Adobe®

# After Effects® CS6
## Visual Effects and Compositing
### STUDIO TECHNIQUES

**Mark Christiansen**

Adobe

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# Adobe® After Effects® CS6 Visual Effects and Compositing Studio Techniques

## Mark Christiansen

# Contents

Scripting appendix by Jeff Almasol and After Effects JavaScript Guide by
Dan Ebberts available on the accompanying DVD.

## About the Author

**Mark Christiansen** is a San Francisco–based visual effects supervisor and creative director. Some of his Hollywood feature and independent film credits include *Avatar, All About Evil, The Day After Tomorrow* and *Pirates of the Caribbean 3: At World's End.* As a director, producer, designer, and compositor/animator, he has worked on a diverse slate of commercial, music video, live event, and television documentary projects for a diverse set of Hollywood and Silicon Valley clients. More recently he has been employed directly by Adobe to produce video marketing material. It was a brief stint advising on the set of *Beasts of the Southern Wild* that sparked the concept for Cinefex for iPad and foundation of the company that produced it—New Scribbler.

Mark has used After Effects since version 2.0 and has worked directly with the After Effects development and marketing teams over the years. He has written four previous editions of this book, and has contributed to other published efforts, including the *Adobe After Effects Classroom in a Book* and *After Effects 5.5 Magic* (with Nathan Moody).

Mark is a founder of Pro Video Coalition (provideocoalition.com). He has created video training for Digieffects, lynda.com, and fxphd.com, and has taught courses based on this book at Academy of Art University. You can hear him on popular podcasts such as "The VFX Show" and you can find him at christiansen.com.

## About the Contributors

**Jeff Almasol** (Appendix: Scripting) is a senior quality engineer on the Adobe After Effects team by day and crafter of After Effects scripts at his redefinery.com site by night. His site provides numerous free scripts, reference material, and links to other scripting resources. Prior to Adobe, Jeff worked at Elastic Reality Inc. and Avid Technology on Elastic Reality, Marquee, AvidProNet, and other products; and at Profound Effects on Useful Things and Useful Assistants. You might find him talking in the third person on Twitter (redefinery) and other sites.

**Dan Ebberts** (Chapter 10: Expressions and After Effects Javascript Guide) is a freelance After Effects script author and animation consultant. His scripting services have been commissioned for a wide range of projects, including workflow automation and complex animation rigging. He is a frequent contributor to the various After Effects forums and has a special interest in expressions and complex algorithms. Dan is an electrical engineer by training, with a BSEE degree from the University of California, but has spent most of his career writing software. He can be reached via http://motionscript.com.

**Stu Maschwitz** (Foreword) is a writer and director, and the creator of the Magic Bullet Suite from Red Giant Software. Maschwitz spent four years as a visual effects artist at George Lucas's Industrial Light & Magic (ILM), working on such films as *Twister* and *Men in Black*. He cofounded and was CTO of The Orphanage, a San Francisco-based visual effects and film production company. Maschwitz has directed numerous commercials and supervised effects work on films including *Sin City* and *The Spirit*. Maschwitz is a guerilla filmmaker at heart and combined this spirit and his effects knowledge into a book: *The DV Rebel's Guide: An All-Digital Approach to Making Killer Action Movies on the Cheap* (Peachpit Press).

*To the true spirit of collaboration.*

## Acknowledgments

## Foreword to This Edition

*Face it, Bart, Sideshow Bob has changed.*
*No, he hasn't. He's more the same than ever!*
— Lisa and Bart Simpson in "Brother from
Another Series," *The Simpsons*, Season 8

The first edition of this book was published in 2005, and I wrote the foreword for the third edition in 2008. I just read it, with an eye to updating it. I didn't change a word.

Everything I wrote then is even more true today. I'm seeing it every time I turn on my television—people are losing their preoccupation with realism and just telling stories. Certainly in many cases this is due to drastically reduced budgets. Nothing inspires creativity like limited resources. But if you can make your point as effectively with a stylized-but-beautiful animation, suddenly spending months of work to "do it photo-real" seems like more than just squandered resources; it seems to miss the point altogether.

Today, our phones come with 1080p video cameras, and our favorite visual effects application comes bundled with a 3D tracker. Every week on Kickstarter there's a new project designed to make some aspect of film production even more accessible. We're expected to make even more for even less.

The combination of Adobe After Effects CS6 and this book remains your best asset in that battle. What I wrote in 2008's foreword was controversial and challenging at the time, but today it just feels like common sense. When the season finale of a hit TV show is shot using a camera that you can buy at the corner camera store—when a professional cinematographer is willing to suffer through compression artifacts and other technical shortcomings of that camera because the images he makes with it create an emotional experience he can't achieve any other way—you're in the middle of a sea change. It's not the 100-artist facilities or the shops with investments in "big iron" that are going to come out on top. The victory will go to the

artists who generate an emotional reaction by any means necessary. The filmmaker with an entire studio in her backpack. The visual effects artist who has an entire show's worth of shots slap-comped while the editor is still loading footage. The graphic designer who ignores the stale collection of stock footage and shoots his own cloud time-lapse using a $.99 iPhone app.

Four years ago it was fun to think about bringing the sex to your work. Today it's necessary for survival. Use what you learn in this book to make beautiful things that challenge and excite people. The tools have gotten better. It's up to you to translate that into a better audience experience.

—Stu Maschwitz

# Foreword

*I can't see the point in the theatre. All that sex and violence. I get enough of that at home Apart from the sex, of course.*

　　　　　—Tony Robinson as Baldrick, *Blackadder*

## Who Brings the Sex?

"Make it look real." That would seem to be the mandate of the visual effects artist. Spielberg called and he wants the world to believe, if only for 90 minutes, that dinosaurs are alive and breathing on an island off the coast of South America. Your job: Make them look real. Right?

Wrong.

I am about to tell you, the visual effects artist, the most important thing you'll ever learn in this business: Making those velociraptors (or vampires or alien robots or bursting dams) "look real" is absolutely not what you should be concerned with when creating a visual effects shot.

Movies are not reality. The reason we love them is that they present us with a heightened, idealized version of reality. Familiar ideas—say, a couple having an argument—but turned up to 11: The argument takes place on the observation deck of the Empire State building, both he and she are perfectly backlit by the sun (even though they're facing each other), which is at the exact same just-about-to-set golden-hour position for the entire 10-minute conversation. The couple are really, really charming and impossibly good-looking—in fact, one of them is Meg Ryan. Before the surgery. Oh, and music is playing.

What's real about that? Nothing at all—and we love it.

Do you think director Alejandro Amenábar took Javier Aguirresarobe, cinematographer on *The Others*, aside and said, "Whatever you do, be sure to make Nicole Kidman look real?" Heck no. Directors say this kind of stuff to their DPs: "Make her look like a statue." "Make him look bulletproof." "Make her look like she's sculpted out of ice."

### Did It Feel Just Like It Should?

Let's roll back to *Jurassic Park*. Remember how terrific the T-rex looked when she stepped out of the paddock? Man, she looked good.

She looked good.

The realism of that moment certainly did come in part from the hard work of Industrial Light and Magic's fledgling computer graphics department, which developed groundbreaking technologies to bring that T-rex to life. But mostly, that T-rex felt real because she looked good. She was wet. It was dark. She had a big old Dean Cundey blue rim light on her coming from nowhere. In truth, you could barely see her.

But you sure could hear her. Do you think a T-rex approaching on muddy earth would really sound like the first notes of a new THX trailer? Do you think Spielberg ever sat with sound designer Gary Rydstrom and said, "Let's go out of our way to make sure the footstep sounds are authentic?" No, he said, "Make that mofo sound like the Titanic just rear-ended the Hollywood Bowl" (may or may not be a direct quote).

It's the sound designer's job to create a soundscape for a movie that's emotionally true. They make things feel right even if they skip over the facts in the process. Move a gun half an inch and it sounds like a shotgun being cocked. Get hung up on? Instant dial tone. Modern computer displaying something on the screen? Of course there should be the sound of an IBM dot-matrix printer from 1978.

Sound designers don't bring facts. They bring the sex. So do cinematographers, makeup artists, wardrobe stylists, composers, set designers, casting directors, and even the practical effects department.

And yet somehow, we in the visual effects industry are often forbidden from bringing the sex. Our clients pigeonhole us into the role of the prop maker: Build me a T-rex, and it better look real. But when it comes time to put that T-rex on screen, we are also the cinematographer (with our CG lights), the makeup artist (with our "wet look"

shader), and the practical effects crew (with our rain). And although he may forget to speak with us in the same flowery terms that he used with Dean on set, Steven wants us to make sure that T-rex looks like a T-rex should in a movie. Not just good—impossibly good. Unrealistically blue-rim-light-outa-nowhere good. Sexy good.

Have you ever argued with a client over aspects of an effects shot that were immutable facts? For example, you may have a client who inexplicably requested a little less motion blur on a shot, or who told you "just a little slower" for an object after you calculated its exact rate of fall? Do you ever get frustrated with clients who try to art-direct reality in this way?

Well, stop it.

Your client is a director, and it's their job to art-direct reality. It's not their job to know (or suggest) the various ways that it may or may not be possible to selectively reduce motion blur, but it is their job to feel it in their gut that somehow this particular moment should feel "crisper" than normal film reality. And you know what else? It's your job to predict that they might want this and even propose it. In fact, you'd better have this conversation early, so you can shoot the plate with a 45-degree shutter, that both the actors and the T-rex might have a quarter the normal motion blur.

## Was It Good for You?

The sad reality is that we, the visual effects industry, pigeonhole ourselves by being overly preoccupied with reality. We have no one to blame but ourselves. No one else on the film set does this. If you keep coming back to your client with defenses such as "That's how it would really look" or "That's how fast it would really fall," then not only are you going to get in some arguments that you will lose, but you're actually setting back our entire industry by perpetuating the image of visual effects artists as blind to the importance of the sex. On the set, after take one of the spent brass shell falling to the ground, the DP would turn to the director and say, "That felt a bit fast. Want me to do one at 48 frames?" And the director would say yes, and

they'd shoot it, and then months later the editor would choose take three, which they shot at 72 frames per second "just in case." That's the filmmaking process, and when you take on the task of creating that same shot in CG, you need to represent, emulate, and embody that entire process. You're the DP, both lighting the shot and determining that it might look better overcranked. You're the editor, confirming that choice in the context of the cut. And until you show it to your client, you're the director, making sure this moment feels right in all of its glorious unreality.

The problem is that the damage is already done. The client has worked with enough effects people who have willingly resigned themselves to not bringing the sex that they now view all of us as geeks with computers rather than fellow filmmakers. So when you attempt to break our self-imposed mold and bring the sex to your client, you will face an uphill battle. But here's some advice to ease the process: Do it without asking. I once had a client who would pick apart every little detail of a matte painting, laying down accusations of "This doesn't look real!"—until we color corrected the shot cool, steely blue with warm highlights. Then all the talk of realism went away, and the shot got oohs and aahs.

Your client reacts to your work emotionally, but they critique technically. When they see your shot, they react with their gut. It's great, it's getting better, but there's still something not right. What they should do is stop there and let you figure out what's not right, but instead, they somehow feel the need to analyze their gut reaction and turn it into action items: "That highlight is too hot" or "The shadows under that left foot look too dark." In fact, it would be better if they focused on vocalizing their gut reactions: "The shot feels a bit lifeless," or "The animation feels too heavy somehow." Leave the technical details to the pros.

