

Zaphiris, P., Dellaporta, A. & Mohamedally, D. (2006). User needs analysis and evaluation of portals. In Cox, A. (ed.) Portals: people, processes and technology, Facet Publishing, London UK.

User Needs Analysis and Evaluation of Portals

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4 Abstract

In this paper, we first present and discuss the importance of usability and accessibility in the design and evaluation of portal systems. We then present an incremental framework for taking this issues into consideration during the design of such systems and finally conclude with the application of this framework to the design of a public service portal.

4 Introduction

As specified in the ISO 13407 standard (ISO, 1999), user-centred design begins with a thorough understanding of the needs and requirements of the users. User needs analysis (or Knowledge Elicitation) and evaluation methods in HCI are a critical function to the success of requirements and design gathering (Maiden et al., 1995), usability testing and user evaluation stages of software development (Zaphiris & Kurniawan, 2001).

Examples of knowledge elicitation methods often start with initial questionnaire feedback, requirements task walkthroughs, interviews techniques, and focus group sessions which will be discussed in further detail in a subsequent section. It can

rapidly scale upwards to more complex psychometric and design and evaluation processes for example various fidelities of prototype construction, direct and indirect observation practices for monitoring user actions and response time comparisons, and methods for eliciting mental categorisation models e.g. in distinguishing expert and non-expert technology usage patterns.

The measure of a good experience can vary from person to person; however the appropriate understanding of a usable design comes from gaining the knowledge that it is functional, efficient and desirable to its intended audience (Kuniavksy, 2003).

John and Marks (1997) identify three key factors to assess the usability of an interface:

Usability is measured by the extent to which the intended goals of use of the overall system are achieved (effectiveness); the resources that have to be expended to achieve the intended goals (efficiency); and the extent to which the user finds the overall system acceptable (satisfaction) (John and Marks, 1997).

The usability of a system is also related to issues surrounding its accessibility. There is a broad range of users to whom web-based services are directed, and the services provided ought to be accessible to them (e.g. visually, hearing, physically or cognitively impaired or even people with different experience of and attitudes towards technology).

The Disability Discrimination Act (DDA) began to come into effect in December 1996 and brought in measures to prevent discrimination against people on the basis of disability. Part III of the Act (to be enforced in Fall 2004) aims to ensure that disabled people have equal access to products and services. Under Part III of the Act, businesses that provide goods, facilities and services to the general public (whether paid for or free) need to make reasonable adjustments for disabled people to ensure they do not discriminate by:

- Refusing to provide a service;
- Providing a service of a lower standard or in a worse manner;
- Providing a service on less favourable terms than they would to users without the disability.

There is a legal obligation on service providers to ensure that disabled people have equal access to web-based products and services. Section 19(1) (c) of the Act makes it unlawful for a service provider to discriminate against a disabled person "in the standard of service which it provides to the disabled person or the manner in which it provides it".

An important proviso here is that education is not covered by the DDA, but by separate legislation, the Special Educational Needs and Disability Act 2001 (SENDA). This Act introduces the right for disabled students not to be discriminated against in education, training and any services provided wholly or mainly for students, and for those enrolled on courses provided by 'responsible bodies', including further and higher education institutions and sixth form colleges. Student services covered by the Act can include a wide range of educational and non-educational services, such as field trips, examinations and assessments, short courses, arrangements for work placements and libraries and learning resources. In a similar wording to the DDA, SENDA requires responsible bodies to make reasonable adjustments so that people with disabilities are not at a substantial disadvantage.

4 Knowledge Elicitation and Usability/Accessibility Evaluation Theory

There are many different elicitation and usability/accessibility evaluation techniques (Cooke, 1994) and selecting the "right" technique in a particular situation is not trivial.

Burge's Table of Knowledge Elicitation Methods (Burge, 2001) provides an extensive comparative view of almost all the common KE techniques found in HCI.

Table 3.2 Burge's KE Techniques Grouped by Interaction Type

Category	Examples	Type	Results
Interview	Structured Unstructured Semi-Structured	Direct	Varies depending on questions asked
Case Study	Critical Incident Method Forward Scenario Simulation Critical Decision Method	Direct	Procedures followed, rationale
Protocols	Protocol Analysis	Direct	Procedures followed, rationale
Critiquing	Critiquing	Direct	Evaluation of problem solving strategy compared to alternatives
Role Playing	Role Playing	Indirect	Procedures, difficulties encountered due to role
Simulation	Simulation Wizard of Oz	Direct	Procedures followed
Prototyping	Rapid Prototyping Storyboarding	Direct	Evaluation of proposed approach
Teachback	Teachback	Direct	Correction of Misconceptions
Observation	Direct Observation Indirect Observation	Direct Indirect	Procedure followed
Goal Related	Goal Decomposition Dividing the Domain	Direct	Goals and subgoals, groupings of goals

List Related	Decision Analysis	Direct	Estimate of worth of all decisions for a task
Sorting	Card Sorting and Affinity Diagramming	Indirect	Classification of entities (dimension chosen by subject)
Laddering	Laddered Grid	Indirect	Hierarchical map of the task domain
20 Questions	20 Questions	Indirect	Information used to solve problems, organization of problem space
Document Analysis	Document Analysis	Indirect (usually)	Varies depending on available documents, interaction with experts

In addition, usability and accessibility evaluation techniques are often grouped into two broad areas: user-based (that often include user testing) and expert based (that often include heuristic evaluation and cognitive walkthrough) techniques.

