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Towards An Internet Site Usability Evaluation Model

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ABSTRACT

The population of web sites continues growing every year, but are the sites usable? Most sites seem to ignore the usability issue. Usability is about making the site easy for consumers to navigate and operate. Unusable sites do not attract and retain consumers. A usable site is one that is concerned with the user' perception and provides the fundaments that allow the consumer to accomplish tasks such as searching and purchasing. According to ISO's usability definition, examining its effectiveness, efficiency and satisfaction, measures the usability of the web site. Five commonly used usability evaluation methods, competitive analysis, scenarios, inspection method, log analysis and on-line questionnaires, were reviewed. Using these earlier concepts as a basis, the usability evaluation model was developed. The model consists of four components - Information, Transaction Service, Trust, and Non-functional requirements.

The model was first tested on Travel sites. It was found that it could be used to classify the sites. It was then tested against a user perception survey of the industry sites. This indicated an agreement between the model and the user perceptions. The model was then tailored for e-commerce web sites and, based on the core similarities, a more abstract level could be postulated. This was then tested against its application to a third industry, Internet banking sites. Similarities and differences between the fundamental elements of the sites in the three industry sectors are related to the sector's needs and those of the customers that they service.

1. INTRODUCTION

The web site is the portal through which a user communicates with the computer. It has a strong influence on how a user views and understands site functionality. The Web considers user experience of the site first, purchase and payment second. On the Web, users first experience the usability of a site and then, if satisfied, buy something. If users have a good experience, then they are apt to turn into frequent and loyal customers. Conversely, the Web offers low switching costs; if you do not find what you want, the competition is only a mouse-click away. Only if a site is easy to use will anybody bothers to use it. Nielsen & Norman [1] claimed most web usability studies still encounter troubles in navigation and page design. Forrester Research reported that Fortune 1000 companies spent anywhere from $1.5 million to $2.1 million each last year on redesigns, however those redesign efforts rarely focused on improving the workability of sites for those who use them. Usability studies have been around since the 1980s, but many web developers are just becoming aware of the issues, while Web managers are using the concept to justify the project dollars they have spent. In corporate circles, usability is thought of as how easily a site can be used. However, usability is a far richer interface design concept with great applicability for improving information retrieval on the Web from the user's viewpoint. In other words, it is something that consumers are now expecting from a site. Usability will continue to play a role in most corporations that use the Web for business.

ISO (cited in [2]) define usability as "…the effectiveness, efficiency and satisfaction with which specified users can achieve special goals in particular environments." This implies that usability is not simply a property of a product in isolation, but rather that is will also be dependent on who is using the site, the goal that they are trying to achieve and the environment in which the product is being used. Usability is a property of the interaction between a product, a user and the task, or the sets of tasks.

This article reviews the usability literature as to measures of usability and commonly used usability methods. Then a Usability Evaluation Model is proposed, and the model is discussed for completeness.

2. WHY IS USABILITIY IMPORTANT?

Unusable sites mean consumers cannot find products they want to purchase. Forrester Research claimed poorly constructed sites are underselling because if a consumer cannot find a product, they cannot buy it. E-Satisfy.com and WebCriteria (cited in [3]) examined human factors in site performance. An example is the visitor's perception that a site has stopped responding when one of the site's pages takes significantly longer to load than others. Therefore from the user's perspective, usability is important because it can make the difference between performing a task accurately and completely or not, and enjoying the process or being frustrated. From the developer's perspective, usability is important because it can mean the difference between the success or failure of a site or system. From a business's perspective, sites that are unusable cost the company more in wasted expense and increased production time. Given a choice, people will tend to visit or repeat visit a site that is user-friendlier. Consumers do like the convenience, the ability to find information quickly and easily, and the fact they can save time. This is why usability has become an important issue in web technology. The web site achieves usability by focusing on the user and the user's need, and in doing so makes user issues, rather than technical consideration, central in the design process. To summarise, usability is an important issue either commercially or technically.

The advantage of usability is to ensure that the web site interfaces created are easy to use and satisfying; and this produces utility and functionality that are highly valued by the target population and will increase user support (or sales) and repeat user support (or sales). Moreover, the usable site can minimise the cost of service, training, and hot-line calls, acquiring a competitive edge by making the usable web site a perfect place to shop.

3. MEASURES OF USABILITY

Jordan [2] translated from the ISO definition that there are three keys that can be used to measure usability of the web site. They are effectiveness, efficiency and satisfaction.

