

# **Unreal for Mobile and Standalone VR**

**Create Professional VR Apps  
Without Coding**

**Cornel Hillmann**

**Apress®**

# ***Unreal for Mobile and Standalone VR: Create Professional VR Apps Without Coding***

Cornel Hillmann  
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ISBN-13 (pbk): 978-1-4842-4359-6

ISBN-13 (electronic): 978-1-4842-4360-2

<https://doi.org/10.1007/978-1-4842-4360-2>

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Cover designed by eStudioCalamar

Cover image designed by Freepik ([www.freepik.com](http://www.freepik.com))

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail [orders-ny@springer-sbm.com](mailto:orders-ny@springer-sbm.com), or visit [www.springeronline.com](http://www.springeronline.com). Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a Delaware corporation.

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*For Audrey and Lenoir*

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# About the Author



**Cornel Hillmann** is a Computer Graphics (CG) artist, virtual reality developer, and entrepreneur, and runs [studio.cgartist.com](http://studio.cgartist.com), where he provides design, visualization, and VR services for his B2B clients.

Cornel started his career as an art director in Los Angeles after receiving his diploma in computer graphics. He founded CNT Media GmbH a media production company in Hamburg, Germany, and Emerging Entertainment Pte. Ltd., based in Singapore. Over the years, he has produced interactive media applications, visualizations, and animations for corporate clients and design partners and has helped media companies as a consultant to optimize their production pipeline. Cornel has produced a line of training video DVDs on the subject of 3D modeling, animation, and visual effects. He has also lectured on the subjects of character animation, design, and virtual reality. He has often contributed to development conferences and interactive media events as a panel member and speaker. Cornel became involved in VR with the first Oculus developer kit in 2013. While using Unity 3D, he moved over to Unreal in 2014. Since then, he has integrated Unreal into his workflow using it as a production environment developing interactive visualizations for his product design and media clients, while secretly working on his own VR mystery game during his spare time.

# About the Technical Reviewer

**Wojciech Jakóbczyk** is a senior software professional with experience in various industries. For the last few years, he has been engaged in virtual reality development—mostly technologies for content creation. He has experience working with Unreal Engine 4 on VR platforms ranging from mobile and standalone to high-end desktop headsets. Currently, he is working as a CTO at Superbright ([www.superbright.org](http://www.superbright.org)), a VR content studio developing games and other interactive VR experiences.

# Acknowledgement

First, I would like to thank my wife, Audrey, for her support and patience as a consultant, concept proofreader, and test audience.

My thanks go out to fellow VR developer Hampus Soderstrom, the ingenious mind behind the classic cult game *Toribash: Violence Perfected*. He got me started in VR, and thanks to him, I was able to get the first Oculus dev-kit 1 in the early VR days, when it was very difficult to get a hold of one. Hampus is the creator of the crazy-wild VR titles *Boxplosion*, *Actionpaint VR*, and *Dimensional Intersection* on Steam VR (do yourself a favor and check them out, as they are a lot of fun).

I would also like to thank Carl-Emil Kjellstrand for hooking me up with the northern European developer scene through his invitation to speak at the Øredev conference, which has resulted in a lot of new professional friendships, partnerships, and inspirations for future endeavors.

I would also like to thank Joanna Adams, the creative director and author behind *The Future is Wild* TV series. The teamwork to produce the first *The Future is Wild* VR showcase at the MIPCOM conference in Cannes, France, was rewarded with a lot of enthusiasm, positive feedback, and new opportunities.

My thanks to my visualization and design clients and partners, whose projects have supported me over the years.

I should also thank my VR course students, who helped me discover new angles in prototyping during class and made it fun to explore new VR concepts. Last but not least, I'd like to thank my fellow VR developers and colleagues in Singapore, including the Asia VR Association, for the community support, enthusiasm, and fun events, and prototype and technology demos that help make this industry as exciting as it is.

# Preface

The Unreal engine has had, for the longest time, the reputation to be used only in major game productions with large teams and budgets in the seven- to eight-digit range and therefore not being very accessible to smaller studios or individual designers to produce interactive visualizations.

This perception is now being challenged as it has become an accessible and reliable tool for real-time visualization in the architecture and product design industry. Real-time graphics are replacing render farm-based production pipelines for animation productions, and visual scripting is making software development accessible to creatives.

Due to the high-end history of the Unreal engine, most literature have been focused on C++ coders and not so much on designers, artists and creators coming from the visual arts field, even though Unreal brings a perfect toolset and production environment for the creative mind.

This book caters to visual artists coming from a traditional 3D background. It only requires an understanding of Unreal engine basics, which can quickly and easily be learned from the Unreal online educational resources. Basic understanding of the interface and being familiar with the most important components for an Unreal project are required as prerequisites. It is recommended to be familiar with the different types of variables and Blueprint classes.

In the hands-on section of the book, we will cover the basic setup for locomotion, teleportation, and motion controller interaction and complete two project-based tutorials. The first is a fully interactive VR product presentation using the widget interaction components and the second is a project focused on puzzle mechanics and AI characters in Chapter 7.

