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Telescreens, keypens, and the expert: A 60 year snapshot

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ABSTRACT

Brian Shackel was responsible for initiating the first international conference on human–computer interaction, INTERACT '84. This was in the same year to which George Orwell referred in the now-classic book, Nineteen Eighty-Four. Both texts share the common theme of being concerned with information and its effects on the individual. In Professor Shackel's paper (the focus here), both aspects are considered over a 60-year lifespan – with a particular emphasis on his interest on "Designing for People in the Age of Information". This keynote address at the INTERACT conference is reviewed and the accuracy of his many predictions for the future considered. It is concluded that despite Professor Shackel's preoccupation with designing for humans some quarter of a century ago, there still is much work to do.

1. INTERACT '84

The year, 1984, was earmarked for a long time as being a seminal year (or so thought George Orwell when he published his book by that title in 1949). In his novel, Nineteen Eighty-Four, Orwell imagined what life would be like in Oceania (an imaginary location in the UK) in 25 years' time. He envisaged a loss of personal privacy which would be replaced by persistent, pervasive surveillance by the state – the so-called "big brother" concept – in order to ensure the maintenance of national security. The book was controversial and despite being translated into 62 languages was banned or challenged by many countries.

In 1984, Brian Shackel organised the first major international conference on human–computer interaction (HCI), INTERACT '84. Although HCI now is a familiar term, in the early 1980s, this was not the case. HCI was in its infancy. Professor Shackel was surprised by the high level of interest in INTERACT '84. As he wrote in the Preface of the Proceedings, "to the surprise of the Programme Committee, a total of 282 synopses were received". Further, 568 attendees from 20 countries around the world took part, and the conference proceedings comprised the largest volume of information published on HCI at that time. There were two keynote addresses: One was given by Brian R. Gaines, entitled "From Ergonomics to the Fifth Generation: 30 years of Human–Computer Interaction Studies"; the other by Brian Shackel on "Designing for People in the Age of Information". It is the latter which is of interest here.

2. The Age of Information

Unlike Orwell, Brian Shackel had the benefit of being able to comment on life in 1984. In his keynote paper, he focuses on the Information Age, and the shift from the Industrial Age and the production of physical goods towards the manipulation and management of information. He mentions the speed of growth in the processing capabilities of computers. He gives the analogy relating to the Rolls-Royce car, which would now cost £1.35, do 3 million miles to one gallon of petrol, and have enough power to drive the QE2 ocean liner – if its technology had progressed at the same rate as seen in computing.

In 1984, the 4th generation of computers (incorporating very large-scale integration of components) had been reached, and the Japanese were initiating the 5th generation programme (Moto-Aka, 1983). Here, more complex problems would be solved by applying the expertise and reasoning employed by humans (Hunt and Shelley, 1988). Professor Shackel comments that the speed of growth of technology has surprised everyone, and has led to greater and wider usage.

The question of use is an interesting one. Although the first, open standard, personal computer (PC) was launched in 1981, deliveries to European markets did not occur until 1982–1983. The development of similar operating systems, modems and remote servers allowed individuals to communicate with each other. Thus, it was around 1984 that the use of computers began to move from the province of the technical specialist to the general population. This explanation explains the new interest in human–computer interaction. Around this time, the British Computer Society (BCS) and the Association of Computing Machinery (ACM) established conferences on human–computer interaction.

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In keeping with this change of emphasis in the Information Age from the physical to the cognitive, Professor Shackel predicts that "machines will enhance or replace mankind's intellectual powers and capabilities". However, he makes one major proviso: that there have only been three major changes in how humans transfer information (assuming we start with the spoken word):

- The development of handwriting.
- The production of print, and finally,
- The use of technology (e.g. film, video).

Professor Shackel predicts that there will be "cheap new ways of transferring information never hitherto available for most people".

3. Predicting the future

Predicting future events is hard, if not impossible. Professor Shackel attempts to indicate how the Information Age will be different. Based on the work of Stonier (1983), he lists the following characteristics of the post-industrial economy.

- It is primarily a service economy rather than manufacturing, with the knowledge industry predominating.
- The labour force will no longer be dominated by people working with machines (machine operatives), but by people working with information (information operatives).
- There will be unprecedented affluence at the private level and in the public sector.
- Change will be exponential rather than linear.

