

Foundation Blender Compositing

Roger D. Wickes



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To the future, embodied in my children, Rebecca and Alexander, and all the volunteer programmers, documenters, and web site hosts who enable and spread low-cost global communication that unites our thoughts, dreams, and aspirations.

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ABOUT THE AUTHOR

Roger Wickes has been involved with software for several decades, has had the privilege of seeing monumental revolutions come and go, and has somehow managed to capitalize on most of the convergences that have shaped computing, networking, and communications as we now know them. He started his career learning leadership at Admiral Farragut and the USCG Academy and fell in love with computerized simulation. His first commercial job was working for CSC at the Naval Underwater Systems Center on big secret things that go boom. He then learned how to run an entrepreneurial startup by joining Technology Applications and Development Company in Newport, Rhode Island. Tired of the snow, he joined EDS in Georgia where he really learned how to run a technology business, ultimately leading more than 120 professionals developing software on all the major platforms. Sensing the opportunity of the Web, he helped form Information Technology Group and filled all roles from CIO to CFO, enabling and leading the development of the first Internet-based payroll and staff exchange systems. He fell in love with visual imagery and Blender a decade ago and is a Blender Certified Instructor. Currently he is managing and developing graphical and business solutions for international companies and global initiatives. He enjoys scuba diving, skiing, travel, and helping others. His web site is <http://wickes.webs.com>.



ABOUT THE TECHNICAL REVIEWER

Roland Hess has been working with graphics and imaging software for more than 20 years. He saved his pocket change for an “advanced” graphics programming package for his home computer in the early 1980s and has been hooked ever since. As one of a handful of people involved with Blender who is both an active user of the software and a member of the development team, he brings a unique perspective to Blender instruction that helps bridge the difficult gap between technical knowledge and artistic endeavor.

ABOUT THE COVER IMAGE DESIGNER

Corné van Dooren designed the front cover image for this book. After taking a brief from friends of ED to create a new design for the Foundation series, he worked at combining technological and organic forms, with the results now appearing on this and other books' covers.

Corné spent his childhood drawing on everything at hand and then began exploring the infinite world of multimedia—and his journey of discovery hasn't stopped since. His mantra has always been "The only limit to multimedia is the imagination," a saying that keeps him moving forward constantly.

Corné works for many international clients, writes features for multimedia magazines, reviews and tests software, authors multimedia studies, and works on many other friends of ED books. You can see more of his work, as well as contact him, at his web site, <http://www.cornevandooren.com>.



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INTRODUCTION

This book is for beginning professionals who are new to film and video production and for experienced professionals who are new to Blender. This book is intended to serve compositors and post-production professionals who want to use Blender in their pipelines, who just need to know the tools available in Blender, or who possibly need a few examples to get them started.

In writing this book, I sought to break down some of the barriers to using Blender as a real-world compositor. These barriers include a lack of accurate documentation, lack of widespread knowledge and experience in using Blender professionally, the complexity of Blender itself, and the issue of integrating Blender into the compositing workflow. Like the documentation of many open source projects, the freely available material for Blender education and training is mostly created by individuals working sporadically in an uncoordinated fashion. These online materials quickly become out-of-date since Blender is codified by more than 50 programmers. Because there isn't any commercial impetus, many authors create a tutorial to document a problem or challenge that they solved, but once solved, there is no motivation to keep it up-to-date or to extend it in any way. With disjointed individual tutorials, there is no formal review and editing process to ensure that the material presented is factually accurate. Thus, the user-generated online tutorials on Blender are frequently out-of-date and often not entirely accurate. Having written and contributed to much of the online user manual for Blender, I thought it was time to pull all of that disparate knowledge together and target it toward a specific need: compositing. However, this type of culmination is not possible without the backing of a large publisher, and Apress stepped up to the plate.

There are very few experienced users with an abundance of free time available to contribute reliable knowledge and experience tailored to Blender. A much wider audience would use Blender if it was well documented, if its features were fully explained, and if its utility within the workflow showed it to be a productive tool in compositing. To this end, I have documented the basic functionality of a broad spectrum of Blender functionality already in some online books and video tutorials at Lynda.com. However, people aren't connected to the Internet all the time, and the format and searchability of a book, coupled with the tactile element, make that format very attractive. We printed this book in full color at considerable expense to bring you the highest-quality experience possible. The DVD contains all the files and assets used in this book (and of course, a recent copy of Blender!). The DVD also includes gigabytes of mattes, models, and textures used in the first two open movies: *Elephants Dream* and *Big Buck Bunny*. The book takes you from start to finish, and I hope you enjoy reading it as much as I enjoyed writing it.

