



Back to the future: A retrospective on early predictions

Russell Beale

Advanced Interaction Group, School of Computer Science, University of Birmingham, UK

ARTICLE INFO

Article history:

Received 15 January 2009

Received in revised form 3 February 2009

Accepted 5 March 2009

Available online 3 May 2009

Keywords:

Retrospective

Brian Shackel

Information age

Research questions

Design

Usability

HCI

Social perspectives

ABSTRACT

Professor Brian Shackel's paper "Designing for People in the Age of Information" was published in 1984. In his paper, Shackel looked ahead to the research areas that he considered important and makes some predictions for the future. This paper provides a current perspective on his views, assessing which areas he successfully predicted and which he did not, and contextualising his work in the field that he significantly shaped.

© 2009 Elsevier B.V. All rights reserved.

1. Setting the stage

1.1. Technology and culture in the mid-80s

Professor Brian Shackel's paper "Designing for People in the Age of Information" was published at the first Interact conference in 1984, and was written during the previous year. If Shackel had the radio turned on, Michael Jackson's 'Billie Jean' would have been competing with 'Every Breath You Take' by the Police and Culture Club's 'Karma Chameleon'. The video for Michael Jackson's 'Thriller' was airing for the first time, destined to become the most famous music video of all time. Early in 1984, Israel signed a treaty to withdraw from Lebanon, the Conservative Party and Margaret Thatcher won their second term in office, Richard Noble set a new Land Speed Record in Thrust 2 of 633.468 m.p.h., and Björn Borg retired from tennis after winning five consecutive Wimbledon titles.

It was 1983, the year he wrote the paper: in computing terms, it saw Apple release the Lisa, the first personal computer with a graphical user interface. It had been inspired by the Xerox Star, which with Lisa heralded the dawn of the modern graphical user interface. A system allowing researchers to collaborate together with the military was becoming quite successful, and so was split into two – MILNET and ARPANET for the military and civilian sectors, respectively. APRANET changed its name to the Internet in 1995, and became quite useful. Microsoft released its first version of Word in October.

As Professor Shackel waited for the INTERACT conference in 1984, other interesting things were happening in the computing world: Richard Stallman started the GNU project (pioneering the free software approach) and Apple released the first Macintosh – for a quarter of the price of the Lisa. In competition, IBM launched the PC-AT. As he travelled to the conference, it's quite possible that he settled into his seat and pulled out a copy of William Gibson's book (published just a couple of months earlier) 'Neuromancer', where he would have first encountered the word 'cyberspace'.

1.2. Conspicuous by its absence

What was not around?

- No widespread Internet
- No online libraries
- No electronic publication
- Few computers outside work
- No mobile phones
- No cheap calling
- No Google
- No Wikipedia
- No social networking
- No blogging

Some email, but no significant problems with spam. No word processing (well, hardly any: Word was new and Latex was not out, though TeX was), and hardly any Undo (so no ctrl-Z/cmd Z).

E-mail address: r.beale@cs.bham.ac.uk

Copy-and-paste meant exactly that, using scissors and glue to move text on paper.

So, Professor Shackel was working with tools almost unrecognisable to current researchers. In that context, he wrote a paper that investigated the ‘new age’ of computing that he saw us entering: an Age of Information. The paper was, essentially, a look ahead into this information age. From our vantage point a quarter century later, we can see what he got right, what he got wrong, and what he missed. But, we should keep in mind that hindsight is much easier than foresight.

2. Enter the information age

In his opening sections, Professor Shackel discusses the information age, in which “machines will enhance or replace mankind’s intellectual powers and capabilities”. He discusses whether the term “Information Age” is merely “newspaper hyperbole” (in contemporary parlance, ‘spin’), but argues strongly that in fact it captures the radical shift in the power of the computer. He links this to how it impacts information, identifying that the multimedia aspects will be important – he refers to the “new facilities such as film and colour video recording”. Interestingly, whilst this is an argument we would agree with nowadays, here he is making essentially the same argument but with video being not a digital medium, but an analogue one (on tape). Still, he views it as a cheap way of transferring information. Thus, Professor Shackel’s information age is slightly broader than our current world view – he includes other methods for capturing and transmitting information, whereas we tend to think of the information age and the digital age as being synonymous.

