INTERACTION DESIGN

SHARP • ROGERS • PREECE

beyond human-computer interaction

5th Edition

Interaction Design continues to be the standard textbook in the field. Seasoned practitioners will find it useful when they need a reference to best practices or to explain a concept to a colleague. Students can turn to *Interaction Design* for an easy-to-understand description of the basics or in-depth how-tos. From personas and disabilities to the design of UX organizations and working in Agile, if you're going to pick one book to bring into the office, it should be this one.

Jofish Kaye, Principal Research Scientist, Mozilla, USA

This is the perfect textbook for a wide range of User interface/User experience design courses. For an undergraduate, it provides a variety of compelling examples that illustrate best practice in Interaction Design. For a graduate student, it provides a foundational overview of advanced topics. This book is also essential for the professional who wants to know the state of the art in Interaction design. I use this textbook and recommend it widely.

Rosa I. Arriaga, Ph.D., Senior Research Scientist, School of Interactive Computing
Georgia Institute of Technology, USA

The *Interaction Design* book has immensely contributed to a growing Namibian HCI skilled community over the last decade. Exposing students, academics and practitioners to the basic principles and theories as well as most recent trends and technologies, with global and local case studies, in the latest edition, allows for reflective applications within very specific contexts. This book remains our number one reference in the education of future generations of interaction designers in Namibia, promoting the creation of thoughtful user experiences for responsible citizens.

Heike Winschiers-Theophilus, Professor, Faculty of Computing and Informatics,
Namibia University of Science and Technology, Africa

Throughout my teaching of user experience and interaction design, the book by Rogers, Preece and Sharp has been an absolute cornerstone textbook for students. The authors bring together their own wealth of knowledge of academic HCI with a deep understanding of industry practice to provide what must be the most comprehensive introduction to the key areas of interaction design and user experience work, now an established field of practice. I put this book in the "essential reading" section of many of the reading lists I give to students.

Simon Attfield, Associate Professor in Human Centred Technology, Middlesex University, UK

Interaction design has gone through tremendous changes in the last few years—for example the rising importance of "big" data streams to design, and the growing prevalence of everyday ubiquitous computing issues of sensing and blending gracefully and ethically into peoples' daily lives. This is an important and timely update to a text that's long been considered gold standard in our field. I'm looking forward to using it with my students to help prepare them for the design challenges they will face in today's industrial practice.

Katherine Isbister, Professor, Computational Media, University of California Santa Cruz, USA

More than ever, designing effective human-computer interactions is crucial for modern technological systems. As digital devices become smaller, faster and smarter, the interface and interaction challenges become ever more complex. Vast quantities of data are often accessed on handheld screens, or no screens at all through voice commands; and AI systems have interfaces that "bite back" with sophisticated dialogue structures. What are the best interaction metaphors for these technologies? What are the best tools for creating interfaces that are enjoyable and universally accessible? How do we ensure emerging technologies remain relevant and respectful of human values? In this book, you'll find detailed analysis of these questions and much more. (It is a valuable resource for both the mature student and the reflective professional.)

Frank Vetere, Professor of Interaction Design, School of Computing and Information Systems,
University of Melbourne, Australia

This is at the top of my recommended reading list for undergraduate and master's students as well as professionals looking to change career paths. Core issues to interaction design are brought to life through compelling vignettes and contemporary case examples from leading experts. What has long been a comprehensive resource for interaction design now incorporates timely topics in computing, such as data at scale, artificial intelligence, and ethics, making it essential reading for anyone entering the field of interaction design.

Anne-Marie Piper, PhD, Associate Professor, Departments of Communication Studies,
Electrical Engineering and Computer Science, Northwestern University, USA

I have been using *Interaction Design* as a textbook since its first edition for both my undergraduate and graduate introductory HCI courses. This is a must-read seminal book which provides a thorough coverage of the discipline of HCI and the practice of user-centered design. The fifth edition lives up to its phenomenal reputation by including updated content on the process of interaction design, the practice of interaction design (e.g., technical debt in UX, Lean UX), design ethics, new types of interfaces, etc. I always recommend *Interaction Design* to students and practitioners who want to gain a comprehensive overview of the fields of HCI and UX.

Olivier St-Cyr, Assistant Professor, Teaching Stream, University of Toronto, Canada

Interaction design is a practice that spans many domains. The authors acknowledge this by providing a tremendous amount of information across a wide spectrum of disciplines. This book has evolved from a simple textbook for HCI students, to an encyclopedia of design practices, examples, discussions of related topics, suggestions for further reading, exercises, interviews with practitioners, and even a bit of interesting history here and there. I see it as one of the few sources effectively bridging the gulf between theory and practice. A copy has persistently occupied my desk since the first edition, and I regularly find myself revisiting various sections for inspiration on how to communicate the reasoning behind my own decisions to colleagues and peers.

William R. Hazlewood, PhD, Principal Design Technologist, Retail Experience
Design Concept Lab, Amazon, USA

For years *Interaction Design* has been my favourite book not only for supporting my classes but also as my primary source for preparing UX studies to industrial and academic settings. The chapters engage readers with easy-to-read content while presenting, harmonically, theories, examples and case studies which touch in multidisciplinary aspects of construction and evaluation of interactive products. The fifth edition again maintains the tradition of being an up-to-date book on HCI, and includes new discussions on Lean UX, emotional interaction, social and cognitive aspects, and ethics in human studies, which are certainly contemporary topics of utmost relevance for practitioners and academics in interaction design.

