

## Improving web site usability for a better e-learning experience

Christophe Renaut\*, Christophe Batier, Laurent Flory and Martine Heyde

University of Lyon, France; University Lyon1, PRACTICE, Villeurbanne, F-69622, France.

A eLearning web based interface barely usable, hard to grasp, makes users not want to use it or even use other tools. Looking at the web site ergonomics can improve the Human Computer Interactions by developing a system adapted to human cognitive characteristics. This study is a proposal on how to use evaluation methods based on observations and tests to detect interface usability problems and to develop web developers' knowledge about end users and human centered design.

**Keywords:** usability; LCMS; ergonomics; adaptive interface; e-learning

### 1. Introduction

The SPIRAL web based e-learning platform is used at Lyon1 University by almost 25000 thousands users in October 2006. Its growth is close to exponential. The stakeholders want to encourage this by developing new usages and stabilizing old ones. A way to achieve this is to look at user real activities, the knowledge needed to achieve their tasks or their comfort satisfaction with the web interface [1]. When we are questioning interface "ease-of-use", looking at its adaptation to human cognitive capacities, the cognitive ergonomics gives methods to evaluate the type of necessary and frequent adjustments between the computer system functionalities and the users capacities [2]. These evaluations can happen at different design stages and are linked to materials, methodological and theoretical constraints to understand a user behavior when using a web site [3]. An ergonomic study of the platform has therefore been conducted. The expected results are some new or improved web design principles for pedagogical resources design. First, we will clarify the principles of usability and its role in our renewal context, then we will present the methodologies used to observe and analyze professors, and finally will highlight some of the main design issues and give some design principles improvements.

### 2. Improving SPIRAL

SPIRAL<sup>1</sup> is developed by the University Claude Bernard Lyon1. This web platform offers its users, professors and students, tools to view, create, manage, and share pedagogical resources. In October 2006 an average of 2000 distinct students logged in per day, and 121132 media files and 1033 quizzes were available. A previous study based on SPIRAL usage and resources [4], has shown that the pedagogical models regarding resources elaboration on which the platform is based, are changing. From simply giving free access for students to resources, it is changing to a co-design situation regarding resources conception in order for the professors to pool and consolidate their resources. For the platform to achieve this goal, the ICTE Department [5] is attempting to develop resources design scenarios that will be able to match the actual pedagogical models used at the University. Marcel Lebrun [6] when talking about e-learning platform innovations says that the technical dimension is dominant over the pedagogical one. We believe that improving some of the usability dimensions can reduce the technical nature and give the Human-Computer Interaction system this invisibility wished by Norman (cited by [7]). The chosen way to proceed was to evaluate the usability of the actual platform. How the interface is used and developed has a strong influence on the professor perception, needs and pedagogical design models.

\*Corresponding author: e-mail: christophe.renaut@recherche.univ-lyon1.fr, Phone: +33628068005

<sup>1</sup> <http://spiral.univ-lyon1.fr/>

Usability is defined by the ISO 9241-11 as "The extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". This standard definition can be interpreted in many various ways. We decided to use an extended definition proposed by Quesenbery namely "the five 5Es". It consists of five usability dimensions of a web site: efficient, effective, engaging, error tolerant and easy to learn [8]. This paper objective's is not to evaluate the relevance of methods. It is an empirical and exploratory research based on the will to improve a user interface. These dimensions have been contextualized, and integrated within the evaluation methods used to assess the usability of the interface and the design process. Thus, evaluation should give us a better understanding of user's behavior and expectations while they are using the platform and give some precious information (graphical inconsistencies, wrong terminology navigation scenarios) to be analyzed and proposed to the web developers. Many studies [9] have shown as well that ergonomics, and therefore usability, can improve the design process currently in place in organizations. One aim of this study is also to look at how the web developers can take into account the end user in their representations of the design problem.

