LEARNING TO PROGRAM

STEVEN FOOTE

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Introduction

Why I Wrote This Book

Like most great (accountant) stories, mine starts with an Excel spreadsheet. The year was 2008, and I was studying accounting at Brigham Young University in Provo, Utah. I was also working as a clerk at the Law School library. One day my boss asked me if I knew how to randomize a list of names in Excel. "Of course," I lied and then proceeded to do what every well-intentioned overpromiser knows to do. Google showed me at least three different ways to randomize a list in Excel, and within 2 minutes, I returned the randomized list to my boss. At that point, she decided that I was good with computers and should work for the library systems department. I'm not certain that an aptitude to Google stuff equates to being good with computers, but I'm grateful that she thought so.

It was there in the law library systems department that my programming journey began. On my first day, my boss gave me a 25-year-old book called *Programming Perl* and showed me to my desk in a windowless room cluttered with old computers, keyboards, and monitors. He was busy with some other things, he told me as he left, but the Perl book would keep me busy until he came back. I opened the book and started reading, and I've never been the same since.

The book was written before Windows even existed, so it expected the reader to be using the UNIX Operating System (which I had never heard of). I ignored that and kept using my Windows XP computer, which had recently been retired from the library's computer lab (before that day, I had no idea there was such a thing as a computer too old for a library computer lab). The book told me to get a copy of Perl by sending a self-addressed, stamped envelope to some address and then getting a floppy disk mailed to me. I decided to use my Google skills instead and found instructions on downloading and installing Perl. I had downloaded software before, but I had no idea you have to download and install programming languages. I was getting a bit nervous that I might be destroying my computer, but I figured it wouldn't really be missed, so I kept going.

The first chapter of the book showed some sample code that was supposed to print `Hello, world!` It looked something like this:

```
print("Hello, world!");
```

I was supposed to save the sample code to a file named `hello_world.pl`. The only software I had ever used to input text into my computer was Microsoft Word, so I opened Word and started typing. It took me about 45 seconds to realize that Microsoft Word was the wrong place to be writing code and 45 minutes to figure out the right place. For all of my Google know-how, I couldn't figure out what to search for to find the right place to type code. I was in a new and unfamiliar world now, and the search terms I was accustomed to were useless. Eventually, I found an answer in Notepad (as you will learn in Chapter 1, "'Hello, World!' Writing Your First Program," Notepad was not the right answer, but it did work), and I continued trudging along, only a little discouraged.

Finally, I typed the code from the book into Notepad and saved the file. Nothing happened. But I was "good with computers," and I knew that if something isn't working, you should try restarting it. So I closed the file and tried to open it again by double-clicking it. A little black box with white text flashed on the screen for a fraction of a second; then it was gone, and Notepad never opened. By this point, I was sure I had broken the computer, and I wasn't quite as confident that my boss wouldn't be upset with a broken computer, however old. Then the idea crossed my mind that my program had actually worked. I ran to the printer across the room to see if I had successfully printed `Hello world!`. The printer sat idly, with no freshly printed paper in the tray. I tried restarting the printer, just in case. No luck. (I didn't find out until much later that `print` means print to the screen, not print on a piece of paper.) The rest of the afternoon proceeded in a similar, frustrating fashion.

By the end of the day, I was feeling like I was *not* good with computers; indeed, the computers were having their way with me, and they seemed to be enjoying it. I was ready to quit, but I needed the job—and I don't like quitting. I wasn't about to let the computers win. Over the following weeks and months, I made slow and sporadic progress. I backtracked a lot, and I had to keep learning the same things over and over again. The only people who might have been able to guide me and answer my questions were either too busy or too experienced to be helpful. Like the Perl book I was reading (which assumed I already knew how to program in C, whatever that was), these potential mentors assumed I knew a lot more than I did. I didn't want to let on how little I knew, for fear of losing my job (probably not a smart move). However, even in those frustrating early days, I could see how powerful programming would be, and I was even having fun. Eventually, the pieces started to come together, and understanding began to emerge.

My introduction to programming was wrong in so many ways, and I realized that anyone trying to teach themselves how to program would have a similar experience. Several times, I wanted to quit, thinking that programming was just for nerdy computer science students anyway. Starting to learn to program is daunting, and the experienced programmers know so much that they seem too intimidating to ask questions. But despite how hard it can be and how many times you might want to bang your head against your desk or throw your computer across the room, programming can be amazingly fun and rewarding. When I realized how great programming can be, I left a Master's degree in accounting and a job at a top accounting firm to pursue it. And I've never looked back. I wrote this book to be the book I wish I'd had when I started programming.

Why You Should Read This Book

Computers are all around us, in almost every aspect of our lives, yet most of us don't really understand how they work or how to make them work for us. We are limited to what the computer already knows how to do. But computers have always been intended to be programmable machines. You can program the computer that is already on your desk to do whatever you want it to do. As the world moves to relying more on computers, programming skills will become essential for everyone, not just professional software engineers and developers. This book will help you learn to program—and have fun doing it.

In the pages that follow, you will build a foundation in programming that will prepare you to achieve all your programming goals. Whether you want to become a professional software programmer, you want to learn how to more effectively communicate with programmers, or you are just curious about how programming works, this book is a great first step in helping to get you there. Learning to program will still be hard, but it will be possible—and hopefully it can be fun instead of frustrating.