Luciana Zaina, Senior Lecturer, Federal University of São Carlos, Brazil

This book is always my primary recommendation for newcomers to human-computer interaction. It addresses the subject from several perspectives: understanding of human behaviour in context, the challenges of ever-changing technology, and the practical processes involved in interaction design and evaluation. The new edition again shows the authors' dedication to keeping both the primary content and representative examples up to date.

Robert Biddle, Professor of Human–Computer Interaction, Carleton University, Ottawa, Canada

This fifth edition provides a timely update to one of the must-have classics on interaction design. The changes in our field, including how to deal with emerging sensing technology and the volumes of data it provides, are well addressed in this volume. This is a book for those new to and experienced in interaction design.

Jodi Forlizzi, Professor and Geschke Director, Human-Computer Interaction Institute,
The School of Computer Science, CMU, USA

The milieu of digital life surrounds us. However, how we choose to design and create our experiences and interactions with these emerging technologies remains a significant challenge. This book provides both a roadmap of essential skills and methodologies to tackle these designs confidently as well as the critical deeper history, literature, and poetry of interaction design. You will return to this book throughout your career to operationalize, ground and inspire your creative practice of interaction design.

Eric Paulos, Professor, Electrical Engineering and Computer Sciences, UC Berkeley, USA

Preece, Sharp and Rogers offer once again an engaging excursion through the world of interaction design. This series is always up-to-date and offers a fresh view on a broad range of topics needed for students in the field of interaction design, human-computer interaction, information design, web design or ubiquitous computing. The book should be the book every student should have in their backpack. It is a "survival guide"! It guides one through the jungle of information and the dark technological forests of our digital age. It also helps to develop a critical view on developing novel technologies as our computing research community needs to confront much more seriously the negative impacts of our innovations. The online resources are a great help for me to create good classes and remove some weight from the backpacks of my students.

Johannes Schöning, Professor of Computer Science, Bremen University, Germany

Nearly 20 years have passed since the release of the first edition of *Interaction Design*, with massive changes to technology and thus the science and practice of interaction design. The new edition combines the brilliance of the first book with the wisdom of the lessons learned in the meantime, and the excitement of new technological frontiers. Complex concepts are elegantly and beautifully explained, and the reader is left with little doubt as to how to put them into practice. The book is an excellent resource for those new to interaction design, or as a guidebook or reference to practitioners.

Dana McKay, UX Researcher, Practitioner and Academic, University of Melbourne, Australia

Computers are ubiquitous and embedded in virtually every new device and system, ranging from the omnipresent cellphone to the complex web of sociotechnical systems that envelop most every sphere of personal and professional life. They connect our activities to ever-expanding information resources with previously unimaginable computational power. To ensure interface design respects human needs and augments our abilities is an intellectual challenge of singular importance. It involves not only complex theoretical and methodological issues of how to design effective representations and mechanisms of interaction but also confronts complex social, cultural, and political issues such as those of privacy, control of attention, and ownership of information. The new edition of *Interaction Design* continues to be the introductory book I recommend to my students and to anyone interested in this crucially important area.

Jim Hollan, Distinguished Professor of Cognitive Science, University of California San Diego, USA

Interaction Design continues to be my favorite textbook on HCI. Even named our undergraduate and postgraduate programmes at Aalborg University after it. In its fifth edition, it captures the newest developments in the field's cumulative body of knowledge, and continues to be the most updated and accessible work available. As always, it serves as a clear pointer to emerging trends in interactive technology design and use.

Jesper Kjeldskov, Professor and Head of Department of Computer Science, Aalborg University, Denmark

I got to learn about the field of HCI and *interaction design* when I came across the first edition of this book at the library in my junior year of college. As an HCI researcher and educator, I have been having the pleasure of introducing the subject to undergraduates and professional master's students using the previous editions. I thank the authors for their studious efforts to update and add new contents that are relevant for students, academics, and professionals to help them learn this ever-evolving field of HCI and *interaction design* in a delightful manner.

Eun Kyoung Choe, Professor of Human-Computer Interaction, College of Information Studies,
University of Maryland, USA

This new edition is, without competition, the most comprehensive and authoritative source in the field when it comes to modern interaction design. It is highly accessible and it is a pleasure to read. The authors of this book have once again delivered what the field needs!

Erik Stolterman, Professor in Informatics, School of Informatics and Computing,
Indiana University, Bloomington, USA

This book illuminates the interaction design field like no other. Interaction design is such a vast, multidisciplinary field that you might think it would be impossible to synthesize the most relevant knowledge in one book. This book does not only that, but goes even further: it eloquently brings contemporary examples and diverse voices to make the knowledge concrete and actionable, so it is useful for students, researchers, and practitioners alike. This new edition includes invaluable discussions about the current challenges we now face with data at scale, embracing the ethical design concerns our society needs so much in this era.

Simone D. J. Barbosa, Professor of Computer Science, PUC-Rio,
and Co-Editor-in-Chief of ACM Interactions, Brazil

My students like this book a lot! It provides a comprehensive coverage of the essential aspects of HCI/UX, which is key to the success of any software applications. I also like many aspects of the book, particularly the examples and videos (some of which are provided as hyperlinks) because they not only help to illustrate the HCI/UX concepts and principles, but also relate very well to readers. I highly recommend this book to anyone who wants to learn more about HCI/UX.

