Interfaces
67 • Summer 2006

British HCI Group
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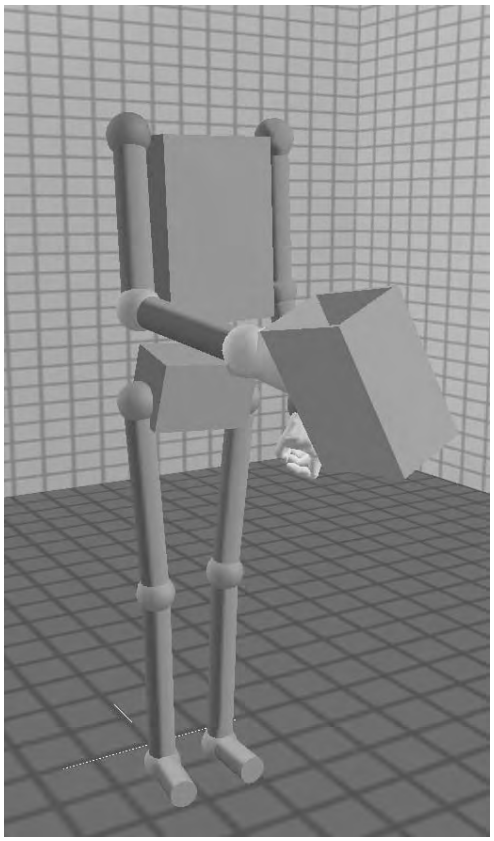
HCI of older people

designing mobile phones and desktop PCs
checking strength capabilities with InclusiveCAD

HCI in medicine

desktop and virtual realities
electronic IDs in healthcare systems



and regulars

Gilbert Cockton
Russell Beale
Robert St Amant

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Human–Computer Interaction

contents

Editorial

Laura Cowen

Spurred on by the scribblings of the Purple Pixie in the scurrilous Purple Press Blog at HCI 2005, I decided to have a go at blogging.

My initial impression of blogs when I first came across them a year or two ago was that they were generally just an outlet for self-indulgent, self-important ramblings; worse still (and I was quite incredulous), some bloggers seemed to think that other people would even compensate them for their time by buying them an item or two from their Amazon wishlist.

Since then, my general opinion of blogging has changed, especially as people who really do have something to say have started to say it. I don't spend a lot of time reading blogs (I feel it could become something of an addiction were I to let it) but you can get a lovely insight into people's lives by reading their blog. And everyone's getting in on it; from politicians to popstars; from global corporations to family and friends. The mainstream media are having to reassess their position as information providers as everyone becomes a 'journalist'; indeed, for people like politicians who are regularly quoted and misquoted in the mainstream media, blogs (or 'weblogs' to give them their proper name) are the ideal way to get their messages out undiluted by those pesky journos.

One of the nicest things about blogging is how easy it is to get the information from your keyboard on to the Web. You don't have to spend over half your time contorting your hands around the angle brackets on your keyboard to produce even the most basic HTML, and you don't have to mess around FTP'ing files back and forth either. You just type into a basic form in your Web browser, click Publish, and that's more or less it.

The Purple Press Blog was produced using a free online provider (www.blogger.com) where all you need to do is register and your blog is hosted for you. This is definitely the easiest way to get your blog up and running. In contrast (mainly because I could), I set up my blog on some personal webspace using WordPress (http://wordpress.org), which turned out to be a nice, clearly documented, easy-to-configure bit of software that caused me very little trouble.

So far my bloggings have been of the self-indulgent kind (I've spent considerably more time trying to find and customise my perfect blog theme) but you are, of course, still welcome to buy me something from my Amazon wishlist if you feel especially enlightened by them.

P.S. Thanks to John Knight for co-editing this issue, and to Fiona Dix for producing it despite a change in printers, new deadlines, and last minute software failures.

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Right to Reply

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

To receive your own copy of Interfaces, join the British HCI Group by filling in the form on page 27 and sending it to the address given.

Next Issue

Interfaces welcomes submissions on any HCI-related topic, including articles, opinion pieces, book reviews and conference reports. The next deadline is **15 July**, but don't wait till then – we look forward to hearing from you.

With thanks to commissioning editors:
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Deadline for issue 67 is 15 July 2006. Deadline for issue 69 is 15 October 2006. Electronic versions are preferred: RTF, plain text or MS Word, via email or FTP (mail fiona.dix@hiraeth.com for FTP address) or on Mac, PC disks; but copy will be accepted on paper or fax.

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and copy email submissions to Fiona Dix, Interfaces production editor; email: fiona.dix@hiraeth.com

PDFs of Interfaces issues 35–66 can be found on the B-HCI-G web site, www.bcs-hci.org.uk/interfaces.html

Deflections

'True' design is inseparable from evaluation

Gilbert Cockton

HCI has largely separate design and evaluation methods, which is curious when one reflects on the nature of design. This is not easy. Like Science, the word 'Design' is tagged onto other words to give what John Heskett (2002, p.4) calls 'an aura of competence' in areas such as 'hair design, nail design, floral design and even funeral design'. So what is design, if anyone can do it with anything? John Heskett (2002, pp. 5-6, *all emphases added*) defines it as 'the human capacity to shape and make our environment in ways without precedent in nature, *to serve our needs and give meaning to our lives*'. For him, designs 'result from … decisions[, because] … the human factor is present … at all levels in design practice. … Choice implies alternatives, in how ends can be achieved, and *for whose advantage*.' We are told that 'design' is not 'making' and thus builders and architects are very different.

Is there anything beyond posturing in this separation of makers from builders, professionals from tradesman, and conception from craft? A literal, binary, black-and-white answer must be 'no', since builders do make decisions by considering alternative choices. There are real differences, largely of degree, but also of intent: 'to serve our needs and give meaning to our lives' and 'for whose advantage'. This is what really distinguishes design. If it's not done for the advantage of users, sponsors and other stakeholders, then it's not design. It must involve explicit choices between explicit alternatives, based on explicit judgements and decisions. There is a palpable thoroughness about 'true' design, but again, what really makes true design is working from a brief focused on demonstrable impact for others; not the muse of the designer or the magical properties of the artefact.

Now, how on earth can designers make explicit human-focused judgements and decisions between alternatives without evaluating them? Two ways are possible. The 'designer' could really be a 'developer', making implicit unsurfaced judgements in a wrong unconsidered way. Alternatively, a 'true' designer could be evaluating, but not very well. John Heskett (2002, p. 134) has rumbled designers: 'Idealistic claims by designers, however, that in some innate manner they represent the standpoint of users is clearly unsustainable'. This takes us straight back to the discussions between Bill Buxton and others in the previous issue of *Interfaces*. Bill knows that all the designers he knows care deeply about their users. And they do, but how well depends on who they are and where they are. In much product design, there is almost a century of understanding users in specific consumer contexts. Designers there really can know about their users, as long as they work effectively with the business functions who track user trends.

HCI has largely separated evaluation because either there is no design, only semi-mindless software development, or because design is poorly supported. Evaluators' methods, for use by roles other than designers and developers, are thus like a canary down a coal mine, but in reverse. When consumed by the effects of gas, canaries sway noticeably on their perch before falling, visibly demonstrating distress for low quantities of gas. When usability evaluators start swaying on their perches, we will know that designers are finally working in supportive atmospheres, and no longer require usability specialists. The latter currently exist largely either to make design decisions that were never made in the first place during development, or to correct decisions of well-intentioned, but poorly informed, designers. It is far better to educate and train developers to make them into designers, and to provide designers with early contextual research to support well-grounded choices. Quality needs to be designed in, not inspected in. The persistence of largely evaluative roles in software development is evidence of development processes that cannot deliver quality. Evaluators then try to fix the unfixable with too few resources too late in the day, resulting in often negative perceptions from software developers (Iivari 2005).

As long as evaluation remains separate, we will have methods that are not used by designers or developers, whether for design or for evaluation. Evaluation and contextual research must be seamlessly integrated into design and development, with a limited need for specialist evaluators, who could thus shift their focus to assessing the actual impact and performance of live systems, rather than design errors from mismanaged development. This is how evaluators in mature areas of design work, as 'metrics' specialists rather than fire fighters. Thus the UK Design Business Association (DBA) awards for effectiveness look for 'designs that prove beyond reasonable doubt a cause and effect between the new design and business success through results' (www.dba.org.uk/awards/dea.asp). The gap in demonstrable effectiveness between established and software design will keep usability canaries safe in their cages, unthreatened by ubiquitous 'true' design. One day, however, like retired pit ponies, they will need to be led back above ground from the grind at the coal face to the world where real impact is measured and assessed. When we can leave designers to design, and evaluate effectively afterwards, HCI will mature in a science of real world impact, rather than a political craft of development fire fighting.

Heskett, J., 2002. *Design: a very short introduction*, Oxford University Press.

Iivari, N., 2005. Usability Specialists – 'A Mommy Mob', 'Realistic Humanists' or 'Staid Researchers'? An Analysis of Usability Work in the Software Product Development, in *INTERACT 2005*, 418–430.

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Oh, Referee!!

Russell Beale

It's a well-known story: a car pulls up alongside a local and asks for directions. "Mmmmm," replies the local, "if I were going there, then I wouldn't be startin' from here".

Whilst it's funny if you're listening to it, it's not that amusing if you're the driver. And yet, whilst we all recognise the absurdity in the comment, it's something that tends to blight an area of our work as well. Grant Refereeing: it's a task that many of us know about, some of us do, less of us enjoy, a few do on time, and a very few do well. It's a basically thankless task: a request to read something of often peripheral interest to us, with a deadline of a few weeks, with no payment or particular return except the fact that we know it is needed in order to make the academic world go around. Much like paying the mortgage, we know we need to do it but we don't like having to do it.

But grants are the lifeblood of continuing research, the developer of careers, the initiation of new researchers into the field – so do you give them the attention they deserve? So often I see reviews that essentially say "if I was doing this, I wouldn't do it this way". Noooo! No-one is asking you how you'd do it – instead, they are asking you if the way proposed is sensible, reasonable, rational, and potentially likely to lead to decent results. It may not be *your* way, but it is *a* way. I drive to work along the back roads, because it's more interesting to me. My colleague who lives nearby drives in via the motorway, because he finds it faster. Is he wrong? Am I? Of course not – we're simply doing it differently – we start in similar places, and arrive at similar destinations, but we take different routes and have different experiences on the way. So it is for research: if you were doing it, you might not start from the same place as the proposer. But who cares – is it an acceptable place to start from, and a feasible way for them to go?

As referees, another problem we suffer from is the human trait in which faults are easier to spot than excellence. At least, they are easier to write about. As a consequence, we fill up reviews with all the negative points, all the issues that could indeed be improved. It's true; there are some aspects of every proposal that could be slightly better. As any plastic surgeon will tell you, if you just fix this little pimple and remove that tiny wrinkle, then everything will be much much better. Noooo! Stop it. Put the imperfections into context: if the overall package is fantastic, the minor issues are just that: minor. By all means point them out, but also point out the excellent features they complement, the overall package that is worthy and beautiful. Make sure they are presented in perspective. Too often I have seen comments written by referees that say 'fine', 'good', even 'excellent': better than a blank space, but only in the same way that 2p is better than nothing. If it deserves it, give it the millionaire treatment: say why the concepts are novel, that the methodology is sound for the following reasons, that the outcomes are worth pursuing – justify your praise, but if it deserves it, make sure you state it. Do remember that people writing grants put a vast amount of effort into them. Whilst there are some benefits to the anonymous system of reviewing, allowing you to be honest when you may otherwise feel constrained, you should also consider what you would say if the Principal Investigator (PI) was sat next to you, watching you write the review. Are you being fair and balanced? Are you phrasing things carefully to give the right impression? Are you making too much out of minor issues? Are your five minutes of commenting being fair to the weeks, sometimes months, of effort?