Happy Blending!

Roger D. Wickes

Layout conventions

To keep this book as clear and easy to follow as possible, the following text conventions are used throughout.

Important words or concepts are normally highlighted on the first appearance in *italics*.

Filenames, directories, and paths are presented in fixed-width font.

Menu commands are written in the form **Menu** ► **Submenu** ► **Submenu**.

Where I want to draw your attention to something, I've highlighted it like this:

Ahem, don't say I didn't warn you.





Chapter 1

BLENDER OVERVIEW

This chapter introduces Blender, the world's foremost open source software package for compositing and postproduction. You'll learn about the features that make Blender stand out in the compositing world, as well as get some background on digital compositing. Then you'll get started by setting up Blender and taking a look at its interface.

What is Blender?

Blender is a full-featured, integrated, 3D animation application that provides a complete workbench for creating and producing video content. For compositing, Blender has three main workbenches: 3D texturing, node-based compositing, and nonlinear video sequence editing. Each of these workbenches is integrated to work together in a seamless workflow. An example of this integration is shown in Figure 1-1, which illustrates the production of a video on interior design.

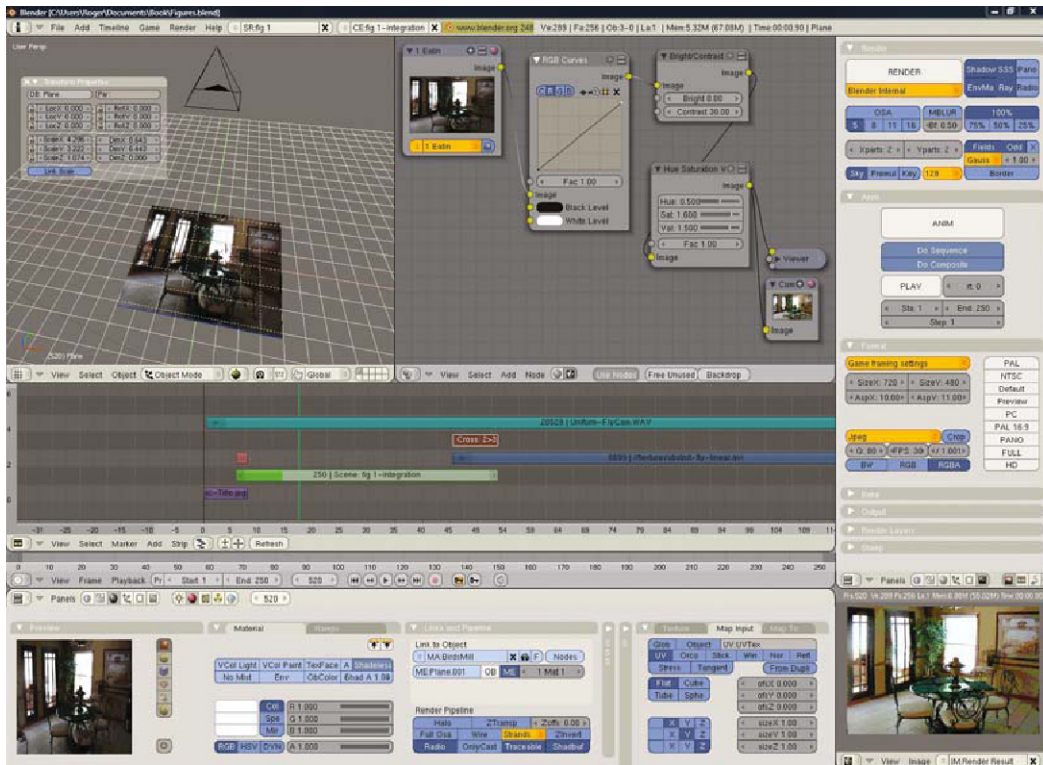


Figure 1-1. A Compositing desktop in Blender

In Figure 1-1, I have used Blender's 3D modeling tools to construct a virtual set that uses a virtual camera to "film" a plane, textured with an image. That original photo was taken with the camera tilted down, and so the room looked skewed. I used UV projection onto the model and adjusted the UV texture mapping to correct this perspective distortion. Using the compositor, I color-corrected that perspective-corrected image. I can now feed it into the sequencer, where it will be mixed with an audio track for final output to an AVI file for TV broadcast. After the rendering, I could rerender this same setup for webcast in Europe with two mouse clicks, or for the Web with another two mouse clicks.

