interaction

Interfaces

76 • Autumn 2008

hci2008
Culture, Creativity, Interaction

Keynote Speakers

Opening Speaker — **Professor Yvonne Rogers**
Open University
New Horizons for HCI

Industry Day — **Andrew Kirby**
Microsoft
Improving Patient Safety Using the Microsoft Common User Interface

Closing Speaker — **Professor Paul Dourish**
University of California, Irvine
Madness in Our Method: Combining Ethnographic Inquiry and Technology Design

Social Programme

Tuesday Informal Gathering, 6–9pm Tate Liverpool, finger buffet, drinks and gallery tour of the permanent collection

Wednesday Digital Live Art, Contemporary Urban Centre, Greenland St, 7pm on, food followed by live performances from the artists of (re)Actor3

Thursday Formal Dinner 7:30pm for 8, Maritime Museum, Albert Dock

In this issue tropical *games* analysis video *games* on video developing *games* split reality *games* measuring *games* usability

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Human–Computer Interaction

Editorial

John Knight

Welcome to the conference edition of *Interfaces*.

I have to start by thanking all of the contributors and an especially big thank you to Fiona and the regular writers who have put this issue together in my absence during my honeymoon.

In a way I see this issue as the culmination of a year spent gently repositioning *Interfaces*. Firstly, I think we have, more than ever, closely linked the magazine to the conference in a way that hopefully engages with the readership and gives us all a focus through the year. Secondly, I have been speaking to you and we are taking this feedback on board in terms of improving design and content and in particular ensuring that *Interfaces* reflects the diversity of its audience.

I have learned that making improvements is a delicate job. We want neither glitz nor dust but relevant, reflective and representative thinking on our work in *Interfaces* and that needs to be reflected in everything from the content to the font.

Lastly, I must thank Gilbert Cockton whose last column appears in this issue. Thanks, Gilbert, for your great articles over the years; and also thanks to the *Interfaces* team that is building around us.

Conference Write-ups

Please send me articles and views on HCI2008 in Liverpool for publication in *Interfaces* 77 and beyond. Workshop reports, sideways views, the highs and lows – *Interfaces* wants your reflections on, responses to, and images of the conference. See box (right) for deadlines and guidelines.

John Knight is a User Experience Manager at Vodafone and works on mobile phone and applications UI. He was formerly Director of User-Lab at Birmingham Institute of Art and Design and has worked as a freelance designer and researcher. John is also chair of IDEC4, which will be at NordiCHI 2008.

Contents

Contribute to *Interfaces*

Interfaces welcomes submissions on any HCI-related topic, including articles, opinion pieces, book reviews and conference reports.

Forthcoming themes

Interfaces 77, Winter 2008: **Social Networks**. Deadline ***1 November 2008***.

Interfaces 78, Spring 2009: Deadline *1 February 2008*.

Articles should be MS Word or plain text. Send images as separate files: these must be high resolution digital originals suitable for commercial printing, cropped if desired but not resized, and if edited, saved as tiff or highest quality jpeg. Please supply photographers' credits as appropriate.

Authors please provide a 70-word biography and a high resolution head and shoulders original digital photo. Photographers' credits will be printed if provided.

Send to John Knight, John.Knight@intiuo.com; 16 Combermere Road, Brixton SW9 9QG

This issue's guest columnists

Jan Borchers is a full professor of computer science at RWTH Aachen University in Germany where he heads the Media Computing Group, studying interaction with audio and video streams, mobile and wearable devices, and ubicomp environments. Before RWTH, he worked at ETH Zurich and Stanford University, after receiving his PhD in computer science from Darmstadt University of Technology.

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Steven Allick is a research student in the School of Computing at the University of Teesside, UK. He is a veteran gamer with strong knowledge of video games and technology. He researches the application of semiotics and tropes to video games.

Clive Fencott and Charlie McElhone, also at Teesside, are researchers of many years standing with sixty refereed papers between them in the fields of computer games, virtual reality and software engineering.

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Since 2007 Paul Cairns has been a senior lecturer in human–computer interaction at the University of York, and programme leader for the brand new MSc in Human-Centred Interactive Technologies. He spent the previous six years at the UCL Interaction Centre. His research interest include immersion and user experience in games and research methods for HCI. Together with Anna Cox, he has edited a book on this topic, imaginatively called *Research Methods for HCI*.

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Graham McAllister is a senior lecturer in HCI at the University of Sussex. His background includes software engineering, computer graphics, network programming and music technology. He now researches into accessibility, in particular how blind and visually impaired people gain access to digital information online with multimodal technology. His other main research area is improving methods for evaluating the usability and user experience of video games.

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Johannes Löschner is a student of Applied Communications and Media Science at the University Duisburg-Essen. Currently he is undertaking his work experience within the Collaborative Virtual and Augmented Environments Department at Fraunhofer FIT, where he focuses on game design studies.

Alan Dix is a professor at Lancaster University. He writes the odd book and the odd very odd paper. He regards the reappearance of *Dr Who* as the most important event in revitalising a generation's technological excitement during the 20 years he has worked in HCI. He keeps trying to get this into his research … and may do some day soon.

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After a degree in Applied Computer Systems (Brunel) Philip Webb designed and developed database applications for 10 years. To learn more about usability and designing for user needs he is currently studying for an MSc in HCI and ergonomics at UCLIC. His project is a distributed cognition study of the Victoria Line control room at London Underground, aiming to understand how current practices will be impacted by the Victoria Line upgrade.

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Cover: David England

To receive your own copy of Interfaces, join the British HCI Group (information on page 24). PDFs of Interfaces issues 35–75 can be found on the British HCI Group website, http://www.bcs-hci.org.uk/about/interfaces/archive/

Deflections
Twilight of the Idolators

Gilbert Cockton

Nietzsche wrote *Twilight of the Idols; How One Philosophizes with a Hammer* on holiday in just over a week in 1888. By the next year, a third maddening stage of syphilis ended his writing. My last *Deflections* column after five years of purple prose, I hasten to add, is no such herald. As a user-centred chappy, I'm going after *idolators*, not idols, and I don't mean copies of the Japanese melodic death metal band Blood Stain Child's third album. If Nietzsche and death metal feel like they go together, then it's time for you to read some Nietzsche. Idolators intensely and often blindly admire what is not usually a subject of worship. Nietzsche did the exact opposite on every count. So sticking to the spirit of *Deflections* to the very end, I'm getting behind the cherished beliefs of HCI, usability, UX and their kin to open up new discourses about what people (us) can really do for people (them, those users, consumers, workers, humans in all their quirks and glories). It's all down to choice: the ends we seek to pursue, the means we adopt in pursuit, the people we pursue ends for, and our approaches to seeing if we have caught our pursuit. These are all hard choices. Designing requires a lot of thinking to coax one's muse out from her slumbers.

So, which idolators should I have one last go at here? Which of their idols warrant my last few hundred words or so of tender deflecting prose? I've found it impossible to choose or focus, so in the spirit of Nietzsche's aphorisms, I will strafe what I can in one last burst of putting the HCI world to rights. However, I cannot see myself meeting Nietzsche's ambition in *Twilight of the Idols* "to say in ten sentences what everyone else says in a book, what everyone else does not say in a book". My offering is this more humble Aphoristic Alphabet that makes no attempt to cover everything and all points beyond.

Accessed, not Accessible

Being needs Doing, Doing gets you Being, Do-be-do-be-do

Contexts fade, outcomes flourish

Designing is connecting, not just creating

E-valu-ation is not just measurement and testing

Felt life feels funny

Goals always arrive too late

Humans value

Interaction = Distraction

Judgements are a designer's best friend

Know how subsumes know that

Learning doesn't have to be easy

Meaning affirms experience

No absolutes! Absolutely not! Never!

Ontological engineering: being from nothingness

Prototypes probe

Quality is an indispensable illusion

Relevance kills 99% of all known user difficulties

Standards, when bog standard, need a good long flush

Technology makes it all possible, but not necessarily desirable

Users are people in between keystrokes

Value motivates, worth arbitrates

We are not machines, and you aren't either

U**X**: usability with attitude

You must choose, the numbers won't

Zero tolerance for disciplinary hegemony

That's all folks. From now on, *Deflections* Mark II will be brought to you by the kinder gentler duo of Mark Blythe and Jeffrey Bardzell. All power to their prose, and may they deflect all future idolators in HCI for the foreseeable future. Thanks for reading me, thanks for the occasional appreciative emails, thanks for the surprise citations, but thanks most of all for being a colleague within the marvellous endeavour of HCI. Interaction design is too young for unshakeable cherished beliefs, so I too look forward to reading Mark and Jeffrey's new perspectives, and, in the best traditions [*sic*] of Third Wave HCI, staying open to interpretation. So long, and thanks for all the fishing.

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Gilbert Cockton is Research Chair in HCI in the School of Computing and Technology at the University of Sunderland. His research group currently provides usability consultancy and training for the Digital Knowledge Exchange, a HEIF Centre of Knowledge Exchange. Gilbert has recently completed a NESTA fellowship, developing worth-centred approaches to interaction design, on which he presented at CHI 2008's alt.chi, Design Theatre and a panel.

HCI2008

Culture, Creativity, Interaction – well under way

David England

By the time you read this HCI2008 will be ready to start or even under way. If you are here – a warm welcome to Liverpool. We have a full programme of workshops, tutorials, full papers, short papers and interactive experiences plus exhibition. You can get the full programme at http://www.hci2008.org or read the proceedings online at the BCS website, http://www.bcs.org/server.php?show=nav.7927.

The workshops cover a range of topics from HCI education and games to methodologies and of course culture. The full paper topics include

- Culture
- Visual experience
- Assistive technologies
- HCI methods
- Sense making
- Coping with demanding tasks

Short paper topics range more broadly and should offer something to everyone in the broad church of HCI.

We have a full set of activities for HCI Practice day on Thursday, including short papers, a panel and keynote speaker, Andrew Kirby.

Our cultural theme extends into our social programme with an informal gathering at Tate Liverpool on Tuesday night, a night of Digital Live Art with our colleagues from (re)Actor3 on Wednesday and dinner at the Liverpool Maritime Museum on Thursday.

Many people put a conference together and there are many to thank including, in no particular order, Russell, Willem-Paul, Janet, Barbara, Peter, Abdennour, Omar, Dianne, Carol, William, Lesley, Ian, Tom, Marta, Oscar, Dan, Andrew, Dhiya, Jenn and Nick. Many others will be helping out during the week and will guide you on your way should you need help.

David England is a Principal Lecturer and head of the Computer Systems group at Liverpool John Moores University. Apart from HCI his main interests are in Computer Games Development and Digital Art. He has worked in the background on the latter for the last 17 years, culminating in an exhibition at the FACT Centre, Liverpool in 2006. For his sins he is this year's Chair of the HCI conference being held in Liverpool, Sept 1–5 2008. He did his PhD in Lancaster University followed by post-doc work at Glasgow University before moving to GMD, Sankt Augustin to work on shared virtual reality.

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View from the Chair

Revising roles: changes in the COG

Russell Beale

This 'View from the Chair' is especially brief, owing to the plethora of other articles submitted for this issue, and it's great to see this activity from across the HCI domains. Partly because of this, the COG (Chairs and Officers Group) has recently agreed a restructuring that affects the way that we view, and manage, the group's activities.

It has essentially been refocused on supporting key groups: academic, education, practitioner, public – and each of these will have a representative person. The group supports these cohorts through its products and services: the conference, *Interfaces*, UsabilityNews, the website, and so on.

We have defined a PR/marketing role, and will be looking to engage even more with the public: if you are particularly interested in working with us on some media issues, both reactively and proactively, then please get in touch with me.

The aim of these changes is to clarify who is responsible for what, and to ensure that we are able to understand and meet the needs of the groups we aim to represent and support. And given the changes in the BCS structures, we may well soon have very many more members and this gives us the opportunity, and the responsibility, of pushing HCI ever more widely.

Russell Beale leads the Advanced Interaction Group in the School of Computer Science at the University of Birmingham. His research focus is on using intelligence to support user interaction. Before returning full time to academia and research in 2003, he co-founded, ran, or worked for various internet-related companies.

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Interacting with ubiquitous media
A research matrix

Abstract

How do you structure your HCI research programme when you are heading your own group? This article presents the Media Computing Group at RWTH Aachen University and its goal to explore the future of collaborative, ubiquitous interaction with audiovisual media. It explains how this initial research vision has led to work in a *research matrix*: contributions on different levels, from HCI theory and algorithms to toolkits, testbeds, and design patterns, intersect with three topical research directions – interaction with audiovisual, ubiquitous, and collaborative systems. It also introduces some of our external collaborations, in particular the Excellence Initiative, Germany's most fundamental change in government research funding to date, which supports RWTH and our group.

