

Maya 6 Killer Tips

The hottest collection of cool tips and hidden secrets for Maya



Eric Hanson

Killer Tips series developed by Scott Kelby

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MAYA 6 KILLER TIPS

Maya 6 Killer Tips Team

EDITOR

Karyn Johnson

PRODUCTION EDITOR

Connie Jeung-Mills

CONTRIBUTORS

Erick Miller

Eric Pender

TECHNICAL EDITORS

Greg Berridge

Adrian Dimond

COPY EDITOR

Nancy Reinhardt

PROOFREADER

Haig MacGregor

INDEXER

Rebecca Plunkett

COVER DESIGN AND CREATIVE CONCEPTS

Felix Nelson

COVER PRODUCTION

Aren Howell

COMPOSITOR

Owen Wolfson

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To the three girls, source of all things good in my world.

—ERIC HANSON

*To my mom, who inspires and supports me in all I do; my dad, for his love;
and my brother Steve, who makes me proud.*

—KENNETH IBRAHIM

To my wonderful wife and son, who bring nothing but happiness into my life.

—ALEX NIJMEH

ABOUT THE AUTHORS



Eric Hanson is a visual effects artist specializing in digital environments and effects for feature films. Originally an architect, he established early 3D visualization studios for some of the country's largest architectural firms, including The Callison Partnership, in Seattle and Gensler, in Los Angeles. An expanding interest in film led to a move into visual effects work, resulting in senior CG artist positions with leading visual effects houses Digital Domain, Sony Imageworks, Dream Quest Images, Walt Disney Feature Animation, and SimEx Digital Studios. His work can be seen in *Spider-Man*, *Cast Away*, *Hollow Man*, *Mission to Mars*, *Bicentennial Man*, *Fantasia 2000*, *Atlantis*, and *The Fifth Element*, as well as many large-format, special-venue films worldwide.

Eric specializes in 3D work with Maya, RenderMan, and Shake, and is an active teacher of those packages. He has taught for several years, having instructed courses on advanced 3D techniques at SGI's Silicon Studio and Gnomon School of Visual Effects, and is currently leading a curriculum on visual effects at the University of Southern California's School of Cinema-TV. He frequently speaks and holds workshops at various trade shows and schools domestically, as well as in Japan, even though he is not sure what to eat while there.

Eric is a member of ACM/Siggraph and the Visual Effects Society and holds a professional degree in Architecture from the University of Texas at Austin.

Eric can be reached at his web site, www.visuraimaging.com.

ABOUT THE AUTHORS



Kenneth Ibrahim began his career in visual effects as an Alias|Wavefront application engineer in Tokyo, Japan in 1994, just as Maya was entering its alpha phase. After returning to the U.S. and spending a total of three years at A|W demonstrating and supporting Maya, Ken moved into production proper by joining PDI's C.A.F.E. group and working on a number of TV spots during which he helped integrate Maya into the PDI pipeline. Ken has since worked at a number of production companies on such films as *Shrek*, *Final Fantasy*, *Matrix Revolutions*, *X2*, *Peter Pan*, and *I, Robot*. He has focused on FX animation/development and lighting and spends a good deal of time MEL-scripting and API coding. Ken graduated from Santa Clara University with a degree in computer engineering before moving to Japan with the goal of becoming fluent in Japanese. While there, he taught English, programmed Macintosh computers, and went to work for SEGA, writing software tools and creating graphics in the AM3 R&D department. His voice was also featured in a number of arcade games including the hit *SEGA Rally Championship* and *Virtua Cop*. When not at the office, he likes to keep busy with various hobbies including music composition and recording, language study, reading, working out, and traveling. He recently spent two months studying Italian in Rome and is preparing another trip somewhere after his current project is complete. Ken has also recently published a Japanese vocabulary building book based on words he learned watching the Japanese anime *Akira*. Ken has created a number of items that are available at shop.shuri-ken.com. He can be reached at his Web site www.shuri-ken.com.



Alex Nijmeh is currently a digital artist at Digital Domain, based in Los Angeles, CA. Specializing in 3D modeling and lighting, Alex recently finished working on Roland Emmerich's blockbuster film *The Day After Tomorrow*, where he contributed to the ambitious effort to digitally model a large portion of NYC, and moved on to his next feature film *I, Robot*. Even before working in visual effects, Alex has been a long time Maya user, since version 2.0. He worked for several years as Lead Modeler and Senior Designer at a San Francisco-based company that produced immersive film-like quality environments and cinematics for a unique virtual reality venue. He has also used Maya to produce work for television commercials, a TV pilot for a police drama series, as well as illustrations for PC games and professional software packages. Alex grew up and attended school in San Jose, California and has a BFA in computer graphics. Alex can be reached via email at alex3d1@comcast.net.

ABOUT THE CONTRIBUTORS



Erick Miller is currently a lead technical director at Digital Domain, the Academy Award–winning visual effects company responsible for digital effects in recent blockbusters such as *I, Robot*, *The Day After Tomorrow*, *Lord of the Rings*, and *X-Men*. Since Erick has been at DD, he has contributed to many projects: a plug-in pose-based deformation system, a proprietary muscle/skin deformation plug-in system, and a crowd animation and rendering system, just to name a few. After wrapping up on the Maya-based facial rigging for a photo-realistic CG that Michael Jordan used in Gatorade’s 2002 Super Bowl commercial, Erick created a Maya-based crowd pipeline for Roland Emmerich’s apocalyptic end-of-the-world feature film *The Day After Tomorrow*. After that, Erick moved on to build a Character TD team for the feature film, *I, Robot*. As a lead technical director, Erick was responsible for the hero facial rigging of the fully CG, photo-realistic main character, "Sonny," as well the character-based Maya pipeline, scripts, plug-ins, and character tools. Some of Erick’s favorite duties include advanced character setup, facial rigging and complex skin deformations. Besides character setup, Erick also often enjoys connecting his creative knowledge with MEL scripting, Maya’s API, and other external programming languages and C/C++ APIs to further advance a character-based pipeline. Erick is a Maya Master Class presenter, has contributed to the authoring of two books on Maya (*Inside Maya* and *Maya 5 Killer Tips*), is Alias|Wavefront certified in Character Setup, has a Bachelor of Fine Arts degree in Computer Graphics from the Academy of Art College, and has been a Maya user since its inception at version 1.0.



Eric Pender has been creating 3D effects animation on feature films since 1996. He has worked on movies such as *Alien Resurrection*, *Batman and Robin*, *Hard Rain*, *Air Force One*, *Sphere*, *Gone in Sixty Seconds*, *Mission to Mars*, and *Kangaroo Jack*, as well as the opening sequence for *Wonderful World of Disney* on ABC. He started out working for Alias|Wavefront in Santa Barbara and specializing in Dynamation, which was the original dynamics package created by Wavefront. Dynamation was used as the framework for the dynamics package in Maya. Eric has been using Maya in production since the first version.

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Without rambling on endlessly like a weepy Oscar acceptance speech, I would like to briefly wish a warm thanks to many of those who laid the train tracks down in front of me or added coal to the engine along the way. First and foremost, much love must go to my beautiful wife Kari and our little love buckets, Taylor and Shelby. 3D artists often mistake the world as one big rendering, and Kari constantly keeps me in check by reminding me that it is indeed much more. She has endured my crazed and relentless obsession with CGI for many years with amazing tolerance and support. Kari, it has been noted by management and you are in line for a modest bonus soon!