Your Project

The best way to learn how to program is to actually program. Throughout this book, you will be programming a complete Chrome extension. A Chrome extension is a program that enhances (or extends) the functionality of the Chrome web browser. The extension we will be building together will ask a user for a name and phone number, then change all the images in the user's Facebook newsfeed to kittens or puppies, based on the user's location (as determined by the phone number). This extension (which we call kittenbook) might not be particularly useful, but it will be fun to build, and it will help you learn a lot of important programming concepts along the way.

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1

"Hello, World!" Writing Your First Program

Note

Project: Create a Google Chrome Extension.

Welcome to the world of programming! I believe that the best way to learn how to program is to actually program (but you already know that because you totally didn't skip the introduction), so we're going to build a program in this chapter. The program will be the first part of a larger project that we will build throughout this book. Go get in front of your computer if you're not already there—you have some code to write!

One word of warning before we get started: We are going to cover a few things in this chapter that you won't immediately understand. Not understanding what you are doing is (for me at least) a big part of programming computers. By the end of the book, all the mysteries will be revealed. For now, trust me.

Choose a Text Editor

One of the most important parts of programming is writing code (but, as discussed in the sidebar, coding and programming are not exactly the same thing). When I say *code*, I mean instructions for a computer written in a programming language that the computer can understand. Code is written in plain-text files using a text editor. Your text editor is perhaps your most important tool (like Robin Hood's bow, King Arthur's Excalibur, and Susan Boyle's voice). You have many text editors to choose from, so choose wisely.

Programming vs. Coding

The difference between programming and coding might be subtle, but it is significant. Coding is just a part of programming. In fact, coding is probably the *easiest* part of programming. Programming includes such tasks as creating an environment in which your code can successfully be executed, organizing your code in a logical way, testing your code to identify errors, debugging your code to find what is causing those errors, working with code and frameworks that others write, and packaging your code in a way that others can use it. When you know how to program, coding can be a lot more fun.

Tip

My first mistake in learning to program was my choice of text editors. I had previously used only Microsoft Word for putting my words and thoughts into a computer, so I tried programming in Word. It didn’t take long for me to realize that didn’t work. Next, I opened up Notepad and used that for months before I discovered the amazing alternatives I could have been using. Notepad doesn’t include any of the core features every good text editor should have. Learn from my mistakes. For crying out loud, don’t use Notepad for programming.

Core Features

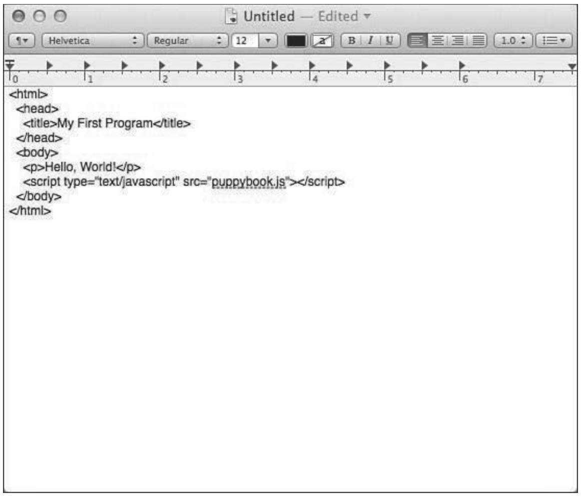
Several text editors are designed specifically for coding. The next section outlines some of the more popular text editors and their most important features. All these editors share a few core features: monospace type font, syntax highlighting, text completion, and extensibility.

Monospace Type Font

Monospace type font is a font style in which every character takes up the same amount of space. In other words, an *i* is as wide as a *w* and also as wide as a space. At first you’ll think the characters look ugly and awkward, but with time, you will come to tolerate, appreciate, then find beauty in the formatting that monospace type font brings to your code.

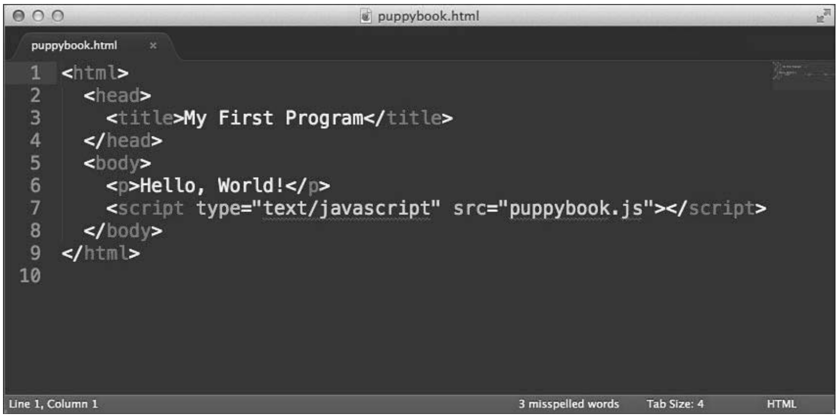
Syntax Highlighting

Just as the English language has nouns, verbs, adjectives, and so on, programming languages are made up of different parts (such as *variables*, *reserved words*, and *strings*). A good text editor differentiates the various parts of programming languages, usually with different text colors. Take a look at Figures 1.1 and 1.2. Even without knowing what the code means, you can see that Figure 1.2 is much easier to look at. Syntax highlighting can also help you find typos in your code.



```
<html>
  <head>
    <title>My First Program</title>
  </head>
  <body>
    <p>Hello, World!</p>
    <script type="text/javascript" src="puppybook.js"></script>
  </body>
</html>
```

Figure 1.1 An HTML document in a nonmonospace type font.



```
<html>
  <head>
    <title>My First Program</title>
  </head>
  <body>
    <p>Hello, World!</p>
    <script type="text/javascript" src="puppybook.js"></script>
  </body>
</html>
```

Figure 1.2 The same HTML document with monospace type font. Is this not much easier to read (and much prettier, too)?

