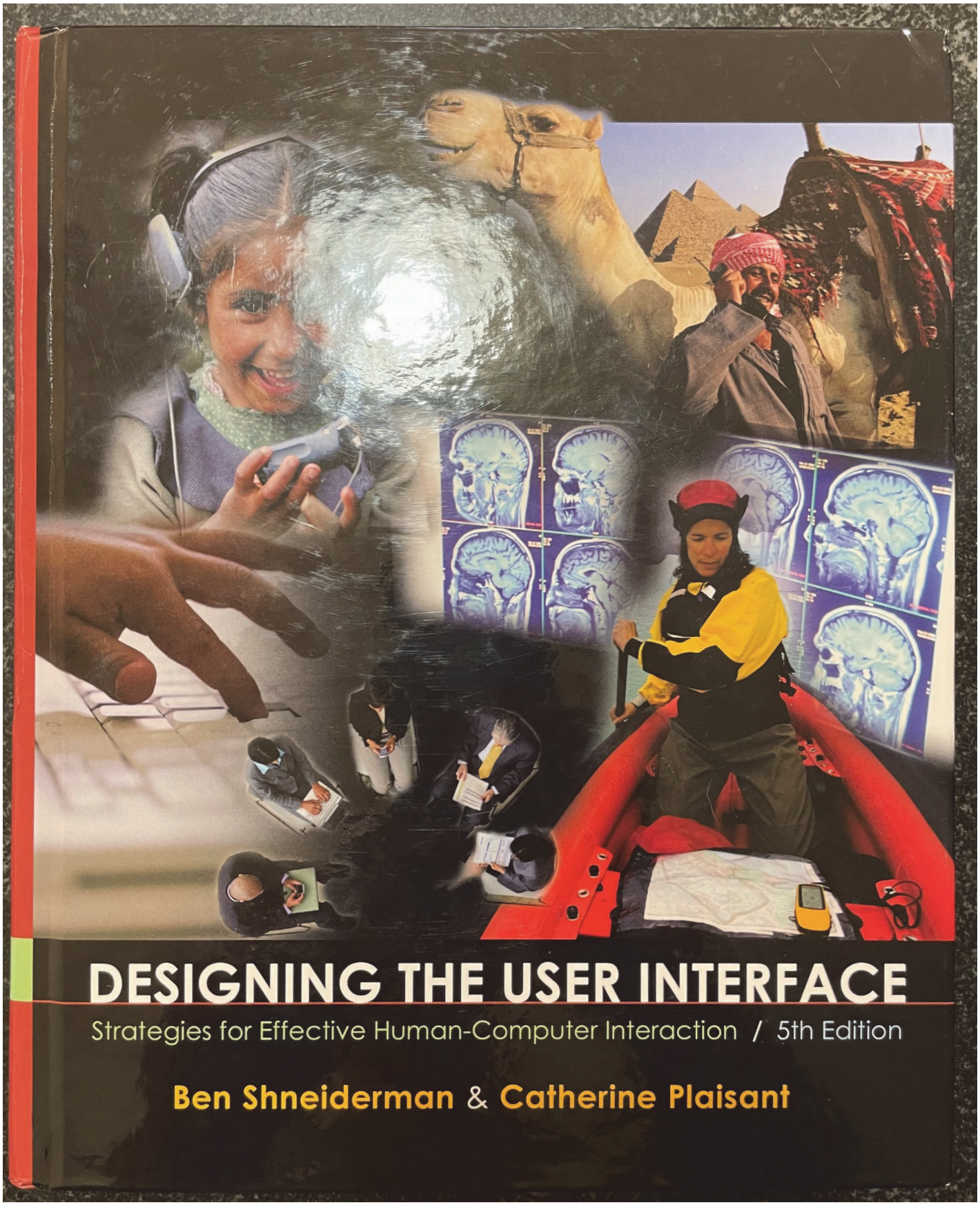

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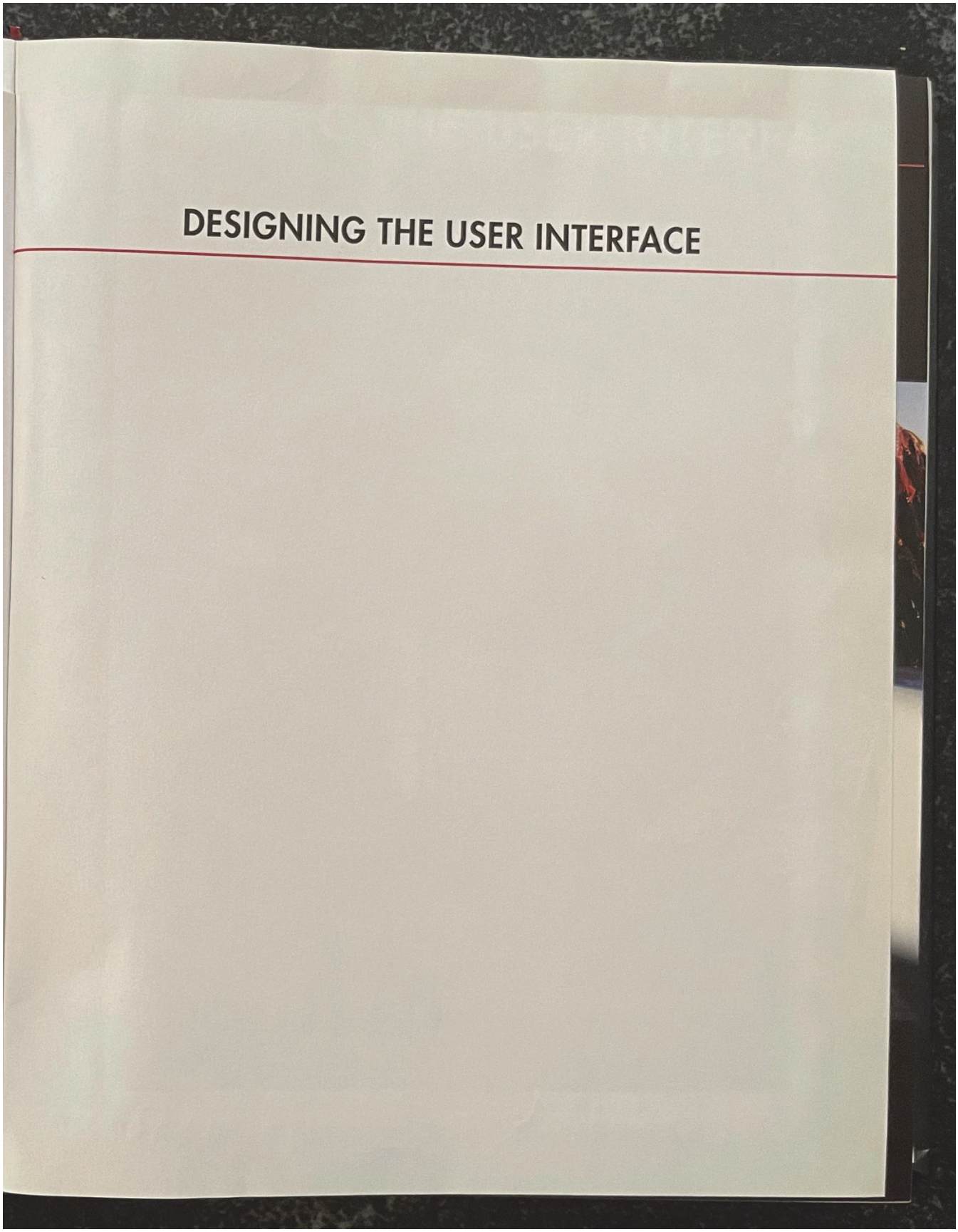