Ego: we all have it, some worse than others – and for those that write columns, there is little hope. But leave it out of your reviewing. I *know* your work is the best in the area. I *know* that I should have referred to it. But if I've covered the main bases, if it's clear that I do know what has been done in the space, should you really feel so slighted that your paper doesn't get a mention that you kill off my proposal? Noooo! Sure, mention it if it's relevant, but keep a perspective. When I write a grant application, I find there is very little space to properly review a field, express my ideas, describe the outcomes and the workplan and the management and dissemination and and and all in six pages – so I must remember you have the same problems. I'm sure it was only that reason that caused you to fail to cite my work anyway…

The one issue that haunts us all is that there isn't enough money to go round. So grant-getting is, in one sense, a competition. But I think we see it in the wrong light. We view the competition between 'your' idea and 'my' idea, and compete at an individual level. Subconsciously, we feel that if I support your proposal and it gets funded, then there are less funds for me and I'll have less chance. But instead of looking at it as a competition between different HCI proposals, consider instead that it's a competition between different Information, Communications and Technology (ICT) proposals. At any one stage, there are not going to be too many competing HCI grants up for funding: instead, HCI is competing against all the other, equally worthy, areas for funds. And if I help yours to actually be funded, then money comes into HCI, and HCI delivers something useful somewhere down the line. And if we deliver, then people will put more funds into our area, and we all benefit. So supporting you actually helps me, not hinders me.

Sometimes, grant proposals are just wrong. They are fatally flawed, and we must be robust in saying so. But sometimes they are simply a little unclear, and rather than stating that they are wrong we need to ask some questions. But it's often easier to criticise for the lack of clarity and damn it outright than it is to make the effort to unpick the central issue and ask a question to clarify it. Sometimes you "wouldn't be startin' from here", but that start point may not be wrong, it may just need explaining. I was chatting to an EPSRC programme manager a while ago, who said that he viewed grant-getting as like a football team: you had your attackers, the glamorous, entertaining ones, who scored the goals and set up the chance of a win – and that was the proposal. The clearer the strategy, the more organised the plan, the more flair and adventure and entertainment, the better. But you also had to have a solid defence: full backs and goalkeepers to ensure that you didn't concede too many goals either. Slightly more dogged, much less in the limelight, the defence was every bit as critical to the team's success – and that was the PI's reply. As referees, we *know* PI's have the chance to respond to our comments. So when it's appropriate to ask questions, ask them – and give

them a chance to defend. Identify what, exactly, your issues are, and see if they can be phrased as questions to be answered: a successful defence may still mean the team can win. As a referee, it is your duty to be as clear in your criticisms as you want the PI's to be in their proposal – identify the shortcomings, note the problems, express them clearly, and give the opportunity for a reply. If you have a fundamental problem, say so, clearly, and give reasons why. If you have a question, ask it. If your points are minor, say so. If they are major, make it clear that they have to be addressed. Remember to consider carefully the consequences of your decisions: grants tend to need the 'excellent' & 'should proceed' boxes ticked if they are to stand a decent chance at the panel. If you are undecided, it makes more sense to tick the 'excellent' box and make incisive, critical comments that the PI can address, rather than abdicate responsibility by ticking the 'adequate' one and refraining from commenting in detail.

The current system is not perfect. The EPSRC form drives me up the wall – and I've volunteered my time (and that of the groups, actually) to assist them in redesigning it. One Programme manager told me that the process must be an assessment one, and not a conversation. I'm less convinced by this: I think a more constructive dialogue that assists people develop ideas into fundable proposals is a good one. But we needn't wait for EPSRC or the other agencies to act: we can help ourselves. I am not advocating that we support any HCI proposal regardless: I am advocating that we work hard to become the best referees we can. Do remember that the more detailed the comments, the clearer the criticism, the better picture you can give of the merits and problems of the proposal as currently written, the better the chance the PI has to improve it for the next time round. We are not bouncers on the doorway of grant funding, turning away the new ideas because they do not fit our stereotypes of acceptable dress code: we should see ourselves as the promoters, trying to attract all to our work, to help those with an interest to get in, and once in to sustain that enthusiasm.

There are people who believe that we as a community stab each other in the back as far as grants go, and to an extent they may be correct – though a Programme manager at EPSRC sagely commented that all fields felt this. And we must not forget that there are many good, even great, reviewers out there, and proposals do get to the panels. But many often fail at these panel stages, often because there is not an HCI person there to champion them, to be enthusiastic, to have the ammunition to present the proposal in the best light. So as referees, we have to provide that enthusiasm, we have to give sufficient information to allow the panel to support the idea with some confidence. If we are clear in our support, then we highlight the good things. If we are equally clear and objective in our criticism, we provide the PI with a clear issue upon which to respond, and if the idea is a good one, then they should be able to address it satisfactorily. And last but not least, if we are decent referees, trusted to present a fair, balanced, clear review, then we will be invited to actually sit on more panels, and can then make even more of an impact.

Being a great reviewer is something that we can all achieve, given time and effort. Putting in that effort will reward us all in the end: it is an achievable goal, and one to which we can all contribute.

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Remembering Enid Mumford

With some sadness I learnt of the death of Enid Mumford, Professor Emeritus at the Manchester Business School, who passed away in April. For those interested, there is a good obituary here: http://galletta.business.pitt.edu/tributes/Mumford.html with references to her own site.

Her ETHICS methodology was the culmination of a lifetime pioneering participative management and design. I was lucky enough to meet her several times within HCI, Systems and the management communities, and hearing the stories of her observation, insight and innovation was at every time both a delight and an inspiration.

My enduring memory will be more anecdotal, namely her memorable story of persuading the North West Coal industry to let her down the mines for a proper participative study of miners and mining. Wearing perfume of course, so that the miners could temper their behaviour and language for their somewhat unexpected visitor. In case *they* were embarrassed ;-).

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Conducting mobile phone research with older persons

Sri Kurniawan

When the British Society of Gerontology agreed that the issues related to the use of mobile phones by older persons are worthwhile investigating, we started hunting for published methods in this area. We originally intended to review only studies related to design but much of the research that we found was ethnographic studies of people's behaviours when using mobile phones in public places, or usability testing commissioned by mobile phone companies. After a brainstorming session with another HCI researcher, BSG representatives, and a social scientist, we decided to implement four approaches:

Delphi interviews
Focus group discussions
Observation of users' cooperative learning strategies
Questionnaire

Delphi interview

The Delphi interview is a technique where a researcher interviews domain experts, prepares a report, hands it to the experts, and discusses the results with them. It is a very powerful methodology for gathering expert opinions on a certain topic. This methodology can potentially uncover issues related to more complex uses of mobile phones.

The first problem we encountered was recruiting domain experts: elderly mobile phone expert users (which would be an expert in both mobile phone operation and issues older people face when using mobile phones). After some failed recruitment attempts, we decided to interview one retired researcher and one mobile phone expert. The older interviewee stated his views on common problems that older mobile phone users face (based on his own experience) such as the backlight that turns off too quickly while the user is still remembering the number to dial or the text to type. The younger interviewee focused on problems older persons might face when using advanced features such as predictive texting, MMS, and 3G technology.

Focus group

Using focus groups is one way to get a large amount of information in a short period of time and it is particularly useful for exploring the degree of group consensus on a given topic. The problem with organising focus group discussions with older people is the difficulty of synchronising weekly meetings where all group members do not have appointments (which can range from surgery to visits to and by family and friends).

The focus group discussions uncovered many interesting issues. Some were expected: the main use of mobile phones is for emergency and safety; older persons preferred a bulky flip phone (easy to pick up and end calls) in bright colours, with an antenna (easy to pick up in crowded handbags); they liked raised metallic square buttons (they clicked when pressed) and easily accessible dedicated buttons for important functions (e.g., emergency dialling and keypad locking). However, the discussions also revealed that older persons are familiar with, and regularly use, more advanced features such as SMS and roaming.

Cooperative learning

Cooperative learning (CL) involves people working together as part of a collaborative effort to study and understand a topic or to complete a task. We hope that by observing how a group of older mobile phone users learn to use a new phone, we can infer design-related usability problems. While our observations did reveal usability problems, like the 'OK' button being too close to other buttons so that users often pressed the wrong button when picking up calls, we also got an insight into their learning strategies.

We found, for example, that older persons have a structured strategy in learning how to use a new mobile phone. They first explored the physical design, then performed basic activities (where they transferred their existing mental model of using either landline phones or their own mobile phones), before they tried new features. When exploring new features, they adopted several strategies: a combination of trial and error, assigning another person to find the information in the manual (the most used strategy), and asking us as the last resort.

Questionnaire

The previous three techniques allow an in-depth investigation of the issues we needed to investigate. However, these techniques are inherently difficult to conduct with a large number of people. Therefore, we conducted an online survey which was designed in collaboration with the focus group. To encourage participation, we decided to give away, through a lucky draw, two mobile phones. Within a month, we collected 100 complete datasets. Some data confirmed the view of the focus group; for example, 90% of respondents thought that mobile phones were for emergencies. However, other patterns emerged; for example, when we factor analysed user ratings of the problems caused by various physical design elements, we found three main causes of problems: device dimension (size, weight, shape), button (button's size, arrangements and characters) and operation (navigating menus, learning to use, choosing options).

Summary

We used a combination of qualitative and quantitative techniques; a technique that is referred to in social science as the *triangulation method*. We found that using a combination of methods allowed us to arrive at a more nuanced understanding of the issues related to the use of mobile phones by older persons. For example, using the qualitative methods we understood in more detail why older people might have problems with backlights (as revealed in the interview), multiple key presses (as stated in the focus group discussions) and button location (as the cooperative learning observation found). The survey then acts as a means to statistically verify the findings from these qualitative methods with a larger sample.

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InclusiveCAD: a design resource on the strength capabilities of the elderly

David Loudon

In older age, the onset of functional limitation is likely, and increasingly so as one gets older. Functional limitation need not however cause disability; disability rather is a result of the relationship between functional limitation and the demands of the built and social environment. More considerate design therefore has the potential to extend the quality of life and independence of older adults. A major challenge which designers face, however, is the lack of understandable information on functional limitations and lack of guidance on how this information can be applied to improve a design.

The aim of this research was to create a prototype software tool that provides product designers with a means to understand the effects of age on biomechanical capability and how this can affect product usability and interaction. The software is an outcome of an EPSRC EQUAL funded, multidisciplinary project running collaboratively between the Bioengineering Unit at the University of Strathclyde, the School of Health Sciences at Queen Margaret University College in Edinburgh, and Product Design Engineering at The Glasgow School of Art.

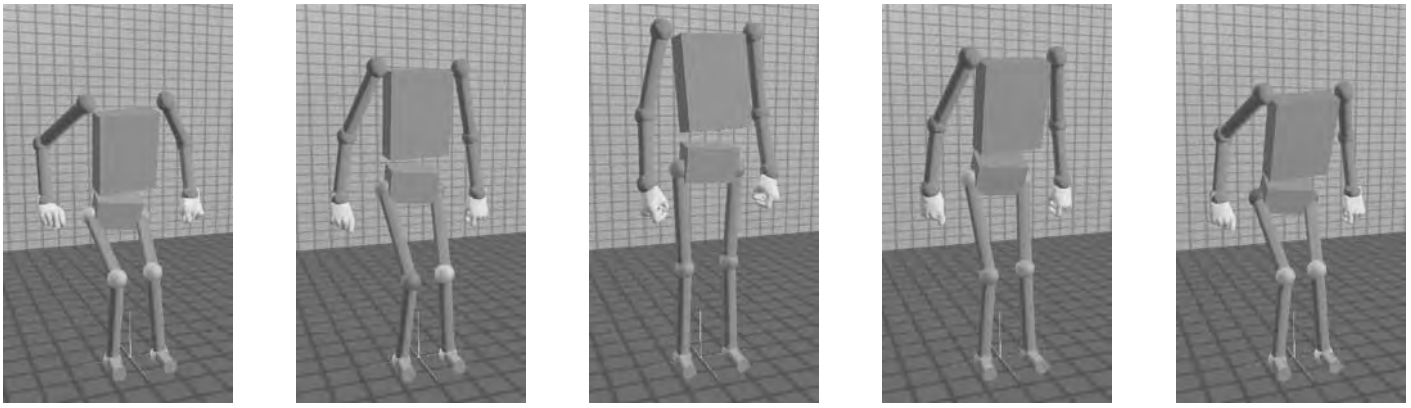
In this project, biomechanical functional movement data was obtained on a set of five defined activities of daily living, using a sample group of 84 older male and female participants in the age groups 60s, 70s and 80+. The activities chosen were walking, sit-stand-sit, door opening and closing, stair ascent and descent, and lifting a small object from one shelf to another at a different height. In order to assess how close to their maximum strength capability the participants were working during the everyday living tasks, isometric strength data (maximum strength measured at a constant muscle length) was measured at the hip and knee of each of the participants. Further details of the data collection can be found in the references.

