
Autodesk
Official Training Guide
Eric Keller
Mastering Maya 2011
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Mastering

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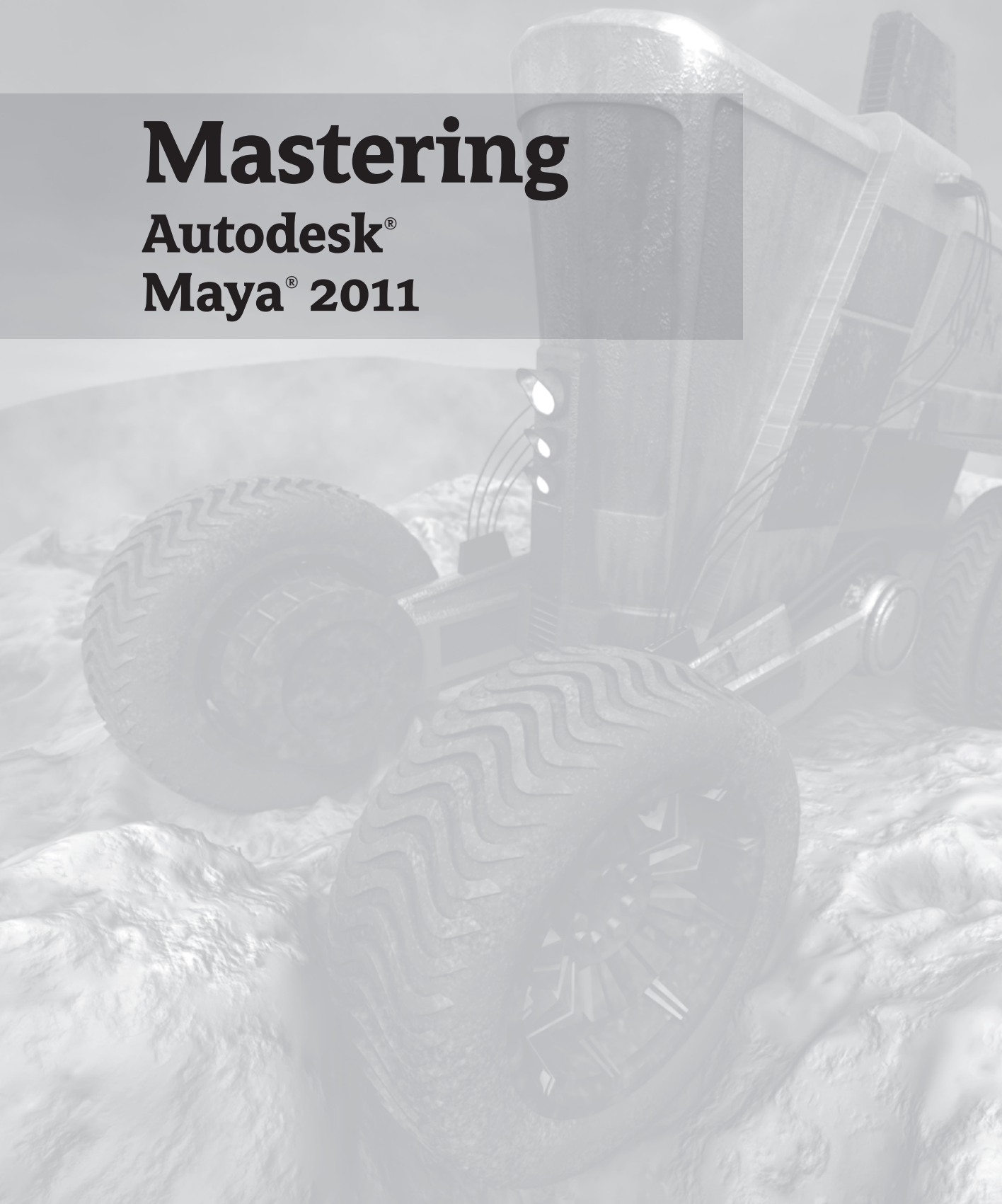