Text Completion

When writing code, you need to type the same words over and over again. For the code to work properly, the words must be typed exactly the same way every time (for example, `myCode` is not the same as `MyCode` or `mycode`). Tiny misspellings and typos are hard to find and can cause major headaches. Every good text editor includes text completion of some sort—similar to the way Google can guess what you're going to search for, your text editor can guess what you're going to type (see Figure 1.3). Using text completion helps you write code faster and can also help you avoid typos and other errors.

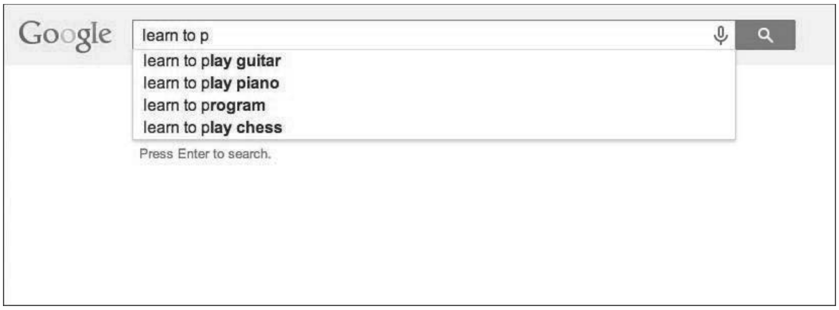


Figure 1.3 Good text editors guess what you want to type, just as Google guesses what you want to search for.

Extensibility

Text editors that are meant for programmers should allow those programmers to build extensions and plug-ins to enhance and modify the behavior of the editor. For example, extensions can modify the appearance of the editor, check code for errors, or quickly add a "snippet" of code to a file. As you will see throughout this book, extensibility is important not only for text editors, but for nearly all software. Almost certainly, there are some features the original creator didn't think of, didn't have time to build, or didn't want. Extensibility makes it possible for those features to be built by anyone who wants to build them.

Making Your Choice

Choosing the best text editor for you depends on your preferences (and your willingness to pay), as well as the project you are working on. I use Vim for most of my coding, but I use IntelliJ when I write Java code, and I use Xcode when I work on iOS apps. The following overview of text editors should help you make your decision.

What Is an IDE?

In the next chapter, you learn about how your computer actually executes the code you write in your text editor. Part of that process involves having an environment that can understand and execute your code. In this book, we use a programming language called JavaScript; the environment that can understand and execute JavaScript is a web browser. For some other programming languages, the text editor is also an environment that understands and executes the code. These special types of text editors are called integrated development environments, but their friends call them IDEs. An IDE is a powerful tool for languages that need an IDE. Your web browser can be just as powerful for writing JavaScript code.

Sublime Text

- Sublime Text has a wide array of plug-ins that can help make you more productive. It is easy to use and has an attractive (dare I say sublime?) user interface.
- It is available on Windows, Mac, and Linux.
- Sublime Text is a good choice for beginners. It is simple and intuitive, and it follows many of the conventions you are familiar with from using a word processor.
- A Sublime Text license costs $70, but you can try it for free.
- Sublime Text is a simple text editor, not a full-fledged IDE.
- You can download Sublime from http://www.sublimetext.com/.

TextMate

- TextMate and Sublime Text have many of the same plug-ins—a plug-in for one usually works with the other. TextMate is easy to learn and easy to use.
- It is available only on Mac.
- As with Sublime Text, TextMate is a good choice for beginners. You can get started and be productive without needing to learn anything new.
- A TextMate license costs $55, but you can try it for free.
- TextMate is a simple text editor, not a full-fledged IDE.
- You can download TextMate from http://macromates.com/.

Notepad++

- Notepad++ is a great option if you are using Windows. The "++" (pronounced "plus plus") comes from the programming language C++; the idea is that C++ is like C, but better—so Notepad++ is like Notepad, but better.
- It is available only on Windows.
- Notepad++ is easy to use and great for beginners.
- Notepad++ is free.
- NotePad++ is a simple text editor, not a full-fledged IDE.
- You can download Notepad++ from http://notepad-plus-plus.org/download/.

Gedit

- Gedit is a good basic editor, but it's not as visually appealing as some of the other editors. If you're using Linux, it is probably already installed.

- It is available on Windows, Mac, and Linux.
- Gedit is easy to use and easy to learn.
- Gedit is free.
- Gedit is a simple text editor, not a full-fledged IDE.
- You can download Gedit from https://wiki.gnome.org/Apps/Gedit/.