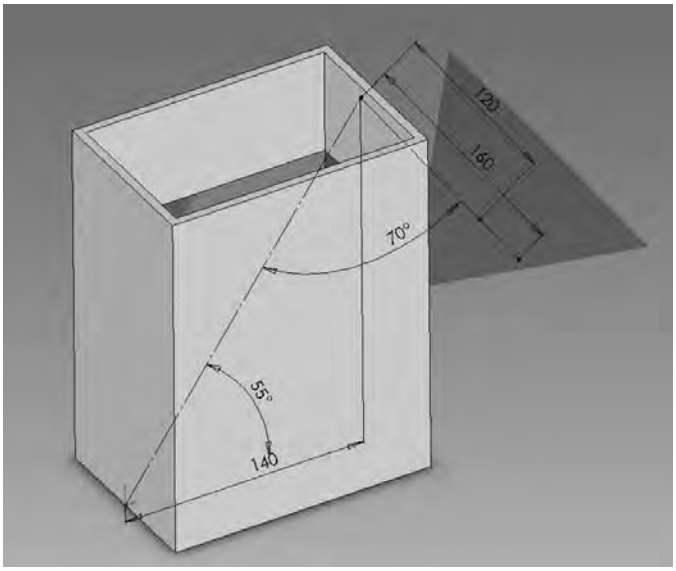
This article focuses on the author's part in the project, which was to take this complex biomechanical information and make it accessible and usable by product designers. Numerical data or graphs of joint moments, joint angles and functional demand data require skill in interpretation and a level of biomechanical comprehension and training. A software tool was created that aimed to provide the designer with a new way to view and interact with the data, which was more appropriate to the needs of design.

The prototype software tool produced enables a designer to select information on a participant performing an everyday living task (selection by age and gender) and view a 3D animated model of the participant performing that task. The strength requirements at the joints are shown as a percentage of their maximum capability – represented on a 'traffic light' colour gradient from green (0%) through yellow to red (100%). This representation of functional demand proved to be effective in reducing the demand for knowledge of biomechanics (if required, the designer can examine the joints to obtain the numerical values, direction of the forces, etc). The designer can view the animation, and get immediate visual feedback of when the participant was working close to their maximum capability. This is illustrated in the following frames from an animation of an older adult participant performing the sitting task. On rising from the chair, the right knee briefly shows an orange colour (which corresponds to medium demand), however mostly moves well within their capability. As the participant sits back down on the chair, however, the red colouring at the hip joints shows very high demand. In this particular situation, the person would probably safely fall into the chair, however one can imagine how the same situation on a flight of stairs could have more serious consequences.

The scenario of designing a kettle was used to explore the potential use of the tool within CAD software. The designer can create a quick and simple virtual model in the engineering CAD package Solidworks, estimating the configuration of parts and the properties of the materials that would be used. A custom written plug-in to the Solidworks package was written that enables the designer to specify the position and orientation of the handle, and where the centre of the grip should be. The model can be as detailed as the designer feels is necessary – in the early stages of the design, the kettle could be a simple box shape; later on in the process, the design could be closer to the final product. In this scenario, the designer is also interested in the effect of the water level, so adds another part to the assembly, with the material properties of water.

The image overleaf (right) shows the kettle model attached to the centre of the hand of the virtual human. The position of the arm can be adjusted to obtain immediate visual feedback on how the stresses at the joints change. The designer can return to the CAD model and change parameters of their design such as handle position and orientation, the shape of the kettle, the water level, or material properties, and use InclusiveCAD to get immediate feedback on whether the situation is improved. A selection of male and female older adults in the age ranges 60s,





70s and 80s are available for comparison.

The prototype software is currently being evaluated, gathering the views of several different stakeholders – bioengineers, designers, human factors experts, health scientists and older adults. Already, in discussions with biomechanics researchers, several guidelines and 'rules of thumb' have been identified that would be of value to designers when considering the limitations of older users. Integrating these guidelines into the tool will give further context and explanation of what is happening in these movements during everyday tasks. Although originally intended as a tool for designers, the feedback and evaluation of this method of visualising the data is beginning to suggest that this tool may be of value across all those involved in the professional care of older adults.

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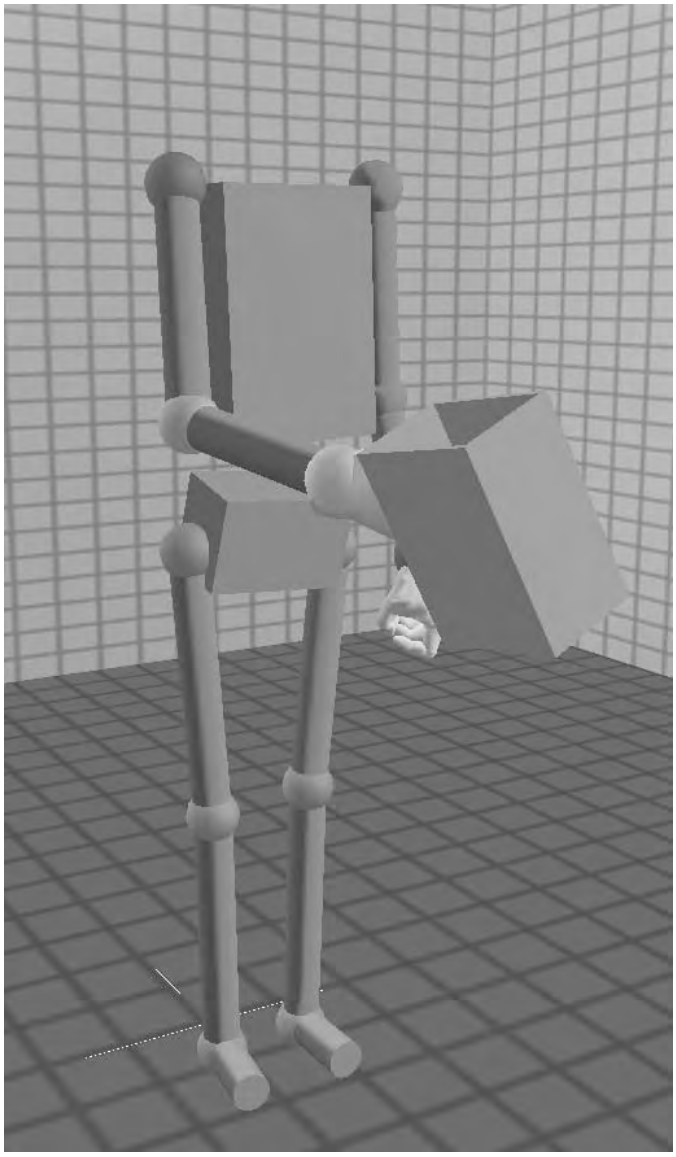

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Combining desktop and virtual realities

Addressing demands of real life clinical environments

Elena Zudilova-Seinstra

Everybody agrees that user tasks and preferences should play an important role in the design and development of applications oriented to non-computer experts. Nevertheless, even medical applications are sometimes developed in a relative vacuum from the real life needs of end-users and environments where they are supposed to be installed.

To provide clinicians with an intuitive environment to solve a target class of problems, a medical application has to be built in such a way that the user can exploit modern technologies without specialised knowledge of underlying hardware and software. Unfortunately, in reality the situation is far from ideal. Very often we do not take into account the fact that clinicians are mostly inexperienced computer users and therefore they need intuitive interaction support and relevant feedback adapted to their knowledge and everyday skills.

Today's clinical workstations support a variety of projection modalities ranging from non-immersive desktop representations on a conventional PC or a PDA, to fully immersive CAVE-like [3] virtual reality (VR) environments and augmented reality systems. As a consequence of this technological explosion, we start facing usability problems. These arise not only from an uncomfortable user interface, but also from a projection modality chosen incorrectly for the deployment of an interactive environment.

Desktop and VR projection modalities are the two most popular solutions to allow users' manipulations with and navigations through visualised datasets. However, none of them is able to provide optimal means for interactive medical exploration. It became clear to me in various projects and experiments, where we focused on the image-based analysis of vascular disorders [2, 6].

Thus, for the assessment of the physical condition of a patient a large-scale immersive VR system is best. On the other hand, accuracy of representation and performance are still the weak points of VR. To achieve real-time user interactions, sub-sampling is often applied, which may result in the loss of anatomical details. Therefore, for 'high-risk' medical tasks desktop applications are usually preferred.

Also, users have different needs as they learn to use the interactive environment. For instance, in the medical context, 'highly cooperative clinicians' are often in favour of a 'Virtual Operating

Figure 1

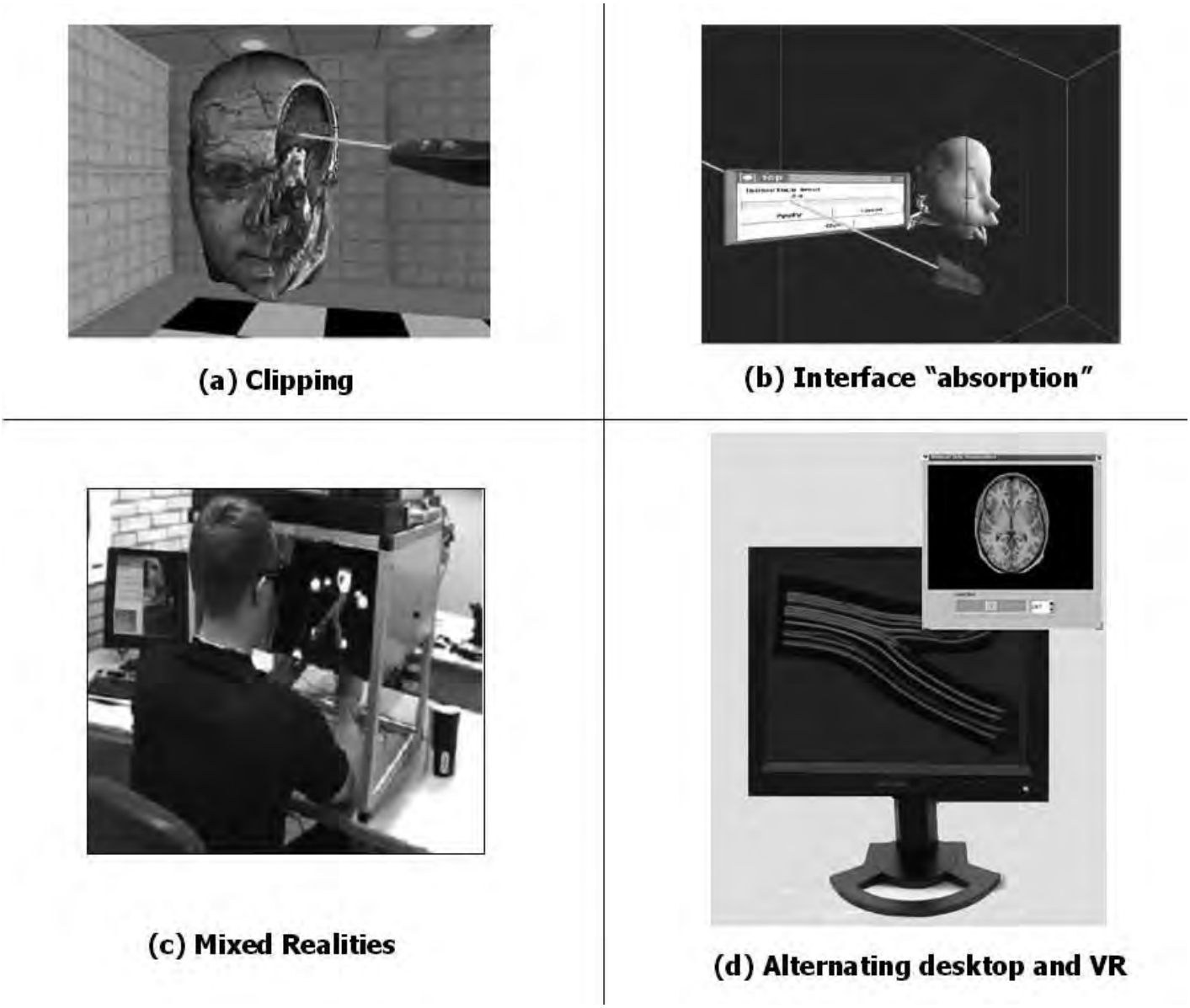

Figure 2

Theatre', because for this user type it is extremely important to have access to different types of information 'on-the-fly' (e.g., X-ray machines, the electronic patient data, ultrasonic equipment, etc.) and to share this information with other people. But for other users such as 'medical experts', a 'Personal Desktop Assistant' available on a common PC can be a valuable alternative, since in decision-making these clinicians rely on their own expertise rather than on the experience of their colleagues.