### 3. Impacts of usability: methods and analysis

#### 3.1 Observing users to improve the web interface

Many different methods for interactive system evaluation exist [10]. What they do have in common is to focus on understanding the users by observing their behaviour according to an analysis grid. Vermersch states that what separates an observation from an experiment is that it is an exploratory research for meanings [11]. Thus, experts or researchers try to model these meanings by analysing the data and weighing them against emergent theories or their own beliefs. Our study, which could be qualified as a semi-observation, was open to methodologies from different disciplines. However it is in the cognitive ergonomics that we found most of our principles and methods [12]. Before doing any observations, we need to define our scope of action. For this research, we decided to perform a usability study, based on the observation of characteristic users while they are performing a specific task using SPIRAL. Analyzing talks, and audio video recording of their activity was to help us measuring criteria based on user performances and finding interface errors. The data obtained was to provide us with qualitative information about user knowledge and understanding, as well as web site operations.

SPIRAL offers many different design tools to professors. Web site usage log analysis enabled us to determine the tool most used by professors: the "multimedia database" (in October 2006, it was the first design tool in terms of total actions performed). Further, we learnt as well from informal interviews with professors that this tool answers their basic and more frequent needs: to distribute pedagogical knowledge among student as download files.

When confronted with user samples selection, authors disagree on the selection method to be used, especially about the sample size. However as, Bastien and others states [13], the variability of user characteristics can greatly influence the expected results of the test. In order to minimize this, we decided to choose the users according to some information obtained from stakeholders and web developers, and tried to build this sample as representative as possible. We also took into account time limitations due to testers' and participants' availability as well as their (participants) platform, design involvement, usage history and last training session. Eleven professors, selected across science disciplines, were available for our user testing. Therefore the results presented below will be in no way generalized against the whole user base. They do however give us new insights on how to improve the relationship between user platform usage, pedagogical and usability expectations, for both experienced and inexperienced users of the platform. Even though we were aware of the added difficulties users may encounter using a different computer than the one they are used to work with, we asked them to pass individual test series on a pre configured laptop. Spread across a large University's campus we thought that the mobility offered by a transportable observation protocol was a good way to quickly access the users at their work place. To

trace our observations, we used the desktop recording software Screencorder<sup>2</sup> to capture the activity on the screen and each audio interactions between the observer and the users. We asked the professors to follow this scenario-based think-aloud task: “How do you give students access to a pedagogical document file using a specific tool, the multimedia database?” One usability expert conducted the tests, with the objectives of making the users feel comfortable and inviting them to comment on his actions as often as possible. The task scenario used gives a lot of liberties in terms of navigation scenarios. As this study was exploratory, we thought than we could get a lot of information with such a flow than with a too predictive one.

### 3.2 Measuring usability to improve the design processes

We believe as well that the design process improvements can be achieved through the appropriation of usability dimensions by the web developers. As suggested by [14] usability can support one aspect of the web design principle, the problem framing. Users needs are therefore addressed through an improved intuitive mental representation of them. Two methods were applied to achieve this:

- A post-test questionnaire to assess the web site usability through professors own subjective evaluation of the web site using the SUS questionnaire [15]. A study proved its better efficiency and reliability, especially on a small number of participants [16]. This questionnaire covers many aspects of a web site usability as described in the 5Es, by looking at needs for help, training, interface consistency, etc.
- Two heuristic evaluations to get a quick overview of usability dimensions problems as an introduction for usability as a set of tools and principles to improve the interface as well as work process [17]. The first evaluation performed by one usability expert before the user testing highlighted some of the major issues regarding the web interface. Then, four web developers and one executive performed an evaluation based on a set of guidelines where each developer had to rate the 5Es dimension expressing their will of improvement areas. For each of the dimensions, interface design approaches are introduced as well as improvements objectives, evaluations techniques and questions about end-users’ needs.

### 3.3 Analysis methodology

The user testing activity was quantified using the software Videograph<sup>TM3</sup>. Mainly used during linguistic researches, it performs video data classification and analyze in real time according to a defined coding protocol. The categories of variable used for our analysis are performance based: it is the task duration, error natures, alerts statements, success rate, amount of session loss and amount of provided help from the observer. This data is then aggregated with spreadsheet software. The qualitative aspect was based on the facial expressions, voice intonations. The heuristic evaluation is based on a star-rating system. The experts have been asked to distribute 10 stars across each of the dimensions, with a maximum rate of 3 stars. The data collected is then analyzed using spreadsheet software and presented in a way that agreements across people and expertise are visible alignments.

## 4. Results, interpretations and recommendations.

All the results obtained cannot be easily synthesized. But some of the results presented below however highlight improving areas we are actually working on.