Vim

- Vim takes a while to learn, but once you know what you're doing, you can work quickly, with a wide range of shortcuts and plug-ins. Additionally, Vim is compatible with nearly every operating system and is often already installed, so working on an unfamiliar OS is less unfamiliar when you use Vim. I used to be afraid of Vim, but now it's my favorite editor.
- It is available on nearly every operating system ever created (it comes preinstalled on Mac OS X and Linux, but you have to install it yourself on Windows). Vim is like a cockroach: It can survive nearly anywhere, and it will still be around long after the rest of us are gone.
- Vim is not easy to learn and is probably not a great editor for beginners. If you want to learn Vim, though, you can find plenty of resources, including a built-in tutorial (type **`vimtutor`** on the command line).
- Vim is free.
- Vim is a simple text editor, not a full-fledged IDE.
- You can download Vim from www.vim.org/download.php if it's not already installed.

Eclipse

- Eclipse is a full-featured IDE generally used for Java programming. If you are working on a Java project, this is a great choice.
- It is available on Windows, Mac, and Linux.
- Eclipse is not particularly easy for beginners to start using because it is far more than a simple text editor. However, learning to program Java using Eclipse or IntelliJ is much easier than using one of the simple text editors listed previously.
- Eclipse is free.
- Eclipse is an IDE focused on Java development.
- You can download Eclipse from www.eclipse.org/downloads/.

IntelliJ

- IntelliJ is a full-featured IDE for Java that is a bit more lightweight (and, arguably, better looking) than Eclipse. IntelliJ also offers support for other languages, such as Scala and JavaScript.
- It is available on Windows, Mac, and Linux.
- IntelliJ is about as easy to learn as Eclipse.
- IntelliJ is available in a free Community Edition. A license for the Ultimate Edition costs $199.
- IntelliJ is a full-featured IDE.
- You can download IntelliJ from www.jetbrains.com/idea/.

Xcode

- If you are writing an iOS or Mac OS X app, Xcode is the IDE for you. Xcode is an IDE built by Apple for the purpose of building software for Apple platforms.
- It is available only on Mac.
- Xcode is not easy to learn, but Apple has extensive documentation and you can find a lot of community support. If you want to learn to build iPhone apps, you need to learn to use Xcode.
- Xcode is free.
- You can download Xcode from https://developer.apple.com/xcode/ or the Mac App Store.

Visual Studio

- Visual Studio is a full-featured IDE mostly used for .NET development (C#, Visual Basic, and so on), but it can also be used for other languages.
- It is available only on Windows.
- Visual Studio is as easy to learn as any other full-featured IDE—not too easy.
- Visual Studio is available for free as an Express Edition, which is both good and usable. The paid editions of Visual Studio range in price from $1,200 to $13,300.
- You can download or purchase Visual Studio from www.visualstudio.com/downloads/download-visual-studio-vs.

I haven't mentioned all the editors here, but this list should be enough to get you started. For the purposes of this book, I recommend Sublime Text (unless you have experience with one of the other editors). Sublime Text is more than good enough for our purposes and is easy to start using.

Create a Project Directory

Before we start writing our code, we need a place for it to live. Computer programs are usually a collection of multiple files working together, so it is a good idea to group all the files you will need for a project in a single folder (folders are often called directories—I use *folder* and *directory* interchangeably in this book). I have a directory called `projects` where I group all such project directories. Create a directory called `kittenbook` somewhere on your hard drive. You can create a new directory by using your file browser (Finder on Mac, Windows Explorer on Windows, and Nautilus on Linux) and clicking File → New Folder.

Start Small: Create a Test File

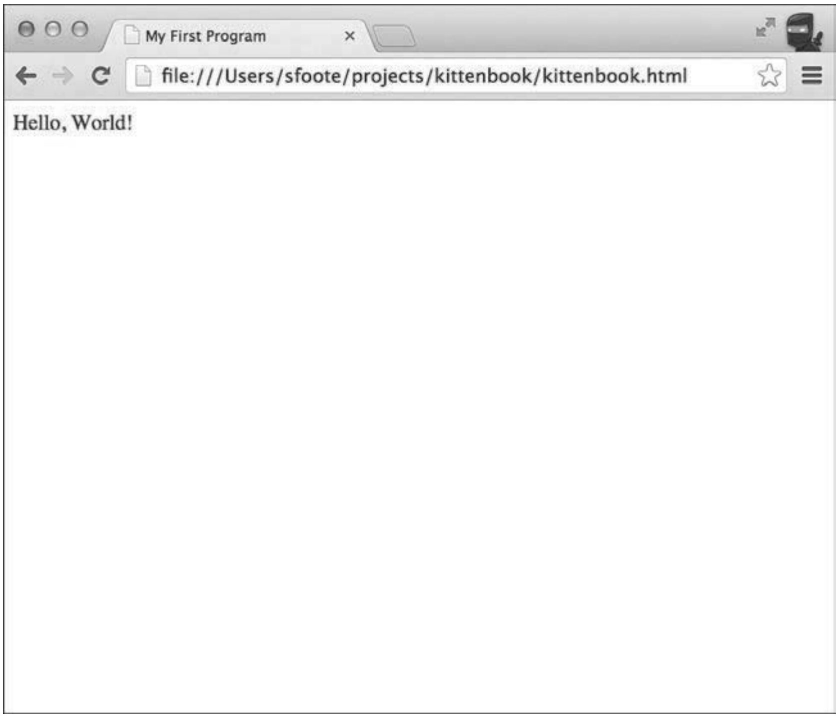
Now that you have your project directory, let's start programming. The first thing you're going to do is create an HTML file in your `kittenbook` directory called `kittenbook.html`. You can create a new file in a few different ways, but the easiest is to open your chosen text editor, create a new file (click File → New File), and then save it as `kittenbook.html` (File → Save As, then find your `kittenbook` directory, type in **`kittenbook.html`** as the filename, and click Save). Now fill in `kittenbook.html` with the code in Listing 1.1.

