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Web Information Systems Engineering – WISE 2007 Workshops

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Nancy, France, December 2007
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Web Information Systems Engineering – WISE 2007 Workshops

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Preface

Workshops are an effective means to discuss relevant and new research issues and share innovative and exciting ideas. Therefore, they are an essential part of scientific conferences. In highly dynamic fields of research and development with strong interaction between academia and industry, workshops are instrumental in sharing ideas, discussing new concepts and technologies that could finally lead to industrial uptake of research results.

The International Conference on Web Information Systems Engineering addresses issues that require focused discussions. In this year's WISE conference, held in Nancy, France, during December 3–6, and hosted by Nancy University and INRIA Grand-Est, the Program Committee selected six workshops, focusing on specific research issues related to Web information systems engineering. The workshops were organized by international experts in the respective fields; each workshop set up an International Program Committee that carefully selected the workshop contributions.

The Approaches and Architectures for Web Data Integration and Mining in Life Sciences, workshop (chaired by Marie-Dominique Devignes and Malika Small-Tabbone) focused on the effective and efficient management and transformation of scientific data in the life sciences. By appropriate concepts and Web information systems, the bottlenecks for research in the life sciences that have shifted from data production to data integration, pre-processing, analysis/mining, and interpretation can be overcome.

In the Collaborative Knowledge Management for Web Information Systems workshop (chaired by Sergei Sizov and Stefan Stiersdorfer), issues related to information acquisition through collaborative Web crawling, classification, and clustering were discussed and the relationship of these techniques to knowledge sharing through sharing of personal ontologies and their alignment was investigated. By bringing the respective communities to the workshop, interesting interdisciplinary discussions were sought.

Methods and techniques to support governance and compliance in Web information systems were considered in the Governance, Risk and Compliance in Web Information Systems workshop (chaired by Shazia Sadig, Claude Godart and Michael zur Muehlen). These issues are currently emerging as a critical and challenging area of research and innovation. It opens new questions regarding, for instance, the modeling of compliance requirements, but existing challenges also have to be solved, for instance, extension of process and service modeling and enactment frameworks for compliance management.

The Human-Friendly (Web) Service Description, Discovery and Matchmaking workshop (chaired by Dominique Kuroopka and Ingo Melzer) focused on annotations of services that facilitates service requestors to easily find and use them. It is based on the observation that existing technologies are either too complex to

use or are just at the syntactic level, focusing on interface definitions. Finding the right level of specification detail is a challenging task that was at the center of this workshop.

The huge amount of information provided by the Web forces the designers of Web information systems to prevent users from experiencing the all-too-prevalent cognitive and informational overload. Elaborate personalization techniques are required to provide users with information that they are actually interested in. Models and mechanisms for personalization as well as personalized access and context acquisition were discussed in the Personalized Access to Web Information workshop (chaired by Sylvie Calabretto and Jérôme Gense).

Given the ubiquity of Web information systems and the immense commercial interest of Web applications, usability issues become increasingly relevant. To broaden the user group, accessibility issues have to be considered. In the Web Usability and Accessibility workshop (chaired by Silvia Abraham, Cristina Cachero and Maristella Matera), concepts, models and languages to improve Web information systems with respect to their usability and accessibility were investigated.

We would like to take this opportunity to thank all the workshop organizers who contributed to make WISE 2007 a real success.

We would like also to acknowledge the local organization, in particular Anne-Lise Charbonnier and François Charoy. We also thank Qing Li, Marek Rusinkiewicz and Yanchun Zhang for the relationship with previous events and the WISE Society, and Ustun Yildiz for his work in editing these proceedings.

