MIDDLESEX UNIVERSITY, INTERACTION DESIGN CENTRE

ABSTRACT

We present the work of the Middlesex University IDC. Our main interest is in the theoretically grounded development and evaluation of interactive systems. We focus on 3 application areas: digital libraries, distributed cognitive systems, and design for all. We use these as complex exemplars to test and validate usability evaluation techniques and as research areas in their own right.

Keywords

Interactive system evaluation, formal modelling, digital libraries, design-for-all, distributed cognition.

1. INTRODUCTION

The Interaction Design Centre (IDC) was established in 1996. It currently consists of 16 full-time academics, 2 Research Fellows and 11 PhD students. The main focus of our work concerns the development and evaluation of novel, theoretically grounded interaction design techniques for specific application areas. Initially we have been concerned with usability, but are increasingly interested with wider aspects of user experience. We investigate how underlying theory can be turned into practical evaluation approaches appropriate for application areas of concern.

We have strength in evaluation approaches from two diverse background. We have particular expertise in the area of formal/semi-formal modelling approaches. In contrast, we also have a focus on methods for investigating social and cultural aspects of interaction design based on rigorous research methodologies from the social sciences. We work with a wide range of commercial, interest group and university partners, currently including: BT, ENAV (the Italian Air Traffic Control Agency), RNIB, NHS hospitals, UCL, the University of Cambridge, Waikato University and Otago University.

2. EVALUATION TECHNIQUES

2.1 Formal and Semi-formal Modelling

A particular focus of our work has been on the use of formal and semi-formal evaluation approaches. The most formal approach developed has been in the area of user error. Paul Curzon, working with Ann Blandford, has developed adapted formal hardware verification techniques to the area of interaction design. This work was inspired by Richard Butterworth's earlier work on Programmable User modelling. In addition to the computer system and its interface, the user of a system is formally modelled as part of the system being verified. The work focuses on modelling the underlying error genotype (the cognitive cause) rather than the phenotype (the erroneous actions) giving greater explanatory power. A novel aspect of the work is that a new user model does not need to be hand-crafted from scratch for each new system. A verification methodology around machine-checked proof has been developed. It has also been shown how the formal model can be used as the theoretical underpinning for lightweight uses of formal methods, outside the design cycle, justifying design rules [5].

Hanna Stelmaszewska applied the EMU methodology (a semi-formal evaluation technique for multi-modal systems) to Musical Digital Libraries [3]. Recommendations resulting from this are being incorporated into a redesign of the NZ Digital Library Music Collection.

2.2 Social and Cultural Issues and Approaches

We are also concerned with social and cultural aspects of the usability of interactive systems. This work extends our interest beyond usability to wider aspects of the user experience. We use ethnographical studies and rigorous qualitative social science approaches, such as Grounded Theory, in the investigation of the wider issues surrounding the use of interactive systems. Elke Duncker, for example, in collaboration with Waikato University,

studied problems with the library metaphor of Digital Libraries for Maoris [6]. She showed, using ethnographical approaches, that the use of the library metaphor raises cultural barriers that inhibit the degree to which Maoris are willing to use digital archives. This is despite there being great interest in such archives and there being reasons to suppose that their cultural background might predispose Maoris to prefer digital libraries.

Several projects are concerned with cross-cultural studies. Sara Gwynn is studying how, across different cultures, changes in work practices are induced by the introduction of electronic journals**Error! Reference source not found.**. Shifts at all levels have been observed. Disciplinary and professional culture also supersedes national/ethnic culture. Continuing this theme, Elke Duncker is concerned with how the introduction of electronic patient records in hospitals changes work practices. Ming Nie is looking at how culture affects the usage of distance learning material in Higher Education.

An example of the way the group's interests extend beyond usability is in the work of PhD student John Salisbury'. He is investigating what makes an engaging interactive game experience. He is eliciting the factors that differentiate an engaging experience from an un-engaging one.

3. COMPLEX APPLICATION AREAS

3.1 Digital Libraries (DLs)

Digital Library research is the group's strongest application area. We have a close collaboration with the University of Waikato and provide a mirror site for the New Zealand DL. The IDCs George Buchanan, in addition to his work on mobile ubiquitous computing, is involved in the development of the Greenstone DL software.

