. For example, the criterion in Table 5.6 under 'Visibility of system status', namely: 'The system should always keep users informed on where they are, as well as provide appropriate feedback within a reasonable time' is reformulated in Appendix C1 as four single-issue statements, 1.1 to 1.4. The criterion for Table 5.7 and 5.8 are formulated in Appendix C2. Of the experts, two were so-called 'double experts' with expertise in both e-commerce and usability, while two were usability experts.

The findings within the three categories are given in Sections 6.4.1, 6.4.2, and 6.4.3 respectively. Discussions per criteria are given in Tables 6.14 through to 6.30. The findings are presented in such a way that problems identified by the experts in the HE, are immediately compared with problems identified by user participants in the UT. In

each table, the right-hand column indicates to which website the row relates, while the other columns respectively list the number of experts who recognized that problem, and specify whether the responses were similar (i.e. common) to the UT by entering a tick (√) or whether the problem was unique to HE by entering a cross (X).

Firstly the general interface design heuristic evaluations are discussed (Tables 6.14 to 6.19), followed by e-commerce usability design heuristic evaluations (Tables 6.20 to 6.30), and then the user experience heuristic evaluations are discussed in Section 6.4.3.

6.4.1 Criterion 1: General interface design heuristics findings:

6.4.1.1 Visibility of the system status

The heuristic evaluation (HE) methods identified seven common problems, and three unique problems (see Table 6.14).

Table 6.14 Visibility of the system status

No of evaluators	Problems identified	Usability testing	Website
All	Lack of intuitive and clear navigation menus.	✓	Cell C
All	Too many homepages, with no clear indication on the purpose of each.	✓	MTN
2	Lower-level pages are overwhelming with content, with no clear indication on what to do next.	✓	MTN
1	Links are clearly marked, but the content is generic and it is difficult to find information that relates directly to cellphone needs.	✓	MTN
All	The content categories on the homepage represent appropriate concepts, for example, *Packages and Deals.* However, expert evaluators pointed out that the content category headings are not actually links and much of the content situated within such categories did not relate to the section, i.e. *Packages and Deals*, instead, it included content links such as: *Iphone registration, Vodacom Direct and Rica.*	✓	Vodacom
All	No *home* link on the lower-level pages. Novice participants struggled to understand that they could also navigate back to the homepage by using the Vodacom Logo.	✓	Vodacom
1	The brand articulation is weak; nothing stands out within	✓	Virgin

No of evaluators	Problems identified	Usability testing	Website
	the content besides the logo that indicates it is a Virgin Mobile website.		Mobile
2	Page titles do not represent the links in the left navigation, i.e. *Package Options*, when the page title is *Overview*.	X	Vodacom
1	The primary navigation headings are not clear and do not appear as part of the homepage content. This may be due to the main banner that separates homepage content and the primary navigation.	X	Vodacom
1	The links within the different content categories on the Vodacom site are not a good representation of links, i.e. they are not underlined.	X	Vodacom

6.4.1.2 User control and freedom

The heuristic evaluation method identified similar problems to those found in the UT, such as the visibility of the system status: no home link on the Vodacom website and two different homepages on the MTN website.

Overall, UT participants and HE expert evaluators found these two issues caused a great deal of confusion when trying to accomplish tasks (see Table 6.14).

6.4.1.3 Consistency and standards

The expert evaluators found three common problems, and no unique problems (see Table 6.15).

Table 6.15 Consistency and standards

No of evaluators	Problems identified	Usability testing	Website
All	The *Find a package* term misled the expert evaluators, who expected to find cellphones as well as plans, but the category only offered plan options.	✓	MTN
All	The pages are not the same as the links that point to them, i.e. clicking on the *Package* link from the homepage content accesses a page with the title, *Top Packages*. This type of structure caused a lot of frustration by forcing participants to search again for the packages that they wanted to view.	✓	Vodacom

No of evaluators	Problems identified	Usability testing	Website
All	*Search* and *Compare* functionality is not intuitive. No instruction informs participants that they can select more than one package in order to compare, then once selected, the packages are moved into the above scroll bar. Participants' initial impression was that all they had to do, was click on a package name and obtain the product detail. The page does not function in that manner, and there is an unnecessary additional step in the process. Participants in the usability test stated that it took time to understand how the functionality works, but once they had understood it, they found the functionality to be very helpful and useful.	✓	Vodacom

6.4.1.4 Error prevention, diagnosis and recovery

Three common problems were identified by the expert evaluators, and one unique problem (see Table 6.16).

Table 6.16 Error prevention, diagnosis and recovery

No of evaluators	Problems identified	Usability testing	Website
All	Too many links. This type of structure creates a tedious journey with no quick option to find a product.	✓	MTN
1	*Best Package Advisor* is deceptive. It does not assist prospective users, but only current users.	✓	MTN
2	The headings and links do not provide the right type of information on first click, i.e. *Packages and Deals*. Once a user lands on the *Packages and Deals* page, they need to search further.	✓	Vodacom
1	This site is the most efficient in providing various options to search for *Packages and Deals.* It can be done via homepage content as well as primary navigation and search functionality whereas other suppliers only provide the primary navigation menu links.	X	Vodacom

6.4.1.5 Flexibility and efficiency of use

The heuristic evaluation methods identified one common problem, and two unique problems (see Table 6.17).

Table 6.17 Flexibility and efficiency of use

No of evaluators	Problems identified	Usability testing	Website
All	Compare functionality is not intuitive, nor efficient (see Section 6.4.1.3 Consistency and standards).	✓	Vodacom
2	Helpful quicklinks are at the bottom of each page.	X	Cell C
1	Users are forced to scroll, due to being unable to use the 'up' and 'down' arrows on the keyboard.	X	All

6.4.1.6 Aesthetic and minimalist design

The heuristic evaluation methods found two common problems, and three unique problems (see Table 6.18).

Table 6.18 Aesthetic and minimalist design

No of evaluators	Problems identified	Usability testing	Website
All	It should be possible to minimise text on the detail pages, as well as on the homepage. The homepage has many distracting visuals and the structure is inadequate.	✓	MTN
All	All the websites investigated take too long to load, due to the large amount of imagery used.	✓	All
1	The user login/registration at the top right of the site appears to be one single heading. They should be well separated from each other. The search function should have the word *search* as well as a text box.	X	MTN
1	The CEO message dominates the entire homepage.	X	Cell C
1	Flash banner promotion on the homepage moves too quickly, not allowing the participant to read the full promotion.	X	Cell C

6.4.1.7 Help and documentation

The heuristic evaluation identified one unique problem (see Table 6.19).

Table 6.19 Help and documentation

No of evaluators	Problems identified	Usability testing	Website
All	No efficient *help* available across the suppliers apart from Cell C. Cell C provides various links at the bottom of the pages such as: *frequently asked questions (FAQs), coverage map* as well as quicklinks to various product offerings. This provides a continuous user journey.	X	All

6.4.1.8 Recognition rather than recall

The heuristic evaluation did not reveal any problems.

The other two heuristics: 'Match between system and the real world' and 'Help participants recognize, diagnose, and recover from errors' were not included in the heuristic evaluation.

The next section will discuss the e-commerce usability design heuristics.

6.4.2 Criterion 2: E-commerce usability design heuristics findings;

6.4.2.1 Communication of the intended message

The HE found two unique problems, and four common problems (see Table 6.20).

Table 6.20 Communication of the intended message

No of evaluators	Problems identified	Usability testing	Website
All	The expert evaluators expected to see pictures of cellphones on the homepages, pointing out that visuals are a key primary driver for visitors to cellular websites.	✓	All
2	The MTN offerings are not clear from merely looking at the homepage. The main focal points on the page at the time of the HE were a large *vuvuzela* and a *Miss Soweto* promotion. Participants that do not know the brand well, might get confused as to what MTN is marketing.	✓	MTN
All	There is too much reading on the lower-level pages.	✓	All

No of evaluators	Problems identified	Usability testing	Website
All	Expert evaluators found that the information on the detail pages was insufficient for a would-be client to make a purchasing decision, i.e. to select a phone.	✓	All
2	The dark background on the website makes it difficult to read certain content areas, especially all the links at the bottom of the page.	X	Cell C
1	The banner on the homepage is too dominant, with no focus on cellular but rather on television and digital satellite television (DSTV). The expert stated that if he had wanted TV information, he would have gone to the relevant websites. Visitors to Vodacom expect to find phone and plan information as the most prominent feature on the homepage.	X	Vodacom

6.4.2.2 Page display, layout and site structure: Information architecture

The expert evaluators identified two common problems, and two unique problems (see Table 6.21).

Table 6.21 Page display, layout and site structure: Information architecture

No of evaluators	Problems identified	Usability testing	Website
2	The *Find a package* section is difficult to understand and navigate due to the inconsistent left navigation menus.	✓	MTN
2	At first glance it is difficult to understand the primary navigation menus: *My Store, My Vodacom, My Content, and Rewards.*	✓	Vodacom
1	Directly below the *Service* link on the homepage, there is a link called *View more services*. A user would expect to find certain main services listed before such a link.	X	Vodacom
1	The naming conventions on the primary navigation menus do not represent the product offering. For example, *Travel* is associated with holiday packages, but on the MTN site, it is positioned as the roaming offering.	X	MTN

6.4.2.3 Page display, layout and site structure: Search

The HE indicates that, across the suppliers, 'search' was not found to be efficient. Expert evaluators did not receive effective results that assisted them in satisfying their goals. Results were generic, with irrelevant links and no recommendations on what the user could do next (see Table 6.22).

This criteria was not applicable (n/a) to usability testing because 'search' was not a criteria.

Table 6.22 Page display, layout and site structure: Search

No of evaluators	Problems identified	Usability testing	Website
1	A search for a contract plan obtained no results, even though the plan required was available on the website.	n/a	MTN
1	A search for *Deals* obtained no results relevant to the search.	n/a	Vodacom
1	A search for a *Top-up Package* found three links at the top of the page directing the evaluator to another website.	n/a	Virgin Mobile

6.4.2.4 Page display, layout and site structure: Site-wide navigation

The heuristic evaluation found one common problem, and one unique problem (see Table 6.23).

Table 6.23 Page display, layout and site structure: Site-wide navigation

No of evaluators	Problems identified	Usability testing	Website
All	No clearly marked *Home* link on the lower-level pages.	✓	Vodacom
1	Links at the bottom of the page are too small. Expert evaluators stated that older target groups with specific needs, might find it difficult to notice these important links.	X	Vodacom & Cell C

6.4.2.5 Page display, layout and site structure: Contextual navigation

The experts identified one common problem, and one unique problem (see Table 6.24).

Table 6.24 Page display, layout and site structure: Contextual navigation

No of evaluators	Problems identified	Usability testing	Website
All	There are currently seven levels of navigation, and page titles do not match the links in the left navigation menus. The deeper the participant navigates into the website, the more confusing and frustrating it becomes to identify orientation within the site.	X	MTN
1	The *Package page* provides various related links suggesting actions, but these links do not access relevant sections.	✓	Virgin Mobile

6.4.2.6 Page display, layout and site structure: Page structure and presentation of information

HE methods found one common problem and no unique problems (see Table 6.25).

Table 6.25 Page display, layout and site structure: Page structure and presentation of information

No of evaluators	Problems identified	Usability testing	Website
All	Journey not intuitive; pages are too long; too much reading and scrolling without tables / bullets for easier readability.	✓	MTN

6.4.2.7 Page display, layout and site structure: Language and tone

The HE identified three common problems, and no unique problems (see Table 6.26).

Table 6.26 Page display, layout and site structure: Language and tone

No of evaluators	Problems identified	Usability testing	Website
2	*My MTN* and *Ayoba* are difficult to understand	✓	MTN
3	The cellular terms *Mobile number portability* and *Rica* are difficult to understand, confirming the point made by participants in the UT, that foreign users living in South Africa would not understand such terminology.	✓	Vodacom

No of evaluators	Problems identified	Usability testing	Website
All	As indicated under the *Information architecture* heuristic, as well as in the usability testing, participants and expert evaluators found the primary navigation menus on the Vodacom site unclear. They appear to be focused more on current Vodacom clients.	✓	Vodacom

6.4.2.8 Value of information provided

The heuristic evaluation found no common problems and one unique problems (see Table 6.27).

Table 6.27 Value of information provided

No of evaluators	Problems identified	Usability testing	Website
All	Expert evaluators were not completely satisfied with the content offered on the sites. All the experts expected to see the plans supported with cellphones. No supplier company provided the intended purchase flow. In addition, there was no *compare* functionality to present plans that they wished to compare, i.e. Top-up and Contract.	X	All

6.4.2.9 Culture

The HE identified no common problems and two unique problems (see Table 6.28).