To take each of these in turn, it is evident that these predictions were largely accurate. In 1984, the UK was being governed by a Conservative Government led by Margaret Thatcher. Manufacturing output had indeed dropped by 30% from 1978 to 1983, although overall economic growth was stronger. The early '80s were a time of industrial unrest – with strikes, and protests against the closing of coal mines and factories. Work in the heavy industries was being replaced gradually by office-type working environments. The nature of work was changing. This move from working with machines to information is illustrated in the following anecdotal example.

> Around 1980 whilst working with the HUSAT Research Group at Loughborough University, I was involved with some human factors work taking place at the Mirror Newspaper Group in Fleet Street, London. The newspaper printers were moving from the (noisy and dirty) factory environments of the "hot metal" production machines to using computers in an office with fitted carpets and rubber plants. There was much discontent. The workforce was reluctant to change from machine operatives to office workers, and HUSAT had been brought in to take various environmental measures to demonstrate the superiority of the new workplace.

The last two bullet points concern affluence and growth and the suggestion that in post-industrial economies, these both increase at great rates. Given the difficulties beset in defining and measuring affluence and economic growth, it is hard to substantiate these claims. Pragmatically however, a perusal of data relating to Human Development and Human Poverty Indices suggests that affluence is increasing in the developed world (although this may not be the case in developing countries), as economic growth continues.

Professor Shackel's concern was that more attention has been given to Information Technology (IT) than to associated human factors. He was anxious about the "technology-push" (e.g., speed and cheapness of moving information) at the expense of considering the meaning and the quality of the information. He summed this up by providing an analogy to the Venus de Milo, whom a removal person might describe as "one statue, weight 70 kg, arms damaged".

In 1984, the Internet was still many years away in terms of its development and availability to the population (as it is today). However, Professor Shackel was certainly pre-cogniscent in his concerns about the technology push. One has only to consider e-mail communications to see that speed and cheapness have been sacrificed for meaning and quality. Take spam, for example: it is estimated that over a billion spam e-mails are sent every day. This is a terrible misuse and abuse of the technology, that has an unproductive and annoying influence on people's lives.

4. Designing for people

Brian Shackel was concerned about the lack of attention to human factors aspects of using technology. In order to begin to address this, he outlines research areas for the next 7 years (and beyond). (These resulted from his review of IT ergonomics in Europe, see Shackel, 1984.)

(1) *The cognitive aspects (areas 1 and 2)*: Professor Shackel mentions the work of Card et al., 1983 as a starting point, but suggests there is much more to do. As an area, cognitive ergonomics gathered momentum and interest in the 1990s. For example, there is the launch of a new biennial conference on Engineering Psychology and Cognitive Ergonomics in 1996 and a new journal, the *International Journal of Cognitive Ergonomics*, in 1997. Other 'cognitive' developments included an International Conference on Cognitive Ergonomics convened in Hong Kong in 1994, an Indiana State conference on Cognitive Engineering in 1997, and a journal, *Cognitive Technology*, launched in 1996. A very recent development is the move away from human-centric towards cognition-centric systems' design (Masakowski, 2008) in order to reflect the "roles, responsibilities and unique requirements of the decision maker". Hence, the approach focuses on human cognition, which echoes what Professor Shackel was suggesting in 1984.

(2) *Humans as users (areas 3 and 4)*: Professor Shackel highlights the need for improving measurement methods, especially those relating to mental load and fatigue. It should be noted that the National Aeronautics and Space Administration Task Load Index (NASA-TLX; Hart and Staveland, 1988) – which is one of the most widely known tools for assessing subjective workload – had yet to be developed.

(3) *Usability (areas 5 and 6)*: Professor Shackel suggests that we need to know more about usability in order to develop valid guidelines. Over the next decade or so, usability as a topic attracted much interest, culminating in the mid-1990s with several books on the topic (see, Nielsen, 1993; Rubin, 1994; Wiklund, 1994, to name but a few). Professor Shackel also highlights the need for prototypes and help for designers to develop and test these prototypes. Mention is made of "rapid prototyping" and the need for tools. The first commercially available rapid prototyping tool was in 1986 (see Cooper, 2001).

(4) *Wider issues relating to work, the workplace, standardisation and the organisation (areas 7, 8 and 9)*: It is a feature of Professor Shackel's work that he takes a more holistic approach to designing for people and considers the "bigger picture". This is advanced for 1984, given that the "joined up thinking" approach endorsed by UK politicians did not achieve popularity until the mid-1990s.

