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About the Authors
Tony Mullen, PhD, teaches computer graphics and programming at Tsuda College and Musashino Art College in Tokyo. His screen credits include writer, codirector, or lead animator on several short films, including the award-winning live-action/stop-motion film Gustav Braustache and the Auto-Dribbletter. He is the author of Mastering Blender, Introducing Character Animation with Blender, and Bounce, Tumble, and Splash!: Simulating the Physical World with Blender 3D, all from Sybex. Claudio "malefico" Andaur is an artist with extensive experience in the use of open-source tools. He works for Licuadora Studio, an animation studio in Buenos Aires, and was cowriter, TD, modeler, animator, and animation supervisor on the 3D CG feature film Plumiferos, produced in Argentina. He won the Blender Foundation’s Suzanne Award for Best character Animation in 2009.

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Best regards,

Neil Edde
Vice President and Publisher
Sybex, an Imprint of Wiley
To all the tenacious dreamers
More than any of the other books I’ve worked on, creating the content for this book was a highly collaborative affair. I’d like to thank my coauthor, Claudio “Malefico” Andaur; the book’s technical editor, Ivan Hoffmann; and the rest of the team at Licuadora Studio: Manuel Perez, Diego Borghetti, and Juan Redondo. It’s no exaggeration to say that this book couldn’t have happened without them. I truly appreciate their involvement in making this book an enjoyable and educational experience for me. I’m very grateful to the editing and production teams at Sybex for bringing all of this to the printed page. Thank you to Mariann Barsolo, Pete Gaughan, David Clark, Liz Britten, and all involved in editing and producing this book. No Blender-related thank-you list is complete without a nod to Ton Roosendaal and the extraordinary team of developers, both paid and volunteer, who make the software what it is. Thank you very much for your wonderful work, all of you. Finally, I’d like to thank my wife, Yuka, and my daughter, Hana, for their love and patience.

—I Tony

I’d like to thank Tony and Mariann for inviting us to be part of this book, for their interest in our little short movie, and for the trust they put in the project from the very beginning. My gratefulness and respect to my comrades at Licuadora Studio, Manuel, Diego, Ivan, and Juan, who were always there trying to get things done in time (for so many years now), and of course to Ton and the Blender developers, for giving me the tools I needed to change my life. Finally, I’d like to thank my wife, Laura, and my little girl, Rocio, for being so patient with me having long hours “playing” with the computer. :) 

—I Claudio
About the Authors

Tony Mullen, PhD, teaches computer graphics and programming at Tsuda College and Musashino Art University in Tokyo. His screen credits include writer, codirector, or lead animator on several short films, including the award-winning live-action/stop-motion film Gustav Braustache and the Auto-Debilitator. He is the author of Mastering Blender, Introducing Character Animation with Blender, and Bounce, Tumble, and Splash!: Simulating the Physical World with Blender 3D, all from Sybex.

Claudio “Malefico” Andaur was born in Buenos Aires, Argentina in 1970. After graduating as a chemical engineer from National Technological University in Buenos Aires, he worked in nuclear fuel research for several years. He always had an interest in art, so he became a self-taught 3D artist and eventually left engineering to dedicate 100 percent of his time to CG. Blender was his first 3D animation suite back in 1999 and still is the only 3D tool he uses regularly.

In 2005 he cofounded Manos Digitales Animation Studio and was involved in the production of the 3D animation feature film Plumiferos as script cowriter, character TD, and animation supervisor.

Always a free/libre/open source software (FLOSS) supporter, Claudio has given lectures and courses on the Blender and FLOSS pipeline in several countries throughout Latin America and Europe.

In 2008 he founded Licuadora Studio together with some of his former colleagues and continues to work there. In 2009 he was awarded the Blender Foundation Suzanne Award for Best Character Animation.
## AT A GLANCE

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Introduction

The past few years have been an incredible time for users and developers of Blender. Since 2006, with the release of the Blender Foundation’s first open movie, Elephants Dream, each year has brought a bigger, more impressively ambitious open project, and with each project Blender’s development has advanced by great leaps, focused on the needs of real artists in a fast-paced studio environment. The project currently underway, tentatively entitled Sintel, promises to result in the most impressive open movie yet, and the long-awaited Blender version 2.5 is set to make Blender accessible to a whole new audience of professional users.