Table 6.28 Culture

No of evaluators	Problems identified	Usability testing	Website
2	The pictures of the customer experience officer is of a South African (SA) comedian who was appointed as Cell C brand custodian. Expert evaluators could not relate to him articulating the Cell C brand.	X	Cell C
All	The experts agreed that it is not necessarily important for the websites to articulate themselves as South African sites.	X	All

6.4.2.10 Security

One common problem was found and no unique problems (see Table 6.29).

Table 6.29 Security

No of evaluators	Problems identified	Usability testing	Website
All	With current advanced technology, users mainly depend on their browsers to inform them if the website is secure. The only security concern that may arise occurs when users provide their personal details online. In such cases participants want to be assured that their personal information will not be stored or sold.	✓	All

6.4.2.11 Overall satisfaction

Table 6.30 following, presents the overall expert evaluators' comments regarding overall satisfaction.

Table 6.30 Overall satisfaction

	MTN	Vodacom	Cell C	Virgin Mobile
Comment	The website provides the impression that it only accommodates participants who are familiar with cellular jargon. There is no support to assist novices and older audiences in finding what they are looking for.	The homepage provides good content categories but they do not link to the appropriate sections on the website. Users are forced to search again.	A very good experience overall. The site is simple and it is very clear how to access the product offerings. Novice participants would be able to make good decisions on this site	In general the site is easy to use, but does not contain enough information to make a decision. Novice participants would be able to make good decisions on this site

The heuristic evaluation culminated by obtaining the expert evaluators' overall positive and negative emotions evoked by the four sites. The user experience questionnaire asked them to list their perceptions of positive and negative emotions they had experienced while using the target systems. The next sub-section will discuss the findings.

6.4.3 Criterion 3: The user experience of the heuristic evaluation:

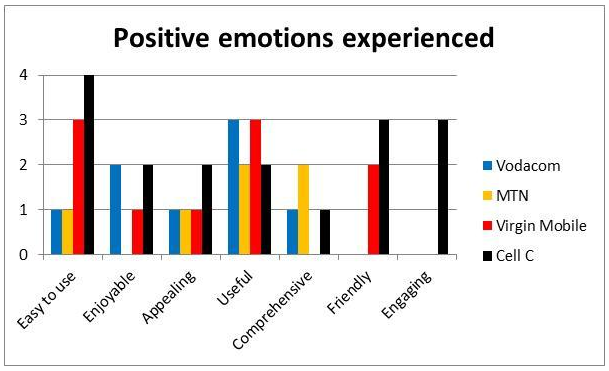


Figure 6.8 Positive emotions (HE)

Most of the expert evaluator responses were similar to the UT result with regards to the aspects that provide a positive emotion (see Figure 6.8) which shows each emotion against the number of expert evaluators (between 0 and 4) who experienced it, such as:

- Clear articulation of the objectives of the website;
- Clear and easy-to-find product offerings;
- Intuitive navigational menus;
- Efficient search functionality; and
- Sufficient functionality and information to make a decision.

The MTN site provided comprehensive product descriptions. The Virgin Mobile and Cell C sites were good examples in providing clear and easy-to-find product offerings and intuitive navigational menus. Vodacom provided useful functionality that could assist in making decisions.

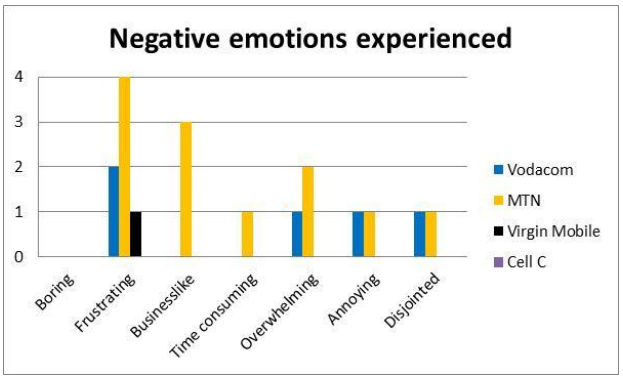


Figure 6.9 Negative emotions (HE)

The first impressions gained across the suppliers, were generally positive, but evaluators encountered problems and experienced negativity when actually using the websites.

See Figure 6.9, which shows each emotion against the number of expert evaluators (between 0 and 4) who experienced it. Some became irritated when:

- Plan details were overwhelmed with distracting visuals;
- Homepage links were irrelevant to the category;
- Links did not provide the anticipated information when users reached the required page, forcing them to search again; and
- Inconsistent navigation menus that did not match the page titles.

Examples of inconsistent structures occurred on the MTN and Vodacom sites. Overall, across the websites, evaluators found that the main aspects lacking for satisfactory completion of the journeys, were images of cellphones on the homepage as well as at plan detail level. No supplier catered for this critical need.

The research findings of this chapter are concluded by interpretations and discussions on the findings common to the two usability evaluation methods, UT and HE, as well as the findings specific to one of the two UEMs. In general, more common findings occurred than unique findings.

6.5 Interpretations and discussions

6.5.1 Strengths of usability testing and heuristic evaluation, as shown by comparing findings

Most of the findings by the four experts in the heuristic evaluation were similar to the results of the usability testing of twelve end user participants. In this study the two evaluation methods found 25 common problems, with the HE finding 16 unique problems and UT identifying 23 unique problems i.e. 64 problems in total (see Table 6.31). The combined use of two usability evaluation methods – one an *expert inspection method* and the other a *user-based study*, strengthened the study and provided both data triangulation and methodological triangulation. Both of the UEMs gave valuable insights based on the selected criteria (see Table 5.4 for UT criteria) and (Tables 5.6, 5.7 & 5.8 for HE criteria).

There were twelve participants in the UT, and after analysis of six participants' evaluations, saturation was reached and very few new findings emerged. UT provided insights into user interface aspects, as well as the type of content and the form of journey that participants preferred when making a purchasing decision, namely:

- Product-based navigation that supports users' different cellular needs;
- Content description to speak directly to user needs with terminology that is user friendly; and
- Most important, the requirement that the key content areas relevant to decision-making be higher up in hierarchy (i.e. price).

The UT results indicate that participants are very task-specific and seek out content that speaks directly to their needs, while user interface aspects are secondary. Problems identified in the HE were mainly directed at user interface aspects such as:

- Navigation and orientation; and
- Relationship between names of links and page titles (which often did not correspond).

The results from this study indicate that HE findings do not always reflect the opinions of end users. The literature study noted a disadvantage of HE (see Section 4.5.4) mentioned by Nielsen (1994b), whose study showed that heuristic evaluation resulted in a 50% hit rate, and a 20% miss rate, because results are not based on observations of user behaviour.

The present study confirmed this finding in that the UT results identified problems beyond those in the user interface. Furthermore, the number of unique problems (23) that emerged from the UT was greater than the number of unique problems (16) that emerged from the HE. Therefore, UT is the better method to use in order to uncover problems that hamper end users' performance when completing tasks, while HE can be used to complement and justify the findings of the UT. Both evaluation methods are valuable because they provide different sets of findings, namely:

- Requirements of participants in order to complete tasks (UT).
- Best practice user interface guidelines (HE).

6.5.2 Findings obtained by similar studies

New and previous studies conducted indicate similar results (see Section 4.7.1):

- Liljegren (2006) investigated four evaluation methods: hierarchical task analysis, cognitive walkthrough, heuristic evaluation and usability testing. He measured these usability evaluation methods against the criteria of thoroughness, validity, reliability, cost effectiveness and clarity. The study found

that usability testing is appropriate as the main UEM, because it complies with all the above-mentioned criteria and addresses the 'difficulty-to-make-errors' aspect of overall usability.

- Tan, Liu and Bishu (2009) found that it is appropriate to use both user testing and heuristic analysis in a usability study, because they have different strengths.
- A study by Martim, Herselman and van Greunen (2009) on how SA online retailers can improve e-commerce usability to enhance growth, showed that expert reviews combined with usability testing assisted in the design of guidelines for developing usable e-commerce websites.
- Ssemugabi and de Villiers (2010) describe a study to establish how effective is heuristic evaluation by experts in identifying usability and learning-related problems in a Web-based learning application. The study, which involved four experts and 61 students (who were end users of an educational website) found that the results of the experts' evaluation were better than the survey results, although they were produced by only four experts compared to 61 students. The experts identified a total of 58 problems, while the students found 55. Of these, 38 problems were common to the HE and the survey. These findings indicate that heuristic evaluation, if conducted by a competent and complementary group of experts, is an efficient and highly effective UEM.

6.5.3 Consolidation of findings from usability testing and heuristic evaluation

Table 6.31 triangulates the data by presenting the problems and positive aspects *in each of the four websites* as identified by both UT and HE (i.e. common problems and positive aspects) and matters identified by on-e of the two methods on its own (i.e. UT-specific and HE-specific problems and positive aspects).

Moreover, Table 6.32 sets out the general types of problems and the positive aspects with respect to *each category of criteria* that UT identified on its own, both HE & UT identified, and HE identified on its own.

Table 6.31 Summary of common, unique problems and positive aspects identified by usability testing and heuristic evaluation regarding the four e-commerce websites of this study

All websites: UT Specific	All websites: Common UT & HE	All websites: HE Specific
Problems • Content does not relate to all segments of the target audience. • Content is more product-focused than needs-focussed i.e. it does not relate directly to user cellphone needs. **Positive aspects** No positive aspects were identified that occurred across all websites.	**Problems** • The journeys cease at plan detail. • Page loads take too long due to the abundance of imagery used. • For potential users coming onto supplier sites, it is difficult to find phones, which should be the key primary driver. • There is not enough information to make a purchasing decision, i.e. supporting cell phone instruments, services, and clear calls to action. • The cellular terminology is difficult to understand. There should be more information in the users' terminology. **Positive aspects** No common positive aspects were identified that occurred across all websites.	**Problems** • Inefficient search facilities **Positive aspects** No positive aspects were identified that occurred across all websites.
MTN: UT Specific	**MTN: Common**	**MTN: HE Specific**
Problems • Navigation menus are too long and not implemented properly. • Misleading purchase flow regarding choice of airtime, phone instrument and service. The website does not allow participants to follow their intended purchase flow. **Positive aspects** • Content supports key decision-making information (price) upfront, as well as providing functionality that helps users make decisions.	**Problems** • Too many homepages, with no clear indication on what the purpose of each one is. • Links are clearly marked, but the content is generic and it is difficult to find information that speaks directly to user cellphone needs. • The *Find a package* term is misleading: the category does not provide cellphones that support the plans. • *Best package advisor* is misleading. It does not assist prospective purchasers, but mainly current users. • Pages are too long; there is too much reading and scrolling with a lack of tables and bullets for easier readability. • Not clear to identify MTN's offerings just by looking at the homepage. • Inconsistent navigation. **Positive aspects** No positive aspects were identified.	**Problems** • Headings, page titles and overall structure are not clear. A large amount of content to look through with no efficient breadcrumbs (Navigation trails that allow users to keep track of their location within the website.) • The user login/registration at top right of the site appears to be one single heading. The terms should be clearly separated from each other. • The naming conventions on the primary navigation menus do not represent the product offering. **Positive aspects:** none identified.

Vodacom: UT Specific	Vodacom: Common	Vodacom: HE Specific
Problems • Social networking is appreciated by some, i.e. '*I like that Vodacom wants to communicate with me outside of the product offering',* but not understood by others, • Some important information necessary to complete decision making, is absent. • Tone of content is business-centric. • Lack of context around social networking. **Positive aspects** • Homepage addresses primary user cellphone needs. • Vodacom website content is similar to the advertised content in print, TV and billboard media.	**Problems** • Homepage content categories are a good concept, i.e. *Packages and Deals*. However, the content category headings are not links and most of the content situated within those categories does not relate to *Packages and Deals*, i.e. Iphone registration, Vodacom Direct and Rica. • The homepage experience is not carried through to the rest of the site. • No *Home* link on the lower level pages, with only the Vodacom logo serving as a home link there. • Page titles are not the same as the links that point to them, i.e. clicking on the *Package* link from the homepage content, leads to a page with a title, *Top packages*. • Vodacom *Search* and *Compare functionality* is not intuitive. • The headings and links do not provide the right type of information on first click, i.e. *Packages and Deals*. After navigating to the *Packages and Deals* page, users are forced to search further. • Primary navigation menus on the Vodacom site are unclear and directed only at current Vodacom users. **Positive aspects** No positive aspects were identified.	**Problems** • Primary navigation headings do not look part of the homepage content. • Links are not clearly represented, i.e. not underlined. • Homepage banner is dominant, with no focus on cellular aspects, but rather on TV and DSTV. • The *Service* link on the homepage, includes a link directly below called *View more services*, it is expected that a few main services would be listed before such a link. • Links at the bottom of the page are too small. **Positive aspects** • Efficient product search options: homepage content, primary navigation and search functionality.
Virgin mobile: UT Specific	**Virgin mobile: Common**	**Virgin mobile: HE Specific**
Problems • Too many font styles • Important decision-making information is lower down on the pages **Positive aspects** • Simple navigation • Different look and feel • Trendy and innovative • Promotions focused	**Problems** • Brand articulation is weak: Nothing stands out within the content apart from the logo that implies it is a Virgin Mobile website. • The *Package page* links do not click through to the relevant section. • Not enough information to make a decision. **Positive aspects** No positive aspects were identified.	**Problems** No problems were identified. **Positive aspects** No positive aspects were identified.