Listing 1.1 **`kittenbook.html`**

```
<html>
    <head>
        <title>My First Program</title>
    </head>
    <body>
        <p>Hello, World!</p>
    </body>
</html>
```

Save the file and then open it in a web browser by double-clicking it in your file browser. You should see something similar to Figure 1.4.

Take a break to enjoy this moment. Now look back at your code and compare it to what you see in the web browser. You should see `Hello, World!` in the window body, and you should see `My First Program` in the tab. HTML (Hypertext Markup Language) is made up of elements. An element consists of an opening tag, an optional body, and a closing tag. For instance `<p>` is an opening tag for the paragraph element, `Hello, World` is the content, and `</p>` is the closing tag. The body of an element can also contain other elements. For instance, see Listing 1.2.



Hello, World!

Figure 1.4 You told the computer to do something, and it worked!

Listing 1.2 **The `<head>` Tag of `kittenbook.html`**

```
<head>
    <title>My First Program</title>
</head>
```

The `head` element contains a title element. This tells the web browser the title of the HTML page, and most web browsers display that title in the tab. You have plenty more to learn about HTML, but we'll leave it at that for now.

How HTML and JavaScript Work Together in a Browser

You've just created your first web page. Now let's make the page a little more interactive. Create another file in your `kittenbook` directory called `kittenbook.js`. This will be a JavaScript file, and it will make your web page more interesting.

Open `kittenbook.js` with your text editor and fill it with the code in Listing 1.3.

Listing 1.3 **Hello, Friend!**

```
alert('Hello, [your name]!');
```

Replace `[your name]` with your real name. For me, this would be `alert('Hello, Steven!')`.

Now open your web page again (or reload it) and see what happens. It's a trick! The page should look exactly the same as it did before. The HTML doesn't know that the JavaScript exists, and that's because we didn't tell the HTML about the JavaScript. Update `kittenbook.html` by adding the line from Listing 1.4 inside the `<body>` element.

Listing 1.4 **Add Your JavaScript to `kittenbook.html`**

```
<script type="text/javascript" src="kittenbook.js"></script>
```

Now `kittenbook.html` should look like Listing 1.5.

Listing 1.5 **`kittenbook.html` with JavaScript**

```
<html>
    <head>
        <title>My First Program</title>
    </head>
    <body>
        <p>Hello, World!</p>
        <script type="text/javascript" src="kittenbook.js"></script>
    </body>
</html>
```

This time, you should see something similar to Figure 1.5.

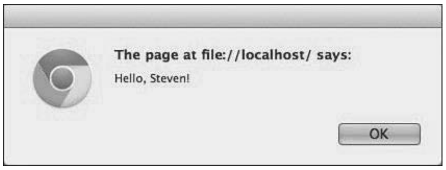

The page at file://localhost/ says:
Hello, Steven!

Figure 1.5 Hello, you wrote a real program!

That was awesome! You made a window appear with your name in it. You could type whatever you wanted, and it would show up in that window. Let's talk about what you just did; then we'll take it to the next level.

The JavaScript you wrote is a single instruction for your computer. `alert` is something called a function that tells the web browser to open a window with an OK button. You can add some text to the window by adding an argument to `alert`. A function is a piece of code that can be called to perform a task. An argument can modify how the function performs the task. The semicolon at the end of the line indicates to JavaScript the end of an instruction. Programs usually have many instructions, so the semicolons separate the instructions.

The Value of Small Changes

Now we're going to enhance our program so that we can say hello to anyone, instead of just "Hello, World!" As you make the enhancements, make small changes. Then test those small changes before you make more changes. At first, this process might seem tedious and unnecessary. However, if you make many changes before testing and find that your program isn't working, you will have a hard time determining which of your changes broke the program. If you make one small change before testing and see that your program is broken, you will know exactly what you did to break it.

Our first small change is to ask for a name. A personalized greeting isn't much good without a name. For this example, we use a function called `prompt` because it is simple and it works well here. However, I beg you not to use `prompt` (or `alert`) with a real website. Although `prompt` and `alert` are convenient for testing and learning, they make for a poor and outdated user experience. We cover alternatives for them in Chapter 8, "Functions and Methods." For now, update your `kittenbook.js` to use `prompt` instead of `alert`, and change the message to say "Hello, what's your name?" (see Listing 1.6).

