Interfaces

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British HCI Group
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5 – 8 September 2000
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Human–Computer Interaction

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From the Chair

"I don't suppose you would consider..."

My job as chair of the British HCI Group is mainly to talk people into doing things. Interact'99 was a wonderful opportunity for doing this. The British HCI Group depends very largely on the voluntary effort of its executive committee members, and other helpers. This year, I and the other committee members were looking for: possible organisers for future HCI conferences, a new exec. member to look after our web pages, someone to develop a simple accreditation process for practitioners, and so on. We were not 100% successful, indeed we are still looking for a web coordinator, but it does seem easier to get people to say yes after a couple of days away from that pile of papers in the in tray, or when they have a drink in their hand. If anyone reading this is taken back to the heady days of the conference and wishes to recapture that feeling of enthusiasm and innovation, they might like to volunteer to help us is some way now. That way next year I shall be able to go to some of the sessions!

Andrew Monk
Chair of the British HCI Group

Stop Press – the HCI Group website
We are pleased to announce that Eamonn O'Neill (Bath ex. QMW) has now agreed to take on the post of website coordinator. Many thanks to Simon Buckingham Shum for his outstanding work over the years, not to mention patience while waiting for his replacement!

and

The HCI Group consultancy listing is now at
http://www.visualize.uk.com/bcshci/conslist/
The new system, designed and maintained by Dave Clarke, has the following facilities:

- database driven for ease of maintenance
- fully automated, including generation of on-line form to print off and sign, to submit with enclosures, etc.
- contact a consultant by email without the need for an email client
- a simple "find a consultant" keyword search and highlight word facility
- server-side driven, so it will run in most "version 3 and above" browsers.
- a password protected "admin only" section for remote administration
- creates static pages for each consultant (with their own personally specified meta tag keywords) to maximise internet search engine indexing.
- automated emails for "application confirmation" and "application successful"

Editorial

You may have noticed it has been a little longer than usual since the last issue of Inter*faces* but members have been busy – if the evidence in this issue is anything to go by. One-day meetings, supported by the British HCI Group, have been organised throughout the year, and in this issue we have reports and abstracts from a selection of them, on teaching HCI, collaborative workspaces and affective computing. The programme of events for next year is already well advanced – a full listing will appear in the next Inter*faces* – but in the meantime contact Bob Steele (details on back cover) if you are interested in attending – or organising – a meeting.

And then there was INTERACT'99 in Edinburgh, the conference of IFIP TC13, this year incorporating HCI'99. Everyone who was there will have their own conference highlights. Perhaps the opening fanfare, or building lego models with Karen Holtzblatt. Perhaps a particular presentation from the excellent technical programme. Personally it was the shades of 'music and movement' in Michelle Bacigalupi's tutorial, and running around Heriot-Watt videoing users of POST-IT notes for Wendy! For those who couldn't make it we have included some tasters: a report on the successful accessibility workshop which included one presentation via a video conferencing link from Belgium, a summary of the mobile devices workshop, Wendy Mackay's tutorial on video, which unfortunately did not make the proceedings, and a view from the doctoral consortium. Alistair Kilgour, the conference chair, opens proceedings with his own view of events. So much went on at INTERACT that I suspect there may be more to come in Inter*faces* – so watch this space!

And thinking of INTERACT'99 is a reminder that preparations for HCI'2000 are already underway in Sunderland. The Call for Papers is out – with the deadline for paper submissions in January. Full details are available on the HCI'2000 web site

http://osiris.sunderland.ac.uk/~hci2000/

or contact Gilbert Cockton (our Profile victim for this issue).

We will see you there!

Janet Finlay
Editor

RIGHT TO REPLY

Make Inter*faces* interactive! We invite you to have your say in response to issues raised in Inter*faces* or to comment on any aspect of HCI that interests you. Submissions should be short and concise (500 words or less) and, where appropriate, should clearly indicate the article being responded to. Please send all contributions to the Editor.

NEXT ISSUE

Inter*faces* welcomes submissions on any HCI-related topic, including articles, opinion pieces, book reviews and conference reports. The deadline is **30 November** – we look forward to hearing from you.

With thanks to:
commissioning editors: Marjory Groundwater (University of Dundee), Barbara McManus (University of Central Lancashire), Alistair Kilgour (Heriot Watt University), Xris Faulkner (South Bank University)

To receive your own copy of Inter*faces*, join the British HCI Group by filling in the form on page 31 and sending it to the address given.

Deadline for issue 42 is **30 November 1999**. Deadline for issue 43 is **28 February 2000**. Electronic versions are preferred: RTF, plain text or MS Word (5/6), via electronic mail or FTP (mail fiona@hiraeth.com for FTP address) or on Mac, PC disks; but copy will be accepted on paper or fax.

Send to: Inter*faces*, c/o Janet Finlay, School of Computing and Mathematics, University of Huddersfield, Queensgate, Huddersfield HD1 3DH
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and **copy email submissions** to Fiona Dix, Inter*faces* production editor; email: fiona@hiraeth.com

INTERACT '99 : a view from the chair

Alistair Kilgour, *Conference Chair*

Mostly, our ideas worked – which was a great wonder to me, but I guess I should not really have been surprised, bearing in mind the tremendous skill and commitment of the whole organising committee, the enthusiastic band of student volunteers, and all the friendly and efficient people from Meeting Makers, our professional conference organisers, who did a great job on the ground of making the whole thing run smoothly. The fact that the sun shone (well, most of the time) was an added bonus which we would never have put any money on.

Some random impressions about what was special for me about the conference:

The number of delegates.
We have lots of theories about how we managed to reach the total of 561, but we have no solid evidence about what were the key factors. Whatever the reasons, attendance was beyond our most optimistic expectations – as witnessed among other things by the fact that we ran out of delegate bags. Fortunately I had insisted on ordering 600 copies of Volume 1 of the proceedings, so we did not run out of these.

The high proportion of industrial and commercial delegates.
Maybe it's a result of the growth of e-commerce, or mobile devices, or whatever, but there seems to be a new awareness of the immediate practical value of HCI in the design of new communication devices and systems, and this is perhaps why we had such a strong representation from practitioners and the commercial sector. The wide sponsorship we were able to attract from industry and from the local enterprise organisations was also I guess evidence of this same trend.

The opening fanfare.
The multifaceted talents of HCI people are a constant revelation – the creativity of Jim Alty who composed the piece and choreographed the performance, the musical ability of Phil Gray and the other members of the Glasgow Computing Brass ensemble who performed with such precision this new and quite challenging piece, and the flair and panache of Jan Borchers on virtual percussion, who combined technical genius in developing the equipment with supreme mastery in performance.

The complexity of the first two days of workshops, tutorials, and doctoral consortium sessions.
Without the wide-ranging support from my own department, in terms of accommodation, equipment, and staff time, this would not have been possible, and I am hugely indebted in particular to Christian Jones of my department, who co-ordinated and liaised and cajoled and placated. It was only through this kind of co-operation and help that we were able to keep the costs of the workshops low. The workshops are of course an extremely valuable part of the programme, but they do absorb a disproportionately large amount of the organisers' resources.

The presence of so many of the pioneers.
It was a great pleasure to me to meet so many of those who had shaped the subject over the last thirty or forty years on my home ground. For those new to the area, it was a veritable who's who of HCI.

The Purple Press.
During HCI'91 (also held at the Edinburgh Conference Centre) there was a daily conference newsletter produced by David Pullinger, and it had always been my hope that we could do something similar for INTERACT. This vision was triumphantly realised through the skill and energy of Lachlan Mackinnon and Tom McEwan, aided and abetted by a certain neat little palmtop with built-in camera. Though I have no solid evidence in support, I strongly believe the Purple Press added significantly to the enjoyment and sense of involvement of everyone who was there. Well I loved it, anyway.

And oh yes, the quality of technical programme.
It's really for others to judge, but I believe the quality of the proceedings, and the programme, stands comparison with INTERACT '90 (which has been the yardstick we have aspired to measure up to across all areas of the conference). This is thanks to everyone who submitted – the whole enterprise falls at the first hurdle of course without a whole host of authors submitting their best work, and we were tremendously fortunate in this regard – but also in large measure to the high professionalism of the IPC chairs and the IPC members, to the editors of both volumes, and to Russel Winder, whose meticulous care and attention to detail in preparing the camera-ready copy for volume 1 ensured we achieved the same high production quality we have come to expect in the UK HCI conference proceedings.

Many non-reproducible and serendipitous circumstances combined to make Edinburgh the right place for INTERACT '99. It felt right to me anyway – I hope those who were there felt the same. Every conference is unique, and whatever you feel about this one, one thing is for certain – there will never be another quite like it.

Making designers aware of existing guidelines for accessibility

M.Noirhomme-Fraiture

Interact'99 Workshop
Making designers aware of existing guidelines for accessibility
Edinburgh
31st August 1999
[see Proceedings Vol.II, p.139]

Report
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The workshop, organised on behalf of the WG 13.3, was very successful, with 18 participants coming from different domains: institutes for disability, computing departments, research centres in accessibility, telecommunication companies.

The morning session was devoted to the presentation of position papers whereas discussion and synthesis were achieved in the afternoon.

Position papers were classified according to four topics: (1) Elderly and Disabled Users, (2) Tools, (3) Evaluation and (4) Designers.

In the first group, M. Maguire gave a broad overview of problems encountered by persons with special needs in respect of the new communication telecommunication facilities.

N. Alm and K. Nakamura advanced commercial arguments to convince designers of the need to take all potential users into account in the initial stages of any design process.

T. Verelst, through a videoconference, explained the position of ISdAC (Information Society disAbilities Challenge) concerning accessibility guidelines. In particular, he defended the idea that people with disabilities must be involved in design and testing processes (summary included in this issue). We express our thanks to A. Kilgour and his team for providing a videoconference of such high technical quality.

Concerning the tools, different solutions were suggested.

J. Lindenberg presented an engineering tool in the form of an electronic handbook. This tool has the advantage that it can present the information at the right time and hide irrelevant information.

A. de Baenst submitted the outcome of research sponsored by the Walloon Region in Belgium. It concerns the design and development of a Web site with methodology and guidelines for accessibility, intended for the designers and developers team of Internet services.

C. Nicolle and J. Abascal explained their project for a source book for accessibility guidelines.

Finally, C. Jarrett presented problems on interpreting guidelines for font size, interlines, type, etc. She is writing a 'How-to' manual on forms design.

In the category of evaluation, C. Colwell reported two experiments, which had been carried out, the first to investigate whether the WCA Guidelines developed by the WAI can be used effectively by web page authors and the second to examine whether pages developed using the WCA Guidelines are accessible to visually impaired persons.

To close the session devoted to position papers, M. Tucker-Kinney, from Nokia Mobile Phones, explained the design organisational process inside a big company and how guidelines are integrated in this process.

The general discussion started with F. Winberg's position on the necessity for a methodology using guidelines, and more than just guidelines. Reference was made by other partners to UserFit project. But the guidelines in the book were judged difficult to be used by non-specialists.

The following questions were then discussed:

Do we have to whittle down guidelines, at the risk of a loss of richness?

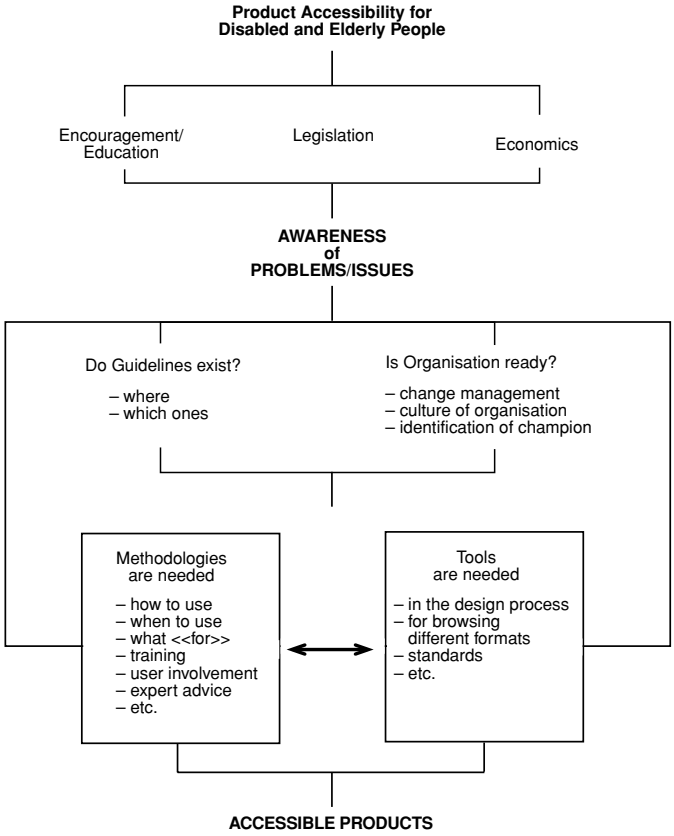
How can guidelines be incorporated in the design process inside an organisation? How can the changes be managed?

Which tools are useful and usable? What tools for whom?

How can elderly and disabled people be involved in the design process?

How should cultural issues be dealt with?

