



AUTODESK
Official Press

Todd Palamar



Mastering Autodesk®
Maya® 2015

 SYBEX
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A 3D rendered street scene featuring a row of brick townhouses with stone columns and railings. A sidewalk runs alongside the buildings, with a white bicycle parked near a decorative metal railing. Lush green trees line the left side of the street, and a classic street lamp is visible. The scene is brightly lit, suggesting a sunny day.

Mastering Autodesk® Maya® 2015



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Best regards,

A handwritten signature in black ink, appearing to read "Chris Webb", written in a cursive style.

Chris Webb
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I would like to thank Eric Keller, whose work on previous editions has built a foundation for this edition. Thanks also to Chip Weatherman, our technical editor. Chip's fresh perspective was much appreciated.

I would also like to thank all the people from Wiley, and a special thanks to Mariann Barsolo and Candace Cunningham for having such great attitudes. Their management and editing skills are superior.

About the Author

Todd Palamar is a 23-year veteran in the computer animation industry. After transitioning early in his career from traditional special effects to computer-generated imagery, Todd did effects work for several direct-to-video movies. He later went on to work on numerous video games, including Sega of Japan's coin-operated title *Behind Enemy Lines*, as well as *Dukes of Hazzard* and *Trophy Buck 2* for the Sony PlayStation console. For six years, Todd taught at Full Sail University in Winter Park, Florida. During this time, he received numerous accolades as an outstanding educator. Todd currently runs his own company, Surrealistic Producing Effects, making and distributing movies. Todd has written several books, among them *Maya Cloth for Characters* (Surrealistic Producing Effects, 2008), *Maya Studio Projects: Dynamics* (Sybex, 2009), and *Maya Studio Projects: Photorealistic Characters* (Sybex, 2011). The breadth of his experience has allowed him to work on location-based entertainment, military simulations, television commercials, and corporate spots. You can see more of Todd's work on his company's website, www.speffects.com.

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Introduction

The Autodesk® Maya® program is big. It is really, really huge. The book you hold in your hands and all the exercises within it represent a mere sliver of what can be created in Maya. Mastering Maya takes years of study and practice. I have been using Maya almost every day since 1999, and I'm still constantly facing new challenges and making new discoveries.

This book is meant to be a guide to help you not only understand Maya, but also learn about Maya. The title *Mastering Autodesk Maya 2015* implies an active engagement with the software. This book is packed with hands-on tutorials. If you're looking for a quick-reference guide that simply describes each and every button, control, and tool in the Maya interface, turn to the Maya documentation that comes with the software. This book is not a description of Maya; it is an explanation illustrated with practical examples.

The skills you acquire through the examples in this book should prepare you for using Maya in a professional environment. To that end, some features, such as lighting and rendering with mental ray®, nDynamics, Fluids, and Maya Muscle, have received more emphasis and attention than others. Features that have not changed significantly over the past few versions of the software, such as Maya Software rendering, standard Maya shaders, and older rigging techniques, receive less attention since they have been thoroughly covered elsewhere.

When you read this book and work through the exercises, do not hesitate to use the Maya help files. We won't be insulted! The Maya documentation has a very useful search function that allows you to find complete descriptions of each control in the software. To use the help files, click the Help menu in the Maya menu interface. The documentation consists of a large library of Maya resources, which will appear in your default web browser when you access the help files. Experienced Maya artists never hesitate to use the help files to find out more information about the software; there is no shame in asking questions! In addition, hovering over a tool or setting will give you a brief description. Features new to Maya, highlighted in green throughout the interface, have links to larger descriptions as well as movies.

Who Should Buy This Book

This book is written for intermediate Maya users and users who are advanced in some aspects of Maya and want to learn more about other facets of the program. The book is intended to be used by artists who are familiar with Maya and the Maya interface or who have significant experience using similar 3D packages. If you have used older versions of Maya, this book will help you catch up on the features in Maya 2014.

If you have never used Maya or any other 3D software on a computer before, this book will be too challenging, and you will quickly become frustrated. You are encouraged to read

Introducing Autodesk Maya 2015, by Dariush Derakhshani (Sybex, 2014) or to read through the tutorials in the Maya documentation before diving into this book.

You should be familiar with the following before reading this book:

- ◆ The Maya interface.
- ◆ Computer image basics such as color channels, masking, resolution, and image compression.
- ◆ Computer animation basics such as keyframes, squash and stretch, and 3D coordinate systems.
- ◆ Standard Maya shaders, such as the Blinn, Phong, Lambert, Layered, and Anisotropic materials, as well as standard textures, such as Fractal, Ramp, Noise, and Checker.
- ◆ Lighting and rendering with standard Maya lights and the Maya software rendering engine.
- ◆ The basics of working with NURBS curves, polygon surfaces, and NURBS surfaces.
- ◆ Your operating system. You need to be familiar with opening and saving files and the like. Basic computer networking skills are helpful as well.