### User navigation and scenarios exploration

Our qualitative date based on the user testing observations helped us characterize the professors’ navigation scenarios. As they are varying greatly in term of number of pages seen and actions performed, be-

<sup>2</sup> <http://www.matchware.com/en/products/screencorder/default.htm>

<sup>3</sup> Videograph has been designed by Rolf Rimmele, IPN Leibniz-Institut, Kiel University

tween users and users groups (novice and expert), we were able to see that these navigation scenarios were to match the professor user pedagogical models. For instance, some users, mostly experts, contextualized their resources, using forums or landing pages, as other users simply share a file using the tool, hoping the students will find it easily. When looking at the qualitative data being performance variables, we can see that an advanced usage of the tool for a platform expert requires more time and the user faces more errors and alert statements, compare to the most basic scenarios applied by another expert. These exploratory and qualitative results taking into account both user navigation scenarios and pedagogical models and interrelated with a more precise data log analysis based on resources spread across different tools, offer an interesting model potential.

#### **Interface design issues**

Many times, tested users showed difficulties with filling in forms on the different setup pages. Only one expert user managed to complete the task after the first attempt. These problems are interface presentation issues, linked to information availability and its impact on the cognitive treatment of the web page. The short term and long term memory as well as the user attention are acting on the information treatment and can misplace the user focus on areas of the site that are not linked with its original goals. Some design principles should therefore be applied: the principle of elements proximity favors the identification of particular areas within a web page, and the principle of continuity and similarity helps user navigating from an area to another [18]. This phenomenon is particularly present in the simple navigation scenario of uploading a file and then sharing it with the student. Many users reported as well terminology problems (38% of the overall amount of errors during the usability test) When users experience syntactic doubt, they are coming back on the already read text in order for them to integrate some misinterpreted information and complete their text understanding. This is a spatial addressing phenomenon disturbance that could be solved [19]. It seems like tone and copywriting actual choices should be improved by being less procedural and more adapted to the actual usage scenarios.

#### **Web design process**

The results of the 5Es evaluation performed by web developers show great variability in terms of usability areas of improvements. There is no uniform vision of what is the most important usability dimension(s) that should be improved first. We believe that this result highlight difficulties for the web developers to integrate and adopt the user point of views. It seems that the design methodology could be improved through more documentations, to conduct the designers towards a better integration of the user's point of view. Lim [7] described actual design process where usability experts are integrated to the product life circle and help sharing the end user concerns in a formal way with developers.

## **6. Conclusion**

The actual distance between pedagogical models and SPIRAL ways of handling them is still very large but could be reduced. The main hypothesis is that the end user real activity ignorance is the cause. What we learned from this study is while professors usability evaluation show a good tools appropriation (72% of the users evaluate the platform as being usable) they were also building their own usage scheme that is different from the one that have originally be developed or supported. This difference disturbs the usability platform (mostly in the efficient and effective dimensions) and involve two types of overloading: one is cognitive, novice users are confronted to a heavy and "unstable" graphical interface, the other one is organizational, developers are actually facing a strong pressure from the expert users who claim for more efficient interface, to the detriment of novices interests in an easy way to learn the platform. To address these concerns, based on results we obtained, we should be able to build an abstracted interface incorporating some of the proposed ergonomics design improvements and test them against the same user sample. If this prototype helps improve some of the usability aspects of SPIRAL, some design new principles should be then developed as guidelines, like web patterns [20] and used by the web developers to enhance the current platform. The real activity taken into account should be reflected into broken down user's navigation scenarios offering SPIRAL designers some feedback and control over the system invisibility.

**Acknowledgements** We would like to thank all the professors, web developers as well as the stakeholder team for their participation to this study. We also thank William Francis for his precious inputs, and in English of course. SUS was developed as part of the usability engineering programme in integrated office systems development at Digital Equipment Co Ltd., Reading, United Kingdom.

