




Unity虚拟现实项目 (影印版)

Unity Virtual Reality Projects

Jonathan Linowes 著

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About the Author

Jonathan Linowes is the owner of Parkerhill Reality Labs, a start-up VR/AR consultancy firm. He is a veritable VR and 3D graphics enthusiast, full-stack web developer, software engineer, successful entrepreneur, and teacher. He has a fine arts degree from Syracuse University and a master's degree from the MIT Media Lab. He has founded several successful start-ups and held technical leadership positions at major corporations, including Autodesk Inc.

This book is dedicated to Lisa — my wife, best friend, and soul mate — and the amazing family we created together: Rayna, Jarrett, Steven, and Shira who know in their hearts that the future is theirs to embrace.

About the Reviewers

Krystian Babilinski began working with Unity and Blender when he was in middle school. Since high school, he and his brother, Adrian, taught via Google's Helpouts service. Through teaching, he exposed himself to a new assortment of problem sets, which he then experienced firsthand. Slowly, he began getting involved in large-scale projects and freelance work. With a growing portfolio and knowledge of Unity 3D along with platform optimizations, he and his brother started their own creative firm in 2014. They began developing assets for Unity's Asset Store and worked for larger clients, such as The Hasley Group and Beach Consulting. These successes wouldn't have been possible without their loyal customers.

Arindam Ashim Bose, as of 2015, is pursuing his master's degree in computer science at the Georgia Institute of Technology in Atlanta. He is interested in computer graphics, virtual and augmented reality, and game development.

He was born in Mumbai and has been fascinated by computers and technology, especially computer games, since a very young age. He would spend countless hours during his vacations and weekends playing games and tinkering with them to modify them. It was this habit of tinkering and modding that got him into computer programming.

He is currently trying to break into the games industry as a programmer while pursuing his master's degree.

Rongkai Guo is an assistant professor in the department of computer software engineering and game design and development at Kennesaw State University. His research interests are serious gaming, computer/mobile gaming, and virtual reality (VR). He has been conducting research on a VR for rehabilitation project for more than 4 years. He has conducted his first basic research study, IN THE WORLD, which formally investigated how VR impacts persons with mobility impairments.

Arun Kulshreshth is a researcher in the department of computer science at the University of Central Florida. His research interests include 3D user interfaces, human-computer interactions (HCI), games, and virtual reality. He received his master of technology (an integrated 5-year program) in mathematics and computing from the Indian Institute of Technology, Delhi, in 2005. He received a master of science in computer science in 2012 and a PhD in computer science in 2015 from the University of Central Florida.

He is the author of several publications that are related to his research work pertaining to utilizing 3D user interface technologies (such as stereoscopic 3D, head tracking, gestural interfaces, and so on) for video games. He is a professional member of the Association for Computing Machinery (ACM) and Institute of Electrical and Electronics Engineers (IEEE). In the past, he has conducted research at several international locations, including Spain, Denmark, and USA. One of his papers was awarded an honorable-mention award in a leading HCI conference (CHI 2014). In 2014, his name was featured in a Reuters article, and one of his projects was featured on Discovery News.

Robin de Lange is a researcher, lecturer, and entrepreneur with a focus on virtual reality and education.

Robin has an MSc degree in media technology from Leiden University and a bachelor's degree in physics and philosophy from the same university. He conducts part-time PhD research at the media technology research group of Leiden University under the supervision of Dr. Bas Haring. For his research, he is exploring the potential of augmented and virtual reality to understand and solve complex problems. Part of this research is an elective course, where Robin leads a group of students to create virtual reality prototypes for the field of education.

Besides his academic career, Robin has started many different initiatives. He is the director of a homework guidance company and the founder of Lyceo CodeWeken, a unique program for high-school students that teaches how to code.

Samuel Mosley is a game designer. He studied programming and game design at the University of Texas in Dallas. Showing an interest in both programming and games, he hopes to play an important role in both fields. He is currently working as a game designer for Bohemia Interactive Simulations.

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Preface

Today, we are witnesses to the burgeoning of virtual reality (VR), an exciting new technology that promises to transform in a fundamental way how we interact with our information, friends, and the world at large.

What is consumer virtual reality? By wearing a head-mounted display (such as goggles), you can view stereoscopic 3D scenes. You can look around by moving your head and walk around by using hand controls or motion sensors. You can engage in a fully immersive experience. It's like you're really in some other virtual world.

This book takes a practical, project-based approach to teach you the specifics of virtual reality development with the Unity 3D game engine. We walk through a series of hands-on projects, step-by-step tutorials, and in-depth discussions using Unity 5 and other free or open source software. While VR technology is rapidly advancing, we'll try to capture the basic principles and techniques that you can use to make your VR games and applications immersive and comfortable.

You will learn how to use Unity to develop VR applications that can be experienced with devices such as the Oculus Rift or Google Cardboard. We'll cover technical considerations that are especially important and possibly unique to VR. By the end of this book, you will be equipped to develop rich, interactive virtual reality experiences using Unity.

What this book covers

Chapter 1, Virtually Everything for Everyone, is an introduction to the new technologies and opportunities in consumer virtual reality (VR) as regards games and non-gaming applications.

Chapter 2, Objects and Scale, discusses how you can build a simple diorama scene. It introduces the Unity 3D game engine as well as Blender for 3D modeling and explores the issues of world coordinates and scale.

