Examining the Quality in Use of Web 2.0 Applications: A Three-Dimensional Framework

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Abstract. Quality in use plays an essential role in a wide acceptance of software applications. It includes two complementary concepts: usability and user experience. With an aim to assure the quality in use of websites, researchers have proposed various metrics, but without guidelines for their use. Additionally, research on this topic in the context of Web 2.0 applications is fairly modest. In this paper, we introduce a framework composed of three dimensions related to categories of the quality in use, functions of Web 2.0 applications, and agile software development methods. The proposed framework can be used for the classification of metrics as well as for a sound and systematic evaluation of the quality in use of Web 2.0 applications.

Keywords: Web 2.0, Quality in Use, Evaluation Framework.

1 Introduction

More recently, quality in use has been recognized as an essential property of successful websites. Development of a methodology for ensuring the quality in use is therefore one of current research objectives of the HCI community. Although literature on evaluation of websites offers a number of diverse metrics, guidelines for their use are fairly scarce. With an aim to address this problem, Ramler et al. [9] suggested a generic cube scheme in which they considered quality aspects, website features, and lifecycle phases as three basic dimensions for evaluating website quality. Following their idea, Ruiz et al. [10] developed a three dimensional web quality model (WQM) meant for the classification of web metrics [2].

There are two main reasons why the aforementioned models, although useful for the assessment of websites, are not suitable for the evaluation of Web 2.0 applications. Firstly, dimensions on web features and quality aspects are exclusively intended for the product-centered usability evaluation while the hedonic-based assessment of user experience is neglected. Namely, the evaluation of Web 2.0 applications should take into account both pragmatic and hedonic facets of the quality in use [5]. Secondly, the lifecycle dimension encompasses diverse phases in a website

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monolithic release which is specific for the waterfall approach to software development. Conversely, the perpetual beta as a core design pattern [3] of Web 2.0 applications enables user driven release of new features during iterative lifecycle and is supported by agile development philosophy.

With an objective to facilitate the assessment of Web 2.0 applications, we introduce a framework that distinguishes three dimensions concerning categories of the quality in use, functions of Web 2.0 applications, and agile software development methods. The proposed framework is illustrated in Figure 1, while each of its dimensions is explained in the following section.

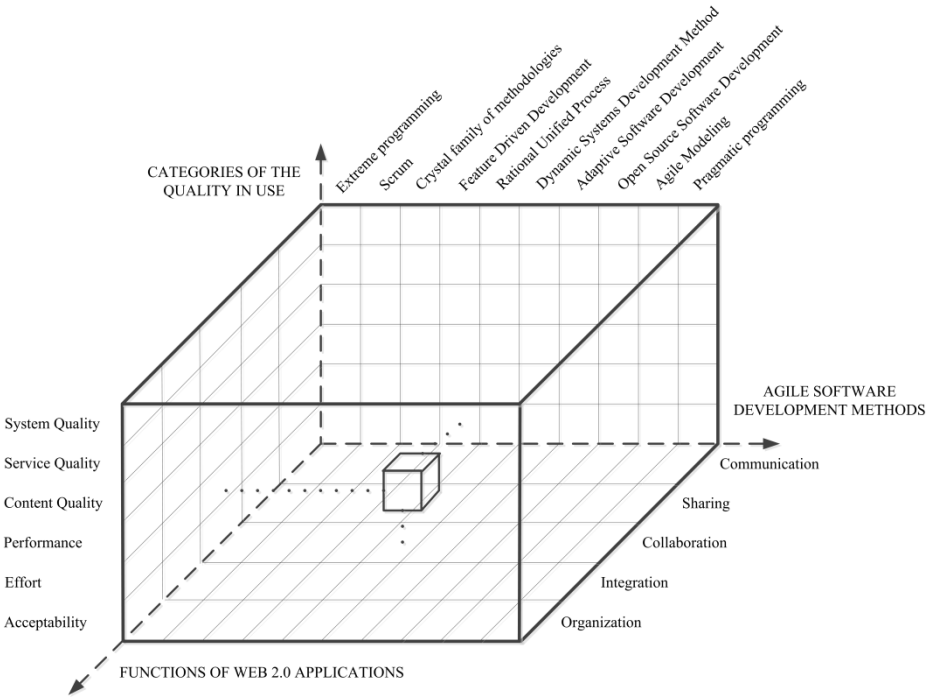

Fig. 1. Graphic representation of the framework

2 Dimensions in the Framework

2.1 Categories of the Quality in Use

As a foundation for the description of the dimension which addresses categories of the quality in use, we use six crucial categories aimed for evaluating the quality in use of Web 2.0 applications: System Quality, Service Quality, Content Quality, Performance, Effort, and Acceptability [4]. Both reliability and validity of the set forth categories were empirically validated in the context of Web 2.0 applications for collaborative writing [6] and mind mapping [8]. To enable fine-grained assessment of various facets of the quality in use, each category is further refined into measurable attributes.