Cell C: UT Specific	Cell C: Common	Cell C: HE Specific
Problems • Brand-focused instead of product-focused. • The content that speaks directly to user cellphone needs, should be higher up on the page. • Too campaign-focused • No overview page; many clicks are required to see what each plan is about. • Cell C only compares the plan category that the user is browsing. For example, a user cannot compare contract plans to pre-paid plans. **Positive aspects** • Good purchase model	**No common problems were identified** **Positive aspects** • Intuitive and clear navigation headings. • User-friendly naming conventions. • Simple structure.	**Problems** • Users are forced to scroll due to not being able to use the ‘up’ and ‘down’ arrows on their keyboard. • The CEO message dominates the entire page on the homepage. • Flash banner moves too quickly, not allowing the user to read the full promotion. • The dark background on the website makes it difficult to read certain content areas. **Positive aspects** • Helpful quicklinks at the bottom of the page.

Table 6.32 General types of problems and the positive aspects with respect to each category of criteria that UT identified on its own both HE & UT identified, and HE identified on its own

Navigation: Problems		
UT unique	**Common to UT & HE**	**HE Unique**
• Too many menu categories	• Product-based rather than user needs-based • Inconsistent and unclear: – Link titles not the same as page titles they point to – Headings and links do not provide the right type of information on first click	• Menus do not look part of the homepage content • Naming conventions on menus are not representative of product offering • Links at bottom of the page are too small • Links are not clearly represented, i.e. not underlined.
Navigation: Positive aspects		
UT unique	**Common to UT & HE**	**HE Unique**
None identified	• Intuitive and clear navigation menus • Clearly marked links • User-friendly naming conventions • Easy to use	• Helpful quicklinks for easy product accessibility
Information architecture: Problems		
UT unique	**Common to UT & HE**	**HE Unique**
• Misleading purchase flow • No overview/summary page, many clicks required to see what each offering is about	• No cross-selling/product support • Content category headings are not links and most of the content situated within those categories does not relate to the category • Some links do not access relevant sections	• Headings, page titles and overall structure are not clear • Large amount of content to navigate, with no efficient breadcrumbs (Navigation trails that allow users to keep track of their location within the website.)

Information architecture: Positive aspects		
UT unique	**Common to UT & HE**	**HE Unique**
None identified	• Good homepage content categorisation	• Efficient product search options: homepage content, primary navigation and functionality
Value of content offered: Problems		
UT unique	**Common to UT & HE**	**HE Unique**
• Information necessary to complete decision is absent or hidden in the content • Tone of content is business-centric • Lack of context around social networking	• No clear purpose of the homepages • Brand articulation is weak, nothing stands out within the content except the logo that uniquely differentiates the sites • Insufficient information to make decisions	• Banners are dominant, and they do not focus on context of the offering
Value of content offered: Positive aspects		
UT unique	**Common to UT & HE**	**HE Unique**
• Consistent communication message across all media channels • Homepage content addresses primary user needs • Content supports key decision-making information (i.e. price) upfront • Adequate amount of functionality that assists users in making decisions	None identified	None identified

Aesthetics and consistency: Problems		
UT unique	**Common to UT & HE**	**HE Unique**
• Promotions focused • Too many font styles • Brand-focused rather than need-focused	• Pages are too long, forcing users to scroll • Lack of tables and bullets to support easy readability • Homepage experience is not carried through to the rest of the site	• Users are forced to scroll due to not being able to use the 'up' and 'down' arrows on their keyboard • Flash banner moves too fast, not allowing the user to read the full promotion • Dark backgrounds on pages can make it difficult to read certain content areas
Aesthetics and consistency: Positive aspects		
UT unique	**Common to UT & HE**	**HE Unique**
• Unique look and feel • Trendy and innovative	None identified	None identified
Functionality: Problems		
UT unique	**Common to UT & HE**	**HE Unique**
• Functionality compares only the offering in the category that the user is browsing, not the offerings of entire site	• Functionality does not assist prospective purchasers, more geared to users • Search and functionality are not intuitive	None identified
Functionality: Positive aspects		
UT unique	**Common to UT & HE**	**HE Unique**
None identified	None identified	None identified

6.6 How can usability impact on the user experience in e-commerce?

This final section in Chapter 6 relates to how usability can support or hamper the user experience in e-commerce. Good customer experience does not happen incidentally, but through careful investigation of users' interactions with the site, as done in this study which applied two UEMs, UT & HE, to evaluate four e-commerce websites. Progress can be made in identifying what will support users in their every-day use of such sites and create an improved customer experience in the process of online-purchasing.

The usability of an e-commerce site is determined by its user interface, visual elements, navigation, information architecture and the way participants interact with the website. More specifically, usability aims to achieve the following objective goals: effective use, efficient use, safe use, sound utility, ease of learning, and ease of remembering.

User experience of an e-commerce site on the other hand, is a sensation primarily related to the subjective impressions and emotions a user has while interacting with a device or system, and the success of a system is determined by a positive user experience. According to van Greunen, van der Merwe and Kotze (2010), user experience is primarily influenced by the user interface, therefore a good user interface design generally allows users to satisfy their goals.

This study views usability and user experience as overlapping concepts that are closely related – see Figures 3.6 and 3.7.

Table 6.33 following, maps key usability aspects to user experience aspects, as identified in this study. The table provides brief motivations as to why these aspects are important in creating good user experience.

The following will be discussed: navigation, information architecture (IA), value of content, structure and layout, satisfaction, aesthetics and consistency, and functionality.

Table 6.33 Usability aspects that impact on user experience

Usability aspects		Related aspects of user experience	Motivation
Navigation	• Keep users informed at all times (Table 5.6, Criterion 1) • Provide familiar words and phrases (Table 5.6, Criterion 2) • Clear presentation of headers (Table 5.4, Criterion 1) • Consistent words, situations and action (Table 5.6, Criterion 4) • Efficient navigation and orientation (Table 5.6, Criterion7)	• Quick and easy user journey • Convenient and easily understandable • Routes related to user-needs	User may be discouraged and consider competitors to satisfy their needs if they cannot find what they looking for, due to complex user journeys and product offerings that are hard to relate to. Consistency supports journeys that are guided by recognition rather than by recall.
Information Architecture	• Logically grouped data (Table 5.4, Criterion 2) • Names conceptually related to function (Table 5.6, Criterion 2) • Information should be easy to search out (Table 5.4, Criterion 2) • Simple structures	• Needs-based rather than product based • Customer-centric approach rather than designed around the business • Conceptually sound • Simplicity of offerings	Users struggle to make sound decisions if they do not understand the offering. If the wording is riddled with business jargon, not grouped logically and does not follow users' intended purchase flow, it hampers the functionality and the experience of the website.
Value of content	• Free cognitive resources for high-level tasks (Table 5.6, Criterion 11) • Bring important data into a higher-level summation (Table 5.6, Criterion 12) • Sufficient tools to assist in decision making (Table 5.7, Criterion 4)	• Meet users primary goals • Not text-heavy • Eliminate unnecessary thinking, i.e. offer comparisons • Important information is summarised in tables / bullets / higher up • Offer detailed and comprehensive product descriptions to support choices	Many users conduct their product research on the Internet. Therefore, content should provide comprehensive descriptions to support choices, but in a way that is optimised for the Web, e.g. bullets and or summaries for easier readability. Most importantly, it should be written around users' primary needs and goals.
Structure and layout	• Clear and consistent display of information • Orderly screens • Simple search paths • Fast and readable presentation of information (Table 5.7, Criterion 2)	• Supports users in achieving their personal goals • Decision-making information is evident and simply presented • Clear and accessible content	Users generally skim content on the Internet, and may miss important content that is hidden in long, text-heavy paragraphs. When content is clearly presented and structured, users will see the most important product features at first glance.

Usability aspects		Related aspects of user experience	Motivation
Satisfaction	• Make users feel efficient and capable of performing all tasks correctly (Table 5.7, Criterion 12)	• An online experience that builds users' confidence • Positive perception and experience • Engaging and enticing for users to return	A positive perception and experience may lead to positive word-of-mouth advertising and customer loyalty.
Aesthetics and consistency	• Appropriate use of colour and graphics (Table 5.6, Criterion 8) • Displays only the information needed by the user at a given time (Table 5.6, Criterion 8) • Copy, tone, colour of font and visual load should communicate the intended message (Table 5.7, Criterion 1)	• Good aesthetics to enhance users' sensory modalities • Innovative designs • Appropriate branding • Fun and informal look and feel and tone • Enticement and engagement	The look and feel of the product, colours, font, graphics and sounds used, can evoke basic emotions such as excitement or boredom when users view product presentations. Designs should engage the users' sensory modalities, so they can have a satisfying experience in the process of acquiring a product.
Functionality	• Flexibility and efficiency of use, functionality to speed up interaction • Cater for both inexperienced and experienced users (Table 5.6, Criterion 7)	• Easy to use and understand • Useful • Efficient, to assist users in meeting their goals rapidly and easily • Comparison and filtration of various product and service options	Functionality offered should be simple in nature, and used as a decision tool to assist users in their task.

Findings from the UT and HE indicated that the site usability aspects do have a key influence on the user experience. Good site usability has several advantages. It pragmatically ensures that users are able to use the site effectively, efficiently and with satisfaction, and that the site does what it is intended to do. However, it goes further, in that sound usability contributes to the subjective, hedonic and pleasurable aspects of user experience. These concepts are depicted in Figure 3.7, Section 3.5, and the findings of this study show that they are important to e-commerce users and contribute to a better user experience. User experience also relates to the issue of participants who have finished using a site and who leave with a positive or negative emotion towards the brand (Gray 2009). Therefore, if the website meets all the usability criteria: efficiency, effectiveness, user-friendly terminology, good content structure, and the like, it should contribute towards a good experience for the user. Furthermore, from a business perspective, the customer is more likely to make a purchase and also more likely to return. This, in turn, contributes to the financial performance of the brand.

6.7 Summary

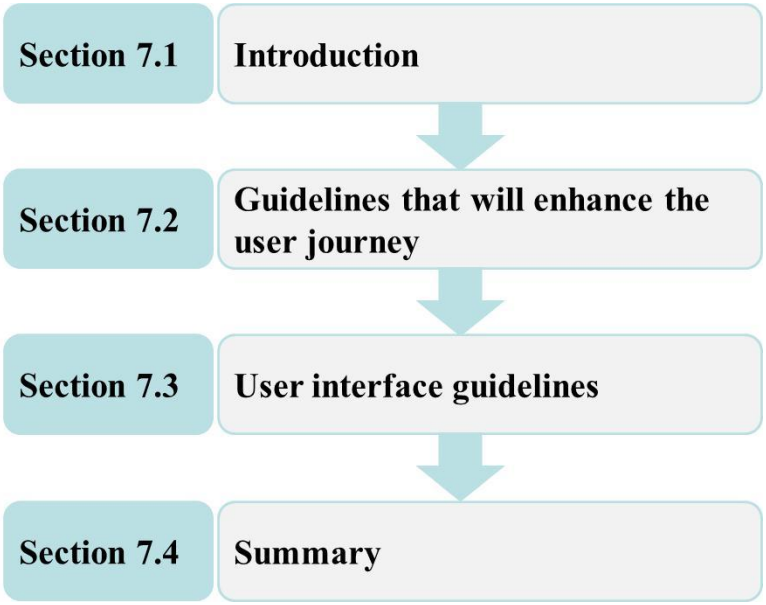
The two UEMs, usability testing and heuristic evaluation, and the criteria extracted from the literature, provided valuable insight on usability problems in the four target systems and on the type of user experience offered by the websites.

Twelve participants in the usability-testing study is not a large number but it is relatively high for UT. However, the use of an expert evaluation as well provides data triangulation and reliability to the study. The findings cannot be generalised to the entire population of e-commerce users, but represent a valuable contribution to the body of knowledge on evaluation of e-commerce websites.