Professionally, I have had many fellow adventurers on this train ride, but huge thanks go out to the truly supportive ones, like brother Bill Hanson of Apple Computer, FX animator extraordinaire Cody Harrington, and design maestro Joe Cordelle. I can attribute much of my success to their well-timed mutual prodding and encouragement. There have been numerous, enjoyable fellow travelers along the way, such as Mark Lefitz, Alex Nijmeh, Pat Finley, Chris Nichols, Travis Price, Ben Procter, Chris Cunningham, John Goodman, Allen Yamashita, and Eric Beggs, where it all started. Much has been learned (and laughed) from all.

Thanks go out to the quality team at New Riders and Peachpit, including Elise Walter and Karyn Johnson. I had four great contributors for this edition, Alex Nijmeh, Kenneth Ibrahim, Erick Miller, and Eric Pender. Thanks to my two eagle-eyed tech editors, Greg Berridge and Adrian Dimond. Lastly, great thanks go out to Scott Kelby for the Killer Idea of the Killer Tips series- onwards and upwards!

Then there is the inevitable thanks and love going out to my parents, who got the train out of the station and continue to support my constantly unfolding path while moving down the tracks.

—Eric Hanson

I would like to start by saying that none of this would have been possible for me without the loving support of my beautiful wife Susan and our adorable son Tyler, who believed in me and stood by my every decision. Susan, I can't even begin to describe my appreciation for you. I can't imagine where I would be now if it weren't for my good friend Eric Hanson who helped grease the wheels for me, and helped to get me where I am today with my career. A special thanks to my coworkers at Digital Domain who help make each day enjoyable. Pavel Prane, John Decker, Esdras Varagnolo, Ryan Vance, Andy Wilkoff, Paul George, Daniel Fazel, Patrick Finley, Melanie Okamura, Chris Nichols, Kevin Jackson, Dan Fowler, and I can't forget Charles Abou Aad, who endures the brunt of my sense of humor as he sits beside me, and who really suffers the most. Thanks, Charles, and great big thanks to my loving parents for always encouraging me to follow my dreams and to never settle for second best. A big thanks goes out to my brother Gabriel, and my Sister Elena, for their continued encouragement.

—Alex Nijmeh

ABOUT THE TECHNICAL REVIEWERS

These reviewers contributed their considerable hands-on expertise to the entire development process for *Maya 6 Killer Tips*. As the book was being written, these dedicated professionals reviewed all the material for technical content, organization, and flow. Their feedback was critical to ensuring that *Maya 6 Killer Tips* fits our readers' need for the highest-quality technical information.



Greg Berridge is currently the head instructor of the Digital Character Animation program at Vancouver Film School. He is a certified Maya Instructor holding accreditation in several areas of Maya expertise. Greg has completed work for several local Vancouver companies, including Lorax International. He has also spent time teaching Maya to content creators at Mainframe Entertainment. Greg has completed work for the NIAC (NASA Institute for Advanced Concepts) on the international front. First and foremost an instructor, Greg has been teaching Maya since it arrived six years ago. In addition to his professional endeavors, Greg is also working as an independent producer and is currently developing several concepts for television and film. He is also an aspiring author, hoping to have his own book published soon on the intricacies of Maya. Above all else, he is engrossed in Maya and breathes 3D content creation at every possible moment.



Adrian Dimond, an animator and designer currently residing in Los Angeles, works on a wide range of projects spanning the last decade. Recent projects include a flying bottle cap for Budweiser, visual effects for *Harold and Kumar go to White Castle* and a music video for an electro-clash band called Lemans. Adrian shares his vast experience at <http://www.highend3d.com>, <http://www.cgtalk.com> and at his website <http://www.gmask.com/tutorials>

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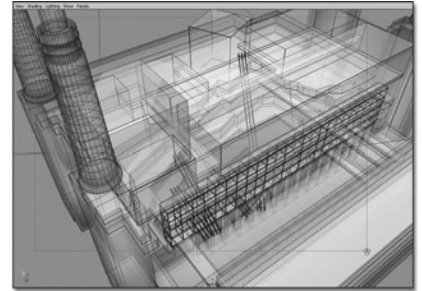
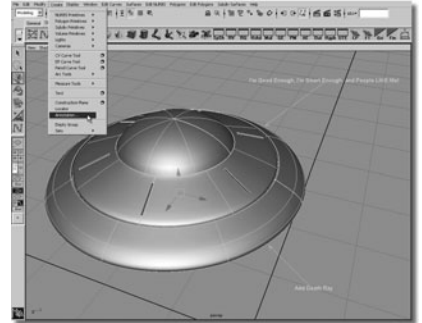
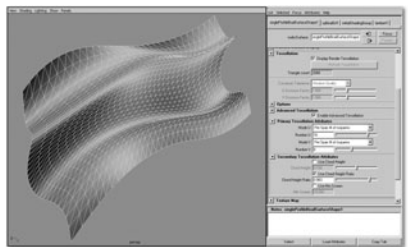
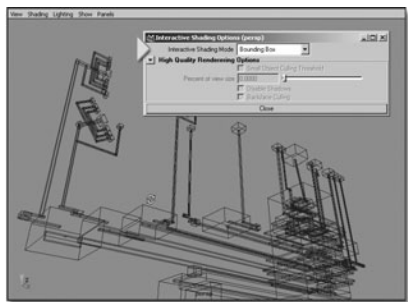
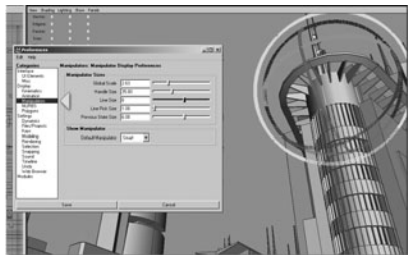


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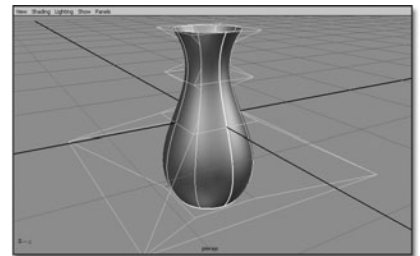
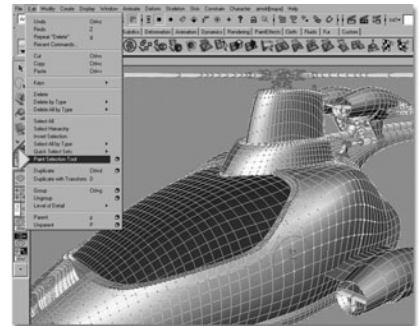
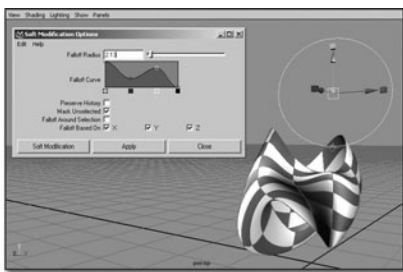
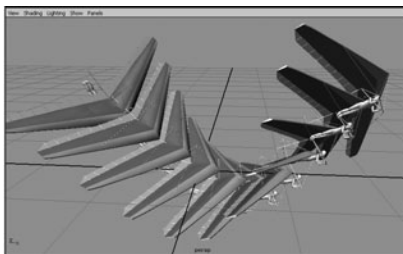
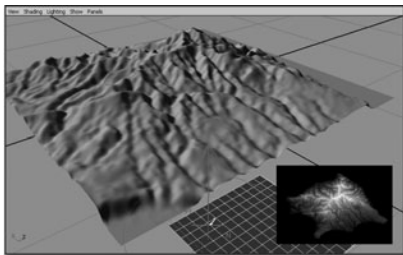


