

User-Centered Design for the Semantic Web

Description of a Full-Day ISWC 2007 Tutorial

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Abstract. There has been a rapid recent increase in interest in the design of user interfaces for systems based on semantic technologies. This tutorial aims to enable those who are involved in the design and development of such systems to benefit from the rich repertoire of concepts and methods offered by the field of human-computer interaction. The first part presents a number of general usability challenges associated with semantic technologies and discusses ways of dealing with them, referring for concreteness to two complementary case studies: a web-based system for access to semantically annotated cultural artifacts and a semantic wiki that features novel interfaces for the annotation of scientific web-pages. The second, longer part of the tutorial covers in turn the most important methods used in three phases of the user-centered design process: requirements gathering, iterative testing of interfaces, and summative evaluation. Participants will be able to practice the use of relevant methods on a small scale with reference to the case study systems. Overall, the presentation will alternate between compact lectures by the instructors (referring to concrete examples) and hands-on work by the participants.

1 Brief Description

1.1 Aims

The goal of this tutorial is to familiarize participants with typical usability challenges in semantic web systems and to give them an overview of—and active experience with—methods for the user-centered design of systems based on semantic technologies.

1.2 Overview of Content

During the first 90 minutes, we will present basic usability concepts, goals and challenges in the context of semantic web technologies. The usability challenges are outlined with respect to the end users of such semantic web systems (not system builders), who can be domain experts, professionals, or lay users. For concreteness, we will refer to two representative case studies with which we are involved, as well as (more briefly) to other relevant semantic web systems. These case studies cover two broad ways of using semantic technologies: for browsing and information retrieval on the one hand and for collaborative knowledge formalization on the other hand:

Case Study 1: Semantically enhanced multimedia access to distributed collections of cultural heritage objects. The MultimediaN E-Culture project (<http://e-culture.multimedien.nl/demo/search>) is a leading semantic web project that won the 2006 Semantic Web Challenge. The main objective of the project is to demonstrate how novel semantic web and presentation technologies can be deployed to provide better indexing and search support within large virtual collections of cultural-heritage resources. There are currently 5 collections and 6 thesauri that are part of the E-Culture demonstrator. The ultimate goal of the project is to provide a systematic approach to the building of a large Semantic Culture Web.

Case Study 2: Collaborative formalization of scientific knowledge in semantic wikis. Project Halo, which has been funded by Vulcan, Inc. since 2002, is a multi-staged effort to create a generally accessible repository of scientific knowledge which is represented richly enough to enable question answering on the level of difficulty exemplified by the Advanced Placement exams that are taken by American high school students each year. One part of this project, being carried out by ontoprise GmbH and AIFB (Karlsruhe, Germany), and DFKI (Saarbrücken, Germany), involves the introduction of interface enhancements for semantic wikis that make it both motivating and efficient for scientists to annotate scientific webpages (such as those found in Wikipedia). In addition to being queried directly, knowledge formalized in this way can be imported into more complex rich modeling systems that are suitable for complex question answering.

During each of the next three tutorial sections of about 90 minutes each, we will introduce the most important methods applied in user-centered interface design and supervise participants as they conduct hands-on exercises with some of these methods.

1.3 Presentation Style

This full-day tutorial will alternate between (a) compact lectures presenting key concepts and methods with reference to concrete examples and (b) hands-on exercises conducted in small groups by the participants with supervision by the instructors.

1.4 Target Audience

The target audience for this tutorial comprises researchers, students, designers, application developers, and project managers who are interested in the design and development of semantic-web-based systems that are highly usable by nontechnical users. Although it is mainly aimed at persons with little background in HCI (human-computer interaction), even participants with such a background may benefit from the examples of application of HCI concepts and methods to systems based on semantic technologies.

1.5 Prerequisite Knowledge

Only a general familiarity with the state of the art in the semantic web field is presupposed.

2 Outline of the Tutorial Content and Schedule

The tutorial will comprise the following four sections:

2.1 Introduction and Overview of Usability Challenges

After a brief preview of the entire tutorial, we will consider in turn a number of general usability challenges that arise with systems based on semantic technologies. For example, with reference to the e-culture prototype we will discuss the general challenge of allowing users who query or browse a semantically based system to take advantage of the ontology that underlies the system without being exposed to most of its details or dealing with it in an abstract way. With respect to the semantic wiki case study, we will discuss ways of motivating users to contribute to knowledge repositories that are useful for a larger community. The participants will be given time to access the two case study systems from their own laptops to get a more active understanding of the points being presented.

Each of the next three sections of the tutorial (lasting about 90 minutes each) will focus on one major phase of the user-centered design process. In each section, we will first introduce the most important concepts and methods in a compact lecture. We will then introduce a relevant hands-on activity that participants can carry out as they work in small groups, each of which will focus on a particular aspect of the interfaces of one of the case study systems. This activity will be short and simple enough to fit into one of the hands-on sessions, but it will convey some essential aspects of the much larger set of applicable methods. For convenience, the participants will use each other as “potential users”, though with more time they would choose more representative potential users.

