

# CONCEPTUAL DESIGN FOR INTERACTIVE SYSTEMS

Designing for Performance and User Experience

**MK**  
MORGAN KAUFMANN

Avi Parush

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*Morgan Kaufmann* is an imprint of Elsevier  
225 Wyman Street, Waltham, MA, 02451, USA

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ISBN: 978-0-12-419969-9

#### British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

#### Library of Congress Cataloging-in-Publication Data

A catalogue record for this book is available from the Library of Congress

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# Foreword

Technology designers who shape user experiences seek to smooth the path for novices and serve the demanding needs of experts. This was true for fifteenth-century book designers, nineteenth-century train designers, and twenty-first-century smartphone designers. Their innovative designs emerged from a deep empathy for people, sensitivity to diverse social contexts, and imaginative sparks to create new ways of thinking about technology.

When scrolls were reconceived as books, the idea of numbered pages made it possible to have tables of contents, indexes, and cross-references. These breakthrough inventions depended on an understanding of how books would be used differently from scrolls. Similarly, when horse-drawn carriages were reconceived as iron-horse trains and then again as horse-less carriage automobiles, the changes were more profound than giving up on buggy whip holders. New user needs and new technologies required a reconceptualization of the entire user experience. The metaphors, terminology, visual presentation, color, sounds, texture, shapes, and sizes of every component had to be rethought. Then the actions permitted were refashioned to accommodate fresh opportunities and new human needs.

Each generation of designers faces fresh opportunities to remake human experiences in ways that will be easier, safer, more enjoyable, and even more compelling than the past. These considerations were strong in my mind as I developed the direct manipulation concept, which accelerated design thinking by providing a set of principles based on cognitive models. The key principle in the conceptual model was the “visual representation of the objects and actions of interest.” For example, the document and file folder icons were the objects and the trash can was a visual representation of the action of deletion. A second direct manipulation principle was “rapid, incremental and reversible operations.” The bold change was to shift from keyboard typing of commands to mouse or touchscreen dragging, dropping, clicking, double-clicking, hovering, and other actions directly on the objects and actions of interest.

This direct manipulation formulation of the desktop concept enabled teaching and redesign of many applications. It also triggered the idea of making words selectable as highlighted links that helped make the World Wide Web such a remarkable phenomenon. Direct manipulation also led to varied touchscreen designs including tiny keyboards plus gestures on mobile devices, as well as touchscreen home controls, airport kiosks, and museum exhibits. The direct manipulation conceptual model also triggered interactive information visualization strategies with multiple coordinated windows controlled by dynamic query sliders to filter data items from 5–15 windows simultaneously.

Other conceptual model designers carried old designs into new directions, such as transforming paper books into electronic books and automobile dashboard knobs into touchscreen widgets. However, the greatest success of user experience designers is manifest in the 6 billion users of cell phones. While Moore's Law and other technology advances were important ingredients, I think the designer chefs who cooked up the Web browsers, desktops, and the smartphone apps deserve ample credit for their widely admired contributions. Life has been made better, much of the time, because of the facility for human communication to bind families, e-commerce to promote business, improved healthcare to lengthen and improve quality of life, and much more. Of course, cyber-criminals, scammers, spammers, and terrorists have also taken advantage of these new technologies, reminding us that ease of use and universal access have troubling downsides for which we must remain vigilant.

The remarkable modern Renaissance thinker Buckminster Fuller promoted "comprehensive anticipatory design science" which encouraged designers of new conceptual models to think about future impacts, consider unexpected side effects, respect the needs of diverse stakeholders, and ensure universal usability. He also constantly advanced the awareness of planetary impacts and ethical aspects of design. We should continue to read and be inspired by his thinking.

In summary, the progress of technology brings great opportunities and challenges for designers. There are thousands of books and Web sites about the diverse aspects of design, including design thinking, design methods, design theories, design research, and design science. Novice designers can learn much from these diverse sources, but now Avi Parush provides a fresh perspective on how designers can develop the basic concepts, as well as the attendant information architectures that support clear function, logical configuration, memorable navigation and policy, comprehensible forms, and engaging details. Such layered approaches have been a standard feature of design guides, but Parush walks novice and expert designers through the steps of creating functional chunks, conceptual model elements, physical model elements, detailed conceptual elements, and the user interface elements.

Parush's characterizations are precise and illustrated with helpful examples. His careful choice of wording and clear figures guide readers and clarify the concepts. Of course, every traveler and designer has to find his or her own path, but Parush's valuable guide will help user experience designers to make it even easier for novices to learn new systems, while giving experts even more flexibility.

