

# How can usability contribute to user experience? A study in the domain of e-commerce

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## ABSTRACT

Despite the accepted importance of User Experience (UX) as a concept related to and yet distinct from usability, there is still some ambiguity about the relationship between UX and usability. This paper aims to investigate the role of usability in contributing to a good UX in the rapidly-growing domain of e-commerce websites, where user experience is of paramount importance. We investigate this relationship by usability testing of participants' interactions with four telecommunication websites and by a questionnaire survey on the user experience of the sites, conducted with the same participants. The complex, context-specific, subtle and subjective nature of UX makes it difficult to measure and design for UX. The contribution of the study is to mention particular usability aspects that influence attributes of UX as an approach towards demystifying designing for UX. The paper should be of interest to designers, developers and researchers in the field of usability and UX.

## Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentations]: User Interfaces – *evaluation/methodology*

## General Terms

Design, Human Factors, Measurement, Performance

## Keywords

E-commerce, Evaluation, Usability, Usability testing, User experience

## 1. INTRODUCTION

The *focus area* of this study is an investigation of the role of usability in contributing to a good user experience, while the *application area* is the domain of e-commerce websites. This is an appropriate domain, because e-commerce in Africa is growing faster than anywhere else in the world [7]. E-commerce involves Internet-based financial transactions for the acquisition of products and services. By 2010 the South African Internet user base exceeded five million [7] and e-commerce increased significantly. The design of websites is a key issue for companies aiming to maximize profits in a competitive market [16]. They require enhanced usability and attractive presentations and should also provide a good user

experience (UX) for the online purchaser [29]. As products and services are increasingly sold online, the body of knowledge on user interface and user experience for e-commerce is growing. In two South African e-commerce studies, websites were evaluated by user testing to identify users' impressions and problems, but the UX was not explicitly evaluated [1, 18]. Usability is a well-established domain, which can be explicated by known and tested principles [24], whereas the concept of UX is less clearly defined [27]. A link between UX and usability should enable designers to apply usability principles in the quest for a positive UX. The focus is primarily on qualitative findings, while providing certain quantitative measures. We address the relationship between usability and user experience by investigating user interactions with four anonymised telecommunication websites, referred to as S1, S2, S3 and S4.

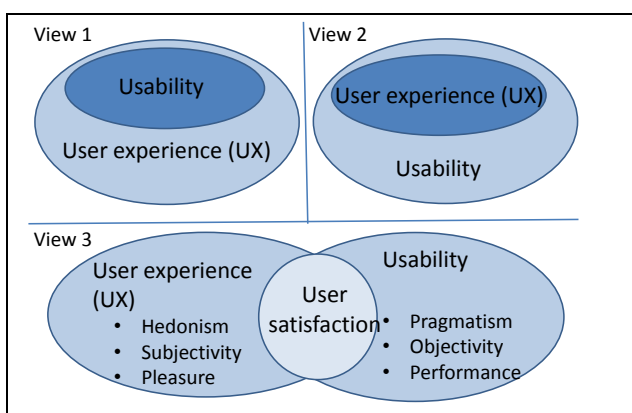
## 2. BACKGROUND AND LITERATURE REVIEW

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' [13]. In evaluating systems for usability, usability goals can be operationalised as questions. This approach provides the designer with a way of assessing various aspects of an interactive product as well as the user experience. In the controlled environment of a human-computer interaction (HCI) laboratory, the performance of typical users on pre-defined tasks is measured as participants perform pre-defined tasks on a system or website [24].

UX focuses on well-being, and not performance, as an outcome of human-product interaction. The current ISO standard 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' [14]. UX supplements attention on the product itself (e.g. functions, applications, interaction) with an approach that takes cognisance of human emotions and experiences. In a broad context UX is described by the Nielsen Norman Group [22] as the feelings users have while interacting with a company, its services, and its product. Furthermore, UX factors should be mapped to the context of use, which 'profoundly influences user interaction with products, resulting in a matrix of factors versus contextual parameters' [23]. Having engaged with an interactive environment, users will leave it with positive or negative emotions towards a brand [8]. A satisfying experience is generally one that addresses the particular human needs of the user [10]. Delivering a good experience involves various disciplines, including marketing, ethnography, interaction design, information design, technical writing and visual

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design [26]. Common to many models and definitions are the roles of emotions (e.g. anger, anxiety, joy, satisfaction, and excitement), visual encounters and reflection. For a company aiming to differentiate itself from the competition and gain loyalty and trust from users, good UX on its website is vital. However, the process cannot be managed without a sound UX evaluation method [29] and, as yet, it is not clear what methods are best for assessing UX, partly due to the fact that there is currently no fixed definition of UX [2]. There are various perspectives on the relationship between usability and user experience. On the one hand, there is a strong perception that UX subsumes usability. Under this point of view, *user experience includes usability* [25, 29] and UX evaluation entails the extension of existing methods for usability evaluation (see Fig. 1, View 1). Other researchers argue that satisfaction is the subjective component of usability and that user experience is a broad and rich term for satisfaction. In this viewpoint, *usability includes user experience* [3] (Fig. 1, View 2). A third stance, applied in the present study, suggests that usability and user experience are separate but closely-related concepts. They can be viewed as intersecting, with common attributes but also with certain distinct differences (Fig. 1, View 3). The *subjectivity* of UX goals and their importance from the user's personal perspective are stressed as a contrast to the *objectivity* of usability goals, by which an interactive product is measured in terms of its usefulness and productivity [24]. Hassenzahl [9] distinguishes between two perceptions of quality: pragmatic and hedonic. *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, which are attributes of UX (Fig. 1, View 3). Hassenzahl argues that lack of usability can block fulfillment of certain human requirements. Bevan [3] indicates the varying roles of usability and UX, explaining that the difference in emphasis between *task performance* (usability) and *pleasure* (user experience) leads to different concerns in the development process. Tullis and Albert [28] view usability as the user's ability to use the product to do a task, while UX takes a broad view of the entire interaction with the product, including thoughts, feelings and perceptions. A survey on the views of 275 researchers and practitioners from academia and industry in the UK, found that UX is viewed as dynamic, context-dependent, and subjective [15]. It is perceived as a new concept, which must become a part of the discipline of HCI and be grounded in user-centred design practices.