All of your video work happens inside one package: Blender. Your work is faster, because you don't need to stop, switch to a different package, save, export, import, refresh, and resume work. This also means that you don't have to "context swap" when you switch between two applications, as you adjust to the different user interface (UI) and recall how to access that particular application's features. Since you work within only one application, and the UI is consistent across functional areas, you do not waste time context swapping.

Blender is extremely important in the compositing world because it has the following characteristics:

- **Functional:** In addition to a rich set of features, the software is stable and relatively bug-free.
- **Free:** You can download Blender for free. Any work you produce is free from any royalty or restrictions. You can install Blender on as many computers as you want, and even make an in-house render farm.
- **Multiplatform:** Blender runs on all the popular operating systems, including Microsoft Windows versions (from Windows 98 to Vista), Linux flavors (Ubuntu, Debian, and so on), Solaris, and Mac OS X versions (Leopard).
- **Open source:** You can get the source code for Blender, which is written in C, and tailor it to meet your needs. You can write your own extensions and functionality. You are not required (but are encouraged) to share those changes with the rest of the community, and thus can use Blender as a base for your own proprietary platform. If you discover any bugs, you can use in-house programming resources to quickly fix them, without waiting for the vendor's next quarterly release.
- **Documented:** The source, architecture, philosophy, and end-user features are documented, giving you the background information to intelligently decide where and how to customize Blender.
- **Nonproprietary:** The development team goes to great lengths to ensure that all the source code and all libraries used fall under the GNU Public License (version 2), and do not require you to pay any royalties or license any modules for a fee at any time. Any work products you produce using Blender are totally yours.
- **Supported:** Blender is supported by a global community of people and publishers who provide nearly 24/7 end-user support through forums, newspapers, e-magazines, and open projects.
- **Interoperable:** Blender operates with many other popular packages. You can easily import and export a wide variety of file formats.
- **Industrial-strength:** Blender supports the leading formats used in the industry, such as OpenEXR, as well as file sizes and video durations exceeding one hour.
- **Recognized:** Blender is globally recognized and used by professional houses as a tool within their pipeline.

Blender finds many users in the academic community, especially the European postgraduate arena. As these students have graduated and moved into professional fields, Blender has penetrated the professional market in film, video, web, architecture, design, and many other industries, with heavy adoption in Europe, South America, Southeast Asia, and Japan.

What is digital compositing?

Compositing is the most visually rewarding experience in computer graphics. Just as a painter starts with a canvas, some tools (paint, brushes, and so on), and most important, a vision, compositing sets visual imagery in motion from a base of many elements.

Digital compositing generally refers to activities that mostly happen during postproduction and includes anything done to an image or video after it has been recorded. In today's high-budget video projects, filled with computer-generated special effects, compositing activities have extended all the way forward in the life cycle of a film into preproduction, where some activities help filmmakers plan and visualize the rest of their project.

A long time ago, compositing was not digital and consisted of editing the film with razor blades and tape. Many physical techniques were developed to achieve artistic effects. These effects are what we see in old films, and are what we have largely come to expect and take for granted now. For example, the *cross-fade* is a smooth transition from one shot to another. This is in contrast to a *cut*, which is where the film was literally cut and taped together.

Special effects

While editing was done with cutters and by splicing film together, compositing itself didn't really exist. Special effects were generally done "in camera," meaning that they were captured with live photography, often using tricks like forced perspective and projected backgrounds. The closest thing to digital compositing would be split screens and matting, which would be used to join two different takes or locations into a single frame. One example is a scene in Alfred Hitchcock's *Vertigo*, where Jimmy Stewart climbs up a rickety staircase and envisions falling down the center column. At the Hitchcock museum, I saw the preserved set of the staircase scene, shown in Figure 1-2, and fell in love with the idea of special effects and using tricks to fake reality.