You may think that those are the worst kind of comments, but they are the best. I've seen crews whine on about "vague" client comments like "give the shot more oomf." But trust me, this is exactly the comment you want. Because clients are like customers at a restaurant, and you

are the chef. The client probably wants to believe that "more oomf" translates into something really sophisticated, like volumetric renderings or level-set fluid dynamics, in the same way that a patron at a restaurant would hope that a critique like "this dish needs more flavor" would send the chef into a tailspin of exotic ingredients and techniques. Your client would never admit (or suggest on their own) that "oomf" is usually some combination of "cheap tricks" such as camera shake, a lens flare or two, and possibly some God rays—just like the diner would rather not know that their request for "more flavor" will probably be addressed with butter, salt, and possibly MSG.

The MSG analogy is the best: Deep down, you want to go to a Chinese restaurant that uses a little MSG but doesn't admit it. You want the cheap tricks because they work, but you'd rather not think about it. Your client wants you to use camera shake and lens flares, but without telling them. They'd never admit that those cheap tricks "make" a shot, so let them off the hook and do those things without being asked. They'll silently thank you for it. Bringing the sex is all about cheap tricks.

## Lights On or Off?

There are some visual effects supervisors who pride themselves on being sticklers for detail. This is like being an architect whose specialty is nails. I have bad news for the "Pixel F*ckers," as this type are known: Every shot will always have something wrong with it. There will forever be something more you could add, some shortcoming that could be addressed. What makes a visual effects supervisor good at their job is knowing which of the infinitely possible tweaks are important. Anyone can nitpick. A good supe focuses the crew's efforts on the parts of the shot that impact the audience most. And this is always the sex. Audiences don't care about matte lines or mismatched black levels, soft elements or variations in grain. If they did, they wouldn't have been able to enjoy *Blade Runner* or *Back to the Future* or that one *Star Wars* movie—what was it called? Oh yeah: *Star Wars*. Audiences only care about the sex.

On a recent film I was struggling with a shot that was just kind of sitting there. It had been shot as a pickup, and it needed some help fitting into the sequence that had been shot months earlier. I added a layer of smoke to technically match the surrounding shots. Still, the shot died on the screen. Finally, I asked my compositor to softly darken down the right half of the shot by a full stop, placing half the plate along with our CG element in a subtle shadow. Boom, the shot sang.

What I did was, strictly speaking, the job of the cinematographer, or perhaps the colorist. The colorist, the person who designs the color grading for a film, is the ultimate bringer of the sex. And color correction is the ultimate cheap trick. There's nothing fancy about what a Da Vinci 2K or an Autodesk Lustre does with color. But what a good colorist does with those basic controls is bring heaping, dripping loads of sex to the party. The problem is—and I mean the single biggest problem facing our industry today—the colorist gets their hands on a visual effects shot only after it has already been approved. In other words, the film industry is currently shooting itself in the foot (we, the visual effects artists, being that foot) by insisting that our work be approved in a sexless environment. This is about the stupidest thing ever, and until the industry works this out, you need to fight back by taking on some of the role of the colorist as you finalize your shots, just like we did when we made those matte paintings darker and bluer with warm highlights.

Filmmaking is a battleground between those who bring the sex and those who don't. The non-sex-bringing engineers at Panavision struggle to keep their lenses from flaring, while ever-sexy cinematographers fight over a limited stock of 30-year-old anamorphic lenses because they love the flares. I've seen DPs extol the unflinching sharpness of a priceless Panavision lens right before adding a smear of nose grease (yes, the stuff on your nose) to the rear element to soften up the image to taste. Right now this battle is being waged on every film in production between the visual effects department and the colorists of the world. I've heard effects artists lament that after all their hard

work making something look real, a colorist then comes along and "wonks out the color." In truth, all that colorist did was bring the sex that the visual effects should have been starting to provide on their own. If what the colorist did to your shot surprised you, then you weren't thinking enough about what makes a movie a movie.

## In Your Hands

You're holding a book on visual effects compositing in Adobe After Effects. There are those who question the validity of such a thing. Some perpetuate a stigma that After Effects is for low-end TV work and graphics only. To do "real" effects work, you should use a program such as Nuke or Shake. Those techy, powerful applications are good for getting shots to look technically correct, but they do not do much to help you sex them up. After Effects may not be on par with Nuke and Shake in the tech department, but it beats them handily in providing a creative environment to experiment, create, and reinvent a shot. In that way it's much more akin to the highly respected Autodesk Flame and Inferno systems—it gives you a broad set of tools to design a shot, and has enough horsepower for you to finish it, too.

After Effects is the best tool to master if you want to focus on the creative aspects of visual effects compositing. That's why this book is unique. Mark's given you the good stuff here, both the nitty-gritty details as well as the aerial view of extracting professional results from an application that's as maligned as it is loved. No other book combines real production experience with a deep understanding of the fundamentals, aimed at the most popular compositing package on the planet.

## Bring It

One of the great matte painters of our day once told me that he spent only the first few years of his career struggling to make his work look real, but that he'll spend the rest of his life learning new ways of making his work look good. It's taken me years of effects supervising, commercial directing, photography, wandering the halls of museums, and waking up with hangovers after too much

really good wine to fully comprehend the importance of those words. I can tell you that it was only after this particular matte painter made this conscious choice to focus on making things look good, instead of simply real, that he skyrocketed from a new hire at ILM to one of their top talents. Personally, it's only after I learned to bring the sex that I graduated from visual effects supervising to become a professional director.

So who brings the sex? The answer is simple: The people who care about it. Those who understand the glorious unreality of film and their place in the process of creating it. Be the effects artist who breaks the mold and thinks about the story more than the bit depth. Help turn the tide of self-inflicted prejudice that keeps us relegated to creating boring reality instead of glorious cinema. Secretly slip your client a cocktail of dirty tricks and fry it in more butter than they'd ever use at home.

Bring the sex.

Stu Maschwitz
San Francisco, October 2008

# Introduction

*If you aren't fired with enthusiasm, you will be fired—with enthusiasm.*

—Vince Lombardi

## Why This Book?

This book is about creating visual effects. Specifically, it dives into the art and science of assembling disparate elements so that they appear as part of a single, believable scene. When people ask me what exactly the book is about, I tell them that it shows artists how to make a shot assembled on a computer look as if it was taken with a single camera. It also hints at how to make an ordinary shot extraordinary, without destroying the viewer's willing suspension of disbelief.

The subject matter in this book goes well beyond the obvious—and what is well documented elsewhere—and deep into core visual effects topics. We look closely at features such as color correction, keying, tracking, and roto that are only touched on by other books about After Effects, while leaving tools more dedicated to motion graphics (such as Text and Shape layers) largely alone. It's not that those tools aren't a powerful part of After Effects; it's just that they literally don't fit in this book.

As the author, I do not shy away from strong opinions, even when they deviate from the official line. These opinions and techniques—which have been refined through actual work in production at a few of the finest visual effects facilities in the world—are valid not only for such high-end productions but really anywhere you are compositing a visual effect. Where applicable, the reasoning behind using one technique over another is provided. I aim to make you not a better button-pusher but a more effective artist and technician.

Visual effects companies are typically protective of trade secrets, reflexively treating all production information as

proprietary. Once you work on a major project, however, you will soon discover that even the most complex shot is made up largely of repeatable techniques and practices. The art is in how the results are applied, combined, and customized, and what is added (or taken away). Visual effects artists, meanwhile, can be downright open and friendly about sharing discoveries, knowing that it's the artistry and not a clever bag of tricks that ultimately make the greatest difference.

Each shot is unique, and yet each relies on techniques that are tried and true. This book offers you as many of the techniques as possible so that you can focus on the unique properties of each shot. There's not much here in the way of step-by-step instructions—it's more important for you to grasp how things work so that you can repurpose techniques for your individual shot.

This is *not* a book for beginners. Although the first section is designed to make sure that you are making optimal use of the software, it's not an effective primer on After Effects in particular or digital video in general. If you're new to After Effects, first spend some time with its excellent documentation or check out one of the many books available to help beginners learn the application.

On the other hand, if you're comfortable with Photoshop and familiar with the visual effects process—which is likely, if you've picked up this book—try diving into the redesigned Chapter 1 and let me know how it goes.

## Organization of This Book and What's New

Each edition of the *After Effects Studio Techniques* series has been organized into three sections. Although each chapter has been refined and updated, the broad organization of the book remains as follows.

▶ Section I, "Working Foundations," is about After Effects itself, and how to make the most of its user interface. This is not a list of each menu and button but a shortcut to power use when compositing.

**NOTES**

This book's technical editor, Todd Kopriva, maintains an excellent blog called After Effects Region of Interest at Adobe, and he has assembled and maintained a page of resources for beginners entitled Getting Started with After Effects. Visit http://blogs. adobe.com/toddkopriva/2010/01/ getting-started-with-after-eff.html.

If you're advanced, don't skip this section. It's virtually guaranteed to contain valuable information that you don't already know, and it has been freshened up with new data and figures pertaining to new features in CS6, including the revolutionary Global Performance Cache coverage in Chapter 4.

▶ Section II, "Effects Compositing Essentials," is about the fundamentals of effects compositing. Color matching, keying, rotoscoping, and motion tracking are the essentials, plus there's a chapter on the camera and 3D along with another on the expressions used to generate animated data with connections, logic, and math. The final chapter in that section introduces you to 32-bpc linear compositing and high dynamic range imaging pipelines.

This section is the true heart of the book. This edition contains dramatic rewrites of Chapters 7 through 9, due to the many new rotoscoping, tracking, and 3D features added to the application since version CS5.

▶ Section III, "Creative Explorations," is about the actual shots you are likely to re-create—the bread-and-butter techniques every effects artist needs to know. Some of these examples are timeless, but you will also find a substantial new section to get you up and running with Adobe SpeedGrade, a powerful new tool that most After Effects CS6 artists will have but few know how to use.

In all cases, instead of leading you step-by-step through a single example, the goal is to explain the fundamentals of how things work. You will then be able to put these techniques to use on your own shot, instead of taking a paint-by-numbers approach. While each shot is unique, they can all be grouped together as effectively the same in fundamental ways.

## Artistry

While working on the first edition of this book, I would ride my bicycle home up the hill out of the Presidio, where The Orphanage studio was located. As I rode, I thought

about what people really needed to know in order to move their work to the level of a visual-effects pro. Sometimes it was very late at night, when raccoons and skunks would cross my path. Here's what I came up with:

▶ **Get reference.** You can't re-create what you can't clearly see. Too many of us skip this step and end up making boring, generic choices. Nature is never boring, and if it appears that way, you're not looking at it closely enough.

▶ **Simplify.** To paraphrase Einstein, the optimum solution is as simple as possible, but no simpler.

▶ **Break it down.** Talented but inexperienced students learn how the software works but are not used to analyzing a shot or sequence and breaking it down into manageable, comprehensible steps. This is a book filled with those steps.

▶ **Learn to take criticism rather than expect perfection.** My former colleague Paul Topolos, now in the art department at Pixar, used to say, "Recognizing flaws in your work doesn't mean you're a bad artist. It only means you have taste." To err is human, to cut yourself a break and keep going, divine.

This is what I learned working at the best studios, and even if you're not currently working at one of them, this is how collaboration, criticism, and perseverance will be your teachers.

## Compositing in After Effects

There's a good reason that Nuke, a node-based compositing application from The Foundry, has almost uniformly become the compositing application of choice at the feature film visual effects studios around the world. Nuke is designed for exactly what those artists need—and only what they need. In some areas, mostly the handling of 3D and stereo, Nuke is clearly ahead of After Effects. In other areas, such as animation and type handling, After Effects has the edge. For compositing fundamentals, the two applications are equally valid, but operations that are simple in Nuke can be complicated in After Effects, and vice versa.

Despite the impression that Nuke has taken over compositing, when you move beyond feature films, After Effects remains the ubiquitous application. They're both awesome tools, but the important takeaway is that Nuke is specialized while After Effects targets a broader set of users.

