***Using Computers: Human Factors in Information Systems,*** by Raymond S. Nickerson. Cambridge: MIT Press, 1986,434 pages ($22.50 U.S.).

***Reviewed by J. T. Giard***

Since *Time* magazine selected the computer as "Man of the Year," reviewers presenting a book relating to this personage often feel the need to prompt potential readers to read on with the opening phrase "This is not just another book about computers. . ." We have no fear of this kind; the book under review here is (mostly) about people.

Computers have been around for some forty years now, and it is commonly acknowledged that the extraordinary usefulness of these machines has made demands for computing magnitude. One of their most remarkable achievements has been to reduce transmission delays to a minimal level. The study of human factors in user-computer interactions does not go back much more than twenty years, but Nickerson makes a strong point in saying that "the challenge for the future is more in the area of psychology than in communication technology. That challenge is to find more effective ways of organizing and presenting information for human comprehension, assimilation and retention."

For the past 20 years, Nickerson has been a prolific and creative researcher in the field of human factors in man-machine communication. His work, as presented in this book, has valuable resources to offer the various categories of people involved in designing and building computer-based systems for individuals who have not been trained in computer technology. It constitutes a compendium of ideas and guidelines that can be applied to the evaluation of existing software and interfaces as well as to the design and implementation of new products. Most of all, because of its extended base of over a thousand references and its questions open for investigation scattered throughout the text or listed at the end, it is a unique source of information concerning past, current and prospective research in the area of human-computer interaction.

The purpose of the volume is therefore threefold: first, to provide an overview of where information technology is at present and where it appears to be heading; second, to review the human factors research conducted on computer-based systems to date; last, to investigate some of the issues and questions that seem to be especially worthy of further research.

The book's first four chapters present an overview of the development of computers from vacuum-tube devices to machines with multiple processors operating in parallel. They also survey areas where computer technology is currently being applied, attempting at the same time to list characteristics of different users, and indicating the great variability in purpose and frequency of use, as well as knowledge and skills within any user group. Chapter 4 elaborates on how computer and communication technologies have merged to a degree where they are rapidly becoming blurred, and points at trends and developments for the foreseeable future.

The following chapters are the piece de in Nickerson's menu; they focus on the study of the person-computer interaction. Licklider's (impossible?) dream of a symbiotic relationship evolving between computer users and their machines is evoked,

the main impediment to its processes, as identified by DeGreene. Approaches including simulation and modelling, observation and controlled experimentation, with this last one appearing to be perhaps the most yielding, are suggested as research methodologies that could induce the development of a true experimental science in the area of human factors in person-computer interaction. Of course, with computer technology evolving at such great speed, experimenters run the risk of seeing the results of their research becoming obsolete even before they are completed. However, Nickerson maintains that this problem can be at least partially avoided if research "is addressed to issues that are system independent and (oriented towards) the discovery of general principles that are applicable across a broad range of equipment."

Chapters 6 and 7 are quite unique in that they explore the many facets of the physical and cognitive interfaces between a computer and a user. Current and prospective manual input devices and visual displays are reviewed: the importance of typing skills is discussed and future developments towards the design of interfaces that would adapt to the idiosyncrasies of the user instead of the opposite are evoked. Features of programming languages and tools are discussed; menus and commands are compared as to their relative advantages and disadvantages; the design of names and abbreviations is explained; current progress towards using natural language and speech as input and output channels is reported. A suggestion is made that the concept of friendliness be replaced by that of usability.

Chapters 8 to 11 review the different types of existing software, such as statistical and data-management packages, authoring and editing tools, as well as available communication and information services, from electronic mail, networking and computer conferencing through to consumer information services and data banks. The impact of this technology on office and other computer-related jobs is discussed briefly. However, these chapters do not seem to offer anything new to the reader who already has a basic familiarity with the field.

More practical issues are tackled in chapters 12 and 13, containing a set of guidelines for designing interactive systems. While agreeing that most suggested guidelines lack empirical validation and are therefore open to challenge, Nickerson underlines the merit of guided evolution as an approach to design. This approach refers to the process of building a system gradually, by repeated interaction between users and designers. The process moves from small configurations containing some of the functions specified by the users, to the larger ones that contain designer-provided improvements. The importance of maintaining flexibility throughout the process is emphasized. Research results concerning user issues related to attitudes and motivation, acceptance, source of errors and different skill levels are presented and discussed.

Chapter 14 presents an original treatment of the topic of computer programming. This activity is viewed as a "new type of intellectual activity . . . that provides a vehicle for representing and cumulating knowledge . . .and a new way of testing the depth and adequacy of our understanding of specific knowledge." Programming is discussed alternatively as a professional activity, a learning activity and a craft. In all cases, it is referred to as a cognitively demanding knowledge-based activity which could benefit from an attempt at determining its cognitive prerequisites and consequences.

Chapter 15 wraps up the second part of the book with a (necessarily brief)

the-art of artificial intelligence. Adopting Kay's (1984) definition ("stuff that is interesting that we do not know how to do yet"), suggests a desire to learn more about human intelligence, to extend the Industrial Revolution to the intellect and to meet an intellectual challenge, as reasons that motivate complexity of commonplace skills and the problems of knowledge representation are evoked in connection with the commercialization of AI through the building of expert systems. In concluding, Nickerson points at the need for "developing a domain-independent theory of human expertise."

The final three chapters list a number of possibly interesting questions related to research on human factors, with a critical one being about where to put limited resources. The book ends with considerations about the potential of information technology for enhancing the quality of life.

No single work can cover everything germane to a given area. This is certainly the case here, although the book is relatively unusual in amassing 'human factors' research from both sides of the Atlantic. Nickerson's book does not provide an in-depth coverage of all these topics, nor does it make a contribution to theory, or pretend to. It is a survey of the practical aspects of human-computer interaction, and as such, it is exhaustive and systematic. Inevitably, the lists of software tools and systems referred to in the book are limited to items existing prior to 1985. But the well-indexed research material will make valuable reading for years to come.

---

J. T. Giard is a teacher of mathematics at College de Sherbrooke, Sherbrooke, PQ and a Ph.D. student in Educational Technology at Concordia University.