Introduction

Until recently, the German HCI research landscape had been relatively sparsely populated. Virtually no research groups contributed consistently to top international conferences such as CHI. This paper aims, on the one hand, to explain how our Media Computing Group, established in 2003, went from an initial broad research vision to creating successful contributions in many fields of HCI, from theories and algorithms, to toolkits and testbeds, to ways to capture lessons learned as design patterns. In this, we hope both to interest partners around the world to get in contact with us to exchange ideas, and to inspire new labs defining and implementing their own research programme.

On the other hand, it is productive external collaborations and well-aimed funding that really make research groups thrive. Therefore, we will also present our links to other partners, and discuss the Excellence Initiative, a recent move by the German government funding body DFG (the German National Science Foundation) to provide extra funding to Germany's top universities and research groups.

Initial research vision: New interactions with ubiquitous audiovisual media

We started out with the conviction that we were most interested in *qualitatively new* interactions with technology (such as conducting an electronic orchestra), rather than *incremental improvements* to existing paradigms and techniques (such as speeding up dropdown menu selection). This approach provides big benefits: it helps to create systems that are 'first of their kind', breaking new ground in how people can interact with technology. However, it also carries specific problems – evaluating a fundamentally new interaction technique quantitatively is hard when there are no competitors to compare it to.

Our research vision joined the domains of audiovisual media and ubiquitous computing. On the one hand, we wanted to provide new ways to interact with, for example, audio or video streams. On the other hand, we wanted to move beyond the existing desktop paradigm and into the world of post-desktop, mobile, ubiquitous, wearable interfaces and ambient computing environments and interaction techniques.

The *Aachen Media Space* initiative turned out to be a great melting pot for these two ingredients: This room prototype provides an environment for scenarios in which people collaborate. They work with text but also multimedia digital material. Post-desktop interaction techniques make sure that their flow of collaborative activity is not interrupted.

From visions to contributions

Many of our concrete research projects, including those leading to PhD theses, have a similar overall structure:

1. **Vision** An initial research vision suggests a fundamentally new way for people to interact with technology. Examples include conducting an orchestra, casting spells by gesturing with a cell phone, or navigating a video by dragging objects in it to get to the moment when they are at that location. Sometimes these research visions are suggested by project opportunities with external partners; in other cases they are the result of internal brainstorming and discussions.
2. **Theories & Algorithms** From that HCI-oriented vision of a particular user experience, technological problems quickly begin to emerge that require hard thinking in computer science. For example, conducting an actual orchestra recording requires time-stretching audio and video in real time at high quality; cellphone spell-casting requires robust gesture recognition on a device with little processing power; and dragging objects in a video to navigate requires computing forward and backward trajectories of every pixel in every frame. Also, after one or two research projects with a similar goal, we have often uncovered more general theories to describe our approach and model the problem or solution design spaces.
3. **Toolkits** To make our results more accessible and reusable, we also found ourselves bundling our technology in software toolkits and frameworks to help ourselves and other similar research projects.
4. **Testbeds** Solving the above problems leads to contributions on the technical side of HCI, and often to presentable prototypes of the idea at work. However, it has become our tradition to try to 'go the extra mile' and apply these techniques to create an actual real-world system – often an interactive exhibit for a public space such as a tech museum or similar exhibition centre. That way, there is only one customer to satisfy, but still a large number of people get to experience the new interaction over time as the system is on exhibition

or in use. An initial conducting system created by the author for the House of Music in Vienna, for example, has made its way into the top recommendations in *Lonely Planet* and virtually all other current Vienna travel guidebooks. This nicely grounds our work and provides closure to our initial vision of a new interaction.

5 **Patterns** We sometimes try to capture what we learned in our projects not just in scientific papers and testbeds, but as concrete design guidance. HCI Design Patterns [1] have been a suitable format to do this in a standard, accessible, and reusable way.

The remainder of this paper looks at the three major research directions introduced earlier: interaction with audiovisual media, ubiquitous interaction, and collaborative environments. For each of these three directions, we explain the above steps in more detail, and what projects and contributions emerged at each level.

Interaction with audiovisual media

In this research direction, we created several contributions on the level of ***algorithms and theories***, to better understand our research problems and ways to solve them. One good example is PhaVoRIT [2], an algorithm that time-stretches audio recordings without pitch shifts or major audio artifacts such as reverberation or distortion, with real-time response to user input with a latency of a few milliseconds, and without requiring any lengthy precomputing. Over several iterations, it greatly changed and improved the user experience of our interactive conducting exhibits. We also studied conducting behaviour of professionals and laypeople, and found clear differences in how these two groups thought about and interacted with a musical system while trying to conduct a recording [4]. At the same time, we noticed that writing software that time-stretched multimedia data was unnecessarily difficult because of a missing abstraction: we introduced *Semantic Time*, a concept that lets programmers think in beats of a music piece rather than in sample numbers or milliseconds of a recording. Another example for an algorithmic contribution in this research direction is the DRAGON [5] algorithm that computes optical flow fields from a given video recording, to enable the aforementioned dragging of objects to navigate a video timeline.

On the ***toolkit*** level, we continued to create the *Semantic Time Framework*, a new multimedia API that used the above concept of semantic time to create time-stretching applications much more easily.

We created ***testbeds*** for most of our research initiatives in this field, not least because interaction with audio and video lends itself perfectly to presentation in demonstrators. Our work in conducting systems was flanked by a series of exhibits; after the initial Vienna installation (Fig. 1), the Boston

Figure 1 Personal Orchestra, an interactive conducting exhibit in the House of Music Vienna

Children's Museum (2003) and the Betty Brinn Children's Museum Milwaukee (2005) received newer versions of interactive conducting systems. Other testbeds included REXband, an interactive music exhibit exploring computer-aided musical improvisation, and the open-source audio scrubbing tool DiMaß.

Our testbed designs were guided by the author's set of HCI Design ***Patterns*** for interactive exhibits [1]. This initial collection proved quite valuable for our projects, as it helped to quickly communicate the most important design guidelines and design values behind our work. Sharing these effectively both with new members of our team and potential clients was a big bonus. At the same time, the guidelines evolved, as experience from subsequent projects strengthened some patterns in the language and weakened others.

Ubiquitous interaction

In this second research direction, our group had decided to look at interfaces beyond the desktop, for mobile and also wearable computing. Many of our initial experiments in this area, however, were hindered by the fact that, in our evaluations, we were trying to compare new, prototype-level interaction techniques (such as using phonecams as tracking devices to move cursors on large displays) with established, industry-strength interface devices such as mice or joysticks. One of the ***theories*** we gradually developed to address this was the idea of *selexels* to effectively measure the potential expressiveness of prototype mobile interaction techniques. In short, selexels are pixels in 'selection space', the movement space in which users make their input to a graphical display; this model extended Card's basic model of display and motor space for input devices, and allowed us to predict more accurately the future performance of our prototype input devices. The same work also led to a redefinition of Card's classic *design space of input devices*, which we extended to devices with multiple modalities. Finally, triggered by a research vision of a wearable device

to help people learn snowboarding, we are developing a haptic language for full-body haptic feedback to communicate complex body stance corrections to someone practising sports or doing other physical activities (such as packing crates), or to those requiring therapeutic help with their body stance.

On the ***toolkit*** level, we discovered that when asked to create a new, post-desktop user interface, students would spend far too much time working on the low-level details of writing serial device drivers, soldering interfaces, or running cables through our lab. We therefore created *iStuff mobile* [3], a user interface framework that lets UI designers and researchers get from an idea for a new, post-desktop interaction (e.g., tilting a mobile phone to scroll through its address book) to a working prototype very easily. iStuff mobile was built on top of our earlier *iStuff* toolkit that enabled arbitrary input and output devices to talk to a ubicomp environment in a simple, standardised, and seamless way. iStuff mobile added off-the-shelf mobile phones as extremely versatile and 'hackable' input and output devices. It also provided a graphical signal-flow-diagram style editor to connect mobile phones to inputs or effects in the ubicomp environment.

One ***testbed*** for this research is *REXplorer* (Fig. 2), one of the first continuous, publicly accessible pervasive games. REXplorer let tourists explore the historical German city of Regensburg with a wand-like device; performing spell-casting gestures with the wand in specific locations let the tourist listen, through the device, to historical figures, who would provide historical information and little quests to continue exploring. Struggling with the balance of high-tech location sensing and gesture recognition versus the need for simplicity in an edutainment setting with casual visitors was an extremely educational, and sometimes sobering, experience. Another example is our *Wearable Snowboard Instructor* prototype to test our sensor network, body model, and haptic feedback languages.

Figure 2 Playing the REXplorer pervasive city game

Collaborative environments

This third research direction, finally, brings the first two together: spaces in which several people can work together, using post-desktop interfaces to access multimedia data streams, to achieve a common goal such as editing a newscast.

On the level of ***theories and algorithms***, we started out with an early *AudioSpace* project that provided audio output (access to the eight speakers around the Aachen Media Space) as a wireless service to any computer in the room. More recently, we have looked into multi-touch tabletop interaction, and developed initial theories on *Social Proxemics* in collaborative game settings, as well as a good foundation of technical knowledge on how to create multi-touch surfaces.

Figure 3 The Aachen Media Space, with its flexible furniture, AudioSpace speakers and Media Boards

Figure 4 A Media Board, a mobile interactive group display in the Aachen Media Space

Figure 5 VICON tracking system in the Aachen Media Space to study precise interactions with mobile devices

The *iStuff mobile* toolkit [3], because it links mobile phones and sensors to an augmented environment, is one of our *toolkits* for this research direction.

The prime ***testbed*** for this research direction is clearly our *Aachen Media Space* (Fig. 3). Its highly flexible architecture, from furniture, to *Media Board* displays (Fig. 4), to collaborative middleware, has helped us use the room not only to evaluate (Fig. 5) and present our research prototypes, but also for our everyday meetings. As other testbeds, we have created exhibits that have allowed us to study social proxemics and the use of multi-touch technology, for display at the *Industrion* tech museum in the Netherlands. Our initial *Table Lemmings* game let multiple users play the classic *Lemmings* game, but by using their own hands as blocks, bridges, or obstacles – an interesting combination of the advantages of classic board games (many can act at the same time) with computer games (dynamically changing environment and actors).

On the ***patterns*** level for this third area, the author is currently completing a book chapter on Media Space design patterns that will hopefully serve to disseminate what we learned through our various projects.

Collaborations and funding

Our group was established by the B-IT foundation, and has worked closely with chairs in architecture and other disciplines in teaching and research, both at RWTH and internationally. RUFAE, for example, is an international network of research groups interested in augmented environments; partners include Electricité de Paris, Stanford, Darmstadt, CMU, Moscow, KTH, and RWTH.

The German Excellence Initiative has turned around the German government's research funding strategy in 2005, directing strong financial support to nine *Elite Universities* selected in a multiyear process based on both current standing and potential for innovation, to let them become more visible in today's global research landscape. Of these nine elite universities, RWTH Aachen University was awarded the highest amount of funding. In particular, our group is part of the UMIC excellence cluster at RWTH on high-speed mobile networks, contributing HCI expertise to the cluster, and of HumTec, a new interdisciplinary research centre at RWTH between the social sciences and engineering and an incubator for international young researchers.

Summary and outlook

Table 1 lists our main projects along our research directions and contribution levels. Our vision-based approach, with a blessing of great students, has worked out well so far: between 2003 and 2008, the group has been the most successful in Germany in terms of overall archival CHI publications [6], and our first PhD graduates have continued on to exciting careers at Nokia's Palo Alto Research Center and Apple's core development team in Cupertino. We are now pursuing some new directions with *Organic Interfaces*, and hope to continue our track record in HCI@Aachen. For more information about our group and projects, simply visit http://hci.rwth-aachen.de.

Vision: New Interactions with Ubiquitous Media			
Audiovisual Aspects	Ubiquitous Aspects	Collaborative Aspects	Requires work on:
PhaVoRIT Semantic Time DRAGON	Selexels Design Space of Mobile Input Haptic Languages	Social Proxemics Audio Space	Theories & Algorithms
Semantic Time Framework	iStuff Mobile	iStuff	Toolkits
You're The Conductor Maestro REXband DiMaß	REXplorer Associative PDA Snowboard Assistant	Aachen Media Space HumTec Spaces Table Lemmings The Logistics Table	Testbeds
Design Patterns for Interactive Exhibits		Media Space Design Patterns	Patterns

Table 1 Summary matrix of our 3 research directions and 4 contribution levels, with project names in each cell. Please see our home page URL at the end of this document for more details and other projects.