In Section 2.2 of his paper, Professor Shackel offers a definition of Information Technology, after commenting that the two major research programmes in Europe that stimulated this area, ESPRIT (European Strategic Programme for Research and Development in Information Technology) and the UK government’s Alvey programme, had neglected to offer one. He says

Information technology is the coordinated application of knowledge about computers, communications and people, so as to research, design, install, operate and maintain integrated interactive systems which serve and satisfy human information needs.

This definition is one that would have most human–computer interaction researchers nodding in general agreement, though some would quibble about whether ‘information needs’ covered aspects such as games, art and aesthetic experiences; others may wonder at the need for ‘integrated’ systems. But the key issue is that the human is put at the centre of this definition: even at this stage, Professor Shackel recognised a need to counteract the technology push that is still prevalent today. He quotes Murray Laver in an 1982 British Library Research Lecture, in which system technologists were likened to removal contractors for their creation of information, focussing on speed instead of quality or meaning “rather like a removal man who might list the Venus de Milo as ‘one statue, weight 70 kg, arms damaged!’”

3. Research needs

Having laid the groundwork, Professor Shackel moves to consider what he thinks are the nine substantive areas requiring attention over the next 6 or 7 years (taking us to 1990). In enumerating these areas, he surveyed the activities of as many relevant research groups as he could, gathering and appraising their published and unpublished reports and devising a classification scheme for the domain of IT Ergonomics. He then visited most of the principle research groups in Europe and recorded the scope of their current work – and entered that into his classification schema. His analysis

showed that more than half the domains had been given too little attention. The experts also were asked to provide their views on future research needs. Those suggested independently by from one-third to one-half of the researchers were regarded as principal issues. When these data were combined, Professor Shackel was left with nine major areas:

(1) *Theory especially in cognitive ergonomics*: Card, Moran and Newell’s 1983 book “The Psychology of Human Computer Interaction” is referred to as “a first step in this direction, which also shows how much is yet to be done”. Given that this book has become a seminal volume in the field (with Google Scholar giving it at least 3281 citations according to Google Scholar in January 2009), it is clear that Professor Shackel was very right on this: it was indeed a major area – but interestingly, it still remains one. Whilst a lot of research and progress has been made in this domain, there still are many more unanswered questions.

(2) *Cognitive/software interface*: I must confess to being somewhat confused by this title. This somewhat ambiguous heading is not defined or explained, but I take it to mean research on how users understand problems and solve them, their mental models, and how this may translate into usable software interfaces that are understandable. This encompasses major contributions including work by Norman in his execution/evaluation cycle, Hutchins on distributed cognition, and the GOMS and Keystroke Level Modelling approaches, to mention just four with direct application to software interfaces. And, of course, the SOAR modelling approaches that provide insights into the cognitive behaviour of users when interacting with information technology.

(3) *User variables and models of users*: In this area, Professor Shackel is prescient in arguing for a more practical approach, in which a concrete task and situation is needed for valid modelling. A lot of work was undertaken on more generic user modelling, especially in the field of educational technology – with varied degrees of success. It would be fair to say that these efforts are severely reduced now, with no substantial breakthroughs recorded. Instead, people have moved exactly in the direction suggested by Professor Shackel – specific scenarios with concrete tasks, which has led to the development and use of approaches such as personas and, more generally across software engineering, use cases.

(4) *Measurement methods*: The next area to be highlighted concerns especially those relating to mental workload and to influences from the social environment. Since we are still at somewhat of a loss to understand exactly what influences from the social environment may be even now, it seems that measuring them is quite a leap in requirement – though there is no doubt that this is correct: work was, and still is, needed here.

