LEARNING Blender

A Hands-On Guide to Creating 3D Animated Characters

FREE SAMPLE CHAPTER

Praise for *Learning Blender*

"Oliver Villar's book will give you a solid foundation in Blender and computer graphics in general. Filled with well-crafted examples and lessons, this book will give you the tools you need to succeed as an artist."

—David Andrade, Producer, Theory Studios

"The days are now over when beginners found learning Blender 3D difficult. Oliver Villar introduces to beginners the best of Blender's 3D features and 3D fundamentals in fun and exciting ways. His approach of completing a character from scratch, touching every aspect of 3D from Blender's point of view, is truly filled with explanations of techniques and important tools that will help readers to bring their ideas to life creatively while following professional workflows in 3D.

Starting with the fundamentals of 3D, this is a great resource for every beginner artist who is looking to learn Blender 3D. It's truly a book written with great dedication!"

—Waqas Abdul Majeed, CG Generalist, www.waqasmajeed.com

"I found Oliver Villar's book *Learning Blender* to be an essential tool for not only getting users acquainted with Blender, but also preparing them by explaining the history and the magic that has made Blender what it is now. His book also prepares users to be productive and informed by explaining the community and its various portals. His book is complete in explaining all the aspects of the UI and acquainting users with the classic G, S, and R. The exercises are perfect for getting users on the level to begin making their own worlds. I was even pleased to see him discussing F2, ripping with V, and even Knife Project, which are classics I usually consider to be more advanced. This book is a no-holds-barred approach to getting the most out of this capable little program. I must also add that the character created is attractive and well created, and is a fine example of using the program for character modeling. Oliver is truly a skilled artist and that shines through in his use of this program."

—Jerry Perkins, 3D Conceptor, Fenix Fire

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Learning Blender

Third Edition

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Learning Blender

A Hands-On Guide to Creating 3D Animated Characters

Third Edition

Oliver Villar

Addison-Wesley

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To Grandma. I'll keep working to make you proud.

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Contents at a Glance

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Preface

Character creation is a big undertaking. It involves several very different skills, and that's what you're going to learn soon enough. In this preface, I quickly show you what this book is about and what you can expect from it. If you already have some experience with other 3D software, you've come to the right place, as you'll find some instructions on how to handle switching between different programs, which can be frustrating—and sometimes even more difficult than learning a program for the first time.

Welcome to *Learning Blender*!

Welcome to the third edition of *Learning Blender: A Hands-On Guide to Creating 3D Animated Characters*. In this book, you'll learn how to use Blender in a complete and complex project. You'll see every part of the process so that you can understand what is involved in the creation of a 3D character and decide which part you like the most afterward. In other words, this book is not a specialized book that will make you a modeling genius or an expert animator; instead, it helps you understand the basic concepts behind every part of the process. The idea is that when you finish reading this book, you'll have the knowledge you need to start any other project, from preproduction to the final result.

If you're a freelancer (or want to be), this book is tailored to you, as freelancers often get small but very different and varied jobs, and having basic or medium skills in different tasks can be more useful than being very good at a single specific thing.

If you want to work for a big company and prefer to specialize, it helps to understand the full process. If you're a modeler, for example, but you also understand how rigging works, when you create your models, you'll be able to recognize the possible issues that your rigger mates will encounter, which will make their work easier. When you work on a team, you'll work on only part of the project, but if you have at least a little understanding of what the rest of the team's job is, your work will be more valuable to them, and everyone will be happier!

Maybe you're already familiar with Blender and want to learn about 3D character creation. Very good. You can skip the first two or three chapters and go straight to the main part of the book—but do this only if you're sure that you understand the basics of Blender.

Finally, if you just want to get started in this amazing world of 3D and dive into the sea of vertices, this book will give you a good insight into how 3D projects are handled. If you have never used 3D software before, don't worry if it looks a bit

overwhelming in the beginning. That's normal. The software has lots of options and crazy stuff that will be unknown to you, and we all tend to be afraid of what we don't know. If you keep going, however, when you start using and understanding Blender, you'll start enjoying the learning process, and your results will get better with time and practice. Good luck!

Do You Come from Other 3D Software?

I took this path myself years ago, so I understand what you will go through. That's why throughout the chapters, I share tips, keeping in mind the differences between Blender and other 3D software. I came to Blender after using commercial software such as 3ds Max, Maya, and XSI for years. Back then (version 2.47), Blender was less user-friendly, but it's been greatly improved since then. It's still a little alien compared with other software, though, and it may feel intimidating to you at first. Don't worry; that reaction is completely understandable. Just don't give up!

Learning Blender may not be easy at first. It took me three or four times checking different versions of Blender until I finally decided to start learning it for good. You'll see weird features, such as the omnipresent 3D cursor, which you always see in the scene but apparently has no function. (I've heard someone say that it looks like a sniper's visor for shooting at your models.)

Also, you'll be "forced" to learn a lot of shortcuts. This requirement makes the learning curve for Blender difficult in the beginning, but when you get used to Blender, you'll love it, as shortcuts help you work a lot faster in the long run!

Before I used Blender, it was difficult for me to work with fewer than three 3D views on the screen at the same time, for example. Now I work in full-screen mode with only one view in a much more comfortable way; it's like using the expert mode in other software all the time! I even feel weird sometimes when I need two 3D views for some special reason.

I've taught a lot of people and talked with many others who came to Blender from other software, and usually, they kind of hate it at first. (That's why most people give up and stick with commercial software.) After a short time using it, though, they start loving Blender and get addicted to it. They find that a lot of tasks are easier or faster to do in Blender than in other software. It's so common to love Blender after that first rejection stage, however, that there's a name for this feeling in the community: Blenderitis.

Blender has its limitations, of course, but for the general needs of most users, it's more than enough.

I really encourage you to keep exploring Blender and find out what it has to offer. I've learned to use a lot of different software and tools, and after repeating the learning process and switching software several times, I've found that Blender works best for me.

I'll share the method I've used with you. Maybe it'll help you too. The key to making a successful change (not only in software, but also in life, work, or whatever you want) is to *learn how to adapt and be flexible*. You have to free your mind to some extent

to leave space for the new situation, software, or anything else to get in. In these situations, a lot of people can only complain ("This software doesn't have that tool," "That was easier on the old one," and so on). Avoid this behavior at all cost, and *try to understand the new software*, as each program has different philosophies behind its development and workflow. Complaining is a waste of energy and time that you could be spending on something much more useful, such as learning how to use the new software.

What is the best way to adapt? Force yourself!

Set a deadline (that way, you'll have a good or bad result, but at least you'll finish something), and decide what you're going to do. Think of an easy project, and go for it. Having a deadline keeps you from drifting around for days, going crazy over small details that make the process too long.

Usually, people start playing around with no purpose. They don't get a specific result, but something random. This result doesn't motivate them and gives them the impression that they can't use the software.

Instead, if you propose a little project, you'll have a goal to work toward, which allows you to find the tools you need to achieve that goal. When you finish, even if the project is not perfect, you'll have learned some tools and achieved a result, which will motivate you to do better next time or to start a different project so you can learn about other tools.

Keep in mind that you probably don't want to start with a very big or difficult project. The key is to start learning little by little, taking small steps to keep yourself motivated. If you start with something big that involves a lot of steps, you may get stuck at some point, which will frustrate you. When you work on something small, even if it goes wrong, you won't have spent too much time after all, so getting attached to the project won't be a real issue.

Over time, after you make a few small projects, you'll have a knowledge base, and you'll understand how the new software works. At that point, you can judge whether you're interested in learning more or whether you're more comfortable with the previous software.

A lot of software is out there, and each program is different, so depending on your work, style, taste, and personality, you may prefer one or another. What is intuitive and comfortable for some people isn't for others. Nonetheless, if you give the new software a good test drive, even if some things that you're used to are missing, you'll learn about others that are really cool that you didn't see before!

In my case, I was very comfortable with 3ds Max, but after using Blender extensively for a few days (yes, only a few days; they were very intense days, though!), I honestly couldn't go back. I missed some tools, of course, but I found that the advantages clearly surpassed the disadvantages for me, so I've used Blender ever since.

I hope that this book motivates you to try Blender and give it a chance instead of deciding that you don't like it because you can't master it in five minutes. (I'll bet you didn't understand any other software in five minutes the first time you used it!)

The essence of practicing to learn is to set a feasible goal, set a deadline (due date), and try your best to reach that goal. No excuses; no complaints! Discipline and not giving up are the keys.

My method is just a guideline. It may not be useful for you, or you may find a better approach. But if you don't know where to start and feel discouraged, just try it!

How to Use This Book

This book is divided into parts to help you to keep track of your progress:

- **Part I, "The Basics of Blender" (Chapters 1, 2, and 3):** Understanding Blender and learning the basics
- **Part II, "Beginning a Project" (Chapters 4 and 5):** Preproduction, project preparation, and character design
- **Part III, "Modeling in Blender" (Chapters 6 and 7):** Starting production, focusing on character modeling
- **Part IV, "Unwrapping, Painting, and Shading" (Chapters 8, 9, and 10):** Unwrapping, texturing, and applying materials
- **Part V, "Bringing Your Character to Life" (Chapters 11 and 12):** Rigging and animation
- **Part VI, "Getting the Final Result" (Chapters 13 and 14):** Postproduction, camera tracking, rendering, and compositing
- **Part VII, "Keep Learning" (Chapter 15):** Other Blender features

You can start with the part you're most interested in, of course, but if you're new to Blender, I recommended that you start from the beginning so that you understand the software before you jump into something as complex as the creation of a 3D character.