Listing 1.6 **Prompt for a Name**

```
prompt('Hello, what\'s your name?');
```

You might be wondering why this code says `what\'s` instead of `what's`. A group of characters such as `'Hello, World!'` is called a string. A string starts with a quote and ends with a quote. If I type `prompt('Hello, what's your name?');`, then I have three quotes (even though one of them is intended to be an apostrophe), which confuses the computer. The computer sees the string `'Hello, what'`, then sees some other characters that it doesn't understand, and then sees another string: `');'`. I use a backslash before the single quote in `what\'s` to tell the computer that I don't mean the apostrophe to signify the end of the string. The backslash is called an escape character.

Now if you refresh your page, you should see a window with a place for you to type your name (see Figure 1.6).

Notice that when you type in your name and click OK, the page still says `Hello, World!` What gives? Why ask for a name if you're not going to show it? Well, we haven't told the computer what to do with the name. We made a small change: We switched the `alert` window for a `prompt` window. It worked, so now we can tell the computer what to do with the name.

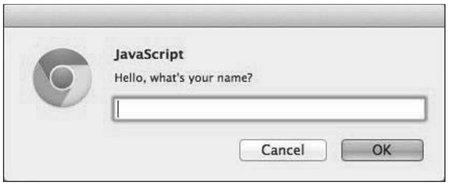


Figure 1.6 What's your name?

One of the most important tools in programming is the variable. A variable is a place to store some data that affects how the program works—Chapter 5, "Data (Types), Data (Structures), Data(bases)," discusses variables in great detail. In this case, we want to store the name from the prompt window. (See Listing 1.7.)

Listing 1.7 **Your First Variable**

```
var userName = prompt('Hello, what\'s your name?');
```

All variables have names, and we have called our variable `userName`. To tell the computer that we are creating a variable, we use a reserved word: `var`. A reserved word is a word that has special meaning to a programming language. It is reserved, so you cannot use that word as the name of a variable; you don't want to confuse your computer.

Now that we have stored our variable, refresh the page to see that everything still works. The web page should look the same as the last time you refreshed. We have stored the username, but we haven't told the computer to do anything with it yet. The next step is to insert the username in the web page (see Listing 1.8).

Listing 1.8 **Put Your Variable to Work**

```
var userName = prompt('Hello, what\'s your name?');
document.body.innerHTML = 'Hello, ' + userName + '!';
```

We add a new instruction to change the HTML `document`'s `body`. Remember the `<body>` element from `kittenbook.html`? `document.body.innerHTML` refers to everything between the opening tag and the closing tag of the `<body>` element. `document.body.innerHTML = 'Hello, ' + userName + '!';` effectively changes the HTML to look like Listing 1.9 (assuming that I type `Steven` when the prompt asks for my name).

Listing 1.9 **kittenbook.html When Your JavaScript Is Done with It**

```
<html>
    <head>
        <title>My First Program</title>
    </head>
    <body>
```

```
        Hello, Steven!
    </body>
</html>
```

Congratulations! You just created a real program. Admittedly, this is not the most useful program that has ever been written, but it is certainly not the *least* useful—and you learned a lot along the way.

Build on Your Success

Now we take the program that you just built and turn it into a Chrome extension. A Chrome extension is a small program that can be installed in Google Chrome to enhance the user's Chrome experience. A Chrome extension can be powerful; some companies' main product is a Chrome extension. The extension that we start in this chapter serves as the basis of the project for the rest of the book.

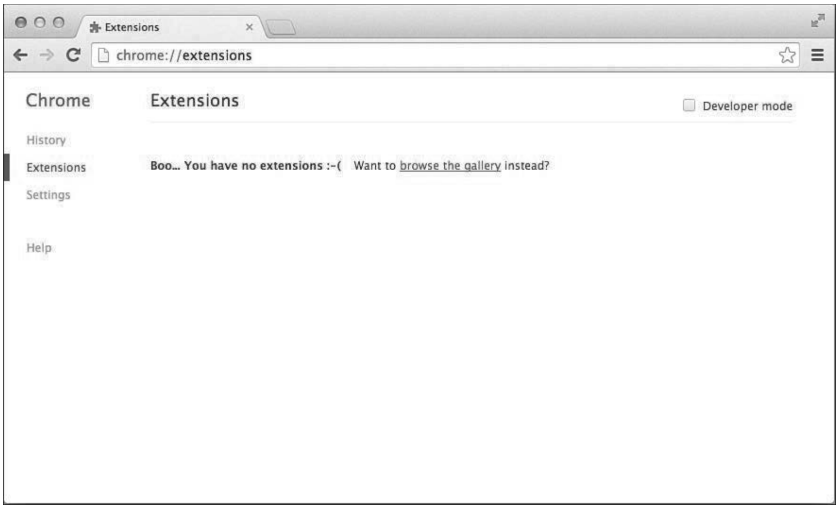
The first step is to create a new file called `manifest.json`. This file gives Chrome information about the extension and how it works. JSON is a type of document that stores data in an efficient way and that both computers and humans can easily read. Fill in your `manifest.json` file to look like Listing 1.10 (remember that every character is important, including the funny-looking characters called curly braces on the first and last lines).