Figure 1-2. *Vertigo* staircase

In the 1940s version of *The Miracle Worker* (a movie about Helen Keller directed by Arthur Penn and starring Anne Bancroft and Patty Duke), I observed a cross-fade, but the fading shot rotated in a strange way that moved off camera. Curious, I set about to figure out how I would do that with real film. I found that in a documentary that used a similar effect, a clever director of photography projected one shot onto a screen, and another shot onto a glass plate using another projector. By filming the composite, moving the glass plate off to the side, turning the light off the glass projector, and filming the result,

he got an image overlay and a panning motion of the first image. (I don't know if this is how the effect was done in *The Miracle Worker*.) In Blender, this effect is called a *translating cross-fade*.

With the advent of the digital age, your initial efforts should go into how to achieve those legacy physical effects when working with digital media, and work your way up a learning pyramid, as illustrated in Figure 1-3. In other words, using a computer, how can you re-create an effect done with (sometimes literally) smoke and mirrors? This area of learning is just about dealing with the complexities of working with digital media, such as digital image formats, since there is no physical media to manipulate.

After you've mastered re-creating legacy effects, you're ready to try new effects. Producers and directors are always looking for a fresh approach, to add a bold, spectacular, and/or memorable look to their films.

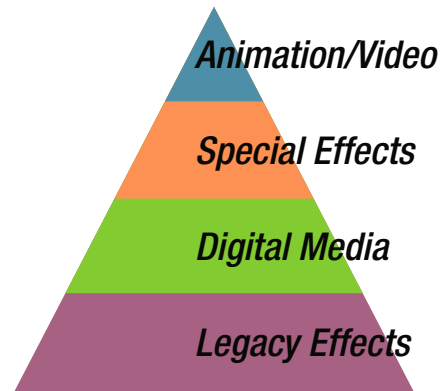


Figure 1-3. Learning pyramid

Once you have designed an effect or look, which is usually the end result of some sort of a storyboard or concept, perhaps even a single-frame mock-up, the pinnacle is figuring out how to apply that effect in a convincing way over a range of frames. How do you animate the effect itself and the transition from a frame that doesn't have it to a frame that does?

When developing a new effect, or more often trying to figure out how someone much smarter than myself achieved some new effect, I find it easier to follow a progression of thought that starts with “how would I get to a middle frame, or get the final result?” and work backward to what I have to start with—the tools I have available. Then I can visualize how to get from point A to point B to achieve the transition. What you see (or what the producer wants) is often a combination of effects that either build on one another or are layered or mixed with one another. Sometimes you need to take almost an analytical approach to break down an overall effect into its constituent parts.

Compositing activities

Compositing and postproduction activities generally fall into one of the following major categories:

- Reformat images and video
- Adjust and correct images and video
- Assemble and animate elements
- Composite and process image elements
- Sequence video strips with audio

Let's take a closer look at each of these areas.

Reformatting images and video

Reformatting is where you have a 1024×768 resolution image saved in the PNG format, but want it resampled and compressed into a 640×480 resolution JPG format to save disk space and maybe in preparation for a webcast. Another example is when you have a film shot in 2.43:1 aspect ratio that needs to be remastered for US TV broadcast, which uses a 4:3 aspect ratio. As illustrated in Figure 1-4, you must either letterbox or crop the image. Letterboxing adds black bars above and below the image. The other choice is to simply lop off the left and right sides of the image, and show only the middle, since that is where most of the action occurs.

Since the shape of the movie resembles a letter mailed in an envelope via the post office (if you are old enough to remember snail mail), and the shape of a TV resembles a box, the term letterbox was coined to describe the look that was accomplished to fit the width of the film on a TV screen.