In addition, successful navigation and manipulation in a 3D virtual world is not an easy task due to difficulties in coordination and motor skills. According to recent investigations [4], almost a quarter of the world population suffers from different forms of a motion sickness, which may result in a simulator sickness when these people work in VR.

The combination of desktop and virtual realities within the same exploration environment provides opportunities to overcome these problems, which a single projection modality is unable to solve. In general, this integration can be approached in two different ways.

Desktop in VR

Desktop visual representations and interface elements can be absorbed in VR. For instance, the method of clipping / cutting planes can be applied (Fig. 2(a)). Thanks to the additional insight view provided via clipping, the effectiveness of the medical exploration improves [5]. However, clipping can be applied to spatial interaction tasks only, where the user's performance is strongly dependent on human coordination and mental abilities.

One more example is shown in Fig. 2(b) (image courtesy of Robert Belleman). This method is based on the integration of WIMP (window, icon, menu and pointer) interfaces in VR, where each desktop application is represented in a separate window [1]. To interact in this combined desktop-VR space, the user employs a wand (space mouse) and a keyboard, which can be tedious, especially if several windows are open simultaneously.

Desktop & VR

Another possibility is to develop an integrated multi-modal environment, which allows users' interactions with both virtual and desktop representations in simultaneous or sequential manner.

The simultaneous approach of 'mixed realities' (Fig 2(c)) involves the combination of VR and desktop display systems and input devices within the same physical space, so that the user is able to work using an immersive VR installation and a desktop PC at the same time.

The sequential approach of 'alternating realities' (Fig. 2(d)) is based on the principle that the user can switch between desktop and virtual realities while working on a single workstation. To alternate 2D projected and 3D stereo representations, I am currently experimenting with the switchable auto-stereoscopic Sharp LL-151-3D monitor (www.Sharp3D.com).

At this moment it is unclear whether the approach of mixed or alternating realities will be more efficient in the medical context. Mixed realities allow sharing information from a 2D monitor and a 3D stereoscopic display. However, constantly alternating between a desktop PC and a VR installation can be tiring due to repeatedly changing input devices and glasses and constant position changes. As for the second approach, users are able to alternate virtual and desktop realities while working on the same workstation. But as they have only one display system available, it becomes impossible to integrate information by simply glancing from one screen to another, which might be important (e.g., for planning a surgical intervention).

To evaluate and compare both experimental set-ups, an empirical study based on a limited set of medical exploration tasks will be performed. Projection modalities differ with regard to visual representations and interaction methods they support. Which interactive tasks does a virtual or desktop reality suit the best? When can the alternation of VR and desktop projection modalities be required: during the task switching only or also during the execution of certain tasks? Can we improve the efficiency of an integrated multi-modal environment by applying the adaptation mechanism?

These are the questions I would like to address next. However, my ultimate goal is to develop a medical exploration environment capable of alternating desktop and virtual realities in a dynamic manner. And for this, more knowledge is needed about users' tasks and preferences as well as about pros and cons of VR and desktop systems.

Acknowledgements

My special thanks go to Robert Belleman, the kick starter of the VR developments in our group. I would also like to thank Henriette Cramer and Vanessa Evers from the Human–Computer Studies Laboratory of the University of Amsterdam for their enthusiasm and major input to the usability studies related to this research. Also, this work is partially sponsored by the NWO Token 2000 project 'Distributed Interactive Medical Exploratory for 3D Medical Images' and the EU-funded VIROLAB project.

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My PhD

I took you for someone else: Electronic ID and social interactions in healthcare systems

Valentina Lichtner

Edited by Martha Hause

It all began with a mistake: I was working in the university nursing library while completing my MSc in Information Systems and Technologies. We used to have a problem with duplicate student records in the library system, and it was usual practice to delete them when they were discovered by chance. Then, one day, I deleted the wrong record: two students shared the same uncommon name, but they were on different courses in different schools, etc. Same name but different people. Yet, I could not see it.

A year later City University awarded me a PhD scholarship to continue my studies in HCI: I decided to focus my research on healthcare systems. It was October 2004. I went on fact-finding missions, with an open mind, eyes and ears, to find, refine and focus a research project. Wherever I went, everyone was dealing with patient records, but I kept thinking of how not to delete – or, even worse, act upon – the wrong record. In the library, we use barcodes so we don't have to remember names, we don't even have to read students' names in order to help them with library services. In healthcare, everyone deals with names, practitioners are instructed to use personal names when dealing with patients and rarely use numbers to identify patient records. Patients' names and dates of births are inexact non-unique identifiers; how can you be sure you have the right record?

In fact, I discovered it is not so uncommon to get the wrong record and the wrong patient (Thomas & Evans, 2004). Among the cases reported in the news, the death of an elderly patient who was given the wrong medication dosage because her record had been merged with another patient's record (BBC News, 2004) seemed particularly pertinent. Correct identification is a priority for patient safety, a key issue for healthcare services which can be seen as safety-critical socio-technical systems. Perhaps it is surprising that errors do not happen more often. In particular, how do practitioners recognise patients' identities? This is what my PhD set out to investigate.

My basic assumption is that contextual cues are essential. Proper names are arbitrary and therefore difficult to remember – associations are necessary to be able to recall people's names. This is also shown in Schegloff (1979) who studied recognition in telephone conversation openings when visual cues are not available.

'Identification' is not a simple act but a dynamic process that relies on context and interaction. The world provides scaffolding, it '…can provide an arena in which special classes of external operations systematically transform the problems posed to individual brains' (Clark, 1997, p.66).

In dealing with electronic records and disembodied information, the interaction with the 'world' is missing and the representation of context assumes an even greater importance. How do we digitally represent 'contextual cues' and the history of personal patient–practitioner interaction, for full individual awareness, customised to the subjective practitioner experiences? Do we really have to rely on chips and barcodes embedded in our body (Gilbert, 2005)? And wouldn't embedded chips raise identification errors similar to those occurring with traditional hospital wristbands?

My intention is to collect primary data with a field study, for which I have been recently granted provisional NHS Ethics Committee's approval. This ethnographic research will be informed by distributed cognition and activity theory, allowing for a holistic view of the 'identification processes' within the socio-technical system.

In the meantime, taking the 'ID' issue beyond the boundaries of healthcare, I am currently investigating identity as a relational concept, explaining it with the theory of affordances. The sense of unity conveyed by its 'objective' representation does not match the subjectivity of a life story, but the identification process may lie in people's ability to pick up invariants over time. How would technology affect this process?

My hope is that the combination of a multidisciplinary theoretical approach applied to the rich complex reality of a specific healthcare setting will support discovery and produce unexpected answers to these too many questions.

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Applying the PEEP method in usability testing

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The development of powerful yet cost-effective methods for evaluating the usability of online interfaces (e.g., websites, browsers and search engines) is of considerable importance to companies involved in web development and commercial usability testing. Over the past few years the consultants at Bunnyfoot (www.bunnyfoot.com) have been deploying an innovative user-reporting methodology that they refer to as **PEEP** (**P**ost-**E**xperience **E**ye-Tracked **P**rotocols). The PEEP method is based on a simple idea: the usability analyst can play back to a user their own dynamic eye-movement trace so as to cue the elicitation of retrospective verbal reports (so-called 'protocols') that can facilitate the identification of salient usability problems (the table below shows the key stages of a PEEP analysis). Bunnyfoot's clients have applauded the findings arising from the use of PEEP, and the impression is that PEEP may improve on other reporting techniques (e.g., think-aloud protocols or standard retrospective verbal accounts) as a way to elicit usability problems. Such has been the success of PEEP with clients that it now forms a key component of Bunnyfoot's usability testing toolkit.

Stage 1	A user's eye-movements are recorded using a non-intrusive eye-tracker whilst they undertake an interaction task (e.g., finding sought-after information within a commercial website).
Stage 2	The eye-movement trace is replayed to the user in real time as an overlay on the dynamic record of screen-based activity, so as to provide visual cues as to where they were looking during task performance [NB: Fixations – where the eye is still – are represented as circles whose diameter signifies fixation duration; saccades – where the eye moves from one location to another – are represented as arcs that connect fixations].
Stage 3	The user is requested to use the dynamic replay of their eye-movement trace as a cue to encourage retrospective reporting of task-based activity (e.g., goals, thought processes, interaction difficulties) etc.
Stage 4	The resulting retrospective verbal protocols are coded and analysed by trained evaluators to determine usability issues associated with the interface [NB: Findings can be checked for reliability across independent evaluators and validated across large samples of users to provide insights into common usability problems and more infrequent – but potentially important – difficulties].
Stage 5	Recommendations for interface redesign and improvement are established and are referred back to clients

The client feedback concerning the value of PEEP has been compelling, but subjective impressions and anecdotal reports can only go so far in validating a novel usability testing approach. More objective comparisons between PEEP and alternative usability evaluation methods are clearly needed before its benefits can be proclaimed. What we report in this article are some highlights from an initial empirical study that systematically compared PEEP with other verbal reporting methods in a usability testing context. This study was conducted as a collaboration between Bunnyfoot and Lancaster University's MRes in Design and Evaluation of Advanced Interactive Systems. Nik Eger, a student on this MRes, undertook the study as the core component of her dissertation whilst on a placement at Bunnyfoot in 2005.

We structure our overview of this study as follows. First, we describe other verbal reporting methods employed in usability testing and summarise the potential strengths of PEEP relative to these approaches. Second, we outline our experimental comparison between PEEP and alternative verbal reporting methods and summarise a few key aspects of our findings. Finally, we discuss ways in which this research might progress so as to enhance an understanding of the potential benefits and limitations of PEEP as a technique in commercial usability testing.

Verbal reporting methods in usability testing

One traditional method used to uncover usability problems is to ask users to 'think aloud' during task-based activity. This technique assumes that mental states are directly available for verbal reporting such that key steps in ongoing cognition (including difficulties and breakdowns) are made manifest (Ericsson & Simon, 1993). Despite the apparent validity of the method there is evidence that concurrent protocols may be *incomplete*, as important cognitive processes may be unconscious, difficult to translate verbally, and arise quicker than they can be reported (Bainbridge, 1999). Thinking aloud can also *interfere* with a primary task by increasing attentional demands so as to change normal strategies (Russo et al., 1989). A less popular reporting method, 'retrospective verbalisation', has been claimed to combat some of the limitations of thinking aloud. For example, because attentional resources are not strained during primary task processing there are no concerns about reactive effects on normal task-oriented strategies. In addition, as the cognitive system is not overburdened during the retrospective phase, the user is free to verbalise naturally, consequently decreasing the production of unfinished or incomprehensible statements; indeed participants are proficient at producing retrospective reports (Van den Haak et al., 2003). Retrospective protocols seem to have especially good validity if given immediately after the primary task, as relevant information can be directly reported or retrieved via contextual cues (Ericsson & Simon, 1993). The main weakness of the retrospective method derives from its reliance on *fallible*, long-term memory, which is open to rationalisation, bias, fabrication and omission.

So, both concurrent and retrospective reporting have their limitations. Notwithstanding these weaknesses, it is claimed that they *can* provide useful clues as to usability issues in an HCI context, and Nielsen (1993) notes that they can be viewed as 'equal alternatives' in system evaluation. Indeed, the empirical evidence seems to justify Nielsen's claim. For example, Hoc and Leplat (1983) showed that retrospective reports (cued by the user watching computer log files of activity), produced similar results to concurrent protocols. In another study, Van den Haak et al. (2003) assessed the validity of concurrent and retrospective protocols during usability testing of an online library catalogue. The techniques showed comparable results concerning the quantity and quality of usability problems identified, but the way in which the problems were highlighted differed: retrospective protocols revealed problems verbally whilst in the concurrent approach problems emerged via non-verbal behaviours (e.g.,

expressions) and on-screen actions. Thinking aloud also showed reactive effects on task performance.

