Obstacles for the Integration of HCI Practices into Software Engineering Development Processes

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INTRODUCTION

Usability has become a critical quality factor in software systems, and it has been receiving increasing attention over the last few years in the SE (software engineering) field. HCI techniques aim to increase the usability level of the final software product, but they are applied sparingly in mainstream software development, because there is very little knowledge about their existence and about how they can contribute to the activities already performed in the development process. There is a perception in the software development community that these usability-related techniques are to be applied only for the development of the visible part of the UI (user interface) after the most important part of the software system (the internals) has been designed and implemented.

Nevertheless, the different paths taken by HCI and SE regarding software development have recently started to converge. First, we have noted that HCI methods are being described more formally in the direction of SE software process descriptions. Second, usability is becoming an important issue on the SE agenda, since the software products user base is ever increasing and the degree of user computer literacy is decreasing, leading to a greater demand for usability improvements in the software market. However, the convergence of HCI and SE has uncovered the need for an integration of the practices of both disciplines. This integration is a must for the development of highly usable systems.

In the next two sections, we will look at how the SE field has viewed usability. Following upon this, we address the existing approaches to integration. We will then detail the pending issues that stand in the way of successful integration efforts, concluding with the presentation of an approach that might be successful in the integration endeavor.

Traditional View of Usability in Software Engineering

Even though usability was mentioned as a quality attribute in early software quality taxonomies (Boehm, 1978; McCall, Richards, & Walters, 1977), it has traditionally received less attention than other quality attributes like correctness, reliability, or efficiency. While the development team alone could deal with these attributes, a strong interaction with users is required to cater for usability. With SE's aim of making the development a systematic process, the human-induced unpredictability was to be avoided at all costs, thus reducing the interaction with users to a minimum.

The traditional relegation of usability in SE can be acknowledged by observing how interaction design is marginally present in the main software development process standards: ISO/IEC Std. 12207 (1995) and IEEE Std. 1074 (1997). The ISO 12207 standard does not mention usability and HCI activities directly. It says that possible user involvement should be planned, but this involvement is circumscribed to requirements setting exercises, prototype demon-

strations, and evaluations. When users are mentioned, they play a passive role in the few activities in which they may participate. The IEEE standard 1074 only mentions usability in connection with UI requirements and risk management. Neither of the two standards addresses any of the activities needed to manage the usability of the software product.

Recent Changes Regarding Usability Awareness

There has been a noticeable shift in the attention paid to usability in the SE field in recent years, since important overlapping areas have been identified in the SWEBOK (Guide to the Software Engineering Body of Knowledge) (IEEE Software Engineering Coordinating Committee, 2001), for example, which is an effort to gather what is considered commonly accepted knowledge in the SE field. The SWEBOK requirements engineering knowledge area includes some techniques that are not identified by the authors as belonging to HCI, but they are indeed standard HCI techniques: interviews, scenarios, prototyping, and user observation. Additionally, good communication between system users and system developers is identified as one of the fundamental tenets of good SE. Communication with users is a traditional concern in HCI, so this is an overlapping area between HCI and SE. Usability is mentioned as part of the quality attributes and highlighted in the case of high dependability systems. It is also mentioned with regard to the software testing knowledge area. The work by Rubin (1994) is listed as part of the reference material for usability testing.

The approval of Amendment 1 to standard ISO/IEC 12207 (ISO/IEC, 2002), which includes a new process called Usability Process, by the ISO in 2002 represented a big change regarding the relevance of usability issues in the SE field. With the release of this amendment, the ISO recognized the importance of managing the usability of the software product throughout the life cycle. The main concepts in a human-centered process, as described in the ISO 13407 standard (1999), are addressed in the newly created usability process. The approach taken is to define in the usability process the activities to be carried out by the role of usability specialist. Some activities are the sole responsibility of the usability specialist, while others are to be applied in associa-

tion with the role of developer. The first activity in the usability process is 6.9.1, Process implementation, which should specify how the human-centered activities fit into the whole system life cycle process, and should select usability methods and techniques. This amendment to the ISO/IEC 12207 standard highlights the importance of integrating usability techniques and activities into the software development process.

The fact that an international standard considers usability activities as part of the software development process is a clear indication that HCI and usability are coming onto the SE agenda, and that integrating HCI practices into the SE processes is a problem that the software development community needs to solve quite promptly.

BACKGROUND

This section details existing integration proposals. We will only consider works that are easily accessible for software practitioners, that is, mainly books, since average software practitioners do not usually consider conference proceedings and research journals as an information source.

Only a few of the numerous HCI methods give indications about how to integrate the usability activities with the other activities in the overall software development process. Of these works, some just offer some hints on the integration issue (Constantine & Lockwood, 1999; Costabile, 2001; Hix & Hartson, 1993), while others are more detailed (Lim & Long, 1994; Mayhew, 1999).

Hix and Hartson (1993) describe the communication paths that should be set up between usability activities (user interaction design) and software design. They strictly separate the development of the UI from the development of the rest of the software system, with two activities that connect the two parts: systems analysis and testing/evaluation. The systems analysis group feeds requirements to both the problem domain design group and the user interaction design group. It is a simplistic approach to HCI-SE integration, but the authors acknowledge that "research is needed to better understand and support the real communication needs of this complex process" (p. 112).

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