Listing 1.10 **Example `manifest.json` for a Chrome Extension**

```
{
    "manifest_version": 2,
    "name": "kittenbook",
    "description": "Replace photos on Facebook with kittens",
    "version": "0.0.1"
}
```

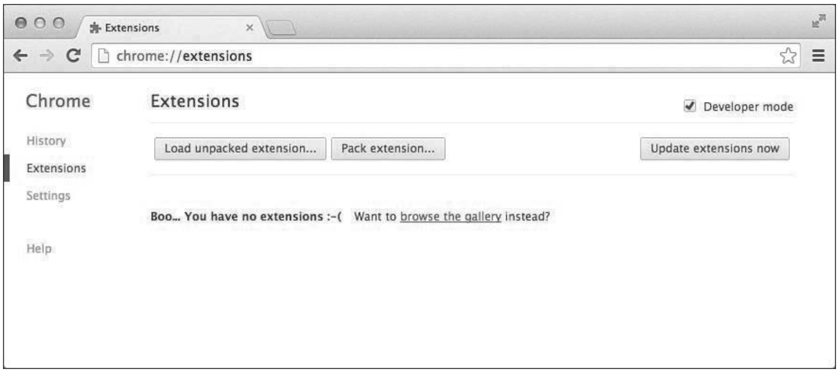
Now that you have a `manifest.json` file, you have everything you need to create a Chrome extension. At this point, your extension won't do anything, but you can still add it to Chrome to make sure your `manifest.json` file doesn't have any problems. To add your extension to Chrome, you need to open the Chrome web browser (download it if you haven't already) and then enter **`chrome://extensions`** in the address bar. You should see something similar to Figure 1.7.

Click the checkbox next to Developer Mode (because you're a developer now!) to be able to add your extension. Now you should see a button that reads Load Unpacked Extension (see Figure 1.8).



Boo... You have no extensions :-(Want to browse the gallery instead?

Figure 1.7 The Chrome Extensions page

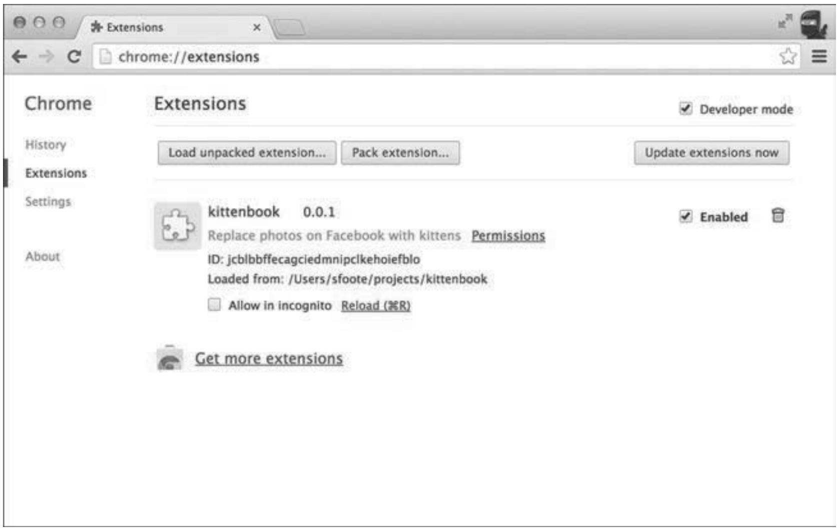


Boo... You have no extensions :-(Want to browse the gallery instead?

Figure 1.8 The Chrome Extensions page in Developer mode

When you click that button, you want to select your entire project directory (instead of a single file within the project directory). If you have selected the correct directory and the `manifest.json` file has no problems, you should see your extension added to the list of extensions (see Figure 1.9).

If your `manifest.json` file has a problem, you get a message like the one in Figure 1.10. If you do see such a message, you should copy the contents of `manifest.json` and paste them into a JSON validator such as http://jsonlint.com/, which shows you just where your error is and how to fix it.



Extensions

✓ Developer mode

kittenbook 0.0.1

Replace photos on Facebook with kittens Permissions

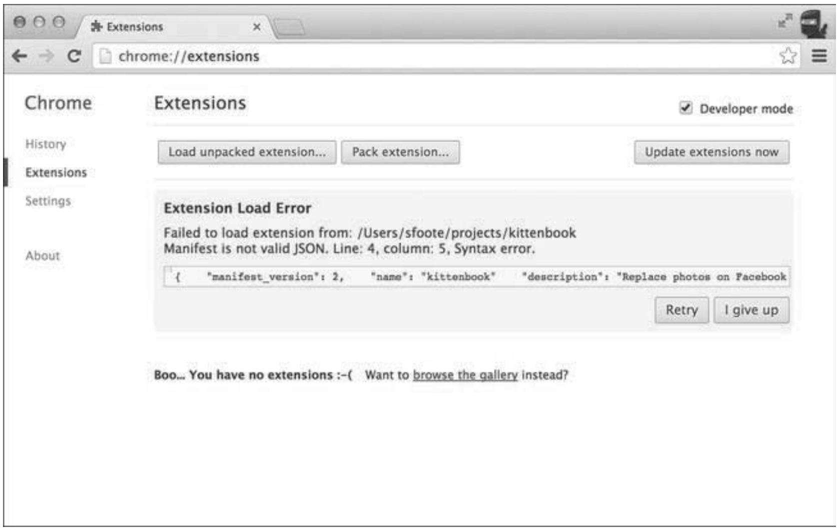
ID: jcblbbffecagciedmnipclkehoiefblo

Loaded from: /Users/sfoote/projects/kittenbook

☐ Allow in incognito Reload (⌘R)

✓ Enabled

Figure 1.9 Kittenbook making its debut in Chrome



Extensions

✓ Developer mode

Extension Load Error

Failed to load extension from: /Users/sfoote/projects/kittenbook
Manifest is not valid JSON. Line: 4, column: 5, Syntax error.

```
{    "manifest_version": 2,    "name": "kittenbook"    "description": "Replace photos on Facebook
```

Boo... You have no extensions :-(Want to browse the gallery instead?