**Figure 1. Different views of the relationship between usability and user experience**

Law et al.[15] list factors contributing to the complexity of obtaining a universal definition of UX:

- UX is associated with dynamic variables, such as emotions, affective, experiences, hedonism and the aesthetics of a product.
- There is a lack of explicit metrics and units of analysis for UX. The evaluation of UX ranges from considering a single aspect of an individual interaction with a single product to all aspects of interaction by multiple users with a company and its range of services.
- The domain of UX research is fragmented and complicated by various theoretical models such as: 'emotion, experience, value, beauty and hedonic quality'.

The literature thus indicates that UX has an inherent quality that seems to defy definition and precise specification of goals. Due to its importance, however, researchers are striving for explicit ways of designing for UX. Establishing ways of attaining this, is the main purposes of this study.

### 3. RESEARCH DESIGN AND METHODS

This study addresses the research question:

*How can the usability of an e-commerce website support the user experience offered by the site?*

The question is addressed in a contextualised way. We undertook an evaluation of the usability and user experience offered on four established e-commerce websites, and inductively produced a mapping between related aspects of usability and user experience. Data triangulation was implemented by using four sites and methodological triangulation by employing two usability evaluation methods (UEMs), namely: controlled usability testing and questionnaires. The evaluation criteria and measures were established from literature studies – see Section 4.

Usability testing (UT) is a user-based UEM that provides insight on problems experienced by end-users as they interact with a product. UT was conducted to investigate *usability* of the four sites (see Section 3.1), while questionnaires were used to assess participants' *user experience* (see Section 3.2) [20]. The idea was to identify generic issues arising from the study and to explore connections between usability and user experience as encountered by the participants.

#### 3.1 The usability testing study

UT observes and records data as typical end users interact hands-on with a target system, performing specified tasks in the controlled environment of a specialised HCI laboratory. It is an effective UEM for determining users' preferences and problems encountered, time spent on tasks, and the number of errors. It is particularly used to improve usability of products [5]. UT focuses on measuring the effectiveness, efficiency and user satisfaction of an application [4, 13]. The data is captured by objective metrics and also by subjective measures such as questionnaires, interviews and observation of emotions and gestures [4]. Due to the time-intensive analysis in usability-testing studies, the number of participants in UT is usually low. It was believed that 4 to 5 evaluators could identify 80–85% of the usability problems [21], but a recent study [12] suggests that between 8 and 12 are required to identify 80% of the problems. The present sample is situated at the top end of this range. Twelve participants were carefully recruited, representing equal splits across the major user parameters, namely: balanced distribution between ages of 18 and 60; six males and six females; four each from English, Afrikaans and African language groups: equal representation of pre-paid, contract and business cell phone usage; and equal distribution across use of service providers, S1, S2, S3 and S4. All the

participants were experienced in using cell phones and, with regard to Internet usage, there were both novices and experts.

Before starting the sessions, they were oriented regarding the laboratory and the testing process, and given an information document. They signed informed consent indicating that their names and affiliations would be confidential and that inputs were for research use only. Two performance tasks were defined, with usability metrics based on the Table 1 criteria.

- Task 1: Find a cell phone plan to suit your needs (For legal reasons, online purchase was not permissible)
- Task 2: Find an Internet plan (Internet via cell phone)

### 3.2 The questionnaire study

Questionnaires are not highly time- and resource intensive and are often used as part of other evaluation methods [24]. Post-test questionnaires are used to capture satisfaction with a system. After the UT sessions, participants took part in the second study, as they completed a custom-designed questionnaire to investigate their UX with the e-commerce sites. The questionnaire was based on the criteria in Table 2.

## 4. EVALUATION CRITERIA

Sets of criteria were identified from the literature. Those in Table 1 are usability criteria, while Table 2 focuses on UX.

**Table 1. Usability testing criteria**

<p>1. <b>Navigation</b> (Efficiency and Effectiveness [6, 10, 13])</p> <ul style="list-style-type: none"> <li>• Is the navigational paradigm logically structured and does it makes sense to the user?</li> <li>• Can users manoeuvre easily between related pages, and between different sections to find the content they need?</li> <li>• How quickly do users find what they are seeking?</li> <li>• Is the terminology of the headings understandable?</li> <li>• Are the links within the content area obvious to the user and is the colour of the links standard throughout?</li> <li>• Are hyperlinks clear or misleading?</li> </ul>
<p>2. <b>Information Architecture / Structure</b> (Efficiency and Effectiveness [6, 17])</p> <ul style="list-style-type: none"> <li>• Is information found where users expect it to be?</li> <li>• Does the site structure and layout hinder usage in any way, i.e. does it lead to errors?</li> <li>• Is the intra-page navigation effective and logical?</li> <li>• How well does the structure of the content facilitate the goals users are trying to achieve?</li> </ul>
<p>3. <b>Value of Content</b> (Satisfaction )</p> <ul style="list-style-type: none"> <li>• Does the content address users' goals and objectives for using the website?</li> <li>• What do users expect to see when they go onto the websites?</li> <li>• What stands out within the content areas? Is the content of value to the user?</li> <li>• Is the informational content concise yet comprehensive?</li> <li>• Does the website support flexible use?</li> </ul>
<p>4. <b>Satisfaction</b> (Satisfaction [13, 18, 24])</p> <ul style="list-style-type: none"> <li>• What feelings do users experience when interacting with</li> </ul>