Suzette Keith, funded by EPSRC, is investigating the potential for known usability evaluation techniques to identify the usability issues of DLs. The BT Digital Library is being used as an environment to develop an understanding of users' and developers' needs. The strategies of experts conducting a search utilising multiple iterations highlights the difficulties faced by less skilled users who lack strategies to use search refinement tools. Modifications are being made to the usability evaluation methods, particularly to Claims Analysis, to incorporate an understanding of the information seeking task[8]. This relates to PhD student, Ravinder Bhogal's work. He is developing an information foraging model that takes the user's context into account as well as the intimate relationship between the foraging process and the realisation stages of information need [2].

Richard Butterworth is leading an investigation into the digitisation of small-museum collections. An initial pilot project identified various issues. For small specialist museums, the librarian plays a central role in the interaction of users with the library. Furthermore small museums do not have the resources to undertake massive up-front digitisation projects. They also have a wide and often unknown user base, utilising the resources in wide and unknown ways. A novel methodology has been developed that keeps the librarian central to the way users interact with the library whilst developing the digital resources in a user centred way. Trials with an initial prototype have already led to the Vaughn Williams library's resources being used in a novel way that may lead to advances in historical research on the collections.

Veronica Perkins' PhD concerns the digitisation of historic photography collections. She is performing a wide ranging comparative study of methodologies used in digitisation projects, with a focus on user expectation. A critical study is under way regarding differences between the original photograph and its digital surrogate, considering social as well as technical issues. Cultural implications of this "convergence" of technologies on areas as diverse as future research into the history of photography, our visual histories and the development of DLs are to be examined.

Middlesex University funded Anne Adams (now a Visiting Academic at Middlesex) to work with Ann Blandford investigating both usability issues and social impact issues of digital libraries when introduced in a clinical setting. Recent work looked at the effect of a project to support evidence-based medicine. A clinical librarian worked as a core member of the medical teams to support their use of a Digital Library. Based on interviews the project was identified as supporting and encouraging a positive motivation towards evidenced based medicine that otherwise was perceived as a chore. The clinical librarians' role within the team acted as an external force and guidance for support and social pressure to adhere to these initiatives in addition to a variety of other positive effects.

3.2 Design for All

Early work on assistive technology for people with disabilities tended to be polarised into those starting with the technology and those starting with the client group. In collaboration with the University of Cambridge, Ray Adams is investigating an interactive approach that iterates between the two based on advanced IT [1]. The project aims to provide client-centred assessment methods for people with acquired cognitive problems producing tailored assistive technology solutions. Interviews and discussions are not sufficient on their own: due to their impairments the client may not be aware of the extent of their problems. Our approach is instead based on a simple model of cognition combined with a hypothesis/test based assessment methodology. The assessment is based on a series of validated tests of cognitive ability. The approach and the core tests have

been validated using exemplar case studies. The results of assessments can be used: as the basis for the selection of appropriate assistive technology in the design of interfaces tailored to specific problems, and in the selection of appropriate computerised assessment tools for further tests.

In collaboration with the RNIB, Gill Whitney is evaluating mobility aids for the blind. In a recent study with Suzette Keith and Judy Wilson, a receiver used to trigger speaking sign systems was evaluated. The aim of this system is to combine direction and location information as identified in an earlier project. The system was found suitable as is for use only in semi-supported situations

3.3 Distributed Cognitive Systems

Work on distributed cognitive systems is concerned with understanding how artefacts are used and manipulated in complex, often multi-user, interaction situations such as control rooms. Early work in this area in collaboration with UCL and Otago University investigated the interaction of artefacts and staff in an ambulance control room.

More recently Bob Fields and Paolo Amaldi have been studying an airport control tower as a distributed cognitive system, analysing the way artefacts function as representations [7]. Early work has produced an ethnographical account of the tower showing that "clumsy" introduction of new technology has caused adverse consequences to work patterns. For example, changes to the physical layout has disrupted the flow of interactions and led to miscommunications. The next stage of this work will involve modelling the observed work practices with the aim of being able to predict how work processes may be transformed on the introduction of new technologies.

PhD student Saif Rehman is using cognitive task analysis to inform the design of simulators for laproscopic surgery in collaboration with St Mary's Hospital, London.

Judy Wilson and Paul Curzon are looking at Navigation scenarios as a distributed cognitive system. This builds on earlier work that highlighted interaction design issues with respect to in-car navigation aids [3] such as the way such aids replace rather than complement other aids including the person's cognitive map. A theoretically grounded evaluation technique for transport systems, including technological support, is being developed that treats such systems as distributed cognitive systems.

4. REFERENCES

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