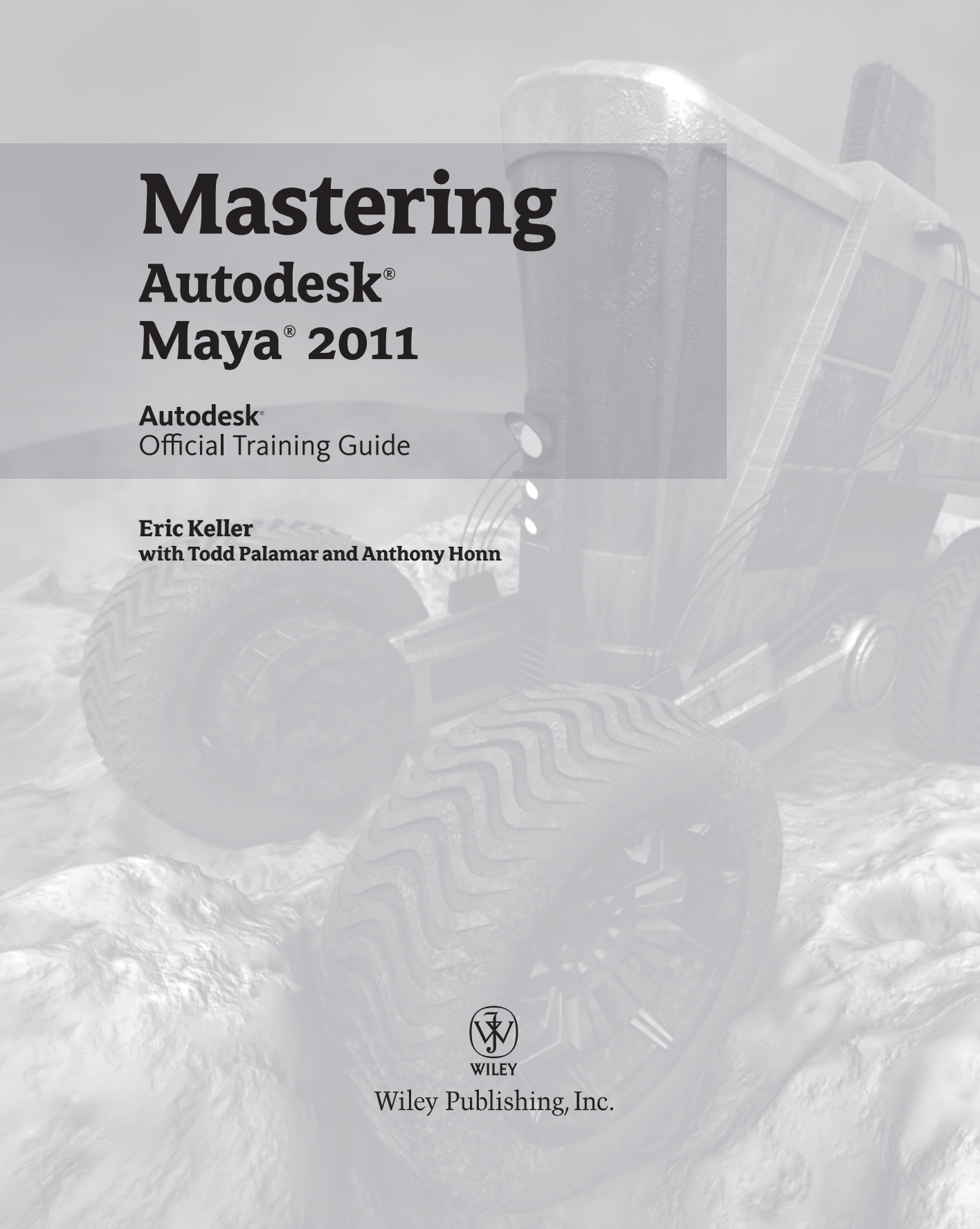

Mastering
Autodesk® Maya® 2011

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Official Training Guide

Eric Keller
with Todd Palamar and Anthony Honn

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Dear Reader,

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Sybex was founded in 1976. More than 30 years later, we're still committed to producing consistently exceptional books. With each of our titles, we're working hard to set a new standard for the industry. From the paper we print on, to the authors we work with, our goal is to bring you the best books available.

I hope you see all that reflected in these pages. I'd be very interested to hear your comments and get your feedback on how we're doing. Feel free to let me know what you think about this or any other Sybex book by sending me an email at `nedde@wiley.com`. If you think you've found a technical error in this book, please visit `http://sybex.custhelp.com`. Customer feedback is critical to our efforts at Sybex.

Best regards,

Neil Edde
Vice President and Publisher
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To my wife and best friend, Zoe.

Acknowledgments

I'd like to thank all the people who worked so hard on this project, especially the editors Thomas Cirtin, my good friend Gael McGill, and Liz Britten. I'd also like to thank Mariann Barsolo and Pete Gaughan. I thank all the folks at Autodesk who provided excellent support throughout the writing of this book.

I'd like to thank Todd Palamar for his help in writing the rigging and texturing chapters. He is an excellent and extremely knowledgeable author. Please check out his book *Maya Studio Projects: Dynamics* (Sybex, 2010).

Several of my good friends contributed artwork that is used in the book. Anthony Honn built the vehicle models used in many of the example scenes; my brother, Travis Keller, designed the kitchen and pergola models used in the lighting chapters; and Chris Sanchez provided the fantastic space suit design used in the modeling chapters. I've worked with these artists at several studios; they are examples of the best of the talent working in the design and entertainment industries today.