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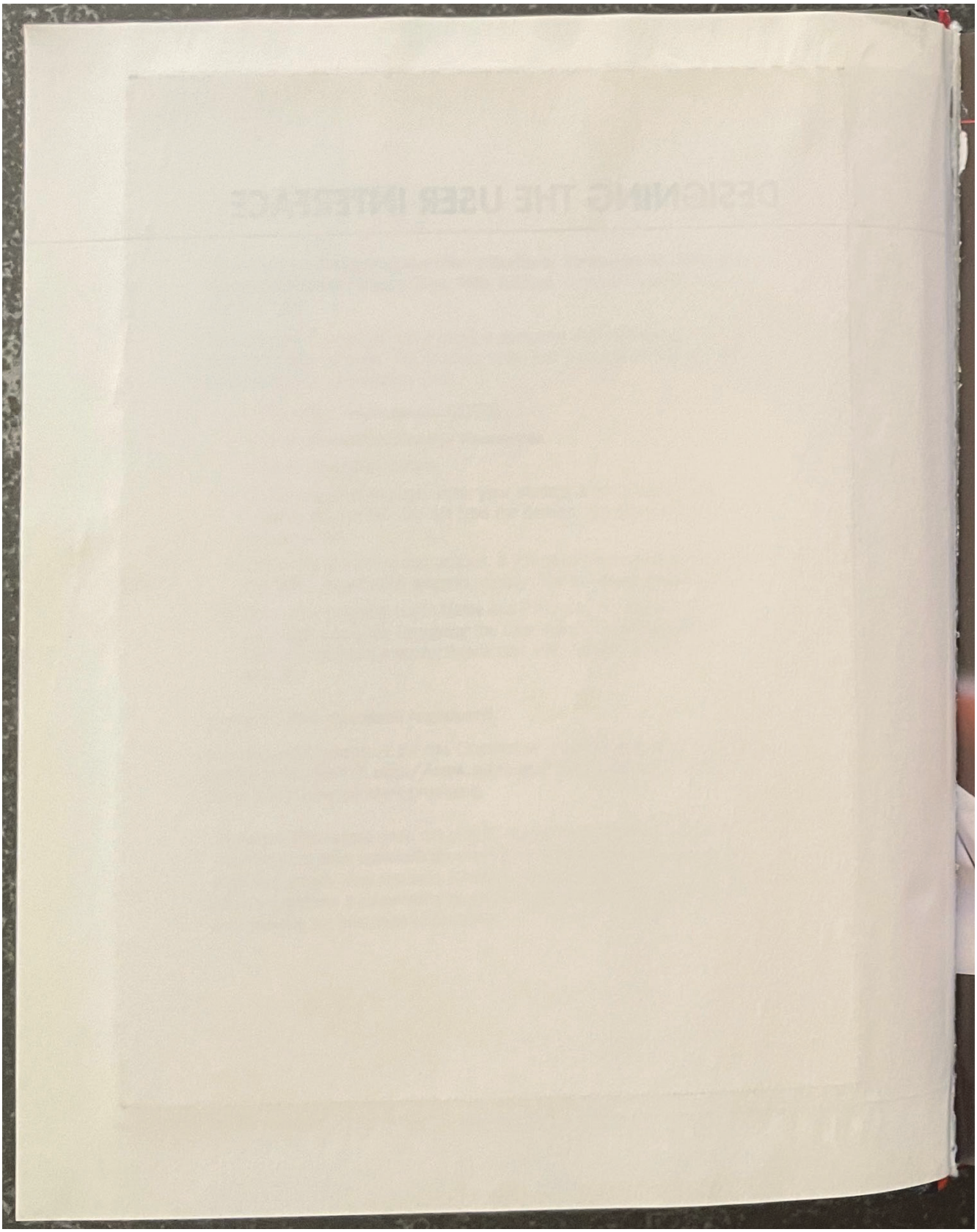