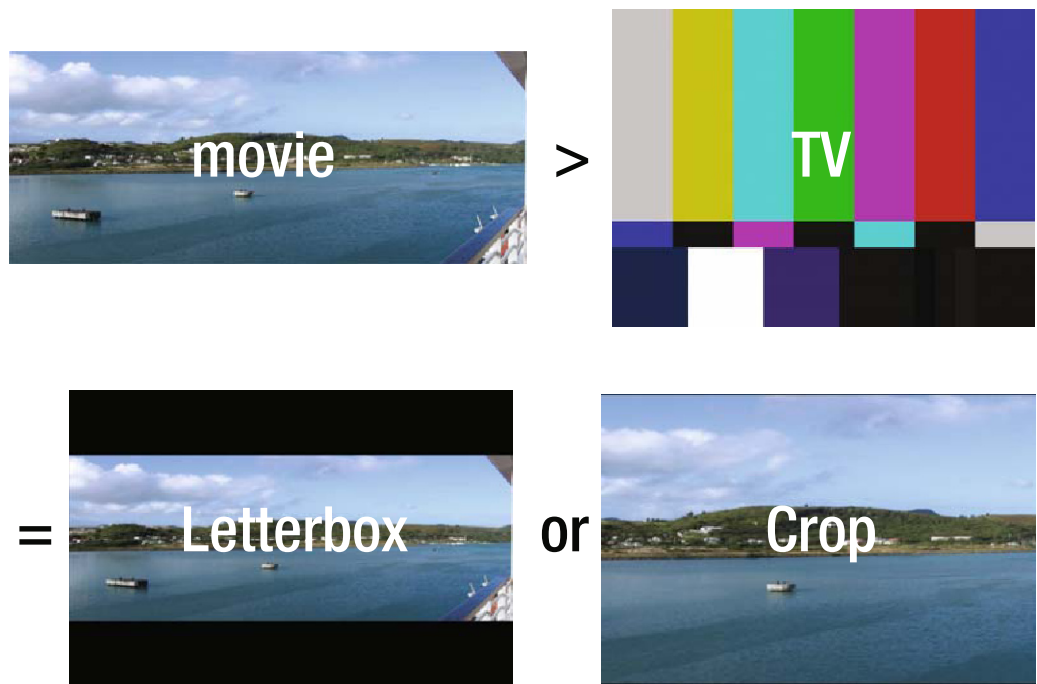


Figure 1-4. Example of reformatting for a different aspect ratio

Adjusting images and video

Another common task in postproduction is to adjust the image brightness, contrast, or tone to achieve a certain look. For example, you may want to adjust a shot that was filmed in bright white light (and is a little washed-out) to give it deeper hues, as shown in Figure 1-5. You could do this by changing the hue, saturation, and the color balance.



Figure 1-5. Example of adjusting an image

Animating elements

Video is motion, and even some still images convey motion through motion blur. Whether it is simply text titles moving over a TV commercial, a high-energy music video, or thousands of virtual birds swirling around a beach, movement of visual imagery captures the eye of the audience.

Blender has a full suite of animation tools that allow you to move elements around and change their color, shape, and visibility over time. You can manually animate and keyframe the location of objects in time, and Blender can even calculate the motion of an object, or hundreds of objects, for you based on rules that you set up. Figure 1-6 shows an example in which the movement and location of each fish within the school was automatically calculated by Blender.

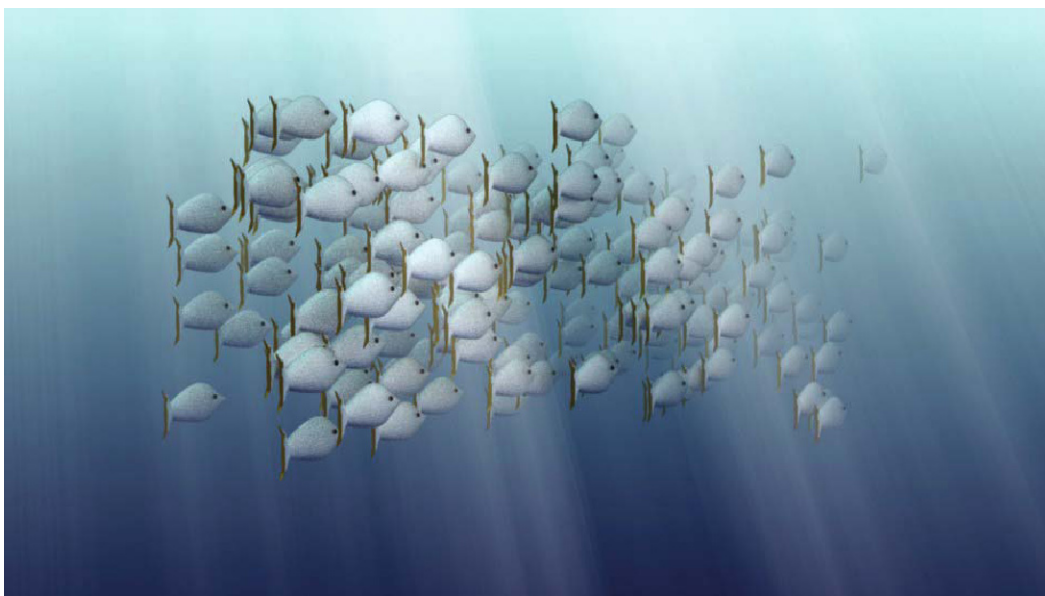


Figure 1-6. Frame from an automatically-computed animation

Compositing elements

To me, a composite is like plywood; the end product is made up of layers of different elements, combined into one image. These elements may be entire photos, parts of photos, or from a computer-generated rendering.