In each chapter, if some basic knowledge is required, I explain it before you dive into the real thing. You'll also find tips and useful shortcuts along the way to help you work faster and more efficiently.

If you're already familiar with Blender, you can skip the first three chapters and start reading about character creation.

Chapter 1, "What You Need to Know About Blender," talks about Blender, open-source software, how the development process works, its history, and what Blender is all about. You don't really need to know these things to use Blender, but it's interesting and gives you an overview of some of the strong points of Blender.

Chapter 2, "Blender Basics: The User Interface," takes you through the user interface, basic navigation, selections, and Blender's innovative nonoverlapping window system for dividing and merging the interface as you see fit.

In Chapter 3, "Your First Scene in Blender," you learn how to create your first scene with Blender. This very basic scene lets you play with the main tools, as well as work

with simple modeling, materials, and lighting, and it helps you understand the differences between rendering with Blender Render and rendering with Cycles.

After this introduction, you start on the main project: creating a 3D character. The reason you create a character as a project for this book is that it involves almost every part of the software: modeling, texturing, rigging, animation, and so on.

This part of the book explains everything you'll go through, talking about preproduction and how to get ready for any project. You'll learn that preparation is essential!

In the final chapters, you see how to track the camera of a real video and composite your character into that scene so that you end up with something cool you can show your friends, not just a character inside Blender.

I discuss some other features of Blender in Chapter 15, "Other Blender Features," so that you get a glance at them, including dynamic simulations, particles, smoke and fire, the Grease Pencil, and add-ons.

I encourage you to create your own stuff from scratch and use your own video to track the camera, but if you prefer to follow the book in detail (with the same material used in it) or want to skip some parts, you'll find all the material you need to start from any point of the book in the production files (at www.blendtuts.com/learning-blender-files), which include

- .blend files with different levels of progress so you can start with whatever part of the book interests you. You don't have to start from scratch.
- Texture images for the character.
- Real video for camera tracking.
- Final results.
- Video tutorials of some parts of the book.

What's New in This Edition

What you have in your hands is the third edition of *Learning Blender.* The whole book has been updated to be compliant with Blender version 2.83 and beyond. Blender 2.83 is the first LTS (long-term support) version of Blender, which means that it will be usable and errors will be fixed for at least two years after its release, making it a good version to start with. (General Blender versions have very short life spans, with new releases every three to four months.) Most figures have been updated or reworked to improve readability and to reflect the changes in the new Blender versions. The whole character-creation process has been redone to make sure that the instructions are compatible with Blender 2.83. New tools are discussed throughout the book, especially (but not limited to) selection and modeling tools. In Version 2.80, a new real-time render engine was added to Blender (EEVEE), and the book shows you how to use it as well. A lot of new tips and tricks have been added, and some chapters have been extended or changed in approach, based on feedback I got from previous editions. That said,

I hope that you find these new additions interesting and that they improve your experience with the book and with Blender.

Without any more hesitation, get ready to start learning. You have a long way to go!

Register your copy of *Learning Blender, Third Edition,* on the InformIT site for convenient access to updates and/or corrections as they become available. To start the registration process, go to informit.com/register and log in or create an account. Enter the product ISBN (9780136411758) and click Submit. Look on the Registered Products tab for an Access Bonus Content link next to this product, and follow that link to access any available bonus materials. If you would like to be notified of exclusive offers on new editions and updates, please check the box to receive email from us.

Acknowledgments

Although the author of a book usually takes most of the credit, a lot of people are needed to make it, improve it, and get it to your hands. Thanks to Laura Lewin and Olivia Basegio for giving me the opportunity to participate in this project since the first edition in 2015; they helped me with everything I needed during the entire process. The same goes for Malobika Chakraborty, who supervised this third edition, and who was very patient and understanding (because this edition was a very challenging one, but more on that later). Thanks to Michael Thurston, Daniel Kreuter, Mike Pan, and Tim Harrington, who did an amazing job helping me write the first edition of this book. Thanks to Andrea Coppola, David Andrade, and Aditia A. Pratama, who worked on the revisions for the second edition of *Learning Blender.* Thanks to Abraham Castilla and Aidy Burrows, who helped make sure that everything was up to date with the latest Blender versions after the huge changes introduced in Blender 2.80. Thanks to Sheri Replin, who made sure that everything in this edition was in place. Thanks also to Rachel Paul, Julie Nahil, and Keir Simpson. Thanks to everyone else who was involved in any way in the creation of this book.

One reason why this edition was so challenging (and why it was so long in the making) is that Blender took a quantum leap between versions 2.79 and 2.80, requiring a huge amount of changes in the book (to the point that some chapters were almost completely rewritten), and the versions 2.81 to 2.83 introduced subtle but rather important changes that polished all that was introduced in 2.80. All those changes made me go back and forth, making sure that everything was as current as possible for Blender 2.83. The fact that it's difficult to keep up with development speaks volumes about the great work that the team behind Blender is doing and how quickly the software is getting improvements and new features, so I'd also like to appreciate the incredible work of the Blender Foundation, Ton Roosendaal, all the Blender developers, Pablo Vázquez for his effort in communicating all the changes introduced in the software to the public, and the amazing Blender community. Thanks, everyone.

Last but not least, this book wouldn't exist without the invaluable help and support of my girlfriend, who never stopped encouraging me. Thank you.

Special thanks to César Domínguez Castro, who filmed the footage used in the camera tracking and compositing chapters that you'll find in the bonus files (www.blendtuts.com/learning-blender-files), which will allow you to experiment with Blender tools.

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About the Author

Oliver Villar, born in Galicia (Spain) in 1987, has been drawing since he was a kid. His interest in art brought him to 3D, which he's been studying since 2004. He used different commercial 3D software before stumbling onto Blender in 2008. Since then, he has used Blender professionally as a freelance 3D designer and tutor.

In 2010, he founded blendtuts.com, a website that offers quality Blender training videos to the community. After a few years, he decided to dedicate more effort to the Spanish community, in which Blender learning material is lacking, and started blendtuts.es.

For years, he's been one of the organizers of the main Spanish Blender event: Blendiberia.

Currently, he teaches Blender to his own students, for online schools, and for the University of Murcia.

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Your First Scene in Blender

You've been introduced to the basics of Blender, and with practice, you'll have the interface under control. It's time to create objects; interact with them; add modifiers, materials, and lights; and then render your creation. This chapter presents a very simple exercise to help you better understand how to create your first scene. You also learn about Blender Render and Cycles, the two render engines included by default in Blender. If you're using Blender for the first time, you'll find this chapter to be especially useful. The idea is that after reading this chapter, you have a basic understanding of the workflow to create a scene in 3D and export it as an image.

Creating Objects

When you open Blender, you'll find the familiar default cube sitting in the middle of the scene. You can use that cube to build your model, or you can delete it. To delete objects in Blender, just select them, press **X** or **Del**, and click Delete in the dialog box that appears to confirm the deletion. (If you press **Del** instead of **X**, you won't be asked to confirm.)

To start, you want to create an object. There are different ways to do it:

- Choosing an option from the Add menu in the 3D Viewport's header.
- Pressing **Shift+A** in the 3D Viewport. (The Add menu from the previous option will appear at your mouse cursor position.)
- Pressing **F3** to display the Search menu, and typing the name of the object you want to create. The menu will filter the options/tools that include what you've entered. If you type **cube**, for example, the menu will show the option Add Cube; click that option, and the cube will be created.

When you use any of these options, the object is created in the position of the 3D cursor inside the 3D scene.

After you create an object, the Adjust Last Operation menu in the bottom-left corner of the 3D Viewport will show the options available to control that object. If you create a cylinder, for example, you'll be able to control its parameters later, such as size and number of sides.

Adjust Last Operation Menu

After you perform any action that can be adjusted afterward, the Adjust Last Operation menu will show up in the bottom-left corner of the 3D Viewport. The menu can be collapsed or expanded by clicking its title (which will show the name of the last action).

Inside the menu, you'll find all options available to tweak the last operation. For example, if you move an object, you will be able to modify the final position in X, Y, and Z; adjust the orientation; and enable or disable proportional editing. Make sure to look at these options after using tools and options, as sometimes, you may discover interesting possibilities you didn't know about before.

If you don't like having this menu enabled all the time, you can hide it from the View menu on the 3D Viewport's header by clicking the option Adjust Last Operation.

Whether the menu is enabled or disabled, you can always call it on a pop-up that will appear at your mouse cursor's position when you press **F9**. Some people prefer hiding the menu and use it (by pressing **F9**) only when they need it.

Make sure that you have adjusted anything before your next action. For example, if you move an object after creating it, the Adjust Last Operation menu will present the options for the Move tool instead of the options for object creation. You can't go back to a previous operation to recover this menu; you'd have to undo (**Ctrl+Z**) and perform that action again.

Animation software often has a test object. In Blender, that object is the *monkey head* (called *Suzanne*), and you'll use it for the test scene in this chapter. Create a monkey head mesh, using any of the methods described earlier in this section. Then create a plane, as this plane later will serve as the floor of your scene. Don't worry if the head and plane intersect in the middle of the world and are not correctly aligned; you'll adjust them in the next step.