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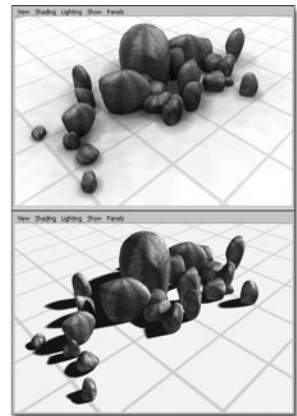
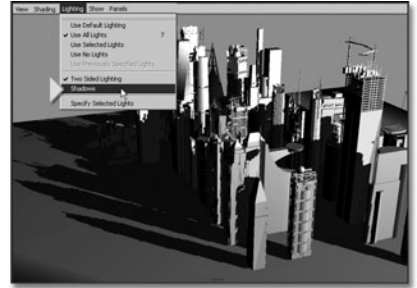
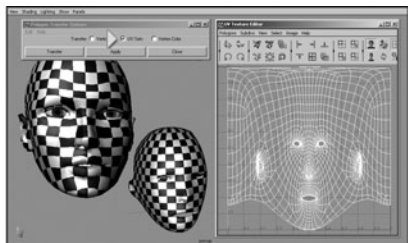


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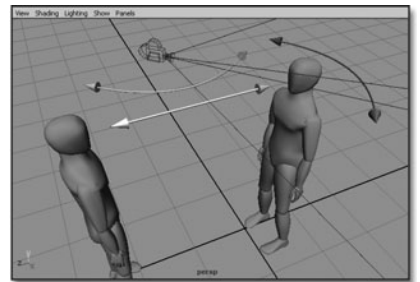
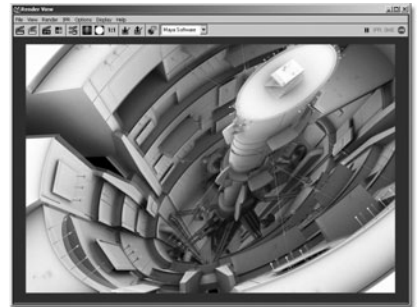
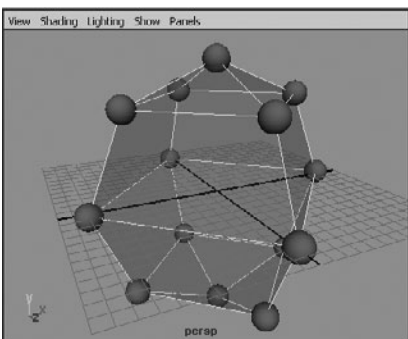
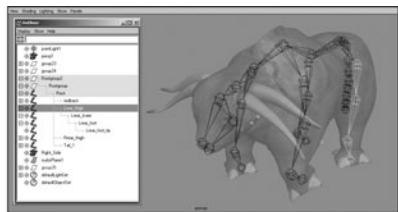


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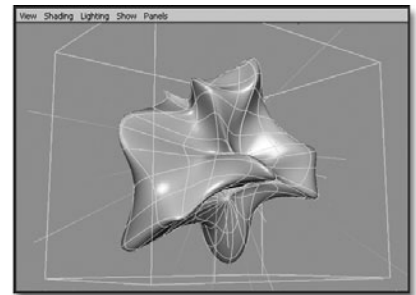
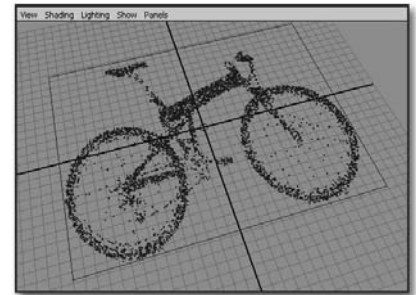
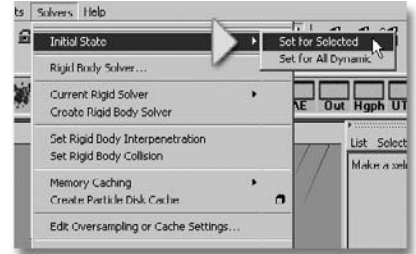
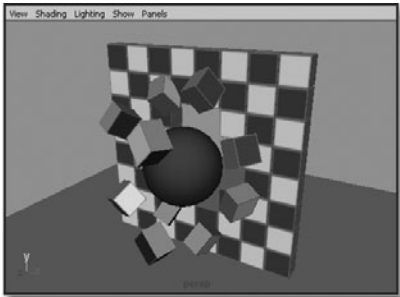
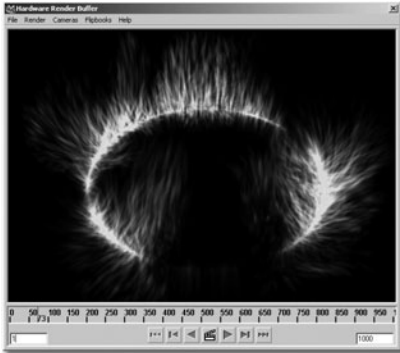
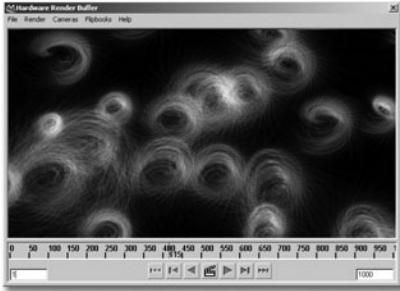


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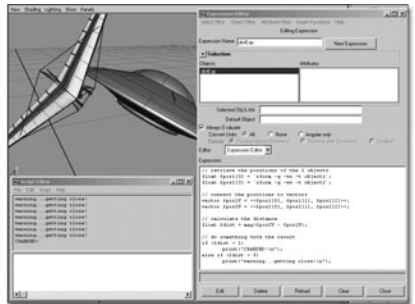
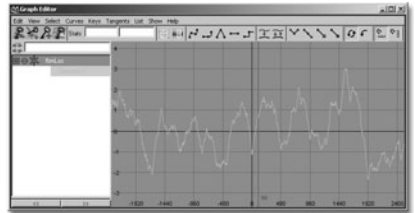
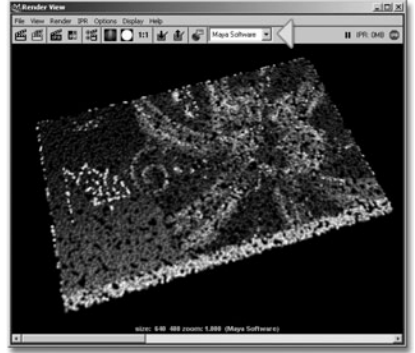
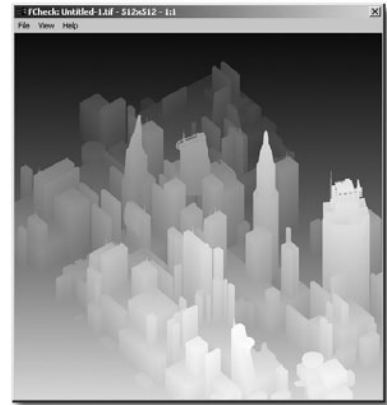
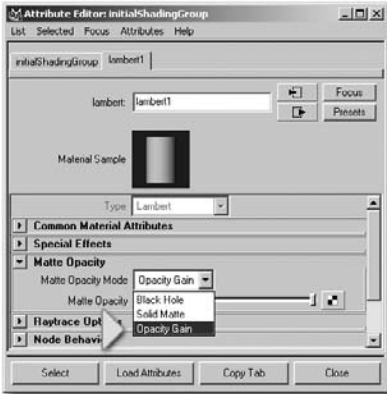
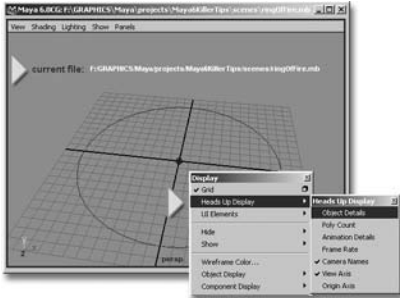


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FOREWORD

Maya 6 Killer Tips

Edited by Scott Kelby

Welcome to *Maya 6 Killer Tips*. As Editor for the Killer Tips series, I can't tell you how excited and truly gratified I am to see this concept of creating a book that is cover-to-cover nothing but tips, extend from my original book (*Photoshop Killer Tips*) into *Maya 6 Killer Tips*.