Some of the features that streamline After Effects for the generalist and animator (and which, paradoxically, can complicate workflows that are more straightforward for video-effects compositing in Nuke):

> ► Render order is established in the timeline and via nested compositions that consist of layers, not nodes. After Effects has Flowchart view, but you don't create your composition there the way you would with a tree/node interface.

> ► Transforms, effects, and masks are embedded in every layer. They render in a fixed order.

> ► After Effects has a persistent concept of an alpha channel in addition to the three color channels. The alpha channel is always treated as if it is straight (never premultiplied) once an image has been imported and "interpreted," as the application terms it.

> ► An After Effects project is not a script, although version CS4 introduced a text version of the After Effects Project (.aep) file, the XML-formatted .aepx file. Most of the text file's contents are inscrutable other than source file paths. Actions are not recordable and there is no direct equivalent to Shake macros.

> ► Temporal and spatial settings tend to be fixed and absolute in After Effects because it is composition- and timeline-based. This is a boon to projects that involve complex timing and animation, but it can snare users who aren't used to it and suddenly find pre-comps that end prematurely, are cropped, or don't scale gracefully. Best practices to avoid this are detailed in Chapter 4.

This book attempts to shed light on these and other areas of After Effects that are not explicitly dealt with in its user interface or documentation. After Effects itself spares you details that a casual user might never need to know about but that, as a professional user, you want to understand thoroughly. This book is here to help.

**NOTES**

All compositing applications are, at root, nodal, as you can glimpse in the seldom-used Flowchart view.

**SCRIPT**

The XML Gibson and pt_OpenSesame scripts by Sébastien Perier (http://aescripts.com/xml-gibson) make clever use of XML to make After Effects more like a script-based application.

## What's on the DVD

The DVD included with this book provides a variety of helpful resources for the After Effects artist, many provided by friends and colleagues (thanks!).

**Scripting Chapter:** Jeff Almasol's scripting chapter is now an appendix, found on the disc as a PDF. This highly accessible resource on this complicated and much-feared topic walks you through three scripts, each of which builds upon the complexity of the previous. Scripting provides the ability to create incredibly useful extensions to After Effects to eliminate tedious tasks. Several of these are included in the scripts folder on the disc as exclusives to this book.

A few useful and free third-party scripts mentioned throughout the book are included as well. For more of these, see the script links PDF in the scripts folder on the disc.

**JavaScript Guide:** To focus on more advanced and applied topics in the print edition, Dan Ebberts kicked JavaScript fundamentals to a special JavaScript addendum, also included as a PDF. This is, in many ways, the missing manual for the After Effects implementation of JavaScript. It omits all the useless Web-only scripting commands found in the best available books and extends beyond the material in After Effects help.

**Special-Purpose Topics:** Certain sections that appeared in the print version of previous editions have been moved onto the disc as PDF files. The tools and techniques are still valid, but the material on topics such as morphing, warping, and color management is able to stand on its own to make way for new features that had to be integrated more directly into the rest of the book.

**Footage:** You'll also find HD footage you can use to experiment on and practice your techniques. There are dozens of example files to help you deconstruct the techniques described.

**NOTES**

To install the additional chapters, lesson files, footage, and software demos included on the DVD, simply copy each chapter folder in its entirety to your hard drive (the desktop is fine). Note that all .aep files are located in the subfolder of each chapter folder on the disc.

NOTES

If you have comments or questions you'd like to share with the author, please email them to aestudiotechniques@gmail.com.

## The Bottom Line

Remember, the tools are just the means for the skilled talented artist to apply the hard work required to inspire an audience with results. By thoroughly learning the tools, you can also learn to think with them, and in so doing, to sort of forget about them as they become second nature. This book will help you do that.

# 4

# Optimize Projects
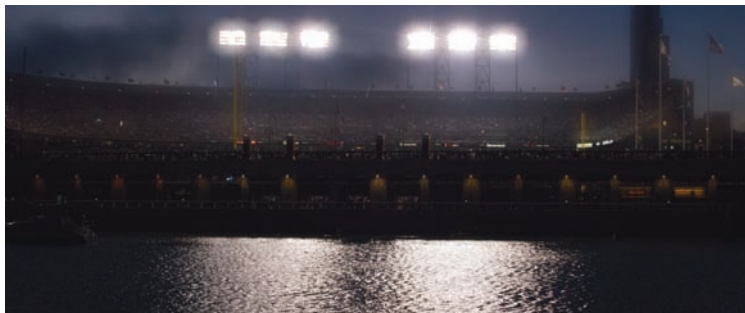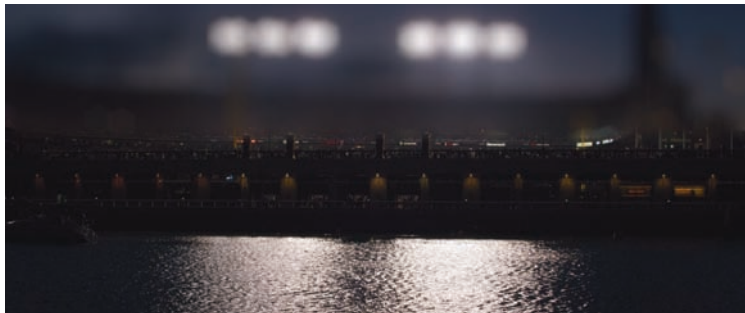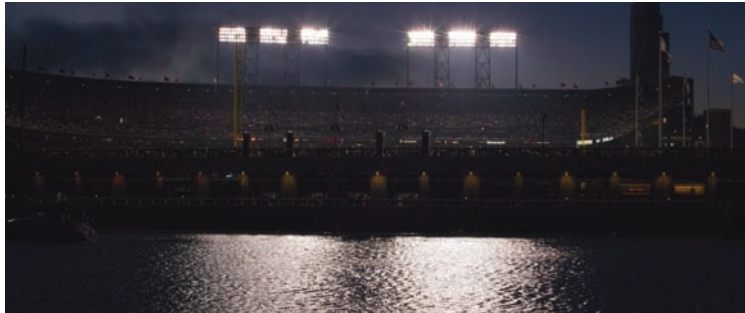
*Build a system that even a fool can use and only a fool will want to use it.*

—George Bernard Shaw

# Optimize Projects

**T**his chapter examines in close detail how image data flows through an After Effects project. It's full of the information you need to help you make the most of After Effects.

Sometimes you take the attitude of a master chef—you know what can be prepped and considered "done" before the guests are in the restaurant and it's time to cook the meal. At other times, you're more like a programmer, isolating and debugging elements of a project, even creating controlled tests to figure out how things are working. This chapter helps you both artistically and technically (as if it's possible to separate the two).

After Effects CS6 received the most substantial performance increase of any single upgrade thanks to Global Performance Cache, a scheme to preserve more individual render data indefinitely, not just when it's buffered into the RAM cache. This addition doesn't obviate the need for a solid understanding of how to work with multiple compositions and when to precomp, nor for specific strategies to optimize render time. It does, however, cut down on a good deal of redundancy on the After Effects side of the equation, leaving it up to you to avoid the possibility of PEBKAC (Problem Exists Between Keyboard and Chair).

## Work With Multiple Comps and Projects

It's easy to lose track of stuff when projects get complicated. This section demonstrates

- ▶ how and why to work with some kind of project template
- ▶ how to keep a complex, multiple-composition pipeline organized

▶ shortcuts to help maintain orientation within the project as a whole.

These tips are especially useful if you're someone who understands compositing but sometimes finds After Effects disorienting.

### Precomping and Composition Nesting

Precomping is often regarded as the major downside of working in After Effects, because vital information is hidden from the current comp's timeline in a nested comp. Artists may sometimes let a composition become unwieldy, with dozens of layers, rather than bite the bullet and send a set of those layers into a precomp. Yet precomping is both an effective way to organize the timeline and a key to problem solving and optimization in After Effects. Motion graphics comps can involve the animation and coordination of hundreds of animated elements. In a visual effects context, however, if your main composition has more than 20 or so layers, you're not precomping effectively, making work way less efficient overall.

Typically, precomping is done by selecting the layers of a composition that can sensibly be grouped together, and choosing Precompose from the Layer menu (**Ctrl+Shift+C**/**Cmd+Shift+C**). Two options appear (the second option is grayed out if multiple layers have been selected): to leave attributes (effects, transforms, masks, paint, blending modes) in place, or transfer them into the new composition.

### Why Precomp?

Precomping prevents a composition from containing too many layers to manage in one timeline, but it also lets you do the following:

▶ Reuse a set of elements.

▶ Fix render order problems. For example, masks are always applied before effects in a given layer, but a precomp can contain an effect so that the mask in the master comp follows that effect in the render order.

▶ Organize a project by grouping interrelated elements.

NOTES

*Precomping* is the action of selecting a set of layers in a master composition and assigning it to a new subcomp, which becomes a layer in the master comp. Closely related to this is *composition nesting*, the act of placing one already created composition inside of another.

**CLOSE-UP**

**Cache Work Area in Background**

One reward for making effective use of precomping is the ability to then save the entire precomp to the disk cache for immediate playback. This happens automatically when you preview the master sequence containing the precomp in question, but you can also select the precomp in the Project panel or open its timeline and choose Composition > Cache Work Area in Background to make After Effects immediately pre-render it in the background. As explained later in the chapter, the resulting cache remains available even if the project is reopened at a later time on the same system.

**SCRIPT**

rd: Pre-compose by Jeff Almasol (http://aescripts.com/rd-pre-compose/) displays a dialog to precomp one or more layers, just like the regular After Effects dialog, but adds the ability to trim the precomp to the selected layer's duration, including trim handles.

**NOTES**

The 04_comp_templates folder and project on the disc contain relevant example comps.

▶ Specify an element or set of layers as completed (and even pre-render them, as discussed later in this chapter).

Many After Effects artists are already comfortable with the idea of precomping but miss that last point. As you read through this, think about the advantages of considering an element finished, even if only for the time being.

## The Project Panel: Think of It as a File System

How do you like to keep your system organized—tidy folders for everything or files strewn across the desktop? Personally, I'm always happiest with a project that is well organized, even if I'm the only one likely to ever work on it. When sharing with others, however, good organization becomes essential. The Project panel mirrors your file system (whether it's Explorer or Finder), and keeping it well organized and tidy can clarify your thought process regarding the project itself.

I know, I know, eat your vegetables, clean your room. Imagine that the person next opening your project is you, but with a case of amnesia. Actually, that basically is you after a sufficient period of time.

**Figure 4.1** shows a couple of typical project templates containing multiple compositions to create one final shot, although these could certainly be adapted for a group of similar shots or a sequence. When you need to return to a project over the course of days or weeks, this level of organization can be a lifesaver.

Here are some ideas to help you create your own comp template:

▶ **Create folders,** such as Source, Precomps, and Reference, **to group specific types of elements.**

▶ **Use numbering to reflect comp and sequence order** so that it's easy to see the order in the Project panel.