In the example in Figure 1-7, in a shot from the open movie *Big Buck Bunny*, the main character is composited on top of an image of a tree trunk, while the backup actors are placed behind the tree. All of that is then layered on top of a background matte image of the sky and distant hills. When all of these elements are combined and layered together, a convincing, seamless image results.

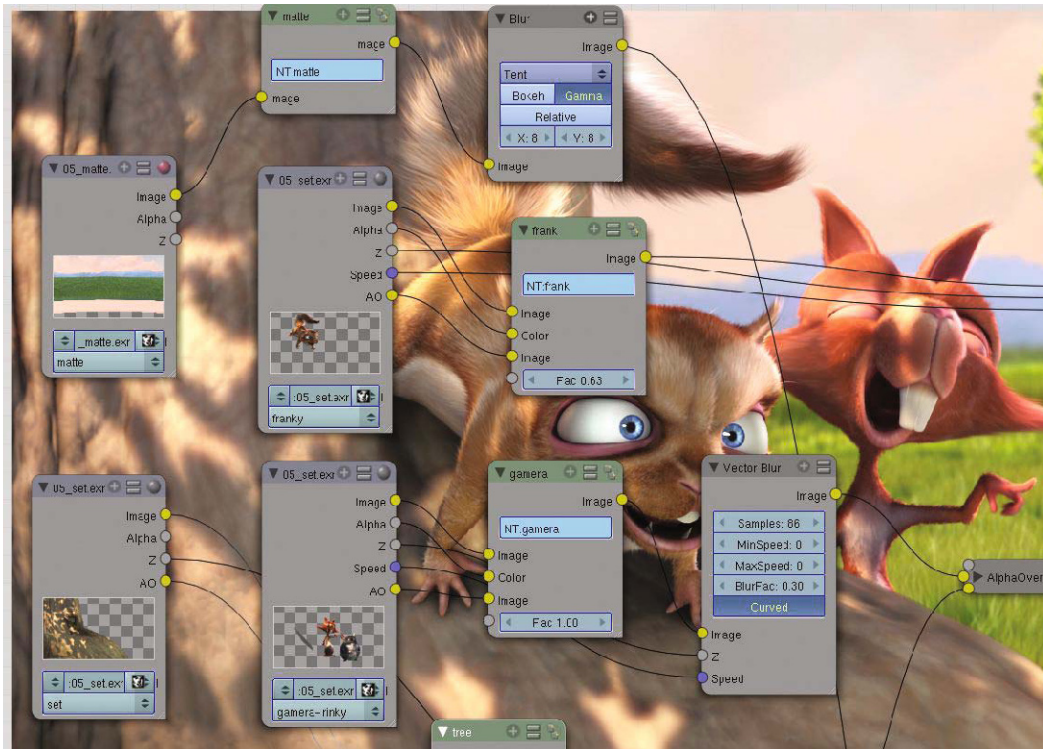


Figure 1-7. An example of a composite

Sequencing video

The final step is arranging the shots into a sequence of events that tells the story. Figure 1-8 shows four frames from the movie *Big Buck Bunny* that represent the first frame of each shot in the opening scene of the movie. The purpose of the first scene is to introduce the movie. These shots set the theme, look, and feel of the movie; let the viewer know that something is amiss (to start the rising tension); and anticipate the introduction of the main character.

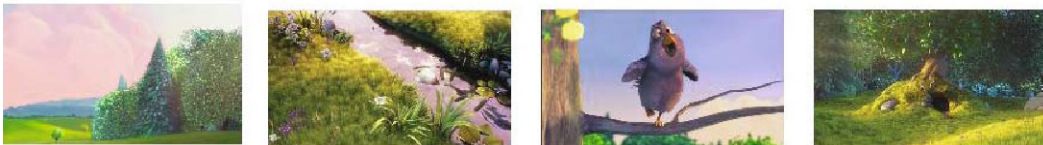


Figure 1-8. An example of sequencing video from the *Big Buck Bunny* opening scene