This study has indicated that website aspects that are characterised by poor usability, do indeed hamper users' overall experience. When inconsistent navigation structures, product-based navigation menus, hard-to-understand functionality, and poor presentation of content offerings were encountered, the majority of UT participants felt that they would need to consult other channels in order to satisfy their goals. In contrast, good usability enhanced the quality of the overall user experience

This study and previous research indicate that the most comprehensive evaluations arise from applying more than one evaluation technique (Jeffries et al. 1991; Desurvire et al. 1992). The combined results from the UT and HE in this study can contribute to creating good user experience guidelines for e-commerce sites. Chapter 7 following will discuss the proposed guidelines that were derived from the usability test and heuristic evaluation results.

Chapter 7: Guidelines



Chapter 7: Guidelines

7.1 Introduction

Users have high expectations in terms of the experience that they expect online. In the pre-test questionnaire, several participants mentioned that one of their favourite websites is Google. Google has probably set these high expectations in users' minds regarding how a website should function, and they have become accustomed to Google efficiency. Due to this and other similar encounters, current users are more demanding and less forgiving if websites are inefficient, slow, and do not effectively execute what they are intended to do.

With strong competition in the marketplace, companies need to invest in all their channels, especially online, in order to attract and retain clients. User experience is not just a single aspect, but rather an incorporation of all aspects: brand, product and service offered across all forms, media and business channels. Given what cellular suppliers provide on their websites, it would appear that cellular suppliers have not taken the time to study user needs. Most of the content is business-centric, presented with technical terms that describe product features, instead of highlighting potential benefits to users. No cellular supplier has taken the time to embark on a segmentation strategy and tie it with distinct product offerings.

Users are attracted to brands that encompass quality, innovation and the ability of the brand to target and engage users throughout the entire customer experience. All four websites failed to innovate and position themselves differently; overall the user journeys were pedestrian, laborious and required considerable reading to satisfy goals. On many occasions, users would need to contact a company representative for more information.

Many current website guidelines are generic and merely deal with user interface aspects such as text size, colour, and balance. The guidelines identified in this study, however, go beyond user interface aspects, as the researcher attempted to uncover aspects of a website that lead to poor user experiences. The proposed guidelines are not a repetition of, but a refinement to, existing guidelines. The guidelines can be applied to any websites that market products and services, in order to create a good holistic user experience, incorporating every aspect of the user's interaction.

This chapter will discuss proposed guidelines that were derived from the usability testing and heuristic evaluation results. These guidelines are designed to aid in creating good user experience for users seeking products and services on a website.

Three principles underlie the guidelines and should be considered throughout the design process, so as to contribute to creating a good user experience:

- Firstly, users should to be viewed as a top priority; users and their needs should be the driving force in the entire design process;
- Secondly, companies should target users with the most needs and significant growth potential; and
- Thirdly, designs need to be innovative in delivering key content, key services and key products to users.

The proposed guidelines are divided into two categories:

- Guidelines to enhance the user journey towards identification of an appropriate product (Section 7.2);
- Guidelines that are specific to the user interface of a website (Section 7.3).

Each guideline is followed by a brief explanation of how its application enhances the user experience.

7.2 Guidelines that will enhance the user journey

Based on the findings, three guidelines have been identified to enhance the user journey on websites that present and market products and services. The guidelines are listed, and then each one is explained in more detail.

1. Present strong brand articulation
2. Provide two types of navigation options: product-based and needs-based
3. Take customers through a user journey and help them understand the different products:
    - Educate and inform
    - Sell the product
    - Allow the user to manage it
    - Entertain and entice.

Guideline 1: Present strong brand articulation

None of the cellular websites investigated in this research articulated their brand strongly. Most pages are text- heavy, with little engagement. Users have to work hard in order to understand the offerings. Users would appreciate a 'strap line' to encapsulate what the website is about. Examples of 'strap lines' include: 'Come to shop, return to learn' (Apple store); 'The fresh new way to manage your money (Mint). Such messages allow the user to get a good impression of the purpose of the website. Following are key considerations for creating a strong brand presence on a website, as well as online personality. These slogans are associated with marketing terminology, but customised here for e-commerce websites.

- ***Brand proposition****: Include a strap line to articulate the purpose of the website.*
- ***Reason to believe****: Why should I choose you? Identify key tangible differentiators.*
- ***Value proposition****: Give me value; do not just sell products.*
- ***Brand needs to echo intelligence:*** *Innovations in the design; future tailored solutions.*

Application of the guideline to enhance user experience

Delivery of the brand promise is the greatest builder of a good experience.

Guideline 2: Provide two types of navigation options: product-based and needs-based

The study established that users find it difficult to choose the right product by searching via product name. With the exception of one site, participants could not relate the product name to their needs. The proposed approach is to provide various navigation options to access products and services. An advantage of having more than one navigation option is that it meets the needs of different kinds of users. Following are two proposed navigation options, both of which should be used, but in appropriate context:

- Product-based
  - Product names are not to be eliminated, but need to effectively convey a user-centric approach, with content incorporating terminology that is easy for users to relate to.
- Needs-based
  - All products should be supported by a needs-based navigation option, i.e. quicklinks on the product pages as well as on the homepage. Examples of needs-based navigation options include:

- Usage needs: make most of my calls at night; SMS a lot; business use; monitor my spending; etc.
- Life stage needs: business user; youth; family plan.

Application of the guideline to enhance user experience

Systematic users appreciate a categorised listing of products or services on offer. On the other hand, other users prefer a presentation that allows them to go directly to products and service that are in line with their specific needs and requirements.

Guideline 3: Take customers through a user journey and help them understand the different products

No two users are the same; individuals search for products differently. In the example of cellular needs: some participants searched first for a phone when looking for a plan, then expected to find all the plans that come with the phone, others started with plan. Design teams should map out different user mental models on how users will search for products and services, and then create corresponding user journeys on the site. Associated content should not be distributed over non- related pages. Instead, it should be located within the anticipated journey.

Overall, the users' primary focus when coming onto a website is to buy/investigate products and services. Therefore, the following four aspects should be considered in order to create a good user experience within each user mental model:

1. **Educate and inform**: *Allow users to learn about the product.*
2. **Sell the product**: *Allow users to purchase the product online.*
3. **Allow the user to manage it**: *Allow users to manage their accounts online.*
4. **Entertain and entice**: *Present enticing and updated content that would attract users to return to the website.*

Application of the guideline to enhance user experience

A well signposted user journey attracts customers, promotes positive word-of-mouth advertising, and can result in loyalty to the brand.

The following subsections expand on the four aspects above to create a good user experience.

Educate and inform

This relates to functionality that could be included to help users find the right type of product on e-commerce websites, specifically sites in the domain of cellular communication. Table 7.1 lists and explains plan advisers, manuals and demos, FAQs and website search.

Table 7.1 Educate and inform (synthesised by the researcher)

Content/functionality	Description
Plan advisers	• Provide specific pre-paid and post-paid functionality. • Include data calculators, i.e. *I only browse Facebook, how many megabytes do I need?* • Allow users to customise the offering according to budget. (Price was identified as a key value driver for users.) • Teach users how to save money when making calls. • Acronyms should be avoided.
Manuals and demos	• Provide phone manuals. • Include product case studies for complex products. • Demonstrate how the products work.
FAQs	• Assist users in solving basic queries. • Include a rating system to determine the validity and usefulness of the answers provided. • Determine from the call centre what the popular FAQs are. • Review search logs to see what users are searching for. • Provide FAQs for every product; review the site to see whether the main content areas could embed the answers, rather than forcing users into the FAQs section. • Format the FAQs into sections; subdivide the FAQs into distinct categories, helping users find their way to what is most relevant to them. • Write questions not statements, in brief, plain language.
Website search	• Conduct predictive search (similar to Google search). • The most relevant results should be situated higher-up on the page. • Search results should provide hyperlinks to the relevant sections on the site.

Sell the product

Table 7.2 provides details for the situation when users have identified a product of their choice, namely: contact details, store locations and online purchasing.

Table 7.2 Sell the product (synthesised by the researcher)

Content/functionality	Description
Contact details	• Provide access to contact details on all sections of the website. • Include contact details for retail stores, i.e. telephone, email, address, managers name and directions.
Store location	• Include a closest store locator. • Provide contact details and maps for all stores. • List of the available stock.
Online purchasing	• Explain how to make a payment online (where permissible). • Detail how long delivery will take and how users can track their orders online.

Manage the product

Table 7.3 suggests added-value services to offer to users who have purchased a product.

Table 7.3 Manage the product (synthesised by the researcher)

Content/functionality	Description
Self-service	• Allow users to view their bills online. • Include online payment options. • Provide users with the option to re-purchase or upgrade their product.

Entertain and entice

Across the four websites, participants found little or nothing that would entice them to return on a regular basis. They would return only if they were looking for something specific.

In Table 7.4 following, are some content and functionality examples that cellular companies could include to entice users to visit regularly.

Table 7.4 Entertain and entice (synthesised by the researcher)

Content/functionality	Description
Enticing content for users to return	• Include 'Did you know?' content to educate users on new products/technology or how to use the site. (E-commerce sites may be complex in nature, offering a lot of functionality.) • Talk to the user: upon joining, welcome them and teach them about being new to the website. • Update content regularly.

The guidelines above provide insights on enhancing the user journey to support users in finding suitable products.

The next section sets out guidelines that are specific to the user interface.

7.3 User interface guidelines

This section discusses guidelines specific to the user interface of a website, which can further contribute to creating a good user experience, namely: website language, terminology, content structure, content, navigation, innovation, visual appeal and overall user experience.

Website languages

In South Africa, there are eleven official languages: Afrikaans, English, IsiNdebele, IsiXhosa, IsiZulu, Sepedi, Sesotho, Setswana, SiSwati, Tshivenda and Xitsonga. English is the most common language for official purposes and most market-related communication is conducted in English. With regard to websites in general, understanding the product offering requires a good knowledge of the business, even though it is written in the most common business language.

The majority of the South African population can speak English, but is not necessary to have the entire website in English. It can be beneficial to translate complex product descriptions, i.e. data and to present major product descriptions in the users' first language, by offering clickable options. This can definitely enhance the experience and users should be able to make better decisions.

Guideline 1	• Multi-language functionality for complex products and intricate details.
Application of the guideline to enhance user experience Makes it simple and quick for users of different cultures to achieve their goals. Users can make better decisions if they fully understand the product descriptions.	

Terminology

In the UT empirical study, participants had to browse each primary navigation menu and click into every product to find out what the product is about. Only one cellular website provided intuitive naming conventions to which participants could relate their needs. Thereafter, the participants found the product descriptions to be riddled with internal company jargon and acronyms.

Guideline 2	• Product names and descriptions should be easy to understand at first glance, and focused around benefits/needs, rather than product features. Companies should not assume that users understand the products as well as they do.
Application of the guideline to enhance user experience Makes the entire experience relevant to personal needs. Users will be able to relate better to the product offering if the content speaks directly to their needs, rather than listing a set of products and services. When users relate easily to the content, they can rapidly find what they looking for. Unnecessary thinking and searching can be eliminated.	

Content structure

- **Homepage**

  Participants are attracted to a homepage layout that is different, innovative, and has a clear offering that is easy to identify. These attributes add to the experience, and entice participants to look further. Users generally ignore busy areas of a site, and look for content that speaks directly to their primary needs.

Guideline 3	Prioritise the content offering, and avoid placing the entire offering on the homepage. Following are three content priority examples: • **Priority 1:** Select one product that you want users to notice, i.e. new product promotion, and make it stand out within the content area. • **Priority 2:** Provide content that meets users' primary needs. • **Priority 3:** Include supporting content to users' primary needs, i.e. post-purchase content, such as: manage your account, upgrade information, and related content that goes well with their selected product.
Application of the guideline to enhance user experience Enables users to achieve their goals quickly and efficiently. At first glance, they should be able to identify the content areas that they need to navigate.	

- **Lower-level page structure**

  Participants found that the content structure did not support them in finding the right product. There was either too little, or too much, product information. Important decision-making information, such as price, was often difficult to locate.

Guideline 4	• Place the most important information higher up in the hierarchy, i.e. price • Follow users' mental model as to how they look for products and services. In the example of cellular, users firstly want to compare products; secondly, read product detail; thereafter, find out where to purchase. • Summarise the most important content in tables and bullet forms. If users want to view more information on the product, provide a link to view more detail as well as various options to purchase.
Application of the guideline to enhance user experience These features provide 'signposting' to the user journey. Users generally skim content on the web. When the most important information is provided in a higher summation, it is easier to scan, read and digest.	

Content

Users are task driven, and find pictures distracting. Most of the time, they look for links and content areas that speak directly to their needs. This insight is supported by the empirical UT study, which indicates that participants looked for content in the primary navigation menus, and not through the homepage content, except on one site. No user related the pictures on the homepage to cellular products.