▶ **Create a unique Final Output comp** that has the format and length of the final shot, particularly if the format is at all different from what you're using for work (because it's scaled, cropped, or uses a different frame rate or color profile).
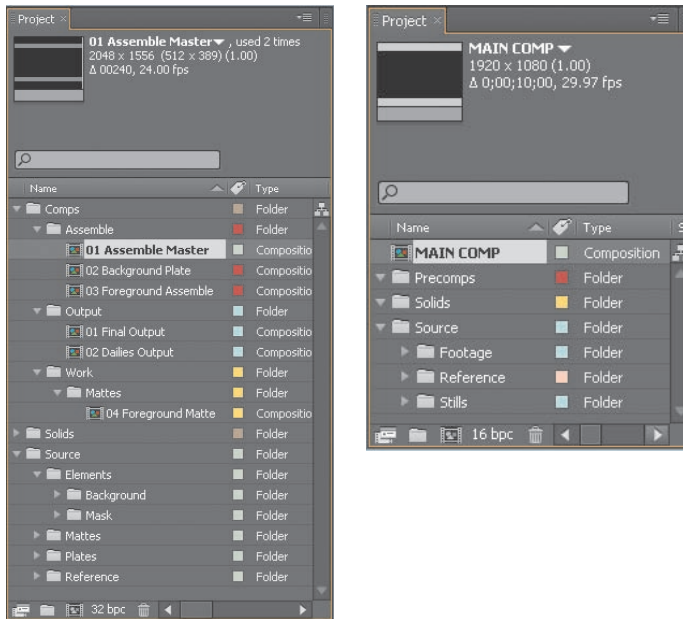
**Figure 4.1** A complex project such as a shot for a feature film might be generically organized (left) to include numbering that reflects pipeline order and multiple output comps with no actual edits, just the necessary settings. At minimum (right), you should have Source and Precomps folders, as well as a Reference folder, to keep things tidy.

▶ **Use guide layers and comments** as needed to help artists set up the comp (**Figure 4.2**).

▶ **Organize Source folders** for all footage, broken down as is most logical for your project.

▶ Place each source footage clip into a precomp. Why? Unexpected changes to source footage—where it is replaced for some reason—are easier to handle without causing some sort of train wreck.

The basic organization of master comp, source comp, and render comp seems useful on a shot of just about any complexity, but the template can include a lot more than that: custom expressions, camera rigs, color management settings, and recurring effects setups.



**Figure 4.2** Here is a series of non-rendering guide layers to define action areas and color.

## Manage Multiple Comps from the Timeline

Ever had that "where am I?" feeling when working with a series of nested comps? That's where Mini-Flowchart, or Miniflow, comes in. Access it via ▦ in the Timeline panel, or simply tap the **Shift** key with the Timeline panel displayed to enable it.

**TIP**

If nothing else, a locked, untouchable Final Output comp prevents losing a render to an incorrectly set work area (because you were editing it for RAM previews).

Miniflow (**Figure 4.3**) shows only the nearest neighbor comps, but click on the flow arrows at either end and you navigate up or down one level in the hierarchy. Click on any arrows or items in between the ends and that level is brought forward. You're even free to close all compositions (**Ctrl+Alt+W**/**Cmd+Opt+W**) and reopen only the ones you need using this feature.



**Figure 4.3** By default, the comp order is shown flowing right to left. The reason for this is probably that if you open subcomps from a master comp, the tabs open to the right; however, you may want to choose Flow Left to Right in Miniflow's panel menu instead.

**SCRIPT**

Arrange Project Items into Folders (http://aescripts.com/arrange-project-items-into-folders/) looks for project items with a matching prefix and groups them together in a folder. Load Project or Template at Startup (http://aescripts.com/load-project-at-startup/) loads a project or template each time you start After Effects—this can really help if you need several people in a studio to follow a certain organizational style. Both scripts are by Lloyd Alvarez.

What about cases where you'd like to work in the Timeline panel of a subcomp while seeing the result in the master comp? The Lock icon 🔒 at the upper left of the Composition viewer lets you keep that Composition viewer forward while you open another composition's Timeline panel and close its view panel. Lock the master comp and double-click a nested comp to open its Timeline panel; as you make adjustments, they show up in the master comp.

**Ctrl+Alt+Shift+N** (**Cmd+Opt+Shift+N**) creates two Composition viewers side by side, and locks one of them, for any artist with ample screen real estate who wants the best of both worlds.

To locate a comp in the Project panel, you can

▶ select an item in the Project panel; click the caret to see where the item is used, along with the number of times, if any, the item is used in a comp (**Figure 4.4**)



**NOTES**

The Always Preview This View toggle 🔲 lets you work entirely in a precomp but switch automatically to the master comp (if this is on in that comp) when previewing.
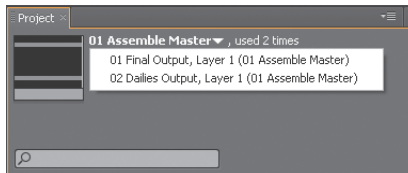
**Figure 4.4** Click the caret next to the total number of times an item is used to see a list of where it is used.

▶ context-click an item in the Project panel and choose Reveal in Composition; choose a composition and that comp is opened with the item selected

▶ context-click a layer in the timeline and choose Reveal Layer Source in Project to highlight the item in the Project panel

▶ context-click in the empty area of a timeline—and choose Reveal Composition in Project to highlight the comp in the Project panel (**Figure 4.5**)

▶ type the name of the comp in the Project panel search field.
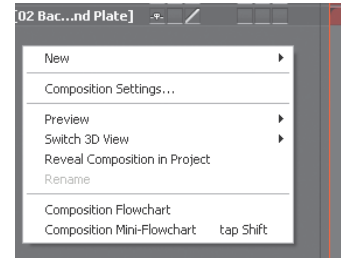
**Figure 4.5** Find the empty area below the layers in the timeline and context-click; you can reveal the current comp in the Project panel.

## Ways to Break the Pipeline

Precomping solves problems, but it can also create more problems—or at least inconveniences. Here are a few ways that render order can go wrong:

▶ Some but not all properties are to be precomped, but others must stay in the master comp? With precomping it's all-or-nothing, leaving you to rearrange properties manually.

▶ Changed your mind? Restoring precomped layers to the master composition is a manual (and thus error-prone) process, due to the difficulty of maintaining proper dependencies between the two (for example, if the nested comp has also been scaled, rotated, and retimed).

▶ Do the layers being precomped include blending modes or 3D layers, cameras, or lights? Their behavior changes depending on the Collapse Transformations setting (detailed in the next section).

▶ Is there motion blur, frame blending, or vector artwork in the subcomp? Switches in the master composition affect their behavior, as do settings on each individual nested layer, and this relationship changes depending on whether Collapse Transformations is toggled on.

▶ Layer timing (duration, In and Out points, frame rate) and dimensions can differ from the master comp. When this is unintentional, mishaps happen: Layers end too soon or are cropped inside the overall frame, or keyframes in the precomp fall between those of the master, wreaking havoc on tracking data, for example.

**TIP**

You may already know that a double-click opens a nested comp, and **Alt**–double-click (**Opt**–double-click) reveals it in the Layer viewer.

**SCRIPT**

The script preCompToLayerDur.jsx from Dan Ebberts (found on the book's disc) starts a precomped layer at frame 1 even if the layer to be precomped is trimmed to a later time.

SCRIPT

True Comp Duplicator (http://
aescripts.com/true-comp-
duplicator/) was created by Brennan
Chapman to address the biggest
bugbear of working with nested
comps in After Effects—in a
node-based app, you can duplicate
an entire nested tree and all of
the components are unique, but
duplicate a comp in After Effects
and its subcomps are the same as in
the source. This script can reside in a
panel ready to create an entire new
hierarchy. Highly recommended.

▶ Are you duplicating a comp that contains subcomps?
The comp itself is new and completely independent,
but the nested comps are not (see Script on this page).

No wonder people avoid precomping. But there is hope if
you recognize any difficulty and know what to do, so that
inconveniences don't turn into deal-killers.

### Boundaries of Time and Space

Each composition in After Effects contains its own fixed
timing and pixel dimensions. This adds flexibility for
animation but if anything reduces it for compositing. Most
other compositing applications such as Nuke and Shake
have no built-in concept of frame dimensions or timing
and assume that the elements match the plate, as is often
the case in visual effects work.

Therefore it is helpful to take precautions:

▶ Make source compositions longer than the shot is ever
anticipated to be, so that if it changes, timing is not
inadvertently truncated.

▶ Enable Collapse Transformations for the nested com-
position to ignore its boundaries (**Figure 4.6**).

▶ Add the Grow Bounds effect if Collapse Transforma-
tions isn't an option (see sidebar on next page).

Collapse Transformations is the most difficult of these to
get your head around, so it's worth a closer look.

### Collapse Transformations

In After Effects, when a comp is nested in another comp,
effectively becoming a layer, the ordinary behavior is for
the nested comp to render completely before the layer is
animated, blended, or otherwise adjusted (with effects or
masks) in the master comp.



**Figure 4.6**  The nested comp has a blue back-
ground and the leg of the letter "p" extends outside
its boundaries (top); a simple quick fix is to enable
Collapse Transformations, and the boundaries of
the nested comp are ignored (bottom).

However, there are immediate exceptions. Keyframe
interpolations, frame blending, and motion blur are all
affected by the settings (including frame rate and timing)
of the master comp—they are calculated according to its
settings (which can become tricky; see the next section).
3D position data and blending modes, on the other hand,
are not passed through unless Collapse Transformations is

enabled. Enable the toggle and it is almost as if the pre-composed layers reside in the master comp—but now any 3D camera or lighting in the subcomp is overridden by the camera and lights in the master comp.

Not only that, but layers with Collapse Transformations lose access to blending modes—presumably to avoid conflicts with those in the subcomp. Now here comes the trickiest part: Apply any effect to the layer (even Levels with the neutral defaults, which doesn't affect the look of the layer) and you force After Effects to render the collapsed layer, making blending modes operable. It is now what the Adobe developers call a *parenthesized* comp. Such a nested comp is both collapsed and not: You can apply a blending mode, but 3D data is passed through (**Figure 4.7**).

To collapse transformations but not 3D data, apply any effect—even one of the Expression Controls effects that don't by themselves do anything—to parenthesize the comp.
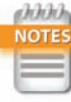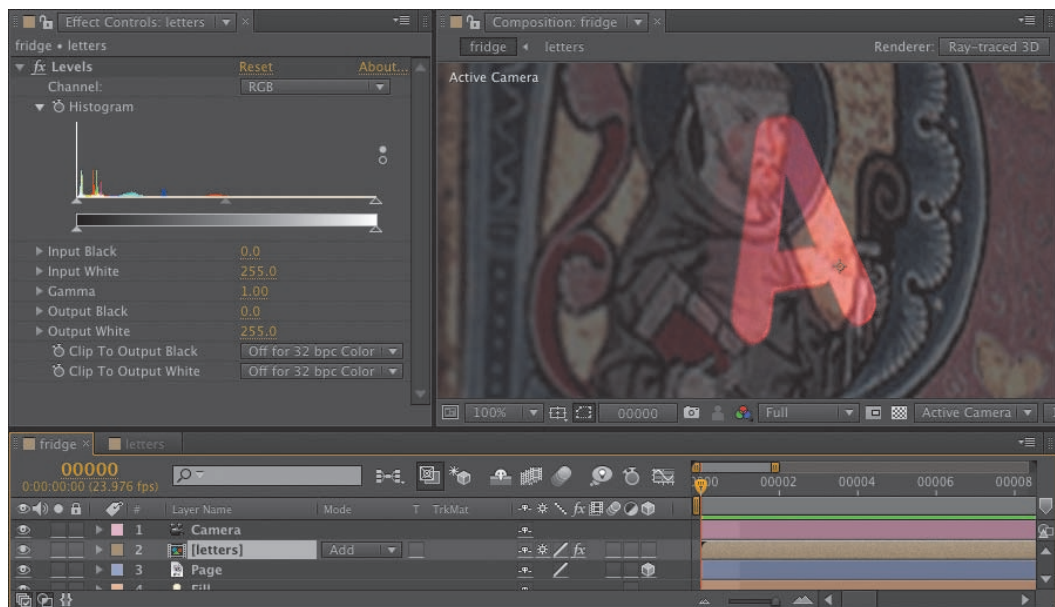
**Figure 4.7** You're not supposed to be able to apply blending modes to ray-traced 3D scenes. You can precomp such a scene and enable Collapse Transformations so that all of its ray-traced 3D qualities are passed through, but you still can't apply a blending mode such as Add (shown here). However, if you add a simple effect such as Levels, unadjusted, transformations and shading are still passed through, but they no longer interact in 3D with the master comp.

