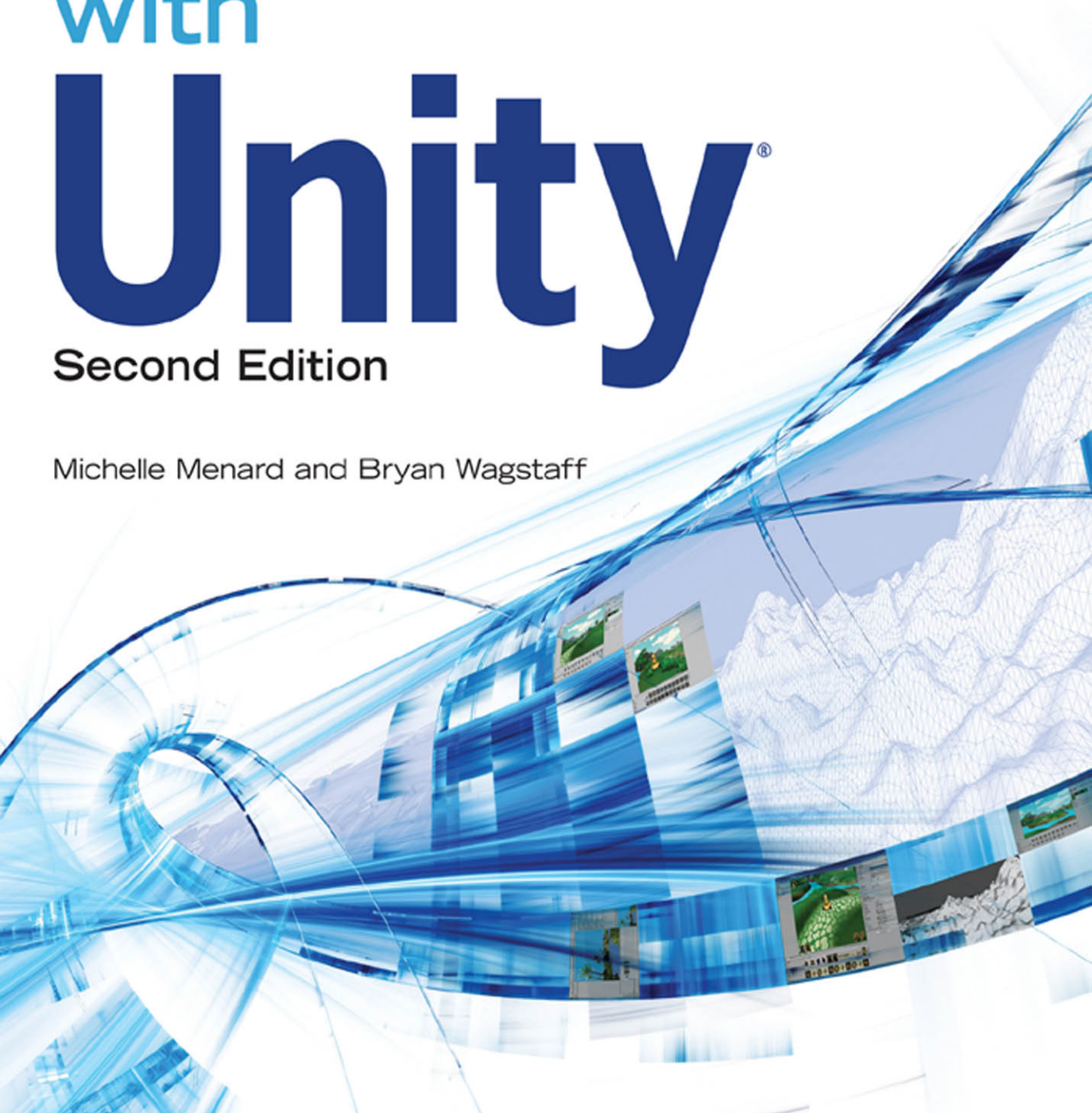


Game Development with Unity®

Second Edition

Michelle Menard and Bryan Wagstaff





GAME DEVELOPMENT WITH UNITY[®], SECOND EDITION

**MICHELLE MENARD
AND
BRYAN WAGSTAFF**

Cengage Learning PTR



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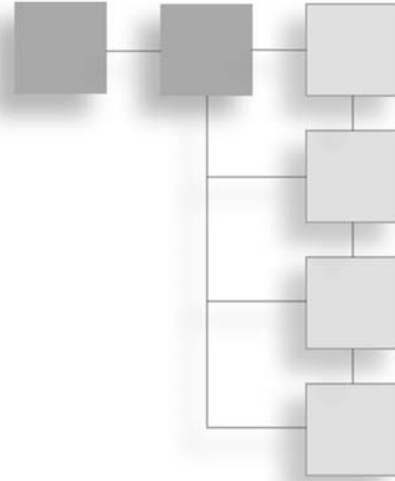
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ACKNOWLEDGMENTS



Revising this book has been quite an adventure. When Emi Smith of Cengage Learning contacted me about this project, I felt I could do the job easily. After all, I was comfortable with Unity, had a list of game credits, and had helped edit books in the past. It certainly loomed larger as time passed. The months revising this book and bringing it up to date have been an enjoyable challenge, and I could not have done it alone.

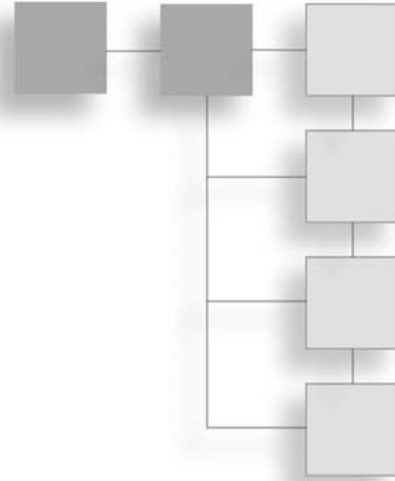
I need to thank the Unity team for their steady stream of updates and providing such a great engine. Unity is updated frequently. The first edition was written against early editions of the 3.x Unity series. Revising it meant every sentence needed to be verified against the current version, every screenshot updated, and every line of code validated. On finding any place that Unity's behavior had changed, sections needed to be rewritten. Unity's animation engine and particle system had been completely replaced, so the book required effort there. The number of supported platforms had grown from three in the first edition to over 15 