<p>the website?</p> <ul style="list-style-type: none"> <li>• Do users enjoy visiting the site?</li> <li>• Are they satisfied with what is available?</li> </ul>
<p>5. <b>Aesthetics &amp; consistency</b> (Effectiveness) [24]</p> <ul style="list-style-type: none"> <li>• Tone, use of graphics and colour. graphical intensity.</li> <li>• Standardised aesthetic norms (e.g. balance, visual load).</li> <li>• Acceptability of branding.</li> <li>• Readability of pages (home page and other pages).</li> </ul>
<p>6. <b>Functionality</b> (Effectiveness) [24, 30])</p> <ul style="list-style-type: none"> <li>• Are users able to locate the available functionality?</li> <li>• Are users able to use the available functionality?</li> </ul>

**Table 2. User experience criteria**

<p>1. <b>Emotions evoked by using the website</b> [22]. (How users experience the product personally – in terms of positive and negative emotions)</p> <ul style="list-style-type: none"> <li>• Easy to use / Enjoyable / Appealing / Useful / Comprehensive / Friendly, etc.</li> <li>• Boring / Frustrating / Businesslike / Time consuming / Overwhelming / Annoying/irritating</li> </ul>
<p>2. <b>Visual appeal and aesthetics</b> [11]</p> <ul style="list-style-type: none"> <li>• What basic feelings (excitement, disappointment, fear, etc) does the user experience when looking at the visual product (involving: background patterns, colours, graphics and sounds used)?</li> <li>• What is the visual impact of the user interface?</li> <li>• Character – what kind of overall image or personality does the website depict to users through the use of graphical elements (branding, text and fonts, pictures, readability, graphics, visual load, and colours)?</li> </ul>
<p>3. <b>Service Quality</b> [19]</p> <ul style="list-style-type: none"> <li>• Convenience – is the website easy to navigate, user friendly and can users get the information they want?</li> <li>• Interactivity – does the e-commerce website facilitate a two-way communication with the users?</li> <li>• Customization – does the website tailor its products, services and transactional environment to individual users?</li> </ul>

## 5. FINDINGS OF USABILITY TESTING

Participants completed a pre-test questionnaire then, for each site, they investigated its home page. Their interactions with the tasks 'Find a cell phone plan' and 'Find an Internet plan' were observed and studied with the laboratory technology. The observation, testing sessions and pre-test questionnaire, were guided by criteria obtained from the literature and listed in Table 1. Standard metrics were recorded, but the study also had a qualitative component.

### 5.1 Pre-test questionnaire

This questionnaire established participants' perceptions of e-commerce sites in general and how they used them. Eleven of the 12 used e-commerce, seven of whom had purchased online for more than two years. For eight of them, *Compare* features were the most popular and, for seven, the *Product reviews*. The *Social networking* functionality was appreciated by four participants. *Podcasts* and *Videos* were hardly used.

Several mentioned Google and Amazon as sites that offered good user experiences, due to the simplicity and efficiency of completing tasks. In contrast, participants found most websites to be static and text-heavy, providing little value.

Given our focus on user experience, participants were also asked what aspects enhance UX on e-commerce sites. Their open-ended responses were categorized under:

**User interface (UI) aspects, contributing to the mood and interaction:** Innovative UI designs (31%) and quick response times (23%) were the most mentioned. Novel designs encourage users to browse further. Supportive tools were required by 44% to help in their decision-making processes. Similarly, 44% required rapid feedback.

**Functionality – tools and applications that help them complete tasks:** All the participants felt it should be easy to satisfy goals. Some required the sensation of being virtually ‘in front of’ a sales consultant when looking for a product.

**Content should be engaging:** Product-based paradigms caused frustration, and contemporary users tend to reject them. They require a needs-based paradigm with customer-centric interaction designs, based on their personal needs, rather than on product features.

These results gave initial insights into participants’ perceptions regarding the e-commerce user experience. They were searching for content specific to their needs; efficient response times; innovative designs that are engaging and appealing; and sufficient tools and functionality to help them choose a suitable product.

The formal usability testing then commenced. Sessions were video-audio recorded, so they could be re-viewed for analysis.

## 5.2 Qualitative findings: Homepages

The main reason why users visit cellular phone websites, is to find plans, deals and phones. Participants were monitored as they used the homepages and their ‘think-out-loud’ comments were recorded. Re-viewing of the videos confirmed their perceptions of the four homepages. We address most of the comments in principle but occasionally relate them to specific sites. The analysis is subdivided under structure (information architecture) and content offered.

**Structure – Positive factors:** Users appreciated innovative, yet functional, homepages; simple, clean layouts; learnability, visual appeal, and structures that clearly differentiate the available sections. Minimalist layouts are less intimidating to users seeking products and services. Although the participants ranged in age, most of them were engaged by innovative pages. Some of the comments were: ‘Quick and easy to see where you want to go’; ‘Good content categorisation’. ‘Pictures are eye catching’, ‘...the navigation is simple’, and ‘Different look and feel’. Categorisation and naming of the navigational menus played a major role in effective usage. Participants appreciated clear and easily-understandable links that helped them satisfy their goals efficiently.

**Structure – Negative factors:** The incorporation of social networking irritated some participants. For those who did not use social networking sites (SNSs), these were intrusive. Another point regarding the type of user, was that S2’s primary navigation appeared to target existing users; since navigation links commenced with ‘My ...’. This made some participants feel that the site did aim to entice new customers. Where terms are selected to resonate with a theme, this should not be done at the expense of clarity

Long series of menus frustrated users, as did the banners that ‘make pages take too long to load’ or are ‘focused on promotions’.

**Content – Positive factors:** Intuitive and easy-to-understand product names at high levels facilitate the search for a plan or product. Confirmed social networkers felt positive about SNS facilities, stating that S2 did more than just sell products; it created an environment that engaged them beyond the product offering. This created trust and a positive experience with the brand. The most important, factor, however, was whether the home page addressed their primary need. It was mentioned regularly that a site either met, or failed to meet, their requirements. When phones, packages and deals were clearly presented, it achieved the purpose of the exercise. Major factors in meeting needs effectively, were simple and easily-understandable menus and navigation. Other requirements were money-saving deals and simple content offerings, particularly sets of options and functionalities to help them make choices.