Fiona Fui-Hoon Nah, Editor-in-Chief of AIS Transactions on Human-Computer Interaction,
Professor of Business and Information Technology, Missouri University of Science
and Technology, Rolla, Missouri, USA

I have been using the book for several years in my Human-Computer Interaction class. It helps me, not only for teaching, but also for theses supervision. I really appreciate the authors regarding their efforts in maintaining the relevance and up-to-dateness of the Interaction Design book. For example, they put Data At Scale and AgileUX in the new edition. Really love the book!

Harry B. Santoso, PhD, Instructor of Interaction System (HCI) course at Faculty of Computer Science,
Universitas Indonesia, Indonesia

During my PhD already the first edition of *Interaction Design: beyond human-computer interaction* in 2002 quickly became my preferred reference book. Seventeen years later, and now in its fifth edition, I commend the authors for their meticulous and consistent effort in updating and enriching what has become the field's standard introductory textbook. Not just about objects and artefact, design today is increasingly recognized as a sophisticated and holistic approach for systems thinking. Similarly, Preece, Sharp, and Rogers have kept the book's coverage with the times by providing a comprehensive, compelling, and accessible coverage of concepts, methods and cases of interaction design across many domains such as experience design, ubiquitous computing, and urban informatics.

Marcus Foth, Professor of Urban Informatics, QUT Design Lab, Brisbane, Australia

"Interaction Design" has long been my textbook of choice for general HCI courses. The latest edition has introduced a stronger practitioner focus that should add value for students transitioning into practice, for practitioners, and also for others interested in interaction design and its role in product development. It manages to be an engaging read while also being "snackable", to cover the basics and also inspire. I still find it a great read, and believe others will too."

Ann Blandford, Professor of Human – Computer Interaction, University College London

Very clear style, with plenty of active learning material and pointers to further reading. I found that it works very well with engineering students.

Albert Ali Salah, Professor at Utrecht University, the Netherlands

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WILEY

Interaction Design: beyond human-computer interaction, Fifth Edition

About the Authors

The authors are senior academics with a background in teaching, researching, and consulting in the United Kingdom, United States, Canada, India, Australia, South Africa, and Europe. Having worked together on four previous editions of this book, as well as an earlier textbook on human-computer interaction, they bring considerable experience in curriculum development using a variety of media for online learning as well as face-to-face teaching. They have considerable knowledge in creating learning texts and websites that motivate and support learning for a range of students. All three authors are specialists in interaction design and human-computer interaction (HCI). In addition, they bring skills from other disciplines; for instance, Yvonne Rogers started off as a cognitive scientist, Helen Sharp is a software engineer, and Jenny Preece works in information systems. Their complementary knowledge and skills enable them to cover the breadth of concepts in interaction design and HCI to produce an interdisciplinary text and website.

Helen Sharp is a Professor of Software Engineering and Associate Dean in the Faculty of Science, Technology, Engineering, and Mathematics at the Open University. Originally trained as a software engineer, it was by watching the frustration of users and the clever "work-arounds" they developed that inspired her to investigate HCI, user-centered design, and the other related disciplines that now underpin the field of interaction design. Her research focuses on the study of professional software practice and the effect of human and social aspects on software development, leveraging her expertise in the intersection between interaction design and software engineering and working closely with practitioners to support practical impact. She is active in both the software engineering and CHI communities, and she has had a long association with practitioner-related conferences. Helen is on the editorial board of several software engineering journals, and she is a regular invited speaker at academic and practitioner venues.

Yvonne Rogers is the Director of the Interaction Centre at University College London, a Professor of Interaction Design, and a deputy head of department for Computer Science. She is internationally renowned for her work in HCI and ubiquitous computing and, in particular, for her pioneering approach to innovation and ubiquitous learning. Yvonne is widely published, and she is the author of two recent books: *Research in the Wild* (2017, co-authored with Paul Marshall) and *The Secrets of Creative People* (2014). She is also a regular keynote speaker at computing and HCI conferences worldwide. Former positions include Professor of Interaction Design at the Open University (2006–2011), Professor of Human-Computer Interaction at the School of Informatics and Computing at Indiana University (2003–2006), and Professor in the former School of Cognitive and Computing Sciences at Sussex University (1992–2003). She has also been a Visiting Professor at UCSC, University of Cape Town, Melbourne University, Stanford, Apple, Queensland University, and UCSD. She has been elected as a Fellow of the ACM, the British Computer Society, and the ACM's CHI Academy.

Jennifer Preece is Professor and Dean Emerita in the College of Information Studies—Maryland's iSchool—at the University of Maryland. Jenny's research focuses on the intersection of information, community, and technology. She is particularly interested in community participation online and offline. She has researched ways to support empathy and social support online, patterns of online participation, reasons for not participating (for example, lurking and infrequent participation), strategies for supporting online communication, development of norms, and the attributes of successful technology-supported communities. Currently, Jenny focuses on how technology can be used to educate and motivate citizens to engage and contribute quality data to citizen science projects. This research contributes to the broader need for the collection of data about the world's flora and fauna at a time when many species are in rapid decline due to habitat loss, pollution, and climate change. She was author of one of the first books on online communities—*Online Communities: Designing Usability, Supporting Sociability* (2000) published by John Wiley & Sons Ltd and several other HCI texts. Jenny is also widely published, a regular keynote speaker, and a member of the ACM's CHI Academy.

Credits

Acknowledgments

Contents

What's Inside?