Acknowledgements

The work presented in this overview was funded in part by the German B-IT Foundation, and by the German Government through its UMIC Excellence Cluster for Ultra-High Speed Mobile Information and Communication at RWTH Aachen University. An earlier version of this article was presented as a non-archival research landscape overview at CHI 2008.

References

1 Borchers, J. (2001). *A Pattern Approach to Interaction Design*. Wiley & Sons.

2 Karrer, T., E. Lee and J. Borchers. (2006). PhaVoRIT: A Phase Vocoder for Real-Time Interactive Time-Stretching. *Proc. ICMC*, 708–715, ICMA.

3 Ballagas, R., F. Memon, R. Reiners and J. Borchers (2007). iStuff Mobile: Rapidly Prototyping New Mobile Phone Interfaces for Ubiquitous Computing. *Proc. CHI 2007*, 1107–1116. ACM.

4 Lee, E., M. Wolf and J. Borchers (2005). Improving orchestral conducting systems in public spaces: examining the temporal characteristics and conceptual models of conducting gestures. *Proc. CHI 2005*, 731–740. ACM.

5 Karrer, T., M. Weiss, E. Lee and J. Borchers (2008). DRAGON: A Direct Manipulation Interface for Frame-Accurate In-Scene Video Navigation. *Proc. CHI 2008*. ACM.

6 http://hci.rwth-aachen.de/chi-ranking

A tropical analysis of game interfaces

By 'tropical' in this paper we refer to the use of tropes as a means to analyse video game interfaces rather than the balmy nature of their climates. Using the linguistic definition a trope can be considered a rhetorical figure of speech. Common examples include the metaphor, metonym and synecdoche. An example metaphor is a table leg; supporting the table as a leg supports a person, a common metonym is the crown used to refer to the monarchy and for synecdoche the head often refers to the whole person as seen in a portrait. The literary definition considers a trope to be a common form of expression, indeed tropes have an established association with understanding and they are the building blocks that enable meaning-making and allow meaning to be communicated, an essential method of improving understanding (Chandler, 2002, p124).

Within the field of video games, about which so much remains unknown, the usage of tropes, a well understood facilitator of meaning-making and improved knowledge, holds potential for substantial enlightenment. This is being accomplished through discovery of common forms of expression in video games which are believed to exhibit characteristics of deeper game tropes in the linguistic sense that are just beginning to emerge.

For common forms to be considered potential linguistic tropes they should have application across all gaming genres. Therefore choosing an effective set of genres capable of covering the majority of game releases was vital. A set of ten genres was chosen based on Clive Fencott's *Game Invaders* (2008) and Stephen Poole's *Trigger Happy* (2000) books. The ten genres chosen for investigation were:

1 Shooter
2 Sports
3 Puzzle
4 Driving
5 Strategy
6 Simulation
7 Adventure
8 Role Playing
9 Platform
10 Fighting

Common forms of expression were initially identified totally independently of the games genre, age, platform, and developer to ensure the study is not influenced in any way and to allow the maximum body of video games to be open for investigation. Each common form identified is initially explained within the context of its genre of origin to provide adequate contextual setting. The study examines games' Heads Up Display (HUD), Interface, Environment and Non Player Characters (NPC) for these common forms but avoids the low level mechanics such as character movement, jumping, button mapping, etc, as these elements taken across a volume of games would quickly become excessive and unmanageable.

To date a total of twenty-two potential common forms of expression have been identified. Out of these fourteen have complete cross-genre applicability. These are:

1 Energy/Status Indication
2 Player Status Indication (Icons)
3 Player Character Icon/Portrait
4 Player Companions/Team Mates
5 Timer
6 Colour (Colour Systems)
7 Physical Representation of Player Character
8 Speed (the control of)
9 Difficulty
10 Level, Stage or Mission Selection
11 Character Customisation and Development
12 Loading and Saving of Game Data
13 The Presence of a Career or Story Mode
14 Character Specific Special Power

In this short paper we are only going to consider two of these common forms in depth. Firstly, player status indication includes HUD based health bars as well as any environmental health systems. Initially it might be assumed that such indicators are limited to the first person shooter and action genres but most genres have been proven to feature either environmental, HUD based health indication, or both. Likewise icons relating to player status are equally universal regardless of whether this relates to an identifiable (human) character or to the strength of a company of soldiers or even the prosperity of a city or theme park.

Figure 1 Energy bars are a common means of status representation. Often colour reinforces the level of energy with green representing good health (the top bar), orange medium (bottom), and red low health (middle).

Examination of status indication methods proved one of the most fruitful parts of the study with the universal presence of these allowing a general concept to emerge of the use of an abstract quantity e.g. score, health, time, etc, to represent the player's power or capability versus that of the game and its internal systems.

Use of colour for communication of vital information to the player is widespread across games, its immediacy making it

ideal for warning a player in action titles where split second reactions are essential. Most common is the three tone system of green, orange and red. Green represents an optimal, good or healthy state, orange an intermediate state and red a negative, danger or low health state. Colour intensity often denotes the extent of the danger. Even within slower paced simulation titles coherent colour systems can be observed on the available map overlays where colour intensity denotes the severity or extent of the data, e.g. of pollution or power, water, waste disposal, facility provision and more.

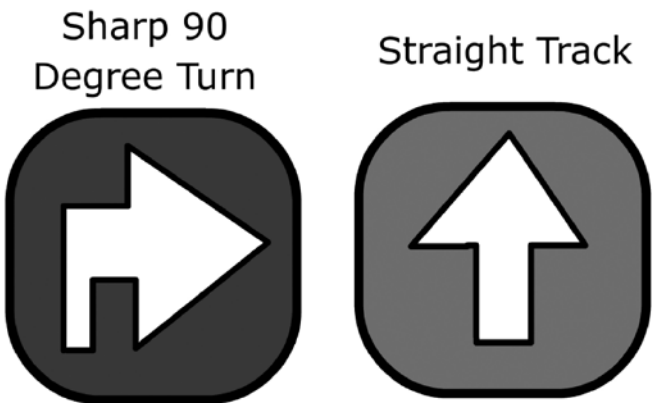

Figure 2 Colour is common in the icons that rally games use to warn of upcoming corners, with increasing colour intensity used on increasingly sharp corners (left) such as hairpins, where a red backdrop would reinforce curve severity. Straight track or gentle curves (right) commonly display against a green backdrop.

Generalisation and further work

Whilst it is acknowledged that more may still be uncovered, the study has succeeded in discovering and validating a comprehensive set of common forms of expression. Separate common forms can combine to form core common forms with each potentially having several related sub common forms. For example the core common form of status representation encapsulates energy and status bars, character representation as well as common forms from real life such as speedometers and rev counters. The interrelationship between status representation and colour systems has also been noted.

This leads us on to consider how common forms can be grouped by location within the game environment, interface and HUD. A majority of common forms are present primarily within actual gameplay and visible within the HUD or environment with a few exceptions such as difficulty which is generally selected before gameplay begins.

Many insights have been revealed with theoretical value and potential game design application. Video games are rich media; a single game uses many common forms; even a tiny component of the game's visual display may use two or more common forms.

It is interesting to observe the relationship between abstract and direct modes of representation. In driving games direct

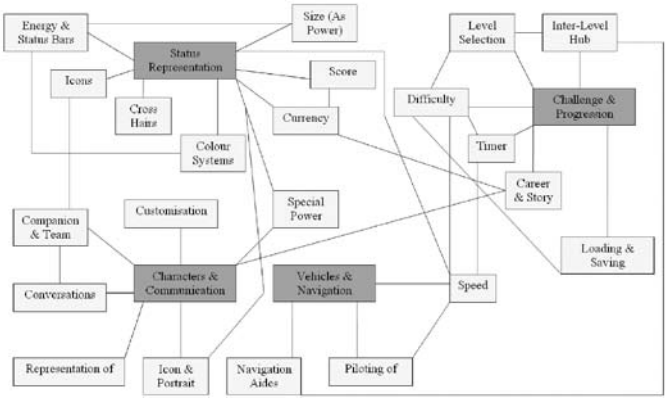

Figure 3 A sample of the relationship mapping between four major common forms and the minor common forms belonging to them

representations are favoured with a rear view mirror, RPM, speedometer and temperature gauges recreated accurately. Meanwhile a first person shooter HUD relies on abstract representation; energy bars do not have a real-world parallel; they are an abstraction that facilitates visual communication of the concept of health which would be felt, both bodily and mentally, in a whole variety of ways by a person in the real world.

It is expected that further study will allow improved understanding of:

> How a game can improve appeal to a specific demographic; relating requirements of a demographic to particular groupings and usage levels of common forms.
>
> How genre shapes games content and user experience; describing a genre with a set of common forms and their usage levels.
>
> How expression forms and modes have evolved over time and the lessons that can be learned from past video games.

It is interesting to consider benefits of integrating the embryonic content model emerging with an established model such as the activity profiling used in *Strange Analyst* (Adams, 2006) to classify game contents using forty- nine unique activity types. It is useful to consider relationships between activities and common forms and whether these two models can be reconciled.

It may also be the case that a relatively simple abstract model of video games may emerge within which the various forms of trope exhibited by video games will be contextualised.

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On measuring the gaming experience

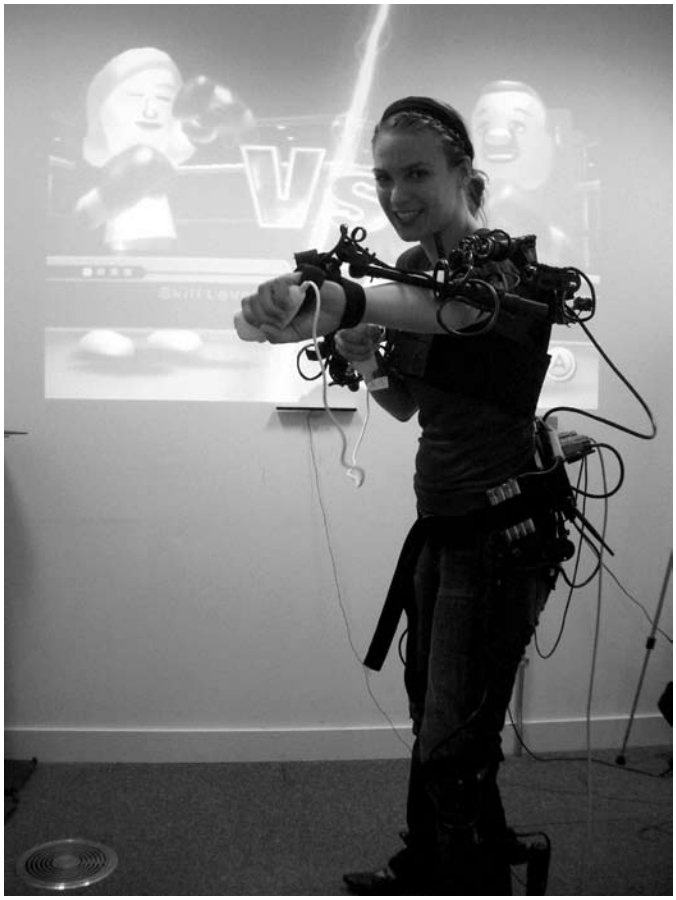
Within HCI, user experience is coming to dominate the concerns of researchers and practitioners alike. It is no longer (if it ever was) sufficient simply to make a system work but it must work in a way that promotes a positive experience for the user. Of course, for some systems, particularly those used in work, the positive experience arises as a result of the system not being frustrating to use but instead being satisfying and allowing you to achieve a task quickly and reliably. That is, the positive user experience is sometimes reached by achieving usability.

But in video games, this narrow understanding of user experience simply does not apply. Games are all about experience but notions of efficiency and satisfaction barely scratch the surface of what really good games can achieve. A good game can provoke emotional responses of being disturbed, delighted, shocked or thrilled with corresponding physiological responses of an adrenaline rush, calmness or euphoria. And really good games provide all of these, and more, and these experiences can arise from spells of frustration, from making mistakes and from overcoming severe obstacles to success – these are not experiences you try to plan for in standard usability.

How then can it be possible to understand these experiences? Moreover, how can we study these experiences scientifically, or, in the language of Popper (1994), put these subjective experiences into World 3, into the world of objective abstractions? For me, measurement is the cornerstone of a scientific approach to knowledge. So these questions become: is it possible to measure experience? But more fundamentally, is it even meaningful to do so?

