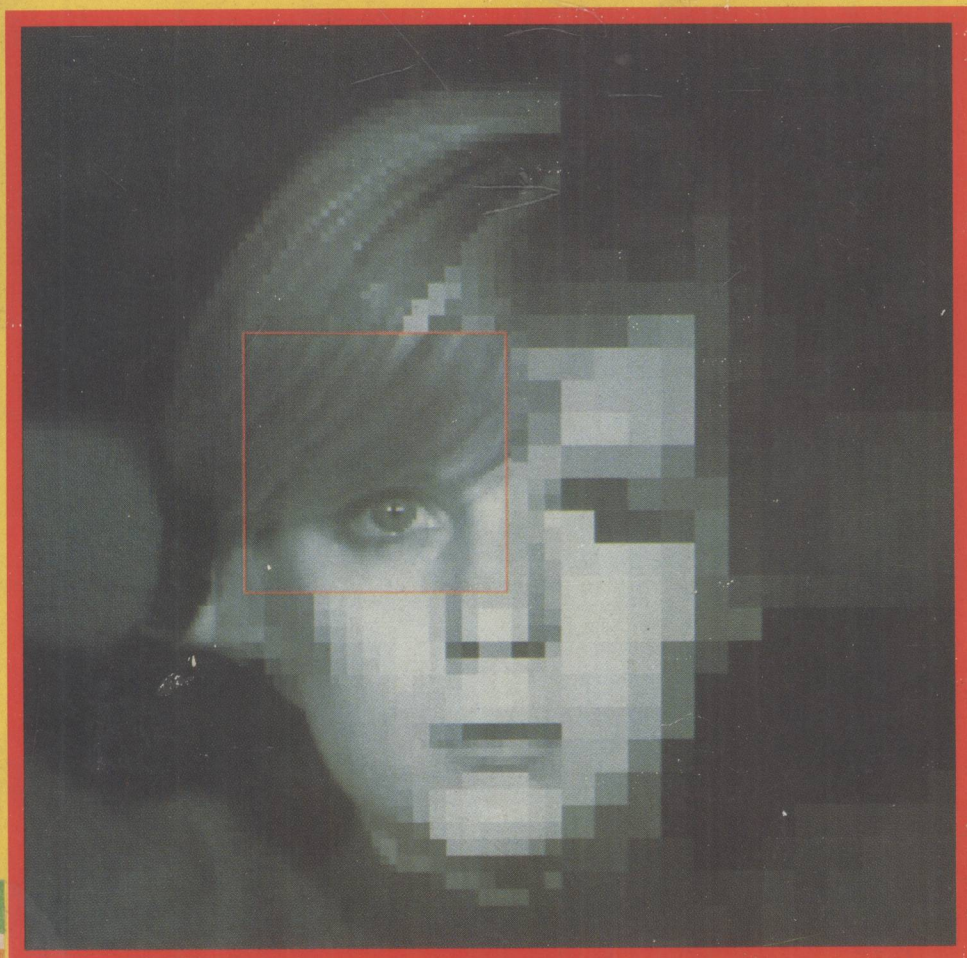


THE HUMAN INTERFACE

WHERE PEOPLE AND COMPUTERS MEET

Richard A. Bolt



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Lifetime Learning Publications

Belmont, California

A Division of Wadsworth, Inc.

London, Singapore, Sydney, Tokyo, Toronto, Mexico City

Production Editor: Richard Mason

Designer: Rick Chafian

Copy Editor: Don Yoder

Composition: Bi-Comp, Inc.

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Printed in the United States of America

1 2 3 4 5 6 7 8 9 10—87 86 85 84

Library of Congress Cataloging in Publication Data

Bolt, Richard A.

The human interface.

Bibliography: p.

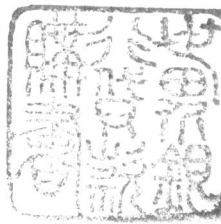
Includes index.

1. Interactive computer systems. I. Title

QA76.9.I58B65 1984 001.64 84-5768

ISBN 0-534-03380-6-Cloth

ISBN 0-534-03387-3-Paper



The Human Interface

WHERE PEOPLE AND
COMPUTERS MEET



*For Olga, John Dimitri,
and Nicholas James*

Foreword

Interface with computers is the physical, sensory, space that lies between computers and ourselves. This space can be unfamiliar, cold, and unwelcoming. Unlike some other places, those we know and love, familiar, comfortable, warm, and, most importantly,

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

presents a different picture. Drawn from specific experiences, the chapters put forward examples of human interaction with sensory apparatus that work in concert with each other to recognize human intentions and to output

FOREWORD

computer responses in a human vocabulary, one not limited to verbal languages. Richard Bolt points to recognition systems never before conceived of as regular channels of communication with computers, whereas we use such systems regularly in interpersonal communications. Who had ever thought of eyes as "output devices"? Yet we use eyes as pointers during almost every moment of 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

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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-