Special thanks go to Ara Kermankian and Scott Ulliman who provided some of the artwork in the color insert.

I'd like to thank the following artists, teachers, and authors for their inspiration over the years: Scott Spencer, Kevin Llewellyn, John Brown, Alex Alvarez, Darrin Krumweide, Dariush Derakhshani, Saty Raghavachary, Drew Berry, all my teachers and students at the Gnomon School of Visual Effects, and all my friends and colleagues on the LA Freelancers list. Naturally, all the programmers and designers who work so hard to develop this software deserve special recognition for their hard work. They are the true artists who allow the rest of us to create such fantastic things.

Extra special thanks go to Daisy and Joe who all forced me to get away from the computer for some much-needed exercise. And to Blue whose hungry little ghost still haunts the kitchen.

About the Authors

Eric Keller is a freelance visual effects artist working in Hollywood. He divides his time between the entertainment industry and scientific visualization. He teaches an introductory ZBrush class at the Gnomon School of Visual Effects and has authored numerous animation and visualization tutorials for the Harvard Medical School course Maya for Molecular Biologists, taught by Gael McGill.

Eric started out as an animator at the Howard Hughes Medical Institute, where he created animations for science education for seven years. In 2005, he and his wife moved to Los Angeles, where he could study and learn from the masters of visual effects. His goal is to bring the artistry and technology of Hollywood computer graphics to the field of scientific research in the hope that it can inspire and inform the scientific community and the general public.

Eric has worked at some of the best design studios in Los Angeles, including Prologue Films, Imaginary Forces, Yu and Company, BLT and Associates, and The Syndicate. Projects include feature-film title animations for *The Invasion*, *Enchanted*, *Sympathy for Lady Vengeance*, and *Dragon Wars*. He has also contributed to numerous commercials, television shows, and design projects.

Other books by Eric Keller include *Maya Visual Effects: The Innovator's Guide* (Sybex, 2007) and *Introducing ZBrush* (Sybex, 2008). He was a contributing author to *Mastering Maya 7* (Sybex, 2006). He authored the video series *Essential ZBrush 3.1* for Lynda.com as well as numerous tutorials and articles for industry magazines. Many of his tutorials are available online at `www.highend3d.com` and `www.molecularmovies.org`.

Todd Palamar wrote Chapter 7, "Rigging and Muscle Systems," and Chapter 11, "Texture Mapping." He began his career almost 20 years ago creating traditional special effects for low-budget horror movies. Quickly gravitating to computer animation, Todd has worked on numerous video games, dozens of military- and game-style simulations, corporate commercials, and theme park rides. He has authored four books, including *Maya Cloth for Characters* (SP Effects, 2008) and *Maya Studio Projects: Dynamics* (Sybex, 2009). Currently Todd is employed as a technical art director at Vcom3D, Inc.

Anthony Honn created the vehicle models used in the example scenes throughout this book. Anthony originally trained in industrial design and architecture. After having graduated from the Art Center College of Design, a series of fateful events resulted in a career within the film and design industries. His clients have included multiple recording artists such as Janet Jackson as well as lifestyle brands such as Nike. Arguably, the industrial designer still lurks beneath, with his continued passion for robotics, automobiles, and furniture. For more of Anthony's work, visit `www.anthonyhonn.com`.

Contents at a Glance

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Foreword

Let me start by introducing this book and its author, like so: *Mastering Maya*, written by a veritable Maya master.

It gives me great pleasure to write this foreword for my friend, industry colleague, and student Eric Keller. (I had the pleasure of having him in my MEL class, which I teach part-time at the Gnomon School of Visual Effects in Hollywood, California.)

I have been using Maya since its early days back in 1996, and over the years I have come across a lot of books written about the subject. I will tell you that this book clearly deserves to be at the top of the heap. I highly recommend you read it, learn from it, and use it to excel at Maya. Here's why—in today's animation/visual effects/content creation industry, Maya rules as the number-one software of choice for digital artists worldwide. Being consistently at the top isn't easy, but Maya has managed to stay that way ever since it was first released. It follows that if you need to succeed in this field (or if you are just starting out and need to get your foot in the door), you need to get good—make that *really* good—at using Maya. That's why this book is called *Mastering Maya*.

As for the "master" part, Eric practices what he preaches, which lends strong credibility to the material in the book. He uses Maya, together with custom MEL code that he writes and with other pieces of software, to work with scientists in biology and chemistry to create informative, visually appealing imagery. In short, he creates awesome scientific animations using Maya. You can see his work at `www.molecularmovies.com` and at his personal site at `www.bloopatone.com`. Browsing through his site, you will discover his artistic talents and the fact that he has also authored a couple of ZBrush books.

Start reading this book now so you can get on the path to mastering Maya. I wish everyone a lot of pleasure reading this book.