DESIGNING THE USER INTERFACE

Strategies for Effective Human-Computer Interaction / 5th Edition

Ben Shneiderman & Catherine Plaisant

University of Maryland, College Park

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To Jenny and Peter;
Anna, Sara, and Thomas

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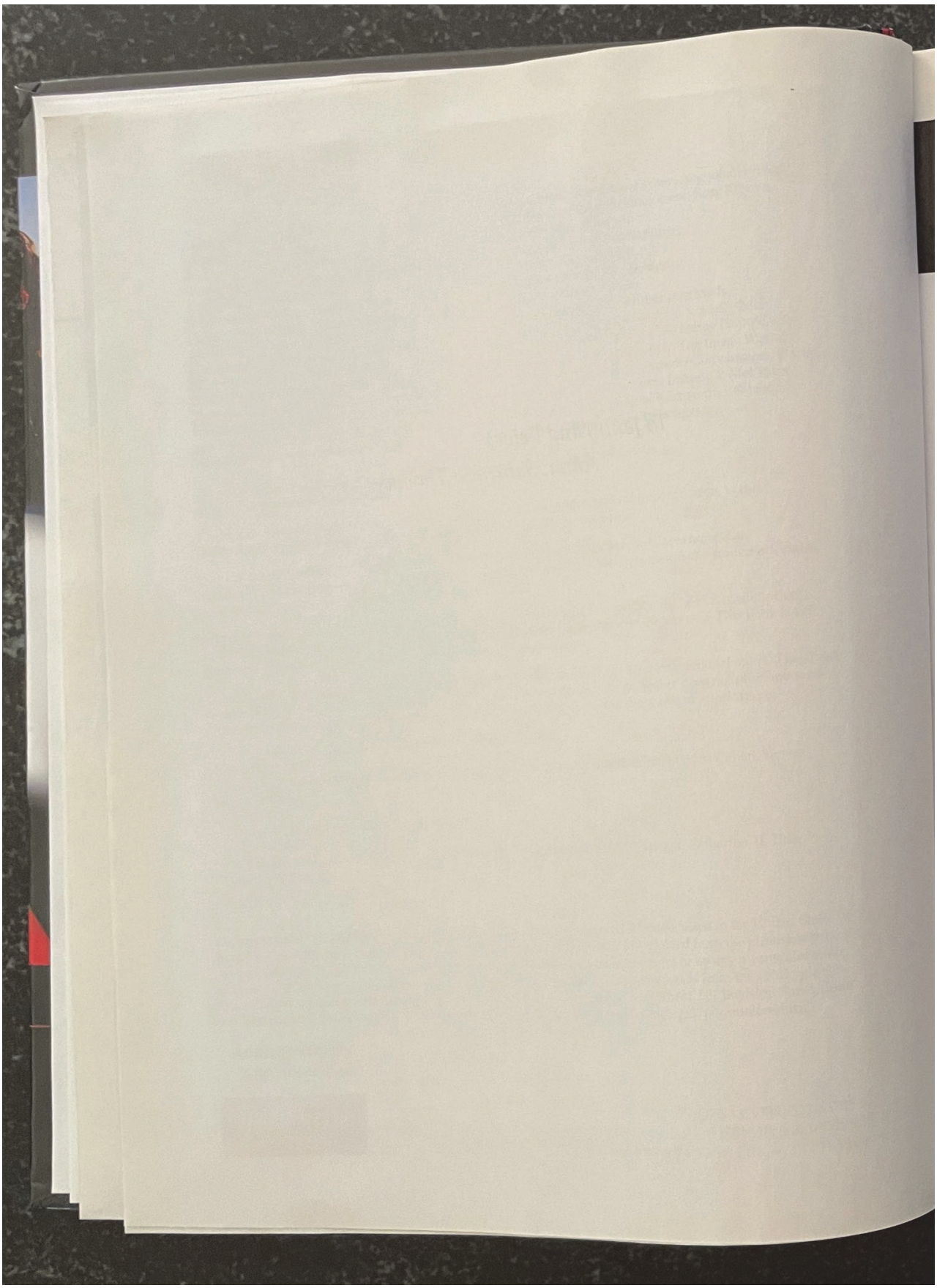