PREFACE

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 ix

Foreword xiii

Preface xv

1. Where in the World Is the Information? 1

Beyond the Keyboard 1

Using Space to Organize Data 3

Space and Computers 5

Highlights 6

Notes 6

2. The Uses of Space 8

The Media Room 8

The World of Dataland 9

Other Ways of Using Space 21

Design Issues 26

Future Developments 29

Highlights 29

Notes 30

3. Speech and Gesture 35

Machines That Recognize Speech 36

Speech and Context 39

When Gesture Is Gesture 41

CONTENTS

Capturing Speech in the Media Room	41
Capturing Gesture in the Media Room	43
“Put-That-There”	44
Economy in Conversation	49
Highlights	49
Notes	50
4. Eyes as Output	53
Eye Actions	54
Tracking Technologies	54
Dynamic Windows: A Prototype	59
Processing Where You Look	62
The Prospects for Tracking	64
Highlights	66
Notes	66
5. The Terminal as Milieu	69
Virtual Solid Space	69
Overview and Immersion	71
The User as Actor	74
Nonplanar Screens	77
Highlights	78
Notes	78
6. Future Interfaces	81
Circumstantial Indexing	81
Multimodal Interaction	83
Self-Disclosure	86
Highlights	96
Notes	97
Bibliography	100
Index	109

List of Illustrations



- Figure 2-1** The Media Room: overhead view 10
- Figure 2-2** The Media Room: end view showing full display screen 11
- Figure 2-3** The Media Room in use with the spatial data-management system (Color Insert)
- Figure 2-4** MIT's Dataland (Color Insert)
- Figure 2-5** The large screen functions as a magnifying glass onto Dataland 12
- Figure 2-6** Zooming-in on Dataland 14
- Figure 2-7** Touching the graphic book's "Table of Contents" 15
- Figure 2-8** The "page-flipping" animation on the Media Room's large screen 16
- Figure 2-9** How characters sent via telephone lines can merge with video graphics to become a "letter" in Dataland's mail-drop 17
- Figure 2-10** Operating the "calculator" on the keymap monitor. 18
- Figure 2-11** Accessing the "telephone" in Dataland (Color Insert)
- Figure 2-12** The author zooming-in on one of the TV sets in Dataland 20
- Figure 2-13** Keymaps for controlling data types in Dataland (Color Insert)

LIST OF ILLUSTRATIONS

Figure 2-14	User station for the CCA system	22	Figure
Figure 2-15	Zooming-in on ship data in the CCA system	23	Figure
Figure 2-16	CCA's system: nesting of information through ports	24	Figure
Figure 2-17	Nested country, state, and county "information space" images in the CCA system	25	Figure
Figure 2-18	The CCA spatial data-management aboard the <i>USS Carl Vinson</i> (Color Insert)		Figure
Figure 2-19	Overlapping windows on the screen of Apple's Lisa computer: each window displays a different data set	27	Figure
Figure 2-20	Different styles of space for data	28	Figure
Figure 3-1	Speech spectrogram of a sentence	37	
Figure 3-2	Patterns of pointing	42	Figure
Figure 3-3	The Nippon Electric Company (NEC) connected speech recognizer, model DP-200	43	Figure
Figure 3-4	The ROPAMS space-sensing cubes (Color Insert)		
Figure 3-5	Put-That-There	45	Figure
Figure 3-6	Put-That-There	47	Figure
Figure 3-7	Put-That-There. Deploying ships about the Caribbean Sea via speech and pointing (Color Insert)		
Figure 4-1	Eyeglass-mounted tracking	55	Figure
Figure 4-2	Diagram showing the optical path of corneal reflection from light-emitting diode (LED) to sensing photodiode array	56	
Figure 4-3	The G&W Applied Science Laboratories eye-movement monitoring system (Model 1998)	58	
Figure 4-4	The extended head-tracking option (EHT) on the G&W Applied Science Laboratories eye view monitor (Model 1998)	59	
Figure 4-5	The "World of Windows." Up to thirty images are on display at one time (Color Insert)		
Figure 4-6	Selective development in the progressive transmission of pictures	63	
Figure 5-1	Beyond the looking glass	70	

23	Figure 5-2	The "Movie Map." Driving by videodisc about the streets of Aspen, Colorado (Color Insert)
rough	Figure 5-3	Typical IMAX theater 73
	Figure 5-4	Typical OMNIMAX theater 74
nation	Figure 5-5	Human animation: light-emitting diodes plus a computer translate actions into illustrations 75
USS	Figure 5-6	The "Cloud Person" figure driven by motions of the human scriptor 76
Lisa	Figure 5-7	The talking-head "persona" (Color Insert)
data	Figure 6-1	Images from MIT's "Communication News" project (Color Insert)
	Figure 6-2	A multimodal command using speech, looking, and gesture 86
ected	Figure 6-3	Record of eye movements during free examination of the photograph for three minutes 89
rt)	Figure 6-4	Spontaneous looking. Record of eye movements during free examination of the photograph for two minutes 90
ib-	Figure 6-5	Task-oriented looking. Seven records of eye movements by the same observer, each record derived from three minutes of looking at the picture at the upper left 91
)	Figure 6-6	Eye-tracking the user of a desktop terminal is feasible with current technology 94

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