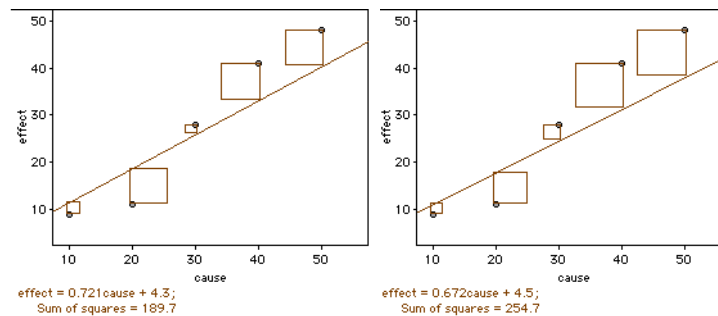


# What Is This Book About?

This is a book of computer-based demonstrations of concepts that appear in many introductory statistics courses. They use the power of Fathom Dynamic Statistics™ software to clarify complicated statistical ideas. For example, if you're studying least-squares linear regression, it really helps to wiggle the line around on a diagram like this one:



and try to minimize the “sum of squares” number, which is the total area of all the squares on the diagram. Before this kind of technology, you might have just believed the regression line some computer or calculator gave you. If you wanted to get to the root of matters, you had to grapple with a formula such as:

$$Y = \bar{y} + r_{xy} \left( \frac{\sigma_y}{\sigma_x} \right) (X - \bar{x}),$$

which is a great formula, but not particularly accessible.

Whether you understand the formula or not, however, seeing what it *looks like* to minimize the sum of squares will make you a more sophisticated user of least-squares lines. Then, when the computer gives you a least-squares line, you will better understand what it is, what it is not, and whether it's what you really want.

The topics in the book range from first-week material such as the median and the mean to quite sophisticated concepts such as the power of a statistical test and the dire consequences of heteroscedasticity.

## How to Use This Book

*Fifty Fathoms* is for teachers and learners of statistics.<sup>1</sup>

If you're a teacher, the most straightforward way to use these demos is as whole-class presentations. You perform these demos for the class—using some projection system—either as an introduction to a topic or as review, perhaps clarifying some idea students have trouble with, or simply showing them the concepts in a different way.

You need no experience with Fathom to do these demos—the hard stuff is mostly done for you in the files on the CD. The book gives you step-by-step instructions pitched to the courageous novice—someone who is experienced with computers but not with this software.

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1. And, as all stats teachers know, we are learners as well:  $T \cap L = T$ .

On the other hand, if you want additional background and some great tips, read *and do* “Tutorial: An Extended Example” on page 13, and look at “A Few Good Skills” on page 17 and “Fathom Overview” on page 19.

Ideally, you should make these demos as interactive as possible: ask students to predict what will happen if you move this point or that slider; have them sketch what they think the next graph will look like; have them discuss with their neighbor the meaning of some value. There are questions within the demos to give you ideas about what to ask, but you will find many opportunities throughout each demo for some give-and-take with the class.

That said, the first time, you may want to stay quite close to the book and not open things up too far. But as you get more comfortable with the software and the material, you can deviate quite widely from the particular path each demo takes.

If you want to make extra copies of these book pages or the computer files, be sure to get permission; write to [publications@eeps.com](mailto:publications@eeps.com).

**Using These Demos As Learning Guides.** You can use these outside of a lecture, however. For example, assign one of these demos for your students to do in groups—at a computer in the back of the class or in the library, say—before you introduce a topic. These demos can also be good for independent, “self-starter” students or as inspirations for projects. In general, however, these are too hard for *independent* work by students learning a statistics topic *for the first time*. This is a book of demos: they supplement *but do not substitute for* a group, a teacher, or a good textbook.

Still, these demos can be great as a reinforcement for learners—such as ourselves—who are *relearning* stats topics. For example, if you have just been told that you’re teaching statistics next semester and you’re feeling a little rusty, these can help. Or these may be perfect for students at the end of the semester, reviewing things they already “know.”

**If You Are a Student.** Use these demos to review material you have already learned, whether you need to remember things you have forgotten or just want to be more secure in your knowledge.


If you are learning these concepts for the first time, you will probably need a textbook, a group, a teacher, or some combination of these, to make best use of these demos. Some of these demos go beyond the typical first course in statistics, so don’t be alarmed if a demo seems to be about something you’ve never heard of (e.g., the Cauchy distribution).

## About the Questions

Most of the demos have explicit questions in the text. Some of these questions are easy and just serve to clarify what’s going on. Some are very hard; some are practically projects in themselves. They appear more or less in order of difficulty. These questions serve at least three different purposes:

- 1 If you’re teaching a class and using these demos with a projector, the easier questions will help you check for understanding; harder ones can be starting points for discussion.
- 2 If you’re teaching a class and assigning demos for students to work through, pick some questions for students to write up and hand in.
- 3 If you’re learning on your own, first try simply to *understand* the questions, then see which ones you can answer.

