HCI at CSIRO: Practical Research

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Abstract The CSIRO division of Mathematical and Information Sciences (CMIS) and its predecessors the Division of Information Technology and the Division of Computing Research, have a long history of research in data visualisation and data interaction. More recently, the division has also started a research focus in HCI: a group was formed in 1995 to support research in both HCI and visualisation. This paper looks at the nature of the earlier work, at the integration of HCI skills into the development of data visualisation applications and at the emergence of HCI research within the division.

Key words usability engineering, data visualisation, user and task modelling, virtual reality

1. INTRODUCTION AND CONTEXT

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is Australia's national research organisation. Its role is to conduct research and to help the Australian industry through both the application of research results and knowledge transfer.

The HCI-Visualisation research group was formed within CSIRO's Division of Mathematical and Information Sciences (CMIS) in 1995. Today, the group consists of 6 researchers and 3 PhD students. Much of the research carried out within the Division is in the form of strategic research centred around problems posed by industrial partners. The work in HCI is multi-disciplinary in nature, involving close collaboration with scientists from many fields (image processing, multi-media, artificial intelligence, knowledge engineering, software engineering). The

results of this work are strategic research in the form of case studies and prototypes, illustrating novel approaches to the problems industry has posed. Other more tactical work is shorter-term, responding to requests from industry to solve specific problems, and involves drawing on a skills base which is not otherwise available in the IT community in Australia.

2. VISUALISATION

A common thread in the work on data visualisation, dating from the late 70's, is the handling of large complex data sets with numerically demanding applications. This often involved anticipating by several years the hardware and software needed to do the job. For example, in the early 90's, massively parallel hardware was used to simulate interaction for an animation of particular scenarios. The system was

1000 times slower than a production interactive system would have required, but was still able to provide the required test-bed for studying algorithms and techniques. Today the HCI-Visualisation group explores the use of small-scale immersive Virtual Reality systems and haptic force-feedback devices to study 3D geology for the mining industry. Each system costs upwards of \$200 000 and the algorithms are in their infancy, yet our industrial partners expect that by the time we have a reasonable mastery of the situation, such systems will be affordable at the site.

The early work was often done in a near-absence of user requirements simply because the users and their applications did not exist. With the growth of HCI as a mature discipline and with a more computer-literate industrial base, we are now finding that we can take a more integrated approach combining techniques from data visualisation, user requirements and HCI.

3. HCI

Current activities in HCI are task analysis and task modelling, user-centred design and evaluation (especially for multimedia and web-based user interfaces [Yap & al. 1996]), user modelling for adaptive interfaces (specifically student for intelligent training systems [Yacef and Alem, 1996]) and data sonification [Barrass, 1996]. Due to lack of space, this paper only describes a subset of these.

3.1 Task and knowledge representation

Task analysis and task modelling techniques are one of the group's main area of expertise. Consequently, we are exploring their use in domains which lie outside their traditional scope of application, for example expert knowledge elicitation and representation. The division has been involved recently in the design and development of a decision support system for the Royal Australian Navy. The various partners in the project adopted the MAD formalism for task representation as the common formalism both for interface design and for knowledge representation [Balbo and Lindley, 1996].

3.2 Usability evaluation

In this area, the group has two main foci: automatic user interface evaluation and the new evaluation problems posed by recent technologies such as multimedia interfaces or web-based interfaces.

In the first stream of research, a robust automatic analyser for the evaluation of user interfaces is currently being developed. The approach is based on a comparison between the end user's actions and a data-flow oriented task model. The discrepancies between the two are analysed using behaviour rules based on ergonomic criteria [Balbo, 1996].

For the second stream of research, the group has developed and is constantly updating methods and templates for the usability evaluation of recent technologies. The problems posed by these new technologies include multimedia software typology and the adaptation of usability methods to software used in contexts different from the work environment such as home, kiosk, classroom, etc. We have also been closely associated with the setting up of a usability lab specialised in multimedia evaluation [Ozkan and Balbo, 1996].

4. FUTURE DIRECTIONS

In addition to the various streams of research briefly described here, we plan to initiate activities in automatic text generation and human-computer dialogue in the near future.

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