To sum up the workshop, participants agreed on the following diagram:



Raising awareness among designers of accessibility issues

Carlos A. Velasco* and Tony Verelst

1 • Introduction

We are in the middle of a revolution similar to that of the industrial revolution of the 19th century, the *Information Society*. This revolution is affecting the way we work, the way we study, the way we shop, and many other aspects of our daily life. Concepts such as teleworking, e-commerce, cooperative work, tele-cottage or tele-training are becoming part of our regular vocabulary.

The birth of this new society has many implications for everybody. It will open new opportunities, but it will close many others. Information is the keyword. Society might be split into two sectors: those who are 'wired' and those who will stay 'un-wired.' Although while you are an active participant in the events it is difficult to analyze the facts happening in your world with some perspective, we feel that people with disabilities cannot afford to stay out of the loop.

The concern of many people on these issues was the seed of ISdAC International Association. It was obvious that we had to inform our constituency about these changes. Conventional channels were no longer effective, and new approaches had to be found. In the middle of the fight, we *must be aware* of many accessibility issues. We realized that we had a twofold target: not only had we to reach our constituency, but we had to deal with content providers and software developers as well. We knew that we would play the role of a *bridge* between the designers and a market sector whose influence would not be negligible.

This presentation will not focus on a particular technical issue, but will present some snap-shots of our experience in relation to the topics of this workshop: web design and software development.

2 • What is Design For All?

The first challenge faced is the definition of Design For All or Accessible Design. There are many definitions circulating around, it is a widely discussed topic and we are sure that the audience is familiar with many of them [1, 2, 3, 4].

We think that the concept *Design For All* is misleading depending on what type of audience you are addressing. Generally, it gives the designers the idea of a highly sophisticated and not cost-effective design process by which their products will reach a wider hypothetical market whose strength has not been shown to them.

In the field of web design and software development, our experience shows that outreach and education benefit when the message is simplified. The message to be sent is that we can solve simple problems with simple solutions. Of course, not all of the problems nor the solutions are that simple, but the designer will be overwhelmed if he/she must tackle two hundred issues simultaneously.

In previous papers [5, 6], it was also exposed that, within this design process, designers can benefit from interaction with end-users whenever a group of those with the appropriate knowledge-base are ready to co-operate with or even drive the industry. As a short remark, we have found out during the latest years that many EU organizations in the sector – with the exception of a few well-known examples – did not have experience nor even interest in technical projects. Thus these organizations play a passive role in R&D projects, which are more often than not a technology push instead of a response to a user need. We must stress that organizations with a stronger focus on accessibility issues are needed to help to send the message around.

Raising awareness among designers of accessibility issues
INTERACT 99 Workshop
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http://www.isdac.org/
31 August 1999

3 • A training experience with web designers

This section will describe a training experience with a group of web designers working for one of the biggest telephone companies in Spain. This group is used to design websites of great size and complexity, and they were 'forced' to learn about web accessibility because of a disability-related website.

The first issue was to figure out whether they were familiar with issues of access to computers. Many of them did not even know that a person with visual impairments could access a computer, not to mention the Internet. Therefore, they were exposed to a session where they were shown different types of disabilities, and how different access problems are tackled. In particular, they found out about:

- Alternative input devices: keyboard emulators, pointers, switches, sticks, mouse emulators
- Auxiliary devices: guides and holders
- Speech recognition software
- Speech synthesizers
- Software aids

This introduction gave them some background on the type of problems people with disabilities face whenever accessing a computer. It helped to put a face behind the problem.

The following step was to show them different standard browsers, text-based browsers, voice-based browsers and screen-readers. In particular they used[1]:

- Internet Explorer
- Netscape Communicator
- Opera Web Browser
- WebTV
- Emacs_W3
- Lynx
- IBM Home Page Reader
- Sigtuna Browser (English version)

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1. For further reference, Browser Watch is a list of browsers compiled by an independent source that can be found at http://browserwatch.internet.com/browsers.html

They browsed the net with these tools, and, in particular, they examined their own designs. This gave them an idea of the consequences of ignoring accessibility guidelines for people with disabilities.

The next step was to show them how simple things such as adding *ALT* tags to images, including *d-links* or providing alternatives to scripts could improve accessibility dramatically. This gave the trainer the opportunity to discard the myth of cost-effectiveness for accessibility. An intensive training followed on how to implement the *Web Content Accessibility Guidelines 1.0*[2]. They learnt – as remarked in the Guidelines – that following them will also make web content more available to all users, whatever user agent they are using (for example, they were not aware of the possibilities for mobile phone access) or constraints they may be operating under. They learnt as well that we were not discouraging content developers from using multimedia, but rather explaining how to make multimedia content more accessible to a wider audience.

Shortly afterwards, this group of people began their design, and the results of the training were excellent. 80% of the designed pages conform to the Guidelines to level-A, and the rest required only simple changes. Even a level-AA was not difficult to acquire after a revision.

This experience was very positive, and although it was not clear whether the management of the company will implement these procedures in other design projects, it will surely influence the future work of the designers. From this experience several conclusions were drawn:

1. *Authoring tools are not very helpful when designing accessible websites*

   A surprisingly high percentage of the web designers in this experience, and some others consulted, were not very familiar with HTML. The growing number of authoring tools providing a WYSIWYG environment, which hide from the author many standard tag attributes, had originated a 'generation' of web authors fully focused on the graphic design, and not very familiar with other subtleties of HTML.

   Furthermore, most of these tools do not incorporate all the changes of *HTML4* that improve accessibility, because these tools are fully focused on what Internet Explorer or Netscape Navigator support. On this token, the support for *Cascading Style Sheets* is still very small on both authoring tools and browsers. This topic is the subject of a W3C working group at the moment.

2. *Training costs and development costs*

   If the designers group of a content provider or a company must be aware of these guidelines, there is an inherent cost associated with an initial training period.

   A second cost of interest is whether the use of these techniques originates higher development times for web projects. In our experience, that is not the case, because once web designers are aware of these issues, they are incorporated naturally in the design process. Of course, some quality control must be present, but it will not represent more than 5% of the total cost.

   Whether the management of the company is willing to accept these costs depends upon an economic factor. Therefore,

   - either a third party must finance this effort, or
   - market penetration must be used as an argument, or
   - law enforcement must be present.

3. *The market*

   We are all aware of the figures involving people with disabilities [7]. But after using them for many years, we can wonder whether they are effective, whether they catch the attention of designers or developers. Being honest, the penetration of these figures is small. It is the same percentage that designers and developers attribute to sales to people with disabilities or elderly people.

   From our point of view, there is a huge difference in access to the Internet on both sides of the Atlantic. The fact that companies like Microsoft, IBM, Sun, Apple and many others have departments related to users with special needs is an answer to a growing internal market pressure. The reasons for this difference are outside the scope of this paper, and are mainly of economic character (from telephone rates, to the offer of ISPs, or to hardware or software prices in relation to the cost of living).

   Therefore, and those objectives are also within our priorities, EU governments must establish the conditions where the Internet is seen as a universal service for every EU citizen. These conditions arrived naturally in the USA as a result of free market and competence, but we do not see the conditions in the EU: fragmented market, monopolistic practices from PTTs, etc. A bigger presence of disabled and elderly people on the Internet will provide some pressure to the content providers.

4. *A Europeans with Disabilities Act?*

   Our final comment deals with the *desirable* existence of a European equivalent of the 'The Technology–Related Assistance for Persons with Disabilities Act' (1988), and 'The American with Disabilities Act' (1991). The publication of the ADA has given a legal tool to private and public organizations in their demands for a more accessible technology, and they can now require the use of accessible hardware and software by the administration, the school system, or the universities. It requires that contents provided electronically conform to the Web Content Accessibility Guidelines, or equivalent documents. Furthermore, private companies willing to bid for Federal contracts must follow these guidelines.

   However, on this side of the Atlantic, social policy is not included in the mandate of the EU, and cannot, at present, be subject to European legislation [8]. An important change on these lines will substantiate the efforts of disability organizations for equal access to education and employment using new technologies.

   Many people feel that legislation of this type will produce the opposite response to the desired effect. We think that an adequate combination of legislation, training and awareness will convert the Internet into a place where everybody can work, play or study. We must deal with these 'electronic curb–cuts' the same way that architects are nowadays aware of accessibility issues for wheelchair users.

continued overleaf

2. A W3C Recommendation that can be found at http://www.w3.org/TR/WAI-WEBCONTENT

4 • An experience with software developers

Recently, ISdAC and Lernout & Hauspie, a leading company of speech and language products, technologies and services, including speech recognition, text to speech, compression, and translation, initiated a collaboration. During the latest months, a group of ISdAC members collaborated with the company testing L&H VoiceXpress speech recognition software in Dutch and English.

Although this is a pilot under a non–disclosure agreement, we can mention that it has been a productive collaboration with a positive response to our feedback. This experience makes us think that it is a way to explore further with other software companies.

4.1 Software development and Java

We do not want to finish this section on software development without mentioning the advance offered by Java™ to develop accessible software. Java is a growing object-oriented language with applications not only in PC or workstations, but in many other devices, from mobile phones to control environment devices. Its portability together with its versatility can ensure a promising future for this technology.

From our point of view, the Sun Accessibility team has done an excellent job, facilitating to the designer the possibility to incorporate Assistive Technology input and output in the software. In fact, version 1.2.2 of the Java Development Kit[3], released a few weeks ago, contains the Java Accessibility API, the Swing user-interface classes, and support for loading Assistive Technologies into the Java Virtual Machine. They also developed an Access Bridge to the API of the Microsoft Windows operating system, to be incorporated in AT products. We cannot forget the efforts of the IBM Special Needs team who made available the *IBM Guidelines for Writing Accessible Applications Using 100% Pure Java*[4].

Again, these advances will not be present in commercial products unless awareness and training programmes go hand in hand, and Authoring Tools implement these changes. Efforts within these lines must be pursued.

3. http://java.sun.com/products/jdk/1.2
4. http://www.austin.ibm.com/sns/access.html

5 • Conclusions

The information is out there. Thousands of gigabytes are available, but we know that they are not available for everyone. ISdAC International Association is willing to share the experience of its members with anyone interested to ensure the achievement of fully accessible products for greater social and economic benefit. Our aim is to ensure the highest levels of accessibility for maximal EU citizen inclusion.

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The second international workshop on human–computer interaction with mobile devices

Interact'99 Workshop
The second international workshop on human–computer interaction with mobile devices took place on 30th August, 1999.

http://www.dcs.gla.ac.uk/mobile99/

Dr Stephen Brewster
University of Glasgow

We had over 60 participants with an almost equal mix between academic and industrial attendees.

We had 25 submissions to the workshop and had to restrict this to 11 papers and 6 posters for the actual day. Topics ranged from novel interaction techniques (such as the finger-joint gesture glove keyboard), investigations of context of use (such as photographic diary studies), in-car devices (and how speech recognition compared to manual control) and the design of Web browsers for small displays (such as that on the Nokia 9000). The wide range of topics covered really showed that this is an area of research where there are many interesting problems. The limitations caused by small screens make designing interfaces hard and the multiple contexts of use make it difficult to know what people will want to do with their devices. The workshop generated lots of discussion and ideas towards solutions to both of these problems.

The papers presented at the conference will appear in a special issue of the journal of Personal Technologies next year.

Video Techniques for Participatory Design: Observation, Brainstorming & Prototyping

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Video is an extremely flexible tool: Video can capture real-world events as they occur, either "staged" as in a laboratory test or usability study or "live" as in a field study. Video can illustrate ideas and concepts, especially dynamic events such as how people interact with computers. Video is a creative tool for exploring new ideas, simulating new technology and allowing users to experience technology that does not yet exist. Video is also useful as both quantitative and qualitative multimedia data. Finally, video is a powerful communication tool, as part of a presentation, in a participatory design workshop, or standing alone, enabling you to share research results, discuss ideas and explore envisionments of future technology.

This is an intensive, hands-on tutorial, designed to give you experience with various aspects of video. Although the techniques are applicable in a variety of design settings, the emphasis here is on participatory design: using video as a tool to help users, researchers and designers gather and communicate design ideas. Working in small groups, you will use video in a series of design exercises that involve prototyping a (deceptively) simple application: an on-line *Post-it*™ note. You will begin by observing and interviewing people who use ordinary paper Post-It notes. Then, you will use various design and prototyping techniques to create and evaluate a new Post-it note application. The exercises are designed to let each person practice using a video camera, both shooting and in-camera editing, while experiencing the full design process involved in prototyping a new interactive software application. We will also discuss practical issues, such as maintaining your video archives, and ethical issues, such as obtaining informed consent.

This tutorial is based on a lecture/laboratory semester course entitled *Design and Evaluation of Interactive Software*. The course is organized into four sessions, each with a combination of lectures, hands-on exercises, and discussion of each group's work.

Lectures emphasize participatory design activities that benefit from using video. Lecture topics include:

- Overview of video and participatory design
- Technical aspects of video: shooting tips, organizing and maintaining a video library, video formats, choosing between digital and analog video
- Finding out about users: video techniques for observing & characterizing users.

  Critical incident interviews, observation of users in the field, videotaping lab and usability studies, creating scenarios & storyboards.
- Generating ideas: video techniques to support design.

  User workshops, brainstorming, video prototyping, Wizard of Oz
- Evaluation & Persuasion: video walkthroughs, multimedia data analysis, video illustrations, stand-alone videos.
- Ethics, Lies & Videotape: video ethics, legal issues, informed consent.