What, then, of the potential value of the PEEP reporting technique? To answer this we first need to take a brief detour toward a consideration of the nature of eye movements in screen-based interaction. What a person is looking at is assumed to indicate the thought 'on top of the stack' of cognitive processes (Just & Carpenter, 1976). This so-called 'eye–mind hypothesis' means that eye-movement recordings can provide a dynamic trace of where a person's attention was directed in relation to a visual display.

In particular, recording fixations (moments when the eyes are relatively stationary so that information can be taken in) can reveal the amount of processing being applied to objects at the point-of-regard. Increased fixation duration is taken to reflect increased cognitive demand or confusion, whilst processing difficulties may also produce patterns of repetitive fixations or fixations located close together (Goldberg & Wichansky, 2003; Jacob & Karn, 2003; Poole & Ball, 2006). One problem with using eye-tracking as a stand-alone technique, however, is that it does not provide direct access to a participant's thoughts, feelings and experiences (Nielsen, 1993). For example, in website usability it is difficult to distinguish whether increases in fixation durations are really due to cognitive demand or simply arise because the participant found a screen element particularly interesting. Eye movements show the experimenter *where* the participant looked, but not *why*, revealing little about a user's intentions (see Cowen et al., 2002, for a case study using eye-movement tracking in usability evaluation and a discussion of its limitations).

Verbal reports, of course, can qualify eye-tracking data by providing access to a user's thought processes. Herein, then, lies the value of PEEP, which combines the cueing potential of dynamic eye-tracking data with the opportunity for participants to provide a detailed post-task commentary of their screen-based interactions under minimal cognitive load. Moreover, details can be gleaned from the report of any usability problems and task breakdowns encountered, and ways in which the user tried to circumvent these. Thus, PEEP affords many of the advantages of traditional retrospective reporting, whilst eye-movement cues serve to increase the report's reliability and meaningfulness.

An experimental comparison of PEEP and other reporting methods

Our study examined the PEEP technique in a web-based usability context. It was hypothesised that the presence of an eye-movement trace would enhance the accuracy and completeness of the retrospective report, thereby increasing the quantity of usability problems highlighted. To validate PEEP we set up an experiment that pitted its efficacy against: (1) a standard think-aloud procedure where the participant simply verbalised concurrent to primary task performance, and (2) a retrospective reporting method whereby the participant provided a verbal account cued by the playback of dynamic screen events (including cursor movement) that had arisen during primary task performance (i.e., a 'screen cue' method). This study also aimed to assess the reactivity effects associated with thinking aloud; latency data alone are not a guaranteed index of reactivity, so task-completion rates were also measured.

We tested 24 participants using a Tobii 1750 remote eye-tracker (Figure 1). ClearView eye-gaze software recorded eye movements and screen dynamics that could then be replayed in the retrospective conditions. Eye-movement data were superimposed onto visited webpages for the PEEP condition

Figure 1 The Tobii 1750 remote eye-tracker.

(Figure 2). Camtasia was used to record participants' verbal reports. The main experimental factor was the *Verbalisation Method* that participants were asked to use: think-aloud vs. PEEP vs. screen-cued retrospective reporting. Another factor was *Search Engine*: Participants completed a search task using two very different search engines: Infomagnet or Google™. Infomagnet (Figure 3) is a novel tool employing the 'i-Globe', a moving visualisation of the earth that can be manipulated to display different aspects of data and to search for economic and geographic information. The top panel of the tool is a search box, the middle panel allows data manipulation, and the bottom panel controls data display. Search results are presented as visualisations on the globe. It was thought that problems with the manipulation of the data panels, navigation of the globe and the aesthetics of the site might promote interesting usability issues. Google™ is a familiar text-based search engine that consists of a search box situated at the top of the page with the results presented down the page displaying links to sites. Sponsored links are presented to the right of the page and the remaining results pages are accessible from the bottom of the screen. To control for the effect of variability in the search terms that could be entered and the consequent variety of results generated, only the second page was presented with the search terms predefined and a set page of results actually given.

Each participant produced a think-aloud protocol with one search engine and one of the two types of retrospective protocols with the other search engine. Counterbalancing controlled for order effects. The same task was given to participants for each search engine: '*Find the GDP annual growth percentage for the UK in 2003*'. We measured task-completion time, task-completion rate, and the quantity/type of usability problems identified. Verbal transcripts were coded for instances of usability problems as categorised in previous research (Rubin, 1994; Van den Haak et al., 2003):

Layout: Visibility issues, failure to spot on-screen items, failure to absorb information, cluttering, irrelevant information/items and aesthetic problems.

Terminology: Failure to comprehend terminology of site.

Feedback: Application does not provide relevant

feedback on actions or error messages, feedback not consistent with expectations and time issues of feedback.

Comprehension: User does not understand instructions and dialogue or actions of site.

Data Entry: User does not know how to conduct a search (enter search term, use drop down menu, start search etc.)

Navigation: Difficulty / failure to navigate around the page logically, or as desired.

Statistical analyses were conducted on the quantity of usability problems identified and on task-completion times and task-success rates. Our analyses supported the following observations:

1. PEEP generated significantly more usability problems overall (mean = 12.5) than the think-aloud method (mean = 8.7). The nature of the problems identified also differed across these methods: PEEP generated more problems of Feedback and Comprehension. PEEP, therefore, seems to have advantages over thinking aloud in identifying usability issues during this search task.
2. PEEP did not lead to the identification of more usability problems than the screen-cue method (mean = 11.3), but interesting differences arose between these methods in relation to the two search engines: PEEP was particularly good at detecting usability problems with Infomagnet, while the screen-cue method was slightly better for Google™ (Figure 4 shows illustrative data relating to the detection of Feedback problems). It thus seems that the value of PEEP may be greatest when examining use of unfamiliar interactive environments (Infomagnet had not previously been seen by any participants whereas they were all acquainted with Google).
3. The time taken to complete the primary task indicated that thinking aloud slowed performance slightly compared with PEEP and screen-cued verbalisation, but this effect was not statistically reliable. However, analyses of task-success rates (whether participants found a correct search result) indicated that participants in the retrospective-reporting conditions achieved significantly more correct responses than those in the think-aloud condition (79% vs. 42%). This difference reveals that thinking aloud interfered quite markedly with task performance.
4. The questionnaire administered after the study had three sections: overall experience of the method; how the method affected normal working; and the effect of the experimenter's presence. All responses were registered on a five-point Likert scale (1 = negative; 5 = positive). Participants found the think-aloud method significantly more unpleasant than either retrospective method, but PEEP and screen cue did not differ. Participants felt they worked significantly slower and with less focus during the primary task when thinking aloud than when silent. The experimenter's presence was viewed as having an unpleasant and unnatural effect during think-aloud reporting relative to retrospective reporting.

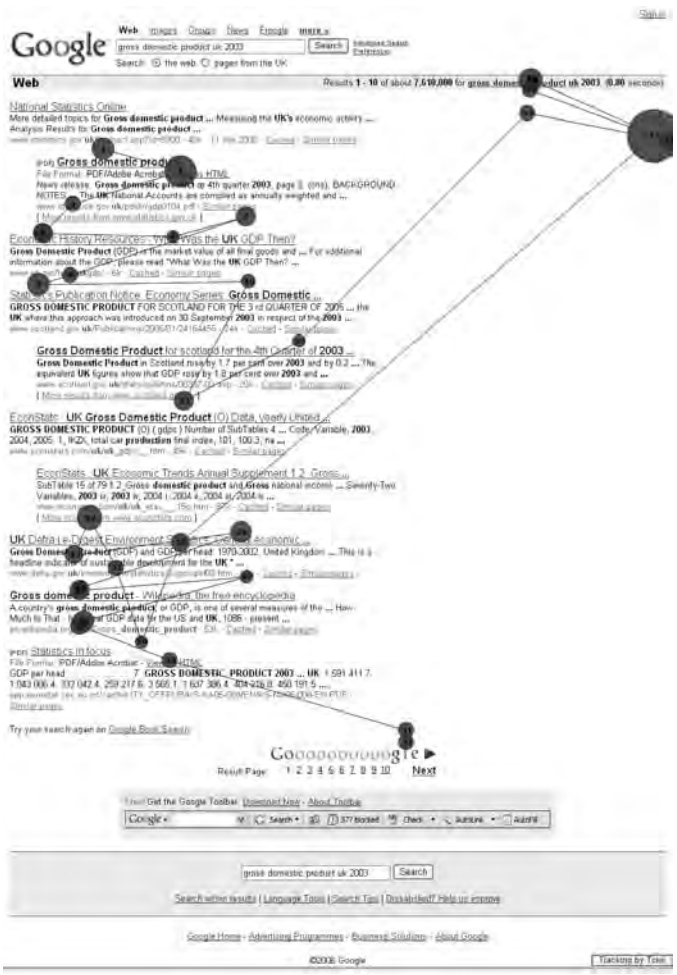

Figure 2 ClearView eye-gaze data replay. Dots represent fixation points that increase in diameter relative to fixation duration. Lines indicate the eye-movement scanpath.

Prospects for PEEP in commercial usability testing

In summary, our findings provide some support for the view that PEEP may be able to elicit more usability problems than thinking aloud or screen-cued reporting – although the benefits of PEEP in comparison with the screen-cue method were dependent on the user interacting with an unfamiliar search environment. In general, we believe that PEEP's capacity to enhance the elicitation of usability problems arises because of the 'direct' cues to previous interaction difficulties that are given via the replay of the user's dynamic eye-movement trace as an overlay on screen-based elements and events. Our data also suggests that retrospective reports can have less of an interfering effect than the think-aloud technique on primary task performance (a search task in the present case). Moreover, participants rated the experience of thinking aloud negatively, believing that it adversely affected their speed and focus.

Despite our suggestive findings regarding the value of PEEP as a usability testing method, we remain acutely aware of the limitations of our research. This was a small-scale study, restricted to a single on-line search task with two search engines. To support and extend our observations future research could use the different reporting methods employed in the present study with a far wider range of search engines, browsers and websites and with a greater variety of interface tasks. Such work would help clarify which reporting methods are optimally suited to identifying particular problems with specific interaction tasks. Furthermore,

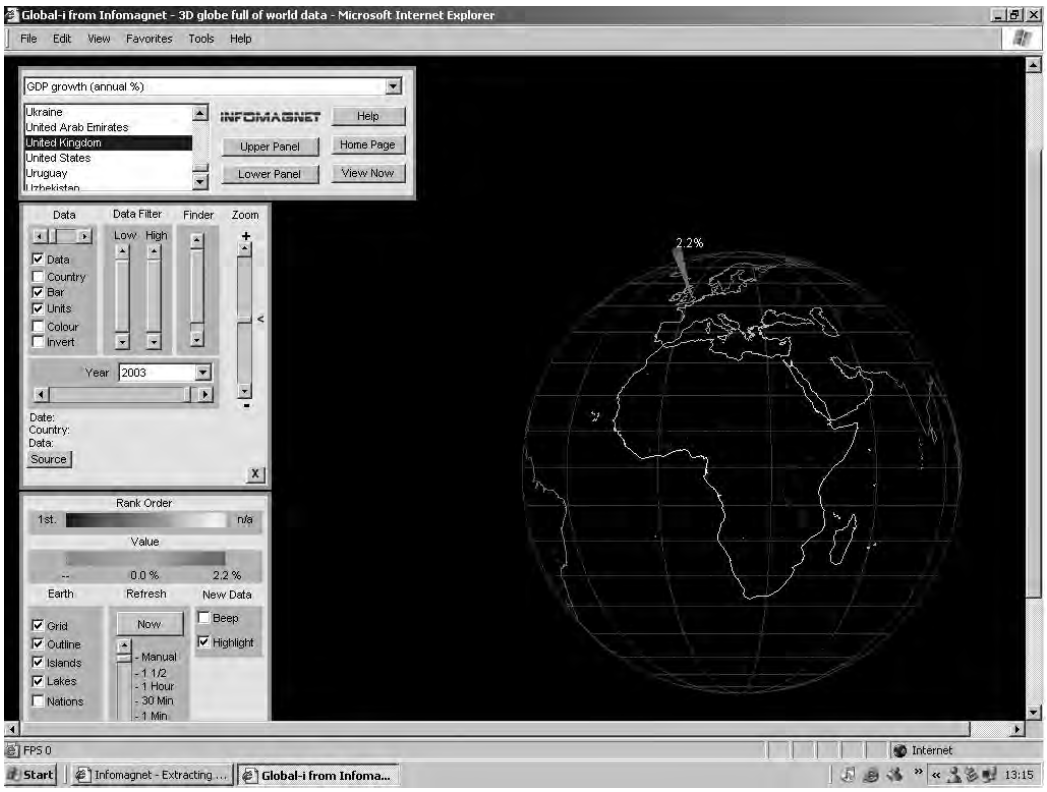

Figure 3 The Infomagnet i-Globe site (infoview.infomagnet.com/view.php)

in the present study the coding of reported usability problems relied on a single coder, and no attempt was made to ascribe a 'severity' rating to the problems and breakdowns identified. We are currently pursuing inter-coder reliability checks in relation to our data, and we are also systematically examining the problem-severity issue.