4.3 Incremental Usability and Accessibility Evaluation Framework

King et al., (2003) presented what they called “An incremental usability and accessibility evaluation framework for digital libraries”. Their framework is broken down into seven key activities and addresses all stages of a design of a digital library system:

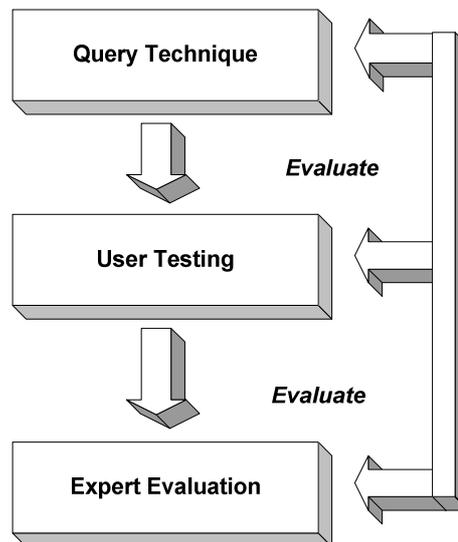


Figure 1: DLs usability/accessibility framework

Activity 1: Conduct Query - Requirement Gathering

Identify satisfaction levels of current users of the system and establish key positive and negative aspects of the interface, what features they would like to see etc.

Activity 2: Analysis

Evaluate current findings and identify issues not yet addressed

Activity 3: Perform Empirical (user) Evaluations

We regard user testing as the strongest evaluation technique, allowing us to identify real user problems by observing users interacting with the system. Retrospective focus groups or interviews conducted after the evaluations also provide a volume of qualitative data.

Activity 4: Analysis

Establish key problems and assess if any areas of the service have not been covered by user evaluations

Activity 5: Expert Evaluations

Appropriate modification of expert evaluation techniques maybe required so that they supplement previous evaluation findings, and address any areas or issues that have not as yet been covered

Activity 6: Analysis

Analyse all data identifying key issues that need to be addressed in the redesign of the service. Establish new usability and accessibility goals for the design

Activity 7: Iterative Process

Re-conduct all stages in the iterative framework to evaluate redesign

4 Methods of HCI Knowledge Elicitation Practices

In this section we describe the key methods that are associated with the above mentioned framework.

3.0 Interviewing

This query based process elicits from users knowledge on a set information topic based on their expertise in the domain in question. It is useful for obtaining behavioural reasoning and background knowledge. Interviews can be categorized as structured or unstructured. Structured interviews elicit limited responses from users, by using a series of closed questions that have to be answered based on given solutions. This enables the user data to be analysed quicker but is not necessarily as informative as unstructured (open ended) interviews.

Preece et al. (1994) suggests that interview processes are most effective as semi-structured based on a series of fixed questions that gradually lead into more in-depth user needs and requirements understanding, then allowing for open ended responses to possibly create new dynamic questions based on prior structured responses (Macaulay, 1996). On-site stakeholder interviews allows researchers to bring about a vivid mental model of how users work with existing systems and how new systems can support them (Mander and Smith, 2002).

Interviews are useful when combined with surveys or questionnaires, as they can be used to improve the validity of data by clarifying specific issues that were raised in the survey or questionnaire.

3.0 Surveys

In conducting surveys, three things are necessary – a) the set of questions, b) a way to collect responses and c) access to the demographics group you wish to test. (Kurniavsky, 2003). There are several widely reported templates for acquiring different types of user data, such as the well known Quality of User Interface

Satisfaction (QUIS) by Chin et al, 1988, and the Computer System Usability Questionnaire (CSUQ) by IBM with Lewis et al, 1995.

Surveys can be similarly open and closed question based, but also allow us to enquire scalar results giving indicators of quality in positive and negative statements. Self-filling surveys can be time efficient to deploy, and results from closed questions can be fast to analyse.

Open questions tend to elicit unanticipated information which can be very useful for early design. Existing survey sampling techniques include face-to-face, paper and pencil based, telephone surveys where the researcher will fill in the results (which becomes more of an interview style) but there is modern interest in computer assisted and web based surveying techniques.