potential platforms today. Even so, the book is already out of date. As this revision nears completion, the 5.x series is nearly here and will probably be released before this book. Thanks to all of you who continue to improve the tools.

I also need to thank Emi for putting up with me. Michael Duggan, Kate Shoup, Karen Gill, and the rest of the team have done an amazing job, and I have been impressed by their speed and professional skills. Then there are the people I've never met but still work hard to bring the book into reality; thank you to those behind the scenes at Cengage Learning. Next, my wife Sarah also deserves thanks for pushing through the days of

writer's block while putting her own book writing aside. Even though it was annoying at times, it could not have been finished without her reminders, "Turn that game off and go work on the book." And perhaps most importantly, thank you to the readers who will use this book. I hope you take what you learn, continue to grow, and develop the next generation of awe-inspiring entertainment.

—Bryan Wagstaff

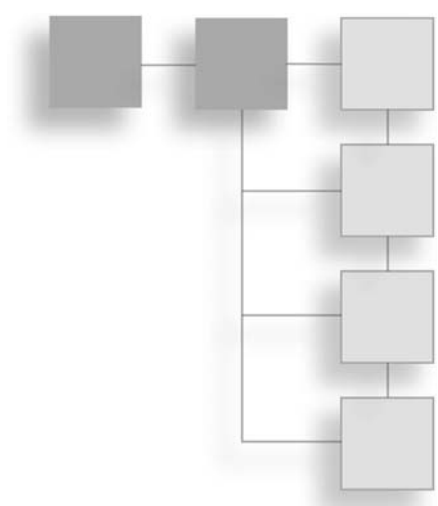
ABOUT THE AUTHORS



Michelle Menard is a freelance writer and a game producer. After receiving a double bachelor of arts in applied mathematics and music from Brown University, she decided to jump into the games industry by getting a master of fine arts in game design from the Savannah College of Art and Design. She lives in Baltimore, MD, with her husband, two plants, and 3,000 pounds of yarn.