Effectiveness is about the extent to which a goal or task is achieved. Task completion and quality of output are addressed. Task completion is the basic measure of whether or not a web site is effective for a particular task or goal by measuring whether the consumer can complete that task on a web site. In other words, it is about the site's business objective, for example, the site aims to sell product via the Internet. Then the site must provide the facility that allows the consumer to complete the sale transaction, such as finding the product that they want, purchasing, paying and tracking the product's despatch. The site must be able to serve its intended task; if not, then the site will be ineffective. Another measurement component of effectiveness is quality of output. Even if the web site provides functions that enable the consumer to complete a transaction on the site, it does not mean that the site is effective. The quality of output resulting from the completed transaction is consequential. Enabling the consumers to find easily what they want and giving what they are expecting, is the cornerstone. Therefore, task completion and quality of output together represent the site's effectiveness.

Efficiency is about the amount of effort required to accomplish a goal. Deviation from the critical path and error are addressed. Ideally, to complete the main task on the site requires the least effort. However, the consumers can deviate from the main task; this would be a cost in terms of time and effort to complete the task. It is not actually an error, as it does not require any corrective action. The consumer just does not know how to use the provided facilities, as there is not a useful guide (or manual) to use the web site. Providing online help or FAQ would be adding usability to the site because the consumers use less time and effort to complete their tasks. Error rate is one of the most commonly used measures of efficiency. If the consumer can complete a task without any errors along the way, the task may requires less effort, than if errors occur on the site.

Satisfaction refers to the level of comfort that the user feels when visiting the site and how acceptable the site is to consumers as a path for achieving their goals. It is attitude analysis; it can be investigated by asking the consumers whether the site satisfies them. Using a questionnaire or interview can achieve this. Those comments can then be analysed to gain an indication of the users' satisfaction level with the sites.

4. USABILITY EVALUATION METHODS

This section reviews the literature on usability evaluation methods. Evaluation is concerned with gathering information about usability or potential usability of a system in order either to improve features within an interface and its supporting material or to assess a completed interface. There are five commonly used methods: competitive analysis, scenarios, inspection method, logs analysis and on-line questionnaires. Each method has a series of properties that gives that method certain advantages and disadvantages.

4.1 Competitive Analysis

This involves analysis of existing web sites provided by similar organisations with similar business objectives [4]. These sites can be analysed to determine perceived strengths and weaknesses and to derive an informal set of desirable features. This analysis is commonly used by most web sites. The analysis is conducted with a representative sample of users, as the use of developers or information providers may reflect their subjective opinion, rather than those of real users.

4.2 Scenarios

This involves using real target consumers. The sample target group should be representative of the user population. They can give an idea of what the user thinks of the web sites in the simulated operational environment. The users might be asked to browse the site. That activity can represent an important part of user behaviour on the Web. However, it is hard to build the appropriate models of user behaviour, to determine whether this behaviour is typical of all users or only particular types of user, or how those particular users could be characterised.

One alternative to use real target consumers is gathering them together to discuss a particular issue. These scenarios can be developed in brainstorming sessions involving the developer and information providers to identify key user types and tasks associated with this target. However, even though this approach is commonly used, there are some concerns whether the key users identified actually reflect real user groups, and whether there are important groups that have not been identified [4]. Scenarios are useful for helping to generate ideas and requirements of a web site.

4.3 Inspection Method

Inspection, or Expert Evaluation, is a diagnostic method lying between the theoretical approach taken in analytic evaluation and more empirical methods. This evaluation method does not require users. It is a class of usability evaluation method that involves a systematic comparison of an interface against a pre-determined set of criteria or guidelines that might be specified at higher or lower levels of abstraction. Those checklists are based on the judgement of an evaluator who is the expert in the usability area. Jakob Nielsen, who has written many usability articles, and whose work is referenced by many usability and web design articles, is such a person. This

method is commonly known as a heuristic evaluation. Ideally, only the expert evaluators can perform such evaluations, though Nielsen (cited in [4]) suggests that non-experts can achieve useful results. However, the guidelines might not be entirely applicable, as this method does not take into account actual user behaviour or user tasks. The solution is to use key user scenarios to guide a heuristic walkthrough and to identify which usability problems are likely to have the most impact on users.