## PREFACE

The instructions cover not only Unreal but also the full roundtrip using Blender, Substance Designer, Substance Painter, and other typical production tools.

All of the examples and tutorials have been chosen to work within a book format. Blueprints can easily grow in complexity; for that reason, we will try to keep the focus on the most essential parts. Feel free to add your own refinements to extend the basic setup to a customized and extended final result. The format of this book was inspired by a development journal, where the detailed description of a Blueprint execution is followed by a screenshot image. This way, it can easily be used as a reference, when coming back to it later. The chapters on optimization, pipelines, concepting, references, ecosystems, and outlook are provided to give a complete roundup of all the factors that play into a VR production and hopefully they provide a glimpse into the exciting VR future that is ahead of us.

This book is intended as an introduction, guide, and hands-on tutorial to virtual reality (VR) production using the Unreal engine. It is intended for designers, artists and multimedia producers interested in expanding their toolset. The new generation of mobile and standalone VR headsets is finally reaching the mainstream of consumers. For content producers, devices such as the Oculus Go offer a solid platform for immersive content and the Unreal engine a proven workhorse for mobile and standalone VR development.

As VR headsets have become more affordable, and easier to use along with increased display quality, adoption rates have accelerated. Today, it is not uncommon to see VR headsets—not only at convention booths, but also at local car dealerships, supermarkets, and shopping malls—being used to introduce consumers to new products, services, and promotions, as well as to provide entertainment at home.

This book aims to give a foundation to approaching and executing a VR production with two different examples. The first tutorial project focuses on visualization and techniques to tweak the rendering quality by looking



at light mapping techniques, among others. The second tutorial project gives a deeper look into Blueprint interactions to understand how a light puzzle-style experience is laid out. This example is not limited to use for games, but can also be applied to the gamification of other content.

## **A Brief History of Unreal and VR**

VR has come a long way, from its humble beginnings in the early '90s, when it was first commercially introduced, to the years behind closed doors in high-end research facilities, up until its most recent incarnation, when the startup Oculus launched its Kickstarter campaign for the Oculus Rift in 2012, and finally its purchase by Facebook for two billion dollars.

## **From Tethered to Mobile and Standalone VR**

When the new generation of VR head mounted devices (HMDs), spearheaded by the Oculus Rift and the HTC Vive was introduced in 2016, the industry was at first in for a bumpy ride as unrealistic market expectations, hype and high ownership costs prevented a commercial breakthrough and kept the user base limited to a niche of enthusiasts and special interest users.

The latest wave of mobile and standalone VR HMDs based on the Android operating system is finally breaking out of this niche and gaining traction with low cost, ease of use and high quality offerings.

While devices such as the Vive Focus and the Lenovo Mirage Solo are using six degrees of freedom (6DOF) tracking on players' orientation through the headset similar to high-end PC-based VR setups, all of these devices, including the Oculus Go, include one common feature—a three degrees of freedom (3DOF) motion controller that only tracks the user's hand rotational movements.

## PREFACE

There has been a heated discussion among users and developers as to what extent is 6DOF more critically important than 3DOF for a solid VR experience. Whichever camp you are in, when it comes to 6DOF, it is only a matter of time until mobile and standalone VR is on par with PC-based tethered headsets. The same is true for visual fidelity, as we are approaching cloud-based VR, enabled through high-performance 5G networks in the not-too-distant future.

Mobile and standalone VR is the future, and the Oculus Go is the first consumer-friendly generation of this device category, as it presents itself with the best value and price-performance ratio. For this reason, this book is focused on development for the Oculus Go. The principles and techniques will fundamentally be the same for subsequent generations of this device category, when 6DOF and other technical enhancements will find its way to the next generation of mobile and standalone VR HMDs.

## **The New Era of Digital Content Creation with Visual Scripting**

To develop for VR we have two major contenders: The Unreal Engine by Epic Games and Unity 3D, both excellent choices in their own ways. The Unreal engine has the advantage of the fully integrated visual scripting system called Blueprints, a successor to the previous, much more limited visual scripting system called Kismet in Unreal 3. Even though there are third-party visual scripting plugins for Unity 3D, nothing comes close to the deep integration into the engine as we have in Unreal 4 with Blueprints. The power of visual scripting is that it opens the doors to non-coders. Today it is possible to do complete productions without writing a single line of code, something unthinkable just a decade ago. Blueprints can be as complex as you want them to be; the possibilities are limitless. By creating game logic with a nodes-based interface, digital artists,

multimedia producers or level designers have access to everything needed to complete and deploy a final application.