**Grow Bounds**

Sometimes, enabling Collapse Transformations is not desirable—for example, if you set up 3D layers with a camera in a subcomp and don't want their position to be changed by a camera in the master comp. The Grow Bounds effect overcomes one specific (and fairly rare) problem (in which the embedded layer is too small for an applied effect), but it is also useful in cases where other effects create a comp boundary that leads visual data to appear cropped.

The Posterize Time effect will force any layer to the specified frame rate.

Alpha channel effects change the alphas of the layers below, not of the adjustment layer itself.

## Nested Time

After Effects is not rigid about time, but digital video itself is. You can freely mix and change frame rates among compositions without changing the timing, as has been shown. However, because your source clips always have a very specific rate, pay close attention when you

▶ import an image sequence

▶ create a new composition

▶ mix comps with different frame rates.

In the first two cases, you're just watching out for careless errors. But you might want to maintain specific frame rates in subcomps, in which case you must set them deliberately on the Advanced tab of the Composition Settings dialog.

### *Advanced Composition Settings*

In addition to the Motion Blur settings covered in detail in Chapter 8, Composition Settings > Advanced contains two toggles that influence how time and space are handled when one composition is nested into another.

Preserve Frame Rate maintains the frame rate of the composition wherever it goes—into another composition with a different frame rate, or into the render queue with different frame rate settings. So if a simple animation cycle looks right at 4 frames per second (fps), it won't be expanded across the higher frame rate, but will preserve the look of 4 fps.

Preserve Resolution When Nested controls what is called *concatenation*. Typically, if an element is scaled down in a precomp and the entire composition is nested into another comp and scaled up, the two operations are treated as one, so that no data loss occurs via quantization. This is concatenation, and it's usually a good thing. If the data in the subcomp is to appear pixilated, as if it were scaled up from a lower-resolution element, this toggle preserves the chunky pixel look.

## Special Case: Adjustment and Guide Layers

Two special types of layers, adjustment and guide layers, offer extra benefits that might not be immediately apparent, and are often underused.

## Adjustment Layers

From a nodal point of view, adjustment layers are a way of saying "at this point in the compositing process, I want these effects applied to everything that has already rendered." Because render order is not readily apparent in After Effects until you learn how it works, adjustment layers can seem trickier than they are.

The *adjustment layer* is itself invisible, but its effects are applied to all layers below it. It is a fundamentally simple feature with many uses. To create one, context-click in an empty area of the Timeline panel, and choose New > Adjustment Layer (**Ctrl+Alt+Y**/**Cmd+Opt+Y**) (**Figure 4.8**).

Adjustment layers allow you to apply effects to an entire composition without precomping it. That by itself is pretty cool, but there's more:

▶ Move the adjustment layer down the stack and any layers above it are unaffected, because the render order in After Effects goes from the lowest layer upward.

▶ Shorten the layer and the effects appear only on frames within the adjustment layer's In/Out points.

▶ Use Opacity to attenuate any effect; most of them work naturally this way. Many effects do not themselves include such a direct control, even when it makes perfect sense to "dial it back 50%," which you can do by setting Opacity to 50%.

▶ Apply a matte to an adjustment layer to hold out the effects to a specific area of the underlying image.

▶ Add a blending mode and the adjustment layer is first applied and then blended back into the result (**Figure 4.9**).

It's a good idea 99% of the time to make sure that an adjustment layer remains 2D, and you will most often also want it to be the size and length of the comp, as when applied. It's rare that you would ever want to move, rotate, or scale an adjustment layer in 2D or 3D, but it is possible to do so accidentally. If you enlarge the composition, resize the adjustment layers as well.



**Figure 4.8** The highlighted column includes toggle switches, indicating an adjustment layer. Any layer can be toggled, but the typical way to set it is to create a unique layer. An adjustment layer created under Layer > New > Adjustment Layer (or via the shortcuts) is a white, comp-sized solid.
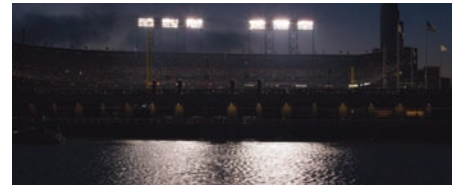


**(a)**
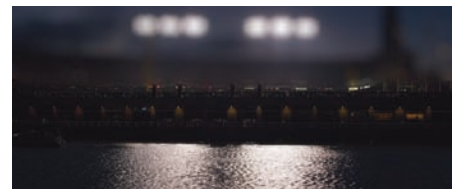


**(b)**
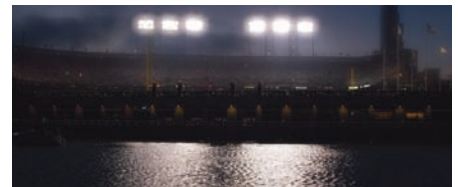


**(c)**

**Figure 4.9** Here, the source plate image **(a)** is shown along with two alternates in which Camera Lens Blur has been applied via an adjustment layer, held out by a mask. With the adjustment layer blending mode set to Normal **(b)**, there is a subtle bloom of the background highlights, but changing it to Add **(c)** causes the effect to be applied as in **(b)** and then added over source image **(a)**.

## Guide Layers

Like adjustment layers, *guide layers* are standard layers with special status. A guide layer appears in the current composition but not in any subsequent compositions or the final render (unless it is specifically overridden in Render Settings). You can use this for

▶ foreground reference clips (picture-in-picture timing reference, aspect ratio crop reference)

▶ temporary backgrounds to check edges when creating a matte

▶ text notes to yourself

▶ adjustment layers that are used only to check images (described further in the next chapter); a layer can be both an adjustment and a guide layer.

Any image layer can be converted to a guide layer either by context-clicking it or by choosing Guide Layer from the Layer menu (**Figure 4.10**).

**Figure 4.10** Check out all the guide layers that won't render, but do help you work: One pushes up gamma to check blacks, and two provide crops for different aspects (1.85:1 and 2.35:1, the common cinematic formats). A picture-in-picture layer shows timing reference from the plate, along with a text reminder that does not render. None of this is visible in another composition or in the render.
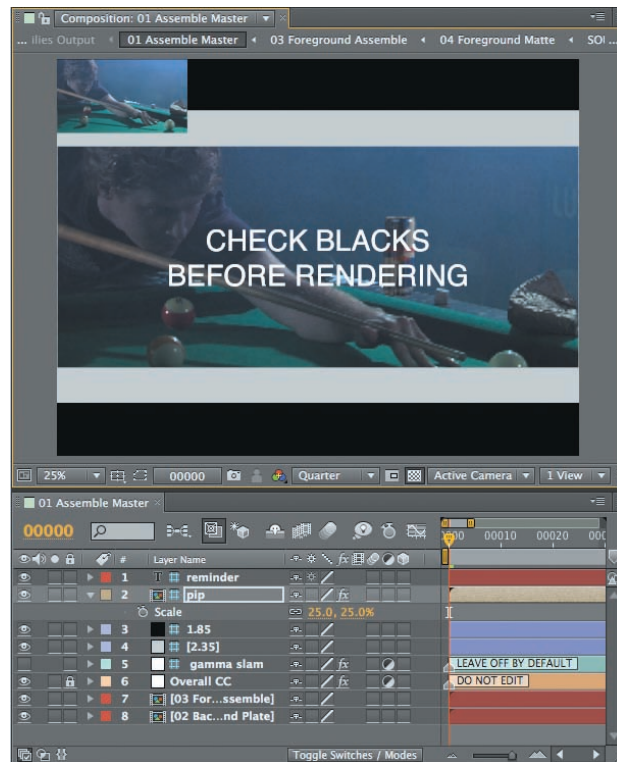
## Image Pipeline, Global Performance Cache, and Render Speed

The *render pipeline* is the order in which operations happen; by controlling it, you can solve problems and overcome bottlenecks. For the most part, render order is plainly displayed in the timeline and follows consistent rules:

▶ 2D layers are calculated from the bottom to the top of the layer stack—the numbered layers in the timeline.

▶ Layer properties (masks, effects, transforms, paint, and type) are calculated in strict top-to-bottom order (twirl down the layer to see it).

▶ 3D layers are instead calculated based on distance from the camera; coplanar 3D layers respect stacking order and should behave like 2D layers relative to one another.

So to review: In a 2D composition, After Effects starts at the bottom layer and calculates any adjustments to it in the order that properties are shown, top to bottom. Then, it calculates adjustments to the layer above it, composites the two of them together, and moves up the stack in this manner (**Figure 4.11**). Although effects within a given layer are generally calculated prior to transforms, an adjustment layer guarantees that its effects are rendered after the transforms of all layers below it.

Track mattes and blending modes are applied last, after all other layer properties (masks, effects, and transforms) have been calculated, *and* after their own mask, effect, and transform data are applied. Therefore, you don't generally need to pre-render a track matte simply because you've added masks and effects to it.

### Global Performance Cache: Way Faster!

We're over 100 pages into the book and just now getting into the most revolutionary addition to the latest version of After Effects. You don't technically need a book to experience what can be extraordinary benefits from how After Effects CS6 preserves your work in progress for instant playback; you probably already know and love this feature, but as a reader of a book like this you probably also want

**TIP**

3D calculations are precise well below the decimal level but do round at some point. To avoid render errors, precomp them in a nested 2D layer.

**TIP**

The Transform effect allows you to position, scale, or rotate a layer before other effects are applied, solely to avoid precomping.
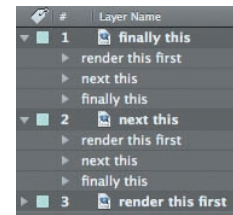


**Figure 4.11** 2D layers render starting with the bottom layer, rendering and compositing each layer above in order. Layer properties render in the order shown when twirled down; there is no direct way to change the order of these categories.

**TIP**

Although After Effects doesn't prohibit you from doing so, don't apply a track matte to another track matte and expect consistent results. Sometimes it works, but it's not really supposed to work, and most often it doesn't.

to know as much as you can about how it works so you can maximize what it does for you.

The feature name "Global Performance Cache" is a generic term for what is, in fact, a set of interrelated technologies:

▶ a Global RAM cache that is smarter about dividing your work to save as many individual processes as possible

▶ a persistent disk cache that saves those precalculated processes for continual reuse

▶ an updated graphics pipeline that makes greater use of OpenGL to present and stream images onscreen, including the UI overlays that are a constant when working in After Effects

You have to hand it to the After Effects development team here. Engineers too easily assume they need to tear technology apart and rebuild it from scratch in order to modernize it. Global Performance Cache is the result of looking at what modern hardware can deliver that simply was not possible a few years ago, and figuring out how to make use of that hardware:

▶ **cheap and plentiful RAM**, and the ability of a 64-bit operating system to access far more of it (up to 192 GB on Windows 7, and well in excess of the 2 GB per processor core recommended for After Effects)

▶ **fast attached storage**, including SSD drives that routinely double the access speed of even the fastest HDD drive or array

▶ **high-end graphics cards** with GPUs that accelerate performance year after year at rates that way, way outstrip Moore's Law

In the past, After Effects has rather notoriously failed to take advantage of these advantages. Lots of RAM is no good if your RAM preview disappears each time you make an edit; fast storage doesn't mean spacebar play of a timeline in real-time; and until CS6, the high-end graphics card that you purchased to work in Maya or CINEMA 4D hardly made a dent in After Effects interactivity.

Each of these areas of performance is directly addressed in After Effects CS6. The result is completely subjective, but

can be quantified as a routine 10–20x acceleration of RAM previews. Depending on how often you review playback during your workday, this means either you can keep working that much faster, or the whole way that you work with the application is changed.