—*Saty Raghavachary*

Head, Digital Training and Technical Development
DreamWorks Animation
Los Angeles, June 2010

Introduction

Maya is big. It is really, really huge. The book you hold in your hands and all the exercises within 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 for 12 years, and I'm still constantly faced with new challenges and making new discoveries.

Learning Maya is similar to learning a musical instrument. Both Maya and music require practice, study, patience, and determination. Just as the best musicians make playing their instruments seem effortless, the best Maya artists make visualizing the impossible seem easy. This is because the musician who masters music and the artist who masters Maya have spent years and years studying, practicing, and perfecting their skills and understanding.

This book is meant to be a guide to help you not only understand Maya but also understand how to learn about Maya. The title *Mastering Maya* implies an active engagement with the software. This book is packed with as many hands-on tutorials as I could provide to keep you actively engaged. If you're looking for a quick-reference guide that simply describes each and every button, control, and tool in the Maya interface, use the Maya documentation that comes with the software instead. 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, and Maya Muscle, have received more emphasis and attention. 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. The authors of this book will not 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!

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 aspects. 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 newer features in Maya 2011.

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 Maya 2011* (Sybex, 2010) or to read through the tutorials in the Maya documentation before attempting this book.

Here are some principles you should be familiar with 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

Here is a description of the chapters in this book. The lessons in each chapter are accompanied by example scenes from the companion DVD.

Chapter 1: Working in Maya 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. References and the Asset Editor are also introduced. These features have been created to aid with large Maya projects that are divided between teams of artists.

Chapter 2: Virtual Filmmaking with Maya Cameras 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.

Chapter 3: NURBS Modeling in Maya Walks you through numerous approaches for modeling parts of a helmet for a space suit based on a concept drawing created by a professional artist.

Chapter 4: Polygon Modeling Continues to build on the model started in Chapter 3 using polygon and subdivision surface techniques. Smooth mesh polygons, creasing, and soft selection are demonstrated on various parts of the model.

Chapter 5: Animation Techniques Demonstrates basic rigging with Inverse Kinematics as well as animating with keyframes, expressions, and constraints. Animation layers are explained.

Chapter 6: Animating with Deformers Takes you through the numerous deformation tools available in Maya. Creating a facial animation rig using blend shapes is demonstrated, along with using lattices, non-linear deformers, and the geometry cache.

Chapter 7: Rigging and Muscle Systems Explains joints, Inverse Kinematics, smooth binding, and proper rigging techniques. Maya Muscle is introduced and demonstrated on a character's arm. This chapter was written by Todd Palamar, author of the book *Maya Studio Projects: Dynamics* (Sybex, 2010).

Chapter 8: Paint Effects and Toon Shading 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. Toon shading is also explained.

Chapter 9: Lighting with mental ray 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 shader are all demonstrated.

Chapter 10: mental ray Shading Techniques Describes the more commonly used mental ray shaders and how they can be used 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 discussed.

Chapter 11: Texture Mapping Demonstrates how to create UV texture coordinates for a giraffe. Applying textures painted in other software packages, such as Adobe Photoshop, is discussed as well as displacement and normal maps and subsurface scattering shaders. This chapter was written by Todd Palamar, author of the book *Maya Studio Projects: Dynamics* (Sybex, 2010).

Chapter 12: Rendering for Compositing 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 13: Introducing nParticles Provides numerous examples of how to use nParticles. In this chapter, you'll use fluid behavior, particle meshes, internal force fields, and other techniques to create amazing effects.

Chapter 14: Dynamic Effects 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 15: Fur, Hair, and Clothing Discusses how to augment your Maya creatures and characters using Maya Fur, Maya Hair, and nCloth. Using dynamic curves to create a rig for a dragon's tail is also demonstrated.

Chapter 16: Maya Fluids Explains how 2D and 3D fluids can be used to create smoke, cloud, and flame effects, and a demonstration of how to render using the Ocean shader is given. Using nParticles as a Fluid emitter is introduced; this is a new feature in Maya 2011.

Chapter 17: MEL Scripting Walks you through the process of creating a time- and labor-saving MEL script, illustrating how MEL is a very useful tool for all Maya artists. The Python interface is also explained.

Companion DVD

The companion DVD is home to all the demo files, samples, and bonus resources mentioned in the book. See Appendix B for more details on the contents of the DVD and how to access them.

How to Contact the Author

I enjoy hearing from the readers of my books. Feedback helps me to continually improve my skills as an author. You can contact me through my website at `www.bloopatone.com` as well as see examples of my own artwork there.

Sybex strives to keep you supplied with the latest tools and information you need for your work. Please check the book's website at `www.sybex.com/go/masteringmaya2011`, where we'll post additional content and updates that supplement this book should the need arise.