Guideline 5	• **Step 1:** Identify users' primary needs, i.e. *I want to...* – *find a cellphone plan that will best suit my communication patterns* – *access the internet when I'm on the move* – *see if I am due for an upgrade* – *manage my account* – *find out more about business packages for my company*. • **Step 2:** Provide intuitive product links on the homepage, with a good balance between banners and content; – Product banners should be avoided; users do not relate banners to products. If the company chooses to promote a product as a picture, the picture needs to be clearly representative of the product. • **Step 3:** For each content category, provide adequate supporting content such as: comparison charts, calculators and decision-making content such as price.
Application of the guideline to enhance user experience Meets the user's primary goals and requirements; supports presentation of choices.	

Lower-level page navigation

It is difficult for participants to make the right decision by simply choosing a product in lower-level page navigation. It is tedious to click through and read the description of each product and, by the time they have read the last product, they tend to forget details of the first one.

Guideline 6	• Placing long lists of product names in the left navigation should be avoided. The proposed structure could provide an overview page that summarises the most important information of each product, thus eliminating click fatigue. • Include a home page link. Linking the logo of a website to the homepage has become common practice and is now second nature for most, but not novice, users. If the target market includes novice users, the company needs to cater for them. • Give users a visual clue as to which links have already been clicked.
Application of the guideline to enhance user experience Eliminates click fatigue; simplifies thinking and reasoning; speeds up interaction for decision making.	

Innovations

Innovative technology available to the market in products such as I-phones, cellphones, gadgets, and applications, have set high expectations in terms of the user experience that users are anticipating. Users have also become less patient and forgiving when a website downloads slowly and does not assist them in finding an appropriate product.

Guideline 7	Create innovative designs that will enhance the users' moods, and entice them to look further. Aspects that can add to the mood and experience include: • Designs that look different from other websites • Material that is engaging and interactive • Information personalized to users' interest • Applications that users can download • Fast, simple and efficient websites/applications. If the website meets the above, it will distinguish itself from others.
Application of the guideline to enhance user experience Creates excitement, lifts the users' moods, and entices them to look further and deeper.	

Visual appeal

Overall, users appreciate simple and clean designs. Users avoid busy areas of a website and look for content that speaks directly to their needs.

Guideline 8	• Avoid white text on a black backgrounds, it is straining on the eyes and the page becomes unreadable. • Limit long textual pages; break up the content with images, headings and clear sections to make it easier to scan, read and digest. • Avoid different font sizes.
Application of the guideline to enhance user experience Guides the eye to key areas, does not strain the eyes and creates a pleasant experience.	

Overall experience

Much of the time, content that is advertised on other channels such as TV, print and billboards is not carried through to the website.

Guideline 9	• User experience should be the same across all the different customer touch points (call centre, retail store and website). • Limit the size of content, which impacts on loading time and performance.
Application of the guideline to enhance user experience Allows users to interact with the brand wherever they encounter it.	

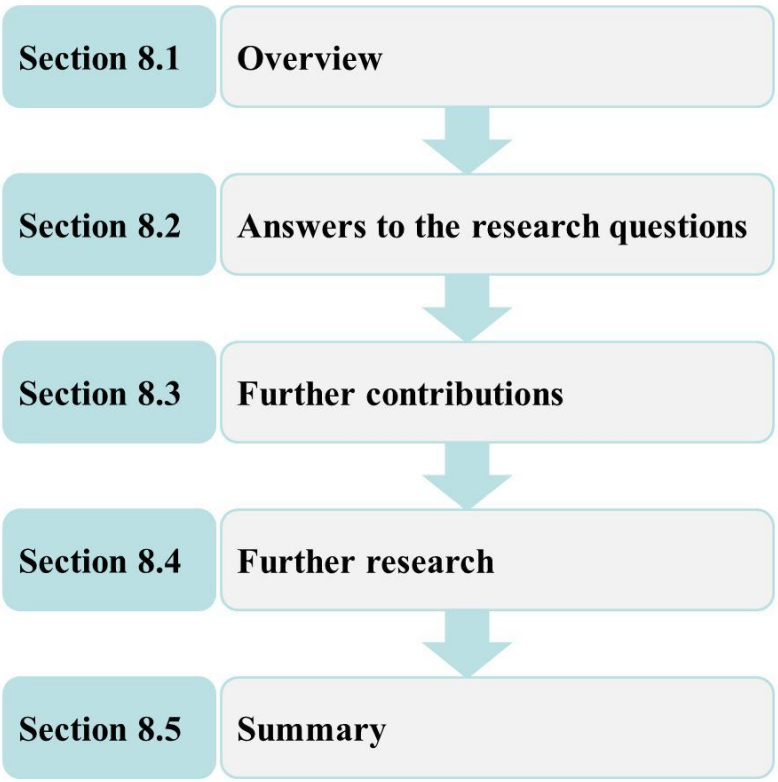
7.4 Summary

The most important concept communicated in this chapter is that users should be regarded as a top priority for companies and designers aiming to reach their target markets. Good user-centric design impacts on many aspects of both usability and user experience, and ultimately influences success in the market place.

This chapter presented guidelines for the design of e-commerce websites, focusing firstly on enhancing the user journey, i.e. improving the design of the interaction from initial viewing right through to culmination. Second, there were guidelines that emphasised the characteristics of a good user interface.

The next and final chapter will discuss the issues and what has been achieved by this study.

Chapter 8: Conclusion



Chapter 8: Conclusion

8.1 Overview

This study describes a dual-method evaluation of e-commerce websites with a view to determining how usability aspects can contribute to the user experience encountered on the sites. In addition, two sets of guidelines were developed for the design and development of e-commerce websites. Usability testing (UT) and heuristic evaluation (HE) methods provide valuable insight into the usability and user experience of a website, including the identification of problems. The study set out to determine the usability issues that cause participants to have positive or poor user experience on e-commerce. The investigation was conducted by designing and conducting both a UT with real users and HE by experts. UT is used more to evaluate finished products than to investigate potential problematic issues (Tan, Liu and Bishu 2009). HE is a usability inspection technique originated by Nielsen (1992; 1994b), which relies on expert evaluators to assess whether a website complies with standard usability principles or heuristics. The results of the two evaluations were then integrated and compared. Furthermore, the research aimed to identify relationships between aspects of usability and user experience.

As a basis for this study, current literature was reviewed in the fields of e-commerce usability and user experience, as well as literature on usability evaluation. Chapter 2 provides an overview of e-commerce, such as the state of Internet retail in South Africa, its growth, critical success factors, challenges and guidelines. The content of Chapter 2 builds up to Chapter 3 where the importance of usability, e-commerce usability and user experience are discussed. Usability evaluation methods are addressed in Chapter 4, where human-computer interaction (HCI) models of interaction as well as usability principles and design, are overviewed. The main focus of Chapter 4 is to identify, discuss and compare the main usability evaluation methods (UEMs), particularly focusing on the two UEMs used in this research.

A set of evaluation criteria suitable for evaluating e-commerce sites is generated in Chapter 5 (see Sections 5.4, 5.6, 5.7 & 5.8). Most of the criteria were derived from Chapters 2 and 3. These synthesised criteria are used in the actual evaluation of e-commerce sites, described in Chapter 6. Usability testing among real users and heuristic evaluation by experts were

performed, and the results compared. The results of the two evaluations and the analysis were used towards answering the research questions.

In this chapter, the major issues of the study are summarised. Section 8.2 revisits the research questions, together with summaries of how they were addressed and the main findings in answer to each question. In Section 8.3, directions for further research are suggested.

8.2 Answers to the research questions

The **primary research question** for this study, posed in Section 1.3.1, is:

'How can the findings of a dual-method usability evaluation of e-commerce websites contribute to the attainment of better user experience?'

In order to answer this question, the first two subquestions were posed in Section 1.3.2:
Subquestion 1: '*How can the usability of an e-commerce site be measured?'*
Subquestion 2: '*How can user experience of an e-commerce site be measured?'*

The secondary data used to answer these, was obtained from literature studies in Chapters 2 and 3. Chapter 5 defined sets of criteria/heuristics that support e-commerce, usability and user experience. The answers to research Subquestion 1 were consolidated in Table 5.4, which sets out the criteria for UT and lays the ground work for the empirical UT study. Similarly the answers to research Subquestion 2 were consolidated in Tables 5.6, 5.7 & 5.8, which set out the criteria for HE and lay the foundation for the empirical HE study.

These criteria and their associated sub-criteria were used by both the user-participants and by the expert evaluators to evaluate four e-commerce sites. The criteria identified can serve a further valuable purpose, namely, in their application as design principles and guidelines in the development and evaluation of new websites as given in Chapter 7.

Subquestion 3: '*What do the findings of usability evaluation by a dual-method approach indicate about the usability and user experience of four different websites?*'

The usability evaluation methods, UT and HE, which were used in this study, are explained in Chapter 4. Chapter 6 presents extensive findings of the evaluations of the four websites by these two methods, i.e. the findings from a triangulated approach (Cohen, Manion and Morrison 2005). As part of the answer to Subquestion 3, Table 6.31 provides a summary of

common and unique problems as well as positive aspects in each of the four websites, as identified by UT alone, by both HE & UT, and by HE alone. Table 6.32 sets out the general types of problems and the positive aspects with respect to each category of criteria that UT identified on its own, that both HE & UT identified, and that HE identified on its own.

As a user-based approach, UT specifically provided insights into detailed user interface aspects, as well as the type of content and user journey that participants prefer when making a purchasing decision, such as:

- Product-based navigation and minimal number of steps to access information;
- Content description to speak directly to user-needs;
- Terminology that is user-friendly; and
- The issue that key content areas relevant to decision-making should be higher up in hierarchy (e.g. price).

Problems identified specifically in the HE were mainly directed at overall user interface aspects such as:

- Principles of navigation and orientation (information architecture).

The type of key common findings identified by both UT & HE include:

- Journeys that cease at plan detail;
- Page loads that take too long, due to the large amounts of imagery;
- Difficulties experienced by potential purchasers in finding cell phones on supplier sites, which should be the key primary driver; and
- Insufficient information to make a purchasing decision, e.g. information supporting cell phone instruments, services, and clear calls to action is inadequate; and the cellular terminology is difficult to understand.

Both UT and HE were found to be appropriate, effective and sufficient usability methods for the evaluation of e-commerce sites. Both UEMs identified a high percentage of usability problems (see Table 6.31 and Table 6.32), and they have different sets of strengths:

- Requirements of participants in order to complete tasks (UT).
- Best practice user interface guidelines (HE).

Therefore, the answer to Subquestion 3 indicates that UT and HE can reliably be used together in identifying problems on e-commerce sites. This dual-method triangulated

approach proved to be effective in identifying different types of problems as well as affirming the major issues. Both evaluation methods are valuable because both UT and HE played confirming and complementary roles. They served a confirmatory role when similar findings emerged, and a complementary role when the particular features of one method obtained data not possible with the other method. Both UT and HE identified problems that were severe enough to cause users either to fail in completing task or to commit errors in completing it.

- Heuristic evaluation identified key usability problems as well as potential usability problems, and whether the websites complied with standard usability principles.
- Usability testing provided primary data for making design decisions on how users want to look for products and services on the Web.

Subquestion 4: '*What particular aspects of the usability of an e-commerce site support the user experience offered by that site?'*

This subquestion was answered in Table 6.33, which tabulates aspects of usability against related aspects of user experience, along with motivations. The findings indicated that site usability aspects do have a key impact on the user experience. Good site usability such as: simple navigation, easily-understandable information architecture, logical structure and layout, meaningful grouping of content, and aesthetic designs, etc. can help users to meet their goals effectively, efficiently and with satisfaction. This should result in the website meeting the criteria defined in Tables 5.4, 5.6, 5.7 and 5.8 and should, in turn, contribute to a good experience for the user.

Subquestion 5: *'What design guidelines can facilitate the design, development and re-engineering of e-commerce websites towards promoting user experience?'*

This subquestion was answered in Chapter 7. Guidelines emerged from the findings of the study and were synthesized by the researcher into two categories:

1. Guidelines that enhance the user journey towards finding an appropriate product, and
2. Guidelines that are specific to the user interface of an e-commerce website.

The category on navigating the journey in quest of a product incorporates three guidelines, while the second category, with guidelines for e-commerce interfaces, includes nine guidelines

Application of these focused guidelines will contribute to creating a good user experience.

To conclude, the main research question is: **'*How can the findings of a dual-method usability evaluation of e-commerce websites contribute to the attainment of better user experience?*'**

The answer to this composite question is the sum of the findings of the sub-questions.

8.3 Further contributions

Further contributions of this study are as follows:

- The synthesis of e-commerce usability design heuristics (Table 5.7)
- The synthesis of user experience design heuristics (Table 5.8).