Preface

Designing the User Interface is written for students, researchers, designers, managers, and evaluators of interactive systems. It presents a broad survey of how to develop high-quality user interfaces for interactive systems. Readers with backgrounds in computer science, psychology, sociology, industrial engineering, information science/studies/systems, business, education, and communications should all find fresh and valuable material. Our goals are to encourage greater attention to usability issues and to promote further scientific study of human-computer interaction, including the rapidly emerging topic of social media participation.

Since the publication of the first four editions of this book in 1986, 1992, 1998, and 2005, HCI practitioners and researchers have grown more numerous and influential. The quality of interfaces has improved greatly, while the community of users and its diversity have grown dramatically. Researchers and designers could claim success, but today user expectations are higher, applications are more demanding, and platforms are more varied. In addition to desktop computers, designers now must accommodate web-based services and an increasingly diverse set of mobile devices. User interface designers are moving in new directions: some innovators provoke us with virtual and augmented realities, whereas others offer alluring scenarios for ubiquitous computing, embedded devices, and tangible user interfaces.

These innovations are important, but much work remains to be done to improve the experiences of novice and expert users who still struggle with too many frustrations. These problems must be resolved if we are to achieve the goal of universal usability, enabling all citizens in every country to enjoy the benefits of these new technologies. This book is meant to inspire students, guide designers, and provoke researchers to seek those solutions.

Keeping up with the innovations in human-computer interaction is a demanding task, and requests for an update begin arriving soon after the publication of each edition. The expansion of the field led the single author of the first three editions, Ben Shneiderman, to turn to Catherine Plaisant, a long-time valued research partner, for coauthoring help with the fourth and fifth editions. In addition, two contributing authors lent their able support to this fifth edition: Maxine S. Cohen and Steven M. Jacobs have long experience teaching with earlier editions of the book and provided fresh perspectives that improved the quality for all readers and instructors. In preparing for this edition, we harvested information from books and journals, scanned the World Wide Web,

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attended conferences, and consulted with colleagues. Then we returned to our keyboards to write, producing first drafts that served as a starting point to generate feedback from colleagues, HCI practitioners, and students. The work that went into the final product was intense, but satisfying. We hope you, the readers, will put these ideas to good use and produce more innovations for us to report in future editions.

New in the Fifth Edition

Readers will see the dynamism of human-computer interaction reflected in the substantial changes to this fifth edition. The good news is that most universities now offer courses in this area, and some require it in computer science, information schools (iSchools), or other disciplines. Courses and degree programs in human-computer interaction, human-centered computing, interaction design, etc. are a growing worldwide phenomenon at every educational level. Although many usability practitioners must still fight to be heard, corporate and government commitments to usability engineering grow stronger daily. The business case for usability has been made repeatedly, and dedicated web sites describe scores of studies demonstrating strong return on investment for usability efforts.

Comments from instructors who used the previous editions were influential in our revisions. The main change was to dramatically expand our coverage of social media participation and user-generated content, especially from mobile devices. We deleted the chapter on software tools, as these change so rapidly and deserve more attention than we could give them in a single chapter. Every remaining chapter has been updated with fresh ideas, examples, figures, and references. At the same time, some topics have become less relevant; they, together with older references, have been removed.

The opening chapter addresses the growing issue of ensuring universal usability for increasingly diverse users of interactive systems. The second chapter presents design guidelines, principles, and theories that have been substantially updated to reflect new ways of thinking. Part 2 covers refinements to development methodologies and evaluation techniques. Part 3 explores progress in direct manipulation and its extensions such as virtual and augmented reality, as well as changes to menus, form fill-in, and command languages brought about by the new platforms (especially mobile devices). Since collaboration and social media participation have become so central, the final chapter in this part of the book has been heavily expanded and updated. Part 4 emphasizes Quality of Service and a series of important design issues. Chapter 12 has been thoroughly revised to reflect the vitality of user documentation and

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online help in serving the goal of universal usability. Finally, information search and visualization now have their own chapters, since we believe that these topics have grown dramatically in importance.

We strive to give balanced presentations on controversial topics such as 3D, speech, and natural-language interfaces. Philosophical controversies such as the degree of human control and the role of animated characters are treated carefully to present fairly the viewpoints that differ from our own. We gave colleagues a chance to comment on these sections and made a special effort to provide a balanced presentation while making our own opinions clear, especially in the Afterword. Readers will have to judge for themselves whether we succeeded.