Moving, Rotating, and Scaling

After you create objects in your 3D scene, you need to be able to control where they are located, how they are oriented, and what size they are. In this section, you see how to do just that. Moving, rotating, and scaling are the three different transform operations you can perform on any 3D object, and there are several ways to do it.

Using Active Tools

The most obvious way to transform an object is to use Active Tools: the buttons with icons that are shown on the 3D Viewport's toolbar (you can show or hide this bar pressing **T**), as shown in Figure 3.1.

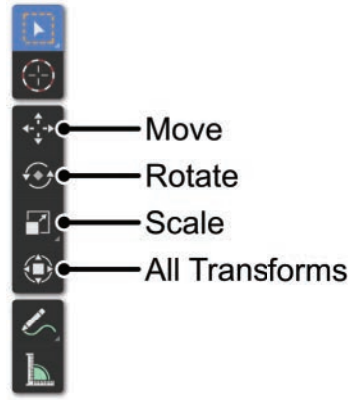

Figure 3.1 Active Tools to move, rotate, and scale objects, located on the 3D Viewport's toolbar

It's simple: you choose the Move, Rotate, or Scale tools, and they become the Active Tools. The manipulators for the selected type of transform will be always shown for the current selection, and you can click and drag parts of those manipulators to perform the transformation. (For more information about using manipulators, see the next section.)

There is a fourth Active Tool for transforms, conveniently named Transform, as it shows manipulators for moving, rotating, and scaling simultaneously.

Although this method for transforming objects can be obvious to new users, it's not always the most efficient method. Sometimes, you may prefer that your Active Tool be a different one, and you have to switch back and forth.

It's convenient when you have the objects in your scene and all you need to do is to place them. The purpose of Active Tools, after all, is to stay active so you can use them repeatedly, but if you're using different tools often, Active Tools may not be your best option.

> **Tip**
>
> You can access the toolbar while it's hidden in a pop-up menu by pressing **Shift+Space** and clicking the desired Active Tool within the menu. In this menu, you'll also see each tool's keyboard shortcut. If you press that shortcut when that menu (**Shift+Space**) is shown, you'll set that tool as the Active Tool. But if you press the same shortcut without the Active Tool menu showing, you'll launch the normal tool, which is not persistent and will stop working after you perform the action.
>
> Essentially, if you want to move many objects in a row, you can use the Active Tool by pressing **Shift+Space** and then **G**; this action will enable the Move tool as the Active Tool (the same as clicking the Move Active Tool on the 3D Viewport's toolbar). If you only want to move the current selection and keep doing other actions, you can just press **G** to use the Move tool, which will be disabled when the action is accepted. Read the next sections for more information about transforming objects by using keyboard shortcuts.

Using Manipulators

There is an option to show manipulators for transforms while using other Active Tools. All you have to do is enable them on the Viewport Gizmos pop-up within the 3D Viewport's header. (See Figure 3.2.)

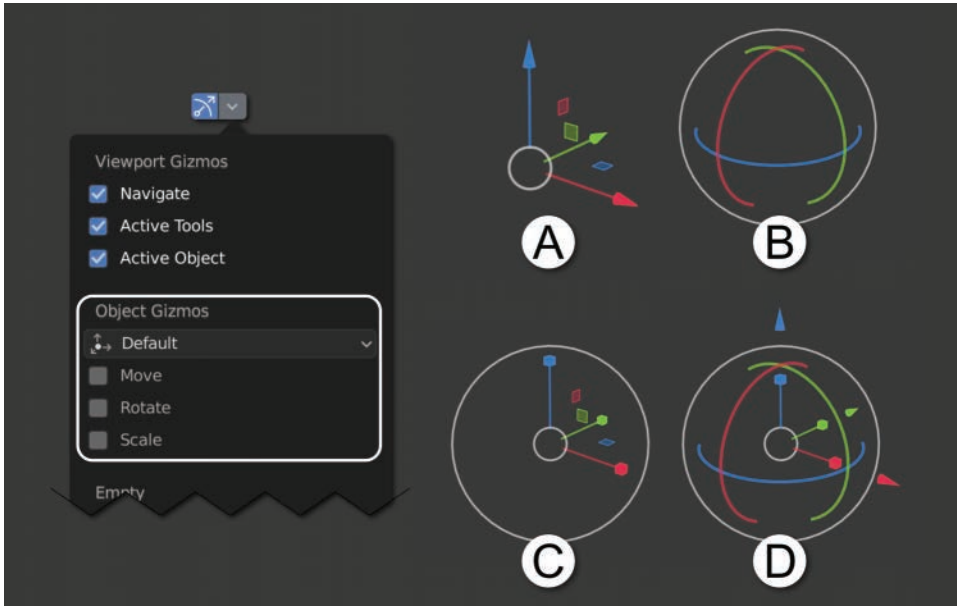

Figure 3.2 Manipulators in the Viewport Gizmos menu on the 3D Viewport's header and different manipulations

When you want to transform objects or elements in the 3D scene, Blender offers manipulators that help you control those transformations. The following are the manipulators:

- **Move (A):** Changes the position of an object in space
- **Rotate (B):** Controls the orientation of an object
- **Scale (C):** Manipulates the size of an object
- **All Transforms (D):** Allows you to use more than one transform manipulator at the same time

In the 3D Viewport's header, you can select the type of transform you want to perform. If you press **Shift** while clicking different transform icons, you can perform multiple transforms at the same time. (In Figure 3.2, example D shows all three transform manipulators being used at the same time.)

Using the manipulators, you can move, rotate, and scale objects. These manipulators appear at the pivot point of the object (marked as a little orange spot called the *origin* in Blender), and you perform an action with them by using the following controls:

- Left-click one of the axes to make the object move, rotate, or resize on that specific axis. (X is red, Y is green, and Z is blue.) Left-click again to confirm the transform. Or press **Enter** to confirm or **Esc** to cancel.
- To enable Precision Mode, press and hold **Shift** *after* you click to transform. This action makes the transform slower, allowing you to make precise adjustments.
- To lock one axis and manipulate the other two, press and hold **Shift** before you click the axis you want to lock. If you press **Shift** and then click the Z-axis to move it, for example, the object actually moves on the X- and Y-axes, as the Z-axis is locked. (This option works only for moving and scaling; it is not available for rotations.) On top of using keyboard shortcuts, you can use the little squares present in the Move and Scale manipulators. You'll see that, for example, there's a green square between the X- and Z-axes, and it's green because it locks the Y-axis (green).
- Move and Scale manipulators have a small white circle in their centers. Click and drag the circle of the Move manipulator to move the object, using the current point of view as a reference (dragging it parallel to the view). Click and drag the small white circle of the Scale manipulator to scale the object on every axis.

  The Rotation manipulator also has an outer white circle but is slightly different; click and drag that circle to rotate the object, using the current point of view as the rotation axis. Instead of having a small white circle in its center, the manipulator for rotations has a spherical shape in transparent gray, and its axes are drawn on the surface of that sphere. Click and drag anywhere within the Rotation manipulator's sphere (without clicking any of its axes) to enter Orbit Mode, which allows you to rotate on all axes at the same time.
- Hold down **Ctrl** while using these manipulators to switch between normal transforms and Snap Mode. This feature allows you to snap to several elements while you perform transforms. If snapping is enabled, holding down **Ctrl** frees the object when transforming; if it's disabled, holding down **Ctrl** enables the snapping. This feature is very useful because you won't need to continuously turn the Snap tool on and off by clicking the Snap icon on the 3D Viewport's header. You'll learn more about snapping tools later in the book.
- In the 3D Viewport's header, you can select Pivot Point and Transform Orientation. Pivot Point defines the point around which objects rotate and scale. By default, Transform Orientation (access this menu by pressing **Alt+Space**) is global, which means that it's aligned to the 3D World axes (default scene axes: X is left/right, Y is front/back, and Z is top/bottom). You can switch Transform Orientation to the local axes of the selection to transform objects using their own orientation.

> **Tip**
>
> If you don't like the default behavior of transforms in Blender (click once to start transforming, and click a second time to confirm), you can activate the Release Confirms option on the Input tab of User Preferences. Release Confirms makes the transform behavior faster so that you can click and drag, and the transform is confirmed as you release the mouse button. This behavior is typical in other software.

Using Keyboard Shortcuts (Advanced)

Although you can use manipulators easily, the expert, really fast way to transform objects in Blender is to use keyboard shortcuts. Sometimes, the manipulators are useful, but most of the time and especially for simple transforms, using the keyboard is faster and more efficient (even though it requires a bit of getting used to and memorizing the keyboard shortcuts). Here are some of the most relevant keyboard shortcuts that make transforms easier and faster:

- Press **G** (Grab) to move, **R** to rotate, and **S** to scale. When you do these things to move and rotate the objects, they move and rotate according to the view. Left-click or press **Enter** to confirm, and right-click or press **Esc** to cancel.
- After pressing **G**, **R**, or **S**, if you press **X**, **Y**, or **Z**, the selection transforms only on that global axis. Press **X**, **Y**, or **Z** twice to align to the selection's local axis.
- Press **R** twice to enter Trackball Rotation Mode, which makes the object rotate in all axes simultaneously following your mouse movements.
- As an alternative to the previous option, when you're transforming with no attachment to a given axis, you can press **MMB.** Lines for the axes appear, and if you move the object close to one of those lines, it is automatically locked to that specific axis.
- The options for precise transforms, snapping, and axis locking using **Shift** and **Ctrl** while transforming with manipulators also apply when you use keyboard shortcuts. Press **G** and then **Shift+Z** to translate the object in the X- and Y-axes at the same time, for example.