September 2007

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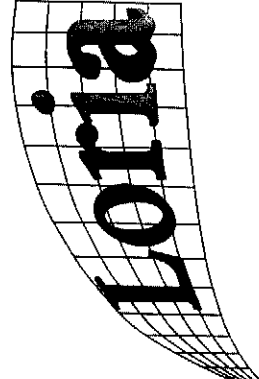
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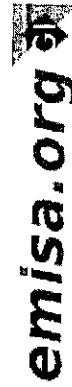
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Including Routes in Web Information Systems as a Way to Improve the Navigability: An Empirical Study*

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Abstract. Simplifying the achievement of the user tasks is a factor that determines usability in Web development. In order to better reflect the best paths that may drive the user through the Web Information Systems (WISS) to search the desired information/services, navigation models have been widely adopted by the Web Engineering community. However, the design of WISS often relies only on a domain model leaving many decisions, which may directly affect usability, to the designer skills. In order to limit this arbitrariness in the navigation design process, we have proposed a hypertext modeling method (HM³) which explicitly bases the construction of the navigation model on the services required by the user. This way, the navigation model built with HM³ includes *routes*, which help the user to properly carry out the required service. The main goal of this paper is to present an experiment we carried out to corroborate the hypothesis that "using *routes* it is possible to obtain more navigable WISS".

1 Introduction

As the complexity of the WISS grows, the difficulty in using them systems grows as well. Usually, the users of traditional information systems spend a lot of time becoming familiar with the features and design of these systems. Conversely, on the Web, users usually do not want to read any manuals or help instructions for individual sites [8]. Several authors claim that design oriented to the user needs is one of the key aspects of usability: "users are never going to even get close to the correct pages unless the site is structured according to user needs and contains a navigations scheme that allows people to find what they want" [8].

It is widely recognized in the Web community that usability is significantly associated with navigation [8,9]. Good navigation aids let users acquire the information they are seeking quickly and efficiently, and therefore contribute to the

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perceived success by site users [9]. Such navigability is usually expressed in Web Engineering methods through navigational models whose design often depends on the skills of the designer. We want to be more rigorous in that sense, so we proposed a method to model WIS navigation from a user needs oriented perspective, called Hypertext Modeling Method of MIDAS (HM³) [6,7]. This method has the particularity that allows identifying *routes*. A *route* is defined as "the sequence of steps established for the WIS that the user must follow to execute a user service". After implementing the *routes* in a WIS, signposting the sequence of steps that the user must follow to properly carry out each service, they will guide users to navigate through the WIS. Moreover, the method proposes to identify a main menu including the services required by the user which represent the beginning of the *routes*. Drawing an analogy with the road system, the main menu is analogous to a signal indicating possible destinations in the origin of several ways, and the route is analogous to the signposting of the road. Thus, in the same way that these characteristics in a road could help the drivers to get their destination, these characteristics in a WIS could also help the users to perform the task they need.

But, although intuitively, it seems obvious to us that a WIS with signposted routes is more easily navigable, as Zerkowitz et al. [13] pointed out, a new proposal in software engineering lacks credibility if there is no empirical evidence of its usefulness. For that reason, we have carried out an experiment in order to corroborate our hypothesis: "Using routes it is possible to obtain more navigable WIS". In order to test our hypothesis, we have decided to compare the navigability of two WISs for conference organization: *ConfMaster* [3], a well known WIS in this field and widely used in prestigious conferences; and *WebConference* [11], a similar WIS built using *routes*. Both WISs have the same functionality and identical interface style, the only difference is in their navigation model; only the second one (*WebConference*) has *routes* and a main menu indicating the beginning of each route. So, our aim is to measure the impact of the *routes* in the final users. Note that, the aim of the experiment presented in this paper is not to test that HM³ is better than other methodologies for WISs development. In fact, the methodology used for developing *ConfMaster* is unknown for us, and it is not important in this phase. In this experiment we just want to measure the impact of the *routes* in the final users. For this reason, we have evaluated two WISs in which the only difference is that one of them includes routes as well as a main menu indicating the beginning of the routes, whereas the other WIS does not include them.

The rest of the paper is structured as follows. In Section 2 we describe the controlled experiment. Section 3 presents the analysis and interpretation of the empirical data. Finally, the conclusion in Section 4 underlines the main contribution of the paper and future work.

2 Experiment Description

The main objective of the experiment expressed using GQM [1] template is: **Analyze the *WebConference* and *ConfMaster* WISs, For the purpose of evaluating, With respect to their navigability, From the point of view of the researchers, In the context of undergraduate students enrolled in the fourth-year of the Computer Science at the Rey Juan Carlos University Hereafter, we briefly describe the experimental process, using the format (with minor changes) proposed by Wohlin et al. [12]**

Subjects. 84 students enrolled in the fourth-year of the Computer Science at the Rey Juan Carlos University (Spain) carried out the experiment. The subjects were selected for convenience i.e. they are students who had on average 5 years of experience in using web applications and whom we considered competent enough to perform the level of experimental tasks required.