Instructors wanted guidelines and summary tables; these elements are shown in boxes throughout the book. The Practitioner Summaries and Researcher Agendas remain popular; they have been updated. The references have been expanded and freshened with many new sources, with classic papers still included. We worked hard to select references that were widely available and often web-accessible. Figures, especially those showing screen designs, age quickly, so many new user interfaces are shown. Printing in full color makes these figures valuable as a record of contemporary design styles.

Ways to Use This Book

We hope that practitioners and researchers who read this book will want to keep it on their shelves to consult when they are working on new topics or seeking pointers to the literature.

Instructors may choose to assign the full text in the order that we present it or to make selections from it. The opening chapter is a good starting point for most students, but instructors may take different paths depending on their disciplines. For example, instructors might emphasize the following chapters, listed by area:

- Computer science: 2, 5, 6, 7, 8, 9, 10, 13, 14
- Psychology and sociology: 2, 4, 5, 9, 10, 11, 12
- Industrial engineering: 2, 4, 5, 10, 11, 13, 14
- Library and information studies: 2, 4, 9, 11, 12, 13, 14
- Business and information systems: 3, 4, 5, 9, 10, 12, 13, 14
- Education technology: 2, 4, 9, 12, 13, 14
- Communication arts and media studies: 4, 5, 9, 11, 12
- Technical writing and graphic design: 3, 4, 5, 11, 12

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Companion Website (www.aw.com/DTUI)

The presence of the World Wide Web has a profound effect on researchers, designers, educators, and students. We want to encourage intense use of the Web by members of all these groups, but the volatility of the Web is not in harmony with the permanence of printed books. Publishing numerous web site URLs in the book would have been risky, because changes are made daily. For these and other reasons, we have established a Companion Website to accompany this book. We hope that every reader will visit the site, and that you will not hesitate to send us ideas for improving it.

In addition to pointers to current web resources, a variety of supplemental materials for this text are available at the book's Companion Website. The following are accessible to all readers who register using the prepaid access card in the front of this book:

- Links to hundreds of human-computer interaction resources, examples, and research studies that enhance and expand on the material in each chapter
- Chapter/section summaries
- Self-test questions and discussion questions for each chapter
- Homework assignments and projects

PowerPoint lecture slides are also available from Addison-Wesley's Instructor Resource Center (http://www.pearsonhighered.com/irc/). For information about accessing these instructor's supplements, visit the Instructor Resource Center or send an e-mail to *computing@aw.com*.

Acknowledgments

Writing is a lonely process; revising is a social one. We are grateful to the many colleagues and students who have made suggestions for improvements to prior editions. We particularly appreciate the strong contributions from Maxine S. Cohen to Chapters 4, 5, 9, and 12 and Steven M. Jacobs to Chapters 3, 7, 10, and 11, as well as their help throughout the book. Their experiences both in industry and in teaching with the earlier editions of the book over the course of many years added valuable perspectives to this fifth edition. After one two-day kickoff meeting, we collaborated smoothly by using e-mail, LiveSync for draft documents, and Skype for hour-long phone calls every one to three weeks. Cooperative personalities, hard work, and appropriate tools made this massive project possible even with tight time constraints. We look forward to a continuing partnership on the Companion Website and future editions.

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Our close daily collaborators at the University of Maryland have a profound influence on our work: many thanks to Ben Bederson, Allison Druin, François Guimbretière, Kent Norman, Doug Oard, Jennifer Preece, Anne Rose, and Vibha Sazawal. We also appreciate the undergraduate and graduate students who provide encouraging feedback and challenging questions, plus the motivation to keep updating this book.

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Thanks also to Jonathan Feinberg, creator of the clever and free Wordle (http://www.wordle.net/), which we used to make the chapter opening graphics. These graphics are based on word frequencies in each chapter and are used per the terms of the Creative Commons Attribution 3.0 United States License.

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Ben Shneiderman (ben@cs.umd.edu)
Catherine Plaisant (plaisant@cs.umd.edu)

