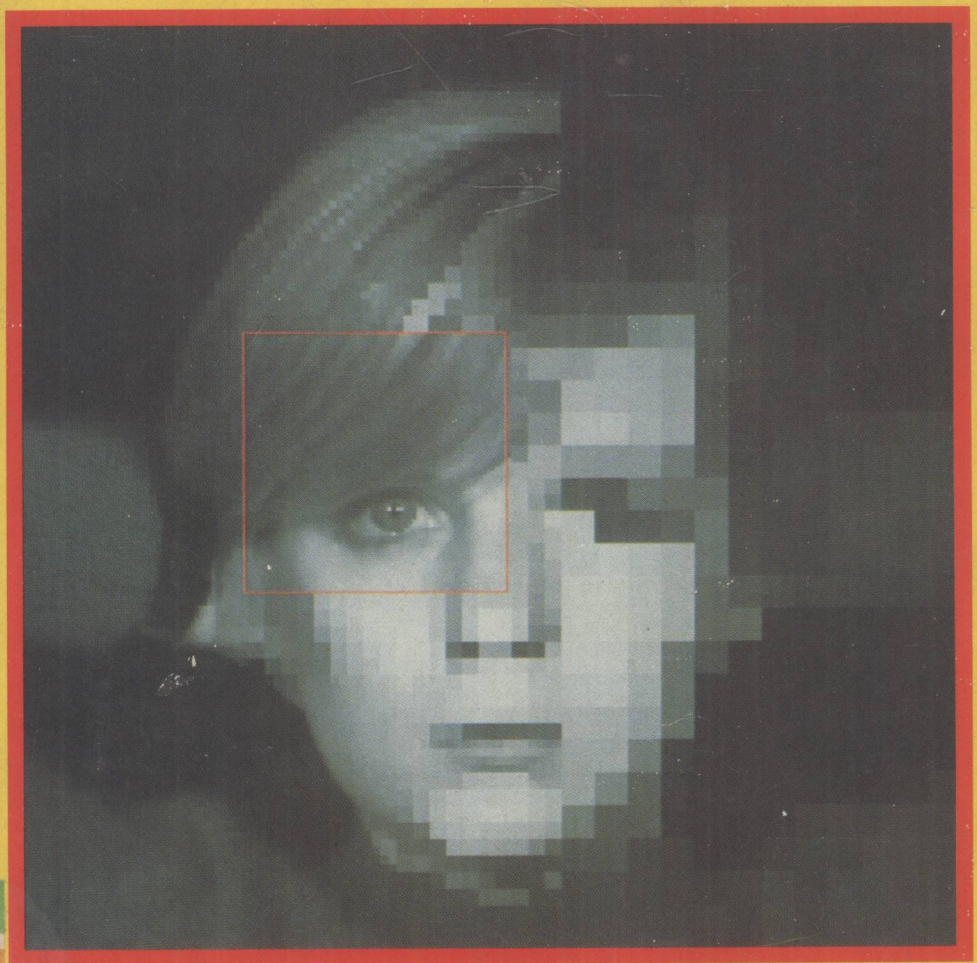
THE HUMAN INTERFACE

WHERE PEOPLE AND COMPUTERS MEET

Richard A. Bolt



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The Human Interface

WHERE PEOPLE AND
COMPUTERS MEET

For Olga, John Dimitri,
and Nicholas James

Foreword

ıterface with computers is the physical, sensory,
ıce that lies between computers and ourselves.
space can be unfamiliar, cold, and unwelcoming.
ike some other places, those we know and love,
iliar, comfortable, warm, and, most importantly,

space tends not to have the elements of personal-
hness, and intelligence to which we are accus-
, in human-to-human contact. Whereas talking to
be as easy as or easier than talking to another
we know intimately, with whom we have had
in fact if we but glance at the most advanced
whether in the military, in commercial use, or in
that the use of the systems ranges from difficult to
e can overcome only by the efforts of professional
the relentless resilience of a child's inherent and
play. Not only can the difficult and debilitating
tems discourage our use of computers in general,
ve do make the effort to use them, their limited
ry apparatus, and recognition facilities preclude
about almost anything and everything that means

nts a different picture. Drawn from specific experi-
ıg chapters put forward examples of human inter-
ith sensory apparatus that work in concert with
er to recognize human intentions and to output

computer responses in a human vocabulary, one not limited to ve
bal languages. Richard Bolt points to recognition systems never be
fore conceived of as regular channels of communication with com
puters, whereas we use such systems regularly in interpersona
communications. Who had ever thought of eyes as "output de
vices"? Yet we use eyes as pointers during almost every moment o
face-to-face, human dialogue.

Richard Bolt's book is meant to excite, to invite the reader into
different styles of thinking about the human interface. It is meant to
encourage you to ask new questions and to look in new directions.
The directions in which the following examples and experiments are
pointing you are the opportunities of the next decade.

Nicholas Negroponte
Massachusetts Institute
of Technology

Preface

THE PURPOSE OF THIS BOOK

As computer technology and society's use of computers continue to converge ever more rapidly, so the need intensifies to achieve a *completely natural dialogue or interaction between machines and human beings.* The aim of *The Human Interface* is to examine the concepts and situations under which this desired interaction takes place or could take place.