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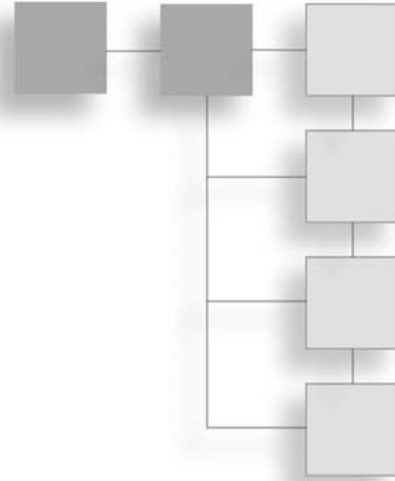
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INTRODUCTION



First things first, welcome to the Unity Engine! Whether you're new to game development or a seasoned pro looking into new technology, the Unity Engine has a lot to offer. Available for Mac, Linux, and Windows, the engine can create games that can be deployed on just about any platform available, from the Web, to the Xbox and PlayStation (if you are a licensed developer), to mobile devices like smart phones and tablets. The easy interface, friendly development environment, and wide-ranging support of all popular gaming platforms make it a great choice for the student, indie, and larger developer team.

Unity's clients include such names as Ubisoft, Disney, and Electronic Arts, but the engine is also highly utilized by small independent studios, hobbyists, students, and even companies outside of the gaming industry for medical simulations and architectural walk-throughs. Whatever the end goal, Unity allows anyone, regardless of background, to create fun, interesting, and interactive content. Let's get started.

WHAT WILL BE COVERED (AND WHAT WON'T)

This book is an introductory look into the engine. It explains what Unity has to offer and gives a few pointers on how to best use its capabilities for whatever it is you want to do. If you're a hobbyist or student, you'll probably want to start reading from the beginning and follow along with the example project. If you're using this book as a tool to evaluate whether the engine is right for you, you're probably best skipping around to the relevant chapters.

If you start from the beginning, you'll learn all the important interface commands, how to set up and organize your project, and all the basics of getting a 3D game up and running, from character importation to scripting to audio. After completing the sample project, you'll have all the skills necessary to go out and make your own games.

What this book *isn't* is a crash course in the Unified Theory of Game Development and Design. By that, I mean you won't be granted some mystical information or mad skills for everything there is to know in design, programming, art, or sound. Each topic covered (such as game design) does include some basic theory and information—enough to get you going on a working vocabulary and introductory concepts. This book won't make you a star designer or a world-class programmer, however. That requires years of study and practice.

If, after reading, you do find yourself interested in a particular field, check out Appendix D, “Resources and References,” for pointers on where to get more information. Think of this as a sampler course stretching across multiple cuisines, not an in-depth exploration of one particular food type. More advanced and singular topics such as network integration and discussions on Unity's shader language are also not covered.

INTENDED AUDIENCE

So, who exactly is this book for, anyway? If you fall into any of the following categories, you've come to the right place:

- A solo developer or generalist looking for some well-rounded information on utilizing the engine
- A developer looking to evaluate the engine for use in future projects
- A hobbyist needing a how-to guide about some specific areas
- A student (or prospective student) wanting to know whether game development is right for you
- Anyone looking to build a game portfolio using an affordable (or in some cases free) professional engine

As stated, all the game development sections cover some basic background knowledge and go over a few key terms. However, the text does assume some knowledge or skills in a few areas if you plan to work away from the sample project. For example, creation of 3D art assets and how to use a 3D modeling package are not covered. All the required models used in the text (and then some) are included on the companion website (more on that

in a moment), but their creation is not described. If you stick to the sample project while reading the book, you won't really need any outside knowledge or skills (although any game development information is a plus). If you plan to work on your own project from the start using this book as a guide, then you'll need to educate yourself in the other areas of development or find other places and people to provide art and code. If creating models and animations isn't your thing, the Unity Store has a wide range of assets for free and for sale, and there are many communities out there who can help you develop your own.

THE BOOK'S STRUCTURE

The information in the book is organized into five parts, each covering a general aspect of game development. Within each part, chapters are devoted to each single concept, such as one chapter for AI development and another for particle effects. If you need help on a specific area of Unity, go to the corresponding chapter or use the handy index. The appendixes include a list of common and helpful shortcut keys, a rundown of the most-used classes, and exercises for you to complete if you want a few pointers on what to do once you finish reading. A compiled glossary for all keywords introduced in the text is also contained there.