One stance would be that it is not. The felt experience (McCarthy and Wright, 2003) of gaming depends on a careful blend of different threads of experience and these are highly specific to individuals both in terms of what provokes experiences and how those experiences develop and evolve. In that sense, the felt experience of gaming is akin to the experience of art. The experience had by the consumer of art depends heavily on the cultural, personal and contextual state of the person, whether the art is a Leonardo cartoon or Beckham's right foot. To quantify the experience would be to miss the essence of art and its value to individuals and to society. Similarly, to quantify the experience of gaming would be to miss out on the richness offered by games. In this view, then, the gaming experience is inscrutable. We can build video games but the response to the games is out of the hands of the designers and left to individuals to experience as they will.

I have two objections to this position. The first is merely intellectual distaste. To say that experience is unquantifiable is to remove it from a strong tradition of scientific enquiry. This tradition has been enormously successful, despite the philosophical problems of trying to say exactly what science is (Feyerabend, 1993). The second is more rational. One of the key things about many human experiences is that we are able to communicate about them. Now, this is not to say that we can tell each other what experiences we had to the point



Maartje Ament researching the Nintendo Wii in a body motion capture suit

where the listeners have the same experience, but rather, in describing our experiences, other people are able to relate to the experiences and understand them in relation to their own experiences. Thus, there is a commonality in the human condition that means it is possible to abstract experiences and place them into objective reality that is independent of any individual experiencer. This is all that is needed, in Popper's view, for science to proceed. This still does not mean that experience can be quantified but it seems worthwhile at least to try.

In talking to gamers and looking at descriptions of games in game reviews, immersion is a term that crops up regularly and it has a well understood meaning colloquially: the sense of being 'in the game' in some way and losing all sense of time passing in the real world. This is not to say that immersion requires a first-person perspective or avatar but rather that a person is able to enter the conceptual world of the game, much as a person can become immersed in a good book. From our early qualitative work on immersion (Brown and Cairns, 2004), it was clear also that immersion was a graded experience. This has two important consequences. First, this sets immersion apart from flow (Csikszentmihalyi, 1990) because flow is an optimal experience which in sports corresponds to being 'in the zone'. There is no sensible way in which you can be 'a bit

in the zone'! Secondly, it suggests that it could be meaningful to quantify immersion, at least in ordinal terms, and so be able to rank a group of people in order of their degree of immersion.

Building on this, with many others but most significantly Charlene Jennett and Dr Anna L. Cox of UCL, we have developed the Immersion in Gaming Questionnaire (IGQ) (Jennett et al, 2008) as a means to measure the experience of immersion had by individuals in a particular instance of playing. Of course, the very fact that it is a questionnaire means that we do not get very fine granularity on the immersive experience – we can't be stopping players every few seconds to fill out the immersion questionnaire. At least, not without disturbing immersion! However, it does allow us some window on what it is like to be immersed but, more usefully, it allows us to make predictions about what would increase immersion or disrupt it.

The main problem now though is that for all we can measure immersion and through validation and extensive use we have good confidence in the IGQ, we do not yet have a good theory of immersion, and without a theory it is going to be hard to do science. Developing this theory, or at least an aspect of it, is core to Charlene's PhD thesis. A key characteristic arising from studying immersion is the aspect of real world dissociation that helps to constitute an immersive experience. Is real world dissociation just a particular case of attention? Does it depend on graphics and sound? Or is it more to do with the narrative structure of games? And can we use it to measure immersion at a finer granularity? At the moment we only have questions but seeking the answers is leading us to a theory of immersion that we can grow and develop.

Studying immersion arose from identifying and isolating an aspect of gaming experience that seemed to be already present in people's minds. And also, immersion is, if not an optimal experience like flow, a sub-optimal experience that you might hope to increase in successful games. But what is the just, general, everyday experience of playing games? Or put another way, what are we missing if we only focus on the gee-whizz experience of games?

To address this, I am working with a PhD student, Eduardo H. Calvillo-Gámez, on the broader gaming experience. Eduardo has analysed game reviews to see what it was that people tried to communicate when they described games to an interested, and arguably game-hungry, audience. It became clear that in describing games, people blur the distinction between the player as a person and the player as an agent in a game (again, not necessarily explicitly represented as an avatar or through a first-person perspective). This is not to say that people lose their identities, but a valuable metaphor is to compare the gaming experience to puppetry where a person controls an external object and, in willing collusion with an audience, imbues it with life (Calvillo-Gámez and Cairns, 2008). Puppetry became the overarching concept of the grounded theory based on the game reviews. This theory of puppetry, though, unlike immersion or flow, is something of a hygienic aspect of the experience: without puppetry the experience will be bad; with puppetry, it won't necessarily be good.

A good metaphor is useful but it does not allow us to investigate the gaming experience scientifically. Fortunately, grounded theory does provide concepts and links between concepts that, in this case, seem to translate well to a structural model of puppetry. The experience is a hidden, latent variable within the model but there are clear external factors that contribute to the experience, which we might be able to use to tap into experience and so explicitly quantify it. Once again, a questionnaire is being used to measure the different aspects of the gaming experience in relation to puppetry. But this time, unlike with immersion, we are putting the theory into the questionnaire and using structural equational modelling to support or refute the theory. So far the signs are good, having conducted a substantial online survey, but the technique is hard and we are seeking technical support to confirm the findings so far.

So whilst user experience and specifically the gaming experience seems to be the most woolly of ideas, so far removed from the scientific method, it seems it is possible not only to make progress but actually to quantify parts of what it feels like to play a game. Numbers cannot catch everything. But theories can and measurement gives us a window into the gaming experience sufficient to try out and assess different theories. The theories and analysis that are emerging will probably never be able to explain why *The Shadow of the Colossus* almost made me cry towards the end but it may give a foundation for why I was so involved in the game that it was a highly likely outcome.

Acknowledgements

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Measuring video game usability

Graham McAllister

Human–Computer Interaction concerns itself with improving the interaction between users and the computer. It achieves this partly by taking into consideration many different forms of user, but how many different forms does the C in HCI address? It appears that the principles and techniques in the textbooks only seem to be applicable to websites and productivity applications, but what if we're interested in evaluating interactive software such as video games?

The cost of developing the current generation of video games is enormous. Halo 3 cost approximately $40M to develop and GTA IV cost around $100M. Whilst both of these games easily made a return on investment in the first day of release alone, not all games will share this success. Game reviews by professional journalists can greatly influence the sales of a game, and websites such as Metacritic (www.metacritic.com/games) are often used by the public to help decide if they should purchase the latest titles or not. Therefore, there is a growing concern among games studios to ensure that they are building a game that contains as few usability issues as possible, leaving only the original design intent.

Assessing video games

Evaluating the usability and user experience of a website or productivity application is well established. Usability techniques can provide quantitative metrics for time on task, task completion rate or how efficient the test participant is relative to an expert. Similarly, techniques for evaluating the user experience can provide us with qualitative information such as how satisfied the user is with various aspects of the application. However, video games are not designed to be 'usable', they encourage the user to explore, to make mistakes, and then eventually reach their goal; which techniques can we use to measure this style of performance?

Current approaches by industry

The video game industry currently assesses its products in a number of ways including focus group testing, play testing, questionnaires and sales figures. Focus groups and questionnaires aim to capture qualitative aspects of the game (e.g. enjoyment), play testing captures technical issues with the game (e.g. bugs) and sales is a crude quantitative measure of the overall success of the game. Some studios (most notably Microsoft) do extensive usability testing, mostly via focus groups; however, they also measure enjoyment by interrupting the player's game every few minutes via a dialog box asking them for their current level of engagement. With such a vast quantity of information to analyse for Halo 3 (over 2300 hours of video data), Microsoft relied on quantitative information (with a visual representation) to firstly identify problems, then go to the richer qualitative data to explain why the problem occurred.

The games industry is becoming more aware of HCI theories and practices and is looking to integrate relevant material into their workflow. Jonathan Napier from Relentless Software states that one of their key challenges is how to integrate usability testing into their development cycle early so that it can help inform the decision making process. Jason Avent from Black Rock Studios also emphasises this point about incorporating usability evaluations early in the lifecycle and is keen to evaluate game components in isolation before they are integrated. Black Rock Studios currently use a combination of focus groups with the think aloud protocol to identify key issues, then focus on these key issues by using pre-prepared scripts to compare performance across participants. They also encourage all members of the development team to observe the focus group tests so that any usability issues are clearly communicated. Finally, during the last four months of production their evaluation process ramps up to a series of daily tests.

Current approaches by academia

Academics in the field of HCI have made attempts at mapping established principles and techniques to aspects of video game evaluation. Most of their focus has been on identifying game heuristics; indeed some of the earliest work by Malone in 1981 set out to identify heuristics for video games. However, the reaction from professional game developers has been that heuristics are too general and do not actually assist in making the game more 'usable'. Other approaches proposed by academia include using the think aloud protocol and post-test surveys. Microsoft Game Studios prefer to use quantitative approaches first to identify any key issues with a game, then refer to the qualitative data to help explain the figures. In order to help analyse the very large datasets gathered, they visualise the data using approaches tailored to their games.

Problem

The general question being raised here is, what can the field of HCI offer video games developers to help make a better game? It seems that the current tools and techniques that we use are only useful for analysing websites and productivity applications, but perhaps not so useful when measuring situations where there is an intended friction in the software design. Indeed, some elements of a game are task-oriented and perhaps traditional usability can fit in here, but it seems that we're trying to modify techniques that were designed for another purpose rather than designing techniques specifically for the problem. There are other unique challenges also. Some games developers are more interested in quantitative approaches driven by the game data as their confidentiality agreements would not allow them to invite non-company employees into a focus group setting. To what extent is it possible to design games for a mass market without being able to test with your target audience?

Design intent

The purpose of conducting a usability study is to identify and remove elements of a software application which were not intended by the designer, with the aim to ultimately end up with a system which is exactly as the designer intended. However, one of the problems with this is that game designers do not currently specify enough detail with which to compare the results of a usability study. What is needed, therefore, is not just new techniques that are specifically aimed at measuring video games, but also guidelines for games designers that help them to specify how users are meant to play their games. For example, during usability testing, Microsoft Game Studios realised that people were spending too much time on certain parts of a level. On examining the data they realised that people were becoming lost, and they solved this issue by providing clearer signposts within the game. This issue was found by analysing quantitative data which was gathered during game play; however, different errors could be uncovered if the designer specified more clearly 'what is reasonable' for the gameplay. In architecture there is the concept of a *design intent* document, which allows all interested parties involved in the construction of a building to verify at all stages of development that the original design is being adhered to. Such a document for video games could help identify usability errors, but work is needed in formulating what the contents of such a document would look like.

Conclusion

Video games are a particularly unique class of software. They are often designed to be used without reading a manual or assuming prior knowledge, they have a wide range of potential users, they are not designed to be 'usable' as challenge is a key element, and they typically demand a precise real-time response in order to succeed. The concept of the extreme user is often useful when creating personas, however it seems that video games are an example of an extreme application.

Usability errors have persisted throughout video game history and remain today. Although it is difficult to assess the impact that usability may have in terms of sales or review scores, the final product should be as close to the design intent as possible.

My work: Developing a mixed reality game

Johannes Löschner

When I began working at Fraunhofer FIT I was given the task of re-designing a mixed reality game, based on some evaluations of an earlier version. The game, known as TimeWarp, uses augmented reality and takes place in the urban environment. Using visual and auditory augmentations the game provides the illusion that people can travel in time. There are two major research aspects within TimeWarp. The first is to explore the use of new and novel technologies. The second is to explore if such systems are capable of altering the user's sense of place as well as social, physical and temporal presence.

Putting the issues related to technology and presence aside there is still a need to develop an interesting and compelling game that can operate in an urban context. In my opinion it is the latter which is the most interesting, for example such games are not played at home indoors, or using mobile devices such as the Sony PSP or Nintendo DS. Furthermore they are not simply about extending game play into a predefined small space but rather into an entire city – from lining the streets with modern augmented skyscrapers through to having space craft fly around. It's the ability to increase the scale of the game space and to augment reality which presents a truly exciting and new way to develop games.