Demonstrations & Discussions allow you to get direct feedback about your work and learn from others in the tutorial. I will explain technical aspects of shooting, managing and presenting video, illustrated with video clips from recent participatory design projects and other student work. Video clips include:

- Field and laboratory studies of users
- Storyboards and design scenarios
- Video brainstorming sessions
- Wizard-of-Oz video prototyping
- Multimedia data analysis
- Edited presentations of video prototypes

Exercises are spelled out in detail and have been carefully designed to build upon each other to form a single design project. These exercises will give you practical experience using a video camera and, at the same time, familiarize you with participatory design techniques that can be used immediately after the tutorial. Although the exercises move very quickly, you should be able to learn enough to adapt these techniques for your own purposes. Specific exercises include:

- Video observation of users
- Scenarios and storyboards
- Video brainstorming
- Video prototyping
- Video walkthrough
- Final video presentation

Karen Holtzblatt supervises Lego Construction at Interact'99 …
… as part of the tutorial in contextual design

Photographer TG McEwan (using a Sony Vaio computer with built-in camera! a fine piece of learning technology)

Interact'99 Doctoral Consortium

Linda Snape
University of Central Lancashire.

I was accepted for the Doctoral Consortium at Interact '99 after submitting a short paper which provided an overview of my PhD work. I presented the paper to an audience of other PhD students and a panel of experts in Human–Computer Interaction. Each consortium member was required to present their own work and to critically review the content and progress of other research projects presented that day. I found the whole experience most worthwhile, as the question sessions (comprising 45 minutes for each member), enabled the panel to offer a great deal of advice in terms of project direction, sources of information and ways to successfully complete a PhD. Talking to the panel members and students socially enabled valuable contacts to be made and enabled us to share the common experiences of undertaking post-graduate research. As an added bonus, all consortium members were awarded free accommodation and meals and also free admission to the three-day Interact conference. I would recommend that all PhD students apply to take part in this very valuable experience.

Congratulations – to Eamonn O'Neill, whose thesis won one of the 1999 Distinguished Dissertation Awards, a high honour and a first for HCI research

Eamonn O'Neill (1998) User–developer cooperation in software development: building common ground and usable systems

Supervised by: Prof Peter Johnson and Prof George Coulouris

Examined by: Prof Chris Johnson, Glasgow (external) and Prof Anthony Finkelstein, UCL (internal).

You can find PDF files of the thesis at: http://www.maths.bath.ac.uk/~maseon/thesisPDF.html

Abstract

The topic of this research is direct user participation in the task-based development of interactive software systems. Building usable software demands understanding and supporting users and their tasks. Users are a primary source of usability requirements and knowledge, since users can be expected to have intimate and extensive knowledge of themselves, their tasks and their working environment. Task analysis approaches to software development encourage a focus on supporting users and their tasks while participatory design approaches encourage users' direct, active contributions to software development work. However, participatory design approaches often concentrate their efforts on design activities rather than on wider system development activities, while task analysis approaches generally lack active user participation beyond initial data gathering.

This research attempts an integration of the strengths of task analysis and user participation within an overall software development process.

This thesis also presents detailed empirical and theoretical analyses of what it is for users and developers to cooperate, of the nature of user–developer interaction in participatory settings. Furthermore, it operationalises and assesses the effectiveness of user participation in development and the impact of user–developer cooperation on the resulting software product. The research addressed these issues through the development and application of an approach to task-based participatory development in two real-world development projects. In this integrated approach, the respective strengths of task analysis and participatory design methods complemented each other's weaker aspects. The participatory design features encouraged active user participation in the development work while the task analysis features extended this participation upstream from software design activities to include analysis of the users' current work situation and design of an envisioned work situation.

An inductive analysis of user–developer interaction in the software development projects was combined with a theoretical analysis drawing upon work on common ground in communication. This research generated an account of user–developer interaction in terms of the joint construction of two distinct forms of common ground between user and developer: common ground about their present joint development activities and common ground about the objects of those joint activities, work situations and software systems.

The thesis further extended the concept of common ground, assessing user participation in terms of contributions to common ground developed through the user–developer discourse. The thesis then went on to operationalise and to assess the effectiveness of user participation in terms of the assimilation of users' contributions into the artefacts of the development work. Finally, the thesis assessed the value of user participation in terms of the impact of user contributions to the development activities on the usability of the software produced.

CHI 2000

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An Alternative Approach to Human–Computer Interaction

B.G. Blundell and A.J. Schwarz

The cathode ray tube (CRT) continues to play a dominant role in human–computer interaction. This widespread adoption reflects its suitability for use in many areas of visualization, and the remarkable capacity it has demonstrated for refinement – rising to the challenge of ever-increasing performance requirements. By means of various advances (e.g. the incorporation of stereoscopic glasses) CRT-based displays have also been able to satisfy the binocular parallax depth cue and thereby not only enter into, but dominate the world of three-dimensional (3-D) visualization.

For alternative types of display (and particularly 3-D systems) to gain widespread acceptance, it must be demonstrated that they possess major advantages over existing techniques. This will not be an easy task, given the relatively low cost of conventional displays coupled with their proven flexibility, and it is made more difficult by the problem of assessing in advance the precise advantages to be derived from applying a new display methodology to a particular area of activity.

Since the rediscovery of accurate perspective projection techniques during the renaissance, we have become accustomed to viewing 3-D scenes via realistic 2-D projections. However, several approaches to the depiction and manipulation of 3-D data sets are currently under investigation. This work is generally driven by a growing recognition that conventional display techniques do not necessarily present, and facilitate the manipulation of, increasingly complex voluminous data in the optimal manner.

Volumetric display systems [1–3] (also known as direct volume display devices [4]) offer to complement a range of 3-D visualization tools and may prove to be of considerable value in certain areas. Such displays have long been the subject of research activity and allow graphical images to be depicted within a transparent volume rather than upon a stationary 2-D screen. The displayed images, constructed from voxels (volume elements), may therefore occupy three physical dimensions. Consequently a number of depth cues including perspective, motion parallax, binocular parallax and accommodation are satisfied automatically and naturally. The images may be viewed directly and, in principle, the use of a volumetric imaging system eliminates the possibility of depth cue conflict and should therefore not impact adversely upon the human visual system. Many volumetric system architectures result in systems which, in principle, offer an almost unrestricted range of viewing position. One or more operators are therefore able to observe an image scene from practically any orientation. This considerable freedom in viewing orientation, coupled with the inherent three-dimensionality of volumetric images, denotes the major difference between volumetric systems and other display techniques.

Volumetric displays may be grouped into two broad categories – swept volume and static volume systems. In the case of swept volume displays an image space is created by the rapid cyclic motion of a surface. The region swept out by the surface defines the maximum extent of the image space and voxels are illuminated upon it as it sweeps through this volume at frequencies in excess of the flicker fusion frequency (~20Hz). A system known as the Cathode Ray Sphere (CRS) was the subject of the authors' research in New Zealand for some years [5,6] and one particular embodiment of this system is illustrated in Figure 1. As may be seen, the CRS employs a phosphor-coated screen rotating at approximately 25Hz. Voxels are created upon the screen's surface by the interaction of electron beams with its phosphor coating – the same physical process used in the CRT. Multi-colour image generation is achieved by employing several types of phosphor [7]. The use of several beam sources ameliorates the voxel placement and distortional dead zones [1] which arise as a consequence of the varying orientation of

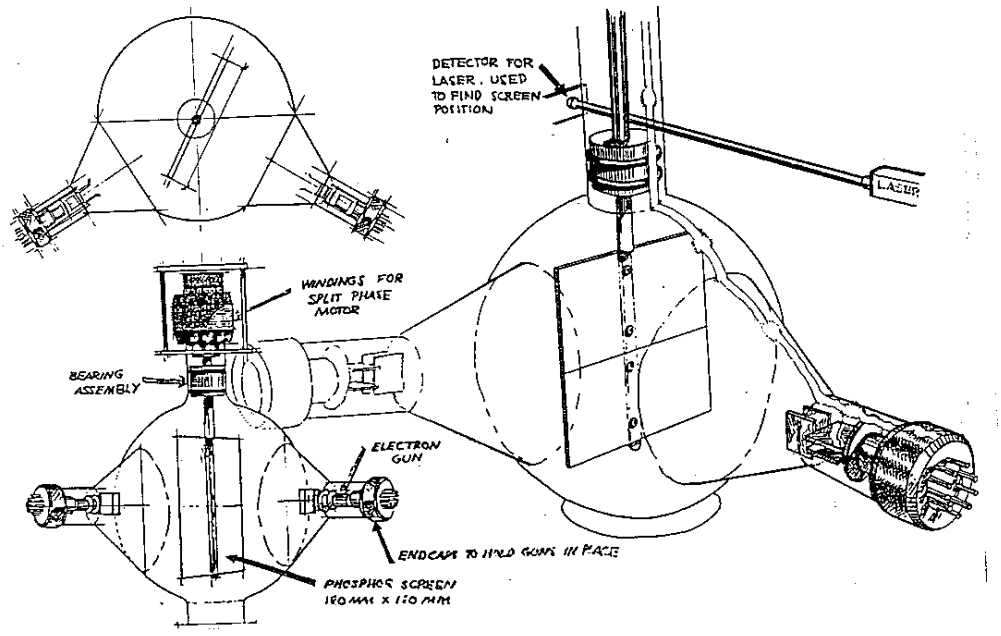

Figure 1: A prototype version of the Cathode Ray Sphere (CRS) volumetric 3D display device. In this early two beam configuration each electron gun is responsible for voxel activation within one half of the image space. Registration between multiple beam sources is achieved automatically.

the screen's surface relative to each beam source. Automated alignment techniques have been developed so as to ensure the proper registration of the beam sources with respect to the image space coordinate system.

Many other techniques have been applied to the implementation of swept volume systems (e.g. [8–12]). These include using helical screen geometries (e.g. the HL3D system [12]), and the use of translational screen motion (e.g. [11]) in which implementation problems centre upon the difficulties of sweeping out an image space of useful dimensions at frequencies above the flicker fusion rate. Furthermore, since the range of viewing orientation is limited, alternative techniques such as the varifocal mirror [13,14] are more promising.

Static volume systems place no reliance upon mechanical motion, the image space being formed from a material or arrangement of materials. In systems employing a homogeneous image space medium, voxels may be activated by, for example, a two-step excitation of fluorescence at the intersection of two directed beams [15,16]. A number of systems which employ a matrix of uniquely addressed voxel generation centres have also been investigated (e.g. [17]).

Current volumetric systems generate emissive voxels and give rise to translucent images. Previous research concerning the generation of opaque voxels which reflect incident light [18] may, as a consequence of advances in photochromic materials and computer performance, permit the development of systems able to depict opaque (solid) images. The occlusion depth cue would then be satisfied and the reliance which at present is placed upon visual accommodation (which compensates for the lack of opacity would be eliminated.

It is interesting to note that any attempt to artificially enhance the three-dimensionality of a volumetric image will immediately result in depth cue conflict. For example, exaggerating the linear perspective of a scene will conflict with the information derived from the accommodation depth cue and furthermore for a display permitting considerable viewing freedom will be satisfactory from only a limited range of perspectives.

Naturally, the underlying techniques employed in the implementation of any display system should be transparent to the operator. In this respect, volumetric display systems developed to date have been disappointing. This arises not as a consequence of the often unwieldy experimental apparatus employed in their implementation (this may be easily refined), but may be attributed to various technical issues which have generally been overlooked in most volumetric architectures. Of particular importance in natural interaction with volumetric 3-D images are:

(1) **Voxel Placement**: The locations at which it is possible to place voxels within the image space should represent a homogeneous and isotropic lattice.

(2) **Voxel Density**: The density of available voxel sites should be sufficient to represent the required level of image detail.

(3) **Attribute Independence**: Each voxel has an associated set of attributes, some of which may be determined by the display system hardware (for example size and form) and others which may be specified within software (for example position and intensity). All of these attributes should be independent of each other – a change made to any attribute should have no impact on any other attribute.

(4) **Optical Uniformity**: The image space should exhibit homogeneous and isotropic optical properties. Consideration must also be given to the impact of the image space boundary upon the emergent light.

The inability of volumetric displays to satisfy such fundamental requirements has resulted in systems that lack *predictability* in the qualities of the displayed image. Consequently an image may be seen most advantageously when positioned within a particular image space region, oriented in a certain way and viewed from a particular location! Clearly this is highly undesirable and negates many advantages of a volumetric display medium. Since the faithful reproduction of 3-D data sets cannot be assured, many ingenious volumetric displays have not been developed beyond the prototype stage. It is interesting to note that adverse voxel uniformity, voxel density and attribute independence characteristics may to some degree be compensated by suitable preprocessing of the image data prior to its depiction. This is, however, generally undesirable since it increases the computational overhead (manipulations must generally be carried out upon discrete voxel data after decomposition of high-level graphics primitives) and may necessitate an overall reduction in the display's performance. Adverse optical characteristics cannot be ameliorated by data manipulation.