The idea for this series of books came to me when I was at the bookstore looking through the latest Photoshop books on the shelf. I found myself doing the same thing to every book I picked up: I'd turn the page until I found a paragraph that started with the word "Tip." I'd read the tip, then I'd keep turning until I found another sidebar tip. I soon realized I was hooked on tips, because I knew that if I were writing the book that's where I'd put all my best material. Think about it: If you were writing a book, and you had a really cool tip, an amazing trick, or an inside secret or shortcut, you wouldn't bury it among hundreds of paragraphs of text. No way! You'd make it stand out: You'd put a box around it, maybe put a tint behind it, and if it was really cool (and short and sweet), you'd get everybody's attention by starting with the word "Tip!"

That's what got me thinking. Obviously, I'm not the only one who likes these tips, because almost every software book has them. There's only one problem: There's never *enough* of them. And I thought, "Wouldn't it be great if there were a book that was nothing but those cool little tips?" (Of course, the book wouldn't actually have sidebars, since what's in the sidebars would be the focus: nothing but cool shortcuts, inside secrets, slick ways to do the things we do everyday, but faster—and more fun—than ever!) That was the book I really wanted, and thanks to the wonderful people at New Riders, that's the book they let me write (along with my coauthor and good friend Felix Nelson). It was called *Photoshop Killer Tips*, and it became an instant bestseller because Felix and I were committed to creating something special: A book where every page included yet another tip that would make you nod your head, smile, and think "Ahhh, so that's how they do it."

TIP

If you were writing a book, and you had a really cool tip, an amazing trick, or an inside secret or shortcut, you wouldn't bury it among hundreds of paragraphs of text. You'd make it stand out: You'd put a box around it, maybe put a tint behind it, and if it was really cool (and short and sweet), you'd get everybody's attention by starting with the word "Tip!"

If you've ever wondered how the pros get twice the work done in half the time, it's really no secret: They do everything as efficiently as possible. They don't do *anything* the hard way. They know every timesaving shortcut, every workaround, every speed tip, and as such they work at full speed all the time. They'll tell you, when it comes to being efficient, and when it comes to staying ahead of the competition: Speed Kills!

Well, what you're holding in your hand is another Killer Tips book: A book packed cover-to-cover with nothing but those cool little sidebar tips (without the sidebars). Eric Hanson has captured the spirit and flavor of what a Killer Tips book is all about. I can't wait for you to get into it, so I'll step aside and let him take the wheel, because you're about to get faster, more efficient, and have more fun in Maya 6 than you ever thought possible.

Have fun and enjoy the ride!

All my best,

Scott Kelby, Series Editor

INTRODUCTION

Not for the Faint of Heart

3D artists have it tough. They have to wade through seemingly endless amounts of technical minutia from dreary manuals, off-the-shelf books thicker than the yellow pages in a grimy Manhattan phone booth, and well-intentioned but often awkward online tutorials. Then they navigate bleary-eyed through the endless layers of cryptic commands in their applications, wrestling with such terms as “Directed Acyclic Graph,” “Non-Rational Uniform B-Spline,” and “Non-Manifold Topology.” If you can recite the meaning of these terms without forethought, you have already been there! We endure this toil just to satisfy our implacable creative urges to muster up fascinating imagery out of the deep well of technology. 3D animation and rendering is certainly the high ground of computer graphics, pushing one’s capacity for technical concepts and jargon to the limit. And, like your grandfather in his youth, mythically trudging through miles of snow making his way to school, we actually LIKE it that way! So, what better reason than to create a book that assembles concise technical tips to speed understanding of the terms, accelerate your workflow to superhuman speeds, and peer into techniques professionals use daily in the visual effects field? When I learned of Scott Kelby’s *Killer Tips* series, I recognized that it would be an instant fit in the 3D CGI* world, like beer and pretzels, or in our case, hot pockets and programmers.

Why Maya?

Maya has had an interesting ride into the annals of CGI history in the last few years. It has pounded its way like Mike Tyson into the forefront of professional 3D, and is now considered the standard for 3D work at most of the major visual effects facilities, such as Acme Animagraphics and Industrial FX R Us. Seriously though, it has swept the field, and if there is anything good about that, it is that artists can now carry their expertise and well-earned training with them as they drift from project to project, like the best migrant beanfield workers.

Maya began life as three competing products (Alias, Wavefront, and TDI) that Silicon Graphics had the good sense to purchase and then fuse, Frankenstein-like, into the ultimate über-3D software. Think of it as Einstein’s Grand Unification Theory applied to 3D. Or dogs and cats happily romping together. Or Steve Jobs and Bill Gates taking a buddy road trip through the southwestern desert together. In any case, it consolidated many of the separately evolved features that 3D artists had grown envious of. It reduced the prevalent 3D application “camp” mentality somewhat and joined the tribes.

But what secured the success of Maya in the high-end world was that it was the first 3D package to “open the hood” for standard users, allowing amateur

* First “TLA,” or three-letter acronym, that 3D artists seem to prefer for basic conversation to each other; in this case, “computer graphics imagery.”

weekend mechanics (non-programmers) to rummage around in the engine and transmission. So rather than offering an ultimately dead-end tunnel of predetermined GUI* commands, Maya reveals all command structure in text format, allowing clever custom tools to be created (or bumbling stupid ones). Some hardcore Maya users balk at using a GUI at all and type everything. The same crowd would probably prefer punch cards if they were still around, but the option does exist.

Maya also delivers cutting-edge performance in most of the areas it is known for, such as extensive modeling, rich character animation, highly developed dynamic simulation, and a multitude of deformations, as well as offering unique technology like fluid effects, cloth simulation, 3D paint effects, and non-linear animation. Ultimately, Maya has become the “Swiss army knife” of visual effects. Of course, Swiss army knives are not exactly sleek and are fairly cumbersome, and Maya can be seen similarly. Thus, a good understanding is needed to “tame the beast” and coax it into doing your bidding. Alias’s early advertising campaign involving a circus lion tamer is not too far off in that regard.

Is This Book for Me?

Absolutely. This book is designed for the advancing intermediate Maya artist, but it will offer gems to all levels. Beginners will find it valuable to clear up some of the arcane mystery of the program, intermediates will use it to add to their growing bevy of techniques, and old dogs will learn a few new tricks to polish off their expertise. The book contains coverage on Maya 6 for users on Windows, Mac, and Linux platforms; however, the screenshots and hot buttons are shown only in Windows. All the tips are applicable for any platform.

Can I Get a Job Working with Steven Spielberg or Jim Cameron After I Read It?

Sure, why not? Stranger things have happened in Hollywood. Steven Spielberg started as a squatter in a studio lot, and Jim Cameron was a truck driver. I would say with that in mind, you could certainly make your mark in Hollywood, armed with the aid of *Maya Killer Tips*. One of the truly great aspects of the visual effects field is that ultimately it is only about your talent. Well, sure, there are SOME power lunches involved, but mastering a difficult package like Maya is a surefire and road-tested route to contribute to the history of the silver screen, and not a bad 8–5 gig if you ask me. Or there’s always the beanfield....

* Another TLA; in this case, “graphic user interface,” affectionately known as “goosey.”