8.4 Further research

Recommendations for further research include the following:

- Use of the criteria applied in this study to evaluate other e-commerce websites.
- Use of the guidelines identified in this study in the design and development of new websites.
- Investigation of how effectively developers apply the identified guidelines in the development of new websites, by evaluating sites designed in accordance with the guidelines.
- Further studies of the interrelationships between usability and user experience.
- Research on the roles of user demographics, Internet/technology experience, and context of use, in the usage of e-commerce.

8.5 Summary

The quest of this study was to attain a better user experience on e-commerce websites. To this end, research was undertaken to evaluate the usability and user experience of four websites in the telecommunications sector, so as to determine how the usability of such sites can support the user experience and to generate design guidelines that promote good user experience.

This dissertation explained the concepts of usability and user experience, and discussed the usability evaluation methods (UEMs) that can be used to evaluate usability and user experience of e-commerce websites. The study employed a dual-method research methodology, involving usability testing and heuristic evaluation. Both were found to be appropriate, effective and satisfactory usability methods for the evaluation of e-commerce sites. They served in synergistic way, playing both complementary and confirming roles. It is recommended that a dual-method approach of both UT & HE be used for evaluation of e-

commerce sites. The findings indicated that site usability aspects have a key influence on the user experience.

The findings from the UT and HE contributed towards creating guidelines for good user experience on e-commerce sites. The main findings indicate that designers and developers should take a holistic approach, and have a clear understanding of user interface best practices, e-commerce attributes, and most importantly, user needs. Once the user needs are understood, website designers should apply the following design principles:

- The user journey should be mapped, based on the user's intended purchasing process;
- Content should be written and structured around user needs, with careful attention paid to the presentation, i.e. decision-making information should be prominent within the architecture; and
- The design should be innovative and engaging, so as to entice users to return.

Finally, it is concluded that users' needs should be the driving force behind design and development of e-commerce sites.

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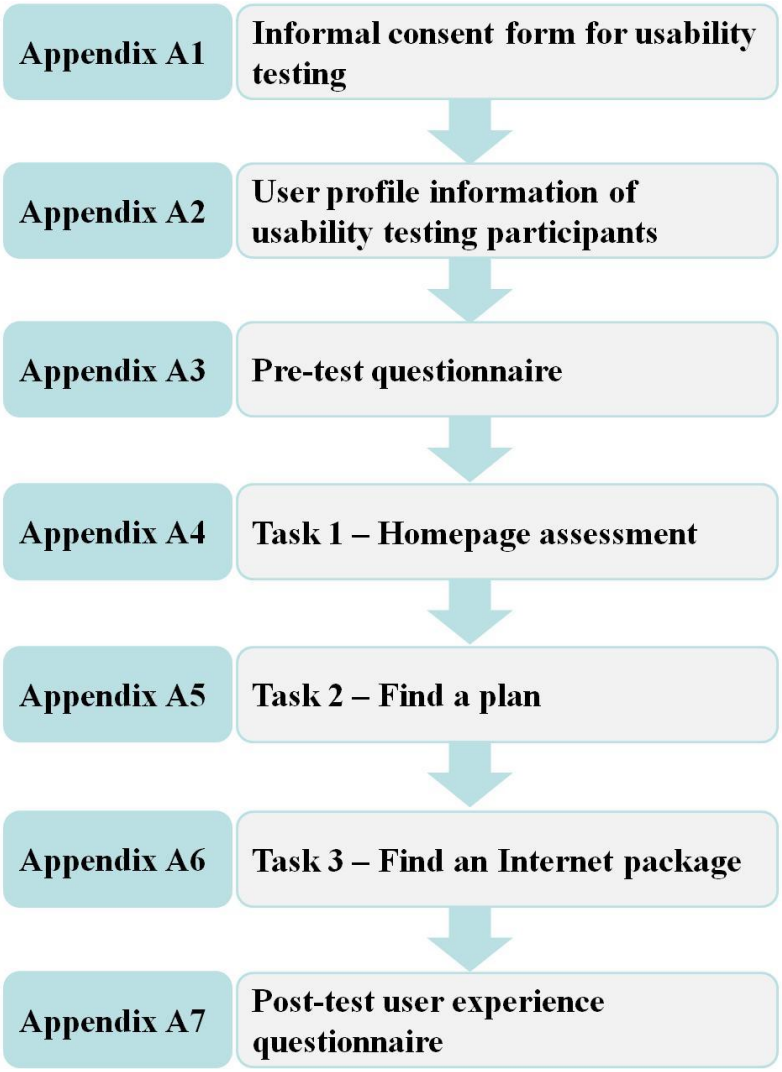
Appendix A: Usability testing of four e-commerce websites



Appendix A: Usability testing of four e-commerce websites

Appendix A1: Informal consent form for usability testing

Please note that the inputs are purely for academic use, and will not be used for consulting purposes. No user names or company names will be published or disclosed.

I _____working as _____

at _____ in the department/divisions

of _____ _____state that I have not been put under any pressure to participate in this usability test as an user. I was approached and have agreed to participate in it.

I realise that the findings of the usability test will be used for research purposes and that the findings may be published in academic publications.

- My name, position and company will not be published.
- My inputs will be used purely for academia.

Signed _____ date _____

Appendix A2: User profile information of usability testing participants

1.1 Please indicate your age

18-24	25-34	35-44	45 +

1.2 Please indicate your gender

Male	Female

1.3 What is your home language

English	Afrikaans	Zulu	Xhosa	Sotho	Other

If other, please specify _____

1.4 For how long have you been an Internet user?

0-3 months	3-12 months	12-24 months	24-48 months	48+ months

1.5 Indicate if you have done any of the following on the Internet.

Browsing	Online shopping	Internet Banking	Forums	Social networking

Appendix A3: Pre-test questionnaire

1.1 Have you ever used an e-commerce website?

Yes	No

If you answered "Yes" above, please complete questions 2.2 - 2.5, otherwise go to question 2.6.

1.2 How often do you use e-commerce websites?

	times per	day / week / month / year (Please circle)

1.3 If you answered "Yes" in question 1 above, what features do you use most often?

A	
B	
C	

1.4 If you answered "Yes" in question 1 above, is there anything you specifically like or dislike about e-commerce websites?

Like	
Dislike	

1.5 Please describe what is important to you in the design of websites in order to create user experience

Appendix A4: Task 1 – Homepage assessment

Procedure

1. Go to the above website URL's.
2. Take about 5 minutes browsing the site to familiarise yourself with the system.

Website name:_____

1.1 For each website, participants were asked for their initial impression of the homepage (graphic intensity, likes and dislikes, see if participants mention that there is no different language option)

_____

_____

_____

_____

_____

1.2 Is there anything missing that you would like to see on the homepage?

_____

_____

_____

_____

_____

Appendix A5: Task 2 - Find a plan

Website name:_____

Task	Time	Errors	Clicks	Success
2				

Observations: If user went to the incorrect please ask why?

2.1 Please rate how **easy or difficult** you found it was to find the required information.

-3	-2	-1	1	2	3

Why?

2.2 Please rate if you were completely satisfied after reading this information, if not what is missing?

-3	-2	-1	1	2	3

Why?

2.3 Is there anything about the website's structure that you feel hampered your performance in finding the required information?

2.4 Rate the **tone and terminology** used?

-3	-2	-1	1	2	3

Why?

2.5 Rate the screen on **structure and layout**

-3	-2	-1	1	2	3

Why?

2.6 Rate the screen on **visual appeal**

-3	-2	-1	1	2	3

Why?

Appendix A6: Task 3 - Find an Internet package

Website name:_____

Task	Time	Errors	Clicks	Success
3				

Observations: If user went to the incorrect please ask why?

3.1 Please rate how **easy or difficult** you found it was to find the required information.

-3	-2	-1	1	2	3

Why?

3.2 Please rate if you were completely satisfied after reading this information, if not what is missing?

-3	-2	-1	1	2	3

Why?

3.3 Is there anything about the website's structure that you feel hampered your performance in finding the required information?

3.4 Rate the **tone and terminology** used?

-3	-2	-1	1	2	3

Why?

3.5 Rate the screen on **structure and layout**

-3	-2	-1	1	2	3

Why?

3.6 Rate the screen on **visual appeal**

-3	-2	-1	1	2	3

Why?

Appendix A7: Post-test user experience questionnaire

4.1 Please select from the list of positive and negative emotions that you may have experienced while using the website.

Positive experience		**Negative experience**	
Easy to use		Boring	
Enjoyable		Frustrating	
Appealing		Businesslike	
Useful		Time consuming	
Comprehensive		Overwhelming	
Friendly		Annoying/irritating	
Engaging – i.e. holds attention		Other:	
Other:			

4.2 Have you seen any of the content offered on the websites being advertised externally? If yes, is the information on the websites the same as it was advertised? Y/N

_____

_____

4.3 Rate the website based on aesthetics.

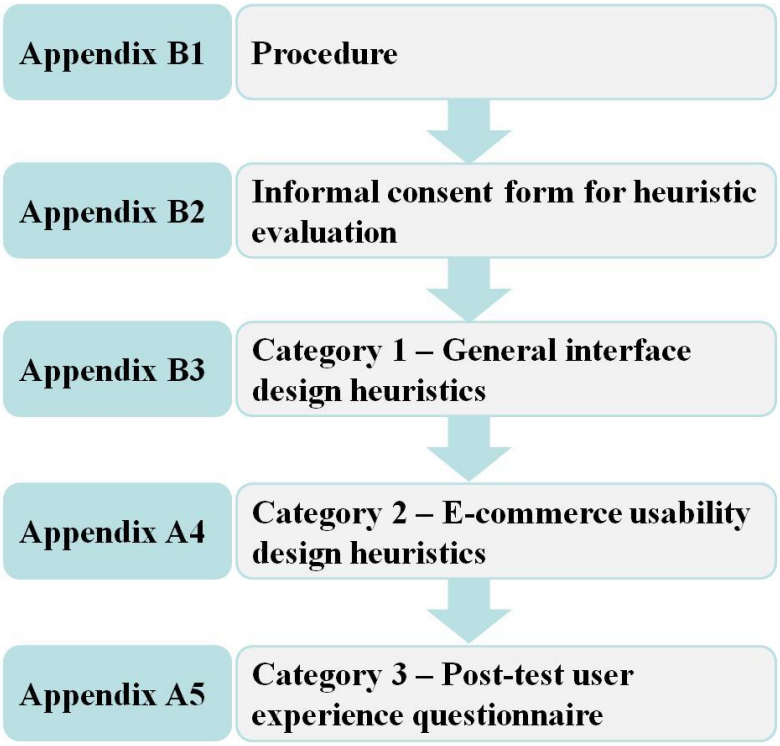
	Bad		Average			Good
Use of colour	-3	-2	-1	1	2	3
Use of pictures	-3	-2	-1	1	2	3
Clear and easy to read	-3	-2	-1	1	2	3
Visual load – (How much on page)	-3	-2	-1	1	2	3
Text size	-3	-2	-1	1	2	3
Text colour	-3	-2	-1	1	2	3
Strength of the branding	-3	-2	-1	1	2	3
Overall visual appeal	-3	-2	-1	1	2	3
Compared to other sites you have seen and used	-3	-2	-1	1	2	3

4.4 Rate the website based on your overall experience.

	Bad		Average		Good	
Features & functionality (search, send an sms etc, drop-downs	-3	-2	-1	1	2	3
Structure of information	-3	-2	-1	1	2	3
Content offered	-3	-2	-1	1	2	3
Navigation structure	-3	-2	-1	1	2	3
Home page layout	-3	-2	-1	1	2	3
Other page layouts	-3	-2	-1	1	2	3
Interactivity (does the E-commerce website facilitate a two-way communication with the users?)	-3	-2	-1	1	2	3
Customisation (does the website tailor its products and services	-3	-2	-1	1	2	3
Tone of the content	-3	-2	-1	1	2	3
Use of graphics	-3	-2	-1	1	2	3
Ease of use	-3	-2	-1	1	2	3
Level of relevance to you	-3	-2	-1	1	2	3
Level of excitement	-3	-2	-1	1	2	3

Thank you very much for your valuable input!