4.4 Log Analysis

Log analysis can help to build models of user behaviour and monitor actual site use. It is the automatic collection and analysis of access logs gathering important information about real users and real patterns of use within a site [4]. This information will then be interpreted. For instance, the results can indicate functions that have been used a lot, or have been used very little or not used at all. The method can be comparatively cheap in terms of both investigator and participant time [2]. Participants may be observed in the context of their usual work, rather than in a contrived session. Web log analysis can provide a variety of information, for example hits-per-page, and information about actual user interactions. It can be automated to an extent, and it can provide an ongoing record of changes in user behaviour. However, defining visitors and sessions is still problem with log analysis of the web site. This concern needs to be addressed. The session refers to the set of activities performed by a single visitor during a single visit to the site. However, visitors cannot be uniquely identified, as the log information records only the IP address. The same users might use another machine for another session, or their ISP may allocate it dynamically, so we cannot be sure that the same user conducted different sessions. This suggests that building models of user behaviour from logs is unreliable.

4.5 On-line Questionnaires

Questionnaires can be used to capture information about user behaviour in term of technical, demographic, user satisfaction and/or visit information. The questionnaires can help to build models of user behaviour and track changes in that behaviour over time. This technique might be more reliable for sites [4]. A disadvantage of this technique is that only a small proportion of the questionnaires issued or available to users are completed and returned. The unsatisfied response rate cannot be used to draw generalised conclusions.

5. USABILITY EVALUATION MODEL

The model used explored further in this paper is based on that of Hersey (cited in [5]). It forms the underlying fundamental architecture. The model's constructs are easier to operationalise and it can measure the overall usability rating of the site. The model proposed can measure effectiveness, efficiency and satisfaction. The model deals with four core components: Information, Transaction Service, Trust, and Non-Functional requirements. Those components are fundamental components that must be present in web sites for them to be considered usable. Effectiveness can be measured by looking at task completion and quality of output. Information and Transaction Service components are used to measure this. The elements in Information component, company information, customer information, and product information represent the main purpose of the site. These could be to provide information, advertising services, selling products, positioning in the market or demonstrating competency. The type of web site should correspond with the Transaction Service component. If it is a selling site, the obligatory transaction service elements should be present. These are search, negotiation, order, payment, delivery, after sale service and help. If the site offers fewer elements, the site effectiveness is lower. This effectiveness also includes the quality of outputs and transactions. Presenting the elements alone cannot guarantee essential effectiveness.

The proposed model can measure the efficiency constituent of usability by considering the amount of user effort required to accomplish goals. Deviation from the critical path and errors are addressed. Use of the Help element is classified as a deviation from the critical path [2], because it helps the users use less effort and time to learn about the site, such as how to use the search facility. Ideally, a site should not produce errors. For example, if error messages such as "the page can not be found" or "there are script errors" appear, the users need to apply more effort to accomplish their tasks. This reflects on the efficiency and usability of the site.

Measuring satisfaction was achieved by surveying users to test the model [6]. The results of the evaluation using the model agreed with the survey results as to the user's requirements. The example sites used by the respondents scored highly in the evaluation model. Thus we conclude that the proposed model can be represented as a tool to measure user's satisfaction. Of particular interest were the two areas where the users felt that the example e-commerce (travel) sites had shortcomings: Promotion and Security. For the first of these, the users felt that they needed more promotional elements that would entice the users to revisit the site. The evaluation model also highlighted this. This observation is also backed up independently by the observation of Foreman [7] [8]. As to the other component, that is trust (containing legal disclaimer, privacy policy and security), the survey and the evaluation model differed. The trust components were well represented in the evaluation performed using the model, yet the survey showed that the respondents still expressed dissatisfaction with them. Other studies (e.g. [9] [10]) also show that those elements, especially security, are of concern for the users performing online transactions via the web site. Sites must ensure that those elements are present to give the users confidence to complete their transactions (especially payment).

The survey also showed that other issues that could not be evaluated by the model were important. This was particularly true of "branding". No matter how well a given site might score in terms of the model's assessment, if it was not well known the users would not know about it and use it.

The proposed model combines four of the usability methods outlined in the previous section: competitive analysis, scenarios, inspection method, and on-line questionnaires. Web evaluation researchers examined the model. Those experts were asked individually to weight elements of the model. The result showed that those experts agreed and accepted that all elements on the model are important as basic elements for usable web sites and can be used to examine the existing web sites. The model was used for competitive analysis by examining the web sites within three industries: Travel, Retail and Banking. The sites were analysed as to their strengths and weakness by giving them a score based on the presence or absence of each of the elements. Then users were surveyed to ascertain their perception (only for the travel and banking industries as those contained few sites). Questionnaires were distributed to analyse the user scenarios.