Studio use of Blender hasn’t been limited to the Blender Foundation’s own open movie projects, either. CG creators around the world have been embracing Blender in ever-increasing numbers. Originally developed as an in-house 3D tool for a commercial animation studio, Blender has repeatedly demonstrated itself to be feature rich, stable, and fast enough for serious production use. Blender is fully cross-platform, working seamlessly and with an identical interface on Windows, Mac, and Linux. It boasts a wide variety of import and export tools and supports numerous formats for digital assets, making it easy to incorporate into just about any CG pipeline. It’s open source, making it possible to modify and tailor the code to the specific needs of any studio. These factors come together to make Blender a very attractive option for many studios. As a generation of young Blender users grow up to be professionals, the increasing availability of a skilled workforce will only make Blender more appealing in the years to come.

As part of the Studio Projects series, this book focuses on Blender use in the context of a professional studio—specifically, Licuadora Studio of Buenos Aires, a commercial CG animation studio that, for reasons of economy and principle, chooses to rely entirely on...
open source tools for its CG work. The Licuadora team includes some of the world’s most experienced Blender users; the studio’s members were the original creative team for the Blender-made movie *Plumiferos*, which recently premiered as Argentina’s first-ever all-3D CG animated feature and the only major full-length feature anywhere to be created with Blender as its primary 3D animation tool. In this book, you’ll take a peek at the nitty-gritty details of how Licuadora’s animation pipeline is set up and the steps involved in creating a CG animated short movie. Along the way, you’ll learn many tricks and techniques for working with Blender that you could learn only from experienced, full-time pros.

**Who Should Buy This Book**

As the title indicates, this book is focused on using Blender for making movies in a studio environment. It’s not intended for beginners who just want to learn how the software works. The techniques described in this book are techniques employed by professional users, and the descriptions of them assume that you generally already know which buttons to click and which windows to look in for the functionality. Although every effort has been made to give clear and thorough instructions, the book would be much longer if some Blender background wasn’t assumed. If you’re not sure what you’re doing with Blender in the first place, please start with one (or several) of the numerous introductory and intermediate books on Blender that are currently available.

If you are thinking about adopting Blender for use in an actual studio or if you are an individual who wants to undertake a serious project with Blender, then this book will have a lot to offer. In this book, you’ll learn about the many different roles that Blender can play in the animation pipeline, you’ll see how file and asset management functionality can maximize your pipeline’s efficiency, and you’ll see how Blender can be supplemented by other open source tools. Along the way, there’s a very good chance that you’ll stumble across some killer Blender features that you had no idea existed, even if you’re already an advanced user. In short, if you’re a professional Blender user or just want to work like one, this book is for you.
Regarding Software Versions

Because Blender is open source, Blender users have unlimited access to stable and development versions, both new and old, at all times. This can sometimes be an embarrassment of riches, and version changes and upgrades are something that serious users need to be able to deal with intelligently. It’s never wise to jump willy-nilly to the next available version on a single project without giving some thought to stability and continuity. This book focuses on a project being carried out using an in-house branch of Blender 2.49, which is the latest stable release at the time of this writing. However, the book also discusses considerations that need to go into an upgrade to the soon-to-be-released Blender 2.5.

Regardless, as mentioned previously, this is not a book about where the buttons are, so if you’re reading it, you should already be knowledgeable enough to be able to abstract the techniques described and apply them in a newer version of Blender.

How to Use This Book

There’s no right way to go through this book. Hand-holding is kept to a minimum, and a background in Blender is assumed, so you probably know all you need to know to dive in anywhere that takes your fancy. That said, the book is written in an order that roughly follows the process of content creation in a typical movie-making pipeline. Reading the book in order will preserve this, so if you want to get a sense of the big picture, I’d recommend reading the book from beginning to end.