Welcome to the fifth edition of *Interaction Design: beyond human-computer interaction* and our interactive website at www.id-book.com. Building on the success of the previous editions, we have substantially updated and streamlined the material in this book to provide a comprehensive introduction to the fast-growing and multi-disciplinary field of interaction design. Rather than let the book expand, however, we have again made a conscious effort to keep it at the same size.

Our textbook is aimed at both professionals who want to find out more about interaction design and students from a range of backgrounds studying introductory classes in human-computer interaction, interaction design, information and communications technology, web design, software engineering, digital media, information systems, and information studies. It will appeal to practitioners, designers, and researchers who want to discover what is new in the field or to learn about a specific design approach, method, interface, or topic. It is also written to appeal to a general audience interested in design and technology.

It is called *Interaction Design: beyond human-computer interaction* because interaction design has traditionally been concerned with a broader scope of issues, topics, and methods than was originally the scope of human-computer interaction (HCI)—although nowadays, the two increasingly overlap in scope and coverage of topics. We define interaction design as follows:

> *Designing interactive products to support the way people communicate and interact in their everyday and working lives.*

Interaction design requires an understanding of the capabilities and desires of people and the kinds of technology that are available. Interaction designers use this knowledge to discover requirements and develop and manage them to produce a design. Our textbook provides an introduction to all of these areas. It teaches practical techniques to support development as well as discussing possible technologies and design alternatives.

The number of different types of interface and applications available to today's interaction designers continues to increase steadily, so our textbook, likewise, has been expanded to cover these new technologies. For example, we discuss and provide examples of brain, smart, robotic, wearable, shareable, augmented reality, and multimodel interfaces, as well as more traditional desktop, multimedia, and web-based interfaces. Interaction design in practice is changing fast, so we cover a range of processes, issues, and examples throughout the book.

The book has 16 chapters, and it includes discussion of the different design approaches in common use; how cognitive, social, and affective issues apply to interaction design; and how to gather, analyze, and present data for interaction design. A central theme is that design and evaluation are interwoven, highly iterative processes, with some roots in theory but that rely strongly on good practice to create usable products. The book has a hands-on orientation and explains how to carry out a variety of techniques used to design and evaluate the wide range of new applications coming onto the market. It has a strong pedagogical design and includes many activities (with detailed comments) and more complex activities that can form the basis for student projects. There are also "Dilemmas," which encourage readers to weigh the pros and cons of controversial issues.

TASTERS

We address topics and questions about the what, why, and how of interaction design. These include the following:

- Why some interfaces are good and others are poor
- Whether people can really multitask
- How technology is transforming the way people communicate with one another
- What are users' needs, and how we can design for them
- How interfaces can be designed to change people's behavior
- How to choose between the many different kinds of interactions that are now available (for example, talking, touching, and wearing)
- What it means to design accessible and inclusive interfaces
- The pros and cons of carrying out studies in the lab versus in the field and in the wild
- When to use qualitative and quantitative methods
- How to construct informed consent forms
- How the type of interview questions posed affects the conclusions that can be drawn from the answers given
- How to move from a set of scenarios and personas to initial low-fidelity prototypes
- How to visualize the results of data analysis effectively
- How to collect, analyze, and interpret data at scale
- Why it is that what people say can be different from what they do
- The ethics of monitoring and recording people's activities
- What are Agile UX and Lean UX and how they relate to interaction design
- How Agile UX can be practically integrated with interaction design throughout different stages of the design process ■

The style of writing throughout the book is intended to be accessible to a range of readers. It is largely conversational in nature and includes anecdotes, cartoons, and case studies. Many of the examples are intended to relate to readers' own experiences. The book and the associated website are also intended to encourage readers to be active when reading and to think about seminal issues. The goal is for readers to understand that much of interaction design needs consideration of the issues, and that they need to learn to weigh the pros and cons and be prepared to make trade-offs. There is rarely a right or wrong answer, although there is a world of difference between a good design and a poor design.

This book is accompanied by a website (www.id-book.com), which provides a variety of resources, including slides for each chapter, comments on chapter activities, and a number of in-depth case studies written by researchers and designers. There are video interviews with a wide range of experts from the field, including professional interaction designers and university professors. Pointers to respected blogs, online tutorials, YouTube videos, and other useful materials are also provided.

Changes from Previous Editions

To reflect the dynamic nature of the field, the fifth edition has been thoroughly updated, and new examples, images, case studies, dilemmas, and so on, have been included to illustrate the changes. Included in this edition is a new chapter called "Data at Scale." Collecting data has never been easier. However, knowing what to do with it when designing new user experiences is much more difficult. The chapter introduces key methods for collecting data at scale, discusses how to transform data at scale to be meaningful, and reviews a number of methods for visualizing and exploring data at scale while introducing fundamental design principles for making data at scale ethical. This is positioned just after two chapters that introduce data gathering and data analysis that discuss fundamental methods.

In this edition, the chapter on the Process of Interaction Design has been re-located to Chapter 2 in order to better frame the discussion of interaction design. It has been updated with new process models and modified to fit its new location in the book structure. This means that the other chapters have been renumbered to accommodate this and the new chapter.