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Embracing the Revolution



Lighting in Maya is, ironically enough, a “dark” art—there just aren’t any cookbook recipes to follow. If you gave 100 Maya artists the same task to light a space or character, you would probably end up with 100 different



Embracing the Revolution

lighting your way

results. Of course on a big project this could pose a major problem, so teams spend time creating standard rigs and approaches, but in general lighting is more an intuitive art than a standardized craft. It is responsible for the success of a scene more than any other factor, but above all it is just plain difficult. Adding to that difficulty is the fact that of all CGI technologies, it has been the most difficult to create photorealism with lighting because of the crudeness of the tools available. However, a major revolution is underway—Global Illumination. With version 6.0, Mental Ray now offers the richest opportunity for GI lighting in Maya. GI offers a simulation-based approach to lighting that is light years ahead in terms of accuracy, though it sacrifices a bit of the carefully sculpted lighting of the artist. Whereas most 3D development is evolutionary, GI is revolutionary, and it is rewriting all our long-standing methods. We are currently in the middle of this revolution, so luckily older and well-proven approaches are still valid because the new ones are being put into serious production stresses. Therefore, you will find Killer Tips on both sides of the lighting movement in this chapter. Viva la revolucion!



TWEAKING LOTS O' LIGHTS

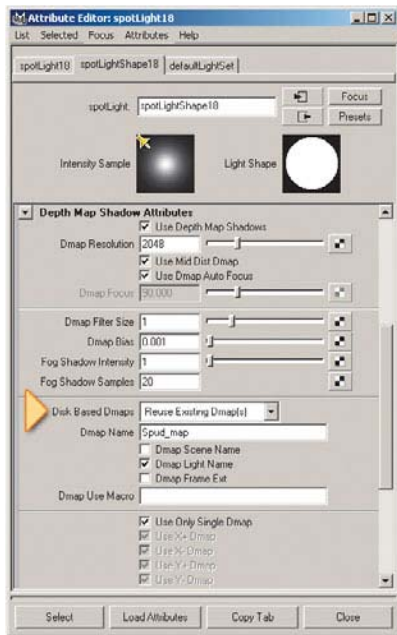
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spotLightShape9	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape8	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape7	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape6	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape5	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape4	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape3	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0
spotLightShape1	1	1	1	1	1	0.2	off	0	0	0	0	0	0	0	0	0	0

Undoubtedly you have created vast multitudes of lights (Maya artists LOVE lights) and had to globally change them for some reason or another. Rather than progressively altering them individually in the Attribute Editor, try the Attribute Spread

Sheet. OK, maybe you have tried that, but what if you need to change all the more obscure attributes, such as Shadow Map Resolution? You may have found those attributes are missing. The trick is to use the down arrow key to select the Shape nodes and load all the previously hidden attributes under the All tab of the Attribute Spread Sheet.



REUSE THOSE DEPTH MAPS

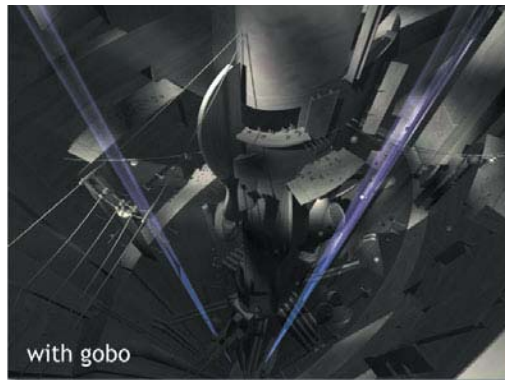
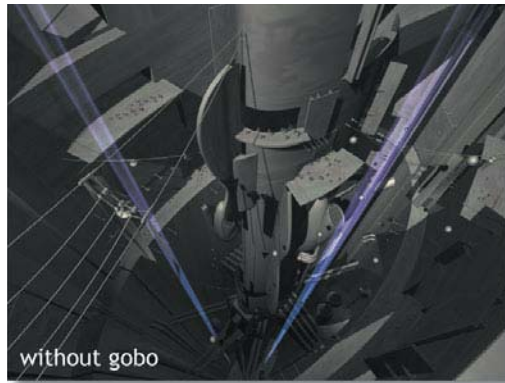
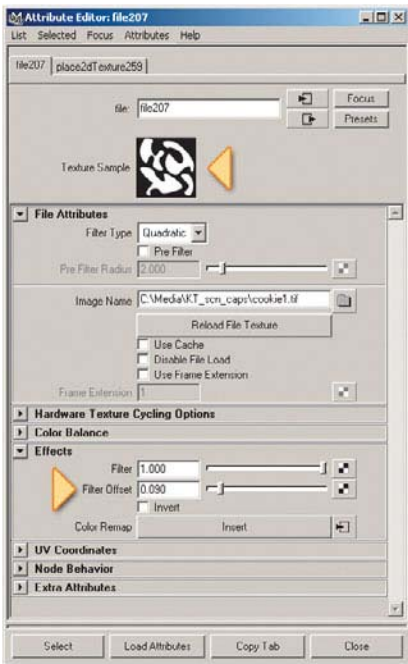


Maya has gotten very quick at calculating Shadow Maps, but over the course of thousands of frames, all that calculating can add up. If nothing moves substantially in your scene or background, consider Depth Map Shadow Attributes, Disk Based Dmaps, Reuse Existing Dmap(s) in the Attribute Editor of the light. This will write out the maps into *Your_project\renderData\depth* directory. They will not be deleted, as is the norm, and they will be reused for every frame. This can substantially cut down your renders if the shadow can stay still. For a character that moves, consider a linked light, which calculates on every frame. Lastly, remember that these depth maps can be inspected with Fcheck and the "z" key, which is very handy when trying to debug shadows.



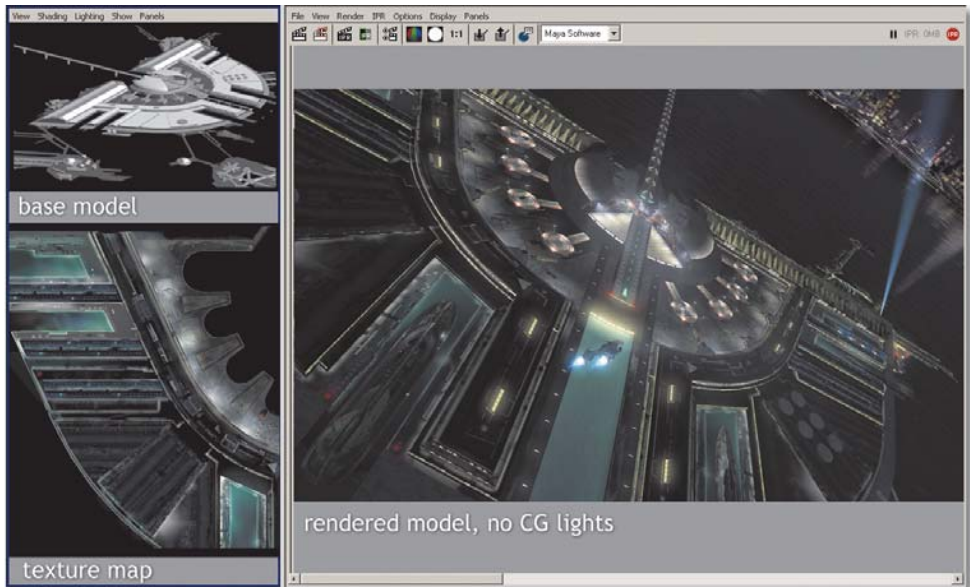
 **COOKIES AND GOBOS**

Sounding like something yummy from your childhood, these are rather old Hollywood terms for ways of manipulating the spread of light. Cookies and Gobos are actually paddles or cards with random holes cut out to deflect key lights into a draping of light and shadow or to soften the spread. Defining the signature look of the Film Noir period, they are useful for dramatic effects or simply for enriching a scene. Cardinal Rule #1 in CGI is that *Imperfection Is Your Goal*, so here is a great way to emulate that technique using a simple CGI Spot light. First, paint a few random black and white organic patterns in Photoshop and save out as a TIFF file. Now create a Spotlight in Maya, and in the Attribute Editor, map a File Texture to the Color channel. Choose a Gobo file of your choice and adjust Filter Offset in the Spotlight Attribute Editor to add blur and softening to the sharp contrast. Adding warm hue into the Texture File Color Gain and cool hue to Color Offset can create further interesting effects.



