

Provided for non-commercial research and education use.
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

Interacting with Computers

journal homepage: www.elsevier.com/locate/intcom

Brian Shackel's contribution to the written history of Human–Computer Interaction

Jonathan Grudin

Microsoft Research, Redmond, Washington, USA

ARTICLE INFO

Article history:

Available online 3 May 2009

Keywords:

History
Human–Computer Interaction
Human factors and ergonomics

ABSTRACT

In 1997, Brian Shackel published the article “Human–Computer Interaction – Whence and Whither?” In this early foray into historical reflection on the field, past work is covered with a focus on identifying European contributions, issues of particular contemporary interest are explored, and a set of 10-year predictions are offered. In this essay, from a vantage-point of an additional decade of history, insights of lasting value that Professor Shackel was uniquely positioned to glean are identified. His work is placed in the broader context now available, and an always-useful reminder of the difficulty of anticipating future events is provided.

© 2009 Elsevier B.V. All rights reserved.

1. Introduction

“Human–Computer Interaction – Whence and Whither?” was published in 1997. Brian Shackel presumably wrote it in 1996: the 141-item bibliography includes several items from that year and none later. In part, he was responding to the 1995 revision of the “Historical and Intellectual Perspective” that was first published in Baecker and Buxton's (1987) *Readings In Human–Computer Interaction: A Multidisciplinary Approach*. Shackel encouraged people to read the two in parallel, noting a “perhaps slightly more North-American orientation” of the earlier work and noting regarding his article that “Every author has his/her orientation; mine is of course British and European.”

Professor Shackel's invaluable contribution to our understanding of HCI history has informed subsequent HCI histories, such as Pew (2003) and my efforts (Grudin, 2005, 2007–2009, 2008). My 2008 handbook chapter cites Professor Shackel's paper more often than it cites any other source. Yet, Professor Shackel did not set out to be comprehensive. With hindsight, we can provide context that helps to understand his contribution.

2. Multiple objectives

Professor Shackel wished to counter “the common North American trait to be ignorant of, or even ignore and fail to reference, work from outside North America.” Of his own effort he said, “Inevitably much must be omitted, but the referenced papers may fill some of the gaps.” He was right. I helped revise Baecker and Buxton for the second edition, and we did indeed leave gaps, either from ignorance or from the inevitable struggle over what to include and what to omit that makes any history a perspective. When it came out, I was extremely pleased to see Professor Shackel's

essay, both for the information and for his perspective on the past.

Professor Shackel's article may most often be read for its review of history, but it is not primarily historical. Only four pages of text and five figures are devoted to the sections “Beginnings of HCI (1950–1970),” “Foundations of HCI (1970–1985),” and “Development of HCI (1980–1995).” It was written for a *Journal of the American Society for Information Science* special topic issue on “Current Research in Human–Computer Interaction.” It thus had multiple objectives: to review the development of the field of HCI by summarizing an extensive bibliography and providing the author's insights, to provide a snapshot of significant contemporaneous issues, and to speculate on future developments.

“Whence and Whither?” The ‘Whence’ is an invaluable source of insights and references. Reading the account of the major issues of 1996 reminds us how much the field has changed. As to the ‘whither,’ Professor Shackel's predictions for the subsequent decade were largely unrealized, though some may yet materialize. Before reviewing the essay from front to back, let's focus on aspects of Professor Shackel's perspective that help explain why he was singularly positioned to identify certain historical patterns, and why he did not focus on others.

3. The humans and the computers varied with time and place

When we think about “Human–Computer Interaction” research in different places and over time, it is easy to think of humans and computers as actors that vary primarily when users gain experience and when programs and interfaces change. However, in examining research past or present, we must keep in mind that users and computers vary geographically at a given time and they also vary over time.

E-mail address: jgrudin@microsoft.com

Professor Shackel incisively described temporal changes in computer use: the transition “from system supremacy to personal empowerment.” He wrote

At the beginning... users of computers had to become computer specialists... The first business machines were... designed by computer specialists for use by data processing professionals... In the beginning, the computer was so costly that it had to be kept gainfully occupied for every second; people were almost slaves to feed it.

Professor Shackel mentioned “the difficulties for the non-specialist” and cited Bennett’s 1979 observation of the emergence of discretionary users.