System Quality refers to the attributes that measure the quality of a web application as a system and is comprised of six attributes: *navigability* (extent to which web interface features are well organized and various navigation mechanisms are provided), *consistency* (degree to which the same structure, design, and terminology are used throughout the web application), *aesthetic* (degree of visual attractiveness of a web interface design), *familiarity* (extent to which interaction with the web application is similar to previously used applications), *customizability* (degree to which a web application can be customized to meet users' needs and suit the characteristics of the task), and *security* (degree to which a web application contains functionalities and mechanisms that protect data from unauthorized use).

Service Quality refers to the attributes that measure the quality of interaction between the web application and users. This category is further decomposed into eight attributes: *helpfulness* (extent to which various forms of help are available and useful), *availability* (degree to which a web application and interface features are continuously available), *interactivity* (extent to which a web application creates the feeling of use of a desktop application and contains functionalities that facilitate different types of interaction among users), *error prevention* (degree to which a web application prevents the occurrence of errors and provides the features for their correction), *reliability* (extent to which a web application is dependable, stable, and bug-free), *recoverability* (extent to which a web application can recover from errors and operational interruptions), *responsiveness* (extent of the speed of a web application's response to users' requests and actions), and *feedback* (extent to which a web application appropriately displays messages and notifies the user about its status or progress of the task at hand).

Content Quality can be viewed from two different aspects. The first one is the quality of information that is located or displayed on a website, while the second one encompasses the quality of the content that is the result of using a web application. Content Quality is measured with five attributes: *correctness* (degree to which the content is correct, accurate, and valid), *coverage* (degree to which the content is complete, displayed clearly, and appropriately represented), *credibility* (degree to which the content is unbiased, trustworthy, and verifiable), *timeliness* (degree to which the content can be supplemented, modified, and updated), and *value-added* (degree to which the content is advantageous and contributes to making new decisions).

Performance refers to the attributes that measure the quality of tasks execution using the web application, including *effectiveness* (extent to which tasks can be executed accurately and completely by using the web application), *usefulness* (extent to which using the web application improves the user performance in task execution), and *efficiency* (extent to which the task execution using the web application saves resources).

Effort refers to the attributes that measure the effortlessness of the web application use. It is comprised of eight attributes: *minimal action* (the perceived amount of keyboard- and mouse-assisted motor activity required to complete a task), *minimal memory load* (the perceived amount of mental and perceptive activity required to

complete a task), *accessibility* (extent to which the web application can be used by people with the widest range of characteristics and capabilities), *controllability* (extent of ease to make the web application do what the user wants), *ease of use* (extent to which interaction with the web application is free of effort), *learnability* (degree to which it is easy to learn to use the web application), *memorability* (degree to which it is easy to remember how the web application is used and where particular interface features are located), and *understandability* (extent to which interface functionalities are clear and unambiguous to the user).

Acceptability refers to the attributes that measure likeability and behavioral intentions related to the web application usage, including *playfulness* (extent to which the use of web application holds the users' attention and stimulates their imagination), *satisfaction* (extent to which the web application use meets user's expectations) and *loyalty* (extent to which the user is willing to continue to use the web application or recommend it to others).

2.2 Functions of Web 2.0 Applications

By introducing the dimension which deals with the functions of Web 2.0 applications, we are considering the fundamental functions of Web 2.0 applications: Communication, Sharing, Collaboration, Integration, and Organization [7]. Each Web 2.0 application can be assigned to the function that best describes its purpose. However, we must emphasize that Web 2.0 applications are not necessarily restricted to a single function. For instance, cloud based office suites can be employed for collaboration on document authoring, communication during document creation, and dissemination of created document. On the other hand, wikis enable users to collaborate on joint projects and integrate shared artifacts.

Communication refers to (i) web applications meant for synchronous or asynchronous interaction (e.g. audio and video forums, microblogs, or instant messengers), and (ii) web applications that provide a feature for communication between users (e.g. chat in a social network or virtual world). *Sharing* encompasses web applications (e.g. social networks and social bookmarking sites) that enable users to disseminate diverse types of artifacts, including photos, podcasts, documents, social bookmarks, etc. *Collaboration* includes web applications such as wikis and cloud based office suites where users work jointly with the aim to reach a common goal. *Integration* refers to web applications (e.g. wikis, blogs, e-portfolios, and mashups) that allow users to generate a repository of created artifacts. *Organization* includes web applications intended for visual representation of information (e.g. mind mapping and diagramming services) as well as web applications (e.g. podcasting services) that allow users to edit or combine previously created artifacts.

2.3 Agile Software Development Methods

The dimension which addresses agile software development methods encompasses diverse agile methods that can be used for the development of Web 2.0 applications such as Extreme programming, Rational Unified Process, Dynamic System Development

Method, Open Source Software Development or Agile Modeling [1]. The main reasons why agile methods are more appropriate for developing Web 2.0 applications than traditional methods are small releases with rapid cycles, adaptability, and collaboration among stakeholders. Adoption of the particular method depends on the size of development team, support for certain lifecycle phases, and type of Web 2.0 application.

3 Conclusion

The contribution of the proposed framework is twofold. Firstly, it can be used for the classification of both subjective and objective metrics thus providing guidance for their effective employment during the evaluation. Secondly, it can be applied for a sound and systematic assessment of the quality in use of Web 2.0 applications. In order to ensure that all important aspects of the introduced dimensions are appropriately considered, our future work will be focused on the refinement, revision, and validation of the introduced framework.

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