(5) *Knowledge for usability design*: Here, Professor Shackel says “Views were expressed strongly about how much we have yet to learn about usability, so as to be able to produce valid guidelines”. He suggests that the way forward is extensive research studying different people in a variety of situations in order to be better able to understand usability. Partly through this approach, and partly through an asymptotic convergence of user expectation and technology provision, we actually have made substantial steps forward in this domain. Whilst no serious researcher would say that we had learnt all there is to know about usability, we do have at least a much better idea of what it is nowadays. We may not yet know enough to be able to create it reliably and first time. Yet, the standardisation of user interface design principles for different platforms (Windows, Mac, Java, etc.), the adoption of standard design patterns for common interactions (news websites, e-commerce sites), and the widespread publication and increasing awareness of accessibility guidelines, makes it reasonable to expect even a relatively new designer to be able to produce a website or interactive program that is not immediately awful. This is not to say that awful systems are still not produced – they are, and in

great numbers. But, this is often because the people ignore guidelines or rush development and do not give guidelines the attention that they require. Of course, design patterns and guidelines are not a panacea. Even with them, huge usability problems exist in systems (and for novel interactions the guidelines may be meaningless). But at least such guidelines do exist: we can and do use them, and in general they are helpful. But we still have a lot to learn about usability, especially if we start to consider the next wave of interaction. Usability for social networks, tangible systems, ubicomp systems all offer challenges to the current researcher.

(6) *Procedures and tools for designers*: This is an area Professor Shackel would not recognise today. He was enthused by the idea of a “rapid prototyping tool” that then could be evaluated by users. The rise (and fall) of Hypercard on the Mac; the role of the web and PowerPoint in developing interactive wireframes; the ubiquity of Photoshop in the commercial design arena for prototyping interface designs: all of these provide powerful, flexible tools for mocking up systems for user evaluation.

(7) *Work, workplace and system operation*: Professor Shackel comments that

Very little work was found in the literature on aspects related to system installation and usage, and to the work and workplace especially user support, social issues and the influence of IT upon work, job and organisation structure and functioning.

This is no longer true. We have numerous case studies of technology *in situ*, of business processes before and after, of tales of helpdesk calls, of the huge changes wrought by new technologies and the whole new forms of doing business that digital systems have allowed and introduced. There is a lot of focus on socio-technical issues, and on the approaches and methodologies for doing such studies.

(8) *Standardisation issues*: Seen “by many experts as of almost equal importance with improving knowledge and improving design methods”, standardization issues are seen by others as prematurely stifling innovation and development. There is no doubt that there has been huge development in standards over the intervening years, but one of the things not commented on by Professor Shackel is the need for standards to have a user focus. The protocols that have been agreed and that make the Internet operate provide, at a standards level, the framework for different services to operate successfully with and upon each other. But, it was the simple approach to interacting with the information presented – clicking on links to navigate – that drove its ultimate success.

(9) *Organisational and social issues*: Professor Shackel does miss a major trend: he realizes that computerization will change the nature of work, but assumes that it will lead to loneliness. The reality of the past years has demonstrated that computers have escaped from their beige boxes under the desk. Rather than being an isolated pursuit only for the geeky, they now connect us to the world, our friends, information, misinformation, sex, sales and socializing. True, they did go through the nerdy phase that was associated, at least in popular culture, with the loner. So, Professor Shackel may be forgiven for not seeing far enough into the future. What he predicted did come to pass. It just so happened that what came to pass also passed.

4. Design issues

Section 3.2 of Shackel's paper covers design issues. It is interesting that he separates this from research questions covered in the previous section. This treatment appears to indicate a world view that ‘research’ discovers the new and unknown, whilst ‘design’ puts it into practice. Yet nowadays that distinction is much more blurred. Many people in the field of HCI actually call themselves designers, and design is regarded as a research area. But we should

note that for Professor Shackel, design was about designing screens, or ergonomic design approaches: it was not about the creation of social and technological ecologies that symbiotically inter-leaved their development and interactions.