What's Inside

The topics in this book move in a progressive order from introductory to complex. They also loosely follow a typical production pipeline for starting and completing assets. The following are brief explanations of the contents of each chapter.

There is also a companion website, which is home to all the project files and samples referenced in the book, as well as bonus chapters on MEL scripting and toon shading. Go to www.sybex.com/go/masteringmaya2015 and click the Downloads tab to access the files.

- ◆ **Chapter 1: Working in Autodesk Maya** This chapter discusses how to work with the various nodes and the node structure that make up a scene. Using the Hypergraph, Outliner, Hypershade, Attribute Editor, and Connection Editor to build relationships between nodes is demonstrated through a series of exercises.
- ◆ **Chapter 2: Introduction to Animation** This chapter demonstrates basic rigging with inverse kinematics as well as animating with keyframes, expressions, and constraints. Animation layers are explained.
- ◆ **Chapter 3: Hard-Surface Modeling** This chapter introduces the various types of surfaces with which you can model. It walks you through numerous approaches for modeling parts of a bicycle.
- ◆ **Chapter 4: Organic Modeling** This chapter focuses on building a humanoid mesh, using polygon and subdivision surface techniques. Smooth mesh polygons, creasing, and soft selection are demonstrated on various parts of the model.
- ◆ **Chapter 5: Rigging and Muscle Systems** This chapter explains joints, expands on inverse kinematics, and covers smooth binding and proper rigging techniques. Maya Muscle is introduced and demonstrated on a character's leg.

- ◆ **Chapter 6: Animation Techniques** This chapter takes you through the numerous deformation tools available in Maya. Creating a facial-animation rig using blend shapes is demonstrated, along with texture deformers, nonlinear deformers, and the geometry cache. We also take a look at importing motion capture.
- ◆ **Chapter 7: Lighting with mental ray** This chapter demonstrates a variety of lighting tools and techniques that can be used when rendering scenes with mental ray. Indirect lighting using global illumination, Final Gathering, and the Physical Sun and Sky network are all demonstrated.
- ◆ **Chapter 8: mental ray Shading Techniques** This chapter describes commonly used mental ray shaders and how they can be employed to add material qualities to the space helmet created in Chapter 3. Tips on how to use the shaders together as well as how to light and render them using mental ray are offered.
- ◆ **Chapter 9: Texture Mapping** This chapter demonstrates how to create UV texture coordinates for a giraffe. Applying textures painted in other software packages, such as Adobe Photoshop, is discussed, as are displacement and normal maps and subsurface scattering shaders.
- ◆ **Chapter 10: Paint Effects** This chapter provides a step-by-step demonstration of how to create a custom Paint Effects brush as well as how to animate and render with Paint Effects.
- ◆ **Chapter 11: Rendering for Compositing** This chapter introduces render layers and render passes, which can be used to split the various elements of a render into separate files that are then recombined in compositing software.
- ◆ **Chapter 12: Introducing nParticles** This chapter provides numerous examples of how to use nParticles. You'll use fluid behavior, particle meshes, internal force fields, and other techniques to create amazing effects.
- ◆ **Chapter 13: Dynamic Effects** This chapter demonstrates a variety of techniques that can be used with nCloth to create effects. Traditional rigid body dynamics are compared with nCloth, and combining nCloth and nParticles is illustrated.
- ◆ **Chapter 14: Hair and Clothing** This chapter discusses how to augment your Maya creatures and characters using XGen, Maya nHair, and nCloth. Using dynamic curves to create a rig for a dragon's tail is also demonstrated.
- ◆ **Chapter 15: Maya Fluids** This chapter explains how 2D and 3D fluids can be used to create smoke, cloud, and flame effects, and provides a demonstration of how to render using the Ocean shader. Bifrost is introduced as a way of creating liquid simulation.
- ◆ **Chapter 16: Scene Management and Virtual Filmmaking** This chapter provides an in-depth discussion of the Maya virtual camera and its attributes. A number of exercises provide examples of standard and custom camera rigs. Stereo 3D cameras are also introduced. References and the Asset Editor are also introduced. These features aid with large Maya projects that are divided between teams of artists.
- ◆ **Appendix A: The Bottom Line** This appendix contains all of the solutions from the Master It section at the end of each chapter.
- ◆ **Appendix B: Autodesk Maya 2015 Certification** This appendix contains the Autodesk Maya 2015 Certified Professional Objectives table that lists the topic, exam objective, and chapter where the information can be found.