Appendix B: Heuristic evaluation of four e-commerce websites



Appendix B: Heuristic evaluation of four e-commerce websites

Appendix B1: Procedure

Three categories of criteria were used for the heuristic evaluation: General interface design heuristics, E-commerce usability design heuristics and user experience design heuristics. The evaluation was conducted on the following websites:

1. MTN (www.mtn.co.za)
2. Vodacom (www.vodacom.co.za)
3. Virgin Mobile (www.virginmobile.co.za)
4. Cell C (www.cellc.co.za)

Procedure

1. Go to the above website URL's.
2. Take about 15 minutes browsing the site to familiarise yourself with the system.
3. User Task: perform the activity listed below to get a feel for the use of the system. Your evaluation will be based on this activity and some other parts of the system.
    a. *Find a cellphone plan that will best suit your needs.*
4. List any violations of the heuristics that you identify in the system, i.e. problems that occur Please be specific in describing the problem by explaining why it is a problem with respect to the heuristic(s) violated. Each problem should be written out separately. The number in the first column of the table of the heuristics may be used to refer to a particular criterion. You are free to visit any section of the site to identify and describe a problem.
5. Write a report about the problems. Indicate how long it took you to familiarise yourself with the system, and to do the evaluation itself. At the end of the report you may include comments on how you found the evaluation process. For example, problems you found in the system, but that could not be related to any of the heuristics, heuristics that were not clear, overlapping heuristics, setup of the whole expert evaluation exercise, how the evaluation could have been improved, etc.
6. E-mail the report to me at izabelam@aquaonline.com

Thank you very much for participating in this evaluation exercise.

Appendix B2: Informal consent form for heuristic evaluation

Evaluation of the e-commerce websites

Expert evaluation

Consent form

Please note that the inputs are purely for academic use, and will not be used for consulting purposes. No evaluator names or company names will be published or disclosed.

I _____working as _____

at _____ in the department/divisions

of _____ _____state that I have not been put under any pressure to participate in this evaluation exercise as an expert evaluator. I was approached to conduct an evaluation and have agreed to participate in it.

I realise that the findings of the evaluation will be used for research purposes and that the findings may be published in academic publications.

- My name, position and company will not be published.
- My inputs will be used purely for academia.

Signed _____ date _____

Appendix B3: Category 1 - General interface design heuristics

Website name:_____

	Criteria	Severity Rating				
1	**Visibility of system status**					
	1.1 You know where you are on the site at all times.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.2 It is clear where you can go and look for a cellphone plan	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.3 Each page is branded and there is an indication which section it belongs to.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.4 Links to other pages are clearly marked.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2	**User control and freedom**					
	2.1 There is a “Home" button on every page.	Strongly disagree				Strongly Agree
		1	2	3	4	5
3	**Consistency and standards**					
	3.1 Page titles and headings on the pages are the same as the links that point to them.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	3.2 Information on the page is displayed clearly and consistently.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	3.3 Information in the navigational headings are grouped logically.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	3.4 Templates are consistent (i.e. product pages, information pages).	Strongly disagree				Strongly Agree
		1	2	3	4	5
4	**Error prevention, diagnosis and recovery**					
	4.1 There is nothing on the design of the pages that can cause participants to make an error.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	4.2 The website constructively suggests a solution. (i.e. search results show no hits, the system provides participants with a link that will broaden the search. Several search options for packages	Strongly disagree				Strongly Agree
		1	2	3	4	5
	4.3 There are many methods available to allow participants to recover easily from errors.	Strongly disagree				Strongly Agree
		1	2	3	4	5
5	**Recognition rather than recall**					
	5.1 Participants recognize where they are by looking at the current page, without having to recall their path from the home page.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	5.2 Labels and links are descriptive.	Strongly disagree				Strongly Agree
		1	2	3	4	5
6	**Flexibility and efficiency of use**					
	6.2 Instructions are clear, informing participants on what to do next.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	6.3 Quicklinks are available on the homepage.	Strongly disagree				Strongly Agree
		1	2	3	4	5
7	**Aesthetic and minimalist design**					
	7.1 There is no irrelevant information on the page that may distract participants and slow them down.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	7.2 The more general information is higher up in the information architecture.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	7.3 The content is written for the web and is not just a repackaged brochure.	Strongly disagree				Strongly Agree
		1	2	3	4	5
8	**Help and documentation**					
	8.1 There is a help link available on every page.	Strongly disagree				Strongly Agree
		1	2	3	4	5

Space for more problems

Use this page to mention any other problems that could not fit in the space provided. Fill in the number of the section in the left column and write the problem(s) in the right column.

Number i.e. 2	**Other problem (s) found**

Please write any additional comments or elaborations you may have in the space below.

Appendix B4: Category 2 - E-commerce usability design heuristics

Website name:_____

	Criteria	Severity Rating				
1	**Communication the intended message**					
	Homepage					
	1.1 On the homepage – it is clear to see what is on offer.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.2 Text and the way it is presented is easy to read.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.3 The tone of the text is user friendly and does not use telecommunication terms	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.4 The most important information is at the top of the page.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	1.5 The page has a good balance between pictures and information.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2	**Page display, layout and site structure**					
2.1	**Information Architecture**					
	2.1.1 The information architecture supports multiple ways to reach content (I.e. search box, top or left navigation, site map, etc.)	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.1.2 The information architecture highlights the best ways to reach content.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	2.1.3 Looking at the navigational headings, it is easy to expect what those sections include.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.1.4 The navigational heading categories are logically grouped.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2.2	**Search box (Search for a contract plan)**					
	2.2.1 Search box is easy to find and consistently placed.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.2.2 Search box is easy to use.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.2.3 Search box supports revision or refinement.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2.3	**Search Results (Search for a contract plan)**					
	2.3.1 Useful results are available at the top of the list.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.3.2 Search results solve the query (list the contract plans or provide clear links to view the contract plans).	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.3.3 Results indicate clearly how many results were retrieved.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.3.4 Useful components are displayed per result.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.3.5 Results are grouped in a useful way.	Strongly disagree				Strongly Agree
		1	2	3	4	5

2.4	**Site-wide Navigation**					
	2.4.1 It is possible to move through the site without experiencing click fatigue (too many clicks). (Try out a few common scenarios.)	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.4.2 Breadth and depth are balanced.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.4.3 Navigation labels are clear and meaningful.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2.5	**Contextual Navigation (product page and information pages)**					
	2.5.1 It is clear where you are in the site.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.5.2 Related links are available.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.5.3 Related links are clearly labelled.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2.6	**Page structure / Presentation of information**					
	2.6.1 Pages are easy to read.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.6.2 There is a good balance between pictures and information.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.6.3 Pages are not so long that they force participants to scroll.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	2.6.4 Some of the information is broken down into tables or bullet forms.	Strongly disagree				Strongly Agree
		1	2	3	4	5
2.7	**Language and tone**					
	2.7.1 The site conveys a clear sense of its intended audience.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.7.2 The site uses language that is familiar to and comfortable for its readers.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.7.3 It is conversational in its tone.(i.e. Fun, friendly and not too corporate).	Strongly disagree				Strongly Agree
		1	2	3	4	5
	2.7.4 Content is interesting to the user.	Strongly disagree				Strongly Agree
		1	2	3	4	5
3	**Value of information provided**					
	3.1 Sufficient information is provided to help participants make a decision.	Strongly disagree				Strongly Agree
		1	2	3	4	5
	3.2 The website cross-sells related content.(i.e. Value added services and phones that come with the cellphone plan).	Strongly disagree				Strongly Agree
		1	2	3	4	5
	3.3 There is functionality (comparison charts etc) to assist in the decision making.	Strongly disagree				Strongly Agree
		1	2	3	4	5
4	**Utility**					
	4.1 The website provides a sufficient set of functions that enable participants to carry out all their tasks effectively.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	4.2 The site provides a store functionality tool.	Strongly disagree				Strongly Agree
		1	2	3	4	5
5	**Culture**					
	5.1 The website offers a secondary language option. (i.e. Zulu, Afrikaans).	Strongly disagree				Strongly Agree
		1	2	3	4	5
	5.2 There are elements on the website that may portray it as a South African website (Colours used and graphics etc, SA participants prefer a colourful, graphical interface)	Strongly disagree				Strongly Agree
		1	2	3	4	5
6	**Effectiveness**					
	6.1 The website supports participants in learning, in conducting their task efficiently, in accessing the information they need, and in purchasing the goods they want.	Strongly disagree				Strongly Agree
		1	2	3	4	5
7	**Efficiency**					
	7.1 Once participants have learned how to use a website, they can sustain a high level of productivity to carry out their tasks.	Strongly disagree				Strongly Agree
		1	2	3	4	5
8	**Learnability**					
	8.1 It is easy for the user to work out how to use the website by exploring the interface and trying out certain actions.	Strongly disagree				Strongly Agree
		1	2	3	4	5
9	**Memorability**					
	9.1 The interface provides support to assist participants in remembering how to carry out tasks, especially for products and operations they use frequently.	Strongly disagree				Strongly Agree
		1	2	3	4	5
10	**Security**					
	10.1 There is a fraud and security link available at the bottom of every page.	Strongly disagree				Strongly Agree
		1	2	3	4	5

	10.2 There is a terms and conditions link available at the bottom of every page.	Strongly disagree				Strongly Agree
		1	2	3	4	5
11	**Satisfaction**					
	Rate the website based on the following: 1 – very poor 2 - average 3 - above average 4 - good 5 – excellent	1	2	3	4	5

Space for more problems

Use this page to mention any other problems that could not fit in the space provided. Fill in the number of the section in the left column and write the problem(s) in the right column.

Number i.e. 2	**Other problem (s) found**

Please write any additional comments or elaborations you may have in the space below.

_____

_____

_____

Appendix B5: Category 3 - Post-test user experience questionnaire

Website name:_____

1. Please select from the list of positive and negative emotions that you may have experienced while using the website.

Positive experience		**Negative experience**	
Easy to use		Boring	
Enjoyable		Frustrating	
Appealing		Difficult to understand (i.e. heavy telecommunication language)	
Useful		Time consuming	
Comprehensive		Overwhelming	
Friendly		Annoying/irritating	
Engaging – i.e. holds attention		Other:	
Other:			

2. Have you seen any of the content offered on this websites being advertised externally? If yes, is the information on the websites the same as it was advertised? Y/N

_____

3. Rate the website based on aesthetics.

	Bad		Average		Good	
Use of colour	-3	-2	-1	1	2	3
Use of pictures	-3	-2	-1	1	2	3
Clear and easy to read	-3	-2	-1	1	2	3
Visual load – (How much on page)	-3	-2	-1	1	2	3
Text size	-3	-2	-1	1	2	3
Text colour	-3	-2	-1	1	2	3
Strength of the branding	-3	-2	-1	1	2	3
Overall visual appeal	-3	-2	-1	1	2	3
Compared to other sites you have seen and used	-3	-2	-1	1	2	3

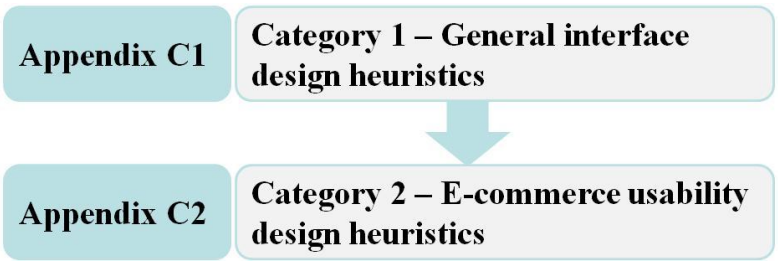
4. Rate the website based on your overall experience.