We conclude that the proposed model can measure usability on the web site with regard to effectiveness, efficiency and satisfaction. It will be called the Usability Evaluation Model.

5.1 User Evaluation Model as a User Evaluation Standard

The components used in the three industries: Banking, Retail and Travel vary. Different models were developed and tested for the Travel [6] Retail [11] and Banking [12] industries. The models have common components such as three types of information, but the elements within those components might be named differently because the way they are presented is different. In this paper we combine the industry models to a more abstract model or User Evaluation Standard. The fundamental components and elements required for each site within an industry sector are evaluated, so that the usability of the individual sites can be determined. This ignores how those elements are formatted on the site, each organisation has a different style, and this might also be reflected in the web sites design to the benefit of their sales.

This abstract usability evaluation model can be applied mainly to commerce web sites. It will be described in the following section. There are four components. These are Information, Transaction Service, Trust, and Non-Functional requirements.

Information – This component contains three elements: company, consumer, and product information because they are essential information that should be provided to the online consumer. The models contain the same elements. Each element is briefly described.

- ***Company Information:*** The web site should provide comprehensive company information as it can reassure the consumer about the organisation with which they deal.
- ***Consumer Information:*** In order to do on-line selling, the e-commerce sites require prior registration and consumer information, such as payment details including credit card information. This information is fundamental information for an e-commerce site to deal with consumers and for marketing purposes.
- ***Product information:*** This element is the theme of an electronic commerce site. Like a traditional shop, if you want to sell something, you should show and tell the consumer what you sell or service.

Transaction Service – In the travel model, the term 'feedback' is changed to "after sales service" to reflect its wider meaning. After sales service includes feedback, return and guarantee policy. These are important for commerce transactions. The transaction service component is about the service that should be provided as part of full online commerce. There are six elements: Negotiation, Order, Payment, Delivery, After sales service and Help.

- ***Negotiation*****:** The e-commerce site should allow the consumer to bargain as the real commercial counterpart allows such an operation. The web site allows all the customisation of the product/ price that the user could reasonably expect.
- ***Order:*** The online order option should be offered to consumers for the site to be a complete e-commerce site.
- ***Payment:*** Typically, the trading cycle includes a payment option. Thus electronic trading should support the online payment option as well.
- ***Delivery:*** The web site provides as wide a selection of delivery options as could reasonably be expected that are generally satisfactory, convenient and reassuring. If the product is a digital one, such as software, a download option is required.
- ***After sales service:*** the contact option provides such items as an e-mail contact or feedback form. It is included because the element is a service by which the site should allow the consumer to contact them to discuss the product's problems. This includes any suggestion or comment from the consumers to the site.
- ***Help:*** On the web the consumer wants help as much as they would in a store. They need help with product selection (such as size, colour), contact information for sales representation, shopping system, credit policy, information about shipping and handling costs, guarantees and statements about product quality. Alternatively, FAQ (Frequently Asked Question) items might be represented as an element.

Trust – This component is included as important as it can help build trust with consumers by providing the legal policies that the site needs to present to the Internet consumer. The Legal Disclaimer, Privacy Statement and Security Service should be stated. Although these elements are not necessarily involved in web development, you cannot ignore them, as they are part of the consumer's concerns [11]. The e-commerce guideline book of Ministry of Economic Development [13] also stresses that they are important elements for electronic business.

- ***Legal disclaimer*****:** It is a statement that informs the user about the conditions for using the site and the legal status of any transaction that is done on the site.

It includes the refund and fee policy for purchased products.

- ***Privacy statement*:** Outlines the reason why the consumer information is collected, and the uses, if any, of the information, including access to it and divulgence to third parties.
- ***Security*:** Outlines the security used to transmit the consumer information. People are often concerned about sending credit card information across the Internet. This is particularly relevant if credit card information is used online to pay for services. The site might use a third party to support and validate their site security such as SSL, RSA, or 128 bit.

Non-functional requirements – A non-functional requirement is a constraint on the system [14]. There are four measurements: Aesthetic effect, Ease of use, Innovation and Community. These are modelled on the 'pillars' supporting the e-commerce process as depicted by Hersey. For the travel model, responsiveness was included, but it is omitted from the usability evaluation model. Responsiveness is more focussed on the web site performance (response speed) and is under the control of the Internet Service Provider (ISP) and telecommunications companies. In the information-based travel industry it is measured by recording how long each site took to respond to an email enquiry. Responsiveness forms an important component in the attempt to create the User Interface Standard. Its relative importance and manifestation will vary between industries. Community is added and it is represented as part of the promotion component in the travel model.