2.2 User-Centered Requirements Analysis

In this phase of the design process, a designer acquires various types of information about potential users (including their tasks, their goals, and the contexts in which they will use the system), deriving functional and usability requirements for the new interface.

A possible hands-on exercise involves (a) observing a potential user as they interact with the current version of the system and (b) interviewing them to derive requirements for the new interface.

2.3 Iterative Design and Testing

In this phase, new interface ideas are presented to potential users with low- or high-fidelity mockups, and the design is revised on the basis of the users’ feedback. The focus is initially on the high-level design, and it moves gradually to the consideration of interface details.

A possible hands-on exercise for this session is for each group to (a) sketch a design idea for their chosen interface (with pencil and paper or some available drawing tool), (b) get feedback from the available “potential users”, and (c) draw conclusions about necessary interface improvements.

2.4 Summative Evaluation

In many projects, some sort of final evaluation is required that reveals the extent to which the system that has been developed meets the previously formulated functional and usability goals. Since it would be infeasible in a hands-on session to conduct even a small part of such a study, the hands-on work will concern the *design* of such a study, including questions such as the setting in which the evaluation is to be conducted, the dependent variables that are to be captured, and the type of methods to be used for the analysis of the results.

3 Justification of the Tutorial

The past 3 years have seen an exponential increase in interest in user interaction aspects of the semantic web. This interest is reflected, for example, in the series of workshops on user interaction that have been held at the last few international semantic web conferences (e.g., SWUI 2006, the 3rd International Semantic Web User Interaction Workshop, held at ISWC 2006) and the Semantic Web User Interaction (SWUI) mailing list (see <http://swui.semanticweb.org/>). With some exceptions, however, the work in this area has been limited in two ways:

1. *Identification of general usability challenges.* The focus so far in work on interaction design for the semantic web has been on usability *opportunities*: ways in which user interfaces can exploit the power of semantic web technologies to provide a better user experience. With a few exceptions (e.g., the first presenter's keynote at ESWC 2007, available from <http://dfki.de/~jameson/abs/Jameson06ESWC.html>) there has not been much effort to formulate general usability *challenges*: general interaction design problems that need to be solved if systems based on semantic technologies are to be highly usable. A benefit of doing so is that design solutions worked out for one particular system can better be generalized to other systems for which the same challenge arises.

2. *Involvement of users in the design process.* In the field of human-computer interaction, there exists a broad repertoire of methods for involving potential users in all phases of the process of designing interactive systems. These methods have relatively seldom been applied where semantic technologies are involved. In this area, user interaction design tends to be seen as a matter of a designing (presumably usable) interfaces on the basis of assumptions made by the system's designer.

The proposed tutorial aims to help interested participants to overcome these two limitations. We also hope that participants will pass on to colleagues and students some of what they have learned.

4 Hardware and Software Requirements for Participants

Each participant should bring a laptop that has the Mozilla Firefox browser installed. Since the software for the two case-study systems is web-based and internet access will be provided, it will not be necessary for participants to install any software on their laptops.

5 Information on Presenters

Anthony Jameson (<http://dfki.de/~jameson/>, jameson@dfki.de) is a principal researcher at DFKI, the German Research Center for Artificial Intelligence, and adjunct professor for human-computer interaction at the International University in Germany. One of his general goals, reflected in keynote addresses at several international conferences, is to promote the user-centered design of intelligent (and otherwise innovative) user interfaces, including user-adaptive systems, language technology systems, and systems based on semantic technologies. His research that is most directly relevant to the current tutorial has been conducted in the projects SemIPort (2002–2004) and Halo (2004 – present), from which the semantic wiki case study for this tutorial is taken. He has given tutorials (several of them full-day tutorials including hands-on sessions) in the conference series IJCAI, AAAI, CHI, IUI (intelligent user interfaces), UM (user modeling), and AH (adaptive hypermedia). He has taught HCI at universities in most years since 1986.

Lora Aroyo (<http://www.cs.vu.nl/~laroyo>, l.m.aroyo@cs.vu.nl) is an assistant professor at Vrije Universiteit Amsterdam, the Netherlands. She is currently working in several cultural heritage and personalized ambient experience projects, including the CHIP, CHOICE, MultimedienNeCulture, and ITEA Passepartout projects. Her research focus is on applying semantic web technologies for personalized information access and presentation of digital collections and on the evaluation of interactive information systems. Lora has also organized various workshops in the context of the semantic web, personalization, e-learning, and e-culture. Her teaching activities involve courses in information retrieval, HCI, and knowledge-based systems.