4. The UK and divergent North American foci

Professor Shackel describes the focus of the Human Sciences and Advanced Technology research centre (HUSAT), his research home from 1970 to 2002, as “ranging from keyboard ergonomics to the dynamics of organizational change.” These issues confronted UK computer users, whether they were “almost slaves” for whom efficiency was of paramount importance or dealt with information technology in banks, insurance companies, government ministries, automotive design groups, and so on.

This breadth enabled Professor Shackel to see slowly emerging patterns, which he summarized cogently in a section titled “From System Design to Interface Usability and Back Again.” The early systems focus relegated ergonomics to “knobs and dials, fitted in as time allowed.” Then came the microcomputer – system considerations were overshadowed by attention to “the single user... Both research and application became focused upon the individual human’s interaction with his/her specific computer, usually in an office environment.” Professor Shackel realized (when many HCI researchers did not) that social and organizational aspects of HCI continued to be explored. He and HUSAT colleagues were among those who kept them in focus; he reviewed their work. Accordingly, Professor Shackel saw the significance of Computer Supported Cooperative Work (CSCW) when it emerged in the mid-1980s. A decade later, he was still ahead of the curve when he wrote

Thus, progress is bringing HCI full circle back to a proper recognition that the system context is crucial. Social and organizational factors will always strongly influence, if not dominate, outcomes; if HCI researchers and practitioners fail to deal with them, or bring in relevant expertise to do so, then others will have to deal with them and probably at the expense of good HCI. So, much more attention than hitherto must be given to this wider orientation.

“The single-user (ec)centricity” as he called it, originated in North America, where HCI research had split into several distinct fields by the early 1980s. The Human Factors Society had a large Computer Systems Technical Group (CSTG). HCI was also a significant research thread in schools of management, in departments of Management Information Systems (MIS, today often IS) – as noted by Banker and Kaufmann (2004). The minicomputer wave led by Digital Equipment Corporation’s PDP/VAX series gave rise to the Office Automation / Office Information Systems (OA/OIS) effort, with many successful conferences in the early 1980s. 1982–1983 also saw the emergence of ACM SIGCHI, which quickly came to dominate HCI in the United States.

HUSAT’s broad span (“keyboard ergonomics to organizational change”) mapped to different groups. In North America, keyboard and other ergonomics issues were the province of CSTG, while organizational change was explored in MIS. HCI aspects of Artificial

Intelligence, which Professor Shackel touches on but intentionally skirts, found expression in the OA/OIS literature. CHI adopted the narrow single user focus that Professor Shackel remarked upon. CHI’s prominence made this focus very visible, but it wasn’t eccentric. CHI addressed a customer base of rising importance at the time in the United States: the suddenly numerous truly discretionary users.

5. Discretion

Discretion – the choice of whether or not to use a system, application, or feature – is a continuum. At one end are people hired to use a technology, such as data entry personnel (Professor Shackel’s near-slaves). At the other extreme are consumers browsing in a computer store. Over time, the level of discretion can vary. For a time, some secretaries were free to choose whether to use a typewriter or a word processor. When word processing skills became a job requirement, discretion diminished, but the choice of *which* word processor might remain – until the office or organization standardized to facilitate collaboration. Then, discretion in that area was gone.

Professor Shackel’s users were professionals whose discretion ranged from low to mid-range, except when they could delegate all hands-on use to others: bank clerks, stockbrokers, insurance sellers, librarians, scientists, managers, lawyers, physicians, and so on. In contrast, the computer and software companies proliferating around minicomputers and personal computing in the Boston and Silicon Valley areas reached out to people with more choice, notably consumers focused on home use. Office workers and professionals remained a critical market, but because lower hardware and software prices meant that training was a growing fraction of IT budgets, satisfying consumers was seen as the gold standard of usability. High-circulation PC-industry trade magazines began to emphasize “user-friendliness.”

To understand this new breed of user, development companies hired perceptual and cognitive psychologists whose focus was individual behavior. The first CHI conference was co-sponsored by the Human Factors Society. Brian Shackel gave a pre-conference tutorial, but it was dominated by cognitive psychologists. Soon, few Human Factors professionals attended CHI. Similarly, CHI and MIS initially collaborated on CSCW, but soon most MIS researchers were gone. Despite some bridging efforts, CHI and OA/OIS never meshed. The latter disappeared with the minicomputers that inspired it. These efforts at interdisciplinarity are described in Grudin (2008), but to set the context we need only note that they failed.