- ***Aesthetic Effect:*** This is a measure that the site is using colour, graphics and text to enhance site attractiveness.
- ***Ease of use*:** It is a measure of the site's performance. It was measured by clicking and linking to the associated information. The links on the site must work (i.e. not result in dead links). The site should provide a good response, no dead links or error messages such as "This page cannot be found".
- ***Innovation***: This measurement gauges whether the organisation develops its site to provide an innovative service using more advanced functions to improve the site's effectiveness and usability.
- ***Community:*** The web site is excellent at fostering community among its consumers. Therefore, the site should provide some sort of facility to establish a community of people sharing a common interest, for example a bulletin board or consumer review. These facilities may give the site a chance to interact with the consumer and build a consumer relationship. There are two different applied techniques: push and pull. Using the push technique the site supplies the consumer with information and, if it is the consumer who seeks information and retrieves this information at his/her own need, it is called the pull technique.

5.2 Application to the Industries

The model was applied on to the Travel and Retail industries (30 sites each). This was further expanded by comparing the results to those from the Internet Banking sector [12]. Chung and Paynter [12] used this model to evaluate all seven retail Internet Banks present in New Zealand.

Industry Sector		
Travel	**Retail**	**Internet Banking**
Information Company Customer Product	**Information** Company Customer Product	**Information** Company Customer Product
Transaction Service Negotiation Order Payment Delivery Feedback	**Transaction Service** Negotiation Order Payment Delivery After-sales service	**Transaction Service** Order - Check account balance - Transfer funds between accounts - Check bank statement - Purchase bank product (e.g. open an account) - Download account information - Make payment - Order cheque or deposit book - Request loan changes - Cheque reconciliation - Make IRD payment - Change password After sales services (e.g. email enquires)
Trust Legal Disclaimer Privacy Statement Security	**Trust** Legal Disclaimer Privacy Statement Security	**Trust** Legal Disclaimer Privacy Statement Security
Promotion 24 hr Clock Calendar Weather Newsletter Auction Other Techniques	Community	Community Competitions/Rewards
Non-Functional requirements Aesthetic effect Ease of use Innovation Responsiveness	**Non-Functional requirements** Aesthetic effect Ease of use Innovation	**Non-Functional requirements** Aesthetic effects Ease of use Innovation FAQ/Tutorial/Help Demonstration Search Navigation Performance Update frequency Response time Download time

Table 1: Testing the abstracted model on the different sectors

Although two of the five sets of the components are the same across the models, it is noticeable that that the banking sector is more exhaustive, reflecting the sensitivity of Internet banks to the level of service that they must provide and the sensitivity of the customer information there. Hence the transactions (services) that must be provided for the bank to be competitive and to differentiate between the different banks' offerings are listed exhaustively. They represent the heart of the services provided by Internet Banks.

The travel industry is all about information. People are unlikely to visit a site unless they have a need for doing so; hence revisit techniques are required. The promotion of a 24-hour clock, or a calendar, for different countries is such an example of a revisit technique. The travel industry because of its international focus had additional components not found in the other two sectors.

The Community is comprised of elements that make the user feel part of web site community. This is achieved in different ways across the industries. For instance, the travel sites might have a bulletin board or similar that allows users to share their travel experiences, while the banks have community sponsorship in the forms of trusts or team sports. Responsiveness for a retail site or travel agent might measures speed of response to an email enquiry, whereas for a bank it is the speed of processing the transactions. Update frequency is also of paramount importance to a bank.

6. CONCLUSION

The proposed usability evaluation model can be shown to measure the usability of web sites by looking at three dimensions: effectiveness, efficiency and satisfaction. However, the model mainly focuses on electronic commerce web sites. The model represents an abstraction level that ignores the format of each element and how the information (pages) should be presented. These designs are subjective; different web designers or developers have their own opinions. Various industry sectors might use different ways to present those components or name the elements using different terms. Regardless, the model represents the fundamental components that the web site should present to make the site usable for consumers. Organisations that follow the guidelines suggested by this model will be rewarded with the site increasing its visitors and, if applicable, sales or custom.

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