Chapter 13, "Interaction Design in Practice," has been updated to reflect recent developments in the use of practical UX methods. Old examples and methods no longer used in the field have been removed to make way for the new material. Some chapters have been completely rewritten, while others have been extensively revised. For example, Chapters 4, 5, and 6 have been substantially updated to reflect new developments in social media and emotional interaction, while also covering the new interaction design issues they raise, such as privacy and addiction. Many examples of new interfaces and technologies have been added to Chapter 7. Chapter 8 and Chapter 9 on data gathering and analysis have also been substantially updated. New case studies and examples have been added to Chapters 14–16 to illustrate how evaluation methods have changed for use with the continuously evolving technology that is being developed for today's users. The interviews accompanying the chapters have been updated, and two new ones are included with leading figures involved in innovative research, state-of-the-art design, and contemporary practice.

We have decided to continue to provide both a print-based version of the book and an e-book. Both are in full color. The e-book supports note sharing, annotating, contextualized navigating, powerful search features, inserted videos, links, and quizzes.
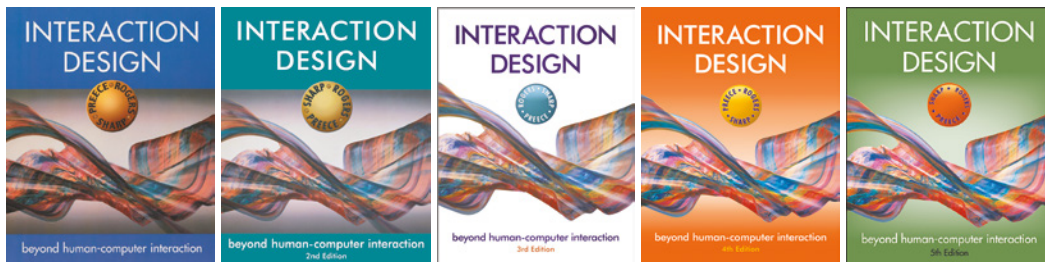
Chapter 1

WHAT IS INTERACTION DESIGN?

Objectives

The main goals of this chapter are to accomplish the following:

- Explain the difference between good and poor interaction design.
- Describe what interaction design is and how it relates to human-computer interaction and other fields.
- Explain the relationship between the user experience and usability.
- Introduce what is meant by accessibility and inclusiveness in relation to human-computer interaction.
- Describe what and who is involved in the process of interaction design.
- Outline the different forms of guidance used in interaction design.
- Enable you to evaluate an interactive product and explain what is good and bad about it in terms of the goals and core principles of interaction design.

1.1 Introduction

How many interactive products are there in everyday use? Think for a minute about what you use in a typical day: a smartphone, tablet, computer, laptop, remote control, coffee machine, ticket machine, printer, GPS, smoothie maker, e-reader, smart TV, alarm clock, electric tooth-brush, watch, radio, bathroom scales, fitness tracker, game console . . . the list is endless. Now think for a minute about how usable they are. How many are actually easy, effortless, and

enjoyable to use? Some, like the iPad, are a joy to use, where tapping an app and flicking through photos is simple, smooth, and enjoyable. Others, like working out how to buy the cheapest train ticket from a ticket machine that does not recognize your credit card after completing a number of steps and then makes you start again from scratch, can be very frustrating. Why is there a difference?

Many products that require users to interact with them, such as smartphones and fitness trackers, have been designed primarily with the user in mind. They are generally easy and enjoyable to use. Others have not necessarily been designed with the users in mind; rather, they have been engineered primarily as software systems to perform set functions. An example is setting the time on a stove that requires a combination of button presses that are not obvious as to which ones to press together or separately. While they may work effectively, it can be at the expense of how easily they will be learned and therefore used in a real-world context.

Alan Cooper (2018), a well-known user experience (UX) guru, bemoans the fact that much of today's software suffers from the same interaction errors that were around 20 years ago. Why is this still the case, given that interaction design has been in existence for more than 25 years and that there are far more UX designers now in industry than ever before? He points out how many interfaces of new products do not adhere to the interaction design principles validated in the 1990s. For example, he notes that many apps do not follow even the most basic of UX principles, such as offering an "undo" option. He exclaims that it is "inexplicable and unforgivable that these violations continue to resurface in new products today."

How can we rectify this situation so that the norm is that all new products are designed to provide good user experiences? To achieve this, we need to be able to understand how to reduce the negative aspects (such as frustration and annoyance) of the user experience while enhancing the positive ones (for example, enjoyment and efficacy). This entails developing interactive products that are easy, effective, and pleasurable to use from the users' perspective.

In this chapter, we begin by examining the basics of interaction design. We look at the difference between good and poor design, highlighting how products can differ radically in how usable and enjoyable they are. We then describe what and who is involved in the process of interaction design. The user experience, which is a central concern of interaction design, is then introduced. Finally, we outline how to characterize the user experience in terms of usability goals, user experience goals, and design principles. An in-depth activity is presented at the end of the chapter in which you have the opportunity to put into practice what you have read by evaluating the design of an interactive product.

1.2   Good and Poor Design

A central concern of interaction design is to develop interactive products that are usable. By this we mean products that are generally easy to learn, effective to use, and provide an enjoyable user experience. A good place to start thinking about how to design usable interactive products is to compare examples of well-designed and poorly designed ones. Through identifying the specific weaknesses and strengths of different interactive products, we can begin to

understand what it means for something to be usable or not. Here, we describe two examples of poorly designed products that have persisted over the years—a voice-mail system used in hotels and the ubiquitous remote control—and contrast these with two well-designed examples of the same products that perform the same function.