I've tried to make learning the engine a little more straightforward by using some general formatting guidelines. Steps for you to complete in the engine always appear in numbered lists. If you see such lists coming up on the page, you should open Unity to follow along.

Links between steps in a folder chain or nested menu are marked with the > symbol. So the line "My Documents > My Unity Project" would mean to open the My Documents folder and then open the folder My Unity Project contained within it. Pretty straightforward. Code to write in the engine is blocked off in its own formatting, as shown here:

```
//I'm a comment
Update()
{
    print("Hello World");
}
```

Finally, some extra information is included in the form of sidebars. These mostly cover more advanced technical data or engine specs and aren't required knowledge for using the engine on a day-to-day basis. They do tend to be helpful, however. Also be mindful of tips, notes, and warnings scattered throughout the text. These are often important, containing information about common pitfalls and helping to stave off potentially hard-to-fix

disasters. If time was taken to graphically embellish something, it's probably worth a second look.

INSTALLATION INSTRUCTIONS

Installing Unity is quick and painless and technically requires an Internet connection. Unity comes in two flavors, Unity Basic, which is free, and Unity Pro. Both are regularly updated by developers. Although you won't need the Internet again after activation, it is advisable to have a connection if only for the patch updates and fixes.

The Unity Engine

First up, install Unity. You can download Unity from the Unity Technologies website: unity3d.com/. From the Download menu, click on either the Mac or Windows version button, whichever is right for you. (This book uses the Windows version for all its examples.) You can choose to download the free Unity Basic version directly or get a Unity Pro license trial version, which is free for 30 days. It doesn't really matter as far as the book is concerned, but it can be fun to see what goodies the Pro version includes.

Note that Unity has grown to include many features and these features require space. The installer is about 1 GB. The download time will depend on your Internet connection. A fast broadband connection can usually handle the transfer in a few minutes.

Once the download is complete, run the `UnitySetup-###.exe` file, accept the terms of agreement, and follow the onscreen command prompts. When you get to the Choose Components screen, shown in Figure I.1, make sure the Example Project checkbox is selected. You'll probably also want to select the Unity Development Web Player checkbox as well, in case you ever want to publish your games to the Internet. In addition, consider selecting the MonoDevelop checkbox even if you have your own development environment because the bundled version of the MonoDevelop editor has some specialized features that are hard to get in other editors. If you change your mind later you can re-run the installer to add or remove components. Then click Next and finish the installation.

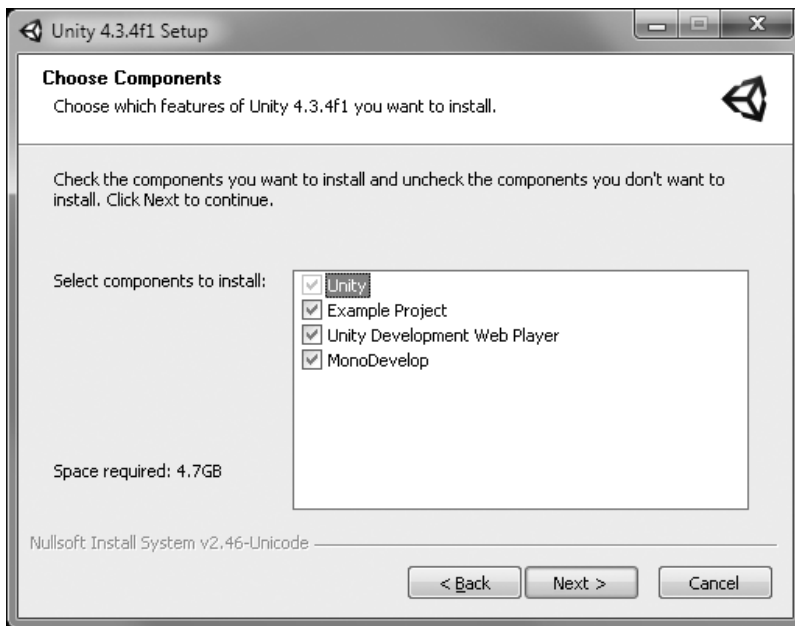


Figure I.1

All components are selected by default, requiring nearly 5 GB of space.