Figure 1.10 When `manifest.json` is busted

Reference Your JavaScript in `manifest.json`

After the kittenbook extension is successfully installed, you are ready to make it actually do something. You already have a JavaScript file written, so all you need to do is make that JavaScript available on Facebook.com. We ran into this problem earlier when we tried to add the JavaScript file to `kittenbook.html`. To solve that problem, we had to tell `kittenbook.html` about the JavaScript file. In this case, we need to tell `manifest.json` about the JavaScript file. We also need to tell `manifest.json` the website to which our JavaScript file should be added. We can do this by using a property called `content_scripts` (see Listing 1.11). Content scripts are JavaScript files that should be added to the content of a given web page or set of web pages.

Listing 1.11 **`manifest.json` with Content Scripts**

```
{
    "manifest_version": 2,
    "name": "kittenbook",
    "description": "Replace photos on Facebook with kittens",
    "version": "0.0.1",
    "content_scripts": [
        {
            "matches": ["*://www.facebook.com/*"],
            "js": ["kittenbook.js"]
        }
    ]
}
```

With the addition in Listing 1.11, our extension now adds `kittenbook.js ("js": ["kittenbook.js"])` to every page that contains www.facebook.com in the URL (`"matches": ["*://www.facebook.com/*"]`). For your extension to pick up the changes you made to `manifest.json`, you need to reload your extension, which you can do by clicking the Reload link in Figure 1.9.

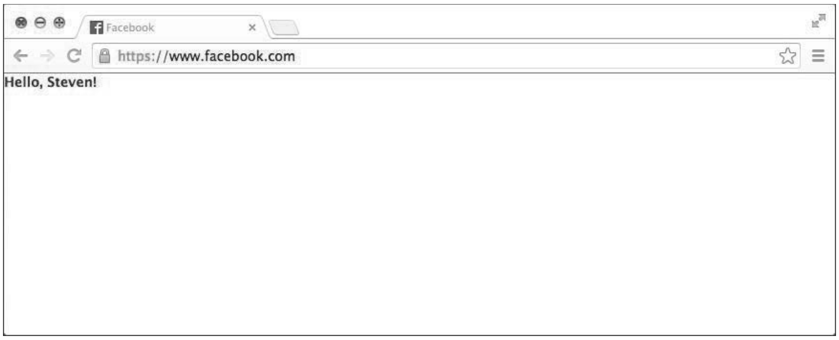
Let It Run!

If your extension has successfully reloaded, you can make one last change to `kittenbook.js` to make the greeting look a little nicer (see Listing 1.12).

Listing 1.12 **Updated `kittenbook.js` for Use in the Chrome Extension**

```
var userName = prompt('Hello, what\'s your name?');
document.body.innerHTML = '<h1>Hello, ' + userName + '!</h1>';
```

Adding the `<h1>` tag styles the greeting as a heading (big and bold text). Now reload the extension and open Facebook to see what happens. You should see your prompt window open and then see something similar to Figure 1.11.



Hello, Steven!

Figure 1.11 Hello, Facebook!

That was amazing—you just changed Facebook. *The* Facebook is showing *your* greeting. That is really cool but not useful at all. In fact, the extension we just built will prevent you from seeing any real Facebook page. That's really annoying. While I was building the extension, my wife tried to check Facebook on my computer; she was not particularly impressed with the greeting that took over her Facebook page. When you're not working on your extension, you can disable it by unchecking the Enabled check box (refer to Figure 1.9).

Great Power, Great Responsibility

By reading this chapter, you have started to acquire remarkable power. You are beginning to learn that you can give your computer instructions and that your computer will do what you say. Software is no longer something you just buy; you can *make* it.

The Chrome Extension that we started in this chapter will be a great tool to help you learn about many different concepts in programming. However, in its current state, the extension is a nuisance. It would be unkind to share it with friends (especially if you don't tell them how to disable it). You have power to create useful, helpful, and fun programs, but you also have the power to create annoying, harmful, and malicious programs. Always use your power for good.

Summing Up

In this chapter you learned about:

- Text editors, the place where computer programs are created
- Project directories to keep your program organized
- HTML and JavaScript, and how they work together
- Small iterations for finding problems early
- Variables and escape characters

Oh, and you built a real, functioning program. Then you turned that program into a Chrome Extension that actually changes Facebook.com. Just think, 40 minutes ago, you didn't even know what a variable was. You should be proud—and probably a bit tired. Now might be a good time for a break.

In the next chapter (after your break), you will learn about:

- How software works
- Compiled software
- Interpreted software
- Input and output
- Memory and variables

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