Numerically Precise Transforms

When you're performing a transform, Blender allows you to input numerical values. If you look at the 3D Viewport's header when you are rotating an object, you'll find that the header buttons disappear and are replaced by a display of the values of the transform in action. At this point, you can enter values directly from your keyboard, and Blender will use them for the current transformation. Here are two examples:

- To move an object 35 units on the X-axis, use manipulators and write the desired numerical value while dragging. Press **G** to move; then press **X** to snap the object's movement to the X-axis. Now you can drag the object through the X-axis. Type **35** on your keyboard, and the object moves 35 units on the X-axis. Left-click or press **Enter** to confirm the operation.
- Press **R** to rotate, press **Y** to snap to the Y-axis, and enter **-90** on your keyboard to rotate an object -90 degrees on the Y-axis. (When you're entering a numerical

value for a transform, you can add the negative value by pressing the minus key at any time, before or after the number. If you press the minus key again, the value becomes positive.) Left-click or press **Enter** to confirm the operation.

Not only that, you can even enter mathematical expressions to save you time if you start by writing an equal sign (which makes Blender understand that you're writing an expression instead of just a number). For example, you can press **R**, **Z**, and then write =360/12 to rotate an object a fraction of a whole circle in the Z-axis without having to calculate it on your mind or spending time opening the calculator for complex operations. When you do this, the information in the header will not only display the expression you're writing, but also show the resulting transform. In the case of the previous example, the header would show this: Rot:[360/12] = 30° along global Z.

As you can see, using this method makes transformations really fast and easy to perform. The shortcuts are intuitive, and you can use them in most editors; **G**, **R**, and **S** always move, rotate, and scale, for example.

Using Menus

You can also use numerical fields in menus to transform objects. You'll find such fields in two places of the interface (see Figure 3.3):

- 3D Viewport's Sidebar (press **N** to show and hide). Within the Sidebar, pick the Item tab, and you'll find the Transform panel, where you can see numerical fields for every location, rotation, and scale axes.
- In the Object tab of the Properties Editor, you will also find the Transform panel.

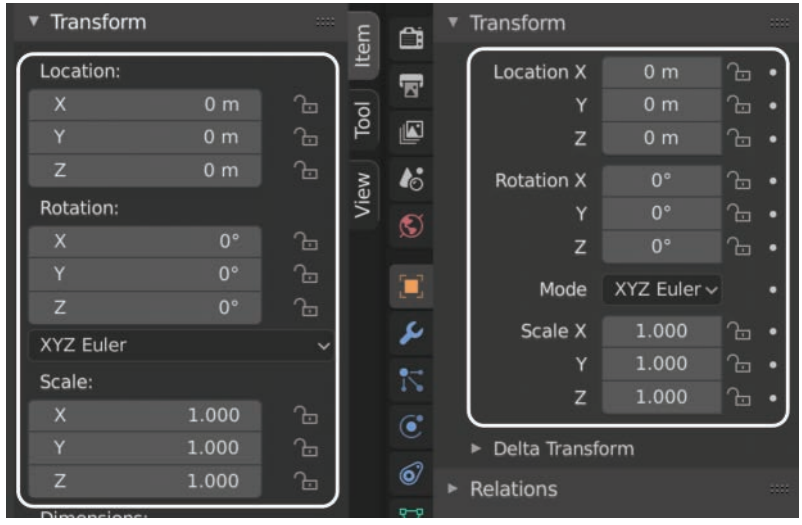

Figure 3.3 On the left side, you can see the Item tab of the 3D Viewport's Sidebar. On the right side, you can see the Object tab of the Properties Editor. Both Transform panels can be used to input values to transform objects.

In any of those panels, you can do either of the following things:

- Click and type a specific number in the input field.
- Click the arrows on the sides of the input field to increase or decrease the number.
- Click and slide left and right to increase or decrease the number. Hold **Shift** while sliding to change the number with more precision. Hold **Ctrl** while sliding to change in increments. Hold **Shift+Ctrl** while sliding to change in smaller increments.
- If you change a value in one of those parameters, the change will affect only the active selection. Hold **Alt** while you change a value to affect the entire selection; this command essentially expands the changes from the active selection to the rest of the selected objects where applicable. Click and drag up and down to select several adjacent fields (works only when those fields are grouped together) and then release to write a number that will be entered simultaneously in all of those fields, or drag left and right to use the sliding options in all of the selected fields at the same time. For example, if you wanted to scale an object in all axes, you could click and drag from the X scale field toward the Z scale field, release, type **2** on your keyboard, and press **Enter** to input the value of 2 in the X, Y, and Z scale axes in a single action.

Arranging Objects in Your Scene

Now that you know how to transform objects, you can make your floor bigger and sit the monkey head on it (see Figure 3.4), as follows:

1. Right-click to select the plane, press **S** to scale, enter **5** on your keyboard to make the plane 5 times bigger, and press **Enter** to confirm. (Or use the manipulators if you feel more comfortable with them.)
2. Select the monkey head, moving and rotating it until it looks as though it's sitting on the floor. As a recommendation, you can switch the 3D Viewport to a side view to see what's going on more clearly and transform the head there by pressing **G** and **R**. Keep in mind that if you're in a side view and rotate using **R**, the object will rotate on the X-axis.

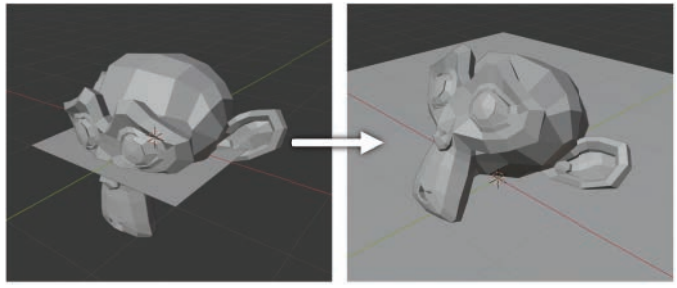

Figure 3.4 The scene before and after the transforms have been performed

Keep in mind that you can do the same thing using any of the methods for transforming objects shown in the previous section, even though throughout the book, I'll use keyboard shortcuts in the explanations to help you use and memorize them.

Naming Objects and Using Datablocks

Before proceeding, you need to learn how to rename objects. This skill will come in handy when you're working in complex scenes and want to recognize objects by their names. Otherwise, you'll find yourself lost in a sea of objects called Plane.001, Sphere.028, and similar generic names.

If a Blender scene were a wall made of bricks, each brick would be a datablock. Every object in Blender has a datablock inside that represents its contents: meshes, materials, textures, lights, curves, and so on. Datablocks can be named and used in the ways discussed in the following section.

Renaming Objects

You have several ways of renaming an object:

- Locate the object in the Outliner. Right-click its name and choose ID Data, Rename within the contextual menu. Alternatively, you can double-click the name, type the new name, and press **Enter** to confirm.
- Press **F2** anywhere in the interface, and a pop-up with the name text field will show up. Press **Ctrl+F2** to open the menu for bulk renaming when you have multiple objects selected.
- In the Properties Editor, go to the Object tab (the one with a yellow cube); type the new name in the text field in the top-left corner; and press **Enter** to confirm.

Managing Datablocks

Datablocks are the most basic Blender components. All the elements you can build—such as objects, meshes, lamps, textures, materials, and armatures (skeletons)—are made of datablocks. Everything in the 3D scene is contained in an object.

Whether you're creating a mesh, a lamp, or a curve, you're creating an object. In Blender, any object has object data inside it, so the object itself acts as a kind of container for the data and stores information about its location, rotation, scaling, modifiers, and so on. Object data defines what's inside an object. If the object data is a mesh, for example, you see a mesh with its vertices and faces inside the object. When you access the object data, you can adjust its parameters. If you click the drop-down list of the object data datablock, you can load a different object data into the object. You could load a different mesh into the object's position, for example. Several objects can use the same object data. (These objects are called *instances* or *linked duplicates*.) This means that even if the objects are in different positions in the scene, all of them synchronize their contents, so if you manipulate the mesh vertices in one of them, the others reflect those changes.

Figure 3.5 shows the difference between the Object and Object Data tabs and how to look for an object's name inside the Properties Editor. The image to the right shows that the mesh's name is inside the object's name. In the image, the object data is a mesh; if it were a lamp or a curve, the icon would change accordingly. The Properties Editor always shows information about the selected object, but if you click the Pin icon, the selected object's information is pinned, and even if you select a different object, the Properties Editor keeps displaying the pinned object's information.