3.0 Focus Groups

This activity is useful for eliciting cross-representative domains of knowledge from several stakeholders/users, in an open discussion format. Sessions are often moderated and tend to be informal by nature, centering on the creation of new topics from open questions.

Evidence shows that the optimal number needed for a mixed experience focus group is between 5 to 8 participants, with group size being inversely related to the degree of participation (Millward, 1995).

3.0 Observation

Observation methods elicit user knowledge from the way users interacts with a prototype or a final product. It can be direct, whereby a researcher is present and can steer users to particular points in an interaction. This tends to utilise video camera equipment and note taking to successfully enquire the timeline of user actions e.g. “getting from point A to point D may require steps B or C”.

The other model of observation is indirect, whereby all user actions are captured electronically.

The researcher has to maintain co-operation between users and should only pose questions if clarification is needed.

4.5 Paper Prototyping

There are several approaches to paper prototypes, enabling users to create quick and partial designs of their concepts. It is often used in early stages of the design processes. Though the methodology lacks standardisation, Rettig (1994) distinguishes between high-tech and low-tech views, and the more commonly modeled categories are of low, medium and high fidelity prototypes (Greenberg, 1998). Rudd et al (1996) also distinguishes prototypes according to horizontal and vertical prototypes, with vertical representing deep functionality of a limited view to the final output, and horizontal giving a wide overview of the full functionality of the system but with a weaker depth of understanding. Hall (2001) discusses the benefits of using various fidelities of prototypes.

4.6 Cognitive Walkthrough

Cognitive Walkthrough is an expert based evaluation technique that steps through a scenario/task by focusing on the users' knowledge and goals. The expert evaluator first starts with descriptions of: the prototype interface, the task(s) from the user's perspective, the correct sequence of actions needed to complete the task using the prototype and any assumptions about the characteristics of the user.

Then the evaluator walks through the tasks using the system, reviewing the actions that are necessary and attempting to predict how the users will behave

A series of key questions are used throughout each sub-task evaluation:

0. Will the user be trying to achieve the correct effect?
0. Will the user know that the correct action is available?
0. Will user know that the correct action will achieve the desired effect?
0. If the correct action is taken, will the user see that things are going okay?

4.7 Heuristic Evaluation

Heuristic Evaluation is an expert review technique where experts inspect the interface to judge compliance with established usability principles (the 'heuristics')

Heuristic Evaluation is usually conducted in a series of four steps:

0. Prepare: create a prototype to evaluate; select evaluators; prepare coding sheets to record problems
0. Determine approach: either set typical user tasks (probably the most useful approach) or allow evaluators to establish their own tasks or conduct an exhaustive inspection of entire interface
0. Conduct the evaluation: evaluators inspect interface individually to identify all violations of heuristics (the usability problems); record the problem (feature and location), severity (based on frequency, impact, criticality/cost) and heuristic violated
0. Aggregate and analyse results: group similar problems; reassess severity; determine possible fixes

5. Case Study

Now we demonstrate how the above framework can be applied to a specific case study from the public sector.

need2know.co.uk is a portal developed by CIMEX which covers areas such as health, relationships, law, money, travel. Although a cross government initiative, the portal should not bear Government branding.

Need2know (<http://www.need2know.co.uk>) aimed to be a 'first-stop-shop' for everything in a young person's life with sign-posts to relevant web sites in the public, private and charitable sectors.

The goal was to create the de facto online 'life' resource for 13-19 year olds that appreciates and satisfies the differing needs of each age group within the target audience. To inspire movement throughout the site and encourage repeat visits, a regularly updated online magazine called 'n2k' was also developed.

The portal had to be easily accessible by all computers, from 56k modems to broadband users as well as by people with disabilities. Therefore, compliance with accessibility guidelines and standards was an important requirement.

An other initial requirement was that individual users should feel that the portal has met their needs.