—Ben Shneiderman,  
University of Maryland,  
February 2015

# Preface

## WHAT IS THIS BOOK ABOUT?

This book is about conceptual models and conceptual design of interactive systems.

There are so many attractively designed applications. Nevertheless, many leave the user frustrated. What do you need to consider before designing the screens in order to ensure that the application will provide a positive user experience? Conceptual design is a key step in the process of user interface design that answers that question. And this book offers an effective methodology to do conceptual design.

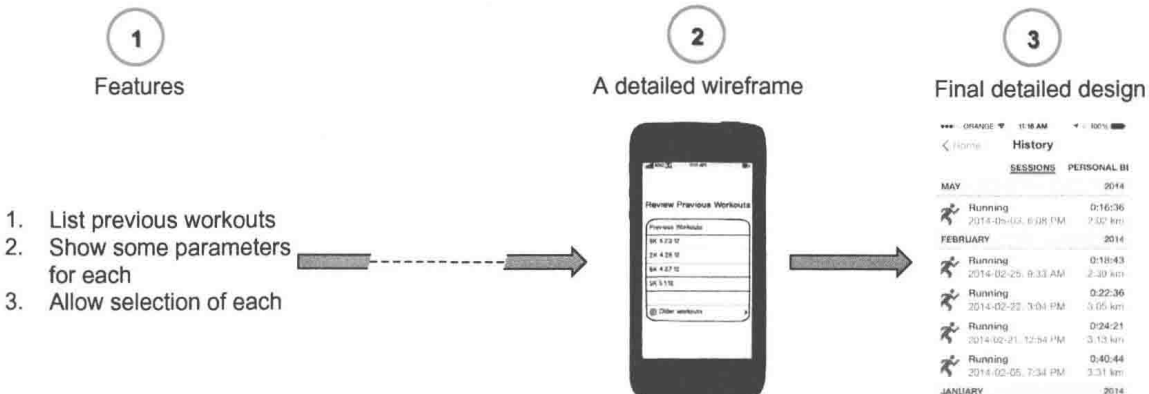
Let us examine a practical example to illustrate where you could encounter conceptual models in the overall context of designing and developing interactive systems. Imagine an application on a mobile device supporting physical workouts. Within such an application, imagine designing the feature of reviewing previous workouts. We can envision a very straightforward 1-2-3 design process consisting of three major steps (Figure 1):

1. Take a few features;
2. Sketch a wireframe, test and revise; and then
3. Finalize the detailed design of the user interface.

However, how exactly did we get from the feature list in step 1 to the detailed wireframe in step 2? There are un-answered questions such as:

- How and when did we decide which items should be grouped? For example, should the “previous workouts” be a group?
- Did we define other *groups* of features? For example, should there be a group of planned workouts?