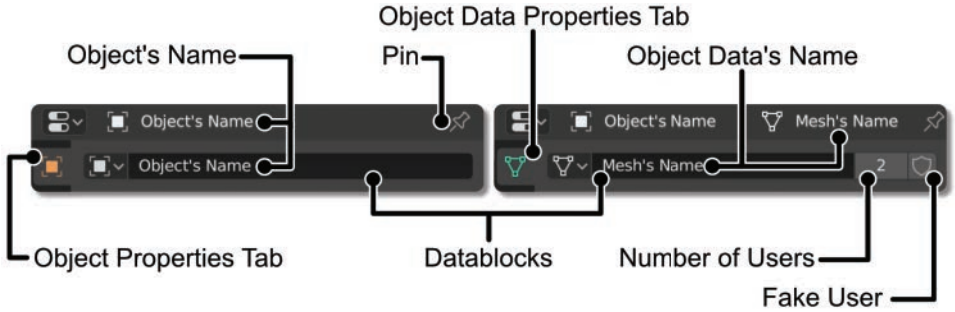

Figure 3.5 Left: Object Properties tab. Right: Object Data Properties tab. You'll find both tabs in the Properties Editor, and in the image, you can see where the names for objects and object data can be found. You can also see how the title of the Properties Editor shows a hierarchy: Object's Name > Object Data's Name, which also serves as an indication of how the object data is contained in the object. The Object and Object Data tabs have been isolated in the image for clarification; you will find those tabs within the rest of the tabs of the Properties Editor.

Duplicates and Instances (Linked Duplicates)

You need to understand the difference between a duplicate and an instance. A *duplicate* is a new object created from an existing one so that it looks the same as the original but is independent, and no link exists between the new one and the original. An *instance* (or as Blender calls it, *linked duplicate*) is also a new object; it can be in a different position, but its content (object data) is directly linked to the original, so if you change the object data in an object, the change also affects all its instances.

When you duplicate an object (**Shift+D**), some Object Data is duplicated with it, and other object data is instanced. You can define the default behavior on the Editing tab of User Preferences. If you duplicate an object, for example, by default Blender duplicates the mesh data contained in it, but it uses the same material data, so both objects use the same material datablock.

On the other hand, instancing (**Alt+D**) duplicates only the object; the rest of the object data it carries inside is linked and synchronized with the original object. An alternative way to instance a mesh (or any other datablock) is to go to the Properties Editor's object data tab and select a different mesh from the drop-down list in its datablock.

To the right of some datablock names, you find a button with a Shield icon as well as a number. The number indicates the number of users that the datablock has. In Figure 3.5, the mesh datablock has two users, which means that two different objects are using that mesh data (they're instances). If you want to turn an instance into an independent, unique datablock, just click the number. Blender creates a duplicate and indicates a single user for the new one.

Blender purges all datablocks with zero users when the file is closed to not accumulate unnecessary data, so if you're not careful, you can lose that great material you created but weren't using. That's why the Shield button next to datablocks exists; it creates a fake user of that datablock. Even if you're not using the datablock in the scene, that datablock will have a [fake] user, which prevents the datablock from being deleted when you quit Blender. Datablocks that have zero users are called *orphan data*.

> **Caution**
>
> If you want to make sure that you keep a datablock in the file when you quit Blender, even if it's not being used (such as a material), click the Shield button next to the datablock's name to make Blender know that you want to keep that datablock.

Keep in mind that you usually work with the names of objects. Most of the time, you don't need to access the names of object data like meshes inside objects, so if you are running low on time, you can generally skip object data naming.

Naming Your Scene's Objects

After you understand what datablocks are and how to rename objects, you can name the objects in your scene accordingly. (You might name the plane Floor, for example.) Sometimes, you have to select a datablock's name from a list, so naming objects and datablocks intuitively will help you find the one you're looking for.

> **Tip**
>
> When you have lots of objects in a scene, it can be difficult to select a specific one, as others may be in the way. If you click the objects in the 3D Viewport several times, the selection jumps between the objects behind the mouse cursor, and if you press **Alt+LMB**, Blender displays a list of objects behind the mouse cursor, so you can select the one you need. This feature is useful only when your objects are named intuitively, of course.

Using Interaction Modes

Blender provides different ways to modify objects in your scene (such as modeling, texturing, sculpting, and posing), called *interaction modes*. By default, when you work in Object Mode, you are able to move, rotate, and scale; Object Mode essentially allows you to place objects in a scene. Probably one of the most useful modes is Edit Mode, which you use to edit object data. For example, you would use Edit Mode to model a mesh; access its vertices, edges, and faces; and change its shape.

You can find the Interaction Mode menu on the 3D Viewport's header (see Figure 3.4); the options it displays depend on the type of object you have selected. For now, I focus on the Object and Edit modes. You'll learn about the other modes throughout the rest of the book.

You use Object Mode to create and place things in your scene (even animate them if you aren't using *armatures*, which are Blender skeletons used to animate characters and deform objects). In Edit Mode, you can perform modeling tasks on the mesh. You can quickly switch between these modes without having to access the selector by pressing the **Tab** key on your keyboard.

When you select an armature, you use Edit Mode to access the bones inside it and manipulate them. Pose Mode is available as well; it's the mode you'll use when animating a skeleton. (For more information, see Chapter 11, "Character Rigging," and Chapter 12, "Animating Your Character.") If you select a mesh, you have access to modes such as Sculpt, Texture Paint, and Vertex Paint, as shown in Figure 3.6.

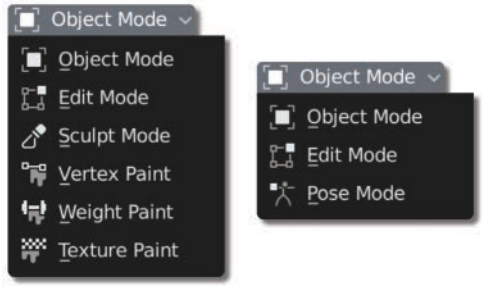

Figure 3.6 The Interaction Mode selector. On the left are the options available when a mesh object is selected; on the right are the options available when an armature is selected.

You can also press **Ctrl+Tab** to launch a pie menu with the available interaction modes for the selected object.

> **Warning**
>
> If you come from previous versions of Blender, or you experience some issues while selecting objects that are in different interaction modes (for example, a mesh object and an armature in Pose Mode), there is a new option that you can try to disable/enable to change the behavior of selections between different types of objects that may have different interaction modes. This option is called Lock Object Modes, which you will find under Edit in Blender's main menu.

As you can see, a lot of options are available, and depending on what you want to do at any point in time, you just have to select the right interaction mode for the actions you want to perform.

Applying Flat or Smooth Surfaces

The monkey head looks weird with the rough edges and polygons that currently compose its shape. This look is useful for some things, but for objects that should look more organic, you may prefer to have a smooth surface. This option changes the surface's appearance but doesn't add any geometry. You have several ways to make a surface look smooth in Blender:

- Select the object you want to smooth. Press **RMB** and choose the Shade Smooth option from the contextual menu (choose Shade Flat for the opposite result).
- Select the object. Click the Object menu of the 3D Viewport's header and select the Shade Smooth option.
- In Edit Mode, select the faces you want to shade with the smooth or flat method, press **RMB**, and select Shade Smooth or Shade Flat from the contextual menu. Alternatively, you'll also find those options within the Face menu in the 3D Viewport's header.

Figure 3.7 shows where these options are in Blender's interface.

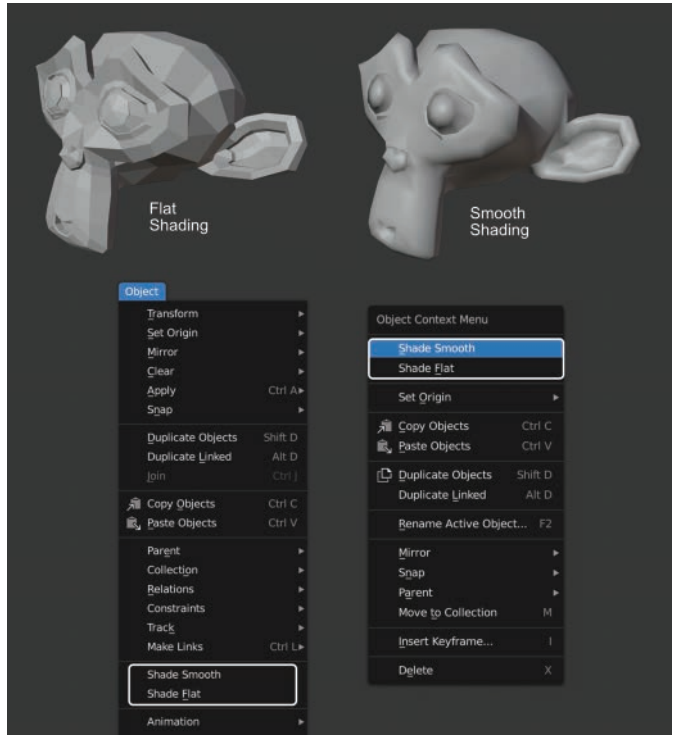

Figure 3.7 A comparison of flat and smooth surfaces and the menus in which you can find these options. On the left, you can see the Object menu from the 3D Viewport's header. On the right, you can see the object's right-click contextual menu.

Working with Modifiers

Even though you used smooth shading in the mesh, the object still doesn't look just right, as it has very low polygonal resolution. You could use a Subdivision Surface modifier to add more detail to the surface and smooth it out (at the cost of adding more polygons to the object). A *modifier* is an element you can add to an object to alter it, such as a deformation, the generation of geometry, or the reduction of existing geometry. Modifiers won't affect the original mesh and adapt automatically to the changes you perform in the original mesh, which gives you a lot of flexibility, and you can turn modifiers on and off when you want. You should be careful, though, as adding too many modifiers may cause your Blender scene to operate slowly.