Source: Unity Technologies.

Use the default install path or select your own, and then click Install. Unity takes nearly 5 GB of install space, so make sure your selected destination can handle this plus any other add-ons or projects you want to use later. Follow the other onscreen instructions to complete the install.

After the install has finished, Unity will prompt you to register your copy. For the free version and trial Pro, this is easy. Select the Internet registration version (if available) and fill out the form on the website the engine takes you to—usually it's just your name and email address. After this, Unity is yours to use.

Once the engine has finished installing, it's time to move on to the contents of the companion website.

Using the Companion Website

To access the book's companion website, visit www.cengageptr.com/downloads, and type the name of this book in the Search field. The companion website is divided into a few main sections:

- **Chapters:** This folder contains subfolders for each chapter in the book, whenever they require the use of files or assets. You can either copy the entire Chapters folder to your hard drive now or just grab the individual files when you need them. The text always specifies when a file is needed and where to grab it.
- **Design Documents:** This folder houses all the basic information for the sample project discussed in the text, a game called *Widget*. When the text says to view the Design Docs, they're located in here.
- **Shader Test:** A sample project detailing and comparing the basic shaders side-by-side that are available in Unity. If you're not sure which shader to use or how some shaders may interact in a specific lighting rig, modify and use this file as needed.
- **Final Project Files:** Unlike the Chapters folder, which houses all the individual files as they come up in the text, the Final Project Files folder is a complete Unity project for the *Widget* game. If you ever get stuck or want to see how something fits together later, you can always check out the game here. Extra assets such as more models, textures, and UI elements are also included here for any further expansion you may want to pursue.

Optional Installs

Between Unity and the contents of the companion website, you can complete every exercise in this book and get the sample project up and running. However, you may find yourself wanting to tweak a graphic or texture here or there, or maybe even sculpt a new model to import. Many free software packages are described both in the text where appropriate and in Appendix D. If you don't already have something installed on your computer, check the appendix for information and a link.

Unity includes MonoDevelop, a free code editor to use for scripting, but you can use your own favorite coding environment if desired. Chapter 6, "Scripting in Unity," covers compatible ones in more detail, and Appendix D also provides links where appropriate.

PARTING WORDS OF WISDOM

You probably have tons of great game ideas floating around in your head. Maybe you've even started working on one, the big one that'll net you that dream job or needed raise. Maybe you have built some small projects in the past and want to use a comprehensive engine rather than doing everything yourself. Or perhaps you've started two games, or three, or...you get the picture. Working on making your snippets of ideas and musings into playable games is great—but how many have you actually finished? Making a game is a huge commitment, fraught with tons of unforeseen setbacks, design changes, and software explosions, all for a tiny little bundle of ideas that you hope others will love as much as you do. It's far too easy once the first dragon rears its head to stop working, take an extended break, and never return to the field to try again. It's not procrastination, you tell others, it's just a short time away to rest your eyes, to let your ideas simmer free of worry. The short break becomes a week, and then a month, and years roll by as your little unfinished game collects dust in the corner.

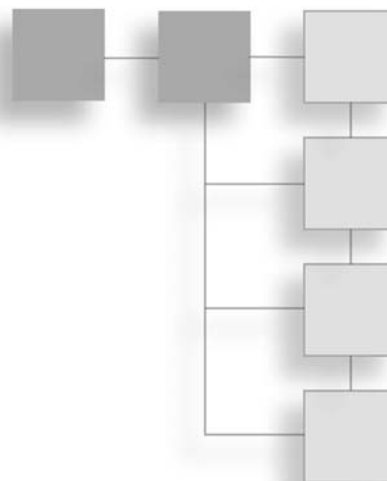
Tackling the problems in game development is hard work. Sometimes you follow a trail of ideas and discover barriers that need to be climbed, worked around, or pushed through. Other times you need to admit that the idea was wrong, it didn't work out as expected, or it's just plain un-fun. Don't walk away from the whole project and leave the game unfinished. Try something else, even if you're unsure where this new path will take you. Maybe it won't work out, but maybe it'll be the solution to a whole host of problems. Try, make mistakes, learn, and try again. Be willing to make mistakes and learn from them, and keep fighting your way through until the game is complete. No game is perfect and defect-free, but you can reach the point where you can say it is complete.