What’s Inside

Here’s a glance at what you’ll find in each chapter:

Chapter 1: Blender in the Studio gives an overview of Blender’s use in commercial studios and describes the factors that might go into a studio’s decision to incorporate Blender in its pipeline. This chapter also introduces Licuadora Studio, whose work will be the focus of the rest of the book, and describes the hardware and software that makes up the studio’s animation pipeline.
Chapter 2: Planning and Preproduction  covers the early stages of planning a narrative movie. Blender’s sequence-editing functionality can play a significant role even in the 2D planning phase, and this is discussed in depth. This chapter also touches on other available open source software that can help you in conceptualization, writing, and storyboarding.

Chapter 3: Creating a 3D Animatic  deals with the 3D planning and blocking stage of the preproduction. In this phase, Blender’s 3D functionality becomes central, and you’ll learn about managing 3D assets to work most efficiently, and how to time the 3D animatic to match the 2D animatic described in Chapter 2.

Chapter 4: Modeling  describes the modeling stage of the animation pipeline, giving tips on how to optimize the topology of deformable meshes by using the Retopo tool. This chapter also encourages you to think outside the box in your modeling, giving pointers on how to use armatures, modifiers, and simulation as mesh modeling tools.

Chapter 5: Rigging Characters  presents the tools available for rigging models for animation and discusses various alternatives to consider to optimize deformations. You’ll learn tricks for using armatures and Mesh Deform modifiers in conjunction for the best possible effect. You’ll also learn to use complex PyDrivers to create simple and intuitive controls for subtle combinations of morph shapes.

Chapter 6: Animating a Character Scene  describes the process of creating a simple character-centered scene and bringing a rigged character to life. You’ll read about how assets and timing are carried over from the 3D animatic, how animation curve types are used to support pose-to-pose animation, and how simulations work together with animated meshes to create a fully realized character animation shot.

Chapter 7: Descent into the Maelstrom  guides you through a complete, moderately complex special-effects shot of a ship being pulled into an ocean whirlpool. The tour begins with the placement of 3D objects in the scene and continues through the final composited render. You’ll see how to use models, textures, and modifiers together to create a breathtaking animated shot of high-seas peril, and learn even more about how assets can be split and organized for maximum workflow efficiency.
**What’s on the DVD**

The DVD contains installations of Blender 2.49 for Mac OS X and Windows, and a source tarball for users of Linux or other Unix-like operating systems. In addition, Licuadora Studio’s in-house branch of Blender, LicuaBlender, is included as a source tarball. In addition to the software, project files are included for exercises or further study, and the complete production tree is included for the relevant portions of the *Mercator* movie project.
Blender in the Studio

This chapter introduces Blender as a professional tool for use by commercial animation studios. If you’re not familiar with large-scale animation projects that have used Blender as their primary 3D software, you may be surprised by how powerful and versatile it can be in the context of a professional animation pipeline. This chapter will show you some projects that have made use of Blender. In particular, you’ll be introduced to Licuadora Studio, a professional animation house in Buenos Aires that uses Blender as its primary animation tool. You’ll learn why using Blender benefits the Licuadora team and how they deal with the challenges and idiosyncrasies of Blender in their professional pipeline.

CHAPTER CONTENTS

- The Professional Blender
- Welcome to Licuadora Studio
- The Blender-Based Animation Studio

The Professional Blender

Blender is unique as the only free, professional 3D animation and modeling application. It’s not the only free software for 3D content creation, and it’s far from the only professional application, but it is the only software around that can lay claim to being both. In the past, the free aspect of Blender has often tended to overshadow the professional aspect. This is hardly surprising; free is an awfully attractive price for software as powerful as Blender, and it makes Blender the obvious choice for students and hobbyists. But it’s a mistake to think that Blender’s appeal is limited to nonprofessional users. You don’t judge an artist by the cost of her pencils, after all.

The truth is, Blender is widely used by commercial studios and in significant animation projects. Many of the studios and projects that have used Blender are widely known (sooner or later, mention of them is bound to crop up on the BlenderNation blog at www.blendernation.com). It is likely that many other professional uses of Blender fly below
the radar. From a licensing perspective, using Blender is extremely convenient. No matter where you are or what computer you are using, it is a straightforward matter to download and install Blender. Even if your studio’s primary software is a different application, this kind of easy, unrestricted access to Blender can come in handy. With Blender’s powerful Python-based importing and exporting functionality, it’s easy to take advantage of Blender without causing so much as a ripple in the studio’s workflow, and have no one be the wiser.