**FIGURE 1:**  
*A hypothetical three-step design process of a mobile application supporting physical workouts.*

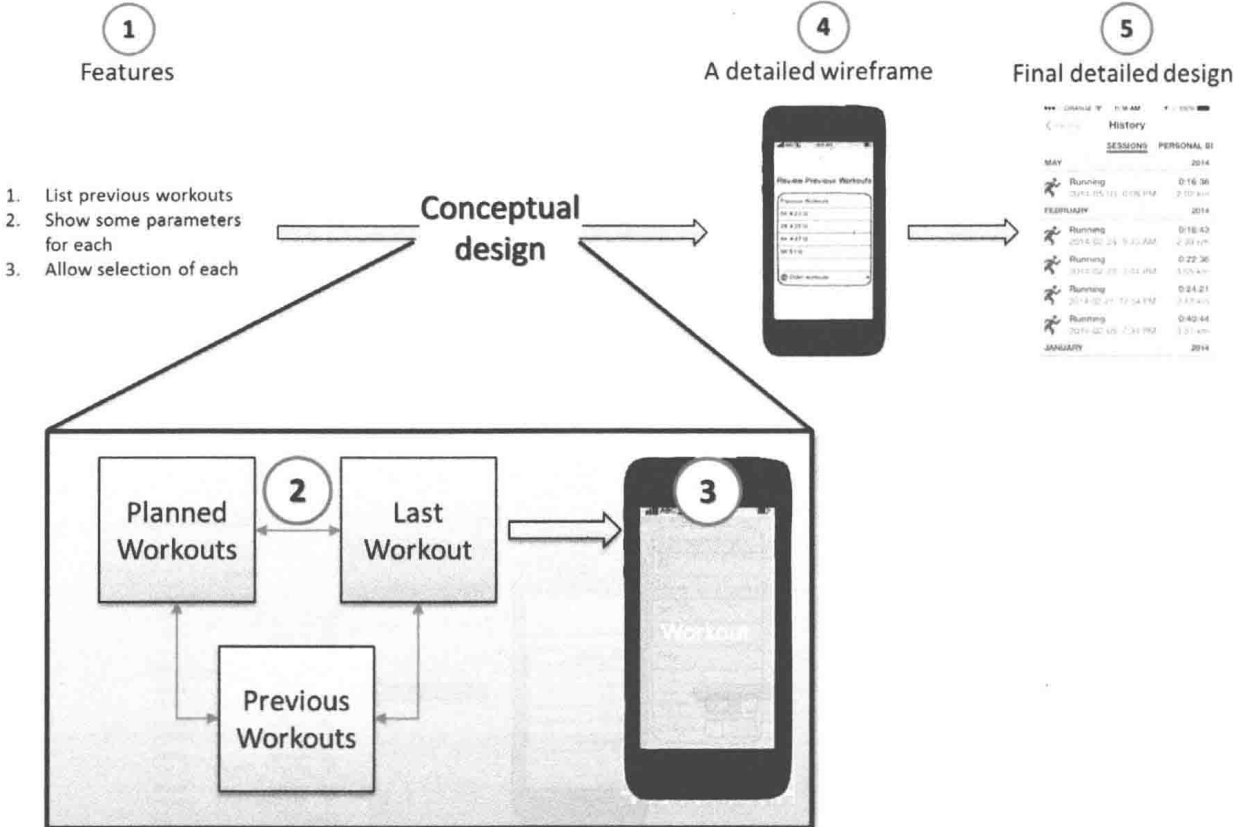


- Did we define the *relations* between the groups? For example, should the planned and previous workout groups be related somehow?
- Did we define if the user should be able to *go* from one group to another? For example, should the user be able to go from the previous workouts group to the planned workouts group?
- Did we determine *where* each of those groups would be? For example, would the previous workouts group be displayed on its own screen or together with planned workouts?
- And more...

These questions and the example reflect a gap in the methodical approach for designing and developing interactive systems. In particular, they reflect a gap between research and requirements (1 in Figure 1), on the one hand, and the detailed design (2 and 3 in Figure 1), on the other hand. However, there is another picture with the gap filled in (2 and 3 in Figure 2).

**FIGURE 2:**  
*Conceptual design as the bridge between doing research and determining features, on the one hand, and detailed design, on the other hand.*

This book addresses the critical steps of the *conceptual design* process. The foundation for this process is effective methodology and good science rather than a magic leap involving more art than science. It fills the gap between research and



analysis and design. In conceptual design, we define the logical model underlying the interactive system that we design and develop.

## Is this book for you?

This book is for you if:

- You design user interfaces.
- You are looking for ways to improve the usability of your product.
- You are looking for a systematic proven foundation to support the creative leap from requirements to design.

If you design user interfaces and are looking for ways to improve the usability of your designs, then this is for you. If you still experience the leap from functional requirements to screen design as a magical mystical experience and you want to introduce a systematic, proven approach, then this is for you. If you review or test user interfaces designed by others and are looking for the words to share your feedback, then this is for you. It is for you whether you are (1) the product manager, (2) the UX or UI designer, (3) the programmer, (4) the marketing person, (5) the graphic designer, (6) an investor, or (7) any other person who has any stake in the product.

Is there any pre-requisite knowledge for using this book? Yes, some. The book focuses on a part of the entire user interface design process: conceptual design. That is why you should know something about the following:

- Fundamentals of user interface, usability, and user experience design
- User-centered or human-oriented design processes
- User research

By studying and using this book, you will achieve two goals:

1. Understand conceptual models in terms of functional chunks, configuration, navigation & policy and in terms of how you can influence human performance, usability, and user experience by the way you define the conceptual model.
2. Implement a solid conceptual design methodology for developing conceptual models.

You can and should devote time to the construction of conceptual models even when you are engaged in an agile or lean development process aimed at expeditiously delivering something to clients and end users. This book challenges the tendency of some developers to think it could be a waste of time to do too much user research, or waste time engaging with wireframes and paper prototypes in exploring various ideas. By engaging in conceptual design instead of skipping this critical phase, you will make the system more usable, saving significant time, money and goods as a result. You can avoid being part of the proliferation of unusable systems and suffer the costs of redesigning those systems to make them effective.



### **How Is the book organized?**

The book has two parts. The first part is a bit theoretical. It focuses on the concept of conceptual models and their impact on human performance, usability, and experience. You can view this part as a primer introducing and discussing this thing we call “a conceptual model.” The second part is the practical part. It focuses on the conceptual design process and the methodology with which we develop the conceptual model. The second part walks you through the steps in developing a conceptual model and you can use it as a “how to” guide.