Chapter 3, VR Build and Run, helps you configure your project to run on a VR headset, such as the Oculus Rift and Google Cardboard (Android or iOS). Then, we go into detail about how the VR hardware and software works.

Chapter 4, Gaze-based Control, explores the relationship between the VR camera and objects in the scene, including 3D cursors and gaze-based ray guns. This chapter also introduces Unity scripting in the C# programming language.

Chapter 5, World Space UI, implements many examples of user interface (UI) for VR, which includes a heads-up display (HUD), info-bubbles, and in-game objects with a lot of code and explanations.

Chapter 6, First-person Character, dissects the Unity character objects and components, which are used to build our own first-person character with gaze-based navigation. Then, we'll explore the experience of having a first-person virtual body and consider the issue of motion sickness.

Chapter 7, Physics and the Environment, dives into the Unity physics engine, components, and materials as we learn to work with forces and gravity in a number of VR project examples and games.

Chapter 8, Walk-throughs and Rendering, helps us build a 3D architectural space and implement a virtual walk-through. We also talk about rendering in Unity and performance optimizations.

Chapter 9, Using All 360 Degrees, uses 360-degree media in a variety of projects, including globes, panoramas, and photospheres. We also have a discussion on how it all works.

Chapter 10, Social VR Metaverse, explores the multiplayer implementations with VR using the Unity 5 networking components. We also have a look at VRChat as an example of an extensible platform for social VR.

Chapter 11, What's Next?, in this chapter the author comments about the potential of this exciting technology.

What you need for this book

Before we get started, there are a few things that you'll need. Grab a snack, a bottle of water, or a cup of coffee. Besides this, you'll need a PC (Windows or Mac) with the Unity 3D game engine installed.

You don't need a superpowerful rig. While Unity can be a beast that can render complex scenes and Oculus has published recommended specifications for PC hardware, you can get by with less. Even a laptop will do for the projects in this book.

To get Unity, go to <https://unity3d.com/get-unity/>, select the version that you want, click on Download Installer, and continue following the instructions. The free Personal Edition version of Unity is fine.

We can also optionally use the Blender open source project for 3D modeling. This book isn't about Blender, but we'll use it if you want. To get Blender, go to <http://www.blender.org/download/> and follow the instructions for your platform.

Access to a virtual reality head-mounted display (HMD) is recommended in order to try out your builds and get first-hand experience of the projects developed in this book. It's entirely possible to build and run all the projects on a desktop monitor, but where's the fun in that? This book addresses the details of both Google Cardboard and Oculus Rift.

Google Cardboard is an example of Mobile VR, where you use your smartphone to run the VR apps. If you have an Android smartphone, you'll also need the Android development tools from Google. If you have an iOS device, you'll also need the Xcode development tools (and license) from Apple. The details are covered in *Chapter 3, VR Build and Run*.

Oculus Rift is an example of Desktop VR. Presently, Unity has built-in support for the Rift. However, if you have a different head-mounted display (HMD), you may also need to download a Unity interface package from the device manufacturer. Again, the details are covered in *Chapter 3, VR Build and Run*.

This should just about do it—a PC, the Unity software, a HMD, and we're good to go!

Who this book is for

If you are interested in virtual reality, want to learn how it works, or want to create your own VR experiences, this book is for you. Whether you're a nonprogrammer and are unfamiliar with 3D computer graphics, or experienced in both but new to virtual reality, you will benefit from this book. It is not a fresh start with Unity, but you do not need to be an expert either. Nevertheless, if you're new to Unity, you can pick up this book as long as you realize that you'll need to adapt to the pace of the book.

Game developers may already be familiar with the concepts in the book, reapplied to the VR projects while learning many other ideas specific to VR. Mobile and 2D game designers who already know how to use Unity will discover another dimension! Engineers and 3D designers may understand many of the 3D concepts, but they may learn to use the game engine for VR. Application developers may appreciate the potential nongaming uses of VR and want to learn the tools that can make this happen.

Conventions

In this book, you will find a number of text styles that distinguish between different kinds of information. Here are some examples of these styles and an explanation of their meaning.

Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows: "Modify the AvatarMultiplayer.cs script."

A block of code is set as follows:

```
using UnityEngine;
using System.Collections;

public class RandomPosition : MonoBehaviour {
    // Use this for initialization
    void Start () {
    }
    // Update is called once per frame
    void Update () {
    }
}
```

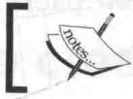
When we wish to draw your attention to a particular part of a code block, the relevant lines or items are set in bold:

```
public class ButtonExecute : MonoBehaviour {
    public float timeToSelect = 2.0f;
    private float countDown;
    private GameObject currentButton;
    private clicker = new Clicker ();
}
```

Any command-line input or output is written as follows:

```
moveDirection *= moveDirection * velocity * Time.deltaTime;
transform.position += transform.position + moveDirection;
```

New terms and important words are shown in bold. Words that you see on the screen, for example, in menus or dialog boxes, appear in the text like this: "Click on the **Create a Room** button."



Warnings or important notes appear in a box like this.



Tips and tricks appear like this.

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1

Virtually Everything for
Everyone

Virtual reality reality! In this book, we will explain what it takes to create virtual reality experiences on desktop. We will follow up with a chapter on the use of next-gen portable devices such as smart glasses, including Unity 5 3D game engine and other tools to make your own VR app. Though the virtual reality technology is rapidly advancing, we'll try to explain the basic principles and techniques that you can use to make your VR games and applications both immersive and enjoyable.

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