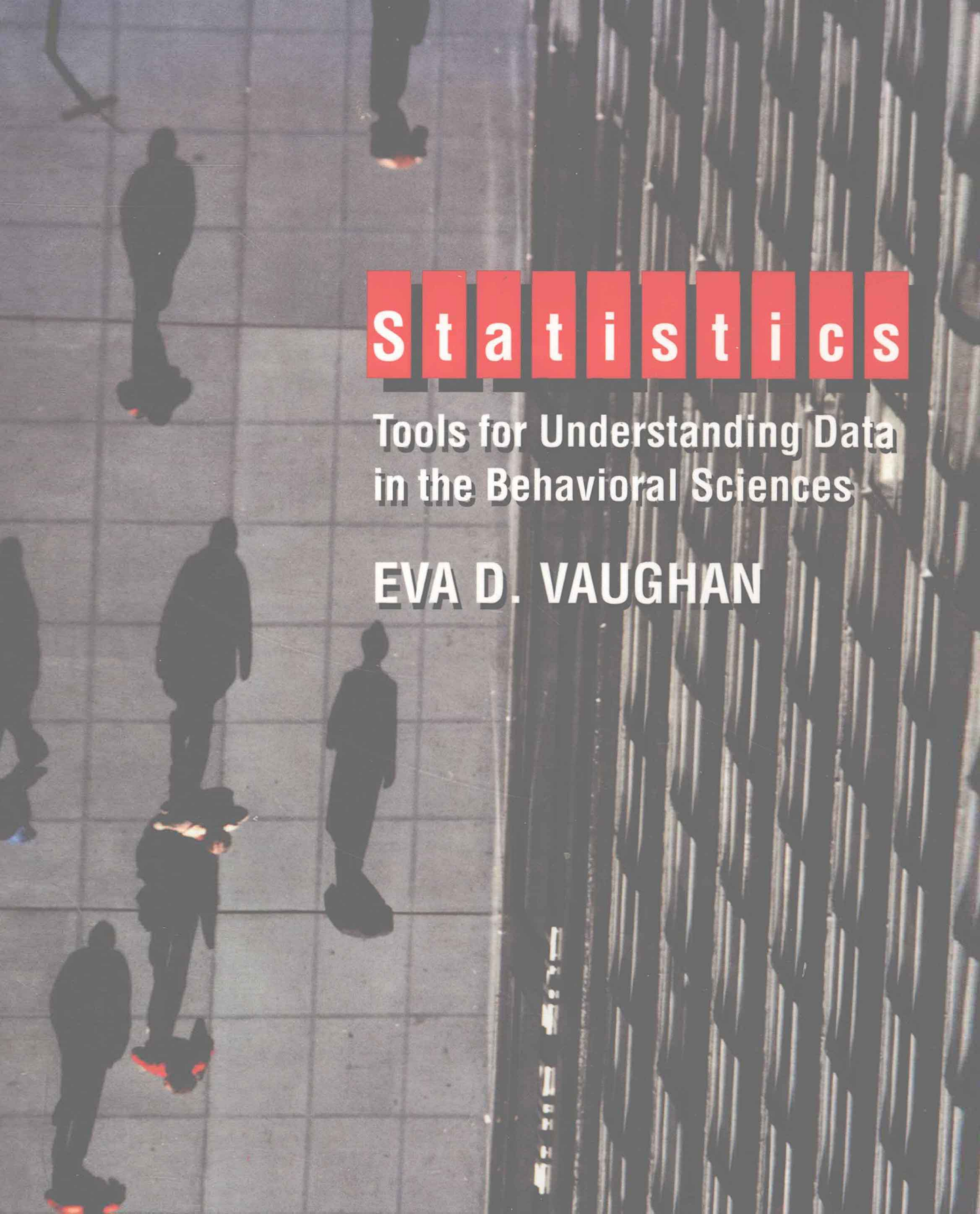

Statistics

Tools for Understanding Data in the Behavioral Sciences

EVA D. VAUGHAN

STATISTICS

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Dedicated to my granddaughter,

Yuriko

May she always be as eager to learn new things as she is now

Preface

Some years ago, I was asked to teach an introductory statistics class for a distance-education program. Most students in the class would have no face-to-face contact with me or other students. They would work with the course materials at their own pace, mail required exercises or homework assignments to me, and take exams, when ready to do so, at designated "testing centers." Obviously, the students would need to rely entirely on their textbook and adjunct printed materials. As I examined possible textbooks, I realized that few, if any, could be used as stand-alone learning materials. This is understandable since statistics courses typically include lectures and other class activities to augment and reinforce the text. I had two alternatives: Choose a published textbook and prepare an extensive set of supplementary learning aids or write a stand-alone book. I chose the latter course.