1.2.1 Voice-Mail System

Imagine the following scenario. You are staying at a hotel for a week while on a business trip. You see a blinking red light on the landline phone beside the bed. You are not sure what this means, so you pick up the handset. You listen to the tone and it goes "beep, beep, beep." Maybe this means that there is a message for you. To find out how to access the message, you have to read a set of instructions next to the phone. You read and follow the first step:

> 1. Touch 41.
> The system responds: "You have reached the Sunny Hotel voice message center. Please enter the room number for which you would like to leave a message."
> You wait to hear how to listen to a recorded message. But there are no further instructions from the phone. You look down at the instruction sheet again and read:
> 2. Touch*, your room number, and #.
> You do so and the system replies: "You have reached the mailbox for room 106. To leave a message, type in your password."

You type in the room number again, and the system replies: "Please enter room number again and then your password."

You don't know what your password is. You thought it was the same as your room number, but clearly it is not. At this point, you give up and call the front desk for help. The person at the desk explains the correct procedure for listening to messages. This involves typing in, at the appropriate times, the room number and the extension number of the phone (the latter is the password, which is different from the room number). Moreover, it takes six steps to access a message. You give up.

What is problematic with this voice-mail system?

- It is infuriating.
- It is confusing.
- It is inefficient, requiring you to carry out a number of steps for basic tasks.
- It is difficult to use.
- It has no means of letting you know at a glance whether any messages have been left or how many there are. You have to pick up the handset to find out and then go through a series of steps to listen to them.
- It is not obvious what to do: The instructions are provided partially by the system and partially by a card beside the phone.

Now compare it to the phone answering machine shown in Figure 1.1 The illustration shows a small sketch of a phone answering machine. Incoming messages are represented using marbles. The number of marbles that have moved into the pinball-like chute indicates the number of messages. Placing one of these marbles into a dent on the machine causes the recorded message to play. Dropping the same marble into a different dent on the phone dials the caller who left the message.
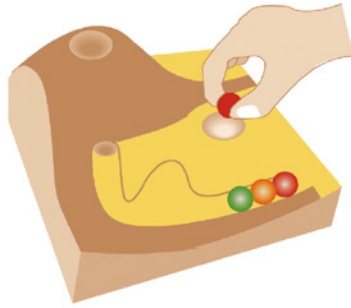
Figure 1.1 The marble answering machine
Source: Adapted from Crampton Smith (1995)

How does the marble answering machine differ from the voice-mail system?

- It uses familiar physical objects that indicate visually at a glance how many messages have been left.
- It is aesthetically pleasing and enjoyable to use.
- It requires only one-step actions to perform core tasks.
- It is a simple but elegant design.
- It offers less functionality and allows anyone to listen to any of the messages.

The marble answering machine is considered a design classic. It was created by Durrell Bishop while he was a student at the Royal College of Art in London (described by Crampton Smith, 1995). One of his goals was to design a messaging system that represented its basic functionality in terms of the behavior of everyday objects. To do this, he capitalized on people's everyday knowledge of how the physical world works. In particular, he made use of the ubiquitous everyday action of picking up a physical object and putting it down in another place.

This is an example of an interactive product designed with the users in mind. The focus is on providing them with a pleasurable experience but one that also makes efficient the activity of receiving messages. However, it is important to note that although the marble answering machine is an elegant and usable design, it would not be practical in a hotel setting. One of the main reasons is that it is not robust enough to be used in public places; for instance, the marbles could easily get lost or be taken as souvenirs. Also, the need to identify the user before allowing the messages to be played is essential in a hotel setting.

Therefore, when considering the design of an interactive product, it is important to consider where it is going to be used and who is going to use it. The marble answering machine would be more suitable in a home setting—provided that there were no children around who might be tempted to play with the marbles!

Video Durrell Bishop's answering machine: **http://vimeo.com/19930744.**

1.2.2   Remote Control

Every home entertainment system, be it the smart TV, set-top box, stereo system, and so forth, comes with its own remote control. Each one is different in terms of how it looks and works. Many have been designed with a dizzying array of small, multicolored, and double-labeled buttons (one on the button and one above or below it) that often seem arbitrarily positioned in relation to one another. Many viewers, especially when sitting in their living rooms, find it difficult to locate the right ones, even for the simplest of tasks, such as pausing or finding the main menu. It can be especially frustrating for those who need to put on their reading glasses each time to read the buttons. The remote control appears to have been put together very much as an afterthought.

In contrast, much effort and thought went into the design of the classic TiVo remote control with the user in mind (see Figure 1.2). TiVo is a digital video recorder that was originally developed to enable the viewer to record TV shows. The remote control was designed with large buttons that were clearly labeled and logically arranged, making them easy to locate and use in conjunction with the menu interface that appeared on the TV screen. In terms of its physical form, the remote device was designed to fit into the palm of a hand, having a peanut shape. It also has a playful look and feel about it: colorful buttons and cartoon icons are used that are distinctive, making it easy to identify them.

Figure 1.2 The TiVo remote control
Source: https://business.tivo.com/

How was it possible to create such a usable and appealing remote device where so many others have failed? The answer is simple: TiVo invested the time and effort to follow a user-centered design process. Specifically, TiVo's director of product design at the time involved potential users in the design process, getting their feedback on everything from the feel of the device in the hand to where best to place the batteries, making them easy to replace but not prone to falling out. He and his design team also resisted the trap of "buttonitis" to which so many other remote controls have fallen victim; that is one where buttons breed like rabbits— a button for every new function. They did this by restricting the number of control buttons embedded in the device to the essential ones. Other functions were then represented as part of the menu options and dialog boxes displayed on the TV screen, which could then be selected via the core set of physical control buttons. The result was a highly usable and pleasing device that has received much praise and numerous design awards.