Some people even learn coding by understanding how Blueprints works. By diving deep into the world of Blueprints, programming principles and terminology becomes clearer and more illustrated. The native programming language of Unreal is C++, with full source code access for developers. Big productions will of course base their development to a good extent on C++, especially in challenging areas such as complex multiplayer projects. But for smaller teams, or even the typical one-man show, Blueprints is all you need. Internally, Blueprints run in what is called a virtual machine, an intermediate abstraction, instead of on a compiled machine code. In case there are concerns for performance, it is even possible to cook Blueprints into C++ code, so even that concern is taken care of.

Nevertheless, for performance optimization, it is also important to understand the typical coding bottlenecks, such as unnecessary ticks. Very often, when a complex Blueprint system is designed in Unreal, it does not hurt to have a programmer look at it, to see if the structure could use improvements.

## **Real-Time Graphics Beyond Games: A Paradigm Shift**

Next to the incredible Blueprint powerhouse that Unreal provides, the quality of the real-time graphics sets it apart.

High-end real-time visualization using the Unreal engine has in recent years disrupted the design- and architectural visualization-industry. What we are witnessing is a paradigm shift from pre-rendered imaging, using costly pipelines and render farms to a much more efficient physically based rendering (PBR) based real-time workflow using game engines powered by the latest high-end graphics cards.

## PREFACE

Even though the excellent Unity 3D engine is catching up, Unreal reigns supreme in visual quality. In fact, the breakthroughs in architectural visualizations using Unreal have made their way into film production and TV commercials. Epic games, the company behind Unreal, is working hard to stay on the bleeding edge of entertainment technology by showcasing real-time live performance capture systems that offer an alternative to traditional pipelines in the movie industry.

Before 2014, Unreal was not very accessible to the average independent studio. Since its beginnings in 1998, the Unreal toolset was limited to AAA developers who could afford the minimum six-digit licensing fees. It was a small exclusive club of high-end studios who were given access to the technology behind games such as *Bioshock*, *Gears of War*, and of course, *Unreal Tournament* itself. What triggered the revolution for Unreal to open up was the success of Unity 3D.

Unity 3D had its early beginnings on Mac OS in 2005. With the rise of indies and mobile gaming, it quickly became a huge success and started to conquer other platforms. The reasons were obvious: Before Unity 3D, game development was a complicated and extremely technical process. Indie developers, who did not have access to the tools of AAA studios as Unreal, had to integrate various middleware solutions with their own libraries. When Unity 3D came along, it had all those components integrated and unified, thus the name Unity. Plus, the base version was free. Unity 3D took the industry by storm—a storm that turned into a hurricane that was starting to eat into the territory of Unreal.

In 2015, having changed their licensing model, Unreal the engine became free to download and use by anyone, with the only condition that the user pays five percent royalties on the gross income of any title that is produced with Unreal. It was a fair deal that helped the company to succeed in the years to come. Today the company is as strong as ever, with huge cross-platform hits such as *Fortnite* under its belt. While Unity 3D is dominating the industry with the number of developers, it is Unreal that is generating the most revenue for its developers.

Unreal today is a powerhouse that is expanding from games into film, live performances, and the visualization industry. And, of course, it has been one of the driving forces behind the new generation of VR.

## **Industry Visionaries Pushing the Boundaries**

The man behind Unreal, CEO and developer legend Tim Sweeney, is one of the most respected visionaries of the industry. He represents the company culture at Epic games, which keeps pushing the boundaries of interactive entertainment.

The same can be said for the man behind the Oculus Go: John Carmack, CTO of Oculus, a legend in his own right and regarded as the father of modern gaming. Carmack basically invented 3D gaming in the early '90s with innovation breakthroughs such as Wolfenstein 3D and Doom. As a CTO at Oculus, he was one of the forces behind the new generation of VR. His focus has been mobile and standalone VR. The Oculus Go is a result of his efforts in micro-optimizing the hardware and software to extreme levels.

Recognizing the exceptional genius and leadership by industry legends such as Tim Sweeney for Unreal and John Carmack for the Oculus Go is a good way of feeling confident about the future of mobile and standalone VR. The technology that we use today is the result of a culture of innovation that goes back two to three decades, of trial and error, of optimizations and breakthrough ideas.

## **Taking Immersive Media to the Next Level**

The innovation in gaming technology today is benefiting other areas, such as interactive media production, which was decades ago dominated by tools such as Macromedia/Adobe Director or Virtools by Dassault Systèmes. The Unreal engine is flexible enough to power interactive product presentations, learning applications and enterprise solutions.

## PREFACE

Serious games, used for business simulation, data visualization, and exploratory learning, are very often benefiting when done in VR, especially when scale plays an important role or immersion enhances the simulated experience. In most cases, mobile and standalone VR is the way to go, as it is the most user-friendly, hassle-free, and cost-effective way to bring the experience to the user or client.

It is an exciting time to develop for mobile and standalone VR using the Unreal engine. As the industry is maturing and a lot of industries are opening up to immersive simulations, there are a lot of opportunities for developers to be innovative and disruptive. Tourism, health care, education, enterprise, and entertainment are just some of the areas that are at the beginning of a new era in which VR adds value through immersion and increased comprehension of complex visual information.