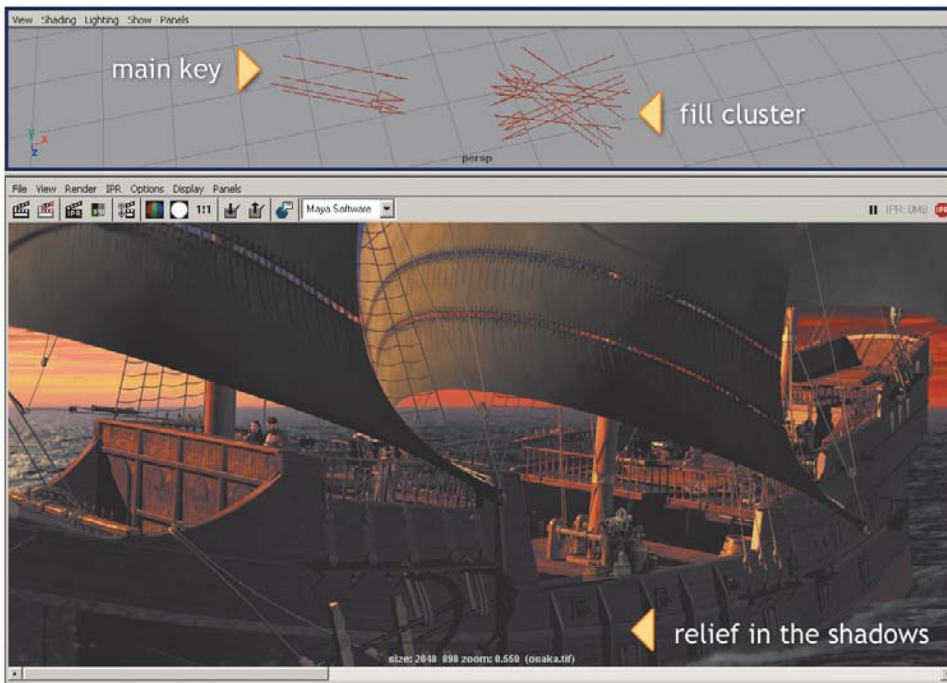
 **LIGHTING WITH PAINT**

Allen Daviau is one of Hollywood’s top directors of photography. An interesting statement he once made is that he often not only “paints with light” as the saying goes but also “lights with paint,” using stage painters to attenuate surfaces into proper exposure. Conceptually, we do the same thing with our shaders. Lighting is inseparably intertwined with our surface properties. One shader attribute that has great usefulness to lighting is Incandescence Mapping. This is a terrific method to add or replace the appearance of lights. It is limited though because it doesn’t offer a lighting solution for objects per se but is simply an illusion or painting of light appearing in the scene. The Incandescence attribute channel of a shader simply takes the color map and renders it at full (or at a potentially partial) value. The trick here is to use a painting program such as Photoshop to pre-paint the lighting onto a simple render or screen grab of the surface. In Photoshop, the Render Lighting filter is very useful; just keep the Ambient slider set to zero in that plug-in. For architectural scenes, it is a great way to simulate the appearance of hundreds of lights without even containing a single one, as the almost entirely incandescent mapped example shows.



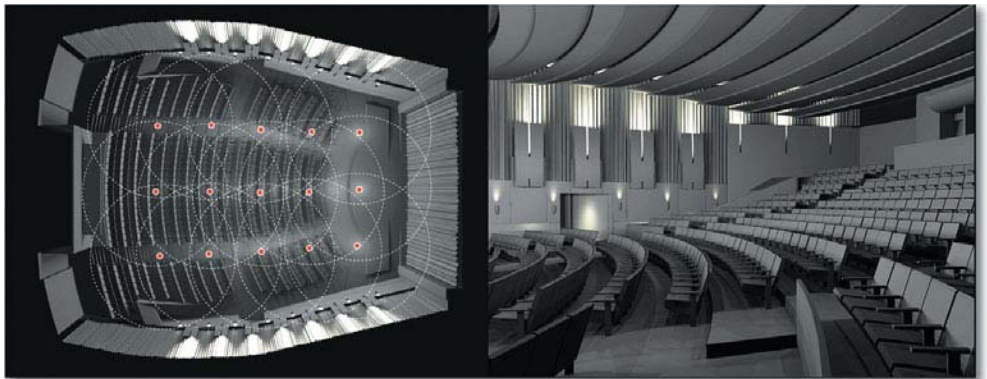
 **KILL THAT AMBIENT!**

I don't normally condone violence, but there is really no place for ambient lights in good CGI. A better solution is to create a Directional light cluster by copying a handful of six or so Directional lights and placing them into a grouped cluster around a single pivot. Now rotate them counter to your main key and begin to rotate them apart, effectively giving light from multiple directions but enabling the etching of the sculpted form to occur, which a stock Ambient light naturally kills. The trick of course is to keep intensities down enough to not notice their directional sourcing. One option is to turn off the Emit Specular component in the light Attribute Editor.



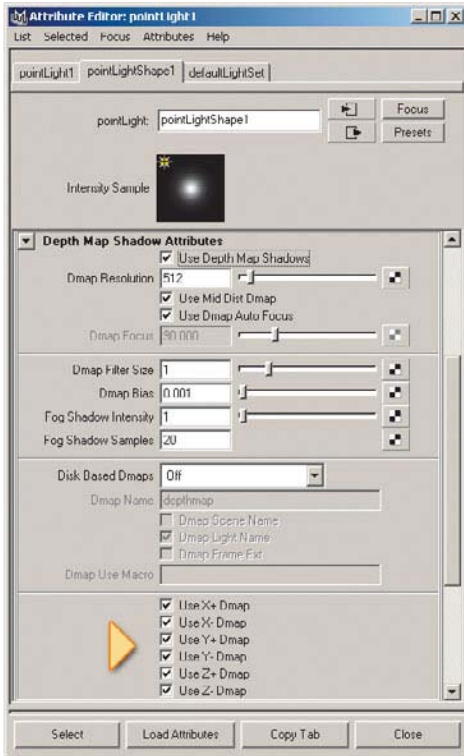
 **CUBIC POINT ARRAYS**

Another great way to avoid the evils of Ambient lights is to use an array of cubic decay Point lights. In the case of lighting an interior space, Ambient light will unify everything into a monotonous flattening. A collection of Spot lights can accentuate certain forms but doesn't really offer a way to do an overall space. Area lights are best for this task, but they can drastically increase render times. A good compromise that offers more flexibility and a GI look is to fill the space with overlapping spheres of quickly decaying light provided by Point sources. Effectively a manual setup of an Area light that is tailored to the space, this method almost always provides a good solution for roughing out an interior scheme. Begin by placing an array of Point sources vertically midway from the ceiling to floor and spaced at that same distance apart. You may end up with rows of lights to fill the room, perhaps up to 20 or 30 lights. Adjust the intensity to equal a net level of 1.0, that is, 10 lights at intensity 0.1 for each. The key here is to use the highest rate of decay—Cubic. The intensities will run very high (about 2000), but they are abstract. With the fast falloff, pockets of shadow will accumulate in the corners, mimicking a GI render with a fraction of the render time. Additional Spot lights can be added for warm or cool shifts and accents on interior elements. A weak Directional light can be used to pull forward any wall that may need accenting over others. Note we have used no Ambient lights in this strategy. Lastly, don't turn on Shadow Maps on these Point lights, which is explained in the next Killer Tip!