Nevertheless, since the appearance of a publication in 1912 describing a volumetric system [19], considerable progress has been made. Many approaches and applications have been attempted and have met with varying success. Not only has this work provided us with a wealth of information concerning hardware issues but it has enabled us to formulate a framework within which essential display system characteristics may be defined. This knowledge provides a foundation for the specification of the next generation of high-definition predictable systems. With this in mind, we will briefly consider the future application of volumetric systems to medicine, CAD and air traffic control. These particular applications have been selected to reflect the essential strength of volumetric displays in the depiction of the 3-D form, spatial separation and dynamic properties of image components.

(1) Medicine

A number of areas in medical visualization may benefit from the use of volumetric display systems. In radiotherapy treatment planning [20] a volumetric system may complement other 3-D display techniques. Spatial features of a tumour and neighbouring structures, particularly sensitive regions to which minimal dose is required, as well as the planned dose distribution, may be more easily discerned. The clinical team may thus be able to process greater volumes of data in a shorter time and with improved accuracy. Other autostereoscopic 3-D display techniques have found application in neurosurgery [21]. Volumetric systems may find a similar role as computer-mediated data is increasingly adopted within the surgical environment.

(2) Computer Aided Design

Volumetric systems may facilitate the design and visualisation of 3-D structures and may be used interactively, so enabling surfaces to be moulded into complex forms. Volumetric displays are best suited to the depiction of qualitative rather than quantitative information (e.g., the insertion of text assumes a particular operator orientation). Therefore, when used in this type of application, the volumetric display takes the form of a computer peripheral – complementing the conventional display upon which quantitative data would be depicted. Ideally, the operator would interact directly with image components such as spline surfaces depicted within the image space [22]. Direct interaction with volumetric images has unfortunately received very little attention. However, it is feasible to provide interactive pointing devices which, by means of cursors located within the image space, could permit the direct manipulation of image primitives.

(3) Air Traffic Control.

During the early 1940s missile guidance provided considerable impetus for research into volumetric systems [8]. More recently the HL3D system [12] developed by the US Navy was evaluated for aircraft guidance on board the aircraft carrier USS Stennis.

If applied to conventional air traffic control in the vicinity of an airport, and if equal scaling factors are applied in the vertical and horizontal directions, the proportions of the image space should match the scale of the scene under observation. For example, consider a display which is to be used to depict aircraft within a 20km radius of an airport and up to an altitude of 4km. The path of each aircraft may be depicted as a vector (perhaps tagged with minimal textual information). If the image space is cylindrical and has a diameter of 1m, it would be only 10cm high and it is questionable whether the inclusion of the third dimension would confer any tangible benefit. The use of unequal vertical and radial scaling factors in a less flat image space may introduce operator error. A further difficulty is that the visibility of relative spatial position in the image (e.g., the separation between two aircraft) is determined by their orientation and distance from the observer. Consequently an observer would need to move around the image space or the image must slowly rotate. We consider both of these scenarios to be unacceptable as they must eventually lead to an observer becoming disorientated with respect to the image scene.

We conclude that the use of a volumetric system in this type of application is problematic. This does not, however, detract from the possibility of using volumetric systems for the training of control staff. Further, in military applications a number of observers may wish to view the trajectories of airborne objects and in this role volumetric systems may be highly advantageous.

The potential benefits that may be derived from the use of volumetric displays have been recognised for many years and a great deal of work has been conducted in this area. This has made it possible for us to begin work upon the development of useful metrics which may be used to characterise this class of display and produce strategies permitting a systems-level approach to be applied to their design. Once the necessary simulation tools have been developed, we believe that it will be possible to quickly produce the next generation of volumetric display. These systems will permit high definition images to be predictably and faithfully reproduced within an image space of appropriate dimensions. Furthermore, direct image interaction will be made possible by means of pointing devices and ideally image opacity will be supported

The wide range of scientific disciplines employed in the development of volumetric systems makes this work particularly challenging. However, as a consequence of this diversity, the natural home for this type of activity is uncertain. We believe that work of this nature will lead to an advance in human–computer interaction and should very much like to stimulate debate within the HCI community upon its relevance.

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CHI'99, "The CHI is the limit"

Pittsburgh, 15-20 May 1999
Trip Report

Andrew Monk
University of York

CHI'99 was in Pittsburgh. This is an interesting city with impressive downtown architecture and mystifying topology on account of the three rivers that trisect it. The conference centre was effective though somewhat lacking in atmosphere. I co-chaired the doctoral consortium.

As always the conference was very stimulating. I always try and attend the CHI conferences as they really define the discipline of HCI in which we work. So what was new at CHI'99? The most noticeable trends I would describe as "out of the box" and "design as design".

Out of the box

Led by MIT Media Laboratory, many industrial research laboratories are exploring the use of information and communication technology (ICT) where the user does not interact directly with a PC. Instead of a keyboard and mouse users might interact with a plush toy or some object that has been electronically tagged. Similarly, a display might be projected onto a real life object or use spatialised audio rather than a conventional CRT display. One of the most talked about examples of this genre was '*PingPongPlus: design of an athletic-tangible interface for computer-supported cooperative play*'. Hiroshi Ishii and his team introduced the term 'tangible interfaces' and had several papers in the conference. PingPongPlus is a ping pong table instrumented with microphones used to locate where the ball struck the table. A projector can then superimpose various visual effects onto the table, e.g, puddle splashes. Also sound effects are linked to the play in an intelligent way (see their video figure on the conference video). There were several papers on audio. '*Nomadic radio: scaleable and contextual notification for wearable audio messaging*' by Nitin Sawhney and Chris Schmandt, again from MIT Media Laboratory, was a notification system for audio messaging sensitive to the sounds around it and using directional spatialised audio rather than headphones. Masaaki Fukumoto and Yoshinobu Tonomura ('*Whisper: a wristwatch style wearable handset*') of NTT had done some experiments with finger conducted sound. To pick up your voicemail you insert your finger into your ear canal! The detection of gaze direction using eye movement monitoring was also a popular input modality (see for example: '*The GAZE groupware system: mediating joint attention in multiparty communication and collaboration*' by Roel Vertegaal). As a final example consider the accelerometer as an input device. It would seem that someone at MIT Media Laboratory had bought a job lot of accelerometers and a number of short papers described conceptual designs where visual and audible displays were driven by shaking or otherwise moving an object containing the said sensor.

Design as design

Many of the inventions for out-of-the-box ICT are aimed at home and recreational use. This has led to another trend, that is for design teams to include people closer to the person in the street's conception of a "designer" than the computer science conception. These people are introducing a quite different approach to the design of ICT. William Gaver and Anthony Dunne of the Royal College of Art reflect on this very different philosophy in '*Projected realities: conceptual design for cultural effect*'. I am still getting to grips with this new community of thought and so I will not attempt to summarise what they say, but I would encourage you to read the paper. HCI design has always included a creative part. These people are telling us how to do it properly, rather as the ethnographers told us how to do our field studies properly. I suspect that, as with the ethnographers, some compromises will have to be made before "properly" fits in with the other things we do, but is going to be an interesting time.

One consequence of this trend is that many papers do not have the traditional ingredients we would expect in an HCI paper. There is generally an analysis of the problem though it may not be very deep and is not normally backed up with any empirical data. Most of the paper is about the technological possibilities and related designs. The contribution of such a paper is the design itself rather than the design as an illustration of some generalisable principle, as has previously been the case. For such a contribution to be convincing the design has to be rich and multifaceted so that it serves as a resource for subsequent designs. I don't have any trouble with this but some authors feel the need to tack on very shallow "evaluations" in order to produce some numbers and a significance test. As a teacher of statistics I can say that a t-test, with no thought given to the generality of the user sample or the tasks set, adds nothing at all. Indeed it is very misleading and only encourages the naïve belief common amongst technologists, but not behavioural scientists, that numbers somehow equate with 'truth'.

Other stuff

Lest you think that all the papers at CHI were about cuddly toys and artistic effects I should say that there was also the usual mix of topics familiar to HCI researchers from computer science, psychology and ethnography: several nice papers on visualising large data sets and solutions to web problems; a number of papers on how to present agent technologies to users; cognitive modelling, and contextual design. My current research interest is electronic socialising and I was particularly taken with a thoughtful design by Fernanda B. Viegas and Judith S. Donath called *Chat circles*.

Next year's conference is in Europe at the Hague so you have no excuse not to be there, I shall.

The Second Workshop in Effective Teaching and Training in HCI

Xris Faulkner

The second Effective Teaching and Training in HCI workshop was held on 12th and 13th April, 1999, at South Bank University, London. It followed the successful and enjoyable first workshop held at the University of Glasgow in the spring of 1998. It was supported by both the CTI and the British HCI Group.

The workshop had as its brief the task of examining assessment issues, the Internet and new media, research and the HCI curriculum. These were all issues that had been identified as needing discussion and some had already been raised in passing at the first Glasgow workshop. Delegates ranged from as far afield as the United States and Dundee but by comparison a couple lived just up the road at Middlesex and City. Most delegates were from universities though there were some representatives from industry. The range of teaching experience was also wide with some old hands and some relative newcomers. The workshop intended to provide an open forum for discussion and a platform for support. On this basis the sessions were arranged as short presentations and more lengthy activities.

In the first session I gave a report on the work carried out by final year HCI students on the BSc Hons Computing Studies course at the School of Computing, South Bank University. This work was based around the idea of small groups of students working together as a small team, typically 4 or 5 students, but also collaborating with the whole cohort towards a common goal. Two of the then current students – Dan Farinha and Mick Wakefield – gave a demonstration of the work they were doing with Fintan Culwin and I, and the rest of the HCI group on the web browsers – Brewsers – project. Stuart Macfarlane from Central Lancs University gave a presentation on the assessment methods adopted by him and his colleagues. He talked about the three-hour, case-based examination used to assess HCI.

Shailey Minocha, then from City University, (now at the Open University) talked about ways of carrying out real-life group projects. She had many suggestions about the ways in which these might be set up and monitored. Peter Gregor finished the morning session by describing the work carried out at the School of Applied Computing, Dundee University where HCI is placed at the centre of the course. Peter went on to explain how the assessment process was done at his School.

After lunch David England, Jonathan Crellin and John Rosbottom talked very entertainingly about teaching HCI to large classes. In the current climate this problem is one that HCI educators are all too often having to contend with (as well as almost everyone else). They looked at ways in which large groups can be taught and managed without reducing the experience for both educators and students. They looked at some of the practical problems involved with large classes like ensuring lists are up to date and that students have met assessment criteria. They explained how they used the Web to ensure that these practical problems were addressed.

After the workshop delegates took an unscheduled and impromptu stop at the George to sample Fintan Culwin's favourite beer (which I shall forbear to mention even at the risk of injuring his pride). We then went on to dinner at the Pizzeria. There followed a pleasant and lively evening at the Hampton though some delegates decided that Fintan's favourite tipple was not for them. Rumours that they will never be invited back to South Bank are unfounded. We pride ourselves in not being that narrow minded.

On Tuesday the first part of the programme ran for three hours and consisted of a parallel session. This turned out to present delegates with a cruel choice and I have since lived to regret the maverick ideas that led to its conception. Fintan Culwin from South Bank University ran a class on Java, JDK and Building for Usability. At the same time Peter Jagodzinski and his research team from Portsmouth University gave a session on New Media. Peter brought with him his PhD research assistant Tom Rogers and the dramatist who is working with them, Simon Turley. Peter and Tom talked about the project they were currently involved with and then Simon showed us drama in practice and how the concepts used there could be also applied to interactive computer systems. Delegates in the other session were intrigued to hear what they believed to be applause from the alternative session but the session leader denies that he bribed his delegates to applaud him as well. He assured me that his pride would not let him stoop to such depths of depravity. Neither is it true that the parallel session was playing a clapping game.

After lunch Michael Muller gave an informative and entertaining talk on links with industry. Sue Maw and Gareth Evans described the work they have been carrying out with a Web-based tutorial on Web Design. This was followed by Lynne Hall who described how she and her colleagues Alastair Irons and Adrian Gordon at Northumberland University were using paper prototyping to teach HCI concepts.

Alastair Irons presented the last paper – rather intriguingly called 'Spoilt for Choice' which examined the effectiveness of teaching undergraduates HCI from the perspective of mainstream software development.

At the workshop Stuart Macfarlane and Barbara McManus, both from Central Lancs University, agreed to host the third HCI workshop on effective Teaching and Training in HCI. This is provisionally scheduled for April 16th and 17th 2000. Both workshops to date have been very useful and highly enjoyable. These workshops are an opportunity for new and old practitioners and educators to come together to share experiences. The atmosphere is open and discussion is encouraged. I urge anyone interested in expounding ideas to the community or anyone who has problems in (and solutions to) the teaching and training of HCI to attend the next workshop. Details will be posted later. Anyone who is keen to volunteer assistance with the next workshop or who has suggestions for suitable topics should

contact Stuart Macfarlane or myself. Help is always needed and appreciated and there's no such thing as too many volunteers or too many ideas.

This seems like an appropriate place to say thank you to all the presenters and delegates who attended the South Bank workshop. I was delighted by the eagerness with which HCI people were keen to slot into the schedule. I have to admit to having enjoyed the workshop very much indeed (once the organisation was over) and I found it fruitful. I was impressed by the range of topics we were able to cover and by the wonderful camaraderie that sprang up in such a short space of time. Thanks are also due to both the CTI (and especially Una O'Reilly) and the British HCI Group for their support of the event. The two student volunteers (OK they were press ganged a bit but not that much) also deserve my thanks. It was agreed at the workshop that Fintan made the best tea boy we could have had so here is a public acknowledgement of that. So far though, he has shown no signs of developing a career in that sphere and seems to be sticking to Java beans ...