The general lack of appeal of the think-aloud method from the perspective of participants is interesting and seemed to be associated with the use of prompts during the periods when they fell silent. In contrast, the effect of prompting during the retrospective-reporting methods seemed less detrimental as there were no other cognitive demands present. In addition, the possibility of interfering with participant behaviour was eliminated as the primary task had already taken place. These benefits of retrospective reporting are especially important to today's usability practitioner, who often does not employ the stringent recommendations for effective elicitation of verbal reports (e.g., as espoused by Ericsson & Simon, 1993), finding them too inflexible (Boren & Ramey, 2000). One general limitation of retrospective reporting remains, however, which is that there is no guarantee that the method leads to accurate reports rather than merely post-hoc rationalisations of previous behaviours. In usability testing, though, the accuracy of the report produced is, arguably, not as serious an issue as it is in research that is focused on deriving a theoretical understanding the underlying nature of the cognitive processes associated with task-oriented activity. If an important usability problem is identified by means of retrospective reporting, then it is not especially relevant whether the participant encountered the problem during the task or whether it came to mind retrospectively. The critical point is that the potential usability problem has been identified, so that the analyst can reflect on its nature, determine its generality, and consider ways of improving the interface accordingly.

In conclusion, we hope that our findings might encourage usability practitioners to examine the possible benefits that may derive from deploying appropriately cued retrospective verbal reports in usability testing. The reduced task interference and the depth of feedback that may arise from effective retrospective-reporting techniques are certainly desirable aspects of any usability testing methodology.

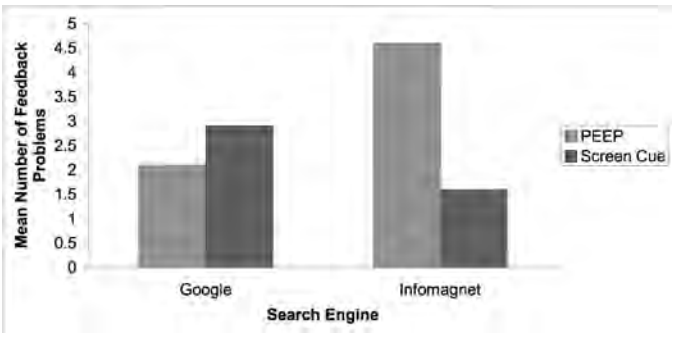

Figure 4 The influence of Search Engine (Infomagnet vs. Google) and Retrospective Cue (PEEP vs. Screen Cue) on the mean number of feedback problems identified.

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Ergonomics Society and BCS HCI Group hold joint symposium

Dave Golightly

The Ergonomics Society HCI SIG and BCS HCI Group recently joined forces to run the ESHCI symposium. The symposium, with a programme committee comprised of both ES and BCS members, was held at Robinson College, Cambridge, on April 4th as part of the Ergonomics Society Annual Conference.

The aim of the symposium was to emphasise the HCI work taking place within the field of ergonomics, with presentations on both practice and research. The day opened with a keynote from Tom Stewart, editor of the BIT journal and co-director of HCI and Ergonomics consultants Systems Concepts. In his talk, Tom emphasised the specific role ergonomics had to play in broader notions of usability for information technology and interactive products.

Following on from this, the symposium covered topics as diverse as keystroke-level modelling for in-car systems, evaluations of emotional interfaces and validating design knowledge for Air Traffic Control. The day concluded with a session on accessibility. This session included papers from UCL, York and Middlesex Universities and examined the relationship between accessibility and a more general concept of usability as well as the evaluation of accessible systems for older adults.

As a whole, the ESHCI symposium emphasised, once again, the need to understand the user when designing interactive systems. The plan is that this will be the first of many collaborations between the Ergonomics Society and the BCS.

All the papers from the symposium are available in the 2006 Ergonomics Society Conference Proceedings, *Contemporary Ergonomics* edited by Phil Bust and published by Taylor and Francis.

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Introducing…
A new facility at Dundee University

AF Newell, P Gregor and ME Morgan

A brand new purpose-designed facility for Applied Computing (soon to become the School of Computing) at Dundee University includes the Queen Mother Research Centre for information technology to support older and disabled people. With over thirty researchers, this large interdisciplinary group, includes creative designers, therapists, nurses, linguists, school teachers as well as computer engineers and psychologists. There is a focus on 'mutual inspiration' as a research paradigm – that is users and designers working together in a creative mode.

We already have over 200 older and disabled people who work with us developing and evaluating our ideas and systems, and, to accommodate them, the new building includes a 'User Centre' (with funding from the Matthew Trust) dedicated to these users, both for social occasions (it is adjacent to coffee facilities) and for informally and formally working with current IT systems and prototypes from our research.

The Centre also includes a fully equipped steeply raked 50-seater studio theatre specifically for interactive theatrical performances (funded by the Wolfson and Leng Trusts). This is designed specifically to facilitate interaction between the designers and users (unlike the traditional two-way mirror usability laboratory), and allows the whole of the design team to be part of the experience. When simulations of real environments are required, the theatre metaphor will encourage 'suspension of disbelief' in the users and the audience.

The Theatre is designed to support our research into the use of theatre in HCI research. We are particularly interested in Boal's 'Forum Theatre', which encourages dialogue between the actors and the audience. We have worked closely with the Foxtrot Theatre in Education Company, who have substantial experience of using Forum Theatre, and their Artistic Director has now become the Leverhulme Artist in Residence in Applied Computing at Dundee.

Forum Theatre involves initial research by a script writer, who talks to users and researchers and then produces short theatrical pieces or scenarios. These address the important design issues needing to be discussed within a narrative style and with the humour, emotional content and tension essential to good drama. The play/scenario is performed by professional actors to an audience of users and/or designers. The play is followed by a facilitated discussion between the audience and the actors (who stay in role).

We have used this technique for requirements gathering for home monitoring systems and interactive television systems, and for raising designers' awareness of the challenges technology can present to older people. It has been found to be a very powerful way of encouraging audience discussion, and has generated many new insights and ideas. It is also extremely effective in keeping the group focused (a particular challenge with older people).

This type of theatre encourages dialogue between protagonists in the audience (e.g. designers and users); everyone's views are respected, and the actor/user is engaged in a creative activity, not just being monitored. We intend to use the theatre both with professional actors and real users depending upon the particular requirements of the research. Although

The School of Computing, the University of Dundee

some circumstances require real users, script writers and actors have been trained as professional observers of human behaviour, with a focus on converting such behaviour into interesting, engaging stories, and know when to exaggerate for effect, and how to articulate feeling in such a way that it communicates effectively to the audience. A further advantage of using actors is that the ego of the actor/user is not involved, nor is the actor dominated by their own emotional baggage, as can happen with 'real users'. A well-briefed actor can thus replace users in usability testing when it is not appropriate to use 'real users', or where this technique could provide additional data.

We are in the relative early stages of our developing the techniques of live theatre and wish to encourage full and frank discussion on the pros and cons of using it. As part of this exploration, a significantly fuller version of these thoughts was the focus of two presentations at CHI 2006 in Montreal.

An example of using theatre to raise awareness of the challenges technology has for older people, the UTOPIA Trilogy, can be found at:
www.computing.dundee.ac.uk/projects/UTOPIA/

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Interfaces Reviews

Edited by John Knight

This issue's *Interfaces* Reviews covers the key books on Information Architecture (IA). IA burst onto the Internet scene just as the dot-com bubble was bursting. IA tackles the pithy issue of how to effectively structure information within a fixed screen space. The goal of IA is an intuitive information structure that matches users' mental models of the information domain. Achieving this requires a range of skills and methods including information science and elicitation techniques drawn from psychology.

Think of IA and many people will think of card sorting. There is much more to it than that, however. These books extend IA into the wider contexts of improving business processes and more complex areas of knowledge management. Presenting a wealth of experiences, the books show a discipline that is coming of age, indeed perhaps reaching its own bubble burst.

The push for new web services exemplified by Google™ suggests a technological solution to finding stuff easily is on the horizon. As well as solving IA problems through better searches, these services also drive up users' expectations. The right content at the touch of a button is still some way off, however. That situation and the diversification of devices and content type suggest that IA still has legs for some time.

Information Architecture: Blueprints for the web
Christina Wodtke
New Riders, Indianapolis, 2002
Paperback, 348pp
Illustrated b/w
List price: £23.50
ISBN: 0-7357-1250-6

Christina Wodtke is worth listening to. As the founding editor of *Boxes and Arrows*, the online journal for information architects, she has made a massive contribution to her industry, placed herself at the nexus of some of the best thinking in the field and spoken to many of the brightest people working in information architecture (IA) today. The credits in the introduction to her book are a who's who of IA. This book is not for information architects – 'If you're doing information architecture for a living… this book is for you as you were a few years back', Wodtke points out. She is right – most people who have spent a few years working in IA will not be surprised by anything in this book, though it is always instructive to hear an expert talk about her subject.

Tips such as 'Zen chores' (doing the hoovering to overcome a creative block) made me smile. Indeed, what makes Wodtke so easy to read is her openness. There's a permissive approach to enjoying ones work, and an empathy for those people who often seem to throw up obstacles for information architects: Wodtke aims to help the reader relax and enjoy the process. She starts to struggle when she tries to paint a picture of who the book is for. According to her introduction, this book is for 'the project manager, the designer or the marketing guy' who has been landed with creating a web site. If so, then at nearly 350 pages this is not, as Wodtke thinks, a short book – it's a big book: too big and sprawling for someone who has another, full-time job to do.

The book begins with a nice debunking of myths – the kind of folk knowledge that exists 'out there' and often gets in the way of good design. Readers with a background in web design will cheer as she smashes some old chestnuts such as 'pages shouldn't scroll' and 'users won't click on banner ads'. She attempts to replace them with some 'principles' but these quickly become rather vague variations on the theme of 'understand your users' – good advice, but lacking in the kind of specifics that a part-time IA working on a mid-size site really needs to get the job done. From here, the book takes the reader on a journey through user-centred design from an information architect's point of view – personas, content inventories, card sorting, site navigation, basic interaction design, right through to presenting work to stakeholders. It is a comprehensive topic list which has breadth as well as depth.

Wodtke's writing style is simple, amusing and easy to follow. For instance, she compares web sites to the Winchester Mystery House – a building that grew without plan or purpose, driven by its owner's need to simply keep adding doors and staircases. It is a witty and apt metaphor for the muddle that consumes most web sites. Up close, though, the mannerisms can grate. Her habit of titling chapters in the style of *Winnie-the-Pooh* and references to Harry Potter seemed childish rather than playful. The layout of the book, too, is full of quirks and tricks. Individually, the cartoons, screenshots, tables and photographs might serve to add interest to the text, but often they interrupt the flow rather than illuminate the text. It's hard to recall individual cartoons or examples in the way that one might from any of Edward Tufte's books. Which is not to say that the book isn't full of great advice or tips. One of the book's great strengths is that it mixes method with experience. Wodtke's personal experience is as good as you could hope for, and she weaves this into her descriptions of techniques. This makes the difference between learning from a textbook and learning from a master – in other words all the difference in the world.