DILEMMA

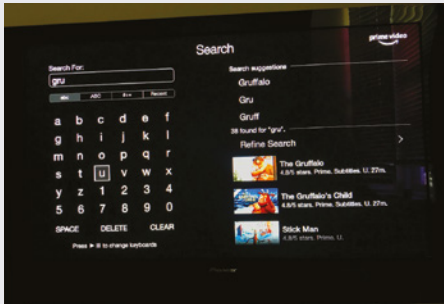### What Is the Best Way to Interact with a Smart TV?

A challenge facing smart TV providers is how to enable users to interact with online content. Viewers can select a whole range of content via their TV screens, but it involves scrolling through lots of menus and screens. In many ways, the TV interface has become more like a computer interface. This raises the question of whether the remote control is the best input device to use for someone who sits on a sofa or chair that is some distance from the wide TV screen. Smart TV developers have addressed this challenge in a number of ways.

An early approach was to provide an on-screen keyboard and numeric keypad that presented a grid of alphanumeric characters (see Figure 1.3a), which were selected by pressing a button repeatedly on a remote control. However, entering the name of a movie or an email address and password using this method can be painstakingly slow; it is also easy to overshoot and select the wrong letter or number when holding a button down on the remote to reach a target character.

More recent remote controls, such as those provided by Apple TV, incorporate a touchpad to enable swiping akin to the control commonly found on laptops. While this form of touch control expedites skipping through a set of letters displayed on a TV screen, it does not make it any easier to type in an email address and password. Each letter, number, or special character still has to be selected. Swiping is also prone to overshooting when aiming for a target letter, number, or character. Instead of providing a grid, the Apple TV interface displays two single lines of letters, numbers, and special characters to swipe across (see Figure 1.3b). While this can make it quicker for someone to reach a character, it is still tedious to select a sequence of characters in this way. For example, if you select a Y and the next letter is an A, you have to swipe all the way back to the beginning of the alphabet.

Figure 1.3 Typing on a TV screen (a) by selecting letters and numbers from a square matrix and (b) by swiping along a single line of letters and numbers
Source: (b) https://support.apple.com/en-us/HT200107

Might there be a better way to interact with a smart TV while sitting on the sofa? An alternative is to use voice control. Remote controls, like Siri or TiVo, for example, have a speech button that when pressed allows viewers to ask for movies by name or more generally by category, for instance, "What are the best sci-fi movies on Netflix?" Smart speakers, such as Amazon Echo, can also be connected to a smart TV via an HDMI port, and, similarly, the user can ask for something general or more specific, for example, "Alexa, play Big Bang Theory, Season 6, Episode 5, on the TV." On recognizing the command, it will switch on the TV, switch to the right HDMI channel, open Netflix, and begin streaming the specific episode. Some TV content, however, requires the viewer to say that they are over a certain age by checking a box on the TV display. If the TV could ask the viewer and check that they are over 18, then that would be really smart! Also, if the TV needs the viewer to provide a password to access on-demand content, they won't want to say it out loud, character by character, especially in front of others who might also be in the room with them. The use of biometrics, then, may be the answer. ■

1.2.1   What to Design

Designing interactive products requires considering who is going to be using them, how they are going to be used, and where they are going to be used. Another key concern is to understand the kind of activities people are doing when interacting with these products. The appropriateness of different kinds of interfaces and arrangements of input and output devices depends on what kinds of activities are to be supported. For example, if the activity is to enable people to bank online, then an interface that is secure, trustworthy, and easy to navigate is essential. In addition, an interface that allows the user to find out information about new services offered by the bank without it being intrusive would be useful.

The world is becoming suffused with technologies that support increasingly diverse activities. Just think for a minute about what you can currently do using digital technology: send messages, gather information, write essays, control power plants, program, draw, plan, calculate, monitor others, and play games—just to name but a few. Now think about the types of interfaces and interactive devices that are available. They too are equally diverse: multitouch displays, speech-based systems, handheld devices, wearables, and large interactive displays—again, to name but a few. There are also many ways of designing how users can interact with a system, for instance, via the use of menus, commands, forms, icons, gestures, and so on. Furthermore, ever more innovative everyday artifacts are being created using novel materials, such as e-textiles and wearables (see Figure 1.4).

Figure 1.4 Turn signal biking jacket using e-textiles developed by Leah Beuchley
Source: Used courtesy of Leah Buechley

The Internet of Things (IoT) now means that many products and sensors can be connected to each other via the Internet, which enables them to talk to each other. Popular household IoT-enabled products include smart heating and lighting and home security systems where users can change the controls from an app on their phone or check out who is knocking on their door via a doorbell webcam. Other apps that are being developed are meant to make life easier for people, like finding a car parking space in busy areas.

The interfaces for everyday consumer items, such as cameras, microwave ovens, toasters, and washing machines, which used to be physical and the realm of product design, are now predominantly digitally based, requiring interaction design (called consumer electronics). The move toward transforming human-human transactions into solely interface-based ones has also introduced a new kind of customer interaction. Self-checkouts at grocery stores and libraries are now the norm where it is commonplace for customers to check out their own goods or books themselves, and at airports, where passengers check in their own luggage. While more cost-effective and efficient, it is impersonal and puts the onus on the person to interact with the system. Furthermore, accidentally pressing the wrong button or standing in the wrong place at a self-service checkout can result in a frustrating, and sometimes mortifying, experience.