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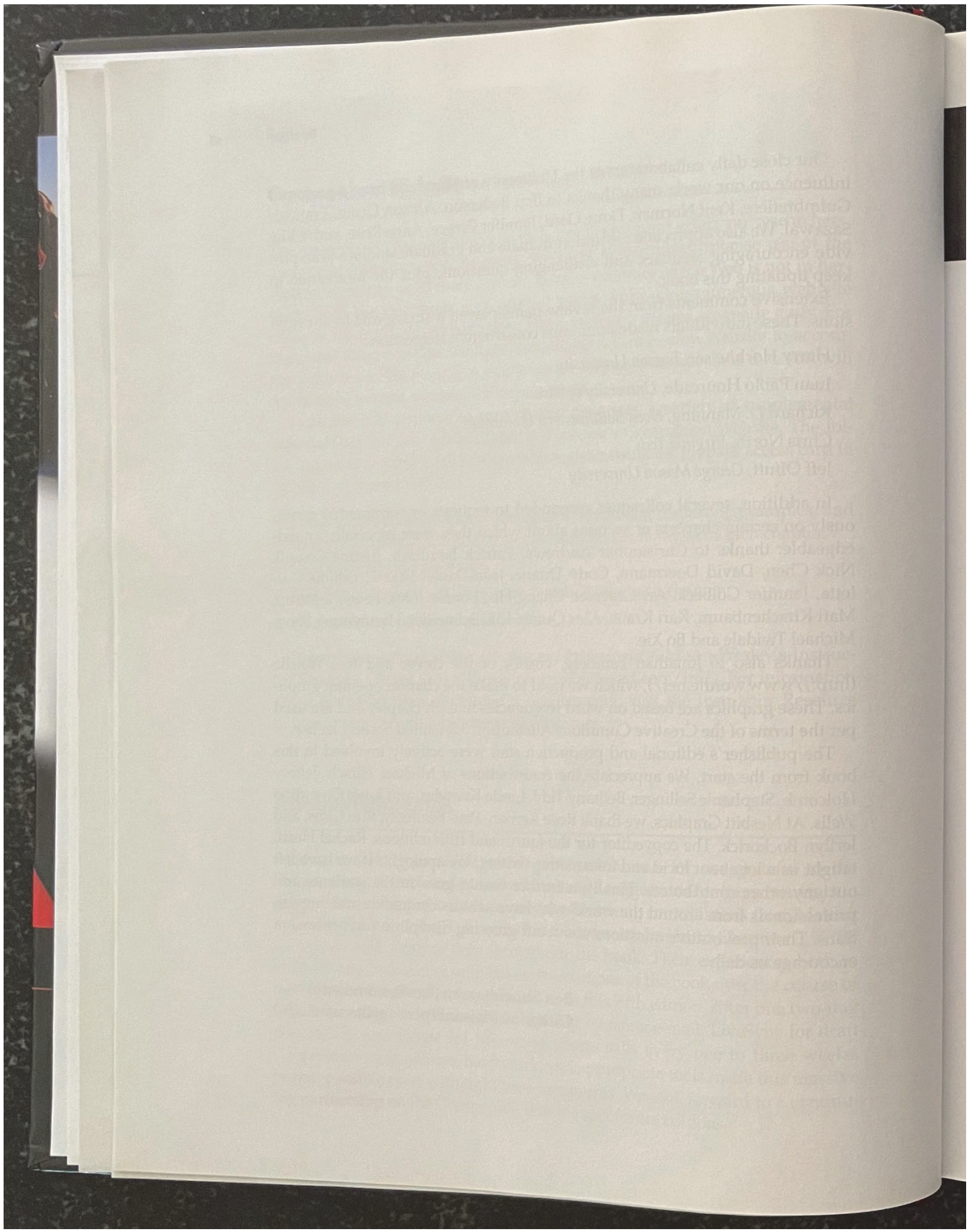

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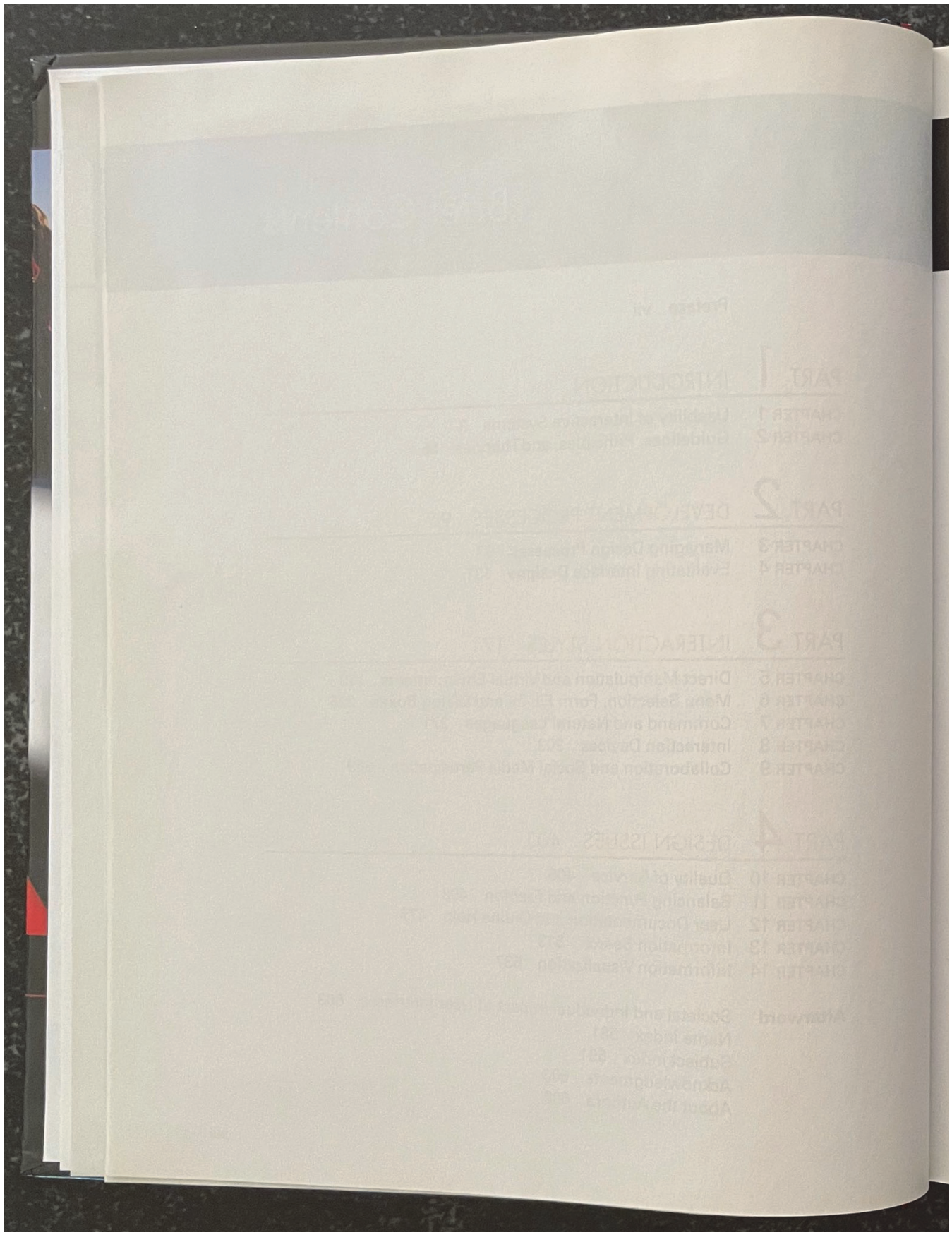