Game designers who are confronted with developing for such a new gaming platform immediately have two major questions they must deal with:

1. How do I interact with such a game?
2. What game mechanics work for such a game?

The first question relates to interaction design and usability. The question concerns not only the devices used in order to play and control the game but also the way such controls are implemented. As noted earlier the game takes place in a city, therefore certain everyday rules of interaction apply, e.g. walking or avoiding real people. Therefore unlike traditional computer games we do not need to worry about the mechanics of movement, e.g. which keys to press or how to move the controller, etc. However, although this is relatively straightforward it is the ability to convincingly render 3D augmented objects within the real scene which becomes a problem. The display device has to be mobile and the default (and often the most seen within science fiction) would normally be a see-through head-mounted display. Let us develop this within the context of a scenario: a player equipped with such a see-through head-mounted display turns her head to the right and spots a +3 *power-up*. She wants to pick it up so she walks towards it until the object is just close enough to be touched. But how does she pick up a virtual 3D rendered object? One option would be just to walk over it. This approach was used within many early console games, but that would make more complex interactions almost impossible. Therefore an alternative approach is required that enables the player to interact directly with the virtual 3D object. It is possible to use a combination of button presses, for example via mouse; however, more interesting alternatives exist. For example, the Wiimote with its buttons and inertial-sensors offers a number of interesting interaction possibilities. An even more interesting interaction device for our purpose could exist in the form of a glove that transports the player's hand movements directly into the game. Regardless of which is the better option, all of the solutions require the player to wear at least two devices. Therefore it could be argued that usability would

improve if there is only one device. The scenario described earlier could also be played with a camera-mounted Sony PSP: The player turns to the right, while holding the PSP in front of her. The game-system on the PSP renders the +3 *power-up* directly into the camera-stream. The player starts walking and once the power-up is reached, she presses one of the easily reachable buttons and thereby picks up the object. This solution appears to provide a more classic and perhaps less technically advanced approach. However as we are interested in exploring the difference in experiences which arise due to changing devices, it is necessary to test two versions, one based on the PSP idea using a Sony VAIO UMPC, and the other using a laptop and see-through head mounted display.

While issues with interaction design are important it is also essential to consider elements within the game design. In order to illustrate the issues involved in designing large-scale augmented reality games it is useful to construct another scenario, this time based around World of Warcraft. In this scenario the player has a view into a fantasy world with magic trees, elves and a small village (just ahead). The player moves into the village by walking 50 real metres to the North. There she talks with the local blacksmith who tells her to kill five orcs in the South. The player accepts the quest and heads South. After a walk of 15 minutes she spots a group of five orcs. The player wants to use her weapons, however the inventory is empty. The best place to get a sword is a blacksmith and so the player heads North again. After 15 minutes she arrives at the blacksmith, buys a sword (and a few health potions) and heads South again. About 15 minutes later she finally spots the orcs and equips herself with the recently acquired sword. Then she charges. But before the first orc is in range, the gaming device starts closing down saying that the batteries are depleted. This example shows two possible problems that can arise in augmented reality game design. Firstly long walks between locations are common within conventional games such as World of Warcraft. However they have a negative impact on a gaming experience when the player has to physically accomplish them – for example during a mixed reality game. Another issue is related to the problems of batteries running out of power while playing a game. It would therefore seem logical to disregard some elements from conventional game design when developing mixed reality versions or even totally new experiences (e.g. TimeWarp). The problem of moving between potentially far (real) locations was resolved within TimeWarp by letting users move between different augmented locations quickly. Moreover, the issue with batteries was used within the game and users are encouraged to search for new ones in order to replenish their energy. Should they fail to do so then the game will be brought to an end gracefully before their power runs out. Both examples illustrate how a problem or constraint can be used within the gaming sphere – and are in some ways similar to the work of Matthew Chalmers with respect to seamful design.

This article only addresses the surface level issues within large-scale augmented reality games; however, they illustrate the range of problems which must be considered in order for such games to become successful. As for TimeWarp, the next prototype is scheduled for delivery in August 2008. When it is completed, it will be an action adventure featuring a range of 3D objects, cooperative multiplayer elements, spatial audio, full voiced dialogues and a music score. TimeWarp is part of the EU funded IPCity project, and will most likely never become a commercially available game; however, it has provided a useful vehicle for exploring the issues surrounding mixed reality games design.

A return ticket to reality, please

Rod McCall

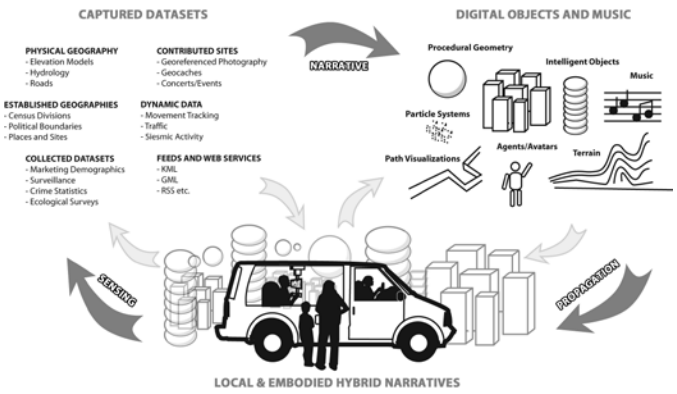
Virtual worlds marked a break from reality, an escape from our perhaps mundane lives into new worlds which would let us fly, shop, meet others, build houses and perhaps even raise a new virtual family. However although there is still much to be done within the field of virtual reality the recent explosion of interest in the field of ubiquitous technologies, including social platforms, pervasive games and mixed reality environments, has marked the return of reality.

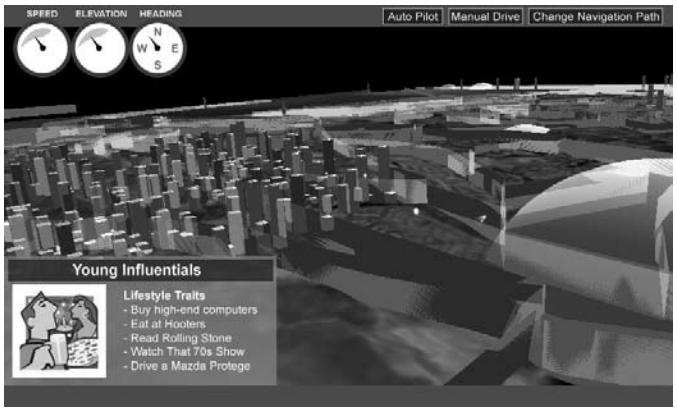
Although there is a growing interest in mixed realities and associated technologies there is still a distinct lack of research that covers in detail the many facets of interacting within such worlds. This becomes ever more pressing as existing research in these two areas has until now predominantly focused on exploring purely real or virtual experiences, thus failing to take into account the rapid shifts in attention, interest and thus place and presence which can occur. With this in mind CHI 2008 played host to the urban mixed realities workshop, which brought together practitioners, developers, researchers and students.

Applications

Body art such as tattoos often provide people with a way of expressing themselves, and this idea is embraced within the Living Tattoos social platform developed by researchers at Universidade de Caxias do Sul (Brazil). With this system users can share their Tattoos by taking pictures on a mobile phone, these images are then displayed on large public screens. From

the perspective of theories and models Rizopoulos et al. presented a model for the social aspects of locative media inspired by work within media studies and activity theory.





Mixed reality seems almost to lend itself to urban planning applications, and this was reflected in the work by TU Graz/IPcity whose urban sketcher application lets all stakeholders join in the planning process. Researchers at Columbia University illustrated work by their students that utilised a range of approaches including fiducial markers and tablet PCs. Other applications included the AuthOr tool for creating MR experiences from Fraunhofer, and JITC3 from The University of Washington. The latter is an AR and mobile computing platform to support situational awareness in urban emergency response operations. Other applications included moblogging – a research method and set of tools to investigate the perceptions of a city based on where people have visited. In contrast work by VTT of Finland approached the idea of tagging aspects of a city so that content and other elements from reality can have an impact within mixed reality experiences.

Interweaving narratives and blends

Cities by nature are diverse, dynamic and rich in experiences and this was reflected in the work of Pamela Jennings who explored how to represent countering movements within a city, namely those within the public transport system and those with a shopping mall context. Work by Eric Kabisch of the University of California, Irvine explored using interactive art as method of displaying geographically relevant information (such as information found in databases).

The creation and sharing of narratives was explored in the work by Blink and the University of Huddersfield in their work on Story Worlds.

Understanding reality

When developing mixed and indeed virtual environments, understanding what people do in reality is critical. Work by researchers at Simon Fraser University concentrated on what navigational choices people take within real and virtual environments – primarily exploring how fear shapes people´s decisions to approach or avoid others or certain locations. Work by Lindner considered how people interact when virtual worlds are integrated into a real context, in this case the social elements of playing games in Chinese Internet cafés. This work illustrated how game playing alters many social aspects in reality. Indeed understanding how to integrate the game into reality, such as using real world elements and street layouts, was another theme addressed in the design of the TimeWarp mixed reality game.

Principles, concepts and theories

Research into sense of presence within mobile experiences is growing in popularity, and work by HIIT (Finland) found that using 3D maps on mobile phones may actually have a detrimental effect on users, while work by Fraunhofer and Sony focused on guidelines for mixed reality experiences from the perspective of how to design mixed reality games and characters – the latter drawing on Disney's 12 Principles of Animation.

The workshop embraced the full spectrum of themes from models and technical platforms, from single user applications through to multi-user social networking tools. However one principal aspect remained throughout, the need to understand the real environment in which all experiences are located. Whether this is from the perspective of improving the underlying technologies or to understand place and presence issues, mixed reality in many ways marks a return to reality.

Acknowledgements

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Externalisation – how writing changes thinking

How many times have you written a paper or report and after having done so thought "now I understand" or "I didn't know that before"? One of my PhD students recently described the feeling after writing her draft thesis of being able to see the work for the first time. That is, writing does not merely record or communicate, but also *transforms* our thoughts

In this article we explore this learning through writing and in understanding the phenomenon suggest how we can use it explicitly and practically in our own learning and research.

Perhaps the simplest way to think about writing, or indeed public speaking, is as *information transmission*: (1) Alan has an idea in his head; (2) Alan represents the idea in words (encoding); (3) Alan writes (or speaks) the words; (4) the reader reads (or hears) the words; (5) the reader interprets the meaning; and finally (6) the reader has the idea in her head.

This view elides many complications such as envisioning the reader (see my article in *Interfaces* 68). Critically, while in conversation we gain knowledge through the interaction, in writing the feeling of 'knowing more' happens *at the time of writing*; it is the act of producing the utterance (steps 1–3) that seems to help us to think more clearly or learn new things.

Another way of thinking about writing is as a form of *externalisation*. External representation is encountered in many ethnographies and is central in theories of distributed cognition and the philosophy of the embodied mind. In HCI we apply this to others, but in order to understand the transformative effects of writing, we need to consider *reflexively* the role of externalisation in our own research practice. Also external representations are normally considered as important while they are available, but in contrast the surprising effect of writing is that we think differently afterwards even when we *no longer have the writing with us*. The effect is on our own minds.

How writing changes us

I suggest there are two sides to the transformative effect of writing, one connected to communication and the other to external representation: writing forces *processing* of your ideas and reflection on them; and writing makes your thoughts available as the *object of study.*

Processing and argumentation

Constructive learning theory views the learner not as a passive receptacle of information, but as actively processing knowledge, constructing meaning by relating new experiences to existing mental structures or worldviews. On the face of it this applies more at stages 5 and 6; to the reader not the writer. Surely as a writer you already know the things you are about to write? However, we have all had ideas that are half formulated or 'feel right', yet we struggle to articulate. The act of writing forces us to process partially formed ideas. These internally generated ideas become more like the externally generated experiences we encounter as a tiny child – both need to be fully integrated into a coherent worldview. In other words, writing makes you think!

However, writing is not just causing internal processing, it forces us to process our ideas *for others*. I often argue that human logic and rational thinking are an accidental side effect of social intercourse. Left to our own devices we can think freely, imaginatively, and associatively ... and then act upon those thoughts. However, if we want others to act alongside us then we need to convince them, give a reasoned argument. Logic is not there as the way to think, but as the way to describe what you have thought. Of course we recruit logic as individuals to tackle problems too complex for informal reasoning, but its origins are in argument. So, in presenting ideas *for others* we, to some extent, rationalise them and the coherence and connections in our written argument may be entirely new to us or at least make explicit the tacit reasoning that was already there.

External representation and reflexivity

More important still is that the ideas and the reasoning behind them are on paper (or screen!) and thus available to read, skim and consider *outside* of your head. In terms of the information transmission model there is an extra stage when you are your own reader. In this role the words are slightly distanced from you, you look at them from the outside.

Andy Clark describes language as the "*ultimate artefact*", a tool that through "*loops and circuits that run outside the head*" allows us to achieve things we could not otherwise. His focus is on the external accomplishments of the human–language–paper system on its environment. However, I would also emphasise the way this permanently transforms our own thought processes; the effects inside our heads.