FEAR OF POINT LIGHT SHADOW MAPS

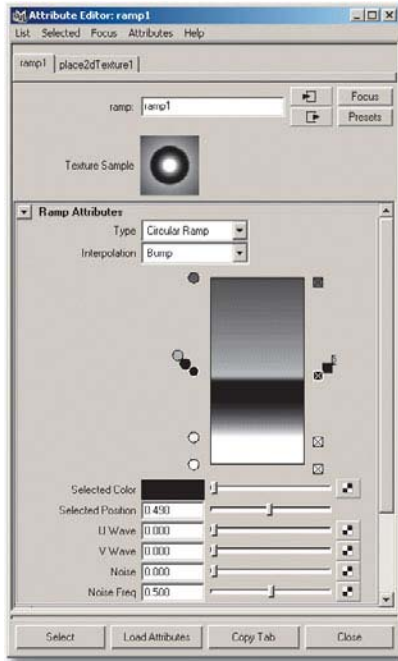


One thing that many artists overlook is that using shadow maps on a Point light does not generate one map, but six! As shadow maps are effectively renderings taken from a point in space to cover a 360-degree area, Maya adds six hidden spot cones, rotated 90 degrees to each other about the Point light center. Each cone angle's coverage is 90 degrees and is square, providing a full surround. Maya is considerate enough, however, to provide a way to turn off these maps under Depth Map Shadow Attributes, with check boxes for Use XYZ+- Dmap. Not that you can't theoretically run 120 shadow maps on 20 lights on a render (though it's probably not a good idea), but now you will know why your box sits there for hours, lost in thought before even rendering a pixel.





LIGHT COLOR MAPPING VERSATILITY

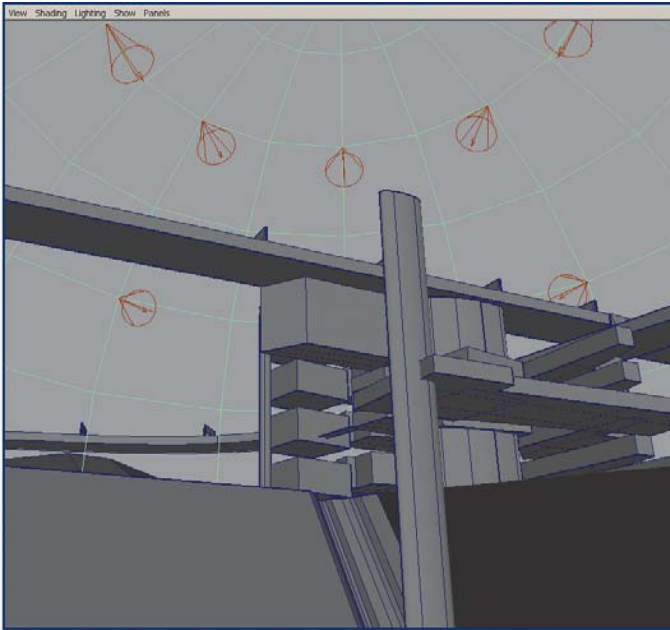


A valuable aspect of Maya lights is the capability to map the Color channel in the Attribute Editor. This simply places an orthographic section cut of your Spot light's color pixels with a rectangular or solid map of your choice, and it offers potential for many varied effects. First, it is useful for custom-designed penumbras. Apply a 2d Ramp Texture node to the Color channel of the light and create a grayscale circular ramp. This acts as a secondary means of controlling the falloff of light within the penumbra already set by changing the effective light color out from the center. Another common use is to assign a 2d Fractal Texture node to the color but adjust for low contrast, so that the even light is randomized to a slight "blotching." If done subtly, this introduces a scale factor and rich irregularity to cast light. The next obvious use of this is to connect a 2d File Texture node, acting as a slide projector of sorts. Lastly, the look of multiple lights can be simulated with one light by mapping a 2d Grid or Bulge Texture or a repeated circular ramp to give the appearance of a light passing through a diffuser. If Shadow Mapping is turned on together with Light Fog, multiple beams will be defined, giving you an instant disco!





POOR MAN'S GLOBAL ILLUMINATION



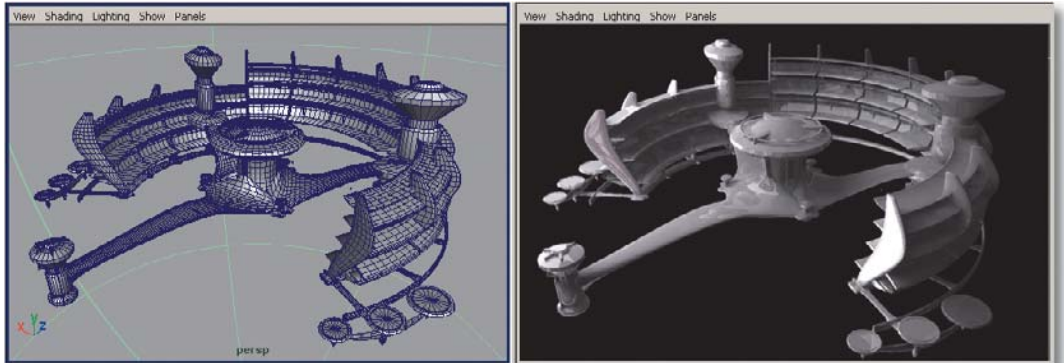
In the constant quest to achieve the look of Global Illumination without the associated exorbitant render costs, many have adopted the use of hemispherical layouts of traditional Spot or Directional lights. Web sites such as Highend3d.com have some excellent rigs available for download, such as GI Joe. If you feel ambitious enough to make your own, create a poly sphere with a Subdivision Axis of 8 and a Subdivision Height of 6. Delete the

lower faces to leave a dome. Create a Spot light, scale to .1, and then snap to one of the vertices. Turn on the Manipulator Tool in the Toolbox and grid snap the focus point to 0,0,0. Copy the light to the next highest vertex and reposition its focus back to 0,0,0. Center each light's pivot back to 0,0,0 and use Edit, Duplicate to copy the two Spot lights 7 times with a 45-degree Y rotation. Group the Spot lights, delete the sphere, and turn on Shadow Mapping with 1024 Map Resolution. Now export the dome as active and import into a scene. Scale up the top node of the lights while choosing Panels, Looking Through Selected on a single Spot light to maximize the area covered by the Shadow Map. Render away, and you get a poor man's version of GI shading. For a middle-income version, try GI Joe, where an environment map can inform each light's color for a High Dynamic Range (HDR) fake, and the number of lights used is far higher for smoother shadowing. For an upper-crust earner, try true GI and HDR rendering in Mental Ray. Expect to pay for the privilege, though.