**Solutions.** Many of the questions are investigatory and open-ended; you can approach them in many ways. Rather than promote “book-bloat” with pages of solutions (including “answers will vary”) that might not fit the path you want to take, we’ve decided to put responses to

selected questions on the web. If you see this thing:  in the side margin, that means that there's a solution on the web at the time of publication. This way, we can update and expand our solutions, discuss topics in more detail, even add new demos—with your input. If you come up with better solutions to a question, or solutions to questions we haven't yet answered, send them to [answers@eeps.com](mailto:answers@eeps.com). Visit <http://www.eeps.com> to see them.

### About Context

The best statistics education uses real data from engaging contexts to illustrate statistical principles. But sometimes, when you need to be general or abstract, reality gets in the way. And a book like this cannot predict what context will be best for *you*. Thus these demos are abstract. We encourage you to endow them with context as you see fit.

For example, in “The Meaning of Mean” on page 22—the very first demo—we use two small sets of pretty-much-arbitrary data. Once you see what the demo is about, however, you could substitute data from the class recorded for some other purpose.

## Software, Installation, and Your License

With this book, you get a CD-ROM. The CD-ROM works with both Windows and Macintosh. Put it in your CD-ROM drive. You will see:

- the **ReadMe** file (which you should read) in two formats,
- a folder called **Fifty Fathoms Files**, and
- a special limited-use edition of Fathom called **FiftyFathoms**.

Do the following:

The limited-use Fathom that comes with this book *is not the same* as the full edition of Fathom. If you have that full edition, *do not use this one*.

**If you already own Fathom.** Copy the **Fifty Fathoms Files** folder and all its contents to your hard disk. It will probably be convenient to put it inside your **Fathom** folder—the folder your Fathom application is located in—perhaps inside the **Sample Documents** folder. Then remove the CD-ROM and put it in a safe place. You're done! Enjoy! Open the files as you would any other Fathom document.

**If you do not already own Fathom.** You will be using a limited-use introductory edition of Fathom included on the CD-ROM by special arrangement with Key Curriculum Press. *This version requires that the CD-ROM be in your computer when you use it.*



Double-click the **FiftyFathoms** application (the icon that looks like a gold ball) to start the program. Choose **Open** from the **File** menu (on the Mac, this is done for you automatically). In the dialog box that appears, navigate to the **Fifty Fathoms Files** folder on the CD, and choose the file you want to open. After you have done this once, you can also open the files simply by double-clicking them.

### Questions about Installation and Use

*Can I copy the files to my hard disk?*

Yes. But it may be best not to copy the application **FiftyFathoms** itself. If you someday buy a full-featured version of Fathom and install it, there's always the chance that your operating system will become confused about which copy of Fathom to run.

*How is the limited-use edition different from the full version?*

With this limited-use edition, you can use all of these demos exactly as they are written. But you cannot customize the files on the CD, make new ones, import or export data, print, copy, use the help system, or open any other Fathom files. For that you need the full-featured edition: visit <http://www.keypress.com> to order the full-featured Fathom or a site license.

And remember:

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To use the limited-use edition of Fathom,  
*you must have the original CD in the drive.*

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*When I double-click a document name, Windows cannot find the application. Why not?*

The first time you use the program, launch the Fathom application by double-clicking the **FiftyFathoms** icon. Then choose **Open** from the **File** menu and navigate to the **Fifty Fathom Files** folder. There, find the file you want and open it. After that, Windows should know that **“.ftm”** documents are associated with Fathom.

*I can't see all the graphs and tables that I can see in the book. I have to keep scrolling around.*

Give Fathom as much screen space as possible. On Windows, maximize the application window and the document window within it. Each file is designed to work at a size of 800 by 600 pixels; at that size, you can see everything in the document without scrolling.

## What You May and May Not Do

Buying this book with the CD-ROM entitles you to copy the documents in the **Fifty Fathoms Files** folder to *one* computer to be used as a demo computer, and to *one* other computer so you can prepare your demos, e.g., one in the classroom and one at home.

This way, a teacher or solo learner can do the demos. But suppose you're a teacher and you want *all* the students in your class to do the demos themselves? What then?

One solution is to have each student buy a book. We offer discounts to bookstores, schools, and individuals for volume sales. Contact [sales@eeps.com](mailto:sales@eeps.com) and check our web site, <http://www.eeps.com>.

If that's too expensive, the first thing you need is a site license for the Fathom software (<http://www.keypress.com>). With a site license, you can install the software on a server or on individual computers, you get additional curriculum materials, and your students get full use of all of Fathom's features. Besides being less expensive than a class set of books, having the software installed is more convenient than keeping track of a class set of the CDs.

If you do opt for a site license, however, we ask that you write for permission to duplicate both the **Fifty Fathoms Files** from the CD and any pages from the book that you want to distribute to your class. Please contact us at [publications@eeps.com](mailto:publications@eeps.com) to tell us how much you will be duplicating; we'll make this work for you at a reasonable cost. For information about permission, you can also check our web site, <http://www.eeps.com>.

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