Finish that game, and then finish another. It doesn't matter if you think they're horrible, terrible piles of swill you'd be embarrassed to show your own mother. Show her anyway. They may suck, or they may not. Either way, analyze what you did that worked and didn't work. The process is as much about learning as it is about creating, and no one ever excelled by stopping halfway. If you get discouraged, it is okay to take a break, but always, always come back to it in the end. Support from friends can help greatly in this—involve some of your buddies in rounds of routine play tests. Make a party of it. Celebrate what you do and remember to have fun. If you're not having fun, you're probably not making fun!

One late night, as we were pushing to finish a game, I was sitting in the cafeteria, dining with co-workers on a large tray of studio-provided “mystery nuggets” for dinner. Someone said, “It is eight o’clock at night and I’m still at work on this crazy project that never seems to end. I could be spending time on so many other things. Will you remind me why we are still here?” Another co-worker spoke up, and his reply was heartfelt: “Because we love it. No matter how many problems we encounter and difficulties we overcome, we love it. We love creating these amazing games that entertain millions of people. We are artisans, passionate about doing our best on every task. We are not just working late and eating deep-fried mystery nuggets; we are building a game to inspire, to entertain, and to give the world something that they may savor and enjoy. Just like the mystery nuggets, most people will have no idea what is inside, but when they play the game they can be entertained and enjoy a moment of life. That makes the difficulties worthwhile.”

Be passionate. Development is work and sometimes it is difficult. Sometimes it is painful. Sometimes you will be disappointed and unsatisfied with the results. Just keep pushing, sharing your passion, and doing your best work. Game development is a powerful career. We create new worlds, teach, entertain, and inspire. We start with a blank file and finish with a product that can change the world. Be a game developer.

PART I



IN THE BEGINNING ...

As with any new endeavor, it's usually best to start somewhere in the beginning. And before you even start, it's best to lay out your tools and get your ideas in order. You wouldn't attempt (I hope) to build a house without a blueprint, and games are no different. The best game ideas in the world won't get you very far unless you have the knowledge, skills, and discipline to see them fully realized and implemented.

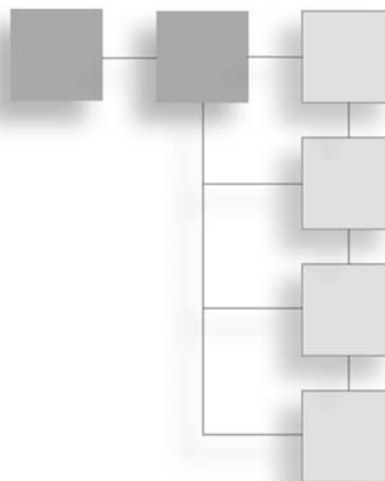
Before Unity, making a game from scratch for the newbie game designer was a rather daunting process. Engines, especially free ones, weren't terribly easy to come across, and those that were often suffered from poor execution or lack of documentation. Now with Unity, you can quickly get your ideas in motion, even if you lack a strong art or programming background.

In this part, you'll learn the basics of the engine and its interface, as well as how to refine your game idea from the get-go, hopefully saving you some time and energy later in the process.

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CHAPTER 1

AN OVERVIEW OF THE UNITY ENGINE



Unity is a powerful integrated game engine and editor, enabling you to quickly and efficiently create objects, import external assets, and link them all together with code. The editor is visually driven and built around the principles that you can do everything with a simple drag-and-drop motion—even connect scripts, assign variables, or create complicated multi-part assets. Unity also boasts an integrated scripting environment, built-in networking capabilities, and the ability to build and deploy for multiple platforms. All of this is wrapped up in a simple, intuitive, and customizable workspace.

GETTING ACQUAINTED WITH THE INTERFACE

Before diving headfirst into making your first game with Unity, it's worth the time to first take a quick look at how to get around in the editor. Unity may look a bit daunting when you first open it, but you'll find that you can easily master its basics in a day.

If you haven't done so already, open Unity. Choose Start > Programs > Unity (C:\Program Files\Unity\Editor\Unity.exe) or click the desktop icon if you created one. Then load the Ch1_TestFile.unity file located on this book's companion website to follow along. Figure 1.1 shows the Unity environment.

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