Adding Modifiers

Clicking the wrench icon in the Properties Editor opens the Modifiers tab, where you can add modifiers (see Figure 3.8). When you click the Add Modifier button, a pop-up menu displays every modifier you can add to the active object. (Not all the modifiers are available for every type of object.) The modifiers are listed in columns based on their functions: Modify, Generate, Deform, or Simulate. Left-click a modifier in the list to add it to the active object.

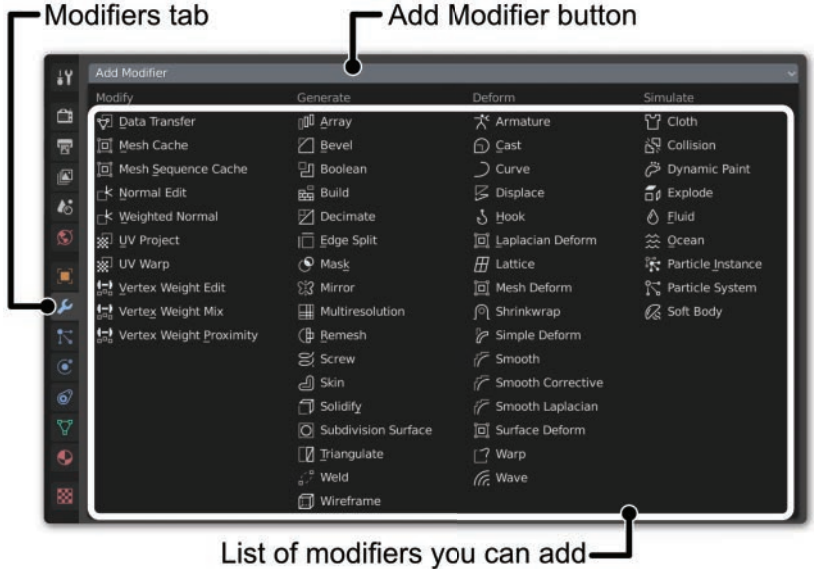

Figure 3.8 On the Properties Editor's Modifiers tab, you can add modifiers to the active object.

When you add a modifier, a block is added to the modifier stack, which works similarly to layers; if you keep adding modifiers, they add their effects to the previous modifiers. Keep in mind that the modifier stack works in the opposite order of layers in other software, such as Adobe Photoshop. In Blender, the last modifier you add is at the bottom of the stack, and its effect alters the effects of the modifiers above it in the list. The order of the modifiers is crucial in defining the resulting effects that the modifiers have on the object.

If you model one side of a mesh, for example, you can assign a Mirror modifier to generate the other half and then assign a Subdivision Surface modifier to smooth the result. The Subdivision Surface modifier should be at the bottom of the list; otherwise, the object is smoothed before being mirrored, and a seam may appear visible in the middle.

Copying Modifiers to Other Objects

When you assign a modifier, it affects only the active object, which is the last selected object (even if you have 20 selected objects). If you want that modifier to be applied to every object in the selection, you have two ways to do this:

- Press **Ctrl+L** to access a menu of linking options. In this menu, you'll find an option that lets you copy modifiers or materials from the active object to the rest of the selection.
- Activate the Copy Attributes add-on in User Preferences (this add-on comes bundled with Blender) and press **Ctrl+C** to access a special menu to copy attributes from the active object to the rest of the selected objects. You'll find the modifiers within those attributes as well.

It's important to know that both **Ctrl+L** and Copy Attributes addon's Copy Modifiers option will overwrite the existing modifiers that objects in the selection have. If you want to keep those, using the Copy Selected Modifiers option within the Copy Attributes addon's menu will add those modifiers from the active object to the existing modifiers in the rest of the selected objects.

Adding a Subdivision Surface Modifier to Your Object

The Subdivision Surface modifier is one of the most common modifiers used in models, because it allows you to increase the details and smoothness of a low-resolution model interactively. You can change the number of subdivisions at any time to display a smoother surface. The modifier basically divides each polygon and smooths the result. As a rule of thumb, when you apply this modifier, the number of faces in your model is multiplied by 4 for each subdivision you apply; therefore, be mindful of the polygon count when setting high subdivision values. You can use this modifier to smooth your monkey-head object, as shown in Figure 3.9.

When you add a modifier, you get a panel in the modifier stack with options that are specific to the modifier you picked. Here are the main options you'll find with a Subdivision Surface modifier:

- In the top row of the panel that encloses the modifier, you can expand/collapse the modifier (by clicking the little triangle to the left), rename it (give the modifier an intuitive name when you have a lot of modifiers added to an object), and define the contexts in which this modifier should be visible. Two buttons with arrows pointing up and down allow you to change the order of the modifiers when you have more than one modifier in the stack. Clicking the X button deletes the modifier.
- Next, you find two buttons: Apply and Copy. Apply transfers the effect of the modifier to the mesh itself. It deletes the modifier, but its effect on the mesh is permanent. Copy duplicates the modifier.
- In the Subdivisions section are two fields that let you define the number of subdivisions that the modifier will perform in the 3D Viewport and in the render. This option is very useful because when you're in the 3D Viewport, you usually want to save resources to ensure that this view is responsive, but in a render, you want a high-quality result. You can set a low number of subdivisions for the 3D Viewport and a higher number for the render.

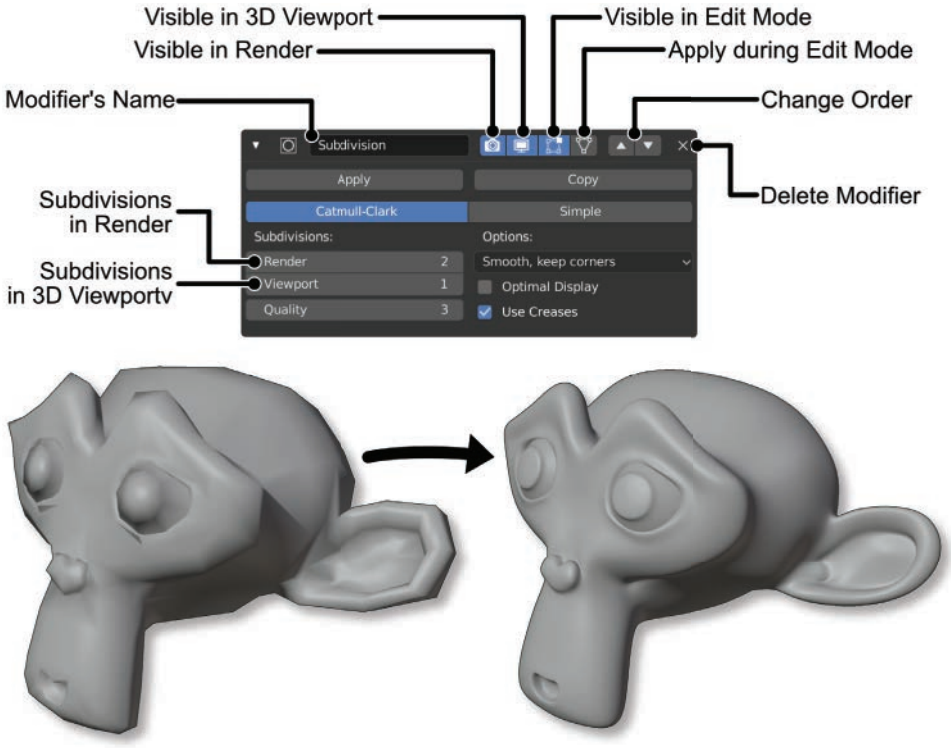

Figure 3.9 Subdivision Surface Modifier options and the monkey head before and after applying a Subdivision Surface modifier

> **Tip**
>
> Subdivision Surface is a widely used modifier, so Blender comes with a keyboard shortcut that lets you add and control it. Press **Ctrl+1** (you must have a mesh selected in Object Mode for this to work) to add a Subdivision Surface modifier with one subdivision. The number you press together with **Ctrl** defines the number of subdivisions shown in the 3D Viewport (doesn't change the subdivision level while rendering). If the object already has a Subdivision Surface modifier added, use this shortcut to change its number of subdivisions. Additionally, if the object has multiple Subdivision Surface modifiers, the shortcut will change the number of subdivisions of the first Subdivision Surface modifier in the stack.

Using Workbench, EEVEE, and Cycles

Blender provides different methods to display and render images, each of them with their uses, pros, and cons. Let's talk about them:

- **Workbench:** This engine runs Blender's 3D Viewport while you're working in Wireframe and Solid viewport shading modes. It's basic, but it has some level of control over how things look. It's lightweight and simple, perfect for general work like modeling, rigging, and animation.
- **EEVEE:** EEVEE has been one of the greatest additions to Blender lately, and it's a real-time render engine, using technologies similar to those used in videogame engines. It can get good-quality results very fast (as long as you have a computer that supports it and can run it with a good performance), although it's based on tricks and sacrifices many calculations to accelerate the render time. It's good for rendering animations that don't require high levels of realism and for previewing scenes and materials that would be rendered with Cycles later. EEVEE is used when you choose the Material Preview viewport shading mode, and it shows at its best in Rendered viewport shading mode (when EEVEE is selected as the active render engine).
- **Cycles:** This realistic renderer is included in Blender. It provides high quality and realism, but it's also much slower than EEVEE, as it doesn't use tricks or sacrifice complex calculations to be faster: it performs all the calculations necessary to achieve the best result. If EEVEE could be compared with what you see in videogames, Cycles would be a render engine used for movies or general video, where render speed is not as relevant as image quality.