This book is one of the first to focus on Blender as it plays a central role in the professional animation pipeline. In particular, this book will take a close look at Blender’s role in the making of the animated short film Mercator currently in production by Licuadora Studio. Before that, however, it’s worthwhile to get a bit more perspective on Blender as a tool for professionals.

Blender’s Professional Beginnings

Blender was a professional tool before it was a free one. Blender originated as an in-house proprietary software application for the Dutch animation studio NeoGeo, founded in 1988. Blender’s original target user audience, therefore, was a very small group of highly trained professional users. Broader use of Blender by the public was something of an afterthought.

This specific, professional targeting of Blender’s early development can still be felt in Blender’s design, for better or (according to some) for worse. The heavy reliance on keyboard shortcuts and the many nonstandard design choices resulted in a user interface that can be lightning fast for those who are accustomed to it. The downside is that it can present an intimidating cement wall for newbies accustomed to finding most of what they want from any software application on a conventionally organized menu bar.

The focus on professional users had many benefits for the development of Blender, but the focus on such a specific group of users also contributed to a perception of Blender as being somewhat impenetrable by outsiders. Much of the inflexibility has changed with the recent 2.5 code refactor, but the goals of Blender’s interface remain focused on speed and efficiency for proficient users.

By the end of the 1990s, another company, Not a Number (NaN), was set up to market and develop Blender itself, with the goal of distributing the software to a broad user base. The main application was available for free, with additional functionality available to users who purchased a code called a C-key. This user base was crucial for the next phase of Blender’s evolution, which occurred when NaN closed its doors as a commercial enterprise.

The Blender Foundation

Things didn’t look good when NaN’s investors halted operations in 2002. The company’s assets, including Blender itself, were the property of the investors, and there were no plans to continue development on the software. In order to save Blender from oblivion,
Blender’s lead developer, Ton Roosendaal, made an unusual proposal to the NaN investors: He would buy the code with money donated by Blender’s worldwide users and release it as free software under the open source GNU General Public License (GPL). The investors went for it and the community rallied, donating the needed 100,000 euros in only seven weeks. On October 13, 2002, the Free Blender campaign was successful, and Blender was released as an open source project. The Blender Foundation was created as a nonprofit organization dedicated to supporting the continued development of Blender.

From the beginning, Roosendaal’s focus was on supporting artists with the software. Software intended for artists could not be developed in a vacuum without focused, intensive input by dedicated power users. If it were, it would surely be doomed to become nothing more than a glorified programming exercise.

Now that NeoGeo was no more, it was important to find a way to promote the use of Blender by power users on serious projects. This was at least as important as the software development itself. The solution was for the Blender Foundation (and later, the commercial Blender Institute) to play the role of a studio. Whereas the software had supported the studio in the NaN days, the Blender Foundation studio came into existence to support and promote the software. The results have been impressive in several ways.

Elephants Dream
The first project initiated and coordinated by the Blender Foundation was the project code-named Orange, which resulted in the 10-minute short film *Elephants Dream*, the first open movie. The movie itself and all its production files are freely released under a Creative Commons license. The Orange project was very much an experimental effort. The project was coproduced by the Blender Foundation and the Netherlands Media Art Institute, Montevideo/Time Based Arts. The production was funded by a combination of grants and subsidies and DVD presales carried out by the Blender Foundation. For the production, six exceptional artists from the Blender community around the world were selected and invited to spend about eight months in Amsterdam working together full-time on a short animated movie. They were given complete creative control over their work. You can see a still from the movie in Figure 1.1.

The project was notable in that it not only used Blender as its primary 3D software, but attempted to use open source software exclusively for all stages of production. This was accomplished with the exception of the soundtrack (for which the Reaktor sound studio was used) and the supercomputing cluster on which processing time was donated by Bowie State University for rendering, which ran Mac OS X. The production of *Elephants Dream* resulted in great advances for Blender itself, including the introduction of the Material and Composite Node editor and the render pipeline refactor, which appeared in Blender 2.42. The release log for that release can be found at [www.blender.org/development/release-logs/blender-242](http://www.blender.org/development/release-logs/blender-242). The Orange project’s production blog can be found at [http://orange.blender.org](http://orange.blender.org).
Big Buck Bunny