Earlier versions of the material in this book have been used not only in distance-education settings but also in traditional courses that meet with an instructor for 3 to 4 hours a week. The responses in both settings have been highly favorable, and both students and instructors have asked me, "Why don't you publish this as a textbook?" I finally took their advice, and the book you have in front of you is the result.

Features of this book that support student learning, whether alone or in a class, include the following:

- Objectives at the start of each chapter so that students know what they will be learning and why it is important.
- A conversational writing style to make students feel as though I am speaking to them (many of my students have commented positively on this feature).
- Repeated explanations, stated in several different ways whenever possible, of difficult concepts.
- Many examples illustrating new ideas and procedures.
- Within-chapter exercises, usually seven or more per chapter, that allow students to check their comprehension of relatively small chunks of new information before going on to the next section.
- An appendix containing worked-out answers to all within-chapter exercises. Students are able to determine whether their answers are correct, and, for incorrect answers, what they did wrong.
- End-of-chapter summaries.

In many ways, the sequence of topics in this book is like that of most introductory statistics textbooks. Perhaps the most marked departure is that the theory and practice of hypothesis testing are introduced earlier than usual (in Chapter 5), using the chi square test rather than the z test for a population mean. The reasons for this choice are that (1) frequencies in categories are more familiar to students than means and standard deviations; (2) the rationale of the test is relatively easy to understand; (3) chi square tests always use one tail of the distribution (the rather difficult concept of one-tailed versus two-tailed tests can be deferred until later, after students have mastered the logic of hypothesis testing); and (4) in practice, chi square tests are used far more often than z tests.

I have found this sequence to be very successful. However, instructors who prefer a more traditional sequence can proceed directly from Chapter 4 to Chapter 6. The z test is introduced near the end of Chapter 6. Students can be asked to read the first part of Chapter 5 just before reading about the z test. The rest of Chapter 5 can be left for later in the course.

Another feature that is, I believe, unique in this book is the inclusion of a final chapter, Chapter 15, Connections, which attempts to integrate material taught throughout the previous 14 chapters and to relate that material to other topics in statistics (e.g., meta-analysis) and beyond statistics (e.g., steps in the research process). I hope that instructors will have time to assign Chapter 15 and will find it useful. I would be especially interested in feedback from both instructors and students regarding this chapter.

Throughout the book, I have attempted to follow a piece of advice attributed to Albert Einstein: "Everything should be made as simple as possible, but not simpler." Yes, material should be presented in ways that make learning as easy as possible. But difficult concepts—and there are many of them in statistics—should not be "dumbed down." I believe that most students *can* learn statistics, even the hard stuff, if they put forth the necessary effort and if that effort is supported by a user-friendly textbook. And that is what this book is intended to be.

Many people have contributed to the writing of this textbook. I am especially grateful to the many students who have used these materials, most of them in a distance-learning setting. They have provided me not only with useful suggestions but also the motivation to persist in the task of reworking the materials into a publishable textbook. I owe a great debt, too, to my family for their patience and support. I am sure there were days when my husband wondered whether I still lived in the same house as he did. My friends, too, must have gotten tired of hearing me say, "Sorry, I can't do so-and-so. I have to work on the book." Many thanks to them for understanding.

Thanks, also, to the reviewers who carefully scrutinized early drafts: Barney Beins, Ithaca College; James Chumbley, University of Massachusetts; Susan Donaldson, University of Southern Indiana; Jack Kirshenbaum, Fullerton Community College; Linda Noble, Kennesaw State College; Carol Pandey, L.A. Pierce College; Toni Wegner, University of Virgina; and Patrick Williams, University of Houston. Their comments and criticisms have made this a better book. Any errors that remain are my own.

Lynn Cooper of the University External Studies Program at the University of Pittsburgh has done a great job preparing the manuscript to send to the publisher. Without her skills the job would have been impossible. Finally, let me acknowledge the assistance of Bill Webber, Jennifer Gilliland, and Linda Pawelchak of Prentice Hall. It has been a pleasure working with all of them.

Eva Vaughan

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