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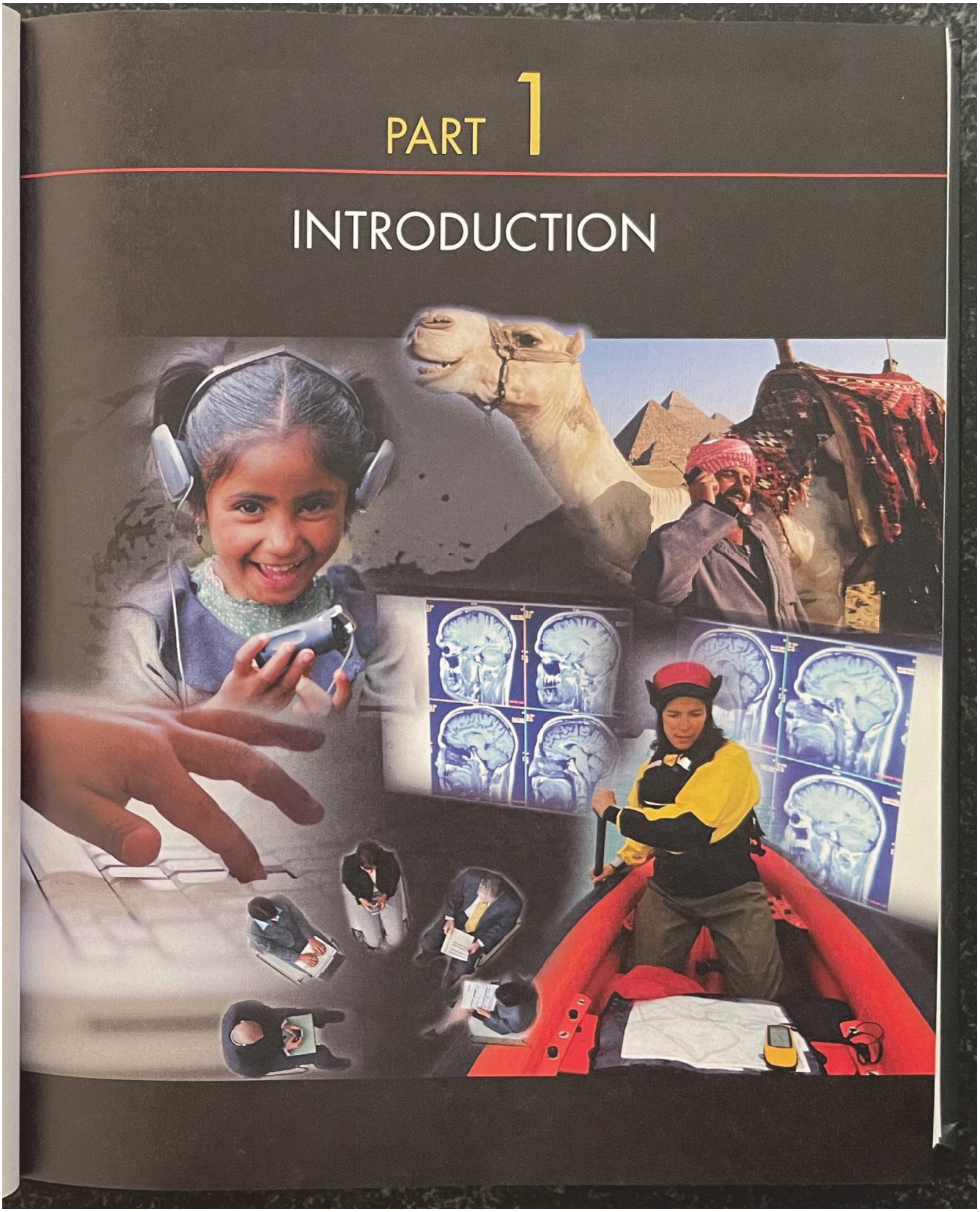
PART 1

INTRODUCTION



zoomable mash-up of Google Maps and Microsoft's Virtual Earth™. Mash-ups are part of an ongoing shift towards a more interactive and participatory World Wide Web aimed at enhancing creativity, collaboration, and functionality. The Web offers an ever-increasing selection of user-generated content and services.