NOTE Go to www.autodesk.com/certification to find information about the Maya 2015 Certified Professional exam covered in this book, as well as other Maya certification exams.

Conventions

Navigating in Maya is slightly different in the Windows and Mac operating systems. You can navigate the Hypergraph by using the same hot-key combination you use in the viewport: Alt+MMB-drag/Option+MMB-drag pans through the Hypergraph workspace, and Alt+RMB-drag/Option+RMB-drag zooms in and out. (MMB refers to the middle mouse button, and RMB refers to the right mouse button.)

It is also important to note that Maya uses three digits for values listed within its tools and editors. The book may only show one or two digits when the last one or two digits are 0.

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How to Contact the Author

You can contact author Todd Palamar with questions, comments, or concerns through his website at www.speffects.com, where you can see other books and productions on which he has worked.

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Chapter 1

Working in Autodesk Maya

The Autodesk® Maya® working environment has evolved to accommodate the individual artist as well as a team of artists working in a production pipeline. The interface presents tools, controls, and data in an organized fashion to allow you to bring your fantastic creations to life easily.

Understanding the way Maya organizes data about the objects, animations, textures, lights, dynamics, and all the other elements contained within the 3D environment of a scene is essential to understanding how the interface is organized. Maya uses what's known as the Dependency Graph to keep track of the various packets of data, called nodes, and how they affect each other. Any single element of a Maya scene consists of multiple nodes connected in a web, and each one of these nodes is dependent on another. The Maya interface consists of editing windows that allow you to connect these nodes in an intuitive way and edit the information contained within each node.

There is usually more than one way to accomplish a task in Maya. As you grow comfortable with the interface, you'll discover which editing windows best suit your working style.

This chapter is a brief overview of what professionals need to understand when working in Maya. You'll learn what types of nodes you'll be working with and how they can be created and edited in Maya. You'll also learn how to work with projects and scene data as well as the various windows, panels, and controls that make up the interface. This will help you, whether you are working alone or as part of a team of artists.

This chapter is about working with nodes, but it is not meant to be a comprehensive guide to each and every control in Maya. You will find that information in the Maya documentation. If you've never used Maya before, I strongly encourage you to read the Maya documentation as well as *Introducing Autodesk Maya 2015*, by Dariush Derakhshani (Sybex, 2014).

In this chapter, you will learn to:

- ◆ Understand transform and shape nodes
- ◆ Create a project

Creating and Editing Nodes

A Maya *scene* is a system of interconnected nodes that are packets of data. The data within a node tells the software what exists within the world of a Maya scene. The nodes are the building blocks that you, as the artist, put together to create the 3D scene and animation that will finally be rendered for the world to see. So if you can think of the objects in your scene, their motion, and their appearance as nodes, think of the Maya interface as the tools and controls you use to connect those nodes. The relationship between these nodes is organized by the *Dependency Graph (DG)*, which describes the hierarchical relationship between connected nodes. The interface provides many ways to view the graph, and these methods are described in this chapter.

Any given workflow in Maya is much like a route on a city map. There are usually many ways to get to your destination, and some of them make more sense than others depending on where you're going. In Maya, the best workflow depends on what you're trying to achieve, and there is typically more than one possible ideal workflow.

There are many types of nodes in Maya that serve any number of different functions. All the nodes in Maya are considered DG nodes. Let's say you have a simple cube and you subdivide it once, thus quadrupling the number of faces that make up the cube. The information concerning how the cube has been subdivided is contained within a DG node that is connected to the cube node.

A special type of DG node is the *directed acyclic graph (DAG)* node. These nodes are made of two specific types of connected nodes: transform and shape. The arrangement of DAG nodes consists of a hierarchy in which the shape node is a child of the transform node. Most of the objects you work with in the Maya viewport, such as surface geometry (cubes, spheres, planes, and so on), are DAG nodes.

To understand the difference between the transform and shape node types, think of a transform node as describing where an object is located and a shape node as describing what an object is.

The simple polygon cube in Figure 1.1 consists of six flat squares attached at the edges to form a box. Each side of the cube is subdivided twice, creating four polygons per side. That basically describes what the object is, and the description of the object would be contained in the shape node. This simple polygon cube may be 4.174018 centimeters above the grid, rotated 35 degrees on the x-axis, and scaled four times its original size based on the cube's local x- and y-axes and six times its original size in the cube's local z-axis. That description would be in the transform node.

FIGURE 1.1

A shape node describes the shape of an object and how it has been constructed; a transform node describes where the object is located in the scene.