While you have an idea it is the thing you are thinking, but when you write it down you can think about it. Writing transforms your thinking into the object of your thinking.

In practice – writing to think

Once we understand how writing transforms thought, we can deliberately use it for the purpose.

Writing for yourself

The first advice is the simplest – just write!

I often talk to students who put off writing until they have something clear to say. Of course, the thrust of this article is that one of the best ways to clarify your thinking is to write about it. The writing need not be good, nor coherent, nor grammatically correct; indeed it may be bullet points, mind maps, or simply doodles. The key thing is that the thoughts are in some way represented *outside* your head. This writing is not for others but primarily for yourself, and often just doing this is enough to create a cycle of reflection.

Do beware of *stopping* at simple lists of terms. These may capture and externalise key concepts and are certainly a useful first step, but, in my experience, are often vague and lack inter-relationships. The problem is that lists, bullet points and often also mind-maps are more an *aide memoire* rather

than communication, and therefore often miss many of the *processing* advantages of writing for others. This is paradoxical – you are writing for yourself, but you have to do it as if it is for someone else! Two ways to increase the utility of lists or bullet points are either to write a few sentences after each – making them more like writing, or to turn them into slides and imagine doing a talk about them. Indeed some of my best papers have been written after delivering a *short* presentation – reducing your ideas to a few slides forces you to bring out the key points.

To make the most of the words as an *externalisation* of your thoughts, the opposite is the case; free text, even short notes, may be too hard to scan rapidly. When someone comes to me with a long but ill-structured paper, we go through it and simply mark where each topic begins and ends. Often one finds ideas start and end mid-paragraph, or flow across section headings! Once the ideas are marked you reduce each to a short phrase and then you effectively have an outline of the ideas in the document (not the section structure). As soon as the ideas are written like this it is usually easy to structure them, see new relationships. This can be used to restructure the paper, or simply to help clarify your own thinking.

Reducing the paper to phrases (effectively bullet points!) enables you to glance at the whole. Once you are reading you are *in* the ideas, your aim is to look *at* them. This is the time to remember Miller's 7 +/– 2: if your list of bullet points is too long, see if you can restructure them so that there are fewer at each level so you can hold them in your head at the same time.

In every case start with whatever form of writing best suits your temperament or mood ... bulleted lists or stream-of-consciousness text – get it on paper – worry later about adding more detail, or abstracting out key points.

Reading

Yes, I know this article is about writing, so where does reading fit in! However, it is common advice to write your own notes about books and papers you read … and what are those notes? … externalisation of course! The obvious purpose of such notes is so that you can read them again later, but the annotations become tools for thought, just like your own writing.

Have you ever read a paper where each paragraph made sense, but you lost the overall argument? If so, simply use the same technique described above: reduce each paragraph or idea to a short phrase and then sketch the relationships between them. The phrases should be sufficient to remind you of the content they refer to; the aim is to reduce the argument of the paper to something you can see at a glance.

This is particularly valuable if English is not your first language. By reducing the paper to a bullet list you are effectively separating the task of reading the paper into: (i) reading single paragraphs and (ii) understanding the overall message. This is helpful for everyone, but more so if you are expending more cognitive effort reading individual words and sentences and so do not have as much 'spare' to understand the big picture.

The same principles apply to a whole literature review or bibliography. I have always told students to write their own mini-abstracts while reading papers, but used to think of this merely to aid memory, not realising the full power of it. The writing of an abstract summarising what is important *for you* involves internal processing that is valuable for understanding now, not just when you revisit the paper. I also tell students to always produce an annotated bibliography before producing a literature review, mainly to avoid the literature review being an annotated bibliography: 'paper X says blah, paper Y says blah blah …'. However, I have only slowly understood the power of the annotated bibliography as external representation. As with one's own papers, writing the mini-abstract as a series of bullet points makes it so much easier to scan a range of material and see patterns and themes.

Final words

Imagine a cat and then imagine a trip to the dentist. They are totally different, but, once they are *words*, 'cat' and 'trip to the dentist' become tokens we can manipulate almost without regard for what they refer to. I say "imagine a [cat]" and "imagine a [trip to the dentist]" and these two, so different, things are being manipulated and thought about in similar ways.

Once written we may notice anomalies: it is sensible to say "stroke a cat" but not "stroke a trip to the dentist". How do 'cat' and 'trip to the dentist' differ so that one makes sense and the other doesn't? And how do 'imagine' and 'stroke' differ? Notice we are now thinking not about a cat, but about the idea of a cat, and even, in this very sentence, the idea of the idea of a cat! Language enables us to think both at higher levels of abstraction but also at higher meta-cognitive levels.

It is not essential to externalise this language in written words. However, most people find it hard to think about their own thinking, or to examine their own arguments. Externalisation in writing or other ways makes this easier.

While the practical techniques given are focused on the processes of writing and reading itself, they can also be applied when working with other forms of data: transcripts, ethnographic notes, experimental results.

And what about this article? Has externalising made a difference to my own thinking? In fact, it is a topic I have discussed many times with students and colleagues and had already externalised extensively, so I expected this writing to be like the initial simplistic information transmission model. But I was wrong. For example, while I have often discussed the importance of mental processing, the full relationship with communication and 'processing for others' was new.

I didn't know that before.

It works!

An extended version of this article can be found at:
http://www.hcibook.com/alan/papers/externalisation/

Designing the WishDish
The dilemmas of user-centred design

Philip Webb

The benefits of user-centred design are clear: the creation of a product that fits users' needs and capabilities, not one defined by features on the basis that they are "cool" or "because I, the designer, would want to use them". But the user-centred approach doesn't come easily, as we discovered during a recent student design experience project.

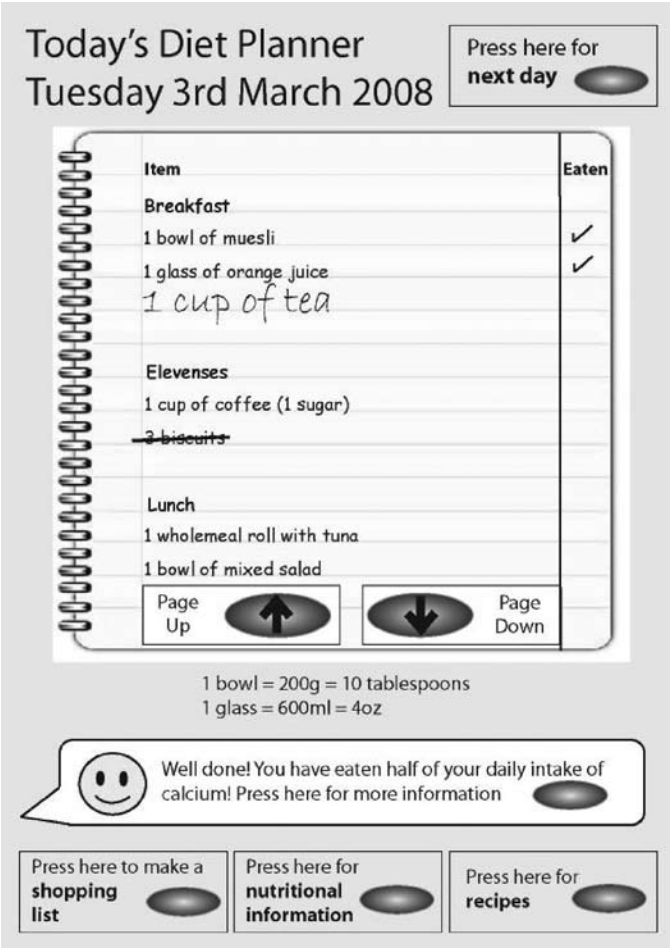
The WishDish was conceived as a personal nutrition coach aimed at supporting people aged 65+ with a recently diagnosed medical condition by helping them to improve their eating habits. Our interviews with elderly people yielded rich insights into both their nutrition habits and their attitudes to technology. We narrowed the context of the use of the device to the preparation of food in the kitchen on the basis that this was most likely to encourage a positive behavioural change. Running our primary persona, Bob (a recently diagnosed diabetic), through various scenarios helped us to specify high-level requirements and sketches of major interactions. So far so good! That's when the fun started.

Rough paper prototypes of our touch-screen/stylus device were duly constructed and presented to our first user, a chatty, intelligent woman aged 70+ with experience of Internet surfing. The usability problems uncovered were multiple and worryingly major! The trouble was how to interpret them. Our user was unable to accomplish a task that involved changing an item on the suggested daily diet plan, despite the fact that we used the word 'change' in our task instructions and despite the fact that there were 13 buttons of the 'screen' labelled 'change'! However, was this due to the fact that the prototypes were made of paper, the fact that our sketches were too rough to be interpreted properly, or was our design fundamentally flawed?

The roughness of our sketches may have encouraged honest criticism by helping to communicate to the user that the designs were not close to completion (Buxton, 2007). But rough sketches do not help indicate to the user that squares on paper are meant to represent buttons! Tohidi et al. (2006) encourage the presentation of more than one design so that users are less reluctant to criticise, but we didn't have the time to prepare or present alternative designs. And in any case, presenting more than one design wouldn't necessarily have helped us understand the root of the usability problems we uncovered.

There was also a suspicion that the user was not comfortable with criticising the design because she was aware that we were the designers, especially as all five of us were watching her every move. The presence of one facilitator, one 'computer', and three observers may have been a tad intimidating! However, the session was priceless if only for the user's revelation that the cost of food suggestions would be an important factor for many pensioners – a factor we had somehow overlooked in presenting her with a lobster recipe!

Nevertheless, the many usability problems raised helped us to form the basis for a re-design. The next prototypes were higher fidelity paper screens designed using Visual Basic and were aimed at discovering whether the roughness of our



WishDish design for diet planner screen

hand-drawn prototypes had contributed to user difficulty. The session was conducted away from UCL at an adult learning centre – a more familiar and relaxing environment for the participants. We took this opportunity to distance ourselves from the design in order to encourage criticism, presenting ourselves as the evaluators rather than the designers. Of course, limited resources dictated that we were both designers and evaluators but we were unprepared for the resulting ethical issues that surrounded the pretence. In hindsight we should initially have remained neutral with respect to the source of the designs and then concluded the session with a debriefing to clarify our roles. Even so it was difficult to wear two hats – as an evaluator I found it frustrating to keep a distance from the designs, although watching people attempting to interact with them was a valuable and humbling experience.

The higher fidelity of the prototypes may have improved the legibility of the designs but we again encountered many of the same usability problems, suggesting that the design was at fault. The main finding from both user evaluations was the difficulty users had in understanding what areas of the screen were clickable and writeable. However, it was noted that participants were comfortable with the interaction style of stylus and touch-screen. The new design relied more strongly

on the analogy of note-paper and pen – a style of input that the personas would have been more familiar with than PC-style widgets such as tabs, buttons and drop-down menus. In order to communicate that the design was grounded in evaluation findings and HCI knowledge, a design rationale was drawn up to justify each micro-level design decision.

A cognitive walkthrough was performed by one member of the team not involved in the latest design, which uncovered some further potential usability problems and was useful in confirming that the WishDish was far from complete. Plans were drawn up to conduct further tests involving physical mock-ups to see how users interacted with it in a kitchen environment, and to determine whether a stylus and touch-screen style of interaction was truly acceptable to our user population of 65+. However, the design experience was at an end and our thoughts turned to a nerve-wracking conference-style poster presentation in front of examiners.

The experience was undoubtedly a valuable one, exposing us to the realities of presenting prototypes and demonstrating some of the dilemmas and difficulties of user-centred design. Above all our heated feature debates served as a testbed for championing HCI. Discarding designs into which people have invested their creativity is not easy but as Buxton (2007) points out, by necessity not all ideas make it through to final design, and designers must be prepared to let go of ideas rejected with good rationale.

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New graduates need to be creators as well as critics

Giles Colborne

"But how much of the design project was spent coming up with the design?" I asked, leaning forward. The candidate didn't realise it, but it was the most important question in the job interview. "A couple of days," he said. "Well, we did an afternoon, but my tutor told me what she wanted the interface to look like." I knew he wasn't going to get the job.

I'm not unique – I've spoken to a number of agency heads this past year and they've all commented on how hard it is to find HCI experts who have design skills. Yet the industry is changing and we need more creativity.

Let me give a couple of examples from two industry conferences I've attended this year.

I'm just back from the Usability Professionals' Association Conference in Baltimore. As usual there were old friends to catch up with, business cards to swap, vendors to check out and the usual mix of presentations ranging from outstanding to useful to okay.

In a specialist field, you do not attend a conference expecting new vistas to open up. Instead, you look for the shifts in emphasis. Sure enough there was plenty on research methods, measurement and process. But this year, there seemed to be more interest in creative activities.