5. Longer term questions

In Section 4, he turns to addressing longer term questions, and these broader questions are interesting. Some are still unanswered, some are so old hat as to be almost beyond comment (except in a paper such as this commentary); others are prescient. But for me the joy of this section is in some of the phrases used (sometimes because of what has happened historically, and sometimes because of how well a sentiment is expressed).

5.1. The passing of paper

The passing of paper is the first possibility. Accepting that at the ‘current’ time such comments were inappropriate, he feels that this is more likely to occur by the year 2000. And yet, our usage of paper continues to grow, even as our creation of digital content grows much faster. My office is a drift of paper, piling up in different corners and threatening to engulf me at any stage. The inability to lay out multiple pages on the floor when they are on my laptop means that I print things out. The glare of the screen, its low resolution compared to print, and a laptop's inability to work well when standing in a crowded train carriage or lying in the bath means that I still revert to old ways. But like Professor Shackel, I have a feeling that its time may be near: perhaps not the death of paper, but a huge reduction in its use. The generation below me creates much more social and ephemeral content, material of only with a limited life span. Its existence on paper is inappropriate and unnecessary. Because of this users are much more accustomed to both creating and reading online content. They also have access to it on mobile devices (better in the train and even the bath), which means that ubiquity of access does not necessarily point to paper as the medium of choice. However, I also think I could be wrong.

5.2. Browsing

Professor Shackel mentions in passing that the browsing of information is critical – that users need to be able to browse, and that we need to find appropriate methods of supporting them in that. In one sense, we have: we have web browsers to access the Internet, and wonderful it is too – and yet the Internet has grown so large, so unstructured, that browsing is harder to do since the chance of stumbling across what you want is sometimes very small indeed, and so we are turning to search instead. But we need to remember, as Professor Shackel memorably quotes

Browsing is rightly regarded by many scientists, when asked, as an important feature – vital for serendipity. And serendipity is certainly important in science. Sir Fred Dainton illustrated this nicely if naughtily by saying that “Serendipity is going to look for a needle in a haystack and finding the farmer's daughter instead”.

Professor Shackel next discusses the reduction in writing, and wonders if “perhaps in time keying [typing] will become widespread”. All I can say is, Yes, it will. N ++ forms, 2, lol.

5.3. Voice

Voice as the major locus of interaction is discussed next. Many of the problems encountered are already raising their head at this time. Limitations of continuous speech recognition systems are discussed and whilst much improved are still there. But more

interestingly, Professor Shackel does not buy into the argument that voice is the panacea and quotes various pieces of research that demonstrate some of the difficulties.

5.4. *The wired society*

One of the historically most interesting sections to read is 4.4 The Wired Society?. He says:

With names like electronic mail, electronic conferencing, electronic journals, etc., it is hardly surprising that people are sometimes confused.

Many other kinds of network activity are developing. The Prestel activity is well known in Britain, as is 'Compuserve' and 'The Source' in the USA. However the computer hobbyist, and news network operating within Prestel, called Micronet 800, is perhaps not so well known. Among the many future uses for networks, the provision home teleshopping and home banking have been proposed. There is already an exploratory service for these, again via Prestel, called Homelink and being operated by the Nottingham Building Society.

However, these exploratory developments are somewhat overshadowed by whole community experiments. Lee (1983) describes the 'HiOVIS' experiment in Japan, in which a township near Nara was built as an experimental 'wired society', comprising a two-way interactive communication system complete with a TV set, a camera, a microphone, and a keyboard at each home terminal.

So we have visions of the Internet, online shopping and banking, social networking with video conferencing, and machines in every home. It behoves us to realise quite how different today's society is, where all these are commonplace, when in Professor Shackel's time these were novel concepts. And little would Professor Shackel have believed that his throwaway comment that "the problems of structuring and organising the information in the various systems for clarity, easier retrieval by users etc. is easy to state but will undoubtedly need plentiful research" would lead to the formation of some of the largest companies, by market capitalisation, in global history.