After the success of Orange, a precedent was set to name projects after fruits. Aside from this similarity, the next Blender Foundation project, code-named Peach, could not have been more different from Elephants Dream. The goal of the Peach project was, in part, to experiment with a more directed, premeditated way of making a movie than had been used with Elephants Dream. There were a few technical goals for the software as well, in particular the development of better tools for creating, editing, and rendering hair and strand particles, as you can see from the still of the film in Figure 1.2. This and the desire to do something completely different from Elephants Dream led naturally to the idea of having animal characters in a funny, lighthearted setting. The result was the lush, colorful, and not a little twisted romp Big Buck Bunny.

The Peach project was supported by several nonprofit and corporate sponsorships, including support from the Dutch foundation Digitale Pioniers, rendering by Sun Microsystems, hardware from Maquina Computersystems, and sound facilities from Wavemage. Big Buck Bunny was also released as an open movie under the Creative Commons Attribution 3.0 license. It can be found at www.bigbuckbunny.org.
Yo Frankie!

Although Blender has always been first and foremost an animation and modeling application, game creation and prototyping is an important aspect of its functionality. These sides of Blender got their day in the sun with the Apricot project, whose goal was to create a fully fleshed-out, industry-quality game prototype. In order to advance the project as rapidly as possible, character designs and 3D assets were recycled and modified from the Big Buck Bunny project. Whereas previous projects had focused on Blender as the central tool, the Peach project also attempted to incorporate development on the Crystal Space open source game engine as a primary goal.

Partners and sponsors of the Apricot project included Grupo Ikusnet, Dutch Game Days Foundation, Amsterdam Fonds voor de Kunst, Maquina Computersystems, Paravizion, Redfish, Nyquist Art + Logic, and Tarent. Yo Frankie! was released as an open game under the Creative Commons Attribution 3.0 license and is available at www.yofrankie.org.

A screenshot of the game play can be seen in Figure 1.3.
Chapter 1: Blender in the Studio

A secondary goal for all of the Blender Foundation projects has been to produce top-quality Blender training material, and each of the projects has contributed to the production of at least one training DVD. These include Bassam Kurdali’s rigging and animation training DVD *The Mancandy FAQ*, Andy Goralczyk’s intensive modeling and texturing over-the-shoulder course *Creature Factory*, William Reynish’s advanced character animation course *Learning Character Animation with Blender*, and Pablo Vazquez’s eye-popping *Venom’s Lab* training DVD, which covers a wide variety of advanced topics, from materials and compositing to sculpting, as shown in Figure 1.4. All of these DVDs are available commercially from the Blender e-shop and feature intensive tutorials on professional techniques for Blender users. All of the training DVDs are released under the Creative Commons Attribution 3.0 license and are part of the ongoing series of releases in the Blender Foundation’s Open Workshop.

**Durian and Blender 2.5**

Two long-awaited projects are advancing rapidly as I write this: the Durian project and the finalization of the Blender 2.5 release. These two Blender Foundation projects go hand in hand. Durian promises to be the most ambitious short film produced by the Blender Foundation yet, with realistic designs, action, heavy use of physics, and
simulation, including newly developed features for fire and smoke. The production is underway, and concept sketches such as the one in Figure 1.5 have been released on the project’s blog. The Durian project promises to go even further than previous projects in proving the quality of work that Blender is capable of.

Figure 1.4
Pablo Vazquez’s charming Korno character teaches you how to sculpt on the Venom’s Lab training DVD.
The Blender 2.5 version has been under active development now for more than a year, in parallel with regular updates of the 2.4x series, development of which is now frozen. As I write this, Blender 2.5 is in an advanced alpha stage for debugging by the community. Blender 2.5 brings a complete overhaul of the event system and interface, eliminating a number of problems that had been deeply embedded in the code of previous versions of Blender. For professional users of other 3D applications who have considered switching to Blender, one of the most attractive aspects of Blender 2.5 is its greatly enhanced capability for customization, accomplished by use of tightly integrated Python scripting. Users can now freely map their keyboard shortcuts, add their own tools to a quick-access tool shelf, and integrate custom scripts more fluidly into the interface. Splitting and uniting