The keynote focused on innovation, there were tutorials on creativity and speakers talking about new user interface formats, semiotics and emotional design. There was enough content on creative design for a conference its own right.

Another example: earlier in the year I spoke at a conference in Milan organised by Microsoft debating the future of interactive design. What struck me was the hegemony of user centred design. In the minds of almost everyone, design began by understanding their users. Usability was a creative process – not an evaluative one.

It didn't use to be this way.

When I first started working in HCI a decade and a half ago, most people in the industry had a hang-dog demeanour. Their refrain was "if only people would listen to me".

Computer systems were forced on staff by their managers. If staff didn't understand it, then they needed training. And if they didn't like it, they could lump it. Usability problems were hidden behind corporate momentum and usability professionals needed to find ways of emphasising problems that couldn't otherwise be seen. Our role, and skills, focused on criticism and justification.

It began to change when the web created a marketplace of user interfaces. Suddenly users were consumers who could choose which interface they liked best – and managers discovered that usability mattered to their customers.

We'd all like to see more, better user centred design. But these days few people question the need for a usability expert on a project team.

So the role we're being asked to play is changing – from critic to editor or even creator. We're asked to come up with solutions, not find problems. We're seen as central to the design process, as drivers of innovation, as the start of creativity, not the end. And we need people with skills to match.

Plenty of usability managers prefer to divide the roles of researcher and designer – and that works for large teams. One agency head I know only hires people with ten years' experience. That's how long he says it takes before someone has the skills they need to be a user centred designer. He's built a quality team of quality people – but what about people coming into the industry?

I believe that we need to teach people to think like designers, as well as critics, at the start of their careers. And I'm hoping that my next interviewee has had more than a few hours' design experience.

Experiencing design
Video games on video

Chaya Narayanan Kutty & Robert St Amant

As children, riding in a car in traffic, we might have imagined that the headlights of our car were ray guns that could make the cars in front of us disappear with the press of a button. Almost everyone has had similar fantasies or dreams: that they can turn everyone into statues and move through the world unobserved, that they can leap over buildings or even fly, and so forth. Decades later, we see these imaginings brought to reality, of a sort, in movies and on television. And, of course, on computers, especially in games.

What if it were possible to extract the logic of a video game and apply that game logic to a video of a real world?

Some popular computer-based video games have surprising longevity. For example, in the classroom we sometimes use Super Mario Brothers to illustrate some aspect of interaction. The vast majority of students are familiar with the game, despite its having been introduced only a few years after most of them were born. What is it about such games (we'll include Frogger, Missile Command, PacMan, and others in this category) that makes them interesting, memorable, and fun to play?

We wish we knew. Recently we have explored a partial, possible answer, though, based on the logic of game play in a novel type of video game that we call a *video game on video*. We reasoned as follows: millions of people have posted videos online showing places, events, and activities that they find interesting. Most of these people have probably played video games of one sort or another, including those mentioned above. What if it were possible to extract the logic of a given video game (moving, jumping, interacting with different characters and objects) and apply that game logic to a video of a real world, modified as necessary to support the game? Would it be fun to play? That is, the goal of this work was to develop a library of abstract models of games, such that anyone might choose a model and provide a video, and an automated system would combine the two into a game. This turned out to be much more ambitious than we recognised at first, but we find the general idea very appealing even if it has proved difficult to realise in practice.

We began with Frogger, a game originally developed by Konami in 1981. In Frogger, the player must move a frog character across several lanes of traffic. The frog moves from the bottom of the screen to the top, avoiding collisions. Once the traffic has been passed, the player must move the frog across a river by jumping onto logs and turtles without falling into the water. Based on this simplified description, we developed a model of Frogger using techniques from the field of qualitative physics in artificial intelligence. In this model, it's the interactions and their results that are important: avoiding or colliding with cars in their lanes, hopping onto and off logs, and so forth.

What kind of video would be appropriate? In principle, any video that shows objects moving along in rows, which a frog character would be able to avoid or come in contact with: a swim meet, a parade, or, ideally, automobile traffic with a nearby river full of turtles and logs. For simplicity, we chose the last option and recorded a video of traffic on a nearby highway (unfortunately we were unable to find a conveniently located river full of turtles and logs).

We then developed software using off-the-shelf libraries of image processing algorithms to process the video. Processing involved separating the background of the video (the road) from the foreground (the traffic moving on the road). Patterns in the foreground could then be identified and treated as objects. A virtual character, represented as a frog, was imposed on the video and put under the control of the user. Interactions in the new game respect those of Frogger, with one exception; the frog can jump onto cars and be carried along until it jumps off. A video of the resulting game, which we call AugFrog, can be seen on YouTube: http://www.youtube.com/watch?v=J51fH_j7GRg. We then moved onto another game, Human Pinball, which involved imposing the logic of video pinball on a video of people moving through a corridor.

Leaving software and modeling difficulties aside (the games would require considerably more polish to be more widely used), what did we learn from this effort in our informal usability testing? We were pleased that users did find the games engaging and fun to play. They liked the combination of real world environments with virtual characters and were occasionally surprised by novelties in the interaction. The limitations of a video game on video quickly became obvious, however. One of the reasons that players return to some video games, even after the games become very familiar, is that they have a tempo in which challenges become gradually more and more difficult to overcome. It is possible to represent this tempo in the logic of a video game, but it is much more difficult to achieve it if interactions are with real objects moving at their own pace as in a video game on video. In the end, the main lesson we learned is one already familiar to game designers (and for that matter interaction designers): that their design task is difficult and subtle, and that it is hard to predict which aspects of a design will be effective and which will not.

Robert St Amant is an associate professor in the computer science department at North Carolina State University. The work in his lab is a blend of human–computer interaction and artificial intelligence, with an emphasis on planning concepts. He's interested in building intelligent tools to help users with complex tasks.

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My PhD
The Interdisciplinary PhD

Cecily Morrison is a 2nd year PhD student at the University of Cambridge's Rainbow interaction research group at the Computer Laboratory. She brings to her research an undergraduate degree in ethnomusicology and dance, a Fulbright Fellowship year studying Hungarian bagpipe culture, teaching experience as founder of First Lego League Hungary, and not least a Diploma in Computer Science. To keep physically and creatively fit, she does contemporary dance, choreographs and plays fiddle and bagpipe music from Scotland, Hungary and Ireland.

The path

At a recent conference, my supervisor introduced my research to colleagues as: developing ethnographic methods, dance and 'new media' arts. As I would not characterise my work in any of those ways, I wondered briefly whether my supervisor had thoroughly read my first year report. I soon realised, however, that this is the nature of doing interdisciplinary research – the results interest many people for various reasons but do not fit easily into any one community or category. Many warn against working interdisciplinary, noting that it is easy to lose focus. Stephen Payne amusingly portrayed the problem in a doctoral consortium discussion as, 'being like a dog without a cage.' However, the interdisciplinary path can also lead to a wealth of unusual ideas. In this article I will highlight how my interdisciplinary background has led to a number of insights during my PhD.

I am not a computer scientist by training. My first degree is in ethnomusicology and dance – that is, the study of how music and dance shape the social structures of a culture. My dissertation, for example, examined how historical Scottish dances were appropriated and codified to form various identities in the 20th century. After a year spent researching the role of Hungarian bagpipes in post-socialist Hungary, I taught in an elementary and secondary school for two years. This odd path gave me training in ethnography, choreography, group interaction, and insight into how people learn. While none of these skills seemed particularly relevant at the start, they have all contributed to my PhD, which consists of three studies that aim to answer the question: 'How can we evaluate electronic patient record usage by ward round teams?'

The studies

My first study compared how multi-disciplinary medical teams use paper, as opposed to electronic, patient records during ward rounds. I began by doing a general ethnography of ward rounds, but soon realised the need to analyse the non-verbal behaviours of the group. The size of the groups, 8–10 members, made non-verbal, as opposed to the more frequently studied verbal, means of interaction, a key way of negotiating who spoke and what was spoken about. This negotiation, during which all pertinent information must be shared but no time wasted, is a vital process for good patient care. Familiar with the work of Adam Kendon from my degree, I built upon his theory of F-formation systems to create the Resources For Collaboration analytical framework, a way of assessing group interaction through understanding various combinations and inter-relationships of non-verbal behaviours. This framework supports evaluation of a given technology set-up by determining whether the resources needed for collaboration are available.

Figure 1 Ward round usage of patient records: paper (left), electronic (right)

The results of the first study, captured graphically in Figure 1, indicated that the static display used for the electronic patient record provided a dearth of resources which the group could use to collaborate, particularly constraining their formation possibilities. My second study aimed to explore whether mobile devices, which would allow the medical team to reconfigure more easily, would alleviate this problem. However, as any upheaval to the ordinary routine can jeopardise patient safety, I was faced with the challenge of studying this problem in the laboratory. Many laboratory studies of collaboration have difficulty demonstrating external validity. I drew upon arguments made by Lucy Suchman in *Human–Machine Reconfigurations*, that 'new media' artists are on the forefront of exploring human interaction. She suggests that they probe this interaction not by thinking about the differences between man and machine as with most AI, but by creating installations that provoke users to reflect upon and adapt their interactions with machines. To explore the question of how mobile devices affect group collaboration then, I created a 'new media' probe, bodyPaint.

Figure 2 Example results from the bodyPaint prototype

bodyPaint is an application in which three people control a paint program with their body movements, both of their limbs and in space. For example, arm movements by the three

participants control the x, y, and length components, respectively, of the paint brush, necessitating groups to coordinate their movements in order to draw. Asking groups to partake in this experience and 'solve' the interaction problem it poses with both mobile and fixed displays, allows me to observe the role of technology in supporting group interaction. Examples of the drawings are shown in Figure 2. In a sense, the 'new media' arts experience permits me to do ethnography in the laboratory. Rather than trying to increase the external validity of 'normal' laboratory experiments through tiny incremental improvements, my background in the arts led me in another direction, producing an unusual idea.

My third study developed from the question, 'How can we encourage medical teams to maximise the effectiveness of their communication by adjusting their technology set-up, formation and pattern of interaction?' Having taught for some years, I realised that people are most likely to find the best solution when the root of the problem is evident to them. It is difficult for teams to reflect upon the effect of a given technology set-up on their own non-verbal behaviour through discussion, as non-verbal behaviour is both unconscious and awkward to describe with words. Drawing on my choreographic experience, I adapted several improvisation exercises to use with these teams, flushing out a concept I named End-user Interaction Design. I am currently in the process of testing these out.

My PhD research has addressed the practical problem of how to integrate electronic patient records into medical environments effectively. Drawing upon my varied background in ethnomusicology, choreography, and teaching, I was able to propose some unusual approaches. While I do not suggest starting a PhD with the goal of being interdisciplinary, broadening one's mind by experiencing different approaches can ease the pain of finding that 'brilliant idea' most PhD students are searching for.

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If you are a PhD student just itching to tell the world about your research or if you've enjoyed reading about some of the emerging areas of research that the My Phd column has recently discussed then we would like to hear from you. We are currently accepting one to two page summaries from PhD students in the UK and across Europe with a focus on being open and accessible to everyone in the HCI community.

If you would like to submit or would just like more information please contact either Stephen Hassard or Eduardo Calvillo using the contact information contained below.

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Book reviews

Three recent books have been reviewed for this edition of *Interfaces*. The first two reviews are by colleagues at the Open University, UK: Dr Nick (Sheep) Dalton and Dr Tina Wilson. Nick has reviewed Prof. Harold Thimbleby's latest book: *Press On Principles of Interaction Programming*. Tina presents her views on the book by Thomas Erickson and David McDonald, *HCI Remixed: Reflections on Works That Have Influenced the HCI Community*. Thanks very much to Nick and Tina for their reviews. I have reviewed a book on usability evaluations by Joe Dumas and Beth Loring, *Moderating Usability Tests: Principles and Practices for Interacting*.

I hope you enjoy the reviews and find them useful. Please contact me if you want to review a book, or have come across a book that you think should be reviewed, or if you have published a book yourself recently. I very much look forward to your comments, ideas and contributions. If you would like us to present reviews of books with a particular theme or domain, please let us know. Many thanks.

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Press On Principles of Interaction Programming

Harold Thimbleby

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Imagine studying Mathematics at university and in the middle of your degree, you have to stop and do some ethnography courses. You wouldn't expect to do well or get much out of it, so you've got to pity Computer Science students doing Human–Computer Interaction courses. The methods and theory don't seem in keeping with the style of the other courses. So it was with a great sense of relief that I read Harold Thimbleby's book *Interaction Programming*. Here was an attempt to try to pitch some theories of the design of interaction software squarely in the comfort zone of most programmers.