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Using Paper Prototyping for Teaching HCI

Lynne Hall, Alastair Irons and Adrian Gordon

Abstract

This presentation focuses on the learning and use of paper prototyping, a low fidelity HCI technique that meets a number of the various requirements of the multiple stakeholders of education. Such requirements coupled with the wide range of IT development environments identify the need for a set of quick, cheap, efficient, independent and effective HCI techniques within the Software Engineer's portfolio.

Paper prototyping is a non-lab-based, experiential activity, and we discuss its use in industry and how we teach it. A case study of undergraduate computing students is presented along with a number of results. From this study we can identify the utility of paper prototyping within an educational context. We have found that it encourages learning development in terms of communication, design and creative thought; it also helps to ground HCI theory and increase students' understanding of this. Finally, future work is discussed.

Overview of presentation

Stakeholder Issues

With government initiatives aimed at mass education there has been considerable growth in student numbers, without appropriate funding. The overstretched resources (accommodation, labs and staff), along with the direct contact hours reduction and increases in student:staff ratios, place new demands on the HCI educator.

The learning experience for computing science undergraduates is tailored to employer and consumer requirements. Consumers want error-free, well-designed, highly usable products and the employer wishes to produce such products as quickly and as inexpensively as possible. In teaching computer science, educators seek to equip students with a series of theories, techniques and tools that enable them to contribute to the software product.

Diversity of IT sector

The relative immaturity of the IT sector and the myriad of technological and organisational contexts that exist have spawned a proliferation of methodologies and techniques. However, software is rarely on time, error-free or wholly appropriate, and the software 'crisis' continues. There is no proven method of software development; the multiple contexts of computer use preclude that.

There is a need to provide students with appropriate skills to enable human factors considerations to occur throughout the software development lifecycle. Whilst HCI has a number of tools and methods there are few standards, and the HCI tools that exist are often experimental, single platform based, difficult to learn or relatively expensive for multiple licensing.

Impact on HCI education

Stakeholder requirements and the IT context impact upon HCI teaching. It is necessary to provide students with generic techniques that can be used in multiple development environments within the constraints of current educational funding and resource. Developing a portfolio of techniques that are neither methodology or tool dependent increases the flexibility and the employability of the student.

There are a range of HCI techniques which have been developed and used by practitioners, yet have received relatively little interest in research articles. Such techniques were developed within the time of severely limited budgets for HCI project intervention. They are often of the 'guerrilla' style of discount usability [Nielsen, 1993], being cheap, fast, efficient, independent and effective. Such flexible techniques were the response to attempts to increase throughput, and to use HCI resource in the most productive way within software development.

Paper Prototyping

In this presentation we discuss one of these techniques, paper prototyping. This is aimed at the early stages of the lifecycle and it has been noted by Rudd [1996] that low fidelity prototyping tools are used to 'communicate, educate and inform.' Paper prototyping is an active process, which involves considerable interaction between the various members of the design team, and offers a useful communication language between users, developers and interface designers, particularly within the elaboration stage.

Paper prototyping is rarely covered adequately in the software texts; further, it necessitates experiential learning to ensure its appropriate use. In this presentation we shall discuss the paper prototyping approach we use and how we teach it to undergraduates. This approach is based on that of User Interface Engineering, presented at CHI 96. It is a form of brainstorming; however, rather than the white board with notes and diagrams, the application (at least the functionality from the viewpoint of the user) is developed in paper or other low level media.

Paper prototyping has been found to be an effective low ceremony technique within industry. Whilst it is mainly a means of enhancing communication, it offers considerable additional benefits. It reduces the complexity of the design space, through focusing on user interaction with the proposed system. It also provides a closure method for negotiation on requirements, thus reducing requirements churn. The deliverable of a tangible, if non-electronic product provides the basis for a software design, being produced quickly and cheaply.

Paper prototyping aims at encouraging creativity and open mindedness in the early parts of the design lifecycle. Its focus on communication and problem solving facilitated by an easy to learn technique provides the educator with considerable scope. It is not lab based and permits easy experimentation for the student, outside of the classroom context.

Paper Prototyping Case Study

The impact on students of learning such techniques needs to be explored in educational and work contexts, to determine principles relating to their use in HCI education. We present a case study based on our experience of teaching paper prototyping to 2nd year B.Sc. Computing for Business students at the University of Northumbria. This was taught as part of a core HCI unit, using lectures and seminars and was assessed through in-course assessment. The results presented are based on individual presentations of paper prototypes as part of in-course assessment. The prototype was of a public access system to a bank to request a loan.

Results

Within this study we obtained a number of positive results. Flexibility of design and a reduction in the anchoring to inappropriate designs could be seen, although we did note that many students were loath even to throw paper away.

Although innovative designs were produced, we found that the majority of students produced Microsoft style designs, revealing the lack of understanding of students of the nature of bespoke software. Many students included help systems, and this again showed the lack of awareness of the typical features of public access applications.

The studying of paper prototyping was seen to be particularly beneficial for the development of communication skills. The presentation included the educator and 2 students acting as users. Although in some groups interaction was minimal (this was markedly different from class-based non-assessed activity, where students were very willing to talk), in most there was considerable discussion of the various features and functionalities displayed in the prototype, often showing considerable awareness of HCI issues and knowledge.

This replicated the finding the previous year, where we taught this unit to a group of students as an elective. Many of the students were those who were poor programmers and most of them were poor at social interaction. During the course of this unit, we saw a marked increase in communication abilities and interaction styles.

Discussion

The continuing need to focus on requirements engineering and the ever increasing complexity of applications, demand that computing professionals are equipped with skills that facilitate this process in a way that minimises cost and reduces error. Paper prototyping is a skill of this type and it can be suggested that through examination of the teaching and impact of this, generic principles for the teaching and learning of low-fidelity techniques can be determined.

The results from the case study suggest a positive impact from studying paper prototyping within an educational environment. Paper prototyping also helps to meet a range of stakeholder requirements within the current constraints of tertiary-level education. We intend to further evaluate the impact of teaching paper prototyping, through focusing on students who will return from placement in September.

Paper prototyping can be seen to have utility within the design process, and can reduce the cost and time of software development. Within an educational setting it not only increases the professional repertoire of students, but also provides learning experiences in terms of human factors, communication and design.

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Spoilt for choice?

Phil Turner, Susan Turner, Julie Horton and Alastair Irons

Background

This research describes the first results of a longitudinal study into the effectiveness of teaching undergraduates HCI from the perspective of mainstream software development. More specifically, we wished to know whether students equipped with a set of HCI techniques would perform better than their peers in the HCI element of a realistic systems design project.

The focus of the study is the recently introduced specialist final year unit on HCI taught in the Department of Computing and Mathematics. The unit was designed according to best practice as then defined by US and UK professional bodies (Hewett et al., 1992; Kirby et al., 1995) and the professional experience of the teaching team. At the time of the study[1], the unit was optional and intended to extend the core teaching of HCI by providing more advanced theory and a set of usable HCI techniques. Core teaching itself (at the time) was limited to a small number of lectures/seminars and a workbook (which was not assessed, and therefore not always completed) and delivered as a part of the structured systems design unit in the students' second year.

Initial student feedback and performance

Feedback from students indicated that the result of teaching the unit had been successful as questionnaire self-reports were very positive. In particular, they revealed that students

1. The study began in 1997/8 and is still running. The results so far are from one year's cohort.

felt confident to 'tackle real-life usability issues'. This position was reflected by their good performance on the practical elements of their HCI unit assignments. (It is a matter of debate whether the short-term effectiveness of HCI education is best assessed through the skills displayed in the *process* of achieving a good user interface or through the *product*, the user interface itself. Gasen (1995) reports a survey of HCI educators which shows support for both product and process based approaches. Our evaluation approach covered both the use of techniques and their end result.)

An acid test

Student self-reports aside, central to our evaluation of the effectiveness of HCI teaching is the belief that it should be grounded in as realistic a setting as possible.

In the final year of the Computing for Business degree course, students are required to work in small groups to complete the 'Business Case' project (BCP). The BCP is both a substantial and demanding team project derived from a real system. The information provided to the students is both comprehensive and noisy, including as it does information not directly relevant to the specification of the system but which is typical of materials gathered during a realistic systems analysis exercise and thus is as close to a real-life situation as one is likely to encounter in a university computing department. Historically students have found the BCP difficult and usually complain of time-pressures, competing as it does with their personal final year project. The software system arising from the BCP has a significant user interface component, the quality and usability of which is assessed, carrying with it 20% of the overall marks for the assignment. Finally, it is worth noting that the user interface to the BCP was not a simple matter and would have benefited from the use of HCI design and evaluation techniques.

Student performance in the BCP

Debriefing the students after the completion of the BCP revealed that most had only used 'common-sense' to guide their interface design. There was no evidence of any of the students using any of the standard HCI techniques in the design or evaluation of their systems. Furthermore there was evidence that those students who had taken the specialist HCI unit did no better, as determined by their BCP user interface mark, than those who had only attended the core HCI teaching.

Accounting for this finding

Our initial thoughts on why the students had not employed any of the HCI techniques they had been taught were (a) time pressure; and (b) there being insufficient marks available for the user interface component of the project. The first is probably the most frequently cited problem by practitioners in the field and almost certainly has some role in the explanation of these findings. However this is very difficult to quantify and, of course, is necessarily related to the size of the incentive provided by the available marks. In the debriefing students were asked to comment on the proposition 'if the proportion of the marks for the UI were increased, I would have spent more time on it' and in the main they still insisted that the functionality of the system must come first, user interface issue second.

However, upon re-analysis of the student feedback data on the HCI unit, it was found that students judged themselves to be significantly poorer at 'critically assessing the usefulness of different methods, techniques and tools for the analysis of requirements on the user interface and its specification, design and evaluation' ($t(37) = 2.63$, $p < 0.01$; two-tailed) than explaining why HCI was important or in applying the techniques. Thus they knew why HCI was important and believed that they could apply the techniques and methods but were unable to decide what to use where and when.

Consequences for teaching and learning practice

The results raise several wider issues for the way our teaching is organised. For example, we will be considering how students can be supported in developing a holistic approach to the material learnt in separate units. Possible strategies could include encouraging students to review their learning as a integrated whole, more explicit linkage across units and a greater emphasis on subject teaching teams who are responsible for 'threads' of subject domain material across related units.

As for the content of the HCI specialist unit, the approach taken already has a 'discount' flavour so far as such issues as the suggested number of test users, the uses of heuristic evaluation and so on are concerned. Students are also encouraged to think about resource implications for both HCI specialists and users. Naturally the techniques are linked to phases of design and development. What is missing seems to be an explicit cookbook or route map which would support decision making based on available resources, the nature of the problem and the phase of development. Ideally, such an instrument would be a substitute for practitioner experience in the field.

But is such an approach possible without rendering HCI trivial and algorithmic, and would it obscure real issues? And surely, at this stage, students should be learning principles for choosing between techniques rather than supplied with easy answers? Maybe the cookbook isn't given out until the very end of the unit? Or perhaps it could be constructed as a collaborative exercise between students and teaching staff? We will be experimenting with these options in our next delivery of the unit, but in the meantime would welcome other participants' views and experience.

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Profile

Gilbert Cockton

Gilbert Cockton has been a Research Chair in HCI at the University of Sunderland since 1997, where he leads the Human–Computer Systems research group. Prior to this, he worked flexibly for 3 years, combining part-time academic posts at Glasgow then UNN, independent and staff consultancy, child care and a little housework.
A founder member of the Scottish HCI Centre in 1984, he has been a member of the British HCI Group executive committee since 1985, with a break from 1991–95 while his children learned to boot a PC on their own. (They were booting Macs from 1992). A member of IFIP WG2.7(13.4) on User Interface Engineering since 1988, secretary from 1993–1999 and a member of 3 INTERACT committees, he received the IFIP Silver Core award in 1998. Having passed 40 last year, he no longer astounds fellow HCI folk with his youth on first meeting. Unruly research students have expanded his initial research interests on specification and architecture to span the complete development cycle from contextual research via design synthesis to usability evaluation. He has fought back with Grounded Design and Literate Development, which attempt to reintegrate his current research threads. He is currently project director of Digital Media Network, a cluster of new media companies in the North East of England.

What is your idea of happines
Sun, good food, good wine, good book, good company, wife, kids, friends and relaxed enough to enjoy them all in turn. That's the idea anyway, but I do work on it whenever I can.

What is your greatest fear?
Serious injury, especially to sight and limbs.

With which historical figure do you most identify?
John Lilburne (a Geordie, same school as me, 17th century).

Which living person do you most admire?
John Harle (another Geordie, same school as me, year above), Senior Professor of Saxophone at Guildhall – his talent for composition, performance and working with others is amazing.

What is the trait you most deplore in yourself?
Short-temperedness – now get on with these questions.

What is the trait you most deplore in others?
Dishonesty in any form from brazen deception to cowardly silence.