Information Architecture: Blueprints for the web is the equivalent of one of those portraits that wealthy Renaissance gentleman had painted to illustrate all of their possessions – a huge jumble of interesting bits and pieces, each worthy of a painting in its own right, organised to fit in the frame. You have to marvel that somehow she has managed to include so many and varied items: there is something for everyone.

If you are looking for a blueprint for junior IAs to dip into, then this book is a good choice. If you are looking for a book to recommend to a project manager who has been given the task of creating a web site, then Steve Krug's *Don't make me think* and Alan Cooper's *The inmates are running the asylum* remain the top picks.

Reviewed by
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Information Architecture for the World Wide Web: Designing Large Scale Web Sites
Louis Rosenfeld and Peter Morville
O'Reilly, 2002
Paperback, 486pp
Illustrated, b/w
List price £22.50
ISBN 0-5960-0035-9

I read the first edition of this book when I was first developing an interest in HCI so I greeted the task of reviewing the second edition with some anticipation; both to see how the book itself has developed but also to gauge how my understanding of the subject has improved.

The authors are information architecture practitioners with a background in librarianship; it is their intention that the audience for this book will comprise both novices and experienced information architects. I think the first thing to say is that there isn't a lot in here for the latter audience; the content, whilst thorough, is nothing an experienced practitioner or academic interested in the field shouldn't already be aware of.

So what is the appeal for novices? Well, what Rosenfeld and Morville have managed to do is adopt an informal writing style that makes what could be a very dry topic approachable to the beginner. The book's sections are clearly laid out and progress logically from an introduction for the need for Information Architecture, to the basics, the processes and methodology required to determine what form your information architecture will take. The next two sections cover the practicalities of putting IA into practice and embedding it into the organisation. The book rounds off with two reasonably in-depth case studies.

The question I found myself asking about this book is how likely is it today that complete novices are going to be responsible for developing large-scale web sites? The basics of IA and the advice on research methods will be useful to anyone involved in web projects, at whatever scale; a discussion on building an information architecture team less so, perhaps.

One aspect that I found disconcerting was when the authors ventured into related areas such as usability. When discussing the relative merits of breadth versus depth in taxonomies (as they refer to hypertext hierarchies) they advise that users should not be forced to click through more than two or three levels. I would regard this as overly simplifying the issue, even for a novice. It is hardly surprising that they resort to such prescriptive recommendations as they only devote two pages to the subject.

Another curious omission occurs in chapter 6 on labelling systems, where there is not one mention of the concept of information scent, nor does the concept appear anywhere else in the book.

I found the authors' view of usability as a discipline and a profession curiously outdated; on page 19 they define usability engineering as the study of time on task and error counts. I was also amused by their discussion of ways to study user populations where they conclude that "Usability firms conduct interviews to determine which icons and colour schemes are the most effective". If only it were that straight forward.

So what is new in the second edition of the book? Quite a lot – the new edition is just over twice as long as the first. User needs and behaviours gets its own chapter as does the discussion of thesauri and controlled vocabularies, and the case studies have been considerably beefed up. However the bulk of expansion comes in the area I feel to be the least useful, that is, the sections on 'Information Architecture in Practice' and 'Information Architecture in the Organisation'. This book seems most suitable for the novice who has no need at this stage in their development to consider these issues. Perhaps it would be beneficial for senior management to have an understanding of what is required, and why it is important, to embed a strategic approach to information architecture within their organisation, if someone could persuade them to read it, that is.

Finally, is it worth reading? I would say that if you've read the first edition then there is little point in reading the second. The increased emphasis on user-centred approaches is welcome but not something the readers of *Interfaces* need advice on. Would I recommend it to students? That would be a qualified yes: parts I, II and III give a good flavour of what information architecture is about, and detailed case studies are always worth reading. In my opinion, parts IV and V are irrelevant to novices and don't have anything to offer to those with experience. Oh, and I'd warn any students to ignore anything this book has to say about usability.

Reviewed by
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Interfaces Reviews agrees with Mark on the limitations of the new sections. The new edition also underplays the changes that have taken place in web technology and the IA profession. However, despite the book's defects, it is the most comprehensive publication in this area. Coming from the O'Reilly stable it speaks to diverse audience and does a good job in outlining IA deliverables and methods.

Information Architecture Handbook: A Hands-on Approach to Structuring Successful Websites
Eric Reiss
Addison Wesley, 2000
Paperback 192pp
Illustrated b/w
Secondhand price £3.50 approx
ISBN: 0-2017-25908

This book was there at the beginning. Written at a time when there were "all of those awful sites… What is a bad website? For me it's one that makes it hard to find the information I need…" (p 1), it tackles the problem of making website structures intuitive. According to Reiss "Information architecture is about setting basic goals for the site and identifying any other information that must be included if the site is to achieve these goals" (p 3). The book concentrates on the web, more or less, which could be a limitation but does mean that pertinent issues such as scent are dealt with.

A classic that is now six years old, it holds up quite well against newer additions to the genre. At under 200 pages it is concise, practical and focused. Indeed, it probably has the best structure, of all of the books reviewed in this edition, as it roughly mirrors the phases of design process.

On the downside, the book's age means that important technical developments are not covered. In addition, the range of methods is limited and application areas are limited to the level of website technology and use at the time of publication.

Reiss sets out the problem in a compelling way and makes a good business argument why IA is needed. He then offers some easy to apply methods to work toward a solution through a UCD process. The process would be of little surprise to HCI practitioners and focuses on "Getting it down on paper" and usability testing. After describing

why IA is needed and how to do it, Reiss moves on to "fine-tuning", different kinds of sites and the impact of WAP.

Each chapter has a similar format and all culminate in useful recommendations. Built on solid research, the book provides an easy read, keeps the bean counters happy and is eerily prescient in identifying future trends. Indeed, the book embodies good IA by offering good content that is well structured and avoids jargon.

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Next Edition

The next edition of *Interfaces* Reviews will look at a range of book on the subject of interaction including:

Thoughtful Interaction Design: A Design Perspective on Information Technology
reviewed by Andree Woocock.

Exploring Interface Design
by Marc Silver,Thomson Delmar Learning
reviewed by Ria Sheppard.

Windows and Mirrors: Interaction Design, Digital Art and the Myth of Transparency
by Jay David Boulter and Diane Gromala, MIT
reviewed by Paul Bellamy.

Total Interaction: Theory and Practice of a New Paradigm for the Design Disciplines
by Gerhard M. Buurman
reviewed by James Woudhuysen.

BrainAcademy 2006 aims to do more than just entertain

Paul Curzon

BrainAcademy, Queen Mary, University of London's answer to TV talent shows is back and aiming to engage the next generation in Computer Science and Human Computer Interaction. In sponsoring BrainAcademy 2006, the British HCI Group joins Microsoft, Soda, ZDNet and Omarketing but also, new for this year, another major industry player: ARM. Rather than looking for musical talent, BrainAcademy is looking for a combination of creative and technical talent with prizes including the chance to win a Computer Science degree place but also, for example, a place on a Digital Performance MSc where students will learn not only about creative digital technologies but also drama and performance art. Also on offer are a range of career plug-ins including tailored fast-track interviews with Microsoft and ARM on graduation. The aim of the competition is to engage people with the wide range of careers computer science can lead to, helping to spread the message that when designing computers you need to understand not only computers but also users and society more generally.

This year's theme is Computer Science and the Entertainment Industry. The web hunt quiz stage explores the way computers have moved out of offices and into living rooms in a variety of ways, from films to games, puzzles and toys, from sport to music, art, photography and playful education. In doing so it illustrates how the subject draws on many different areas; from the social sciences to engineering, from maths to the performing arts and ethics. The programming stage is a creative challenge. You need to pass the quiz stage to discover the details, but hints on the BrainAcademy site suggest it has a lot to do with Digital Performance and turning your computer into a potential talent-show winner itself.

BrainAcademy was first launched in 2003. The fun 'life-changing-prizes-game-show' caught the imagination and received commendations from the government's Minister for IT. The 2003 winner, Adam Kramer, from North London, is currently at the end of his second year of his Queen Mary Computer Science course prize. He is also part of Microsoft's 'Most valued students' scheme. Adam, then 17, was a self-taught programmer when he entered. Simon Kinsey, winner of the 2005 competition, will be returning to study on an Advanced Methods in Computer Science MSc as a mature student; after a varied career as a community health officer, manager of homelessness services, teaching mathematics and most recently as a Data Analyst with Anglian Water. Simon created an artificial life program, where a goldfish had to search for food in its virtual environment. The judges were impressed by the humour in the animation, as well as the technical competence of the programming. Simon also demonstrated a deep knowledge both of technology and its impact on society. Part of his prize is membership of the British HCI Group.

For the first time the postgraduate competition is open to overseas students. ARM together with cs4fn are also sponsoring a new category, BrainAcademy: The Next Generation. It is open to school students who are too young to enter the main competition. Prizes include the chance to get involved in HCI research in action in Queen Mary's Augmented Human Interaction Research Laboratory. The aim is to excite the next generation about Human–Computer and Human–Human Interaction research. The BrainAcademy 2006 opens on 20th March 2006 and closes on 14 September 2006. For more infor-

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Experiencing design
Finding one's way

Robert St Amant

I recently spent a day in Venice, wandering through the streets, admiring the buildings, canals, and bridges. Lacking a strong sense of direction, I was never entirely sure where I was. A guide book told me that this effect is deliberate: the curving streets and unexpected crossings were at least partly intended to confuse invading forces.

There are obvious parallels to navigation issues in user interface design. This occurred to me only afterwards; I am not single-minded enough to have been thinking about user interfaces while following the signs between the Rialto Bridge and San Marco. It's become commonplace that interfaces should let users know, at all times, where they are, where they've been, where they can go, and how they can get there. Lacking good cues for this information, an interface becomes difficult to navigate.

It's easy to find examples of poor support for navigation in the real world. What's interesting about them is how different aspects of design can combine to make navigation hard. In some connected buildings on campus, the floors do not match up. For example, to get from the second floor of Caldwell to the second floor of Winston, you must take the stairs or the elevator rather than simply walking straight ahead – if you did, suddenly you'd be no longer on the second floor of one building but on the first floor of another. Even if the buildings were built at different times, the floor levels still could have been matched up. Finding rooms can be hard for people who haven't visited the buildings before.

Independently, each of these two buildings may follow a logical internal structure, but their combination leads to problems. Here's a related user interface story, somewhat artificial but not implausible. Imagine a database program that allows you to add, delete, copy, or modify records. For copying, the application brings up a window showing the fields of the record so that you know what's being copied; for deletion, the application shows a similar window so that you can verify that the correct record is being removed. Following Windows conventions, copying might be activated by a Control-C, deletion by Control-X. Now suppose that your finger slips and you press the X instead of the neighbouring C key. If the windows for copying and deletion are very similar, it may not be obvious that you've selected the wrong operation until after you've already press 'OK'.

A mistyped command is no excuse for the designer, because it can be expected to happen once in a while, just as someone may occasionally walk through the wrong door or down the wrong hall in a building. I recently returned to the U.S. from Europe, arriving at the airport in Raleigh-Durham. I hate waiting, so I'd traveled with only carry-on luggage. I'd expected to go through immigration, then through customs, and then out the door to the parking garage. Unfortunately, you can't leave the international gates without going through the rest of the terminal, and since 9/11, that means you have to go through another security checkpoint. So after customs I had to wait in line with everyone catching a connecting flight, walk through the metal detectors, and then fight my way through the crowd of people re-checking their luggage, all just to leave. And why do passengers arriving from Europe need yet another security check?

In this example we see the problem of two groups of people with different goals going through the same procedure, one that is much less efficient for some of the people. I occasionally run into a related problem when I go online when I'm away from my office. In my office, I'm able to look through various online libraries without trouble; my access is authenticated by the network I'm on. If I'm working at a coffee shop, however, these same libraries ask me for user names and passwords that I can only figure out with difficulty, because I ordinarily don't have to deal with them directly. In other words, I'm shunted off to an area where I have to prove my bona fides, even if they're irrelevant to my goals. This may be inevitable, but it makes for less efficient interaction.