What this all amounts to is a multitude of choices and decisions that interaction designers have to make for an ever-increasing range of products. A key question for interaction design is this: "How do you optimize the users' interactions with a system, environment, or product so that they support the users' activities in effective, useful, usable and pleasurable ways?" One could use intuition and hope for the best. Alternatively, one can be more principled in deciding which choices to make by basing them on an understanding of the users. This involves the following:

- Considering what people are good and bad at
- Considering what might help people with the way they currently do things
- Thinking through what might provide quality user experiences
- Listening to what people want and getting them involved in the design
- Using user-centered techniques during the design process

The aim of this book is to cover these aspects with the goal of showing you how to carry out interaction design. In particular, it focuses on how to identify users' needs and the context of their activities. From this understanding, we move on to consider how to design usable, useful, and pleasurable interactive products.

1.3   What Is Interaction Design?

By interaction design, we mean the following:

Designing interactive products to support the way people communicate and interact in their everyday and working lives

Put another way, it is about creating user experiences that enhance and augment the way people work, communicate, and interact. More generally, Terry Winograd originally described it as "designing spaces for human communication and interaction" (1997, p. 160). John Thackara viewed it as "the why as well as the how of our daily interactions using computers" (2001, p. 50), while Dan Saffer emphasized its artistic aspects: "the art of facilitating interactions between humans through products and services" (2010, p. 4).

A number of terms have been used since to emphasize different aspects of what is being designed, including user interface design (UI), software design, user-centered design, product design, web design, user experience design, and interactive system design. Interaction design is generally used as the overarching term to describe the field, including its methods, theories, and approaches. UX is used more widely in industry to refer to the profession. However, the terms can be used interchangeably. Also, it depends on their ethos and brand.

1.3.1   The Components of Interaction Design

We view interaction design as fundamental to many disciplines, fields, and approaches that are concerned with researching and designing computer-based systems for people. Figure 1.5 presents the core ones along with interdisciplinary fields that comprise one or more of these, such as cognitive ergonomics. It can be confusing to try to work out the differences between them as many overlap. The main differences between interaction design and the other approaches referred to in the figure come largely down to which methods, philosophies, and lenses they use to study, analyze, and design products. Another way they vary is in terms of

the scope and problems they address. For example, information systems is concerned with the application of computing technology in domains such as business, health, and education, whereas ubiquitous computing is concerned with the design, development, and deployment of pervasive computing technologies (for example, IoT) and how they facilitate social interactions and human experiences.
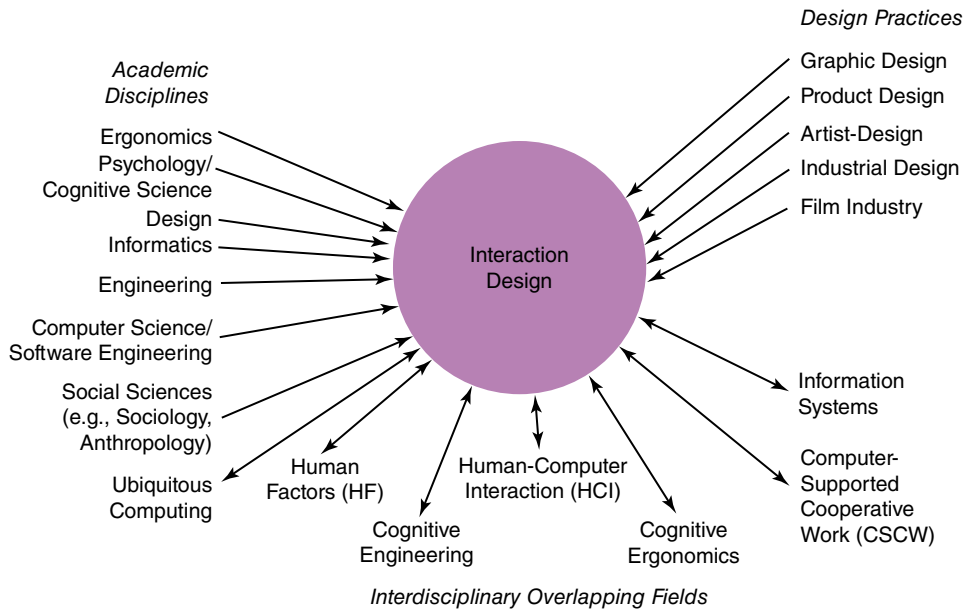
Figure 1.5 Relationship among contributing academic disciplines, design practices, and interdisciplinary fields concerned with interaction design (double-headed arrows mean overlapping)

BOX 1.1

Is Interaction Design Beyond HCI?

We see the main difference between interaction design (ID) and human-computer interaction (HCI) as one of scope. Historically, HCI had a narrow focus on the design and usability of computing systems, while ID was seen as being broader, concerned with the theory, research, and practice of designing user experiences for all manner of technologies, systems, and products. That is one of the reasons why we chose to call our book *Interaction Design: beyond human-computer interaction*, to reflect this wider range. However, nowadays, HCI has greatly expanded in its scope (Churchill et al., 2013), so much so that it overlaps much more with ID (see Figure 1.6). ■