6. Research drivers

In Europe, research responded to requirements of the large public and private sector organizations that dominated computer use everywhere. A large organization might have one or more very expensive mainframes, to which over time they added minicomputers and inexpensive microcomputers. In the United States, the highly profitable minicomputer and microcomputer industries faced a problem: Large organizations had much less invested in their products than in mainframe hardware and software, so who would promote research of interest to them? They took the initiative and were heavily involved in OA/OIS and CHI activities. Because university research labs also used minis and micros, research interests coincided. Minicomputer and microcomputer development was not as significant in Europe, so less comparable research was promoted.

Brian Shackel was well aware of the North American developments. In addition to his CHI’83 tutorial, he was on the program

committee of the first ACM-sponsored Computer Supported Cooperative Work conference in 1988 and helped organize INTERCHI'93, the joint production of CHI and the INTERACT Conference series he initiated in 1984. Not surprisingly, INTERACT attracted more diverse threads of HCI research than did CHI. Whether or not he attributed the “single-user (ec)centricity” to the needs of suddenly prominent companies around Boston and Silicon Valley, Brian Shackel correctly saw that it was insufficient and he anticipated the growing role of social and organizational issues as technology became ever more enmeshed in the lives of a social species.

One factor in HCI development is missing from the essay: technical innovation is tied to the breathtaking ‘exponential’ growth in some aspects of semi-conductors. Professor Shackel marveled that his 1996 laptop was far more powerful than the world’s most powerful computer (that he had helped redesign) 40 years earlier, but he did not pursue the implications. New technologies – IM, mobile computing, tabletop displays, social networking software, and so on – must appeal to individuals. CHI shifted to new technologies, retained its primary focus on “the single user,” and left the refinement and emergent social/organizational aspects of maturing technologies to Human Factors & Ergonomics, IS, and CSCW.

Consider graphical user interfaces, unmentioned in Professor Shackel’s article. The commercial success of the Macintosh in 1985 brought GUIs to the center of CHI attention, with knock-on effects: To build functioning prototypes, cognitive psychologists needed advanced computer science skills or computer scientist colleagues. But in the organizational settings that Professor Shackel’s users inhabited, GUIs had negligible presence until well after Windows 3.0 and Windows 3.1 were released in the 1990s. A 1992 *PC Magazine* article complained, “The problem is that we don’t yet know enough about GUIs. This is a new field; we’re still figuring things out.” (Seymour, 1992).

One area of undisputedly discretionary computer use with which Professor Shackel was familiar was academic research – and he gave it considerable attention. Although Loughborough students still wrote papers by hand in the early 1990s, Professor Shackel adopted e-mail early. He was reportedly the only HUSAT e-mail user at the time. He had for years assembled the digital bibliography of HCI literature analyzed in his article. The article also covers in some detail his involvement with electronic journal efforts.

Brian Shackel revealed his deep interest in the nature and evolution of academic research in his timelines and contrasts of HCI with other disciplines. But the nature of computer use in the UK, as Internet use spread and the Web was in its infancy, also helps explain why his article focused as much as it did on support for academic researchers.

7. ‘Whence?’ A summary of Brian Shackel’s review of the past

Professor Shackel noted that when he was redesigning computer consoles in 1957 and 1959, “only a few people... foresaw the growth of the whole new field now called Human–Computer Interaction (HCI).” In three one-page sections, he set out his intentions, disciplinary contributors (notably ergonomics) to HCI that preceded digital technologies, and early changes in computing that increased demand for HCI research and application. This excellent survey included information absent from other reviews, especially regarding European contributions. Professor Shackel also noted the evolution of users: first engineers, then non-specialists trained to use computers, and finally professionals and consumers focused on other tasks.

The next three sections cover only four and a half pages, of which one-third comprise tables and figures. They describe partially overlapping periods: 1950–1970, 1970–1990, and 1985–1995. The overlap results from linking each to a functional phase:

Beginnings, Foundations, and Development. The effort to shape a developmental forest out of expanses of event trees is worthwhile, even if (as noted above), it is unclear that a single field emerged – or even that a single technology is described, given the vast differences between a barn filled with vacuum tubes and a laptop of 40 years later.

HCI continues to face identity crises. In North America, many leading HCI researchers struggled to gain acceptance in computer science departments, with mixed results. Today many have moved to Schools of Information that often constitute a major broadening of library schools, a phenomenon that did not exist when Shackel wrote (and that now are found at prominent universities – e.g., Berkeley, Michigan, Syracuse, and the University of Washington).

