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An approach for usability evaluation of e-commerce sites based on design patterns and heuristics criteria

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Abstract

DEPTH (evaluation approach based on Design PatTerns & Heuristic criteria) is an approach for performing scenario-based heuristic usability evaluation for e-commerce sites. It is comprised of a preparatory and execution phase where specific steps are performed for evaluating the usability along three axis: usability comparison tests among similar e-commerce sites, expert / heuristic evaluation, scenario-based user inspection/enquiry sessions.

1 Introduction

The e-commerce market has exploded over the last three years and is projected to continue its rapid expansion. Although in the early years of e-commerce sites, companies mainly aimed in designing a system the quickest possible in order to achieve an early presence in the market, nowadays usability matters. Systems' user interfaces are now redesigned, taking into account the user needs. The benefits they anticipate are as follows: increased sales, customer satisfaction, customer retention, reduced support, stronger brand equity.

In contrast to mainstream business applications relatively little emphasis has been given on formal usability within the e-commerce sector [optimum.web: <http://www.optimum-web.co.uk/improvewebsite.htm>]. Most of the researchers and practitioners agree that E-commerce is indeed task based and these sites are therefore relatively easy to evaluate in a quantitative way. In addition, they are special types of websites on a bit more explorative in nature that offer flexibility and personalisation in navigation, thus typical evaluation heuristics can be applied. In the literature one can find three dimensions particularly applicable to e-commerce usability evaluation [optimum.web: <http://www.optimum-web.co.uk/improvewebsite.htm>]:

- Usability comparison tests among similar e-commerce sites.
- Expert / heuristic evaluation.
- Scenario-based user inspection/enquiry sessions.

Scenarios provide a versatile and reproducible means of evaluating a system. A scenario is an instantiation of one or more representative work tasks and transitions linking those tasks [ROSSO01]. The granularity of the scenario is not fixed; a scenario can be highly scripted or loosely defined. One of the main difficulties is how to create such scenarios.

In this paper we present the DEPTH approach, an innovative approach for usability evaluation of e-commerce sites based on design patterns and heuristics criteria. This approach tackles all three of the aforementioned dimensions of usability evaluation. Moreover, DEPTH prescribes how to perform the steps of the evaluation giving emphasis on how to compare the e-commerce sites as well as how to easily create scenarios for user inspection. The main aid in this prescription is the usage of design patterns. Design patterns describe a problem and a solution for this problem in a particular context, together with the rationale for using that solution and the consequences (pros and cons) of using it [GAMMA94]. “The pattern is, in short, at the same time a thing, which happens in the world, and the rule which tells us how to create that thing, and when we must create it. It is both a process and a thing; both a description of a thing which is alive, and a description of the process which will generate that thing” [ALEX77]. The structure of the paper is the following: Section 2 gives an overview of the DEPTH approach while section 3 illustrates an example of its application. The paper concludes with few ideas about the effectiveness of the approach as well as our future plans.

2 The DEPTH approach

As in other evaluation methods (e.g. SUE method [GARZO98]) we require two operational phases of evaluation: the *preparatory phase* and the *execution phase*. The preparatory phase aims to define the conceptual framework that allows the evaluation to be carried out in a systematic and effective way. We propose four different activities:

- Gathering all design patterns related to domain under evaluation
- Generation of a list of user-centred tasks for each design pattern according to the underlying functionality of the pattern
- Generation of the scenarios for user inspection
- Selection of usability criteria that apply to each scenario (or task of the scenario) and generation of the toolkit (e.g. questionnaire) for quantitative and qualitative evaluation

The execution phase occurs each time a specific site is evaluated. We propose the following activities:

- Execution of the inspection utilising the toolkit
- Gathering of results
- Calculation and comparison of partial and global quality preferences of sites using the LSP mathematical approach
- Analysis of data gathered and presentation of results

The ultimate aim of both phases is to support the measurement of the usability of an e-commerce site by examining three dimensions: i) usability comparison tests among similar e-commerce sites, ii) expert / heuristic evaluation and iii) scenario-based user inspection/enquiry sessions.

2.1 The preparatory phase

Most of the times, the preparatory phase is entirely dependent on the experience of the usability expert/engineer. In order to systematize the whole process and provide an effective way for identifying a) the comparative matrix, and b) the main scenarios for user inspection, we propose the utilisation of design patterns. According to [ALEX77]: “each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over”. A “problem” is normally a specific functional or non-functional requirement from the system. Because we are interested in solutions that improve the usability of the system in use, we focus on customer-oriented problems and not developer-oriented. Aid in the ‘pattern mining’ approach is the work on

hypermedia patterns [GARZO98], [ROSSI00], as well as the HCI patterns [HPR02]. Before we proceed to the next step, each design pattern is categorized as in [XENOS01] in high, middle, and low category. High level comprises of those characteristics of e-commerce systems under evaluation that are most important. Middle level consists of those characteristics that are related to the services provided, but are not as important as those of the high level. Finally, low level includes the least important characteristics.