### Memory Acceleration: Global RAM Cache

After Effects has always loved plenty of RAM, but until CS6 it used it in a much more brute-force way. You have always needed lots of RAM to store and play back a given large-format clip using physical memory and perform operations on that large frame. The brute-force part is that as soon as you made even a teeny change to all of that cached data, it all tended to be blown away, only to be recreated more or less from scratch the next time you previewed a frame or sequence.

By slicing a clip with its many selections and effects into discrete chunks and storing each of those render steps individually, After Effects CS6 greatly reduces the amount of re-rendering of cached footage. You can change a given effect setting or range of keyframes without disrupting other parts of the image and clip that are unrelated to that change.

Reusable frames are recognized anywhere on the timeline: when you use loop expressions (Chapters 8 and 10), remap time, or copy and paste keyframes. Duplicated layers or whole duplicated comps are also recognized.

The net result is that you can try something, preview the result without rendering from scratch, and undo the change without penalty. Since this, in essence, is how you spend your working day as an After Effects artist, the resulting 5–15x speed increase ripples throughout the process, allowing you not only to get to a result more quickly but to try more options without worrying about the time cost.

This tends to work a lot better with 2D layers than with a ray-traced 3D comp. It is easy to consider an effect or setting in a 2D layer to be an island unto itself, but in 3D, light, reflection, shadows, refraction, and translucency are all considered to be influenced by the adjustment of a single element such as a light or the position of a layer.

### *Continuous Access: Persistent Disk Cache*

Data in the RAM cache is now much less fragile because it is constantly backed up in a *persistent disk cache*. If you run out of RAM, increment and save to a new version of the project, or even quit the application and reopen the project. Its cache is available for instant playback and immediate rendering (**Figure 4.12b**).

Persistent disk cache is also the most tweakable of the Global Performance Cache options, and the one for which your choice of hardware may make the greatest difference. Here's a list of the most effective tweaks, followed by a breakdown:

▶ dedicate **fast attached storage** to the After Effects cache

▶ use the **Cache Work Area in Background** command as you work

▶ incorporate **Dynamic Link** with Premiere Pro

▶ render locally

**TIP**

Want to see how caching behaves on individual layers? Under the Timeline panel menu, hold down Ctrl/Cmd and click Show Cache Indicators, even if it's already checked. Now each layer has its own blue or green bar if it's cached (**Figure 4.12a**). Turn it off when you have a good sense of how it works, because it will slow down your renders.
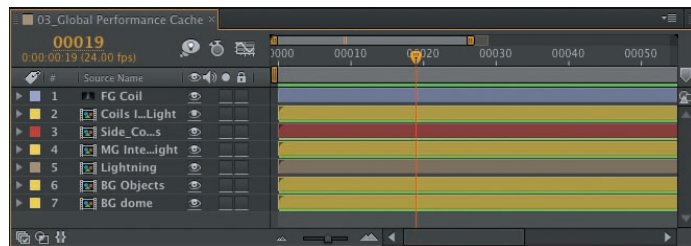
**A**
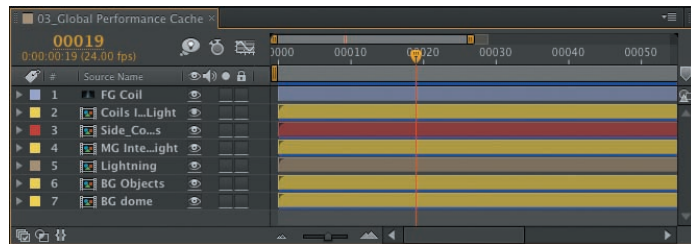
**B**

**Figure 4.12** With Layer Cache Indicators on, you begin to see how After Effects breaks down the RAM cache into individual layers and even effects (**a**). With fast attached storage, you will see those green lines turn blue as they move from RAM to the disk (**b**).

Before drawing out the first three points in more detail, note that the persistent disk cache cannot be considered sharable or portable. Place the cache on a shared drive and point two systems to it and all you do is introduce the likelihood of instability; the two systems will not recognize those cached files in the same way and will simply continue to generate their own cache data. This data is designed to be accessed instantly and is cleverly designed to track a given comp and layers even as project versions change on a given system (**Figure 4.13**).

This is not to say that I haven't tried and succeeded at replacing the disk cache on a given system with one that's already preloaded with a bunch of rendered frames and effects, but I wouldn't make that standard practice. The disk cache is designed to be local to a given system. The benefit is that a cached comp may render faster locally than it will even on a large render network. The downside, if you want to think of it that way, is that the render network has essentially no opportunity to take advantage of a disk cache, at least not on the first pass.

### Disk Cache Boost 1: Get Fast Attached Storage

The permanent disk cache can be a little like a huge RAM extension providing much longer memory and far greater capacity. As such, it's in your interest to maximize its performance and, if possible, capacity. Why? Not only because faster is better; After Effects actively evaluates whether it's in the application's best interests to commit a given process to disk. The greater the difference between processor and cache speed, the more likely a frame gets the blue cache indicator, ready to turn green at any time (and the faster it turns green, ready for real-time).

Let's start at the low end, with you laptop people. I know, I know, you are the cutting edge. But your single, slow hard disk drive will make you long for something better—something like a dedicated solid state drive, which at this writing is sparking a laptop evolution in which nearly useless DVD drives are replaced with a sled holding a high-capacity SSD. Yes, there is a cost involved. It will also set you free.
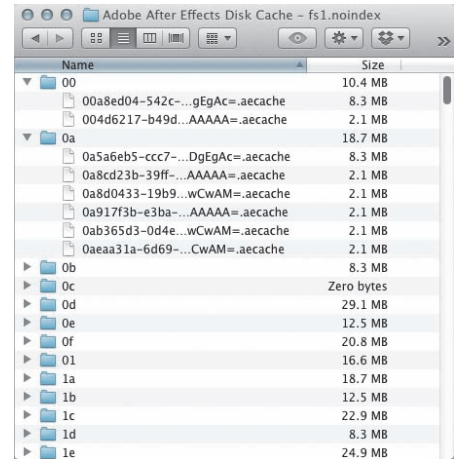


**Figure 4.13** If you were thinking the disk cache is a bunch of easily recognized files you can share and edit, think again!

**CLOSE-UP**

**How do I get more stuff to cache?**

You've followed the tip above to show layer cache indicators, and are dismayed to find a number of layers that don't cache, presumably because they don't pass the After Effects evaluation that it's not a faster option than re-rendering. You then have three options: load up, cheat, or get faster storage.

Add render-heavy effects to a given 2D layer, and at some point it will cache. Similarly, you can hack the preferences file (using instructions later in this chapter) and change the "proclivity" preference, the basic metric for caching.

The real, practical solution is to get more and faster attached storage. The faster the physical disk you have available for the hard-disk cache, the more likely that it will pass the test for providing better speed than simple re-rendering of elements.

Also, while a ray-traced 3D scene does cache nicely, ready to be replayed when you restart After Effects, changes to such a scene tend to wipe out the cache, because ray-tracing creates dependencies between all 3D elements in a scene.

**Figure 4.14**  The revolutionary power of fast attached storage.

At the other end—the high one—the release of After Effects CS6 coincided neatly with the debut of Fusion ioFX (**Figure 4.14**). It's not easy to quantify, but it's being regarded in After Effects circles as something like a half-terabyte extension to SDRAM, with the disk cache ready to fill it with your inspirations and missteps alike. It's all part of the process, and way less hard on your body than amphetamines, which never let you get out of the studio in time for a dinner date.

And in the middle, that striped RAID array you have attached to your system is still going to help you a bunch. Any drive other than the internal boot drive will work better, and if you edit footage professionally, you already have just such a dedicated drive available.

Bottom line? Everyone wins. Even on a laptop you can see 10–15x speed increases that will make you hungry to feed the disk cache more and faster storage space.

### Disk Cache Boost 2: Commit a Comp

Disk caching in After Effects need not be a passive response, like Aslan, only appearing when not expected and most needed. It's true, you get all of the subcomps associated with the comp that you cache committed to disk as well (assuming After Effects judges them faster to render if committed to storage), so caching a master comp gets you a lot of free material to work with. But sometimes, for whatever reason, that master comp doesn't commit to disk when previewed, or more often, it needs way longer to render than you want to wait watching it draw frames.

I just realized as I typed the last sentence that the days of waiting and watching a RAM preview progress frame by frame could, in fact, be completely over if you want them to be. Composition > Cache Work Area in Background (**Ctrl/Cmd+Return**) renders a comp into the disk cache while you continue to work.

If you really hate waiting for a comp to preview, and have a half-decent system and something better to do with your time, you can select a whole set of comps in the Project panel and cache them. Yes, if you're on a non-CUDA-enabled Macbook Pro and those comps are all full of HD

ray-traced 3D animations, your system is going to sound like a jet preparing for takeoff and your laptop will scorch your lap. On the other hand, if you're on one of those systems that has more processor cores than you can count when you open up their little capacity meters in the system, well, you are finally going to get your money's worth.

Caveats? Downsides? You gotta pay to play. This is where gobs of low-latency storage is going to be your new best friend, other than the actual best friend that you get to spend time with when you are done for the day and not already burning the midnight oil. But there's always that CBB.

### Disk Cache Boost 3: Rethink Dynamic Link

Odds are better than even that, alongside After Effects, sit a number of other apps (or *programs* as you Windows people and characters in Tron apparently call them) that also begin with the word "Adobe." Go ahead, take a look, I'll wait.

Oh, you're back! And you have just discovered that fully half the contents of the applications (programs) begin with A? Welcome to the world of video, in which company names start with A. While you wonder why you installed Flash Builder with no plans to build anything in Flash, go back, scroll down, and note the little nonlinear editor that could. I'm talking about Premiere Pro.

No longer solely the favorite among wedding videographers (and I say that with no disrespect, but let's face it, After Effects is not big with that group), Premiere Pro CS6 has become many people's favorite NLE, mine included. Like many others, I treated Premiere Pro as a utility, not a place I wanted to spend time working, and for me the CS6 version changes that. I find that I actually like working in it.

Premiere Pro has a unique ability to link directly to an After Effects comp. Dynamic Link is a feature that allows Adobe Premiere Pro to actually look inside an After Effects project for an existing comp that it can import (**Figure 4.15**), or designate a clip in a sequence as the basis for a new After Effects comp.

**NOTES**

CBB stands either for Can't Be Bothered or Could Be Better. Both apply in visual effects circles, but unfortunately it's the latter that got the moniker.

**NOTES**

Preferences > General > Dynamic Link with After Effects Uses Project File Name with Highest Number is unchecked by default, but it could instead simply be called Make Dynamic Link Usable in the Real World.
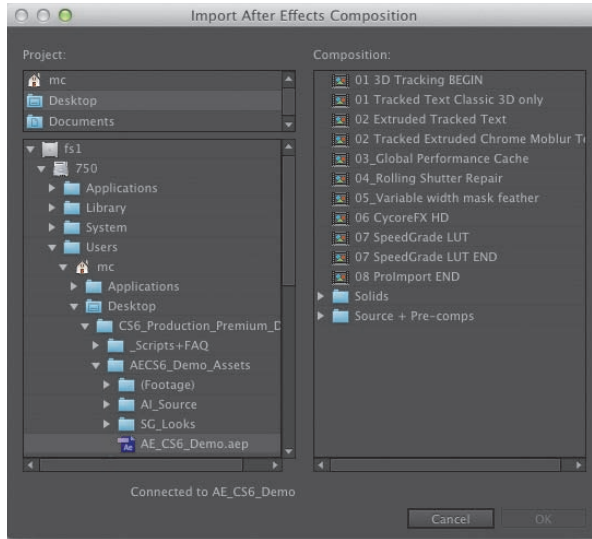
With either approach, there is an actual, live After Effects comp sitting in a Premiere Pro sequence. After Effects invisibly provides the ability to render it, headlessly, in the background. As any change is made to the comp on the After Effects side, it remains up to date in the Premiere edit.