5. Long term questions

In the final part of his paper, Professor Shackel moves to considering longer term questions. These include:

(1) *The Passing of Paper?* He predicts that by 2000, the printed book may have disappeared (although the "turning pages" issue mentioned still needs to be addressed, where it is relatively easy to skim and browse printed pages but hard to scroll electronic text). This is an important, often confounding factor in computer versus paper experiments (as noted by myself and by my colleague, Kate Garland, in numerous publications on this topic). In our research, it became evident that people like books, and despite the many disadvantages associated with them, there is a strong affective component. Paper is unlike to fade in popularity because of this.

(2) *The Reduction of Writing?* A comparison of handwriting and keying indicated that the former is a more complex psychomotor task which is executed more slowly. Shackel suggests that we need to move towards handheld, portable devices, his *keypen concept* (which formed the basis of the Ph.D. (Martin, 1981) that I carried out under his supervision). It probably is true that for the majority, keying (and in particular, texting) has reduced the amount we handwrite.

(3) *The Victory of Voice?* Professor Shackel considers the use of speech input and output for HCI, but is cautious about "voice" being the panacea for our interactions with technology (even after taking into account the limitations of automatic speech recognition at that time). Even today, the limitations associated with speech recognition technology have not been fully addressed. Since 1984, there have been many declared breakthroughs in speech input, but the reality is that speech recognition works extremely well for relatively small vocabulary sets with dedicated users who can train (enroll) the system. The use of natural language applications for the untrained public is still within the realms of science fiction.

(4) *The Wired Society?* Mention is made of electronic mail, electronic conferencing, electronic journals and the BLEND Programme (Shackel, 1982a,b), which focused on the development of an electronic information system. This could be seen as a precursor of the Internet. Again, Professor Shackel is concerned about the social issues and the isolation of the individual. Certainly, this would be true when considering computer games. The psychology literature is full of studies on the negative correlates of gaming especially among younger adults.

(5) *The Expert in the System?* This touches on expert systems and the difficulties inherent in their development – which is confounded by a lack of human factors research and input. The end result for the user is primitive systems that are abstruse and complex. Coupled with some of the input problems relating to speech and handwritten input, this probably is still the case. Expert systems are beset with problems in their development because they are trying to emulate human reasoning and decision making. Systems that exist tend to operate in very narrow application domains although the capacity and data processing problems of the 1980s will have been overcome.

6. Conclusions

Orwell in his book, Nineteen Eighty-Four, was concerned with predicting life in the UK in 35 years' time. Professor Shackel in this paper is able to comment on life at this time; we in 2009 are able to reflect on developments over the 60 year timespan. The pervasive theme involves "getting it right" in terms of the human-technology balance. Orwell wrote about the telescreen and how it continually monitored people's activities from the corner of the room. Professor Shackel is concerned with the technology push at the expense of considering the human, and this is his key message. Both also are occupied with the role of information as well as the larger societal context.

Looking to the future, perhaps we have much to learn from Brian Shackel's paper in terms of ensuring that we design for people. As Orwell wrote

He who controls the past, controls the future.

About the author

Professor Noyes first met Brian Shackel when she joined the HUSAT Research Group at Loughborough University as one of his Ph.D. students, in September 1977. Prior to the start of the academic year, HUSAT ran a very successful, one week short course on Computer Ergonomics; she was invited to this.

Professor Shackel was a lecturer on the course and at its first meeting he gave her a single sheet of paper with two short paragraphs on "handwriting substitutes". (She still has this.) This was his *keypen concept*; he predicted that in the future, writing implements as we knew them would be replaced with technological devices. It was also her Ph.D. topic for 3 years.

Professor Shackel was an extremely busy person. Around this time, he moved from being Head of Department to Dean of Faculty. In addition to his administrative responsibilities, he maintained his research activities. But, he always had time for his students. Although, there often was slippage on the agreed meeting time. By the end of the day, he usually was running late, and his secretary, Jeanne, would do much frantic phoning around, to rearrange meeting times.

As a PhD student, Professor Shackel left you to "get on with it" until the final year. Whilst writing up, he was very diligent and meticulous in returning draft chapters with copious comments and extremely useful feedback. She still recalls some of his foibles: he did not like the word "explore" in research writing, as it smacked of children's books and hunting for treasure. He was a stickler for correcting split infinitives and sometimes would use Latin phrases that she did not understand.

After gaining the Ph.D., Professor Noyes went on to work as a post-doc at HUSAT, organised by Professor Shackel. She then left higher education to train and work as a classroom teacher before returning to take up a post-doc at the University of Bristol, where she climbed the academic ladder to where today she is a Professor of Human Factors Psychology.

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