What vehicles do you own?
A Punto 75 SX (driven by my wife, I drive her 405 GLXDT estate) and a touring bike that I assembled myself nearly 20 years ago.

What is your greatest extravagance?
Books

What makes you feel most depressed?
Exhaustion

What objects do you always carry with you?
A comb

What do you most dislike about your appearance?
The way it turns out in photos

What is your most unappealing habit?
Interrupting

What is your favourite smell?
Excellent Pinot Noir (Carneros, Cote de Beaune, Cote Challonais, Sancerre, Oregon – I'm not too fussy).

What is your favourite word?
Apt

What is your favourite building?
5 Inverleith Place Edinburgh, our previous residence.

What is your favourite journey?
Whitley Bay to Glasgow, as the sun is rising, via Hadrian's Wall and Beattock.

What or who is the greatest love of your life?
My wife Ros and my children Jenny and Sam

Which living person do you most despise?
Margaret Thatcher

On what occasions do you lie?
Whenever I can't get the truth out properly

Which words or phrases do you most over-use?
Gorgeous

What is your greatest regret?
I have a few, but then again, too few to mention

When and where were you happiest?
Whenever I'm with my family and we are all relaxed and well

How do you relax?
By doing nothing

What single thing would improve the quality of your life?
Vast wealth, then I could iterate on the rest

Which talent would you most like to have?
John Harle's

What would your motto be?
Carpe diem

What keeps you awake at night?
Things I've forgotten to deal with during the day

How would you like to die?
As late in life as possible, preferably during a telesales call, when I'd order all the windows, conservatories and kitchens possible with my dying breath.

How would you like to be remembered?
As good company

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Those readers who have an interest in representing music through a computer package will be aware of a number of software packages that claim to ease this task. Essentially, they divide into two types: the first allows the user to play instruments through the software which records what is being played and then converts this to musical staff notation ready for printing. Such systems also cater for playing musical notation composed at the computer and probably the most well known of these is from Sibelius Software in Cambridge. The second type of musical software is more or less a music processor in that this type is similar to a word-processor except that its output is music on a stave as against a piece of text. The two main differences can equate to the fact that the second type must have the music inputted into the software note by note whereas the first type can accommodate played music and this is reflected in the price of the software. Thus a system of the first type comes for around £500 for a student's version (or into thousands of pounds for a professional system) while the second type can be purchased for around £60.

But there is also a more subtle difference in that some musicians may claim that creating music through a medium (in this case the computer) may detract from the composer's concentration and hence the music's quality may fall. There seem to have been no academically proven studies in this area and musicians continue to argue the merits of immediate publication of a work (achievable with the first type of musical processor) as against the possibility of refinement of the work over time. Of course, the now well-known (at least to HCI specialists) principle of first designing screens with paper and pencil away from the computer so that the design process can be as free as possible is an argument in strong support of not using instant publishing software. However, studies are needed to assess the merits of both ways of composing, since throughout musical history improvisation (i.e. composing while playing the instrument) has formed the basis of a number of compositions, but perhaps it is worth adding that great composers such as Bach and Mozart are known to have refined improvisations before publishing them as finished works ready for public consumption. But enough of such philosophical musings.

The system considered here is of the second type and runs under Windows '95 but other operating environments can be accommodated too. The software has three modes of use with the standard (middle) being the default. The software comes with an A5 size manual which in general is easy to follow, the index being comprehensive enough to allow quick answers to required keystrokes. The notes are associated with the keyboard letters so that the user presses 'a' for that note to appear on the screen. The pitch of each note is context sensitive but notes can easily be moved up or down an octave using the cursor keys. Some of the keystrokes are less obvious; for example, the numbers 1 to 8 are used for dividing notes of the breve, so that a crotchet (being 1/4 of a breve in length), for example, requires the numeral 4, thus relying on musical theoretical knowledge. The software is well laid out on the screen and the developer has provided a number of templates such as voice and piano, and organ (three staves).

While evaluative principles can be derived for a full evaluation of the software, probably the best question to ask relates to the ease with which a user can achieve the goal of inputting music for editing and printing. From scratch, it took me about 40 minutes to achieve the first two bars of the National Anthem (Figure 1) with heavy reliance on the manual. One of the problems seemed to be the different number of keystrokes needed to do the basic tasks of inserting barlines, aligning key signatures etc. Of course, if we equate this time with what we would learn about wordprocessing, I guess this is good progress. After all, I have also learnt to save the file in a format for insertion into this document (which is easily done in a .PCX format), and this seems to be one use of the software which is not really advertised. Music students writing about music, as against composing, would find this software really useful as musical quotations and illustrations can be inserted into essays so easily.

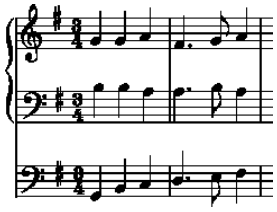

Figure 1 The first two bars of the National Anthem using the organ template

Of course, the software will do much more than in my example (Figure 1). Quaver joining lines can be at a variety of angles, different fonts can be used as well as a wide range of musical symbols including bar numbers and fingering (Figure 2). The software is powerful in that the needs of the music publisher have been thought about and implemented in a sensible way. To conclude, this software is good for users who want to publish music in a clearly readable format whether this is for the use of a choir, a performer or as illustrations in a text-based article. It is good value for money and deserves to succeed.

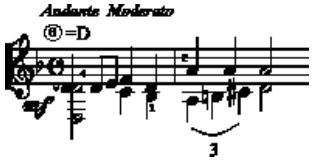

Figure 2 An example from the software sampler

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‘Changing Places’

a workshop on workspace models for collaboration

Tim Kindberg

Introduction

The Changing Places workshop [1, 2] took place on 12th April 1999 at Queen Mary & Westfield College. It was supported by a grant from the Engineering and Physical Sciences Research Council[1] and it was sponsored by the British HCI Group. The 45 people in attendance were from the UK, USA, Mexico, Norway, The Netherlands, Germany, Australia and Canada. Academic establishments and industry were well represented.

The aim of Changing Places was to gather experience of designing, using and evaluating models of workspaces for collaboration – in particular, the ability of these models to support users’ differing and changing needs. Several models exist of network ‘places’– electronic workspaces for collaborating and socially interacting groups of users. These include Web-based models such as BSCW, purpose-built 2D places such as Mushroom, Orbit and TeamWave, and 3D places such as MASSIVE and Sony’s community places.

The workshop aimed at addressing the basis for thinking that generic approaches to supporting CSCW applications are possible. If so, many problems remain to be solved. In particular, we need to understand how to enable users and application developers to customise and adapt workspaces to their particular needs.

Paul Dourish of Xerox Palo Alto Research Center gave the keynote talk, entitled “The Changing of Places”. Paul’s talk was followed by ten papers organised into three sessions, and a discussion session at the end of the day.

The presentations

Paul Dourish’s talk was based on his work with Steve Harrison [3], which suggests that users need to be able to appropriate the workspaces they are asked to use, if those workspaces are to be acceptable to them for everyday use. They consider the role of space as a metaphor in Computer Supported Cooperative Working (CSCW). Their assertion is that many systems borrow from the real world too simplistically. By reproducing (some) aspects of physical space, they hope to provide a suitable framework for users’ behaviour.

Places, however, must be made by their users, in a given space. “Space is the opportunity; place is the understood reality.” For example, users have understandings, in a place, of what is or is not appropriate behaviour. This understanding is cultural: it is in no way connected with any property of the space *per se*.

The first session addressed issues of workspace organisation and scale. Babak Farshchian of the Norwegian University of Science & Technology talked about the problems of large groups working on composite products [4]. He suggested that the structure of the product itself should be used to inform the organisation of the many workspaces constituting the collaboration-in-the-large. Michael Muller described work at the Lotus Development Corporation [5] on supporting virtual communities of users who share knowledge according to their interests, practices, etc. He introduced the design of an indexing tool to support their varying views of the underlying data. Caroline Jarrett of Effortmark raised challenges of boundaries and scalability that she has come across as a consultant to large organisations such as the Inland Revenue [6]. She is particularly concerned with issues of control of information, and the need for boundaries between sub-groups to change according to such factors as the roles of the individuals involved.

Caroline Jarrett’s concern with shifting boundaries led us to the second session, which was on issues of culture and difference. Paula Bourges-Waldegg of CINESTAV, Mexico, discussed a methodology for dealing with cultural diversity in the workspace [7]. Her main argument was that we should pursue an approach which enables the integrated co-existence of culturally heterogeneous groups working together, rather than presenting users with multiple culturally adapted interfaces. Martin Rich of City University went on to give us an account of his experiences in trying to support an international learning community [8]. Many of the problems encountered were concerned with rapidly changing conferencing technologies and the student users’ unfamiliarity with some of their features. But students also exhibited uncertainty over what would be construed as acceptable on-line behaviour by their remote counterparts. Alison Lee of IBM TJ Watson Research Centre talked about her work on social interfaces [9]. She is concerned with interfaces that instill a sense of “place-ness” for remotely connected users. In particular, she described her work on enabling users to contact others in their group, informed by information about their accessibility.

“Space is the opportunity; place is the understood reality.”

Issues of making one’s presence known in a group activity were the subject of the third session. Andrew Monk of the University of York presented experimental work on participatory status with respect to video links [10]. He discussed the relationships between participatory status, the group task and the visibility and audibility configuration of the links. Marike Hettinga of the Telematica Instuut in The Netherlands is also investigating videoconferencing [11]. She introduced a conceptual model based on structuration theory for identifying changes in the work process as collaborations over video links evolve. Andrew McGrath of British Telecom [12] presented an interface for introducing users to others with similar interests, based on monitoring their activities and providing avatar-based respresentations. The system enables users who ‘encounter’ one another through the interface to hold an audioconference. Finally, Michael Beigl of the University of Karlsruhe described another system for representing the presence of remote users [13]. His system

1 EPSRC grant GR/M46594

generates ambient sounds derived from the devices that users typically manipulate as they go about their work. The audible devices may be something obvious such as a keyboard, but Michael brought along a coffee cup equipped to produce sounds, to demonstrate the monitoring of more conventionally sociable artefacts!

Geraldine Fitzpatrick organised the final discussion session. The workshop split into small groups to discuss topics which the participants had suggested throughout the day. The results of those discussions are too multifarious to present here, but several themes emerged: of the politics of groups and such issues as control and privacy; of the need for a theory to help us reason about adapting workspaces; and of the effects of scale on the dynamics of interaction.

Conclusion

CSCW is a burgeoning and important area of computer science. The presentations and discussions at the Changing Places workshop have raised topics in the design of collaborative workspaces which are very relevant to the CSCW research agenda. But the problems of the adaptability of workspaces remain largely unsolved. It was the unanimous view of the programme committee members that the workshop was sufficiently successful to warrant a repeat event. We look forward to the second Changing Places workshop, to be held in 2000 or 2001.

Thanks are due to my colleagues on the programme committee: George Coulouris of QMW, Alan Dix of Staffordshire University, Paul Dourish of Xerox PARC and Geraldine Fitzpatrick of the University of Queensland. Thanks also to fellow Project Mushroom members Nick Bryan-Kinns and Ranjit Makwana, and to Sue White of QMW, for help with local arrangements.

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British HCI Group

Exec business

We thought you might be interested to know what your Executive Committee get up to, so we will publish regular notes and summaries of meetings and activities to keep you informed. Please let us know if there are issues you feel we should address as a committee – we are there to represent you.

The British HCI Executive, usually referred to as 'The Exec', met on 13 September 1999 at the University of York for its first meeting after the AGM. Ten members were present with nine apologies. After the usual committee procedures of approving Minutes and dealing with matters arising, the Exec turned to the first of two important discussions, that of one-day meetings. In previous Exec meetings, concern had been expressed that there were insufficient of these and it was pleasing that seven meetings were in the planning stage on topics ranging from standards to user-centred design. The second topic for discussion was Interfaces and considerable time was spent allocating sub-editing roles and generating ideas for new features to be commissioned by volunteers from a wide cross-section of the Group's membership. Some of these can be seen in this issue and others will be introduced later.

The rest of the business was no less important but could be settled more quickly. The vacant post of web coordinator and the Practitioners' Strategy Document generated enough interest for the latter to be declared the main business for the next Exec meeting, to be held on January 25th 2000 at University College London. The reports from INTERACT'99 and plans for HCI 2000 can be found elsewhere in this issue and the meeting closed with the standing item of reports from the relevant role holders.