**Content – Negative factors:** Information overload was a problem on homepages and menus. ‘Seems like S1 is trying to place every department on the homepage’ and ‘Confusing to determine exactly what is on offer’. Participants wanted related services as follow-ups: ‘There is no option to choose a phone once I have selected a contract plan’; ‘Product-focused and brand-focused, rather than selling products that meet consumer needs’. They did not appreciate telecommunications terminology. Some complained about banners, which they did not relate to products. Banners cluttered designs and slowed downloads. One site had an international identity, different from a South African look-and-feel.

## 5.3 Quantitative findings: Tasks 1 & 2

Participants completed Task 1 ‘Find a cell phone plan’ and Task 2 ‘Find an Internet Plan’. The former required them to identify a plan suited to their cell phone needs, while Task 2 involved a plan for browsing the Internet wirelessly on a phone or laptop. In both cases, quantitative and qualitative data was gathered. All 12 participants completed Task 1 successfully on each supplier site, as shown in Table 3.

Table 3. Times and clicks to complete tasks

Site	Task 1: Find a cell phone plan			Task 2: Find an Internet plan		
	No of cell phone plans	Average no of clicks	Average time (mins)	No of Internet plans	Average no of clicks	Average time (mins)
S1	15	3	8	7	2.75	13.5
S2	24	1.67	7.5	14	2.83	13
S3	15	1.58	3.2	6	1	4
S4	4	1.83	3	No Internet packages		

Variations in completion times indicate the respective efficiencies of access, although rapid access along with inadequate information shows ineffectiveness. For Task 1 on S1 (the most complex) with an average time of 8 minutes, times ranged from 4.5 to 12, while for S4, all times were close to the average (3 mins). Participants related well to S2, which had a low click tally despite offering 24 plans (1.67 clicks due to strategic product links on the homepage), but the task as a whole took on average 7.5 minutes, due to the extensive information on the *Deals/Package* feature. S1 and S3 both offered

15 plans, yet the click tallies and times differed greatly, showing that where plan names address user needs, users can choose suitable plans regardless of the number on offer.

Table 3 shows a similar pattern for Task 2, with S3 providing the fastest (average 4 minutes) in contrast to S2 (average 13) and S3 (average 13.5). Again, S1 and S3 offered a similar number of Internet plans, but tallies and times differed notably. In contrast, S2 (14 plans) had double S1's offerings (7 plans), but tallies and times were the same. Overall, participants avoided cluttered areas and looked for items that met their needs. Yet they did not perform as well as in Task 1, due mainly to confusing terminology. Cellular companies refer to Internet packages as data. However, in seeking an Internet plan for a phone, users do not relate to 'data' but rather to '3G'. In Task 2, three of the 12 made errors on S1 due to this. 'Internet' was indeed offered, but it related to online payment of accounts, while Internet access via cell phone was under the *Data* link. On S2, Internet access was under the *Value-added services* menu, leading to mistakes by three participants. On S3, Internet packages were located in a top-level menu called *Internet* and participants succeeded.

## 6. QUALITATIVE FINDINGS

### 6.1 Qualitative findings: Task 1

This section addresses the more qualitative usability issues, but measured quantitatively with Likert scaling. Criteria from Table 1 were converted to statements rated on a Likert scale of -3 to +3 with respect to ease of use, content satisfaction and structure, for which the average findings are shown in Fig.2.

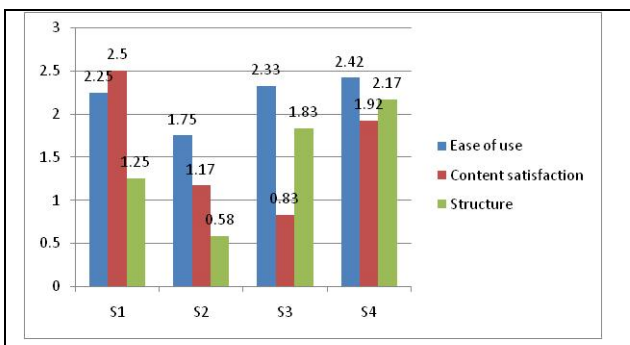


Figure 2. Qualitative findings Task 1

Although S1 frustrated participants by the longer times they spent on the site, it was rated highest in terms of content and comprehensive product descriptions. S4, where they completed Task 1 the fastest, was highly rated for its structure and ease of use.

**Ease of use:** Tasks were completed efficiently when navigational headings were clear and intuitive. High levels of clicking and extensive reading frustrated participants, which occurred when structures were not aligned with their intended purchase flow (plans, phones, services and call to action). Participants preferred a needs-based paradigm to product-based navigation. In the needs-based approach, menus indicate the nature of services and relate to users' varying requirements, e.g. headers/links such as *Only make calls at night*, *SMS a lot*; or *Business packages*, rather than a product-based approach, where headers/links are names of products. A frequent comment was 'It speaks (or does not speak) to my needs', because product offerings made it difficult to compare and choose products.

**Content satisfaction:** Product names should be easy to interpret without clicking into them. Product descriptions should be comprehensive, to avoid achieving goals by, e.g. phoning a store. Key decision-making information, such as price, should be prominent, and functionality should be provided to compare features of products or view summaries. Experienced users require filter functionality to speed up visits. Sites should be current; obsolete products should be removed. Participants believed that sites should speak to target groups for both business- and personal use. S1 offered comprehensive product descriptions and S3 used product names to which users could easily relate. S2's presentations were consistent with advertised content in print, TV and billboards. This branding helped users relate to the site. The social networking links were controversial.