In the past, the difficulty with this approach has been that Premiere Pro has no real concept of render management, and the steps that you take for granted to make a preview render faster in After Effects, working at half or quarter resolution, aren't available. Imagine that every time you wanted to play something back, you had to render it at full resolution.

If you're thinking that Global Performance Cache helps in such a case, you are correct. Suppose you have a heavy comp that requires 10 seconds to render each frame at full resolution. If you cache the comp at full, Premiere Pro has access to those cached frames *even if After Effects isn't open.* Render the sequence and that clip is ready for real-time playback in seconds, not minutes or hours.

Note that you do, however, still have to render to get rid of the red line above that clip, even if it's completely cached at full resolution. And, when you do so, it doesn't add to the After Effects cache. The way to make this work is to generate a preview in After Effects. This still requires you

to perform an edit, but once you do so, it helps speed up the Premiere Pro timeline just as it does in After Effects.

## Proxies, Previews, and Network Renders

Previous editions of this book advocated the use of proxies and previews as ways to accelerate the previewing and rendering process. This is exactly where Global Performance Cache changes the game, but only as long as you work on the "one artist, one project, one system" model, given that the cache is neither portable nor sharable.

For this reason, the old ways are still valid in any case where a project needs to be moved or shared, even if only for rendering purposes. The good news is that the cached data helps even this process to happen much more efficiently, because it is also used to render on the system that generated it.

### *Post-Render Options*

Tucked away in the Render Queue panel, but easily visible if you twirl down the arrow next to Output Module, is a menu of three post-render actions to incorporate a render into a project. After the render is complete, you can use

- ▶ **Import** simply to bring the result back into the project
- ▶ **Import & Replace Usage** to replace the usage of the source comp in the project without blowing it away
- ▶ **Set Proxy** to add a proxy to the source (the most elegant solution, but the most high-maintenance)

The latter two options even let you use the pick whip icon adjacent to the menu to connect whatever item in the Project panel needs replacement. If you've already created a pre-render or proxy, you can target that (**Figure 4.16**).

### *Proxies and Pre-Renders*

Let's face it, dutifully rendering proxies is boring and will seem completely unnecessary with all of the new cache features—right up until the moment when you're in a rush and no longer have access to that cache, either when rendering remotely or handing off the project. Are you willing to buy some insurance on that cache? If so, this section is for you.
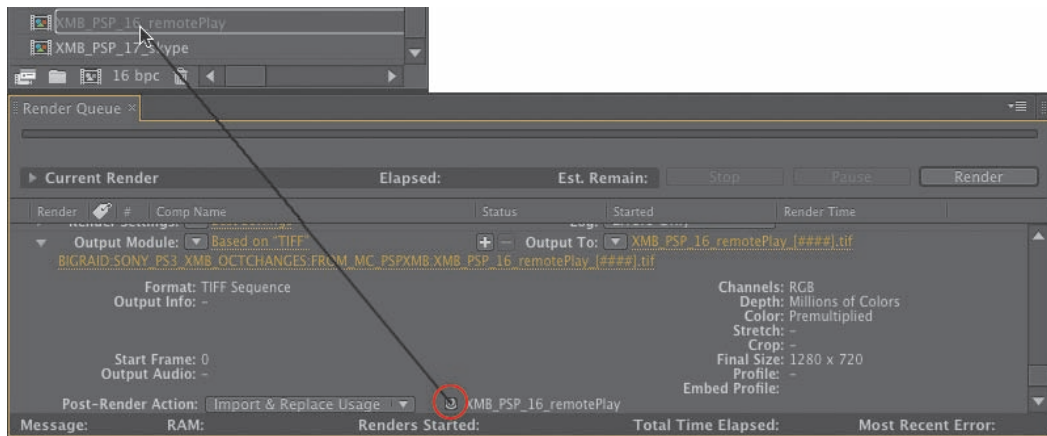
**Figure 4.16** Virtually any project item can be the target for replacement or a proxy; click and drag the pick whip icon to choose the item to be replaced by the render.
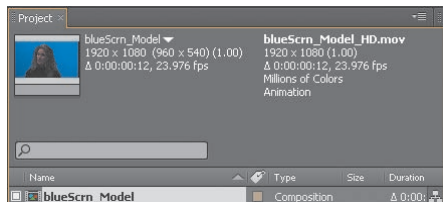


**Figure 4.17** The black square icon to the left of an item in the Project panel indicates that a proxy is enabled; a hollow square indicates that a proxy is assigned but not currently active. Both items are listed atop the Project panel, the active one in bold.



To remove a proxy from a project, select the item or items with proxies, context-click (or go to the File menu), and choose Set Proxy > None.

Any image or clip in your Project panel can be set with a proxy, which is an imported image or sequence that stands in for that item. Its pixel dimensions, color space, compression, even its length and frame rate, can differ from the item it replaces. You can have a quick-and-dirty still or low-res, compressed, low-frame-rate clip stand in for a render-heavy comp.

To create a proxy, context-click an item in the Project panel and choose Create Proxy > Movie (or Still). A render queue item is created and, by default, renders at Draft quality and half-resolution; the Output Module settings create a video file with alpha, so that transparency is preserved and Post-Render Action uses the Set Proxy setting.

**Figure 4.17** shows how a proxy appears in the Project panel. Although the scale of the proxy differs from that of the source item, it is scaled automatically so that transform settings remain consistent. This is what proxies were designed to do: allow a low-resolution file to stand in, temporarily and nondestructively, for the high-resolution final.

There's another use for proxies. Instead of creating low-res temp versions, you can instead generate final quality pre-rendered elements. With a composition selected, choose Composition > Pre-render and change the settings to Best for Quality and Full for Resolution, making certain that Import and Replace Usage is set for Output Module.
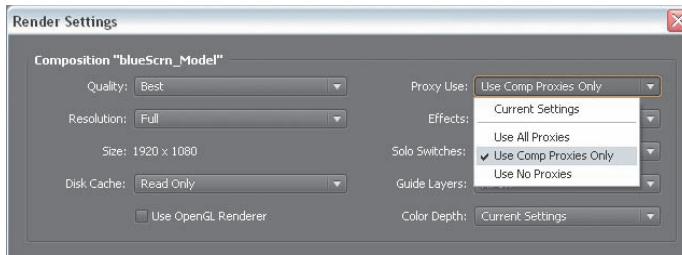
**Figure 4.18** I typically set Proxy Use to Current Settings, but Use Comp Proxies Only lets you set low-res stand-ins for footage and full-resolution pre-renders for comps, saving gobs of time.

Here's the key. By default, the source file or composition is used to render unless specifically set otherwise in Render Settings > Proxy Use. Choose Use Comp Proxies Only, Use All Proxies, or Current Settings (**Figure 4.18**) and proxies can be used in the final render.

## Background Renders

Rendering from the render queue ties up the application and much of the machine's processing power, which used to mean that renders were left until lunchtime or off-hours. On a modern system with multiple processors, you can do much better than that (but take breaks anyway, they're good for you).

### *Adobe Media Encoder*

It is easily overlooked that Adobe provides a background rendering application. Adobe Media Encoder (AME) has, for a couple of versions, been the best option to render certain video formats optimally—including Flash video (FLV and F4V), H.264, and MPEG-2—that don't work well with the frame-by-frame rendering model of After Effects. H.264, for example, is a "long GOP" format that relies on keyframes with lots of image data surrounded by in-between frames containing only shorthand for the changes for those keyframes, and it requires all of the frames to be rendered before it can work its magic. Only Adobe Media Encoder collects frames to compress them, and offers the option to render an After Effects comp on two passes.

Drag and drop an After Effects project into Adobe Media Encoder and you are able to look inside the project for renderable comps (**Figure 4.19**). You then choose render settings by either selecting them from the Preset Browser

BG Renderer by Lloyd Alvarez (http://aescripts.com/bg-renderer/) may be the most universally used After Effects script. Not only does it automatically set up a background render by creating the command line for you, but it offers you a user interface for extra variables you might miss that determine the priority and number of processors used to render (**Figure 4.20**).
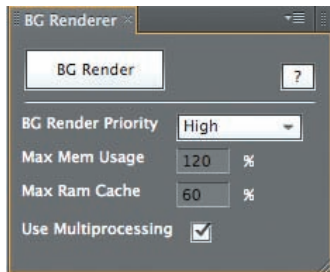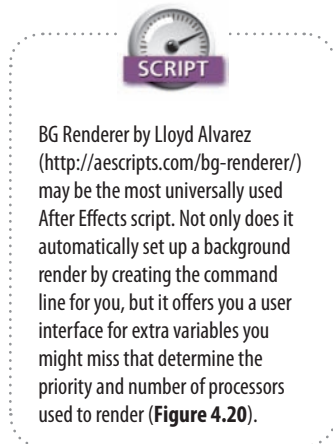


**Figure 4.20** BG Renderer uses ScriptUI, which means that it looks like it's part of the interface and can remain in an open panel as you work. When you're ready to render, you can specify priority and number of processors; click the button and a terminal window opens that shows the render progress, line by line. You may miss the progress bar of the render queue, but if you can live without that, the benefit is that you can keep working while your machine renders.
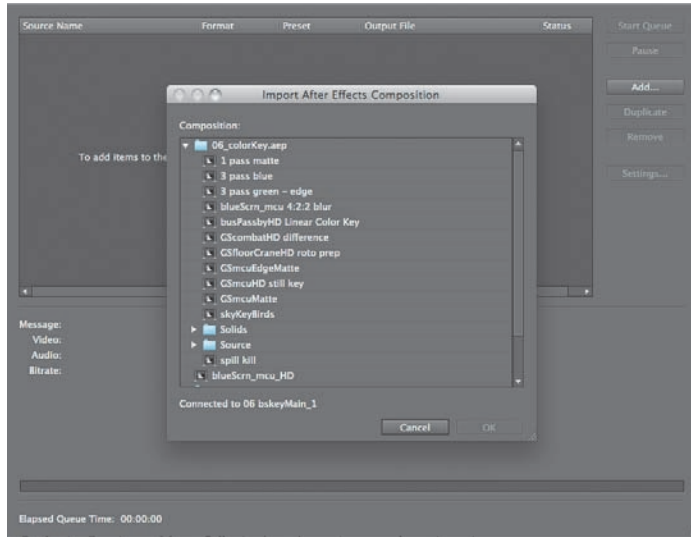
or customizing the settings by clicking on the Preset for the render item and specifying your own (which you can then save as a preset).

The best thing about Adobe Media Encoder, in addition to multipass rendering, is that it provides the option to render in the background while you continue to work in After Effects, which a regular render doesn't permit. The challenge to AME is that it has a lot of presets without a lot of clues to which is the best for your situation. Worst of all, the layout for these settings is unfamiliar if you are accustomed to After Effects, and that alone stops a lot of people.

### aerender

*Background rendering* allows a render to occur without the user interface, allowing you to continue working with it. The aerender application is found alongside the After Effects CS6 application on your system but runs via a command line (in Terminal Unix shell on Mac OS, or the command shell in Windows). You can drag it into the shell window to run it, or press **Enter** (**Return**) to reveal its Unix manual pages. This lists the arguments that can be added in quotes to the command aerender, and the location string of the project file.

But that's all such geeky gobbledygook when you have the BG Render script, which gives you access to all of these options via a panel in the After Effects UI, with no need to type any code.

### Network Rendering

The `aerender` command is also used by third-party rendering solutions that work a lot like BG Renderer but are distributed across multiple machines on a network. These programs can manage renders on multiple machines and do tricky stuff like pause a render until an updated element from 3D is done, or automatically re-queue failed renders. Because these third-party rendering options—Rush Render Queue, Pipeline's Qube!, Überware's Smedge, or Muster by Virtual Vertex, to name a few—also support other terminal-friendly applications such as Maya and Nuke, it's an investment facilities that are large enough to have a render farm don't have to think twice about making.