For example, Harold ingeniously uses information theory to map the shortest number of key presses on a mobile phone to a given number of functions ordered by frequency of use. He then goes on to introduce finite state machines and graph theory to map the complexities of a microwave oven. This work maps well on to the mindset of the typical engineer, trying to design not just any machine but the optimal machine for the job. Clearly this book has a lot to say to the wider Human–Computer Interaction community; so fortunately there are clear introductions to the domains of computing, including finite state machines, information theory, graph theory and a short introduction to JavaScript, and in non-technical terms.

What works so well in *Interaction Programming* is the reinterpretation of HCI themes in familiar Computer Science terms. This surely is something that we should strongly welcome. Anything that inspires computer scientists and software engineers to spend more time getting the user interface right is clearly of great value. Also the book is an attempt to be a call to the HCI community to create underlying predictive theories that can be used in a number of contexts rather than rely on extensive end user testing to achieve product maturity.

Yet while I read the computer scientist in me is engaged, but the interface designer part of me is cautious. The author never mentions testing the results of the interfaces on people to gauge the success of the methods. There are large numbers of references to other works in the field, but the book itself never points to papers that gives details of testing the theories with real users. For example the finite state machine method can help spot problems in the design.

It's hard not to wonder whether if this was compared to a less technical method the benefits would be so clear-cut. Finally almost all of the examples produced are about consumer products. It is a delight to see someone focused on the Cinderella area of interaction design microwave ovens, TV remote controls, digital multimeters, and so on. Yet again you do wonder about the applicability of these highly button-centric approaches to the broader range of applications.

Ultimately I think the author has produced a valuable book, a signpost to the way human interaction could develop by strongly engaging with the field of informatics. As such I would not hesitate in recommending it. Yet while the approach is laudable the actual items presented appear more debatable, so I don't think I could, in all honesty, recommend this as the college text book it should be.

Reviewed by

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HCI Remixed: Reflections on Works That Have Influenced the HCI Community

Edited by Thomas Erickson and David McDonald

MIT Press, 2008
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ISBN-13: 978-0262050883

This book reviews early research in the field of HCI. Although a relatively new area, early work, which was valuable in defining the multidisciplinary nature of the discipline, should be rediscovered and reflected upon. This book could act as a reference that points to many articles revealing pioneering research in this area. One can compare one's own interpretations with those of the authors. Alternatively, this book provides a useful starting point for those new to this subject domain, including those setting out on undergraduate or postgraduate study of HCI. The book contains eight discrete sections, which are discussed in turn below. Each section of the book showcases between five and eight short essays, which accounts for 51 essays in all.

This book provides personal and historical views of HCI and a wide variety of topics are covered from different perspectives. Though not a collection of research papers, the enthusiasm of the authors is infectious and invites the reader to find out more from the referenced literature.

The 'Big Ideas' section considers early development in HCI and how the various authors were inspired and influenced by what they encountered. In 'Influential Systems' the authors discuss the development of human interaction with early computers, Graphical User Interfaces and the concept of Ubiquitous Computing. Computer-mediated Communication in formal and informal online systems is the focus of the section 'Large Groups, Loosely Joined'. This

latter section is complementary to 'Groups in the Wild' where observation of group work in leisure and occupational settings informs the discourse.

The influence of art and visual design on the development of interaction design for different technologies is core to the section 'Reflective Practitioners'. The section 'There's More to Design', which looks at design in the broader context of the world we live in, corresponds well with the previous section. The way in which we learn, progress and change as a result of pursuing a design idea is key to the section 'Tacking and Jibbing'. The final section 'Seeking Common Ground' looks back to find fundamental areas of agreement and looks forward seeking approaches that build on previous work.

Not all essays will be of universal interest but many of the essays in this book will have a wide readership.

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Moderating Usability Tests: Principles and Practices for Interacting

Joseph S. Dumas and Beth A. Loring

Morgan Kaufmann, 2008
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ISBN-13: 978-0123739339

The book is, as the title indicates, about running usability sessions with participants. One key aspect that we as HCI instructors tend to miss in our courses is providing interview training to our students; that is, how to effectively conduct unstructured, semi-structured and structured interviews, and yet interviewing and moderating or facilitation skills are key to the success of usability testing. Also, most of us tend to learn from our own experiences or by watching others and without any formal training. In fact, moderating and running a session is generally perceived as an 'art', a skill that is difficult to teach.

The book by Dumas and Loring fills this gap in our learning and teaching: it covers the best practices in facilitation and moderating usability tests: what to do and what not to do while interacting with participants, including the ethical considerations of usability testing. The book doesn't provide guidance on formulating an evaluation strategy such as when you should apply heuristic evaluations, evaluations with respect to some standards or guidelines, conduct user-observations in a laboratory set up, or conduct ethnographic studies or naturalistic observations. However, as a reader you don't miss these aspects as the title of the book sets the focus of the book and the expectations of the reader, and Dumas and Loring do full justice to this focus. The book is complementary to other HCI texts such as Rogers, Sharp, et al., or Dix et al.

The book starts with an introduction – the rationale of this book and the purpose it will serve amongst your other HCI resources and books. The introductory chapter also gives an outline of the book. The second chapter provides guidance on the role of the moderator or facilitator: attributes of a 'great' moderator; types of testing; conflicting roles that a moderator might be expected to enact; the basics of running a test, and how to get started as a moderator. The authors present ten 'golden rules' of moderating: decide how to interact based on the purpose of the test; respect the participant's rights; remember your responsibility to future users; respect the participants as experts, but remain in charge; be professional, which includes being genuine; let the participants speak; remember your intuition can hurt and help you; be unbiased; don't give away information inadvertently; and watch yourself to keep sharp. Each of these rules is explained in much detail through examples, photographs and practical tips and guidance in chapters 3 and 4 of the book.

The various stages starting from setting up an initial contact with the participants, screening, recruitment, pre-test briefing, and interacting during and after a session are discussed in detail in chapters 5–7. In chapter 8, the authors discuss setting up and running remote usability tests. There are various possible arrangements of moderator–participant distance and co-location. Chapter 9 discusses the arrangements such as effect on the quality of data due to physical separation or due to physical proximity and how the choices a moderator can make may depend on variables such as objective of the test, interactivity of the product and the characteristics of the participants. In chapter 10, the authors discuss interactions with diverse populations such as people with physical disabilities, the elderly, people with cognitive skills or low literacy skills, children and teens, and people from cultures different from the moderator's.

The book has a companion site that features a number of short role-playing videos, filmed in the Bentley College Design and Usability Center Laboratory. The companion site is accessible via http://tinyurl.com/3yt6au.

Chapter 11 of the book provides a key to the videos and suggests how to get the most value from them. The videos include pre-test briefing, interacting during a session, and interacting during remote evaluations. These videos illustrate the points being made in the book. The clips show both good and not-so-good moderating practices. In addition to the role-playing videos, the authors filmed a discussion by a panel of usability experts. The experts give their opinions about what they see in the videos and discuss the trade-offs that might be considered in each situation.

Each chapter of the book has transcripts/snippets of interview(s) with experienced moderators. Several chapters of the book also have a section entitled: 'what the research says', which helps to set up the context of the practical guidance and tips being given in the chapter. A colleague recently alerted on one of the usability mailing lists: "Run, do not walk to pick a copy of [this] book". I did what he said and ran or navigated to Amazon's site to buy this book. Dumas and Loring's book is an invaluable resource for HCI students at various levels of their studies, HCI and software engineering researchers, practitioners and instructors, technical communication professionals, and quality assurance personnel – anybody who is interested in or conducts usability tests with users. The book is not only useful for moderators who are new to usability testing but will also serve as a useful resource for expert moderators who may like to 'dip' in for helpful tips and ideas and even to validate their own practices.

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Profile

Joanna Bawa talks to John Knight

Joanna is a Chartered Psychologist and currently the Editor of UsabilityNews, which makes up one strand in her 'portfolio career'. Her first proper job was Human Factors Engineer at BT Martlesham Heath, where she designed icons and ran usability tests, before a spell of technical copywriting at an agency in London. The two skills came together at PC Magazine UK, where she set up a comparative usability evaluation lab and ran it for six years, whilst also developing an interest in technical journalism and the extravagant press parties which are a necessary feature of cutting edge technology research. Hooked on writing for a living, she eventually went freelance and now writes, researches and consults for publications, organisations and research groups on usability and human–computer interaction issues, as well as mainstream technologies and their social and psychological impact.

When not working, she swims and gyms (you've got to, really), avoids football with small boys, holds all-day Sunday lunch parties and tries to persuade other people to do the washing up.

What is your idea of happiness?
Early evening in a warm sunny place, sea view, G&T (ice and lime) to hand, with an important and interesting project successfully completed, swordfish on the grill, champagne in the fridge, favourite people around me.

What is your greatest fear?
Something bad happening to either of my children.

With which historical figure do you most identify?
This is hard. I'd say Jane Austen or Marie Curie but that's more admiration than identification. Realistically it's all the women who chose love and balance over fame and glory and never got a write up.

Which living person do you most admire?
Also hard. Lots of people for many different reasons, mostly those who persist with ridiculously difficult and unlikely challenges when any normal person (including myself) would have given up.

What is the trait you most deplore in yourself?
Procrastinating, over-thinking, over-researching, over-analysing when I should just get on and do it. And not always persisting enough.

What is the trait you most deplore in others?
Cruelty.

What vehicles do you own?
>yawn< Peugeot 406sw; a mountain bike

What is your greatest extravagance?
Books. Lipstick. Wine. Not necessarily in that order.

What makes you feel most depressed?
Being sold, despite failing to comprehend, personal finance 'products'. Pensions, ISAs, trusts… bleugh.

What do you most dislike about your appearance?
The usual things that bother most women, which I won't spell out, since you either know what I mean, or you neither know nor care.

What is your most unappealing habit?
Lateness.

What is your favourite smell?
Depending on the season and time of day: sleeping children, coffee brewing, warm bread, dry grass, wet leaves, lilac and garlic frying.

What is your favourite building?
Any grand ancient ruin, preferably abandoned and with ivy growing all over it – temple, palace, theatre… imagine what they once meant and the stories they could tell.

What is your favourite journey?
The school run (it's a walk) – dropping them off as well as picking them up.

What or who is the greatest love of your life?
My family and friends.

Who would you invite to dinner if you could invite anyone?
Hard, hard question. Sci-fi writer, Stephen Baxter, Tracy Chapman, Andrew Marr, Joanna Lumley, Sanjeev Bhaskar, Hugh Laurie, Susan Greenfield – and Captain Jean Luc Picard of the Starship Enterprise.

What or who annoys you the most?
'Celebrities' – ie the vacuous, talentless, synthetic, identikit under-achievers who dominate certain strands of our media and impose their shallow, distorted, values on impressionable minds. Ahem.

Which words or phrases do you over-use?
I'll be right with you. Absolutely. Here's the deal. Stop doing that. Put it down. Pick it up. What did I tell you. Bed!

What is your greatest regret?
Not really settling down to write The Great Novel (there's still time… if I can just stop… procrastinating…)

When and where were you happiest?
Whenever I'm in control of my actions and responsible for my decisions. And especially happy when it all works out OK.

How do you relax?
Anything physical, energetic, manual or all of the above which is entirely absorbing but doesn't require any intellectual power, analysis or reasoning. And which is followed by eating and drinking.

What is your favourite piece of music?
Anything by Tracy Chapman. Or Abbess Hildegard of Bingen.

What single thing would improve the quality of your life?
Call me shallow, but more money. I see it as a way of gaining real choice and eliminating a lot of anxiety and soul-destroying drudgery. Also – a much bigger study with huge windows overlooking a vast garden.

Which talent would you most like to have?
Singing. No, teleportation. No, teleportation and singing.

What would your motto be?
Carpe diem. Relatively recently adopted, given my Most Deplorable Trait and the hours I spend awake at night pondering the rate at which time is passing and how little I've got done.

What keeps you awake at night?
The rate at which time is passing and how little I've got done.

How would you like to die?
Quickly, comfortably, contentedly, with my To Do list almost complete.

How would you like to be remembered?
As someone balanced and kind who never put work before love and friends.

The British HCI Group is served by Sub-groups comprising representatives from a broad range of academic and industrial centres of HCI interest. The Sub-groups are committed to promoting the education and practice of HCI and to supporting HCI people in industry and academia. For contact details of the persons in each Sub-group, please select from the following:

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HCI2008: www.hci2008.org

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