Variables. We considered the WIS used to be the independent variable. This variable has two levels: *WebConference* and *ConfMaster*. On the other hand, the dependent variable was navigability, measured through the following measures, taken from [5]:

- Perceived Ease of Navigation, defined as the degree to which a person believes that using a particular tool facilitates the navigation through the WIS.
- Effectiveness, defined as how well the usage of a particular WIS allows the required tasks to be achieved.
- Efficiency, is defined as the effort required to use a particular WIS correctly..

Hypotheses. The following hypotheses investigated were shaped by our experience with WIS modelling:

- $H_{0,1}$: There is no difference in Perceived Ease of Use of subjects using *WebConference* and *ConfMaster*. $H_{1,1}$: $\neg H_{0,1}$
- $H_{0,2}$: There is no difference in Efficiency of subjects using *WebConference* and *ConfMaster*. $H_{1,2}$: $\neg H_{0,2}$
- $H_{0,3}$: There is no difference in Effectiveness of subjects using *WebConference* and *ConfMaster*. $H_{1,3}$: $\neg H_{0,3}$
- $H_{0,4}$: The subjects prefer using *ConfMaster* over *WebConference*.
- $H_{1,4}$: The subjects prefer using *WebConference* over *ConfMaster*.

Experimental material. For each participant, we had prepared a folder containing for each WIS: a debriefing questionnaire regarding subjects' experience; four tasks to be carried out using the WIS; a survey of 8 questions related to the Perceived Ease of Use of the WIS (survey 1), and; a survey where the subjects had to compare both WISs (survey 2).

Execution. The experiment was carried with two groups of subjects (G1 with 44 students and G2 with 40 students) located in two different laboratories. In the first laboratory we first gave the material related to *ConfMaster* and secondly *WebConference*. In the second laboratory we changed the order to cancel out learning effects. Subjects were given an intensive training session before the experiment took place. In this session, we gave them a test similar to those we used in the experiment and we explained to them the tasks they had to carry out. The students worked under examination conditions, with no speaking among themselves or asking questions about doubts to professors supervising the experiment. The subjects had to perform the following experimental tasks for each WIS:

- To fill out a debriefing questionnaire (including personal details and experience).
- To perform, using the corresponding WIS, the four tasks required, writing down the time when they began doing the first task and the time when they finished the

- fourth task. Moreover, they had to write down the name of the links they navigated while performing each required task. From these tasks, we obtained values for:
- Effectiveness = N° of Correct Clicks Done / N° of Clicks the task required
 - Efficiency = N° of Correct Clicks Done / Time
- To answer the eight questions in survey 1, which had to rate them using a 5 point Likert scale.
- On finishing the experimental tasks with both WISS, the subjects had to fill out survey 2, where they had to express their preference between both WISS.

Data validation. We collected the material filled out by the subjects, checking if they were complete. There was a bit of incomplete data detected and rejected with the statistical analysis.

Threats to validity. In our opinion the greatest threats are to the internal validity of our experiment; i.e. the degree to which conclusions can be drawn about the causal effect of the independent variable on the dependent variable [2]. One possible threat to internal validity is the accuracy of subject responses, given that they have to write down manually the time spent on doing the tasks and the name of the links they navigated. Even though we placed special emphasis on the relevance of the accuracy of these data in the training part of the experiment, we never could be sure about this and we have to trust them. The students were motivated to participate in the experiment by a "prize", 0.5 points of the final mark for participating, and another 0.5 points for performing the required tasks correctly. With respect to the external validity, i.e. the ability of generalize the obtained findings to the population under study and other research settings [2], we consider that the functionality of the WISS selected was probably simple. For that reason the results need to be confirmed by replication experiments.