At some fast food restaurants, there are two drive through windows. The first window takes your money and the second window gives you your food. The problem is that the windows can be too close together. Once you pay and pull up behind the person who is getting their food, there is not enough distance for the person behind you to pull up to the payment window. This causes a bottleneck at the food window. If the two windows were at a half car length further away from each other, three cars could be serviced instead of two. Also, people who have a large order wouldn't back up the line as much, and the person working the payment window would have less downtime during busy periods.

This example is more subtle in its relationship to navigation. The path is clear, in that people know where to go, and nothing prevents them from (eventually) reaching the end. However, it is slow going because there are other people involved and the system is not designed for the most efficient flow. We can see an analogy to bandwidth issues for online services. If a service is consistently overloaded, slowing response time to frustrating levels, users will simply go elsewhere for what they need.

For some interfaces, such as those for interactive games, Robert Louis Stevenson's observation can be appropriate: 'To travel hopefully is better than to arrive' suggests in part that the experiences encountered on the way to a destination, including surprises, are what make a trip worthwhile. In most interfaces, however, especially for productivity applications, users will generally be happier if they simply get where they are going with as little time and fuss as possible.

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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Desktop adapted for Dad

Adam Trickett

At Easter in 2005 I gave my 69-year-old father his first computer. I had carefully installed and configured the software especially for him. I had taken care to consider his needs, and had attempted to second guess any problems he might have. I wrote my experience down in an article I published on my web site[1], and which I recently presented to my Linux User Group[2]. This short article is a summary of some of the steps I took to optimise my father's computer and some of the observations I made.

My father had never used a computer when I gave him his. He had never worked in an office environment or used a typewriter. Like many people his age, his eyesight is not perfect even when corrected, and his glasses are bifocal, which does make using a VDU more awkward than normal.

My plan for the computer was to configure it with the smallest set of software necessary to make it function correctly, to greatly simplify the desktop, and to select a visual design that would be clear and unambiguous.

We took the computer to him and showed him how to connect to the Internet, send and receive email, and how to drive the desktop. We spent several days with him, and during this time I continued to adjust the settings to suit his needs.

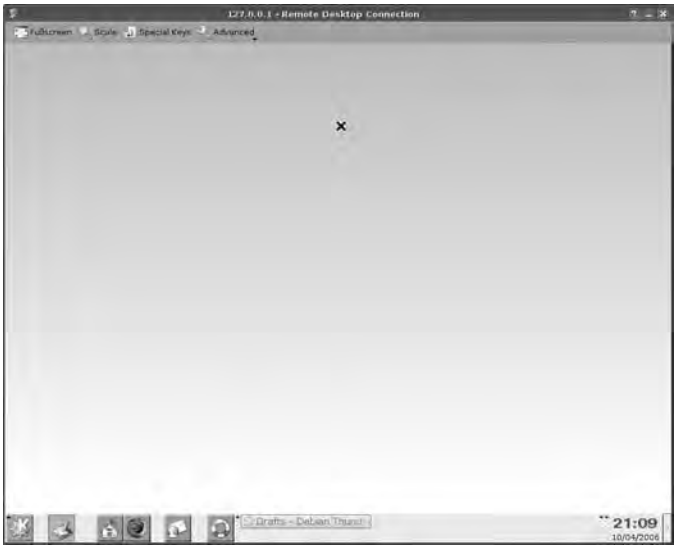
My first surprise was that what I thought was big and clear, was not anywhere near big or clear enough. Like many long-time computer users, I tend to run my computer screen at a high resolution, and use a small font and minimalistic window decorations theme. For my father I had anticipated that my preferences would be hard to read, so I had selected a larger font, and a large clear theme. However, my father found the text too small to read, so I made the fonts even larger. Where I had selected large icons my father preferred extra-large. I had selected a large back pointer, but this did not stand out enough, so I changed this to a huge red pointer which clearly stands out against the background. To my eyes this made the desktop and applications look ugly, but he could use them.

It is obvious to anyone who watches a new user that using the mouse is quite hard. My father found it hard to move along a drop down menu to select a sub menu. Double-clicking is hard to learn so I configured the desktop to run off single click, but some applications still use double-click, so it could not be totally avoided. To improve his mouse skills we encouraged him to play with the built-in games, he has become quite a fan of Kpatience now. I also stressed that these games were a training aid and not be seen as trivial time-wasting toys.

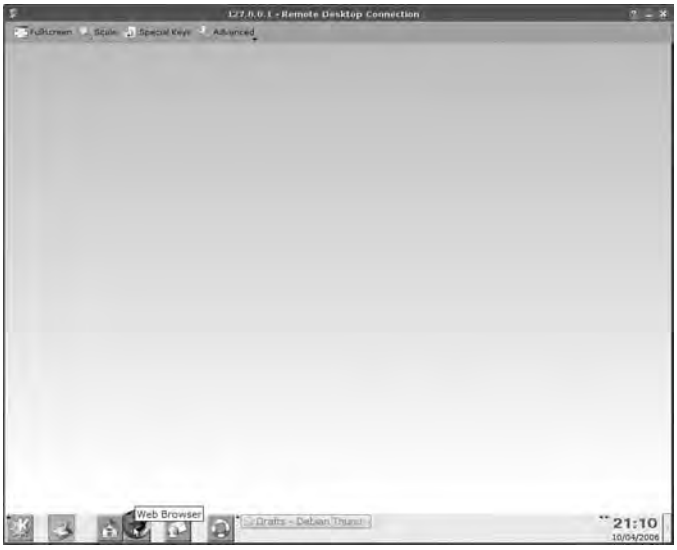
After a few days we left my father with written instructions and returned home.

My father found sending emails useful. Our family is geographically scattered, and catching people on the phone is less than ideal. Using email has been an important de-isolating tool for him, and both he and I have been very pleased with it.

After about a month of using dial-up my father asked if he could change to broadband, as he found dial-up slow and complicated to use. Even after my best attempts I must admit that dial-up is a less than satisfactory solution. Dial-up is not very reliable, it is slow and it is hard to use Internet software with only an intermittent Internet connection. I sent my father a small pre-configured ADSL router in the post, and talked him through how to plug it all in. Then I connected to his PC via the dial-up



Desktop 1 This figure shows the very plain basic desktop. Large buttons for the key applications are colour coded on the Panel at the bottom. The screenshots are taken with VNC and do not show the true colour of the desktop or the shape or colour of the pointer at the remote end.



Desktop 2 When the mouse hovers over a button a balloon help bubble pops up. The function is shown, not the branded name of the application.

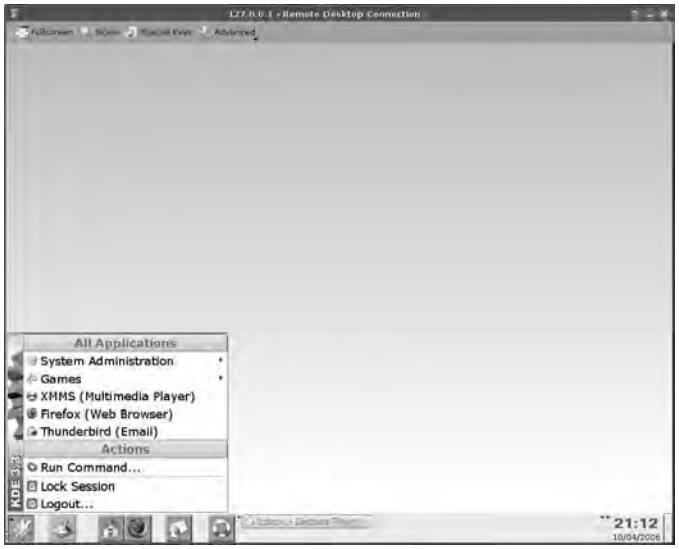
connection and remotely reconfigured it to use the ADSL router. Now he has no difficulty in connecting to the Internet, and he uses the Internet more frequently than before.

An immediate benefit of using a higher speed connection is that I can now use Virtual Network Computing (VNC) to see his desktop while he uses it (all the screenshots in this article were taken directly this way). The second benefit is that the telephone line is now free for normal use while my father is connected to the Internet. Together this makes it easier to talk my father through any problems he may have on the phone.

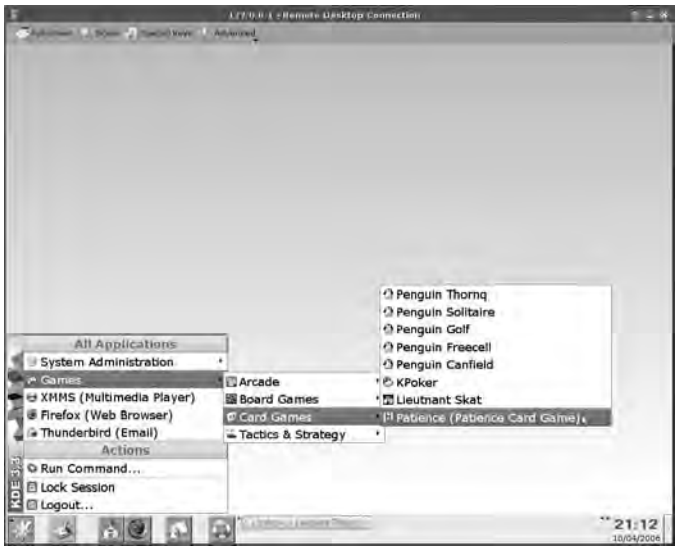
Over the following year my father has continued to make slow steady progress on his own, gradually using the computer

more and more. He has also made a number of observations that I found quite striking. My father has no idea what the various icons are or what they are meant to represent; for example, while the envelope may be a popular metaphor for email, it is not that obvious that the image is an envelope or that an envelope would represent electronic mail. He recently asked if it would be possible to check the spelling in his emails, the huge button with 'ABC and a tick on it' simply does not mean anything to him, and he would have never realised what it was for until I showed him what it did.

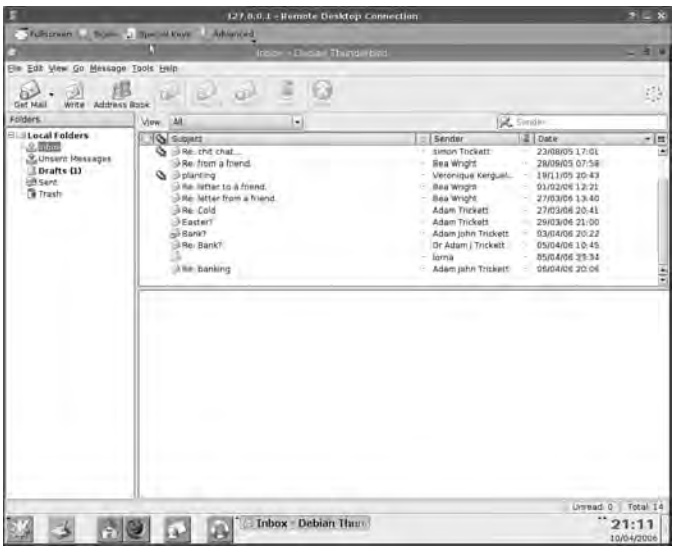
Many icons don't even represent anything tangible; for example, to my father the Mozilla organisation's Firefox logo is a blue and red ball, and in no way represents anything to do with the Internet. He recently asked what the little orange "RSS" logo that appears in the Firefox browser meant. Unless you know, it is hardly obvious what many of the icons stand for – though some are office metaphors, many are arbitrary. It is not that my father is unable or unwilling to learn, it is just that he is cautious, and without any explanation most of the metaphors of modern desktop software are utterly opaque to him.



Desktop 3 The main menu is heavily simplified and the font size greatly increased.



Desktop 4 Deeply nested menus make things logical and lists short enough to navigate, but they do require high levels of eye–hand coordination to use.



Thunderbird 1 The email application Mozilla Thunderbird is shown with its icons set to the largest size possible and their function is listed underneath.

I set my father's computer up with a GNU/Linux operating system. One basic feature of Linux is that each user has their own login to the system, and normally you do not log in to the system as the super-user. This limits what my father is able to do on the system as he is not the super-user. To my surprise my father was delighted that he is restricted in that way, because then he knows that he cannot break the system by accident.

To conclude, I would say that my experience with my father and other inexperienced computer users convinces me that modern desktop software is not obvious, but that with basic training it is very easy to use. I firmly believe that anyone can use a computer, but it is essential that users have a properly configured desktop suitable for their use, as one size does not fit all.

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