

A Concept-Based Approach for the Design of Web Usability Evaluation Questionnaires

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Abstract. Questionnaires are widely used instruments for usability evaluation, but their correct construction is often a complex task since several previous administrations are required to obtain a fine-tuned version of the questionnaire. In this work, we describe a novel approach to design questionnaires that is based on a knowledge representation of the concepts involved in questionnaire-based usability evaluation. As a proof of concept of the model, a prototype has also been constructed, aimed at supplying a guided questionnaire development process especially useful for novel Web designers.

1 Introduction

Nowadays, the usability of Web interfaces is being considered a factor of increasing importance in application development and, therefore, it should be taken into account in all phases of the development life cycle [3], including evaluation in different process stages. In this work we focus on the use of questionnaires [5] in usability evaluation, which are commonly used in this process.

There exist some tools that allow for the construction of generic questionnaires, but there are very few ones focused on usability questionnaires, like Perlman's user interface questionnaire page¹, however, this artifact is exclusively based on predefined standard questionnaires, and it is not possible to guide the evaluators in the definition of the tasks that participants have to perform to carry out the evaluation. In this paper we sketch how the construction of questionnaires can be facilitated using an ontological questionnaire model which allows the development of guided design applications. In contrast with database information storage approaches, the use of ontologies provides flexibility and enables the sharing of own and external model entities instances and also reasoning on them. All these features can give rise to a useful approach for novice Web architects who need a questionnaire to evaluate and to improve the usability of a concrete Web application.

¹ Perlman, G.: Web-Based User Interface Evaluation with Questionnaires. Available at <http://www.acm.org/perlman/question.html>

2 A Questionnaire Model for Usability Evaluation

The model must hold all the entities that take part in the evaluation, and also it must be rich enough to enable some reasoning activities that allows for the construction of a solid questionnaire suitable for the application that the tester wants to evaluate. Focusing on the aim of this paper, the following main model entities must describe: the questionnaire and the questions it includes, the usability attributes, the different functionalities that the application holds, which depend on the kind of Web application and the tasks that are required to be carried out by the participant in the course of the evaluation. The model also includes other terms, some of they described in [2], that enable the representation of all the knowledge needed to carry out a usability evaluation using attitude questions along with opinion or factual-type ones. Figure 1 depicts a conceptual UML diagram that shows the core model entities used in this paper. The `<<ontology_term>>` stereotype is used to denote elements in a richer logic-based conceptualization.

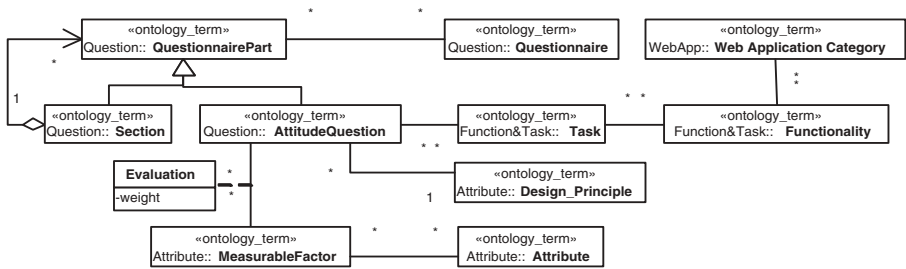


Fig. 1. Core classes of the usability questionnaire model

As we are aimed to design close-ended attitude questionnaires, we represent here exclusively the knowledge about the questions that enable the collection of the user opinion according to his/her personal experience. It would be possible that evaluation participants had never used the application before, so that providing them with a collection of concrete tasks is useful to guide their evaluation process. Each task is aimed at evaluating a specific functionality of the application, and in addition, we have considered that usually each kind of Web application contains a minimum well-defined set of functionalities. Questions are formulated to the user according to the task that he/she has to carry out, so it's possible to adjust the statement text with the performed task.

Another important model section is about the attributes that can be evaluated using the questionnaire. Taking into account the terminology used in [4], a usability attribute can be defined as a system feature that contributes to make the system more easy-to-use. As we have previously exposed, the questionnaires we are modelling are attitude questionnaires, so they enable the acquisition of the user satisfaction measure about the application, and we can't consider that

the results directly reflect a usability attribute but rather they obtain the perception the users have about the attributes. Then we have defined as measurable factor the system feature measure that can be obtained using an attitude questionnaire. These factors can have different impact level on different usability attributes. Only the satisfaction attribute can be directly obtained taking into account the overall questionnaire results. Normally, different questions relate to different measurable factors, and each factor is composed of weighted contributions from the ratings received for its statements.

The model elements are divided in four interrelated ontologies: The *Web applications ontology*, that represents the knowledge about the different kinds of applications available through the Web, the *functionalities and tasks ontology*, that models both the main Web application (or section of the application) elements that enable the more typical functionalities and the task/s that lead the participant to accomplish them, the *attributes ontology*, that represents the knowledge about the usability attributes and the different factors that can be measured using a questionnaire and the *questionnaires ontology*, that models close-ended questionnaire items that can contain different sections — which in turn contain questions — or simply be a sequences of questions. Each question is aimed to contribute in one or more measurable factors (perhaps with different weight) or dialog principles, and it's usual that sections correspond to specific tasks, if more of one are required, or dialog principles.

3 Questionnaire Design Case Study

To prove the usefulness of the questionnaire model based on ontologies we have developed a prototype that guides the questionnaire design process through a number of sequential steps (a “wizard”). The information requested in the different phases of the design process doesn't require a thorough knowledge about usability evaluation, so, this approach can be considered a tool specially useful for novice information architects and Web designers. In order to determine the tasks that the test respondents have to complete, the first step is the specification of the application type. The Web application ontology supports this process. It allows the questionnaire designer to navigate in the ontology to find the most appropriate, until no more subclasses of selected terms are found.

Once the application type is specified, the wizard shows the elements that this kind of systems usually include to support their more typical functionalities. The tool retrieves the elements using the semantic relationships defined among terms of Web application ontology and functionality and task ontology, such as the displayed elements are associated with the selected application type or its ancestors and are subsumed by high-level **functionality-element** term defined in the functionality and task ontology.

In the basis of the previously selected elements, tasks that guide the participants are retrieved using the relationships among the terms of the functionality and task ontology. In the third step of the construction process the designer is required to introduce such specific items as the tasks require using other on-

tology terms, in order to complete meaningfully their statement. The use of a knowledge representation like the functionality and task ontology also enables some other reasoned behaviors like the establishment of pre-required tasks, in addition to the ones derived from other ontology features like the subsumption.

Using the questionnaire ontology and before tasks are confirmed, the questionnaire is displayed and the designer can make use of it. The attribute ontology is built so that a generic default attribute list that covers the other ones exists, and both the questions and evaluation are selected and carried out according to it.

4 Conclusions and Future Work

In this work we have described a new approach to design usability attitude questionnaires. The approach is based on a knowledge representation of a questionnaire which includes four different ontologies: questionnaire, attribute, functionality and task and Web application.

The use of a well-defined ontological model enables the development of different applications like a guided construction of questionnaires and also the shallow reasoning on the model and its instances, which is applicable in our current case study in the selection of the task and the presentation/performance order in which they have to be carried out. An another important advantage derived from the questionnaire model definition is that of enabling the representation and storage of all necessary data to subsequently apply artificial intelligence techniques that optimize and enhance several process in the usability evaluation, like those described in [1].

Further evaluation would be needed for a detailed account of the benefits of the proposed tool. In addition, the Web application taxonomy should be extended to obtain a more comprehensive coverage of the current variety of Web applications.

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