## References

- [1] N. Bonnardel, Créativité et conception. In: *Approches cognitives et ergonomiques*. Solal (Eds), Marseille, France, pp. 115-121 (2006)
- [2] A. Tricot. Interpréter les liens entre utilisabilité et utilité des documents électroniques. In M. Mojahid & J. Virbel, *Les documents électroniques, méthodes, démarches et techniques cognitives*. Europia. (Eds.), Paris, France, pp. 357-371(2001)
- [3] T. Baccino. In: *La lecture électronique*, PUG. Coll. Sciences et Technologies de la Connaissance (Eds), France, pp. 209-232 (2004)
- [4] F. Poyet. Influence des modèles pédagogiques des enseignants sur l'utilisation d'une plateforme en formation initiale, Les institutions éducatives face au numérique, Colloque du SIF, Paris, France, 12-13 December 2005 (2005)
- [5] M. Heyde, J. Randon, C. Batier and D. Debouzie. De la décision stratégique à la mise en pratique d'une politique favorisant le développement des TICE dans une université de masse. *TICE 2006, Information and Communication Technologies in Higher Education and Industry*, Toulouse, France, 25-27 October 2006 (2006)
- [6] M. Lebrun. eLearning pour enseigner et apprendre : Allier pédagogie et technologie. *Academia Bruylant* (Eds), Louvain-la-Neuve, Belgium. p233 (2005).
- [7] D. Lim, Modélisation du processus de conception centrée utilisateur, basée sur l'intégration des méthodes et outils de l'ergonomie cognitive: Application à la conception d'IHM pour la télévision interactive. PhD thesis, ENSAM (2003).
- [8] W. Quesenbery, Using the 5Es to understand users, URL: <http://www.wqusability.com/articles/getting-started.html>, 04.10.2006: 11:00. (2002)
- [9] J.Gulliksen and Inger Boivie. Usability Throughout the Entire Software Development Lifecycle - A Summary of the INTERACT 2001 Workshop. In: *proceeding of the eighth ifip tc.13 conference on human-computer interaction*, Tokyo, Japan, 9-13 July, 2001. Pp. 06-17 (2001)
- [10] M. Villey-Migraine. Evaluation ergonomique de produits multimédias pour des publics spécialisés: Apports méthodologiques et sélection des mesures en fonction du contexte. In *proceeding of Informations, Savoirs, Décisions et Médiations*. ISDM, Toulon-Marseille, France, 12 January 2004, 12 p (2004)
- [11] P. Vermersch. L'observation systématique dans l'étude du fonctionnement cognitif. In : *Psychologie française*, 29, 3-4 (1984)
- [12] Y. Clot. Pourquoi et comment s'occuper du développement en clinique de l'activité. *International Symposium ArtCo : Artefacts and collectives*, Lyon, France, 4-6 July 2005 (2005)
- [13] J.M.C, Bastien, C. Leulier and D.L. Scapin. L'ergonomie des sites web. In *Créer et maintenir un service Web*, J.-C. Le Moal & B. Hidoine (Eds.), ADBS, Paris, France, pp. 111-173 (1998)
- [14] N. Bonnardel, and E. Marmeche. Evocation Processes by Novice and Expert Designers: Towards Stimulating Analogical Thinking. In *Creativity and Innovation Management*, 3,13, pp. 176-186, (2004)
- [15] J. Brooke. SUS: a "quick and dirty" usability scale. In P W Jordan, B Thomas, B A Weerdmeester & A L McClelland (eds.) *Usability Evaluation in Industry*. London: Taylor and Francis (1996)
- [16] S. Tullis Thomas, J.Stetson and N. Jacqueline. A Comparison of Questionnaires for Assessing Website Usability, *Usability Professionals Association (UPA) 2004 Conference*, Minneapolis, USA, 7-11 June 2004 (2004)
- [17] C. Barnum, E. Henderson, A. Hood and R. Jordan. Index Versus Full-text Search: A Usability Study of User Preference and Performance. *Technical Communication*, 51, 2, May 2004, pp. 185-206 (2004)
- [18] L. Leger, C. Tijus and T. Baccino. La conception ergonomique de sites web: discrimination visuelle et sémantique, *Revue d'Interaction Homme-Machine*, 6, 1, pp. 81-106. (2005).
- [19] D. Chesnet and D. Alamargot. Analyse en temps réel des activités oculaires et grapho-motrices du scripteur. Intérêt du dispositif « Eye and pen ». In *L'Année Psychologique*, 105, pp. 287-304 (2005).
- [20] M. van Welie, G.C. van der Veer, A. Eliëns. Patterns as Tools for User Interface Design: In: *International Workshop on Tools for Working with Guidelines*, Biarritz, France, 7-8 October