**Structure, visual appeal and navigation:** Content should be clearly laid out, with the product offerings easily visible. Three sites had content overload and one had too little content. All the participants appreciated simple navigational headings and minimalism, yet adequacy, in the amount of information on product pages. Orientation was problematic in one site, where users who followed a link to an associated site struggled to return. Other irritants were duplicate links on the same page, excess textual information, and imbalance between content and distracting banners. Not a single user clicked on a banner. Two sites offended with regard to technical jargon and un-user-friendly terminology.

### 6.2 Qualitative findings: Task 2

Task 2 was undertaken on three sites, because S4 does not offer Internet packages. The qualitative measures were: ease of use, content satisfaction, structure, terminology and visual appeal, and route and errors. Figure 3 depicts the results. For S1 and S2, all aspects were rated negatively, indicating particular dissatisfaction with the content of S1 and ease of use of S2. In contrast, S3, where participants did the task successfully and intuitively, received only positive ratings.

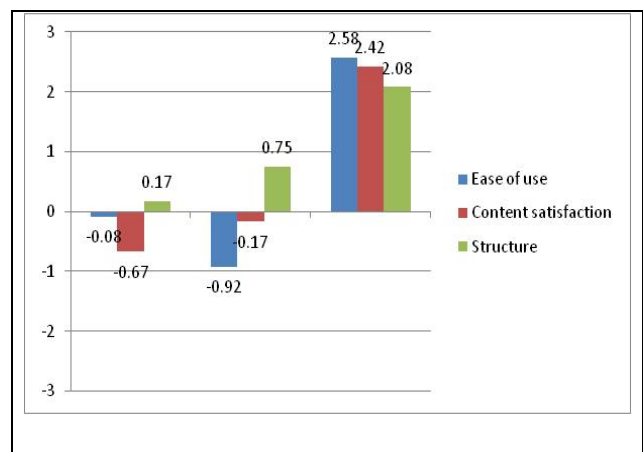


Figure 3. Qualitative findings Task 2

**Ease of use:** When navigational headings were clear and intuitive, tasks were completed efficiently. When structures were not aligned with users' intentions and purchase flow, there were high levels of clicking and extensive reading, which frustrated participants. The ease-of-use findings emphasize the value of logical grouping of product offerings and naming practices that represent the content. One average rating was as low as -0.92 for a case where there was no



obvious link to the goal. Participants can make better and more efficient decisions if naming conventions are good.

**Content satisfaction:** Participants were frustrated when they clicked randomly or erroneously to understand an overall offering. On reaching product detail, they need descriptions that support decisions. Examples of inadequate structures occurred on S1 and S2. One average rating for content satisfaction was only -0.67. Examples of comments are: ‘I do not understand the product offering’; ‘No summary’; and ‘Disconnect in the user journey’. The effectiveness of content can be strengthened by descriptive information; optional elaboration of terms; and additional functionality.

**Structure:** Eight participants would appreciate a summarized display of the entire product offering. Some comments were: ‘Need to click through all the products to understand them’; ‘no structure or engagement’; ‘very static’; ‘too textual’; ‘too much scrolling’. Long product pages are tedious, but they can be supplemented with bullets or tables consolidating the most important strategic information (e.g. price, benefits, call to action) to support users’ decision-making processes.

**Terminology and visual appeal:** As stated previously, users use different terms for mobile Internet, and did not relate the word ‘data’ to Internet access via phone or laptop. Designers should understand that users are unfamiliar with technical terms and should offer supplementary information. Furthermore, corporate branding and jargon should be consistent across media. If a company uses specific terms in brochures and on billboards and TV, the terms on the website should be the same. To quote: ‘Not as advertised, i.e. GPRS and 3G’, ‘The *Best data advisor* should be called *Best broadband*’, ‘Data is information not *Internet!*’ S3, however, provided rich product descriptions and explanations, and named its products and services appropriately. The visual appeal findings indicated that participants were attracted to layouts with a sound balance between text, tables and pictures, as well as clear product pathways to expedite

involved some guessing. S3 was the only site with 100% successful completion, due to the clear primary navigational heading *Internet*, on which all participants clicked and went directly to the required package. S1 was considered slightly more intuitive than S2, due to *Broadband* under the *Services* menu, but participants would have preferred it under *Find a package*, because it is a contract plan and not a service.

It appears that cell phone companies assume (incorrectly) that potential users fully understand the product offerings and terminology. This study showed that some users do not, resulting in dead ends. Insufficient support and assistance is given, hindering usability. Optional links to elaborations would improve the situation. The errors that occurred on S1 and S2 were due to confusing terminology. See Table 3 which presents the average times and associated explanations.

Comparing performances on Tasks 1 and 2, participants took much longer to complete ‘Find an Internet plan’ than ‘Find a cell phone plan’. Contributing factors were the non-intuitive navigation menus and lack of guidance. In some situations, there was too much to choose from without signposting to point users to the right product. In this respect, the S1 and S2 sites performed less well. Participants needed an average of 2.75 clicks to find an Internet plan on S1 and 2.83 clicks on S2, compared to a single click on the S3 site.

## 7. FINDINGS OF USER EXPERIENCE QUESTIONNAIRE

The participants in the UT study were also the participants in the user experience study. After doing the tasks: ‘Find a cell phone plan’ and ‘Find an Internet plan’, they completed a UX questionnaire that captured their overall perceptions. The 12 participants had to list the positive and negative emotions they had experienced while using each target website. The questionnaire template supported them by presenting a set of emotions they might, or might not, have experienced (see Table 2, Item1). It is not the purpose to do a comparative study of e-commerce sites, but rather to address aspects of UX in principle, referring to websites to substantiate points. Next we address the positive and negative emotions that participants experienced. The sections that follow, discuss the aesthetics of the sites and the overall experience.