THE THEMES

This book pursues themes that are central to any consideration of *the interface*—the place where people and computers meet. The chief themes considered are as follows:

- *spatiality* as a radically new approach to storing and retrieving data (chapter 2)
- *speech and gesture* working together in a powerful way to express commands (chapter 3)
- *eye contact* with the computer to manage a dynamic display of images (chapter 4)
- *the interface as a place*, not just a tiny porthole into data (chapter 5).

THE AUDIENCE

This book is for conceptualizers and designers of computer systems—both hardware and software—who need to extend their understanding of the interface. It is also for computer programmers, for engineers, architects, ergonomists, psychologists, physiologists—specifically those concerned with how computers deal with people. Students in computer science and related programs who are involved in the human/computer dialogue will also benefit from this book.

THE APPROACH

Throughout I have emphasised the main ideas, rather than transient techniques. I have presented specific examples of each concept as it relates to the interface, based on actual prototypes researched at MIT's Architecture Machine Group laboratory. I have also noted related work done elsewhere and stressed applications of that work. In considering future developments I conclude the book with a selective look at what I think will be key themes for future interfaces. At the end of every chapter, under the heading "Highlights," I have summarized the main principles considered in that chapter, whilst detailed commentary and references have been placed in the "Notes" for each chapter so as not to clutter the main text.

THE ACKNOWLEDGMENTS

The impetus for writing this book arose from my participation in human/machine interface work at MIT's Architecture Machine Group, where I helped to formulate a vision of the interface as an eminently habitable place to be. I am therefore indebted to my association with that unique laboratory, now merged into the Media Laboratory at MIT's new Center for Arts and Media Technology.

Some further notes of thanks are due. I wish to thank Professor Patrick Purcell of the Royal College of Art, London, who, while visiting at MIT, read an early draft and furnished many helpful criticisms. My thanks go also to Professor Andrew Lippman, director of the Architecture Machine Group, for permission to use photographs from the Group's collection to help illustrate this book. (Those pho-

tographs without specific accompanying acknowledgments are copyrighted by the Architecture Machine Group, MIT.) Some photographic credits are also due: to Christian Lischewski for the photographs in chapter 2 illustrating MIT's Spatial Data Management System, as well as for Figure 3-7; to Bob Mohl for Figure 5-2; and to Scott Fisher for Figure 4-6, which also appears on the book jacket. Eric Hulteen drew Figures 2-1 and 2-2.

Especial thanks are due to the people at Lifetime Learning who contributed so much to the production of this book.

Thanks also to Professor Nicholas Negroponte for his encouragement when I first undertook this project and for supplying the Foreword.

Most of all, my thanks to my wife Olga, and to my sons John and Nicky, whose love and forbearance allowed me the time to write this book.

Richard A. Bolt

Contents

List of Illustrations

1.

Where in the World Is the Information?

- *Beyond the Keyboard*
- *Using Space to Organize Data*
- *Space and Computers*
- *Highlights*

People are very good at using the space around them for organizing and storing things. They lose this option, though, when they sit down to work with computers. The opportunities and means to use space in dealing with data just aren't there. This chapter is about regaining those opportunities and means.

BEYOND THE KEYBOARD

I am using a personal computer to write this book, typing in words and sentences with the help of a special word-processing program. This program enables me to present the text I am writing on a display screen. I can insert phrases, delete them, even move whole sections of text about.

What I especially appreciate, since I tend to revise a lot as I go along, is that I can print out on paper a fresh draft of my text whenever I need it. Once I've marked up the draft, made cross-outs and

additions, placed little balloons and arrows all about, I can go back to my computer and make the changes. More and more, I make such changes directly on the screen. I feel free to revise knowing I don't have to retype everything to get back to a clean, error-free copy. This is a marvelous boon to excruciatingly slow typists like me. The computer-as-word-processor is just plain wonderful. It is one of the best things ever to happen to writers.[1]

The computer is just plain wonderful but . . . .

What is less wonderful about the computer-as-writing-partner is that, as I write it, my book becomes tucked away somewhere inside the machine. What I see of the text is only what can fit at any one time on my computer's twenty-five-line display screen. There is something disconcerting about this.

I don't mean fears that the machine will gobble up all the text and throw it away. Or that the machine will inadvertently wipe out the little flexible magnetic disk files it uses to store the text of my book. That could happen. But it's unlikely, and I faithfully follow the suggested backup procedure of always writing out an extra copy of everything. And I certainly don't suffer from "cyberphobia," a new label for the irrational fear of computers.[2]

What bothers me is that I can't, on the computer, *see* my book. I can't spread it out so that I can take in its overall organization like a painter stepping back from the canvas. This is something we do to help us think about things, to see where we are in the midst of them. It's part of the "task demands," as the human-factors engineer might put it, of writing a book.

To see the overall pattern of data, we have to spread it out.

Well, I spread things out anyway. At home, our dining room table has been commandeered for the duration of this book. I have the material for each chapter—outlines, notes, papers, five-by-eight cards, articles, clippings, and so forth—stacked in file folders, one for each chapter. The folders in turn are arranged clockwise around the perimeter of the table, starting with Chapter 1 at my left elbow.

Then, about the dining room, on chairs, on the floor, on the tiny writing desk, I have books, journal articles, and yet more notes placed strategically, not in chapter order, but by topic. These stacks are not labeled in any way. I just know what things are where. And as long as I don't shift things around too much, and I replace the piles carefully when they get disturbed—as when I had to move everything out while we had company for dinner last evening—I can easily find what I need.

Now, I would have been doing all of this spreading things out even if I hadn't had the word processor to help me. It's the way I