

# Stepping into Virtual Reality

Mario A. Gutiérrez A. • Frédéric Vexo •  
Daniel Thalmann

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Mario A. Gutiérrez A., PhD  
Frédéric Vexo, PhD  
Daniel Thalmann, PhD  
EPFL VR Lab  
Lausanne  
Switzerland

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## Preface

This book is the fruit of many years of experience on the creation of synthetic worlds and virtual realities. Our goal is to transmit this experience to students and ease the learning curve required to master the creation of Virtual Reality (VR) applications. We start by providing some brief answers to key questions such as: where did VR come from? what are the main concepts that help us understand this research field? what are the current VR trends? and last but not least, how can we create virtual worlds?

Throughout the book we consider the terms “virtual environment,” “virtual world” and “VR application” as equivalent concepts: computer-generated environments mainly composed of interactive computer graphics, designed to physically and/or psychologically immerse one or more users in an alternative reality.

The first part of the book makes a review of the basic theoretical and practical concepts involved in the visual aspect of virtual environments. We start by presenting the basic mathematical foundations for the synthesis of 3D graphics, including basic modeling and rendering techniques. A comprehensive review of the state of the art of computer animation closes this part.

The second part provides more details on the components, structure and types of virtual worlds that can be created. We provide a detailed explanation of the main modeling and animation techniques for virtual characters, which are one of the most important actors in a virtual world. A review and discussion of the main types of VR system architectures serve to define the different alternatives for organizing and designing a VR application. Virtual Reality is only one of the different types of mixed reality environments that belong to the “reality continuum,” defined in Chapter 1. This part of the book provides more details on how to create mixed reality applications, such as augmented reality.

The third part covers the main principles of Virtual Reality hardware. Instead of providing an exhaustive review of the state of the art of VR hardware, which would get outdated very soon due to the fast pace of this research area, we present a generic classification of interaction devices using

a human-centered approach, based on the five main human senses: vision, audition, touch, smell, and taste. Each chapter explains the importance of a specific human sense and describes the different types of input and output devices that can exploit a given modality to establish a dialog between human users and virtual worlds.

The last part deals with the present and future of Virtual Reality. Successful VR systems and applications are reviewed and discussed. We highlight how the basic principles explained throughout the book were applied and analyze the practical and theoretical problems that were addressed.

This work was conceived as a guided tour that will give a practical explanation of each step in the process of creating a Virtual Reality application. It can be used both as a textbook for a Virtual Reality course and as a reference for courses covering computer graphics, computer animation, or human-computer interaction topics.

Lausanne  
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*Mario A. Gutiérrez A.*  
*Frédéric Vexo*  
*Daniel Thalmann*

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