Stella Mills
HCI Group Executive Committee

Affective Computing

The Role Of Emotion In Human Computer Interaction

Andrew Monk, Angela Sasse, Alison Crerar

British HCI Group one-day meeting
in conjunction with University College London

Special Guest Speakers:
Rosalind Picard, MIT Media Laboratory
Aaron Sloman, University of Birmingham
Michael Muller, Lotus Development Corporation

Saturday 10th April 1999
The Lewis lecture theatre, Windeyer Building
University College London

Programme

10.30 Rosalind Picard *MIT Media Laboratory*
'Toward interfaces that recognise and respond to a user's emotional expression'

12.00 Aaron Sloman *University of Birmingham*
'Why can't a goldfish long for its mother? Architectural prerequisites for various types of emotions'

12.30 Michael Muller *Lotus Development Corporation*
'Dimensional analysis of awareness technologies: reducing risks for non-consensual computer users'

2.00 Short position papers
Kim Binsted, *Sony Computer Science Lab, Tokyo*, 'Emotionally responsive systems'.
Antonio Camurri and Gualtiero Volpe, *University of Genova, Italy*, 'A goal directed rational component for emotional agents'
Zippora Arzi-Gonczarowski, *Typographics, Ltd., Jerusalem*, 'ISAAC: A mathematical categorical integrated schema for affective artificial cognition'

3.30 Short position papers
Veikko Surakka, *University of Tampere, Finland*, 'Facial emotions and affective computing'
Gillian Wilson, *University College London*, 'The relationship between media quality and user cost in networked multimedia applications'
Iain Murray, *University of Dundee*, 'Affect in synthetic speech'

How might a computer detect and respond to its user's emotional state? How can we model emotion and what theories can we draw on? What are the dangers of having a computer monitor your emotional state? These were the issues addressed at this stimulating meeting. Rosalind Picard (see also abstracts by Binstead, Surakka, Wilson and Murray) addressed the first issue by demonstrating a number of innovative systems. It is now possible to monitor physiological data such as skin conductivity and heart rate without the user being wired up like an astronaut. They are also working on ways of characterising the emotions they can detect and thinking about how the computer could usefully respond. As Roz was very willing to admit this part is as yet very much less well developed. This provided a useful lead in for Aaron Sloman who addressed the second issue (see also abstracts by Camurri & Volpe; Arzi-Gonczarowski). His computational architecture shows how emotion may interact with intention to produce action. The third issue was addressed by Michael Muller who provided a framework for judging the potential for organisational abuse of individual rights arising from different forms of computer monitoring, including the physiological monitoring of affective state.

The star of the day was George the goldfish, brought by Rosalind Picard as a surprise present for Aaron Sloman to illustrate his talk. It did not prove possible, in the time available, to determine whether George did or did not long for his mother.

Andrew Monk, *University of York*
Angela Sasse, *University College London*
Alison Crerar, *Napier University, Edinburgh*

Toward Interfaces that Recognize and Respond to a User's Emotional Expression

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Research in 'affective computing' aims to give computers the skills of emotional intelligence, including the ability to recognize emotions, to appropriately express them, and to know how to interpret and respond to emotions expressed by other people, animals, and machines. In some cases machines (including agents, and other computational devices) will also have internal mechanisms of emotion. Hence, additional skills of emotional intelligence will be needed to regulate those emotions and harness their use.

In this presentation I will highlight our recent efforts to give computers the ability to recognize and respond intelligently to a user's emotional expressions. I will show wearable computers with customized pattern recognition software, including eyeglasses that communicate expressions such as confusion or interest, and a wearable 'StartleCam.' The StartleCam records pictures based on the orientation response of the wearer, and hence is a first step toward a system that reduces information overload by recognizing and responding to the wearer's physiological signals.

I will also describe new software that responds to frustrated users with a careful mix of empathy, sympathy, and other skills of emotional intelligence. This 'emotionally savvy' software significantly improved users' willingness to interact with the system, as measured in a behavioural study involving 70 subjects, two control conditions, and a frustrating computer scenario. Among other things, we found that if a user gets particularly frustrated, it may even be beneficial for the computer to apologize. In short, it appears

that computers can not only do a good job of frustrating people, but they can also actively support people in reducing their frustration level.

Affective computing raises a number of potential concerns, together with potential benefits for fundamentally improving the nature of human–computer interaction. I will mention a few of these philosophical, social, and ethical issues, especially some that have already arisen in our experiments with 'artificial empathy.'

Why can't a goldfish long for its mother? Architectural prerequisites for various types of emotions

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Our everyday attributions of emotions, moods, attitudes, desires, and other affective states implicitly presuppose that people are information processors. To long for something you need to know of its existence, its remoteness, and the possibility of being together again. Besides these *semantic* information states, longing also involves a *control* state. One who has deep longing for X does not merely occasionally think it would be wonderful to be with X. In deep longing thoughts are often uncontrollably drawn to X.

We need to understand the architectural underpinnings of control of attention, so that we can see how control can be lost. Having control requires being able to some extent to monitor one's thought processes, to evaluate them, and to redirect them. Only 'to some extent' because both access and control are partial. We need to explain why. (In addition, self-evaluation can be misguided, e.g. after religious indoctrination!).

'Tertiary emotions' like deep longing are different from 'primary' emotions (e.g. being startled or sexually aroused) and 'secondary emotions' (e.g. being apprehensive or relieved) which, to some extent, we share with other animals. Can chimps, bonobos or human toddlers have tertiary emotions? To clarify the empirical questions and explain the phenomena we need a good model of the information processing architecture.

Conjecture: various modules in the human mind (perceptual, motor, and more central modules) all have architectural layers that evolved at different times and support different kinds of functionality, including reactive, deliberative and self-monitoring processes.

Different types of affect are related to the functioning of these different layers: e.g. primary emotions require only reactive layers, secondary emotions require deliberative layers (including 'what if' reasoning mechanisms) and tertiary emotions (e.g. deep longing, humiliation, infatuation) involve additional self-evaluation and self-control mechanisms which evolved late and may be rare among animals.

An architecture-based framework can bring some order into the morass of studies of affect (e.g. myriad definitions of 'emotion'). This will help us understand which kinds of emotions can arise in software agents that lack the reactive mechanisms required for controlling a physical body.

HCI designers need to understand these issues (a) if they want to model human affective processes, (b) if they wish to design systems which engage fruitfully with human affective processes, (c) if they wish to produce teaching/training packages for would-be counsellors, psychotherapists, psychologists.

Dimensional Analysis of Awareness Technologies: Reducing Risks for Non-Consensual Computer Users

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Non-consensual computer users are people who are required to use computers by their jobs or by their need for services. While they theoretically have a choice about whether to use the computer, these users are 'non-consensual' because the practical circumstances of their lives would impose an unacceptably high penalty for not using the computer (e.g., loss of livelihood, denial of health services, etc.).

In this presentation, I am concerned about the relationship of awareness technologies to these classes of computer users. Awareness technologies are a broad class of applications that tell users about one another. Some awareness technologies tell us about other users in real time, such as buddy systems, chat rooms, and other notifications of who is on-line at a particular moment. Other awareness technologies help us to find people with particular interests, skills, or work histories. Another category of awareness technologies helps us to know where people and objects are in a physical office environment. Awareness technologies have been used – primarily by knowledge workers and informal participants in on-line services – to enhance their effectiveness and to increase their opportunities for communication and collaboration. Many organizations are engaged in research into the organizational and personal benefits of awareness technologies.

As awareness technologies move from the research and on-line services spaces into office applications, they have the potential to reduce the quality of worklife for non-consensual computer users, through invasions of privacy or surveillance of work. In the extreme case, invasive awareness technologies may harm workers and their enterprises. If we can anticipate these difficulties before they occur in practice, can we design awareness technologies in ways that reduce their risks?

I will outline the problem, including its historical roots in Bentham's concept of the panopticon, as well as modern tendencies toward surveillance and the consequences for workers. I will then focus on a dimensional analysis of awareness technologies. This approach analyzes awareness information into different dimensions (e.g., person vs. place vs. activities), and asks whether certain dimensions or combinations of dimensions may be (a) relatively non-intrusive for non-consensual users, while being (b) valuable to organizations and individuals and (c) interesting to researchers.

continued overleaf

Short Position Papers

Emotionally Responsive Systems

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We are trying to build systems which can sense and respond to the affective state of the user. In particular, we are looking at emotionally responsive gaming; that is, games which try to maximize positively valenced arousal in the game player by adjusting the parameters of the game appropriately.

There are several problems to be solved before such systems can be built. First, we need to be able to detect the affective state of the user, whether via contact sensors (skin conductivity, BVP, etc.) or non-contact means (facial expression recognition, laughter detection, etc.). Then, we have to be able to identify the state, at least in terms of valence and arousal. Finally, we have to know which game parameters to adjust, and how to adjust them, to achieve the desired change in affective state. This will vary with both game type and user.

At this early stage of the project, we are working on the first two problems: detecting and identifying the user's affective state. Although we are unlikely to be able to present even preliminary results at the meeting in April, we hope to be able to discuss related issues in detail.

A goal-directed rational component for emotional agents

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The paper presents a component of our emotional agent architecture [1], concerning a goal-directed rational component of an emotional agent. We aim at modeling and developing emotional agents in multimodal environments, intelligent interfaces, with particular interest to non-verbal communication. We apply our research mainly in interactive dance/music systems [2], interactive art and museal exhibits involving mobile robots behaving as cicerone or as a special kind of visitor [1,3].

This paper focuses on a model of rational component whose main role is to integrate rationality, personality and emotions, mainly in the goal selection and action selection processes and in the evolution of the rational state. The model takes in account three mechanisms:

1. The direct dependence of the rational evolving knowledge on the current emotional state.
2. The mechanism of action selection on the basis of the current rational and emotional states.
3. The mechanism of goal selection not only on the basis of the rational and emotional states but also on the basis of the agent's personality.

We consider also the influence of the current rational state on the emotional state's evolution. In particular, success or failure of goals produces positive and negative stimuli, which modify the agent's emotional state.

The current prototype model of rational component contains five active modules:

1. A data driven production system is the main module. Generally, it contains a set of condition–action rules which utilize the agent's perceptions to match conditions and to select the actions that could be applied in the current state to satisfy the current goal.
2. A goal management component: it contains a list of current possible goals and periodically updates the set of decision parameters it uses to select the agent's current goal. The values of such parameters depends on the agent's emotion and personality. When the current active goal succeeds or fails, the consequent stimuli are sent to update the agent's emotional state.
3. An action selection component that selects an action between several actions that the production system judged rationally equivalent and applicable. The action selection algorithm works in dependence on the current emotional state.
4. A rational input component that gathers information coming from the other components of the general agent's architecture [1] and translates it so that the production system and the goal management and action selection components can easily utilize it.
5. A rational output component that generates information to send to the other components of the general agent's architecture [1], mainly in order to execute the actions chosen by the rational component.

Our approach supports a rational state evolving on the basis of rational and emotional knowledge encoded as facts in the production system working memory, a rational choice of a set of possible actions, an emotional and personality based selection of the current goal and action.

The proposed approach is currently under testing in an application of a museal robot behaving as a particular kind of visitor in the Music Atelier for children (interactive games to learn basic music concepts [1]). Its main communication channels include sound and music, style of navigation, environmental light and visual media controlled in the exhibit.

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A Mathematical Categorical Integrated Schema for Affective Artificial Cognition (ISAAC)

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An assumption of AI is that cognitive and affective intelligence could come in embodiments which are not

human. This often leads to research by endowing machines with human cognition and emotions. This constitutes an analogy between humans and lame imitations that is based on an imperfect, affected, similarity. It is suggested, instead, to base the analogy on an abstracted structural similarity between these radically different embodiments. A context free schema is proposed that captures a structure that may underlie a generalized notion of cognition and affect, thus avoiding over-determination and suggesting principles of functional design for beings that perceive, and interact with, an environment (possibly a social environment, featuring other such beings). Various intelligent life forms or artifacts become substitution instances of the schema, allowing for variation in embodiment, perception, and conceptualization. The rigorous structural similarity opens the way for meticulously formalized paths of communication that may bridge the differences while preserving the autonomy and particular strengths of the parties involved (this, itself, being a feature of emotional intelligence). In some respects machines may perform better (e.g. memory tasks, numerical and logical computations), while in other respects human agents will perform better, building on a nervous infrastructure that evolved from millions of years of natural selection. Each should best exploit its own capabilities for tasks such as sensitive communication.

The proposed structure is based on context free mathematical premises that capture a basic notion about perceiving an environment, producing responses, and recording the experience in some internal structure (a basis for further internal processing). The mathematical categorical treatment ensures rigour, that all assumptions are stated explicitly, with no hidden assumptions about cognition and affect. By applying further constructions and deductive tools of mathematics for higher level layers, one may model more advanced capabilities that underlie intelligent behavior, such as planning, decision making, etc. The abstract schematic approach provides a general formal account of perceptual cognitive and affective processes, as well as possibilities for the approximation of particular instances, with the advantage of avoiding a fixation on a single (i.e. the human) paradigm. Human introspection provides inspiration and invaluable pre-theoretical intuitions; however, a certain alienation from our idiosyncratic experiences as affective and cognitive agents, by sorting out formal structures, should result in clearer insights about the role of emotions, emotional sensitivity, the interfusion of cognition and affect, and other related issues.

Facial emotions and affective computing

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Human emotions have been repeatedly found to be a central part of inter- and intra-individual human behaviour. A profound question in the study of inter-individual behaviour is how a person's emotions affect the emotions of another, receiving person's emotions. Recently, it has been suggested that emotions can be contagious from observing other person's nonverbal expressions. We, for example have found evidence that subjects react differently with their facial muscle activity and emotional experiences to facial emotional and non-emotional expressions. Stronger facial electromyographic (EMG) activity was found from periocular (orbicularis oculi) and cheek (zygomaticus major) muscle regions in response to Duchenne than non-Duchenne smiles. The Duchenne smile which includes visible changes related to activation of both periocular and cheek muscle regions has been found to be better related to experiences of pleasure than non-Duchenne smile, that is a smile which does not include the visible activity of periocular muscle region. The experiences of pleasure were also stronger in relation to Duchenne than non-Duchenne smiles.