Figure 2 shows a screenshot of the front page of need2know

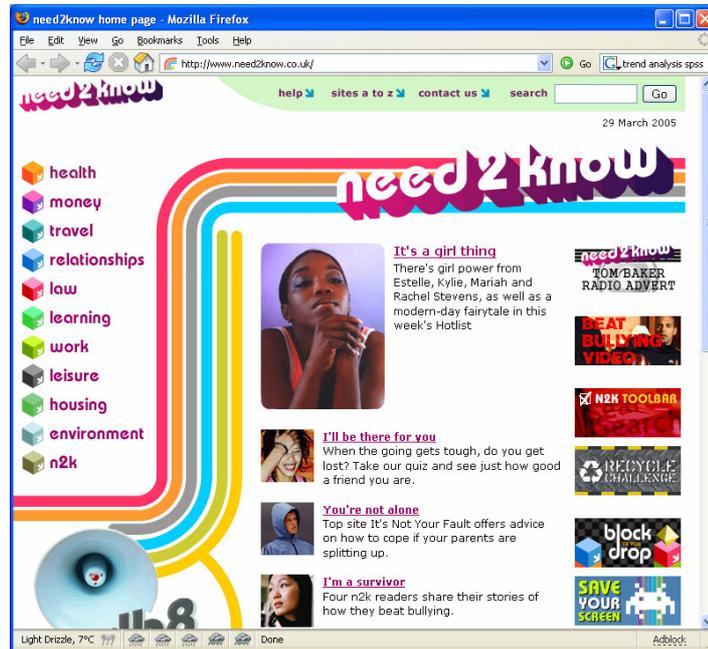


Figure 2: Screen shot of need2know homepage (April 2005)

To develop need2know a series of user need analysis techniques and formative evaluation techniques had to be conducted. A variety of methods and techniques had to be used to diagnose usability and accessibility issues early in the development process and as the development built up and evolved.

The process outlined in this case study fits within a framework of an iterative development process which evolves through cycles of development and testing.

5.1 User Analysis/Needs analysis

Once the requirements have been gathered following research (interviews, surveys) with over 2,000 young people across the UK the requirements had to be analysed and prioritised from a user experience point of view and from a business perspective (client).

What are the tasks the user will be able to do on the site and what needs do they meet? What are the portal's intended functionalities? We had to have answers to these questions well before proceeding to the first evaluation. Also it is of utmost importance that findings from each evaluation activity need to be built into all the architectures and designs prior to the next test.

5.2 Formative evaluations cycle: what to evaluate? How? At what stage?

Once a draft site architecture diagram has been developed and some basic low fidelity prototypes that demonstrate basic functionalities were designed, the first evaluation was conducted.

Cognitive walkthrough can be used in this case by one or more evaluators to go through the prototypes in the correct sequence trying to model what the user would do on the system and if the interaction and dialogue design supports the user tasks.

In the case of Need2know which has a diverse audience aged 13-19 with diverse interests a series of prototypes had to be walked through to model different user behaviours. This way missing steps, inadequate instructions, user overload or poor feedback were identified.

Once the prototypes were enriched and refined, a heuristic evaluation was performed by 3 to 5 experts on the prototypes. This method quite handy as it is inexpensive and can detect a significant amount of issues. You need to make sure that the heuristic evaluation covers information architecture. An accessibility checklist was also used by an accessibility expert to ensure that accessibility requirements are met. The results of these evaluations were summarised and prioritised and amendments made.

The next step was to take the refined prototypes and to do user testing to see if everything is on the right track. The homepage, the main menu as well as important functionalities were tested to assess information architecture, interface layout and navigation design ideas early in the development.

It was important that a representative sample of users from the target audience was selected because the portal is aimed at 13 to 19 year olds. The participants were of various ages between 13 and 19, have different interests and come from different areas and backgrounds. They should have had different levels of experience with computers and the web.

The participant questionnaire used for recruiting participants contained questions that helped recruit users with the above characteristics.

When setting the tasks for the testing care was taken with wording. The testing had to be as objective as possible. The testing sessions were one to one enabling us to focus on one user at a time. The evaluation was structured around questions such as: what do you think this means? What do you think will happen if you click here? Is this what you expected to see or not? Why? Also the participants were encouraged to think aloud so that it can be understood what is going on in their minds. A short interview followed after the testing that gave the participant the opportunity to reflect on their experience with the prototype and captured their overall impressions and recommendations for improvement.

It is better if the test is performed in a usability lab and that some members of the development team are present to observe the testing behind one way mirrors so that the participant doesn't feel uncomfortable. This will give them greater understanding of the users.

The next stage is to refine the prototypes and enrich them with additional features. A basic clickable HTML prototype was developed with no images on it or colours so that the users can concentrate on the content and the navigation. This prototype should have had enough content for the users to give feedback about the tone of voice, the layout and the level of engagement with it. Scenarios were also used to ensure that

the functionalities inserted remain task specific and are related to the user needs identified in the requirements stage.

It is very important that the prototype is tested in advance with heuristic evaluations that concentrate on both usability and accessibility. Some scenarios of use can be provided for the experts to make sure they cover the important functionalities the way a real user would.

User testing should occur the same way as illustrated previously. This time disabled users from the target audience need to be recruited as well to test the accessibility of the prototype. This prototype will be clickable and more “realistic” than the one developed earlier.

The success of this methodology is evident from the fact that the portal was given a 'green light' by the Government's Gateway Review team.

6. Conclusion

In this chapter we described an incremental user needs analysis and evaluation usability and accessibility framework and its associated methods and demonstrated how it has been applied to a public sector portal system.

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