### 7.1 Emotions experienced

Figure 4 displays positive emotions experienced. If a site has a score of, say 80%, for an emotion, it means that 80% of participants chose that adjective from a list. E.g., Sites 3 and 4 were found ‘easy-to-use’ and ‘friendly’ by high percentages of participants. After the questionnaire, the researcher held informal interviews, asking participants why they chose those emotions. Discussion follows of the key factors that contributed to positive emotions:

**Easy to use:** The key factors were content simplicity and understandable product offerings experienced on two sites.

**Enjoyable:** Participants enjoyed websites with an innovative look-and-feel, and where the tone made the content easy to read.

**Appealing:** Websites appealed to all the participants when the home page content spoke directly to their needs with links such as *Phones* and *Deals*. Eight felt that uncluttered sites are attractive, and lead to clear differentiation of product categories.

**Useful:** A website offers a utilitarian experience if menus and navigation paths are clear, leading to short user journeys, and if product names are intuitive, supporting decisions.

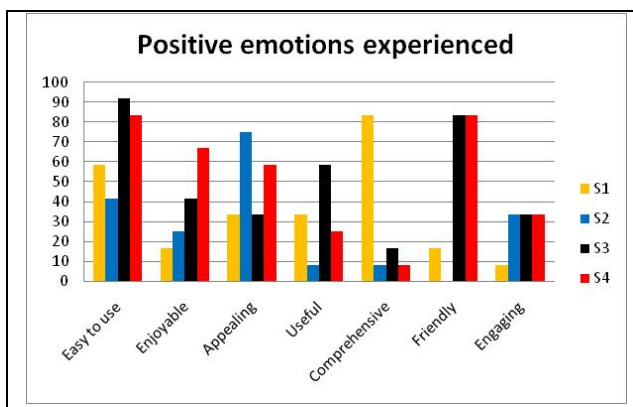


Figure 4. Positive emotions

attainment of goals. The frustrations that emerged as participants tried to find an Internet plan, left a negative impression of the brand, affected user engagement, and reduced motivation to complete journeys. Analysis of Task 2 provided useful information about factors that contribute to poor usability, such as poorly designed journeys, unintuitive naming, and insufficient product description to support decision making once users reached the product detail.

**Route and errors:** Eleven of the 12 stated that searching for an Internet plan on S1 and S2 was tedious and text-heavy. No participant was sure which product would be most suitable, and all would need a personal consultation for more information. The routes were unintuitive and most strategies

**Comprehensive:** Ten participants required tabulated or bulleted summaries of strategic decision-making aspects. S1 was paradoxical – although all participants rated its content as the most comprehensive, they found it to be pedestrian, laborious, and running counter to efficient search.

**Friendly:** Participants were unanimous that designers should not assume they know technical and in-house terminology.

**Engaging:** No site received a high rating for engagement. There were no inviting sections such as *New product info* or *Reviews*, that would entice users to return for ‘window shopping’ when they were not seeking specific information.

Negative emotions were also elicited. Novice users were irritated by technical product descriptions without resources to help them make choices to meet their needs, e.g. *Deals*. S1 and S2 elicited several negative emotions – see Figure 5. S1 was criticised because, in spite of its detailed information, it was business-like and overwhelming to browse. For S2, most participants could not understand how to use its functionality. Across all four suppliers, participants found most journeys to be tedious.

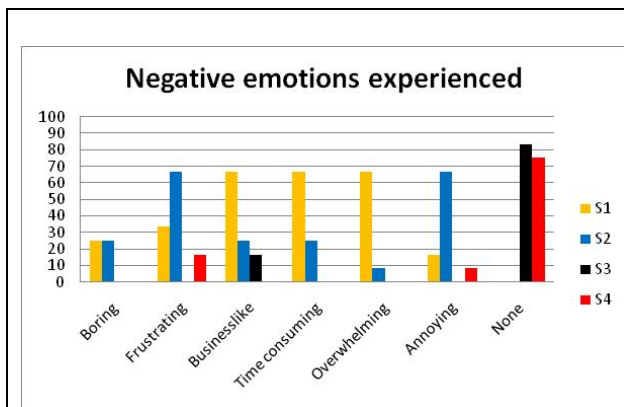


Figure 5. Negative emotions

## 7.2 Aesthetics

To judge the aesthetic aspects of UX, participants rated sites on a scale of -3 to 3 for their use of colour and pictures; clarity and ease of reading; visual load; text size; text colour; strength of the branding; and visual appeal. The quantitative ratings are not given, the purpose of this section being to consider principles that emerge from the data.

**Use of colour:** In general, there was preference for a contemporary ‘fun’ and informal look, rather than a formal approach. For example, they felt that S3 and S4 had ‘playful’ associations. Most participants preferred the same homepage, but seven felt that it over-used a certain colour. Although they understood the corporate identity of the colour, they would have preferred less adherence to branding and the inclusion of other colours to improve aesthetics.

**Use of pictures:** Ten liked layouts with attention-grabbing photographs and diagrams. They believed that the illustrations should be less cellular-focused and be more lifestyle-oriented. They all agreed that illustrations are a key contributing factor to online purchasing decisions.

**Clarity and ease of reading:** Readability was satisfactory across the suppliers. Two participants who wore glasses preferred the larger font in S4.

**Visual load:** Good balance between banners and text is important. Only one site achieved this, but did not follow through in excellence, because it had insufficient information for participants to satisfy their goals.

**Text size:** The participants who wore glasses, found it difficult to read upper and lower case text segments within the same section. An example of this type of structure occurred within the S4 site. Overall, the text size was functionally acceptable across the suppliers.

**Text colour:** Text colour was rated similarly across sites. The links were clear and easy to distinguish from the content.

**Strength of branding:** Nine participants felt that some of the corporate identity was overwhelming and too strong for websites, e.g. red on one site and blue on another.