	Bad		Average			Good
Features & functionality (search, send an sms etc, drop-downs	-3	-2	-1	1	2	3
Structure of information	-3	-2	-1	1	2	3
Content offered	-3	-2	-1	1	2	3
Navigation structure	-3	-2	-1	1	2	3
Home page layout	-3	-2	-1	1	2	3
Other page layouts	-3	-2	-1	1	2	3
Interactivity (does the E-commerce website facilitate a two-way communication with the users?)	-3	-2	-1	1	2	3
Customisation (does the website tailor its products and services	-3	-2	-1	1	2	3
Tone of the content	-3	-2	-1	1	2	3
Use of graphics	-3	-2	-1	1	2	3
Ease of use	-3	-2	-1	1	2	3
Level of relevance to you	-3	-2	-1	1	2	3
Level of excitement	-3	-2	-1	1	2	3

If you are interested in the results of this evaluation please provide your e-mail address here:

_____

Appendix C: Heuristic evaluation data and ratings



Appendix C: Heuristic evaluation data and ratings

Appendix C1: Category 1 - General interface design heuristics

	Criteria	Ratings															
1	**Visibility of system status**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	1.1 You know where you are on the site at all times.	3.5				3.25				4.25				3.5			
		4	4	2	4	4	5	1	3	5	5	4	3	3	4	4	3
	1.2 It is clear where you can go and look for a cellphone plan	3.25				3.25				4.25				3			
		3	4	2	4	4	4	3	2	5	5	4	3	1	4	4	3
	1.3 Each page is branded and there is an indication which section it belongs to.	3.25				3.25				4.25				2.75			
		5	4	2	2	4	4	3	2	5	5	4	3	2	2	4	3
	1.4 Links to other pages are clearly marked.	2.5				3.5				3.5				3.5			
		4	2	2	2	3	4	4	3	3	5	4	2	2	4	4	4
2	**User control and freedom**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	1.1 There is a “Home" button on every page.	2.25				4.5				1.75				3.25			
		1	1	2	5	5	5	4	4	1	1	3	2	3	2	4	4
3	**Consistency and standards**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	3.1 Page titles and headings on the pages are the same as the links that point to them.	3.25				2.75				4.5				3.75			
		4	4	3	2	2	5	2	2	5	5	4	4	3	4	4	4
	3.2 Information on the page is displayed clearly and consistently.	3				3				4.25				3.25			
		4	4	2	2	4	4	2	2	5	5	4	3	1	4	4	4
	3.3 Information in the navigational headings are grouped logically.	3.5				3.25				4.25				3.75			
		4	4	2	4	4	4	2	3	5	5	4	3	3	4	4	4
	3.4 Templates are consistent (i.e. product pages, information pages).	3.25				3.5				4.25				3.5			
		3	4	3	3	4	4	4	2	5	5	4	3	2	4	4	4

4	**Error prevention, diagnosis and recovery**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	4.1 There is nothing on the design of the pages that can cause participants to make an error.	2.25				3				3				2.5			
		4	3	1	1	5	3	2	2	4	3	2	3	1	3	3	3
	4.2 The website constructively suggests a solution. (i.e. search results show no hits, the system provides participants with a link that will broaden the search.	3.5				2.5				3				2.75			
		4	4	4	2	2	3	3	2	3	3	4	2	3	3	3	2
	4.3 There are many methods available to allow participants to recover easily from errors.	3.25				2.5				3				2.5			
		4	3	3	3	2	3	3	2	3	3	3	3	2	3	2	3
5	**Recognition rather than recall**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	1.1 Participants recognize where they are by looking at the current page, without having to recall their path from the home page.	3.75				3				4.25				3.75			
		4	4	3	4	4	4	2	2	5	4	4	4	3	4	4	4
	1.2 Labels and links are descriptive.	3.25				3.5				4.5				3.75			
		4	4	1	4	4	4	2	4	5	5	4	4	3	4	4	4
6	**Flexibility and efficiency of use**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	6.1 Instructions are clear, informing participants on what to do next.	3				3				4				3.25			
		4	4	2	2	4	3	3	2	5	4	4	3	2	4	4	3
	6.2 Quicklinks are available on the homepage.	4.25				2.75				4				3.5			
		5	5	3	4	4	2	1	4	5	5	2	4	4	4	2	4
7	**Aesthetic and minimalist design**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	7.4 There is no irrelevant information on the page that may distract participants and slow them down.	3				1.75				3.25				3.5			
		4	4	2	2	3	1	1	2	5	4	2	2	2	4	4	4
	7.5 The more general information is higher up in the information architecture.	3.5				3				3.75				3.5			
		4	4	3	3	3	3	3	3	4	4	3	4	3	4	3	4
	7.6 The content is written for the Web and is not just a repackaged brochure.	3.75				2.5				3.75				2.75			
		4	3	4	4	2	3	1	4	4	4	3	4	1	3	4	3
8	**Help and documentation**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	8.1 There is a help link available on every page.	3.5				1				2.75				2.5			
		3	5	5	1	1	1	1	1	4	4	1	2	1	5	2	2

Appendix C2: Category 2 - E-commerce usability design heuristics

	Criteria	Rating															
1	**Communication the intended message**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	Homepage																
	1.6 On the homepage – it is clear to see what is on offer.	4				2.25				3.25				3			
		5	4	4	3	2	2	1	4	4	4	2	3	1	4	4	3
	1.7 Text and the way it is presented is easy to read.	4				3				3				3			
		5	4	3	4	3	3	2	4	3	2	4	3	1	4	4	3
	1.8 The tone of the text is user friendly and does not use telecommunication terms	3				2.75				4.25				3.25			
		4	3	3	2	3	3	4	1	5	4	4	4	1	4	4	4
	1.9 The most important information is at the top of the page.	3.25				3				3.75				3.5			
		4	4	3	2	3	4	1	4	5	4	2	4	2	4	4	4
	1.10 The page has a good balance between pictures and information.	3.25				2.5				3.75				3			
		4	4	3	2	3	1	2	4	5	4	4	2	1	4	4	3
2	**Page display, layout and site structure**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
2.1	**Information Architecture**																
	1.1.1 The information architecture supports multiple ways to reach content (I.e. search box, top or left navigation, site map, etc.)	4				3.75				3.75				3.25			
		5	4	4	3	5	4	4	2	4	4	4	3	1	4	4	4
	1.1.2 The information architecture highlights the best ways to reach content.	3				3.25				3.5				3.25			
		4	3	2	3	4	4	2	3	4	3	4	3	1	4	4	4
	1.1.3 Looking at the navigational headings, it is easy to expect what those sections include.	3				3.5				3.75				3.75			
		4	4	1	3	5	4	2	3	4	4	4	3	3	4	4	4
	1.1.4 The navigational heading categories are logically grouped.	3.75				4				4				3.75			
		4	4	4	3	5	4	4	3	4	4	4	4	3	4	4	4
2	**Page display, layout and site structure**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
2.2	**Search box (Search for a contract plan)**																
	2.2.4 Search box is easy to find and consistently placed.	4				3.75				2.5				3.75			
		4	4	4	4	5	4	2	4	1	1	4	4	2	5	4	4
	2.2.5 Search box is easy to use.	3.5				4.25				3.75				3			
		4	4	4	2	5	4	4	4	3	4	4	4	2	4	2	4

	2.2.6	Search box supports revision or refinement.	3				1.75				3.25				3.25			
			4	3	3	2	2	3	1	1	4	4	3	2	2	5	2	4
2	**Page display, layout and site structure**		**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
2.3	**Search Results (Search for a contract plan)**																	
	2.3.6	Useful results are available at the top of the list.	2.75				3.25				3.75				2.5			
			2	3	4	2	4	4	4	1	4	4	4	3	2	2	2	4
	2.3.7	Search results solve the query (list the contract plans or provide clear links to view the contract plans).	2				2.75				3.75				3			
			1	1	4	2	4	4	2	1	3	4	4	4	4	4	2	2
	2.3.8	Results indicate clearly how many results were retrieved.	2.25				4.5				2				2.5			
			1	2	4	2	4	5	4	5	3	2	1	2	3	2	3	2
	2.3.9	Useful components are displayed per result.	3				3.25				3.75				2.75			
			3	3	4	2	4	4	4	1	4	4	3	4	3	4	2	2
	2.3.10	Results are grouped in a useful way.	2.5				2.75				3.5				3			
			3	3	2	2	4	4	2	1	4	4	2	4	4	4	2	2
2	**Page display, layout and site structure**		**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
2.4	**Site-wide Navigation**																	
	2.4.1	It is possible to move through the site without experiencing click fatigue (too many clicks). (Try out a few common scenarios.)	3				2.5				4				3.5			
			5	2	3	2	3	4	2	1	4	4	4	4	3	4	4	3
	2.4.2	Breadth and depth are balanced.	3				3.25				3.5				3			
			4	3	3	2	3	3	3	4	4	3	4	3	2	3	4	3
	2.4.3	Navigation labels are clear and meaningful.	2.75				3.5				3.5				3.25			
			4	4	1	2	4	4	2	4	4	4	4	2	2	4	4	3
2	**Page display, layout and site structure**		**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
2.5	**Contextual Navigation (product page and information pages)**																	
	2.5.4	It is clear where you are in the site.	3.75				3.25				4				3.5			
			5	4	4	2	3	4	2	4	4	4	4	4	3	4	4	3
	2.5.5	Related links are available.	3.5				2.75				3.75				3			
			4	3	4	3	3	3	3	2	4	5	4	2	2	3	4	3
	2.5.6	Related links are clearly labelled.	3.25				3				3.75				3			
			4	3	3	3	4	3	3	2	4	5	4	2	2	3	4	3

2	**Page display, layout and site structure**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**					
2.6	**Page structure / Presentation of information**																		
	2.6.5 Pages are easy to read.	4				3				4.25				3.25					
		5	4	4	3	3	4	2	3	5	4	4	4	1	4	4	4		
	2.6.6 There is a good balance between pictures and information.	3.75				2.25				3.75				3.25					
		5	4	3	3	2	3	2	2	5	4	4	2	1	4	4	4		
	2.6.7 Pages are not so long that they force participants to scroll.	3				1.75				2.75				3.25					
		4	4	2	2	2	2	1	2	4	3	2	2	3	4	4	2		
	2.6.8 Some of the information is broken down into tables or bullet forms.	3.5				3				3.5				2.75					
		4	3	4	3	2	3	3	4	4	3	3	4	2	3	4	2		
2	**Page display, layout and site structure**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**					
2.7	**Language and tone**																		
	2.7.5 The site conveys a clear sense of its intended audience.	4				2.25				3.5				3.25					
		5	4	4	3	2	4	1	2	5	4	2	3	1	4	5	3		
	2.7.6 The site uses language that is familiar to and comfortable for its readers.	3.75				3				3.5				3.25					
		4	4	4	3	2	4	4	2	4	4	4	2	2	4	4	3		
	2.7.7 It is conversational in its tone.(i.e. Fun, friendly and not too corporate).	3.25				2.75				3.5				2.5					
		4	3	3	3	2	3	3	3	4	3	3	4	1	3	3	3		
	2.7.8 Content is interesting to the user.	3				2.75				3.75				3					
		4	3	3	2	3	3	2	3	4	3	4	4	1	4	4	3		
3	**Value of information provided**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**					
	3.3 Sufficient information is provided to help participants make a decision.	3				2				3.5				2.75					
		2	4	2	4	2	2	1	3	3	4	4	3	1	4	4	2		
	3.4 The website cross-sells related content.(i.e. Value added services and phones that come with the cellphone plan).	3				2				3				3					
		2	4	3	3	2	2	2	2	4	4	3	1	1	4	4	3		
	3.4 There is functionality (comparison charts etc) to assist in the decision making.	3.5				3				3.5				2					
		5	2	4	3	4	4	2	2	4	4	3	3	1	1	4	2		

4	Utility	Vodacom				MTN				Cell C				Virgin Mobile			
	4.3 The website provides a sufficient set of functions that enable participants to carry out all their tasks effectively.	4				3.25				3.5				3			
		5	4	4	3	4	4	2	3	4	4	4	2	1	4	4	3
	4.4 The site provides a store functionality tool.	3.5				2.75				2.5				2			
		5	1	4	4	4	1	2	4	4	1	3	2	1	1	3	3
5	**Culture**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	5.3 The website offers a secondary language option. (i.e. Zulu, Afrikaans).	1.5				1.5				1.5				1.5			
		1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
	5.4 There are elements on the website that may portray it as a South African website (Colours used and graphics etc, SA participants prefer a colourful, graphical interface)	2.25				4.25				2.5				2.25			
		1	3	2	3	4	4	5	4	1	3	3	3	2	3	2	2
6	**Effectiveness**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	6.1 The website supports participants in learning, in conducting their task efficiently, in accessing the information they need, and in purchasing the goods they want.	3.5				2.75				3.25				3			
		4	3	4	3	4	3	1	3	3	3	4	3	1	4	4	3
7	**Efficiency**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	7.1 Once participants have learned how to use a website, they can sustain a high level of productivity to carry out their tasks.	3				3.5				3.25				3			
		4	3	4	3	4	3	2	3	5	4	4	3	2	4	4	4
8	**Learnability**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	8.1 It is easy for the user to work out how to use the website by exploring the interface and trying out certain actions.	3.75				3.25				3.75				3.5			
		4	4	4	3	4	4	2	3	4	4	4	3	2	4	4	4
9	**Memorability**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	9.1 The interface provides support to assist participants in remembering how to carry out tasks, especially for products and operations they use frequently.	3.25				3				4				3.5			
		4	3	3	3	4	3	2	3	5	4	5	2	2	4	4	4
10	**Security**	**Vodacom**				**MTN**				**Cell C**				**Virgin Mobile**			
	10.3 There is a fraud and security link available at the bottom of every page.	1.5				2				1.5				2			
		1	1	2	2	1	1	2	4	1	1	2	2	1	1	2	4
	10.4 There is a terms and conditions link available at the bottom of every page.	4.75				3				2.25				2.5			
		5	5	5	4	2	2	4	4	1	1	4	3	1	1	4	4

Appendix D: Ethical clearance

UNISA | college of science, engineering and technology

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16 September 2010

TO WHOM IT MAY CONCERN

Permission to conduct Masters Research Project **Ref: 005/GKA/2010**

The request for ethical approval for your research project entitled: "How can the usability of E-commerce web sites support user experience of E-commerce by South African users?" refers.

The School of Computing's Ethics Committee has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the School of Computing's Director or CSET Executive or CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:
http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Yours sincerely

Prof JH Kroeze
Chair: School of Computing Ethics Committee

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Draft article based on this study