Developments

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Introduction

User-centred design (UCD) investigates design principles for those who are responsible for developing interactive software solutions. It places a special emphasis on the need to develop software that is usable, i.e., effective, efficient, and satisfying to use. It has been suggested that the way to achieve these qualities is to adopt a user-centred approach to software design and development. This approach normally involves a number of key activities throughout the development of the software including involving users, obtaining their feedback on the design and use of the system, providing prototypes for users to try out and re-designing in the light of user feedback and comments. The benefits of this approach include increased productivity, enhanced quality of work, reductions in support and training costs, and improved user health and safety. Adopting a UCD process leads to more usable systems and products. It reduces the risk that the resulting system will under-deliver or fail.

We differentiate between two views in UCD research: (1) the product view and (2) the process view.

The product view

Product-oriented research (the product view) deals with generating generic and substantive knowledge for user-centred design. The main activity in this research line is the development of a theoretical framework of user-system interaction styles.

An interaction style characterizes the ‘look and feel’, or appearance and behaviour, of a product. The characteristic properties can be defined at the level of the kind of operation, the interaction structure, and the input/output technique. For example, a user can make a selection (kind of operation) from a hierarchical menu (structure) presented on a screen (output technique) using a mouse (input technique). We can improve user-interface specifications based on a better definition of the characteristic properties of interaction styles. With a better understanding of the strengths and weaknesses of different interaction styles, we can conduct more targeted usability evaluations.

One important factor is that different users form different conceptions or mental models about their interactions and have different ways of learning and retaining knowledge and skills (different ‘cognitive styles’). In addition, cultural and national differences play a part. Another research topic is that user interaction styles change rapidly, thus offering new interaction possibilities to which previous research findings may not apply. Finally, user preferences change as users gradually master new interfaces.

The short-term goals of this research are to find out how to apply human factors knowledge to the design of interactive systems. The medium-term goals are to generate generic and substantive human factors knowledge for the design of interactive systems.
The long-term goal of this research line is to contribute to the development of the next generation of user-interface concepts.

The process view

Generally, the process view covers all methodological issues of a user-centred design approach and is characterized by the following:

1. An appropriate allocation of function between user and system.
2. Iteration of design solutions (incl. evaluation).
3. The active involvement of users (incl. participatory design).
4. Multi-disciplinary design teams (incl. design sessions).
5. Evaluation of the running system (incl. usability testing).

The main cost to achieve the benefits of user-centred design following this process view is that the manager's task initially appears more difficult. Project planning has to allow for the iteration and incorporation of user feedback loops into the whole system's life-cycle. More time is also required for effective communication between design team participants and for reconciling potential conflicts and trade-offs. However, project managers will benefit from the additional creativity and ideas from an extended development team and skill base. In addition, informal communication and discussion of usage issues early on in the project result in a better design and significant savings at later stages when changes are more costly.

The short-term goals are to develop tools for the five aspects of this research line (see above). The mid-term goals are to find the links between the outcomes of the 'product view' research line and their incorporation into the system's life-cycle. The long-term goal is to find ways of best practice for system development.

Focus of the product view

The product view of the UCD programme focuses on the study and development of prototypes for new interaction styles that improve the quality of user-system interactions. Further descriptions of the principles of user-centred design for this product view are provided in several textbooks about Human-Computer Interaction (HCI), in several collections of guidelines, and in some national and international norms and standards.

Focus of the process view

The process view of the UCD programme focuses on the study and development of methods, techniques and tools that improve the quality of product specifications and evaluations. Requirements analysis is the process of determining what is required of a future system or product. This may be a computer-based system for a particular customer or a product to be launched onto the open market. This document uses the term 'system' to cover all classes of application including large-scale computer-based systems, software packages and stand-alone electronic products. A further description of the principles of user-centred design for the process view is provided in the ISO 13407, User-Centred Design, ISO Draft Standard.
Projects

Support for user-centred design
This research is aimed at improving support for user-centred design. It combines a theoretical and a more applied path. As part of the theoretical path, a literature survey was conducted to examine the underlying assumptions behind some design approaches that advocate user involvement. Based on the survey, an overview was made of the similarities and differences between five of these design approaches. As part of the applied path, a pilot study was conducted to explore the influence of variations in a design technique for task analysis on the outcome of using the technique. Another aim of the pilot was to explore research methodology issues concerning the evaluation of design techniques.

Usability evaluation of voice-operated information services (NWO-TST: Human factors)
On the basis of an inventory of the literature, various unanswered research questions in the area of spoken dialogue systems evaluation were identified, such as ‘Which usability problems deserve priority?’ and ‘How are subjects’ preferences associated with system performance measures and system characteristics?’. To answer some of these questions, an exploratory, comparative study was carried out, in which 20 subjects queried two systems via telephone on a number of train journeys. The systems differed in verification strategy, utterance length, and speech output (synthetic vs. concatenated speech). Though the performance of both systems does not differ significantly, users have a clear preference for the system with the most pleasant voice.

Choice and value elicitation of complex technical systems
In this PhD project a literature survey on decision making and judgment was made first. From this survey, some research questions arose that were tested in three small experiments. The project then centred on a comparison of positive and negative evaluative judgments (e.g., ‘choice’ versus ‘rejection’, ‘pleasure’ versus ‘displeasure’). These evaluations are linked with positive and negative attributes of the systems. Negative attributes seem to have greater impact on choices and judgments than positive attributes. Since modern technology both shows major benefits as well as some serious drawbacks, the present study can offer some fundamental knowledge concerning evaluative studies that can be used to investigate these technologies.

Is usability compositional?
Architectures for user-system interaction describe how a user interface can be constructed in a modular way. Elementary interaction components form the basis for complex interaction components. These compounded interaction components are used to create even higher-level interaction components, on top of which the entire user interface can eventually be built. The aim of this PhD project is to study the usability of the constituent components of the interface separately, and to assess their contribution to the usability of the total interface. More in particular, the specific aims are: (a) to develop observational evaluation techniques for measuring usability (effectiveness, efficiency, and learnability) of interaction components at various levels of abstraction and (b) to determine how the usability of higher-level interaction components is influenced by the usability of their supporting lower-level interaction components.