**Visual appeal:** Participants liked structures with good balance between banners and text and wanted to achieve their aims by reading minimal information. Considering websites in the light of other media, experienced users preferred an innovative, distinctive style, different from the look and feel of printed matter, stating, ‘Fresh, went the extra mile’ and ‘They wanted to be different and they were!’.

## 7.3 Overall experience

Finally, participants were asked to describe their holistic user experience of the decision-making process in an e-commerce environment. They had to consider website features and functionality in the contexts of: content, navigation, page layout, interactivity and 2-way communication, relevance, and the level of excitement on a site.

**Features and functionality:** Regarding the vital balance between *features and functionality* and *content and product descriptions*, they acknowledged that concise layouts and efficient functionality, though preventing overload, can result in inadequate feature information for purchasing decisions.

**Content offered:** The sites offered either too little or too much content. Only one was characterised by simplicity and appropriate levels of content. Even there, key factors such as prices were hard to find, but the inviting user journey was unthreatening. On another issue, eight participants were concerned about misleading content when, for example, a site announced ‘price-saving deals’, yet had only one special offer.

As stated, the sites focused more on product features than on user’s requirements in obtaining phones and services. From the viewpoint of site designers, a critical balance must be attained between: *needs and products*, and between *information overload and inadequate information*. In this paradox, the site that provided the most comprehensive product details also frustrated participants by its extensive, almost overwhelming, amount of text.

**Navigation:** The product naming conventions in navigation menus hampered performance, particularly in the task, ‘Find an Internet plan’. Two sites used notably unintuitive naming but despite this, all the sites received fairly good ratings for the navigation processes to access suitable products.

**Page layout:** Participants identified key attributes that they found lacking in the *homepage* experiences:

- **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, don’t just sell’.
- **Engaging and compelling designs:** ‘Provide more innovations and be different!’
- **Do not assume that users understand product offerings well:** ‘Design websites for novices’

The study found that that not one of the target sites was consistently good or consistently poor. Each had strengths and drawbacks. Six participants found S2’s homepage to be

engaging and enticing to look further, but the strategies were not perpetuated in the rest of the site. On S4, category names were placed obviously upfront in an innovative layout, but it lacked engagement. Nine felt S3 had an admirable design, but lacked substance for decision making. Regarding the text-heavy S1, all participants laboured to satisfy their goals. For *other pages*, participants did not appreciate large amounts to read, extensive scrolling, or layouts that did not support efficient and effective information access. They liked simplicity in content presentation, user-friendly terminology, and visual appeal. Some did not realize that banners were product promotions; they thought they were decorations.

**Interactivity:** Participants were asked to list the most popular functionalities of e-commerce sites. They mentioned *Help me choose, Product reviews and Recommendations*. Yet none of the four telecommunication suppliers provided such features to help users choosing products online. Moreover they found most content to be static and unengaging. Five participants mentioned slow downloads which, at times, drove them to abort. They appreciated content that is conversational in tone, with user-friendly terminology.

**Level of excitement:** Across all suppliers, the participants gave low ratings to 'level-of-excitement', due to the lack of interactivity and engagement. African participants requested cultural aspects such as language options to help them understand complex information.

**Concluding the user experience study:** The findings show that it is complex and demanding to design for good UX. It confirms the purpose of this research, namely, the fostering of good UX design. Many of the key factors are inter-related and it is not realistic to achieve all of them. Designers of e-commerce websites should aspire to attain an optimal balance.

## 8. DISCUSSION

### 8.1 Research question revisited

This study investigated relationships between usability and user experience. The focus area is the role of usability in contributing to good UX, and the application area is the domain of e-commerce websites.

Usability testing and UX evaluations were conducted on four telecommunication websites, addressing the research question:

*How can the usability of an e-commerce website support the user experience offered by the site?*

Given the complex, context-specific, subtle and subjective nature of UX, we ask whether good UX is an attainable and worthwhile goal in website design and, if so, what role traditional usability plays in this quest. The findings of this study support evidence from the literature on its importance [12], and we argue that high quality UX is a goal worth pursuing.

**Table 4. Relating UX to usability in the context of e-commerce**

	User experience attributes	Related usability aspects	Evidence from findings
Navigation	<ul style="list-style-type: none"> <li>Quick and easy user journey</li> <li>Accessibility</li> <li>Easy to understand and use</li> <li>Routes related to user-needs</li> <li>Meaningful terminology and naming conventions</li> </ul> <p><b>References:</b> Table 2: Service quality ('Refs' italics to distinguish)</p>	<ul style="list-style-type: none"> <li>Logical and interpretable navigation structures</li> <li>Obvious positioning of links</li> <li>Efficient navigation and orientation</li> <li>Effective task support</li> <li>Consistency and semantic clarity</li> <li>Users informed at all times</li> </ul> <p><b>References:</b> Table 1: Navigation</p>	Section 5.1: Pre-test questionnaire; Section 5.2: Qualitative findings – structure; Section 6.1: Qualitative findings –ease of use; navigation; Section 6.2: Qualitative findings –structure, route and errors; Section 7.1: Emotions – ease of use, useful; Section 7.3: Overall experience –navigation
Information Architecture	<ul style="list-style-type: none"> <li>Needs-based rather than product-based paradigm</li> <li>Customer-centric interaction design rather than business-centric</li> <li>Simplicity in offerings</li> <li>Summaries to support product differentiation and decision making.</li> </ul> <p><b>References:</b> Table 2: Service quality</p>	<ul style="list-style-type: none"> <li>Logical groupings to support task performance</li> <li>Names conceptually related to function</li> <li>Important data in high-level summation</li> <li>Structures easy-to-learn</li> <li>Architecture that facilitates access to common goals</li> </ul> <p><b>References:</b> Table 1: Information Architecture</p>	Section 5.1: Pre-test questionnaire –content should be engaging, Section 5.2: Qualitative findings – structure; content; Section 6.1: Qualitative findings –ease of use; structure; Section 6.2: Qualitative findings –ease of use; Section 7.1: Emotions – appealing, Section 7.1: Emotions – easy to use, useful, comprehensive; Section 7.3: Overall experience; page layout
Value of content	<ul style="list-style-type: none"> <li>Speaks to primary user needs</li> <li>Not text-heavy; avoids overload</li> <li>Eliminates unnecessary thinking: filter functionality in form of comparisons and summaries</li> <li>Adequately detailed product descriptions to support choices</li> <li>Meaningful naming</li> </ul> <p><b>References:</b> Table 2: Service quality, Emotions</p>	<ul style="list-style-type: none"> <li>Cognitive resources freed for high-level tasks</li> <li>Major objects prominent</li> <li>Decision-making tools/features</li> <li>Information: comprehensive yet concise; avoidance of overload</li> <li>Content relevant to main purpose of artefact</li> </ul> <p><b>References:</b> Table 1: Value of Content</p>	Section 5.1: Pre-test questionnaire – content should be engaging; Sections 6.1 and 6.2: Qualitative findings – content satisfaction; Section 7.1: Emotions – useful, engaging; Section 7.2: Aesthetics – pictures, visual load; Section 7.3: Overall experience: content offered