In another study we investigated facial EMG responses to vocal affect expressions. Subjects were presented a Finnish word [Sa:ra] in angry, content and neutral tones of voices. Facial EMG was measured from the brow (corrugator supercilii) and periocular muscle regions. The results showed that the prosodic cues of contentment activated the periocular muscle region more than cues of anger. The brow muscle region was activated more while hearing angry than content vocalizations.

The results support the view that people tend to react with corresponding emotions to the emotions they perceive from other person's facial and vocal cues. Thus, emotions are contagious. The knowledge of the fine-grained cues in emotional expressions could be useful in building computers for affective computing. This knowledge might be of use in recognizing user's emotions. The understanding of the phenomenon of emotional contagion might be helpful in formulating a relevant response for the user.

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The relationship between media quality and user cost in networked multimedia applications

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The aim of the research described in this paper is to establish the relationship between the media quality experienced by users of networked multimedia applications and user cost, which is defined as stress. In the networked multimedia community there is much activity in the area of quality of service (QoS) requirements, yet this tends to focus at the level of the network provider, rather than the end user.

Previous research has shown that the relationship between users' perceptions of audio and video and the objective quality parameters at the centre of the QoS discussion is not straightforward. Recent work on the subjective assessment of audio and video quality has shown that factors such as users' task and level of experience (Watson & Sasse, 1998) and whether users are required to pay for that quality (Bouch & Sasse, 1999) significantly influence subjective ratings of the same objective quality. Whilst this shows the importance of subjective ratings, it also illustrates potential dangers of relying on subjective assessment alone.

Therefore, work which aims to establish quality thresholds for audio and video (such as the ETNA project at UCL and Glasgow University) needs to consider the degree to which objective levels of quality represent significant cost to the

user. Thus, we are measuring users' physiological responses to different levels of audio and video quality, in experimental settings and field trials.

Specific questions to be addressed are:

- What is a meaningful way to measure user cost?
- What aspects of quality can be stressful?
- Is quality more important in some tasks than others?
- How important are factors which contribute to quality but are not network QoS factors?

Our starting point for investigating users' physiological responses is symptoms of stress. Stress is commonly defined as a disruption in the homeostasis of an individual due to an event. A computerised biofeedback system is being used to measure these responses. In the position paper, results from early studies will be presented and a development at MIT in physiological measuring equipment will be discussed.

In summary, this area has not been widely investigated. From this research, designers of multimedia technology will have guidelines for the quality that specific users require for undertaking specific tasks without significant user cost. In addition the results will assist the design, implementation and assessment of new videoconferencing technologies.

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Affect in Synthetic Speech

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Text-to-speech and other speech output technologies are becoming increasingly widespread, and many low-priced commercial systems are available which offer very high intelligibility. However, most are still easily identified as artificial voices and no commercial systems yet allow prosodic variation due to emotional state and related pragmatic factors. Also, TTS systems have been designed to read 'normal' text, and thus with some types of material the speaking style does not sound appropriate.

These limitations are partly due to the complexity of incorporating such naturalness factors into the current generation of speech synthesis engines, and largely due to our very limited knowledge of what voice changes actually occur as a result of the speaker's affective state (and their intended speaking style). There has also been a limited amount of work done on modelling affective states and their inter-relations. However, affective and prosodic content in synthetic speech is seen as increasingly important in interactive computer systems, where the additional vocal dimension offered by emotionally coloured speech output could make the output more useful and meaningful to the user. The ability to recognise the user's emotional state in vocal input could also be of practical benefit.

Some prototype systems have been developed which offer synthetic speech output with affective content; these are typically text-to-speech systems with an additional input parameter – the required emotion (accessed by name or via suitable control parameters from an emotion model). These systems have been developed as demonstration systems, or for use with non-speaking people who use a computer with a speech synthesiser for personal communication, but the technology could equally be used in any other application requiring affective speech output.

At present, there is renewed interest in the investigation of human vocal emotion and the development of synthesis models to allow greater prosodic variation.

This paper will review progress to date in the investigation of emotion modelling, human vocal affect and its simulation in synthetic speech, and provide suggestions for future research and applications in this area.

Poster Presentations

Towards including simple emotions in a cognitive architecture in order to fit behaviour better

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Emotions are an important aspect of human behaviour. It is time to include them in cognitive architectures. We will describe how emotions and affective behaviour may be realized within general cognitive architectures like ACT-R, based on generalized and unified approaches of existing theories of emotions. This will provide a more complete architecture for modelling behaviour, and a platform for performing future studies of affect within a unified theory of cognition.

We will ground our discussion by considering adding several basic emotions to ACT-R to support a particular ACT-R model that interacts with a $2^{1}/_{2}$-D world to solve a puzzle, a task similar in many ways to many HCI tasks. Adding emotions and their effect on problem solving are very good candidates for the next step to improve this model. Emotions are presumably not task specific, so they belong in the architecture, not as task knowlege. It is possible to fairly directly compare the theories of emotions with data expressing these emotions.

We demonstrate how curiosity, distress, and joy, three primary emotions, can be implemented in ACT-R. The set of parameters that may be modified by emotions in ACT-R includes the amount of working memory, the speed of production rule firing, the amount of noise applied to Expected Gain (with increased EGN, behaviour of the system may become more chaotic), and Expected Gain of particular rules or even classes of rules making them more preferable over the others (Clore, 1992). Emotions may also change the goal stack or generate new goals. Perceptual characteristics may also be affected (LeDoux, 1990). In our model this would include the sizes of visual areas, including the fovea and parafovea.

These emotions can be initially implemented by changing the decision (rule matching) procedure, adding rules to make parameter changes, and by augmenting working memory to include affective information (e.g., a block construction looks

good or bad or achieves a goal). These changes will allow an existing model, which matches adult behaviour well, to better match adult and children's behaviour when modified to lesser or greater extents. These emotional effects will do this by (a) slowing down performance in general, (b) slowing down initial performance as the child explores the puzzle driven by curiosity, and (c) abandoning the task if performance is not successful. The mechanisms also can be used to study more complex emotional behaviour using a cognitive architecture where the task involves interaction.

Activity Theory as a framework for considering human affect in the design

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Over recent years there has been the growing recognition that the human element is not to be treated as a source of possible errors, but as a unique component, being part of any complex system, which excels with its creativity and flexibility especially when abnormal situations are encountered. This is reflected by research like Naturalistic Decision Making, Human-Centred Design, Situated Action, or Distributed Cognition where the major emphasis is on the cognitive support, the quality in use, and the situational dependency.

We argue that in the design of complex systems we need to introduce another dimension, namely the need for *affective support* of the humans. Human decision making and all human behaviour is not determined by principles of rationality alone. Neglect of affective factors has frequently led to breakdowns in the interaction and sometimes to serious incidents. Feelings of uncertainty about or even negative feelings towards artefacts or automation may lead to its disuse or may prevent the necessary co-operation. Usability studies are not sufficient to discover and point to contradictions within the complex system, such as a human's disappointment because he or she was not questioned adequately during the design, or because a different type of support would have been preferred, or even due to fears that the new system will act as a competitor or supervisor. It discounts the emotions certain types of artefacts will induce in a human.

In order to explicitly include the consideration of affective influences in the analysis and the design of complex systems we believe that Activity Theory has the potential to be an integrating framework. Activity Theory is rooted in the cultural–historical approach of Soviet psychology and stresses the unity of consciousness and activity. This means that the human mind emerges, exists, and can only be understood within the context of the human interaction with the world. This interaction is always directed towards an object and is socially and culturally determined. This view reflects the acquisition of affective biases. We are not claiming that Activity Theory can be used to fully comprehend the underlying neurobiological mechanisms of emotions, nor to provide an ontological description. In this paper we put forward that Activity Theory with its emphasis on goals and motivations of a human, and their simultaneous consideration together with the subject, the environment and the interactions which exist between these, is a natural instrument to call attention to the human affect. An Activity Theory analysis may be used to describe possible contradictions on the affective level in an integrative way. The insights gained can then continuously feed into and promote a design for affective support and help to reduce the likelihood of interactional breakdowns.

Subjectivity and Emotion in Quality of Perception

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At the end of the day, it is what the user gets out of the computational experience that should be driving technology and not vice versa. To this end, our research has been concerned with the impact of the delivered Quality of Service (QoS) of multimedia applications on not only human users' satisfaction with the presentation quality of such clips, but also on their ability to understand, analyse and synthesise the encapsulated informational content. We have called this user-level measure of informational retention Quality of Perception (QoP).

Inevitably, in interactions between the human element and the computer, subjectivity plays a great part. Not only does a person's a priori disposition to the subject matter being shown influence the QoP, but results of our work have evinced that the manner in which a person makes inferences regarding the information presented to him/her in a multimedia clip is by no means obvious or straightforward.

In fact, we can say that, as far as information assimilation goes, human behaviour is characterised by the inequality WYS<WYG (what you see is not what you get). This inequality represents, in our opinion, the fundamental difference between human understanding and perception, the effects of which we are still investigating in the context of multimedia communication.

In the meeting, we intend sharing our experiences in the area of Quality of Perception and discussing possible future directions for our work.

Emotion in customer interfaces, creating a hedonic shopping experience

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Shopping via the WWW is often described in terms of gathering information about products or services to make purchase decisions, or to conduct a purchase transaction. In this view, the consumer is seen as a problem solver. However, shopping encompasses both task related or product acquisition activities as well as hedonic value through responses evoked during the experience. Hedonic shopping value reflects shopping's potential entertainment and emotional worth.

During the GAIA service evaluation, concerned with music brokerage, participants described shopping for CDs as a leisure activity, referred in term, of mood, surprise, seeing, hearing and touching. For example, a participant described shopping in those terms: while strolling in the city, when in the mood, entering a shop and buying CDs.

Furthermore, hedonic researches have showed that the emotional component has more influence in some types of consumption, especially related to entertainment. Looking in more detail at consumer behaviour shows the effect of emotion in this domain. Prior studies found that emotions

play an important role in problem solving and decision making by providing information on the emotional desirability of the options available. In some instances, emotional desire dominates utilitarian motives in the choice of products. Emotion also plays an important role in some types of purchase (i.e. impulse purchase), and situation (e.g. purchasing a gift).

Thus emotion should also prove critical to e-commerce and the design of customer interfaces, by facilitating the purchasing process, or by encouraging the customer to visit and return to particular sites. Consumers report being delighted over becoming immersed in a store, the same should be true from a virtual store.

The task of providing a hedonic shopping experience is a complex one. As the next step we will focus further on the expression of emotions in customer interfaces: by using human characters, rhetorical devices and persuasive multimedia. In conclusion, establishing a framework for creating hedonic shopping will also be discussed.

The Virtual Helpdesk Adviser: automating people skills in HCI

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Information technology in the workplace is notoriously adept at invoking a range of negative emotions in the end user. Frustration, exasperation, anger and impatience are common and often reach a level where they may impede the search for a suitable solution. Unfortunately, contemporary help systems are blind to these emotional variations, and can often increase anxiety and frustration with a dishearteningly clinical and unsympathetic tone. They lack the emotional intelligence of their human counterparts.

Finely tuned emotional intelligence is important for any helpdesk adviser, who must be helpful, informative and supportive without being patronising. As automated help systems develop from mere indexes of user manuals to pre-emptive virtual assistants, the possibility of an emotionally intelligent automated help system becomes more feasible. This paper explores some of the qualities that may be required, and discusses general architectures that may be used to achieve them.

The first step is to gather some data indicating the user's emotional state. Physiological patterns, facial expressions and vocal tone can provide important clues, but they each require specialised monitoring mechanisms and complex analysis software which are not yet widely available. Given the constraints of current officeware, simple self-report questionnaires are more expedient. The assessment cues may be verbal (e.g. descriptive keywords) or non-verbal (e.g. simulated expressions).

The data can then be used for two purposes: to reduce the user's anxiety levels and to modify the solution strategy. The help system can select from a range of presentation techniques, perhaps adjusting the terminology and linguistic tone, or tailoring more subliminal stimuli such as sound effects and colour balance. Indeed, a virtual help assistant could display virtual empathy using suitable sympathetic facial expressions.

By analogy with human reasoning, the emotional data can be used to prune the solution search tree. Complex decision making employs a range of affective markers which label possible actions as more or less suitable according to current mood. Endowing a help system with similar capacities could improve user satisfaction by adjusting the level of detail or selecting a different action strategy. Moreover, this system could learn the favoured strategies of different users, generating a personalised set of affective markers for each one. The requisite architecture must employ learning algorithms and interchangeable profiles.

An automated help system endowed with some measure of emotional awareness and affect-driven response schemes would be a lot less intimidating for the end user. The potential benefits in a commercial environment include reductions in IT support time and expensive helpdesk calls, and perhaps even a welcome boost in office morale.

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HCI 2000

Key Dates

Web instructions for submission: October 1999.
Submission Deadlines: 18th January 2000 (Full papers and tutorials) 3rd May 2000 (All other submissions, camera ready).
Notification of acceptance: 17th March 2000 (Full papers and tutorials) 12th June 2000 (All other submissions).
Camera ready for proceedings: early May 2000.

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