5.5. *The expert*

Finally, Professor Shackel discusses the potential for the expert in the system: specifically, expert systems. (It was another two years before Rumelhart and McClelland had the breakthrough that allowed the computational development of perceptron systems, which led to the field of neural networks – and a few more years before genetic algorithms and programming would come onto the scene.) So Professor Shackel was not really considering learning systems, but instead systems that would appear to work in a manner similar to another human in terms of interaction style and knowledge representation.

6. His conclusions and mine

Professor Shackel's conclusion starts with the note that "Design does not operate in a vacuum and designing for people must include recognition of many broader issues". He goes on to applaud the arrival of the Information Age, seeing it as releasing individuals from tedious work, allowing them to focus on human interactions whilst the machines do the rest. He continues by commenting on the "many other changes in attitude, in societal and economic organisation, and in industrial and even personal relationships, which are needed if we are to enter the information age with success and enjoy it." And finally, he realizes that collaboration between human, social and technical disciplines is required to achieve these goals.

My own conclusions echo his sentiments. In terms of comparing 'then' to 'now', we can see that we have undergone huge social and economic shifts to maximize our use of these pervasive technologies – and that further radical shifts are inevitable. It is clear that to research, design and evaluate work in this domain, we need interdisciplinary expertise. We cannot create systems in a vacuum.

In terms of his prophetic abilities, I think he got it pretty much right. Some of it happened hugely quickly, some of it more slowly, and some of it is still to happen – though many of the issues still remain (despite intervening progress). There are things he missed. Mobile, pervasive and ubiquitous computing are not mentioned. The focus of the paper is on computers supporting work, not play: jobs, not education or games. Their use as communication tools, whether textual through email or messenger, video via skype and webcams, or as facilitators of social networking, is notably absent. The massive success of the Internet, and the changes it has wrought on all our lives, is also not present in his paper – but despite these gaps, his work paints an accurate picture of the issues and challenges that HCI has faced and continues to face.

Finally, let's consider the references in his paper: 57 of them. Nowadays, accessing 57 major references would take a morning through Google Scholar, the ACM Digital Library, Scopus, and other electronic resources. We'd add them into BibTeX or Endnote and cite them easily as we wrote. He would have received interlibrary loans – dark-edged photocopies, sometimes smudged, held together with paper clips and staples – or would have pulled books down from shelves, having mastered the Dewey classification system and negotiated librarians with a predilection for silence, and then painstakingly typed them into his manuscript, bottle of correction fluid to one side. I can safely say that, no matter what the wider world position, some things have certainly changed for the better. Israel may be about to withdrawn from an occupied state, a prime minister may be about to win another term in office – but the Police are on my CD player.

About the author

Dr. Russell Beale leads the Advanced Interaction Group in the School of Computer Science at the University of Birmingham, an interdisciplinary team specialising in intelligent user support, user-centred design and distributed, mobile and ubiquitous systems. His current focus centres on synergistic interaction: combining artificial intelligence with user-centred design to produce more effective, usable systems. His active research themes include:

- Using artificial intelligence techniques to assist interaction, with particular interests in ubiquitous, pervasive and mobile systems;
- Affect and personality in interaction;
- design approaches;
- HCI theory, and
- Agent based interaction.

His interests range across all aspects of the border between modern computer and communications technology, and society. His aim is to push his work out in to the public arena, so that it can achieve some significant impact.

Dr. Beale has spent time in commercial organisations as well. He worked as Creative Technical Director for LetsBuyIt.com, once the largest co-buying e-commerce site in the world (and one of the dot com's largest crashes). He also founded four hi-tech companies and currently runs two of them.

When not working, Dr. Beale races sailing yachts. He rode mountain bikes and climbed mountains, before having a toddler—who now takes up most of his time.

Dr. Beale may be contacted at R.Beale@cs.bham.ac.uk.