You can change the render engine that you want to use in the Render tab within the Properties Editor (see Figure 3.10). When you render the final image, as explained at the end of this chapter, the active render engine is the one that will be used.

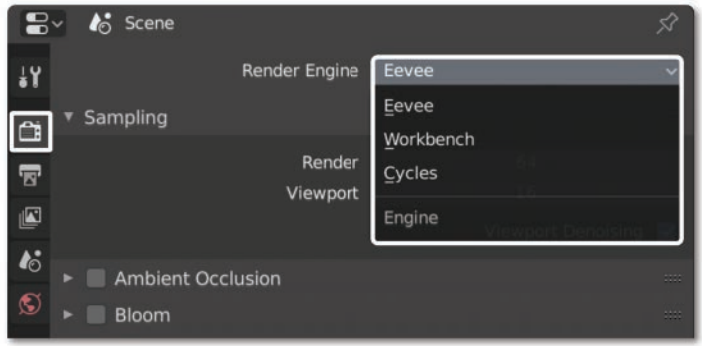

Figure 3.10 You can change the render engine between Workbench, EEVEE, and Cycles from the drop-down menu within the Render tab of the Properties Editor.

Materials Compatibility

Workbench doesn't use materials, but EEVEE and Cycles have been designed so the materials are as compatible as possible between them. Of course, there are certain things that may work only on one of the engines or look different, given that they use different technologies, but in general they are surprisingly compatible.

This makes it possible to create materials using EEVEE (allowing for fast previews) and then render them with Cycles with minimal or no adjustments.

Some advanced rendering effects, such as emissive materials (that emit light from their surface), refractions, and Subsurface Scattering, will work only in Cycles or with certain limitations in EEVEE.

Understanding Viewport Shading

Viewport shading defines how objects are visualized in the 3D Viewport, and it's important to understand how they work before you start adding materials to the scene.

While working, you can change the viewport shading mode in the 3D Viewport to show Wireframe, Solid, Material Preview, or Rendered mode (see Figure 3.11), and different engines will be activated for different modes, although Rendered viewport shading mode will always display a result similar to the final render, but interactively and in real time, using the selected active render engine. Depending on what render engine you use, options for viewport shading will change:

- **Workbench Engine:** Material Preview viewport shading will not be available, as Workbench doesn't use materials (although colors and other properties can be added to objects); it's meant only for general work and simple screenshots. Wireframe, Solid, and Rendered viewport shading modes all use Workbench Engine. A render taken from this engine would be like a screenshot, useful for quick playblasts to check your animations.

- **EEVEE Engine:** Wireframe and Solid viewport shading modes will use Workbench, but Material Preview and Rendered viewport shading modes will use EEVEE.
- **Cycles Engine:** Wireframe and Solid viewport shading modes will use Workbench, Material Preview will use EEVEE, and Rendered viewport shading mode will use Cycles.

Whichever render engine you're using, you'll see their options for rendering in the Render tab of the Properties Editor.

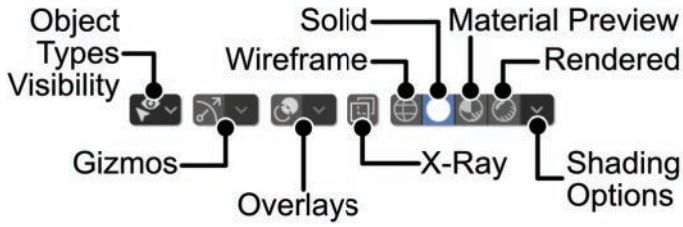

Figure 3.11 Viewport Shading and visibility options. You can find them in the right corner of the 3D Viewport's header.

You can also find interesting options for how the image is shown by clicking the Shading arrow next to the 3D Viewport's shading mode selector. For example, Material Preview Mode will let you change the environment to see how the materials behave under different lightings, and Solid Mode will let you choose different options for how objects are visualized.

Real-Time Preview Rendering

In Blender, you have options to see a rendered preview in the 3D Viewport while you work and adjust parameters using the Rendered viewport shading. It's very useful to see what's going on in the scene and how the shadows and materials behave as you arrange them.

Rendered viewport shading mode, in this case, is not actually real time; it just means that Blender is performing the render interactively, and you can change things in the scene as it's rendered. The speed of the render depends, of course, on your computer's processing speed. For Cycles, a powerful CPU or GPU is recommended for faster performance; EEVEE relies mainly on GPU.

While using Rendered viewport shading mode, you can choose to show or hide manipulators, object outlines, and so on from the Overlays menu on the 3D Viewport's header.

Switching Viewport Shading Modes

To switch viewport shading modes, you can simply click the button for that mode in the 3D Viewport's header (refer to Figure 3.11).

Alternatively, and to speed things up, you can use keyboard shortcuts:

- Press **Z** to launch the viewport shading pie menu, and choose one of the options.
- Press **Shift+Z** to switch between the current viewport shading mode and Wireframe viewport shading mode.

Managing Materials

Materials define how an object looks, such as what its color is, whether the object is dull or shiny, and whether it is reflective or transparent. With materials, you can make an object look like glass, metal, plastic, or wood. In the end, both materials and lighting define how your objects look. In this section, you see how to add materials to your objects by using both Blender Render and Cycles.

On the Materials tab (the red sphere with a checkered pattern icon) of the Properties Editor, you can add new materials or select existing ones from the drop-down list shown in Figure 3.12. A single object can have multiple materials, and these materials appear in the list at the top of the material properties. You can add and remove new slots for materials by clicking the + and - buttons on the right side of the list, and you can assign each of those materials to a selection of faces when you're in Edit Mode.

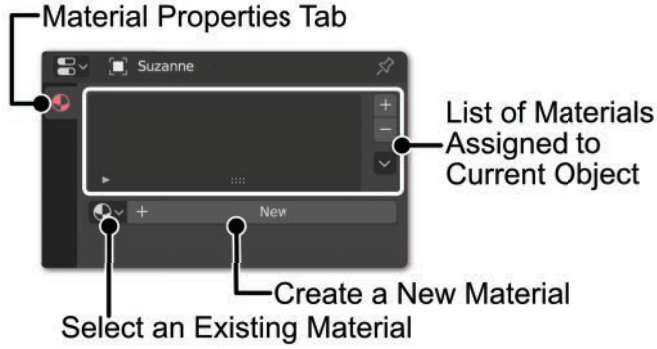

Figure 3.12 Use this menu on the Material Properties tab of the Properties Editor to add materials. Keep in mind that the Material tab has been isolated for clarification; in the Properties Editor, you'll find it within the rest of the tabs.

Adding and Adjusting Materials

Advanced materials require the use of node trees in the Shader Editor, but don't worry; for now, I'll keep things simple. Inside a material, you'll find the Surface panel, which includes various types of surface shaders, such as

- **Diffuse:** Creates a basic material with only color—no shine, reflection, or other special properties.
- **Glossy:** Makes the material reflective and shiny.
- **Emission:** Makes the material emit light into the scene.
- **Transparent:** Lets light pass through the material.
- **Glass:** Simulates a glass surface.
- **Principled BSDF:** Includes many of the properties provided by the others, so it's a very useful shader type, and conveniently, it's the one you get by default when you create a new material.
- **Mix:** Mixes two shaders to achieve a more elaborate effect.

Many surface shaders are available; these are just some of the main ones. Each of the shaders has different parameters to control how light affects that shader, such as color and roughness. Accessing nodes makes it easier to create complex and custom materials by combining the effects of some of the shaders and using textures. (See Chapter 10, "Materials and Shaders.")

Remember that these materials are almost completely compatible between EEVEE and Cycles, so for simple cases, the same settings will work in both engines (even though there may be some differences in the result, given the different approaches that both engines used to calculate the final image).

> **Tip**
>
> When working with materials, it's recommended that you work with Material Preview or Rendered viewport shading in EEVEE, as they will let you see how the material looks in real time.

To add materials with different colors to your scene, you just need to select each object and create a material from the Material Properties tab in the Properties Editor. Follow this procedure:

1. Select the monkey head.
2. Go to the Material Properties tab of the Properties Editor.
3. Add a new material by pressing the New button and name it properly to make it recognizable.
4. You'll get the options for a Principled BSDF shader. Adjust the base color parameter to choose the color you'd like for the material. Play with other parameters of the material to see how it changes.
5. Repeat the process with a new material for the floor plane.

Turning On the Lights

Now that you have materials set up, it's time to make the scene look more realistic with some light and shadows. Lights are also compatible between EEVEE and Cycles, even though some of their options are different. For basic use, however, there shouldn't be any problem. (Chapter 14, "Lighting, Compositing, and Rendering," provides more information about lighting.)

Light Options

There are different types of lights with different properties, but there are two properties that all of them share and that are compatible in both EEVEE and Cycles: Color and Power. Color, as the name implies, will change the color of the light, and Power will increase or decrease its intensity (it's measured in Watts).

To access the light properties, select a light in your scene, and the Object Data tab of the Properties Editor should change into a teal light bulb. From that tab, you will find options to change the light type and its properties.