# Acknowledgements

This endeavor of writing a book was an enormous undertaking for me. But it was possible because so many have supported and inspired me in the long journey to get here.

First and foremost, Debi, my wife, best friend, and partner. For many years we have worked together in the field of human–computer interaction and you actually understand what this book is all about. We have shared many opportunities to develop and crystallize my views on conceptual design and the methodologies that can help develop conceptual models. Debi, you have enabled my dream to write this book become a reality.

My brother Zeev Parush, who is also an experienced professional in the field of user interface design and user experience. We have discussed and debated design in general, the many challenges in conceptual design, and the significance of engaging in it. Zeev, your valuable comments on an earlier draft of the manuscript helped me rethink and rewrite parts of the book.

Professor Ben Shneiderman has been an inspiration throughout the years. I have learned so much from your pioneering ideas and concepts, and from our discussions on research in human–computer interaction. Your support throughout the various phases of my professional and academic career, and your support and encouragement of this book have been very influential.

Professor Tom Hewett with whom I shared many stimulating and enlightening discussions on a variety of issues in human–computer interaction, research, cognitive psychology, ethics, and the differences between an excellent and mediocre single malt.

Clients with whom I have worked in my years as a practitioner in the field of human–computer interaction. All the projects gave me valuable opportunities to develop my model of user interface design in general and conceptual model, in particular.

Generations of students who had to sit through lectures on an abstract topic such as conceptual design, and yet ask thoughtful questions, challenge my ideas, and push me to keep on refining them.

The reviewers of the original book proposal, my friends and colleagues Professor Ben Shneiderman, Whitney Quesenbery, and Dr Ohad Inbar, who have not only provided very constructive advice for how to write the book, but also encouraged me to write it.

The reviewers of an earlier version of the manuscript, Claire Rowland and Linda Lior, who gave great and constructive feedback that helped me revise the manuscript to become a better book.

The people at Morgan Kaufman, the editors Lindsay Lawrence, Meg Dunkerley, Heather Scherer, the production manager Punitha Govindaradjane, and Todd Green. Your support, patience, and understanding made it all possible.

Finally, my dear parents Miriam and Meir. Growing up in an atmosphere of scholarly writing, my parents encouraged me to pursue my academic interests. As an accomplished author on his own, my father inspired me to write. Thank you for the strong foundation my career is built on.

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# The Conceptual Model— Fundamentals

So far, the preface and the title of this section suggested that a key concept in this book is the “conceptual model.” The objective of the first part of the book is to present the fundamentals of the conceptual model in interactive systems and discuss its impact. Briefly, a conceptual model is the configuration of conceptual elements and the navigation between them. As such, a conceptual model is the foundation of the user interface of any interactive system. However, before we proceed any further with abstract-sounding words and sentences, let us dive into an example. Designing an effective and consistent user experience across the interaction channels is challenging. We will put emphasis in the book on this challenge. The running example for this part of the book is a multiple and cross-channel interaction one.





# A Multiple and Cross Channel Example: Setting an Appointment

In order to illustrate the fundamental components of the conceptual model, we introduce and analyze **four existing calendar applications**. Each of the four applications supports setting an appointment and each is on a different interaction channel. Such a comparative illustration can demonstrate how you can achieve the same goal using different conceptual models.

The first step in the interaction flow is common to all four applications: In order to set an appointment, the user can select a starting date and time by pointing at it on the calendar or by activating an option for setting a new appointment. The illustration of the conceptual model starts here after this initial step by looking for what comes next. For the four applications, we will use the following tasks:

1. Defining the basic details of the appointment: topic, place, date, and time.
2. Setting a reminder for the appointment.
3. Setting the appointment as a recurring one.

The sample calendar applications are on the following four interaction channels:

1. Desktop Windows
2. Web-based
3. Tablet
4. Smartphone

The following is a detailed description of the interaction with each of the applications.

**The first application** for setting an appointment is a well-known Windows-based program typically installed on desktop and laptop computers with a familiar graphical user interface (GUI). In the Calendar user interface, the user can perform these tasks in the very first tab of the Appointment window. The label for that window and the first tab is “Appointment” (Figure 1.1). Notice where and how the user performs each of the following tasks in the GUI:

1. Setting the basic appointment parameters: text fields to specify the subject and location of the appointment, in addition to a couple of controls to specify the date and time of the appointment.
2. Setting a reminder: a pop-down list to select the lead time for the reminder.