Mash-ups are often created using Ajax, a group of interrelated web-development techniques used for creating interactive web applications or rich Internet applications. With Ajax, web applications can retrieve data from the server asynchronously in the background without interfering with the display and behavior of the existing page.

The recent emergence of web mash-ups and open-source software is driving the development of new practices in software and systems development (Jones et al., 2007). In the area of user-generated content, designers can rapidly create web site applications by combining pre-existing software components. Current World Wide Web technologies such as these permit rapid user interface prototyping and application development, reduce the development risk, and reduce the time-to-market for new web sites.

11.6 Window Design

Computer users frequently have to consult documents, forms, e-mail messages, web pages, and more to complete their tasks. For example, a travel agent may jump from reviewing a client's e-mail request to viewing the proposed itinerary to reviewing calendars and flight schedules to choosing seat assignments and selecting hotels. Even with large desktop displays, there is a limit to how many documents can be displayed simultaneously. An increasing number of users are adopting large, multi-monitor displays, but without sufficient visual cues on such display workstations, they can they miss details (Hoffman et al., 2008).

Designers have long struggled with strategies to offer users sufficient information and flexibility to accomplish their tasks while reducing window-housekeeping actions and minimizing distracting clutter. If users' tasks are well understood and regular, there is a good chance that an effective *multiple-window display* strategy can be developed. The travel agent, for example, might start a client-itinerary window, review flight segments in a schedule window, and drag selected flight segments to the itinerary window. Windows labeled "Calendar," "Seat Selection," "Food Preferences," and "Hotels" might appear as needed, with a charge-card information window appearing at the end to complete the transaction.

If window-housekeeping actions can be reduced, users can complete their tasks more rapidly, and probably with fewer mistakes. The visual nature of win-

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dow use has led many designers to apply direct-manipulation strategies (Chapter 5) to window actions. To stretch, move, and scroll a window, users can point at appropriate icons on the window border and simply click on the mouse button and drag. Since the dynamics of windows have a strong effect on user perceptions, the animations for transitions (zooming boxes, repainting when a window is opened or closed, blinking outlines, or highlighting during dragging) must be designed carefully.

Window design evolved rapidly in the 1980s from influential designs at Xerox PARC to innovative syntheses by Apple for the Macintosh (Fig. 1.1) and finally Microsoft's modest refinements, which led to the highly successful Windows series (1.0, 2.0, 3.1, 95, 98, 2000, NT, ME, XP, and Vista; Fig. 1.2). Overlapping, draggable, resizable windows on a broad desktop have become the standard for most users. Advanced users who work on multiple tasks can switch among collections of windows called "workspaces" or "rooms"; each workspace holds several windows whose states are saved, allowing easy resumption of activity. Much progress has been made, but there is still an opportunity to reduce dramatically the housekeeping chores tied to individual windows and to provide task-related multiple-window coordination.

11.6.1 Coordinating multiple windows

Designers may break through to the next generation of window managers by developing *coordinated windows*: windows that appear, change contents, and close as a direct result of user actions in the task domain. For example, in a medical insurance claims-processing application, when the agent retrieves information about a client, such fields as the client's address, telephone number, and membership number should be automatically filled in on the display. Simultaneously, and with no additional commands, the client's medical history might appear in a second window, and the record of previous claims might appear in a third window. A fourth window might contain a form for the agent to complete to indicate payment or exceptions. Scrolling the medical-history window might produce a synchronized scroll of the previous-claims window to show related information. When the claim is completed, all window contents should be saved and all the windows should be closed with one action. Such sequences of actions can be established by designers or by users with end-user programming tools.

Similarly, for web browsing, job-hunting users should be able to select the five most interesting position-description links and open them all with a single click. Then, it should be possible to explore all of them synchronously to compare the job details (description, location, salary, etc.) using one scrolling action. When one position is selected, it should fill the screen, and the other four should close automatically.

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Software Engineering / User Interface

Ben Shneiderman & Catherine Plaisant
written in collaboration with Maxine S. Cohen & Steven M. Jacobs

Designing the User Interface: Strategies for Effective Human-Computer Interaction provides a comprehensive introduction to the dynamic field of human-computer interaction (HCI). An expanded author team brings unparalleled industry and academic experience to this latest edition. Practical techniques, research-supported design guidelines, and a multitude of current examples and figures illustrate good design principles and practices, effectively guiding readers through their first HCI design projects.

The Fifth Edition addresses the profound changes engendered by user-generated content and social media participation, which increase the need for compelling user experiences. Topics covered include:

- Current HCI issues, with balanced emphasis on mobile devices, the Web, and desktop platforms
- Innovations in social media and social networking
- Strategies for enhancing quality of user-generated content
- Universal usability, sustainable design, and societal transformation
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