<b>Satisfaction</b>	<ul style="list-style-type: none"> <li>• Pleasurable online experience that evokes positive emotions</li> <li>• Engaging; enticing to return</li> </ul> <p><b>References:</b> Table 2: Emotions</p>	<ul style="list-style-type: none"> <li>• Easy to learn and effective to use</li> <li>• Supports user confidence</li> </ul> <p><b>References:</b> Table 1: Satisfaction</p>	<p>Section 5.1: Pre-test questionnaire – UI aspects;</p> <p>Sections 6.1 and 6.2: Qualitative findings – ease of use, content satisfaction;</p> <p>Section 7.1: Emotions – easy to use, enjoyable, friendly, engaging;</p> <p>Section 7.2: Aesthetics – all;</p> <p>Section 7.3: Overall experience</p>
<b>Aesthetics and Consistency</b>	<ul style="list-style-type: none"> <li>• Aesthetics that evoke users’ sensory modalities</li> <li>• Innovative designs</li> <li>• Consistent and appropriate branding</li> <li>• Look, feel and tone: fun and informal</li> <li>• Enticement and engagement</li> <li>• Visual balance between text and illustrations</li> </ul> <p><b>References:</b> Table 2: Visual appeal and aesthetics</p>	<ul style="list-style-type: none"> <li>• Appropriate use of colour, aesthetics and graphics</li> <li>• Adequately minimalist: avoidance of visual overload</li> <li>• Layout: displays only the information needed at a given time</li> <li>• Copy, tone, colour and visual load should communicate the intended message</li> </ul> <p><b>References:</b> Table 1: Aesthetics and consistency</p>	<p>Section 6.1: Qualitative findings –visual appeal;</p> <p>Section 6.2: Qualitative findings – content satisfaction; terminology and visual appeal;</p> <p>Section 7.1: Emotions – easy to use, enjoyable, friendly, engaging;</p> <p>Section 7.2: Aesthetics – all</p>
<b>Functionality</b>	<ul style="list-style-type: none"> <li>• Easy to use and understand</li> <li>• Supports users in meeting goals rapidly and easily</li> <li>• Comparison and filtration of various product and service options</li> </ul> <p><b>References:</b> Table 2: Service quality</p>	<ul style="list-style-type: none"> <li>• Flexibility and efficiency of use;</li> <li>• Functionality that expedites interaction</li> <li>• Caters for both novice and expert users</li> </ul> <p><b>References:</b> Table 1: Functionality</p>	<p>Section 5.1: Pre-test questionnaire – functionality;</p> <p>Sections 6.1 and 6.2: Qualitative findings – ease of use;</p> <p>Section 7.1 Emotions – easy to use, useful, appealing;</p> <p>Section 7.3: Overall experience: content offered</p>

Based on the findings, UX appears to be a phenomenon where the whole experience is greater than the sum of the parts of applying usability principles. In constructing a website, the designer thus has to weigh and prioritize trade-offs between usability principles to balance decisions in the cause of positive UX. Further work must be done on the relationship between usability and user experience, but this study gives an indication of its nature in the domain of e-commerce. The application of some general usability aspects and other e-commerce-specific usability factors listed in Table 4, can contribute to supporting a *good user experience*. The table maps desirable UX attributes against usability aspects that contribute to their attainment, and provides evidence by citing findings from this study.

Considering the usability criteria listed as row headers in Table 3, the following can be observed for the UX cells. Navigation relates primarily to ease of use, rapid access and a focus on user needs, which relates to usefulness. The same goes for information architecture, value of content and functionality. Satisfaction and aesthetics relate to more subjective criteria such as what is deemed engaging, enticing and fun. Certainly, ease of use and usefulness are fundamental concepts of usability but we believe that highlighting the relationship between these two concepts and user experience contributes to a better understanding of UX.

## 9. CONCLUSION

We advocate that, just as usability studies are undertaken, evaluation and measurement of user experience should be formally conducted. Findings from evaluations of UX, guided by principles in Section 7, can support designers in optimal decisions to achieve the balance that characterises good UX.

This paper highlights the relationship between the mature concept of usability and the developing concept of UX. While acknowledging the complex and subjective nature of UX, the study emphasises its important role in e-commerce

applications. A further contribution of this research is the synthesis of criteria to evaluate user experience.

Future studies, possibly more quantitative, can be conducted to test these findings on other types of e-commerce sites and in other domains. By extending Table 4 with its prototypical relationships between user experience attributes and usability principles, a more concrete framework can be developed.

Based on the literature, UX seems to be viewed as much as an art as it is a craft. Since UX also depends on various hedonic and subjective aspects, this remains true but the contribution of this article is to demystify UX to some extent by relating it to specific usability principles.

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