Professor Shackel’s useful Figure 2 timeline reveals his priorities. It covers conferences, journal launches, major books, and the founding of PARC and HUSAT. The only technology mentioned is the 1969 ARPANET launch. There is no mention of Engelbart’s landmark demo, the Macintosh, or Mosaic.

8. HCI and professional organizations

Professor Shackel quantified participation – papers, professional society membership, and conference attendance. Of particular interest is the hundred-fold increase in the decade 1979–1988 (his Figure 3). The exponential increase in his Figure 4 may yet continue if one includes HCI-related spinoff conferences and workshops. If so, the literature that Shackel reviewed comprises less than 1% of the existing HCI literature today.

Shackel said of the German DIN standard draft worked on in the late 1970s and early 1980s, “The recognition that an ergonomic standard could override all other considerations in the marketplace came as a big surprise and had a powerful effect on quite a number of US companies.” He backed up this fascinating observation by citing a 1984 survey.

I was not included in the survey, but can further support Professor Shackel’s conclusion. I was working on keyboard design for a US computer company in 1984. We decided to follow the DIN constraints to be able to market in Europe. When I saw the Macintosh keyboard, I observed with amusement that Apple had innovated in keyboard UI at the expense of losing the prospect of sales in Germany. But the joke was on us. Only later did we realize that the DIN standards never progressed beyond unenforced guidelines. Shackel was correct, though, that they raised awareness of ergonomics in engineering settings.

Under “The Stimulus of Funding Programs,” Shackel credits the Japanese Fifth Generation, British Alvey Program, European ESPRIT projects, and the US MCC consortium for advancing HCI research in the mid-1980s. These funding efforts primarily focused on Artificial Intelligence, which may have found more common ground within HCI in Europe and in the journal *International Journal of Man–Machine Studies* than in the United States. However, his gentle qualification, “also involving human factors to some extent,” hints at some reservation. In my experience and observation, the two disciplines often competed for funds and researchers. Personally, in 1983 I left work as a practicing human factors or usability engineer to join MCC, where I worked for years on prototype LISP systems that had, one might politely say, limited influence on products. HCI seemed to advance during AI winters and treaded water when AI was in full bloom. For example, in the mid-1970s, following the Lighthill Report and the de-funding of AI in the UK and US, most of the major HCI research labs formed – those that later contributed to the early CHI conferences (Grudin, 2006). At times of vast AI funding, morsels were directed to HCI, often to explore interfaces to AI systems such as speech and language systems that never reached successful application.

9. HCI Issues in 1996

Section 7, “Continuities from the Past and Perspectives into the Future,” comprises half of Professor Shackel's article. It dwells on current research, bringing in historical information as warranted while focusing on the present and opportunities going forward. The system vs. personal empowerment issue discussed above brackets this section. In the middle are discussions of

- (i) the Internet, which was just going mainstream but not yet heavily commercial;
- (ii) detailed treatment of electronic journals; and
- (iii) extensive discussion of CSCW, Hypertext, and Digital Libraries – three very active HCI-related specialized conference series at the time.

In hindsight, Professor Shackel accurately identified user-based requirements in these areas, then offered solutions which were often not those eventually settled upon.

For example, he anticipated the demand to locate people on the Web, but proposed a centralized name server rather than search engines. He also identified the demand for monetary transactions and commercial activity on the Internet, a relatively new possibility. Electronic journals were a significant interest. Professor Shackel covers their history and identifies issues, including a repeated call for low-cost full-page monitors, which were by then falling rapidly in price in the US.

The two unresolved journal issues that Professor Shackel considered most significant were the question of what constitutes a page in an electronic journal and how many different systems a reader will have to learn. These issues slowly went away. Pages remain approximately the amount of text fitting on a printed page and, used in different contexts, PDF and html led to sufficient standardization. As successful online journals slowly appeared, they yielded the advantages that Professor Shackel anticipated – but they have not yet exerted a revolutionary shift. For CSCW and Hypertext Professor Shackel largely deferred to the Baecker et al. coverage, adding European references; for Digital Libraries, he accurately called for better search engines, but he also called for many more “information specialists” to help individuals cope. Adding people can help, but the movement has perhaps been in the other direction, toward developing individual skills and better tools for finding and assessing information.

Professor Shackel ended the section on current research with a brief mention of health hazards (radiation and RSI), accessibility, and HCI methods. The latter were being more energetically explored in North America due to the new, dominant focus on users with unparalleled discretion.

