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Testing Interactive Software: A Challenge for Usability and Reliability

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Abstract

Recent years have seen an increasing use of sophisticated interaction techniques including in the field of safety critical interactive software [8]. The use of such techniques has been required in order to increase the bandwidth between the users and systems and thus to help them deal efficiently with increasingly complex systems. These techniques come from research and innovation done in the field of human-computer interaction (HCI). A significant effort is currently being undertaken by the HCI community in order to apply and extend current usability evaluation techniques to these new kinds of interaction techniques. However, very little has been done to improve the reliability of software offering these kinds of interaction techniques. Even testing basic graphical user interfaces remains a challenge that has rarely been addressed in the field of software engineering [9]. However, the non reliability of interactive software can jeopardize usability evaluation by showing unexpected or undesired behaviors. The aim of this SIG is to provide a forum for both researchers and practitioners interested in testing interactive software. Our goal is to define a roadmap of activities to cross fertilize usability and reliability testing of these kinds of systems to minimize duplicate efforts in both communities.

Keywords

Software testing, Usability, Reliability Safety critical systems, Human Error.

ACM Classification Keywords

Interactive systems (I.5.5) Interfaces (B.4.3) Human safety (K.4.1), Reliability (D.2.4), User interfaces (D.2.2).

Introduction

Graphical User Interfaces have changed the underlying paradigm of interaction between users and interactive systems. With their advent, control is left in the hands of the users, providing them with the maximum freedom for triggering commands or entering data. This is made possible by the event based nature of such systems and the fact that input devices provide a large interaction space for triggering those events. However, when it comes to addressing the reliability of such interactive software, testing techniques available in the field of software engineering do not apply. Indeed, the test space is very large, making it impossible to produce reasonable test coverage. Especially with direct manipulation interaction techniques, the effect of the action cannot be presented to the user before a long sequence of events (such as, for instance, when dragging a file to the Trash icon) has been performed. However, reliability of the interactive software is a prerequisite for its usability as undesired behaviors will jeopardize users' performance and increase frustration.

Recent studies in the field of HCI have shown that goal-based and task-based testing provide more useful results than other testing techniques based on heuristics or user interface structure [6]. The aim of this SIG is to bring together specialists in the field of

usability evaluation techniques in order to address both usability and reliability on the same level. We believe that usability evaluation techniques could provide a good basis for improving testing techniques of interactive systems by, for instance:

- Providing a means of assessing the expected state of the user interface after a sequence of events has been performed
- Providing an abstract representation of the user goals and tasks (e.g., through task modeling techniques) to provide insightful and relevant testing sequences
- Storing tested sequences and user feedback by exploiting information gathered in usability tests in labs and in real environments for reliability purposes
- Reducing the duplication of effort currently performed by two usually loosely connected teams, namely software development and usability testing teams

Similarly, engineering techniques could support usability testing by, for instance, reusing information from incidents and accidents in order to prevent them from reoccurring in an improved version of the system.

Related Events

At CHI 98 we organized a workshop on "Designing User Interfaces for Safety Critical Systems" [10]. Even though the workshop was successful, almost no work in this area has been presented at CHI since then. At CHI 2004 we organized a SIG on "Safety-Critical Interaction: Usability in Incidents and Accidents" in order to take the opportunity of having CHI organized

in Europe to attract participation from European research centers and practitioners involved in this field [11]. As a possible consequence Safety was one of the highlights of CHI 2005 conference (with the motto Technology, Safety, Community) and we believe that this SIG will be a good opportunity to pursue in that direction. At CHI 2005 we also organized a SIG on the role of HCI for the next generation of control rooms [4]. We plan to reuse this application domain [5] and other connected ones (such as aircraft cockpits [2] and air traffic control workstations [1]) and learn from other application domains where reliability testing is less prominent (e.g., interactive TV [3]). The SIG organizers have significant experiences in these application domains, and they will discuss similarities and differences to foster participation from the audience.

Audience

One of the goals of this SIG is to identify and gather people interested in the field of human-computer interaction for safety critical systems, software engineers interested in the reliability and usability of interactive systems, as well as researchers interested in the maturation of usability evaluation methods. We foresee the following types of participants:

- Practitioners who work in the design, construction testing and certification of safety critical interactive systems. We welcome both practitioners coming from the engineering side of interactive systems as well as practitioners with a background in user interface usability testing.
- Academics working or interested in the state of the art and research activities in the field of usability and reliability testing.

The audience would be approximately 50-150 professionals and academics interested in how to improve both usability and reliability of interactive systems by addressing testing techniques within a unifying framework.

SIG Organization

The activity plan for the SIG is as follows:

- Introduction of the SIG goals and participants (10 minutes);
- Presentation by the organizers of issues in the various fields related to the topic of the SIG (5 minutes per topic), namely software engineering test techniques for reliability, HCI test techniques for usability, incident and accident analysis and reporting as a source of test sequences (total 20 minutes)
- Gathering from the audience (as well as presenting from the SIG organizers' experience) significant examples of usability testing failing because of the low level of reliability of the interactive systems (10 minutes). These examples will be taken from the application domains selected for the SIG and presented above
- Interactive discussion with participants to list the issues related to interactive systems' usability testing in order to inform interactive software testing. The relevant usability evaluation techniques will be discussed. Those that seem more important will be selected, and comments on the solutions will be recorded (30 minutes).
- Interactive discussions on the issue of new interaction techniques (Post-WIMP, multimodal, ...) and the issues they raise, both in terms of usability

and reliability testing. How can we use results from various areas of usability testing to improve and support reliability when faced with these new interaction techniques [7]? (10 minutes)

- Discussions on future plans and, in particular, how to increase CHI community interests in the reliability side of interactive systems design. Similarly, future plans will be discussed on how to increase software engineering community involvement in building reliable interactive systems. (10 minutes)

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