These are not one-click installs and they're generally justified only by dedicated machines and a dedicated nerd to manage it all. If that's beyond your facility at this point, you can still take advantage of all of this technology via the Cloud, or via a service such as Render Rocket. You upload your source files and get back rendered output. The downside for compositors is that we generally require a lot of source data to produce final shots, compared with 3D artists who can sometimes create a final cinematic image with virtually no source.

### Watch Folder

The myopic and slightly dotty granddaddy of network rendering on After Effects is Watch Folder (File > Watch Folder). Watch Folder looks in a given folder for projects ready to be rendered; these are set up using the Collect Files option. The Adobe Help topic "Network rendering with watch folders and render engines" includes everything you need to know.

Watch Folder is kind of okay on small, intimate networks, but it requires much more hands-on effort than dedicated

**CLOSE-UP**

**Multiple After Effects Versions**

When desperate, you can open more than one After Effects on Mac OS or Windows. This is memory intensive and not ideal for rendering (for which BG Renderer is much preferred), but it lets you work with two projects at once.

On Mac OS, locate Adobe After Effects CS6.app and duplicate it (**Cmd+D**); both will run after you clear the warning that the application has moved. On Windows, go to the Start menu, choose Run, type `cmd`, and click OK. In the DOS shell that opens, drag in AfterFX.exe from your Programs folder and then add –`m` (that's a space, a dash, and m as in "multiple"). Voilà, a second version initializes.

**SCRIPT**

Suppose you just have one machine and a big render. You want it to keep running but shut down the system when it's done, and even notify you remotely that the render was a success. Render, Email, Save, and Shutdown by Lloyd Alvarez (http://aescripts.com/render-email-incremental-save-and-shutdown/) exists for this purpose; just queue up your render and fire one of them off.

**CLOSE-UP**

**Setting Preferences and Project Settings**

Here are a few default preferences I always change.:

▶ **Preferences > General > Levels of Undo:** Got RAM? Set this to 99.

▶ **Preferences > General:** Check the options Allow Scripts to Write Files and Access Network.

▶ **Preferences > General:** Toggle Default Spatial Interpolation to Linear.

▶ **Preferences > General:** Dynamic Link with After Effects Uses Project File Name with Highest Number.

▶ **Preferences > Display:** Check all four boxes (unless you love those little thumbnails; they can slow you down on a network).

▶ **Preferences > Import**: 29.97 for broadcast, 24 fps for film, 23.976 for both (film for broadcast), and 25 fps for PAL-derived systems.

▶ **Preferences > Media & Disk Cache**: Choose a folder on a fast, attached disk.

▶ **Preferences > Appearance:** Cycle Mask Colors; on.

▶ **Preferences > Auto-Save**: On.

**TIP**

Press **Alt+Ctrl+Shift** (**Opt+Cmd+Shift**) immediately after launching After Effects to reset Preferences. Hold **Alt** (**Opt**) while clicking OK to delete the shortcuts file as well.

render management software, and it breaks easily, at which point it requires human intervention. Since individual systems have become so powerful, it's easy to become lazy about taking the trouble required to set up a Watch Folder render, but if you're up against a deadline, don't have the dedicated software, and want to maximize multiple machines, it will do the trick.

## Optimize a Project

Here are a few more workflow tweaks to get the best performance out of After Effects.

### Hack Shortcuts, Text Preferences, or Projects

Some people are comfortable sorting through lines of code gibberish to find editable tidbits. If you're one of those people, After Effects Shortcuts and Preferences are saved as text files that are fully editable and relatively easy to understand. Unless you're comfortable with basic hacking (learning how code works by looking at other bits of code), however, I don't recommend it. The files are located as follows:

▶ Windows: [drive]:\Users\[user name]\AppData\ Roaming\Adobe\After Effects\11.0

▶ Mac: [drive]:/Users/[user profile]/Library/ Preferences/Adobe/After Effects/11.0/

Mac OS X started hiding the User/Library folder with the release of 10.7 (Lion). The easiest way to reveal it from the Finder is to select Go > Go to Folder and then type Library. The names of the files are

▶ Adobe After Effects 11.0-x64 Prefs.txt

▶ Adobe After Effects 11.0 Shortcuts

These can be opened with any text editor that doesn't add its own formatting and works with Unicode. Make a backup copy before editing by simply duplicating the file (any variation in the filename causes it not to be recognized by After Effects). Revert to the backup by giving it the original filename should anything start to go haywire after the edit.

The Shortcuts file includes a bunch of comments at the top (each line begins with a # sign). The shortcuts

themselves are arranged in a specific order that must be preserved, and if you add anything, it must be substituted in the exact right place.

Be extra careful when editing Preferences—a stray character in this file can make After Effects unstable. Most of the contents should not be touched, but here's one example of a simple and useful edit (for studios where a dot is preferred before the number prefix instead of the underscore): Change

```
"Sequence number prefix" = "_"
```

to

```
"Sequence number prefix" = "."
```

This is the format often preferred by Maya, for example.

In other cases, a simple and easily comprehensible numerical value can be changed:

```
"Eye Dropper Sample Size No Modifier" = "1"
"Eye Dropper Sample Size With Modifier" = "5"
```

In many cases, the value after the = is a binary yes/no value, expressed as 0 for no and 1 for yes, so if you're nostalgic for how the After Effects render chime sounded in its first several versions, find

```
"Play classic render chime" = "0"
```

and change the 0 to a 1. Save the file, restart After Effects, and invoke those 20th-century glory days of the beige Mac. Ask an After Effects veteran sometime what that chime evokes, and get ready to buy that warrior a beer.

### XML

After Effects projects can be saved as .aepx files. These work the same way but are written in plain Unicode text; you can edit them with an ordinary text editor. Most of what is in these files is untouchable; the main use is to locate and change file paths to swap footage sources without having to do so manually in the UI. If that means nothing to you, you're probably not the shell scripting nerd for whom a feature like that was created.

SCRIPT

A fantastic script for specifying your own modifier keys called KeyEd Up was developed specifically for After Effects by Jeff Almasol, author of other scripts included with this book. Find it on Adobe After Effects Exchange at http://tinyurl.com/6cu6nq.

SCRIPT

Batch Search-n-Replace Paths by Lloyd Alvarez (http://aescripts.com/batch-search-n-replace-paths/) may save you the need to dig around in an .aepx file to change footage source locations; it also makes use of regular expressions to make the matching process more sophisticated than what is possible with an ordinary text editor.
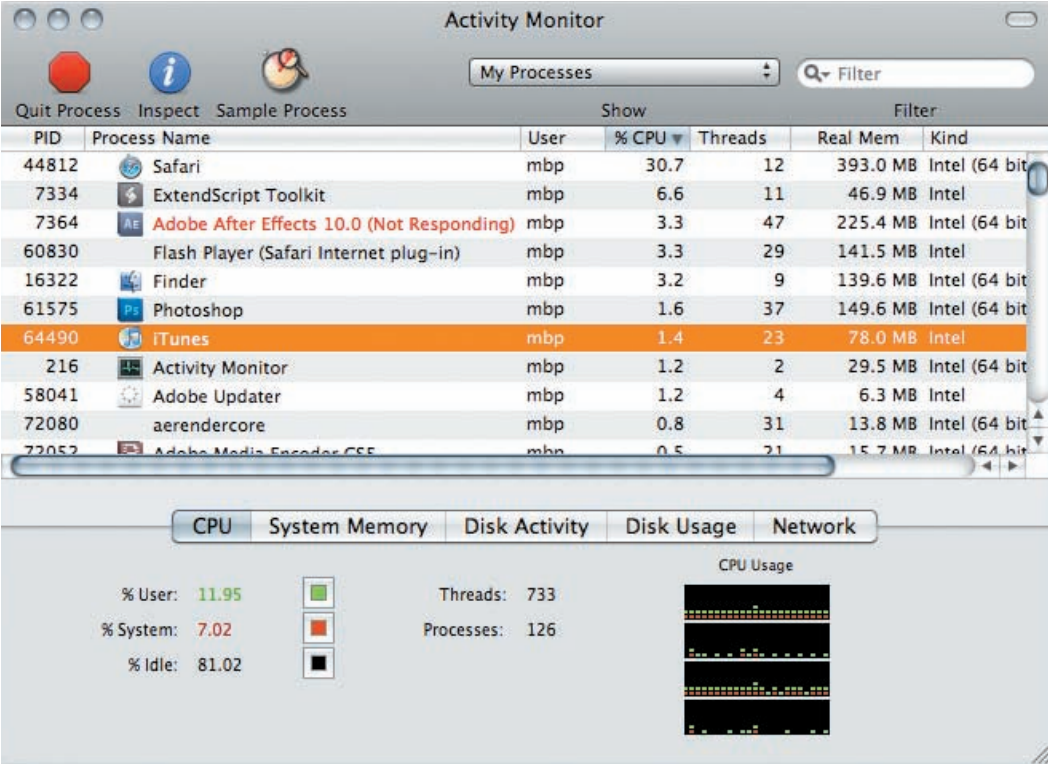
**Figure 4.21** The Process ID for the nonresponding application is shown in the left column.

## CLOSE-UP

**On the Mac: Force a Crash**

When After Effects does crash, it attempts to do so gracefully, offering the option to save before it exits. The auto-save options, if used properly, further diminish the likelihood of losing project data. On Mac OS X, an extra feature may come in handy when the application becomes unresponsive without crashing.

Open Activity Monitor and look for After Effects to get its PID number (**Figure 4.21**). Now open Terminal, and enter kill -SEGV ### where "###" is replaced by the After Effects PID value. This should cause the application to crash and auto-save.

### Memory Management

Chapter 1 included advice about running After Effects with multiprocessing enabled on a system with multiple cores and a good deal of physical memory. If you see your system's wait icon come up—the hourglass in Windows, the spinning ball on a Mac—that means there is a fight going on somewhere for system resources. In addition to following the advice in Chapter 1 to leave memory available for outside applications, you may have to quit any application that is both resource-intensive and outside the memory pool managed by After Effects (in other words, any app besides Adobe Premiere Pro, Encore, Prelude, Adobe Media Encoder, or Photoshop).

The best idea is to provide the system with more physical memory. As a rule of thumb, 2 GB of RAM per processor core is not a bad guide. You can go below this to, say, 1.5 GB per core, but much lower and your system will be less efficient unless you also limit the number of cores After Effects uses (in Preferences > Memory & Multiprocessing).

## These Are the Fundamentals

You've reached the end of Section I (if you're reading this book linearly, that is), and we've done everything we could think of to raise your game with the After Effects workflow. Now it's time to focus more specifically on the art of visual effects. Section II, "Effects Compositing Essentials," will teach you the techniques, and Section III, "Creative Explorations," will show you how they work in specific effects situations.

So here comes the fun part.



Although the RAM cache is less likely to become full or fragmented with 64-bit processing, Throttle-n-Purge by Lloyd Alvarez (http://aescripts.com/throttle-n-purge/) provides a UI panel with a one-button solution to clear all caches and get maximum efficiency out of a preview render (**Figure 4.22**). It also lets you switch bit depths, more easily than the Project panel, and it lets you turn multiprocessing on and off without opening Preferences.
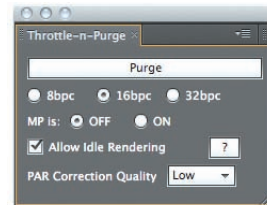


**Figure 4.22** Throttle-n-Purge exposes controls to help you manage memory usage as well as offering a one-button option to purge all caches (undos and image buffers) and start over.

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