10. ‘Whither?’ The hazards of forecasting the future

In the final section, Professor Shackel reviewed his major points and listed HCI trends and topics that he thought would be developed over the decade to follow – the decade that has just ended. The trends continued and the anticipated needs were met: larger displays, a standard for online publication, improved computer-mediated communication, and more HCI research into social and organizational issues. As noted above, some requirements were handled in ways he did not expect.

His predictions did not fare so well. He seemed to fear this outcome, noting, “comparing the results of Delphi studies with the actuality 5–10 years later shows that even such ‘best guessed’ predictions only seem to be 50–60% valid.”

Professor Shackel predicted advances in HCI theory while expressing a preference for data over theory. Whether theory

advanced significantly is debatable. Among the technologies he found promising in 1996, but which contributed little to HCI in the following decade, were neural nets, smart cards, virtual reality systems, and spinoffs of Japanese AI initiatives. He thought that virus control and environmental issues would require HCI attention. The decline in the virus scourge has come more through better design and rapid detection and response, and serious HCI involvement in environmental issues is still largely a hope.

11. Conclusion

History is more a matter of perspective than a question of truth. For that reason, it always is worthwhile to read multiple histories. I have read Brian Shackel's great essay several times and encourage people interested in HCI history to read it. I also encourage anyone working in HCI who is not yet interested in its history to develop such an interest, to obtain a more motivated understanding of the topics we attend to and the methods we use, and to identify and understand trajectories of the changes that will influence the lives of researchers, developers, and technology users – often more rapidly and dramatically than they expect.

About the author

Dr. Jonathan Grudin is a researcher at Microsoft. He previously was Professor of Information and Computer Science at the University of California, Irvine. He began working in HCI in 1982 at the Medical Research Council Applied Psychology Unit in Cambridge (where Brian Shackel had worked briefly, years earlier).

From 1983 to 1986, he was a Human Factors or Usability Engineer at Wang laboratories; since then, he has been in research. Dr. Grudin published extensively in HCI and CSCW literatures, edited the *ACM Transactions of Human–Computer Interaction* for 6 years, and served on the editorial boards of *Interacting with Computers*, *Human–Computer Interaction*, and *Computer Supported Cooperative Work*.

Dr. Grudin became acquainted with Brian Shackel through the INTERACT conferences. He presented two papers at the first conference, in 1984, and has attended all INTERACTs save one that occurred the week his first daughter was born. He had a minor role helping with Professor Shackel's HILITES bibliography effort in the late 1980s.

On the several occasions over the years when Dr. Grudin approached Professor Shackel with questions or requests for reprints, Professor Shackel unflinchingly responded generously. Dr. Grudin reports that he was overwhelmed and honored when Professor Shackel sat in on a CSCW tutorial that Dr. Grudin presented at INTERACT 1990. Also, Dr. Grudin is pleased that he and Professor Shackel were inducted into the ACM SIGCHI “CHI Academy” the same year.

Dr. Grudin may be contacted at jgrudin@microsoft.com.

References

- Baecker, R., Buxton, W., 1987. A historical and intellectual perspective. In: Baecker, R., Buxton, W. (Eds.), *Readings in Human–Computer Interaction: A Multidisciplinary Approach*. Morgan Kaufmann, pp. 41–54.
- Banker, R.D., Kaufmann, R.J., 2004. The evolution of research on information systems: a fiftieth-year survey of the literature in management science. *Management Science* 50 (3), 281–298.
- Grudin, J., 2005. Three faces of human–computer interaction. *IEEE Annals of the History of Computing* 27 (4), 46–62.
- Grudin, J., 2006. Turing maturing: the separation of artificial intelligence and human–computer interaction. *ACM Timelines* 13 (5), 54–57.

Grudin, J., 2008. A moving target: the evolution of human–computer interaction. In: Sears, A., Jacko, J. (Eds.), *Handbook of Human–Computer Interaction*. CRC Press.

Grudin, J., 2007–2009. HCl history: trajectories into the future. In: *Course Given at ACM SIGCHI Conferences*.

Pew, R., 2003. Evolution of human–computer interaction: from MEMEX to Bluetooth and beyond. In: Jacko, J.A., Sears, A. (Eds.), *The Human–Computer Interaction Handbook*. Erlbaum, pp. 1–17.

Seymour, J., 1992. New interface dilemmas. *PC Magazine* (July), 99–100. <<http://www.guidebookgallery.org/articles/newinterfacedilemmas>>.