After gathering the design patterns related to domain under evaluation e.g. “Shopping basket”, “Landmark”, “Opportunistic Linking”, etc., a list of user-centred tasks/subtasks can be derived according to the required functionality proposed by the underlying design pattern. These tasks describe (or can be derived from) “good practices” on how to implement the underlying functionality, which then will be used a) for comparing a specific e-commerce site to an “ideal” one, and b) for evaluation during the inspection process. However, the existence of required functionality is not enough to make the e-commerce site usable since how each design pattern is implemented will make a difference in usability terms. Thus, appropriate scenarios should be easily generated to measure the usability of the site. These scenarios will guide the user inspection. For each scenario (and sometimes for a group of tasks) we identify the main heuristic evaluation criteria that should be measured.

The next step of the preparatory phase is the generation of a toolkit (e.g. a questionnaire) that will provide data for quantitative and qualitative evaluation. In the case of a questionnaire, it should consist of two sections: a specific and a general section. The specific section is comprised of questions that measure the existence as well as the user satisfaction, easy of use, and/or usefulness of all the functionality points identified by the list of tasks included in the previous step. The questions are grouped according to the task they belong while an appropriate (small) scenario is preceding in order to guide the user to answer the questions. The general section consists of questions that measure general aspects of each design pattern according to Nielsen’s heuristic evaluation criteria.

2.2 The execution phase

At the execution phase we perform the user inspection of e-commerce sites. The underlying scenarios incorporated into the toolkits developed at the preparatory phase guide user inspection. With the execution phase we compare the completeness of the functionality of the e-commerce site under examination against an “ideal” site which contains the full range of functionality of a site as described by a design pattern. Moreover, we measure the usability of the functionality offered. Thus, we do not only care about what the site offers but how well it does offer it.

After gathering the results we propose the Logic Scoring of Preference (LSP) model and continuous preference logic as mathematical background for the calculation of partial and global quality preferences of sites [DUJMO96]. The same approach has been proposed by Web-QEM [SANTOS99] for the evaluation of academic web sites.

3 An example

In this section we give a small example to demonstrate the steps of our approach. Suppose we want to evaluate some e-commerce sites with main emphasis on checking the usability of the online purchase of a product. Starting the preparatory phase we should firstly gather all relevant

design patterns and categorize them in high, middle and low level category. We can gather a series of design patterns such as:

- **Shopping Cart/Basket:** Allows users to gather all products first and pay for them all at once and whenever they want.
- **Advising:** Help the user find a product in the store, assist him according to his wishes.
- **Opportunistic Linking:** Keep the user interested in the site. Seduce him to navigate in the site even when he has already found what he was looking for.
- **Explicit Process:** Help the user understand the buying process when it is not atomic.

We identify the “Shopping Cart/Basket” as the most essential capability of an e-commerce site according to our objective. The description of the design pattern “Shopping Cart/Basket” can be found at [WELIE02].

As we can see from the solution element of the design pattern there are a number of “good practices” describing how to implement the underlying functionality. The total number of user-centred tasks identified was 19 as shown in table 1.

Table 1. The list of user-centred tasks

1.1. Shopping cart/basket
1.1.1. Appropriate name
1.1.2. Ability to add items from anywhere
1.1.3. Any type of item can be included
1.1.4. Contents viewable at any time
1.1.5. Properties “Description”, “Qty”, “Price”, “Availability”, “Category” defined for each line item
1.1.6. Additional properties defined describe each line item appropriately
1.1.7. Delete Line Item
1.1.8. Modify quantity
1.1.9. Link to detailed description
1.1.10. Total costs calculated according to changes performed
1.1.11. Help customers proceed with order
1.1.12. Provision of label next to the shopping basket image
1.1.13. Links related with shipping and handling costs and their calculation
1.1.14. Links for applicable taxes
1.1.15. Link for return policy
1.1.16. Validation within shopping basket contents
1.1.17. Shopping carts saved period
1.1.18. Crossing selling
1.1.19. Up selling

Now, we can generate for each task appropriate scenarios to guide the user inspection. These scenarios are integrated into questionnaire along with the necessary questions that measure the existence as well as the user satisfaction/easy of use/usefulness of each criterion/characteristic defined in table 1. Table 2 shows an example of how a small scenario is integrated into questionnaire.

Table 2. Tasks/Scenarios generation.

1.1.7 Delete item
Task: By now more than one item are located in the basket. Delete one item from the shopping cart
Question & Evaluation mark scale definition
Question 1.1.7.1: Did you find easy to perform this task? Mark with any value between 0-100% (Too difficult 0% - Very Easy 100%)
Question 1.1.7.2: Are you satisfied with the task implementation? Mark with any value between 0-100% (Not satisfied at all 0% - Too much 100%)

4 Conclusions

E-commerce sites are a particular kind of Web applications with similar requirements, as for example, good navigational structures, usable interfaces and so on. They present new challenges to the designer: we not only need to help the user find what he wants (a product he will buy) but also ease the shopping process. The DEPTH approach is valuable for examining the completeness of the functionality of the site under evaluation, illustrates the use of scenarios in performing user inspection, and identifies easy-to-measure correlates of more important, but complex, behaviours. Third parties have not extensively applied this approach as yet. Thus we cannot provide any evaluation data of the efficiency and the effectiveness of DEPTH. We plan to organise systematic user trials of this approach as well as to start experimenting with applying DEPTH for evaluating the usability of other types of hypermedia systems like Learning Management Systems.

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