Chapter 27
Usability Evaluation Methods:
A Systematic Review

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ABSTRACT

This chapter aims to identify, analyze, and classify the methodologies and methods described in the literature for the usability evaluation of systems and services based on information and communication technologies. The methodology used was a systematic review of the literature. The studies included in the analysis were classified into empirical and analytical methodologies (test, inquiry, controlled experiment, or inspection). A total of 2116 studies were included, of which 1308 were classified. In terms of results, the inquiry methodology was the most frequent in this review, followed by test, inspection, and finally, the controlled experiment methodology. A combination of methodologies is relatively common, especially the combination of test and inquiry methodologies, probably because they assess different but complementary aspects of usability contributing to a more comprehensive assessment.

INTRODUCTION

The Human Computer Interaction is a research area that results from the convergence of several disciplines, including cognitive science, software engineering and human factors engineering (Carroll, 2013). Research and practice in this area emerged in the early 80's of last century, originally integrated as a sub-specialty of computer science and, ever since, expanded on an ongoing basis, attracting professionals from many other disciplines, and incorporating diverse concepts and approaches (Carroll, 2013).

The research related with Human Computer Interaction, which seeks to minimize the effort of users and simultaneously to provide a wide range of functions, is being influenced by a broad set of trends arising from various technological developments, namely (Vanderheiden & Henry, 2001): increasing capacity of the communication infrastructures, extension of the wireless communications, multimedia integration, multimodality and mobility, increasing use of technologies that enable the miniaturization of the terminal equipment, the growing importance of portable devices that combine multiple functions (*e.g.*

calculus, telephone or internet access), increasing importance of services customization considering different systems and different contexts, gradual release of the screen and keyboard interactions, and advances in a broad range of knowledge areas (*e.g.* computational linguistics, artificial vision, artificial intelligence or speech recognition) that provide new interaction mechanisms.

All these technological developments have led to the recognition of human-computer interaction as an interdisciplinary scientific area (Carroll, 2013), within which the issues related to usability are of great importance in terms of research efforts.

In addition to this Introduction, the present paper is composed of more six sections: Usability, Usability Evaluation Methods, Methods, Results, Discussion, and Conclusion.

USABILITY

The concept of usability was originally articulated naively in the slogan 'easy to learn, easy to use' in the 80's of the last century. This term was often used to refer to the capability of a product to be easily used. This corresponds to the definition of usability as a software quality in ISO 9126-11: 'a set of attributes of software which bear on the effort needed for use and on the individual assessment of such use by a stated or implied set of users' (Carroll, 2013).

During the 90's, more sophisticated understandings of usability shifted from an all-or-nothing binary property to a continuum spanning of different extents of usability. Usability turned to be about supporting users in achieving their goals, and not only the user interaction characteristics (Cockton, 2013). According to ISO 9241-11, usability is the extent to which a system or service may be used by specific users in a given context of use, to achieve particular goals with efficiency and effectiveness, while promoting feelings of pleasure (Nielsen, 2003; ISO, 1999).

Current understanding of usability is thus different from the early days of HCI in the 80's. Usability now often subsumes qualities like fun, well-being, collective efficacy, aesthetic tension, enhanced creativity, support for human development, and many others. Usability is part of a broader concept, user experience (Nielsen & Norman, 2013), that, according to the definition of ISO 9241-210 (ISO, 2010), includes all the user's emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after the interaction.

Gualtieri (2009) argues that a good user experience should be useful - users must accomplish their goals; usable - users should be able to achieve the goals, performing tasks with minimal effort; desirable - should appeal the emotions of the users. User's desires are influenced by aspects such as image, language, aesthetics, fun and sophistication (these are the aspects that allow emotional involvement and make brands stand out from their competitors) (Gualtieri, 2009).

Even so, usability remains important. The value of the recent widening focus to user experience is that it places usability in context. Usability is no longer expected to establish its value in isolation, but is instead one of several complementary contributors to design quality (Cockton, 2013).

These recent focus on quality in use and user experience makes it clear that the design of interactive systems cannot just consider the features and attributes of the systems. Instead, the designers must focus on the interaction of users and software in specific settings. They cannot reason solely in terms of whether software is inherently usable or not, but instead they must consider what does or will happen when systems are used, whether successfully, unsuccessfully, or some mix of both. Once the designers focus on interaction, a wider view is inevitable, favoring a broad range of concerns over a narrow focus on software and hardware features (Cockton, 2013).

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