Remember that using EEVEE in Rendered viewport shading mode, you should be able to preview the lights' effect on your scene as you adjust them.

Adding Lights to Your Scene

Follow these steps to create a basic lighting scheme for your scene (and remember that you can access the menu for adding new objects to the scene by pressing **Shift+A**):

1. Select the light in your scene (or create a new one if you don't have a light yet).
2. Duplicate the light, and place it on the other side of the scene to fill the shadow areas.
3. Adjust the Color and Power of your lights so that the one on the right is brighter (this will be your main light), while the one on the left is dimmer and a different color (this will act as a fill light, to prevent the area in the shadow from being completely dark).

Moving the Camera in Your Scene

You need a camera in your scene, of course, so that Blender knows the point of view to look from when it takes the final render. Follow these steps to position the camera:

1. Select the camera in your scene or create a new one (**Shift+A**) if you deleted it previously.
2. Place the camera so that it focuses on the monkey head from a point of view that appeals to you. You can divide the interface into two 3D Viewports. In one of those views, you can look through the camera (**NumPad 0**), and in the other

view, you can adjust the placement of the camera. Alternatively, you can use Walk Mode or Fly mode (**Shift+`**) to position and orient the camera while you're in Camera View.

Figure 3.13 shows what your scene should look like at this point of the process.

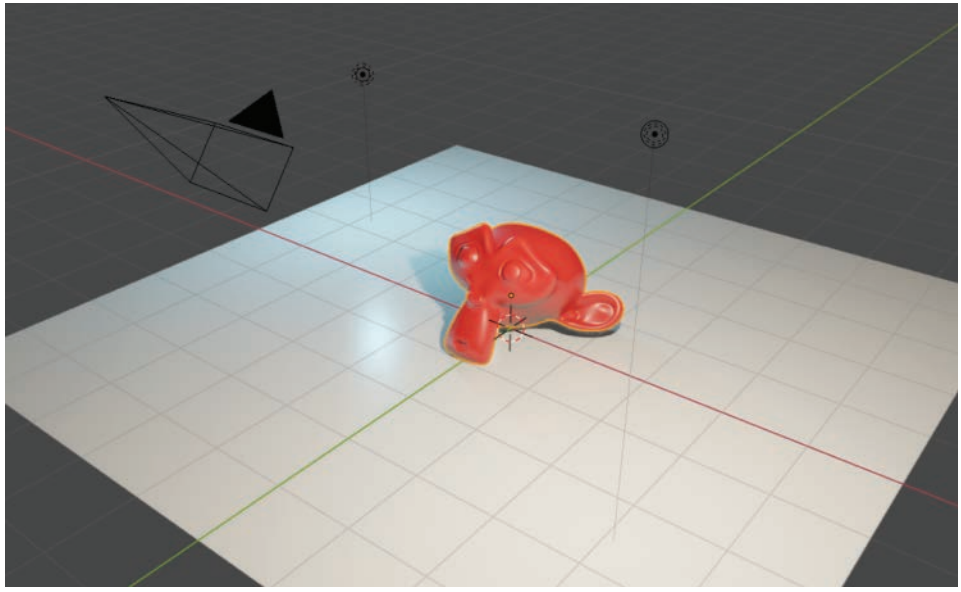

Figure 3.13 At this point, your scene should look something like this image. The monkey head is on the floor, the camera is pointing at it, and two lights illuminate everything in the scene.

Rendering

Rendering is the process that converts your 3D scene to a 2D image or animation. During this process, Blender calculates the properties of materials and lights in the scene to apply shadows, reflections, refractions, and so on—everything you need to build your cool final result and turn it into an image or a video.

Whether you use EEVEE or Cycles, you would access options for rendering within the Render tab in the Properties Editor.

Select your desired render engine. For such a simple scene, not many changes should be made, but here are a couple of things you can try:

- **For EEVEE:** If you want the surfaces to reflect other objects, you can enable Screen Space Reflections in the Render Properties tab.
- **For Cycles:** Cycles calculates light paths and bounces throughout the scene. This generally means that the more calculations (and more render time), the cleaner

the result. If you have a low samples count, you'll have noise in the resulting render, as the pixels still don't have enough information to display the complete result. You can increase the render samples amount in the Render Properties tab of the Properties Editor to get a cleaner image.

Enabling GPU Rendering with Cycles

GPUs can be much faster than CPUs for rendering with engines such as Cycles. If you want to use your GPU to render the scene, follow these steps:

1. Open User Preferences.
2. On the System tab, you'll find a panel called Cycles Render Devices. Depending on your graphics card, some of the options within that panel will be available. Make sure to select one of them and enable the GPU or GPUs that you want to use.
3. Go back to your scene, and within the Render Properties, you'll find the Device menu (right under the render engine selector). Select GPU.
4. Finally, go to the Performance panel in the Render Properties, and set the Tile Size to a number such as 64, 128, 256, 512... try rendering the scene with different values in the Tile Size, as depending on your GPU, you will get better results with different sizes.

Tile Size defines the size of the squared parts of the image that the CPU or the GPU can render at a time. Generally, CPUs work better with small values (16, 32, 64, and so on), while GPUs work better with bigger values (128, 256, 512, and so on). Setting the right value for your hardware can help you get faster results, but keep in mind that in general, rendering with Cycles requires high-performing equipment, so anything that isn't very powerful may be very slow, regardless of the settings.

In User Preferences, you can also choose if you want to use CPU and GPU to render together (you just have to enable both the CPU and GPU). If you choose this option, it's recommended to use little tile sizes so that the CPU doesn't lag behind GPU while rendering.

Now you're ready to launch the final render. But first, let's learn how to save the .blend file.

Saving and Loading Your .blend File

Now you're at a good point to save your file. Rendering can take some time, and something can go wrong in the meantime (such as power failures or software crashes) that could cause you to lose your work. That's why it's recommended that you save your file often.

You can save your file by pressing **Ctrl+S**. If you're saving a file for the first time, Blender displays a menu where you can select the location where you want to store your file and name the file. If you've saved the file previously, press **Ctrl+S** to overwrite the

previous version. If you press **Shift+Ctrl+S**, Blender displays the Save menu again so that it allows you to create a new version of the file with a different name.

To open a file, press **Ctrl+O**. Blender shows you the folder navigation menu, where you can look for the .blend file you want to open. On the File menu, you can also access the Open Recent option, which shows you a list of the latest files you've worked on so you can open them quickly.

You don't need to use those shortcuts, of course; you can always choose the Save, Save As, Save Copy, and Open options from the File menu.

Save Copy doesn't have an assigned keyboard shortcut and it's a bit unusual, so what does it do? Well, it's similar to Save As except that it saves the current status of the scene in a file, but then you keep working on the original instead of in the new file.

> **Tip**
>
> There's a little trick for saving different versions of a file really fast. Sometimes, you want to save your progress in a new file, so you'll have different files from different parts of the process and can go back to a previous version if necessary. Choose Save As from the File menu (or press **Shift+Ctrl+S**), and press the **NumPad +** key. Blender automatically adds a number to the filename. If the filename is already numbered, Blender adds 1 to it.

Launching and Saving the Render

Before launching the render, remember to select the desired Render Engine from the Render tab in the Properties Editor. Remember as well that the image format can be set up in the Output tab of the Properties Editor. Then, you can launch it in several ways:

- Press **F12** for a still render.
- Press **Ctrl+F12** to render an animation.
- Select the Render Image or Render Animation options from the Render menu on the main menu at the top left of Blender's interface.

By default, the render will appear in an Image Editor in a new window. You can change this behavior so the render shows up within the main interface: for example, turning the biggest area into an Image Editor and displaying the render in it.

To save the image once it's rendered, you can do it in different ways:

- In the Image Editor where the render is shown, go to the Image menu within the header, and select the option to save the image.
- In the same Image Editor, you can launch the Save menu by pressing **Alt+S** or **Shift+S**.

When you're rendering an animation, images are automatically saved after being rendered, using the format, name, and destination defined in the Output tab of the Properties Editor.

You can press **Esc** after the render to go back to switch to the main interface again. If you chose to display the render within the main interface, the Image Editor will turn into the previous editor type, while if the render is shown in a different window, it will remain open (you can close it).

Figure 3.14 shows the images that result from both engines' renders. Given that the scene is very basic, there are no many differences between EEVEE and Cycles renders, although some subtle differences can be spotted. Cycles, for example, has bounced light that spreads some of the monkey head's red color on the ground and makes the areas in the shadows a bit brighter, making for more realistic lighting. Still, EEVEE got very close with a fraction of the render time. In complex scenes with complex materials, you will find a more noticeable difference, but for now, I just wanted you to try both to see how easy it is to switch between them, given the high compatibility of materials and lights.

Figure 3.14 Resulting renders. Left: EEVEE. Right: Cycles.

Summary

In this chapter, you learned how to create and transform objects; add modifiers, lights and materials; and launch a render. This chapter gave you a lot to process, but I hope that you now know the basics of interacting with your scene. You're ready for the more extensive information in the chapters that follow.

Exercises

1. Create and manipulate a few objects.
2. Add some other modifiers and play with them to see their effects.
3. Try different things with EEVEE and Cycles to get acquainted with the differences between them.
4. Add more lights to the scene and play with materials to change the results.

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