3 Analysis and Interpretation

For testing the hypotheses we merged the empirical data of groups G1 and G2. All the data analysis was carried out by means of SPSS [10]. The debriefing questionnaire allows us to obtain the following data that reflects the profile of the participants: 24 year old on average, with 5 years of experience using WISS, 2 years of experience designing WISS and 4 years of experience designing traditional ISs.

The data used to test the *first hypothesis* are the subjective ratings given by the subjects in the first survey. First, we checked the inter-rate reliability (Cronbach's alpha [4]) to determine how consistent the results of the rates were with what order. The Cronbach's alpha obtained for the responses about WebConference was 0.81 and for ConfMaster 0.91. Both coefficient values were above 0.7, the suggested value to consider the results reliable. We tested the first hypothesis for each question (Q1..Q8) and also considered the median (M) of the eight responses using the Wilcoxon test (a non-parametric test for ordinal measures). As all the significance levels were lower than 0.05 we can reject H_{01} . This means that the Perceived Ease of Use is different in ConfMaster and WebConference. Moreover, comparing the median values of the

responses obtained for each WIS, we can conclude that the Perceived Ease of Use is better for the WebConference. Moreover, we found that 67% of subjects have rated WebConference with a value greater than 4 (as a median). This fact demonstrates that the majority of subjects perceive WebConference to be easier to use.

To test the *second hypothesis* we calculated the mean of the efficiency between the values of efficiency for carrying out the four tasks required for each WIS. As both measures are ratio scale measures, we will carry out an ANOVA, considering the WIS as a within-subject factor and the order in which the subjects receive each application as a between-subject factor. As the significance levels is not less than 0.05 we can not reject the H_{02} . Thus, it seems that there is not a significant difference between the efficiency of subjects when using WebConference or ConfMaster. We also carried out an ANOVA for investigating the efficiency obtained in each task separately, and we only found differences between the efficiencies of both WIS for task 4. We also investigated the behavior of the mean of the Time spent on carrying out the tasks. ANOVA indicated there was difference between the times spent when using each WIS, and we discovered that the order when using each WIS influenced the results. Table 1 reveals that on average subjects spent more time using ConfMaster.

Table 1. Descriptive statistics for the mean of Time (seconds)

	Min	Max	Mean	St. Dev.
WebConference	18.8	305.44	89.5119	57.0183
ConfMaster	25.8888	261.78	108.4840	50.5317

As the order influences on time, we compared the means by order, and results indicated that, independently of the order, the subjects spent less time using WebConference (see Table 2).

Table 2. Comparison of the mean of Time considering the order (seconds)

WebConference(1)	105.9890	WebConference(2)	71.3005
ConfMaster(1)	111.4058	ConfMaster(2)	86.8628

To test the *third hypothesis* we calculated the mean of the Effectiveness between the values of effectiveness in carrying out the four tasks required for each WIS. As both measures are ratio scale measures, we carried out an ANOVA, considering the WIS as a within-subject factor and the order in which the subjects received each WIS as a between-subject factor. The ANOVA results allow us to reject H_{03} , which means that there exists a difference between both WISS with respect to Effectiveness.

To test the *fourth hypothesis* we used the data obtained in the second survey, assigned to the subjects after they performed the experimental tasks with both WISS. As a result we found that 34 subjects preferred WebConference, 15 ConfMaster and only 4 did not have a preference. Analyzing the probabilities of preferences we obtained a p-value < 0.001 that suggests to reject H_{04} , confirming thus there exist greater probability that the subjects prefer WebConference over ConfMaster.

4 Conclusions and Future Work

In this work we have presented an experiment to corroborate if effectively, using *routes*, it is possible to build more navigable WISs. The most important conclusions obtained through the empirical study are that the subjects perceive WebConference, (the WIS that was built using *routes*) is easier to use. They were more effective using it, i.e., using WebConference leads them to perform the required tasks in a more correct way.

Even though the results obtained are encouraging, we consider them to be preliminary. Further validation is needed to obtain conclusive results about whether HM³ really leads to WISs which are easier to use, more effective and more efficient. For that reason, we are planning to carry out a replication of this experiment. Moreover, due to the WISs evaluated are very simples, we're also planning to make the experiment with more complex WISs, in which the results should be more conclusive.

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