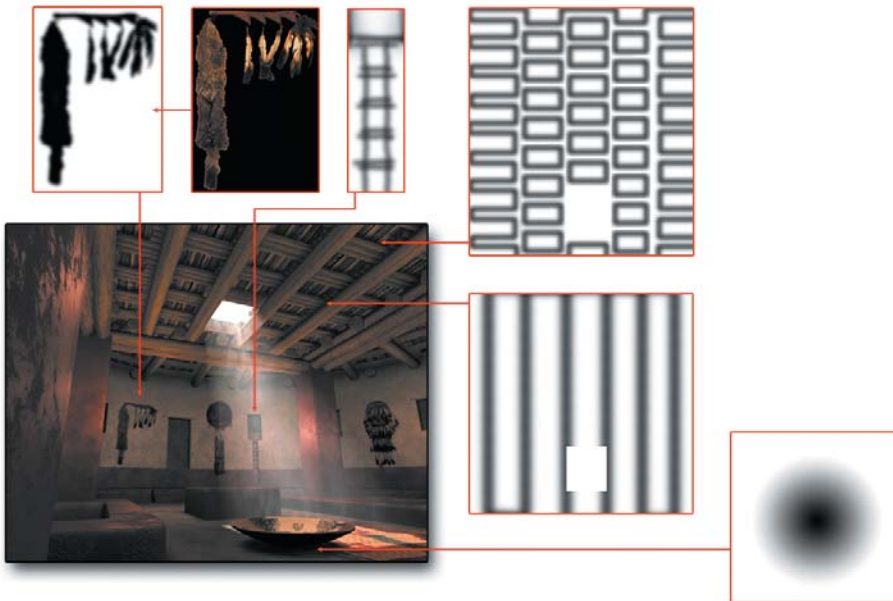
 **HDR GI CGI TLA**

High Dynamic Range is more than another of those geeky three-letter acronyms (TLAs); it is a fantastic way to match CGI into photographic backgrounds using photography itself to act as the only lighting source. At its highest implementation, it relies on Global Illumination raytracing to provide all lighting and shadow into the scene, albeit at a costly rendering expense. HDR can be faked somewhat using GI Joe, mentioned in the previous Killer Tip, but now that Mental Ray is native in Maya, the doors are wide open. To start, acquire an HDR image online, such as those found at Debevec.org. Open Window, Settings/Preferences, Plug-in Manager to check to see if Mayatomr.mll is loaded. Create a sphere and scale it up well past the scene you have created. Now create a Lambert shader, and assign the HDR image to a File Texture mapped to both the Color and Ambient color channels. Make sure your scene objects have Blinn or Phong shading models, as you need reflectivity attributes. Render using Mental Ray, and turn on Final Gathering. Use Draft quality to check results, then try Production quality around the time to take a dinner break. New in version 6.0 is a shortcut for this process. In Render Globals, locate Image Based Lighting under the Mental Ray tab, then press Create to set the entire process up automatically.



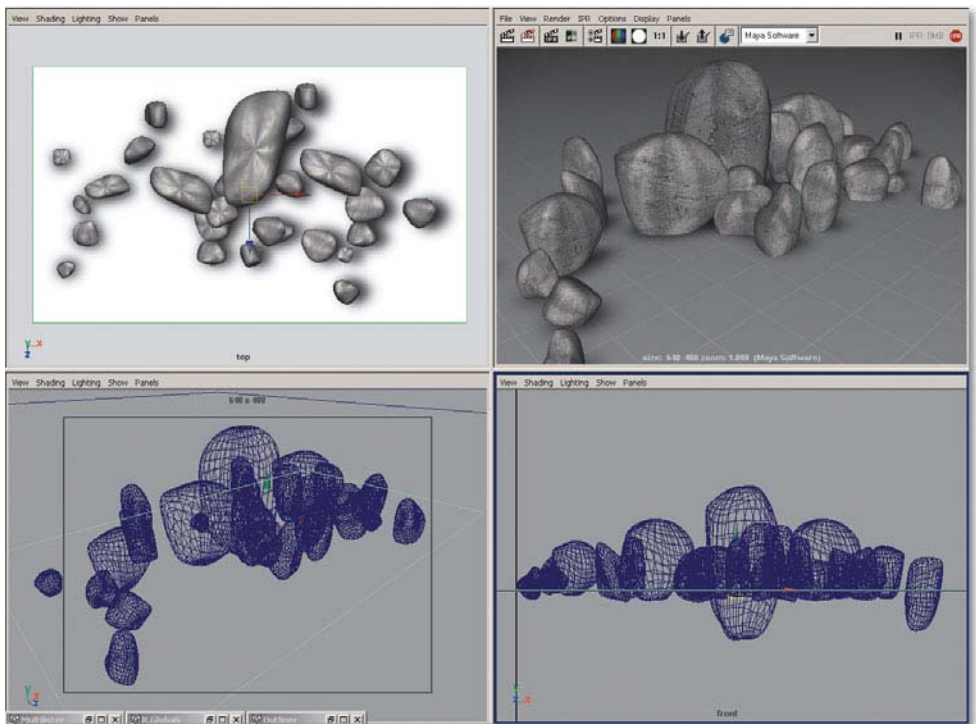
 **PAINT THOSE SHADOWS**

After all that previous discussion on snooty high-brow rendering technique, let's dumb it down (in a good way). Shadows can actually be cheated in a very easy and successful way by painting them in. There are various ways to accomplish this, from painting them into textures to creating shadow planes under objects. Let's look at a great way to add them where you need them using Layered Shaders. In this illustration, soft shadows were required for the beams overhead in this Native American kiva. Rather than use expensive GI, a Layered Shader was constructed with layers of soft shadow images created in Photoshop. Started by screen capturing the top view of the elements, it was pen-path-stroked by an airbrush in Photoshop into a clean layer and saved out as a TIFF file. The Layered Shader in Maya effectively composites the multiple layers, and it can mix shading modes like Lambert and Blinn onto the same surface. Use of Lambert for the shadow layers prevents unrealistic specular washes in the shadowed areas. Shadows on the walls are added by applying a 2d Ramp Texture to the Color Gain of the 2d Texture File, multiplying it down toward the ceiling. Lastly, the woven bowl and structures on the floor have shadow plates below them, to be discussed in the next tip.



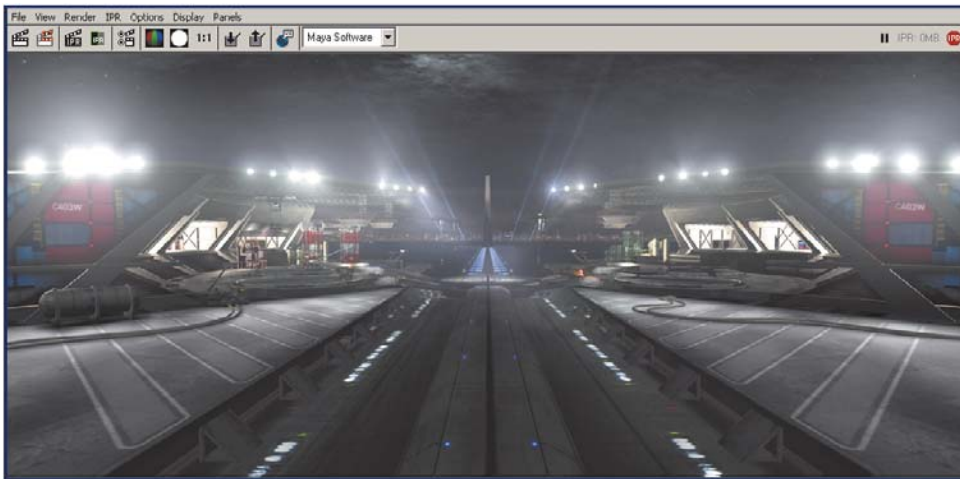
 **SHADOW PLATTERS**

Pronounced Shadow “Plaa-tairs” in French, this highly advanced tip will challenge even the most astute Ph.D. (another TLA). Okay, here we go, try to follow: Create a NURBS or poly plane, position it just above the floor surface and below your shadowing object, and attach a Lambert shader. Make the color black and map a 2d Ramp texture to the Transparency channel. Make the ramp circular or boxed, add a bit of Noise in Ramp Attributes, and render away. You are left with a beautiful soft shadow with virtually no render overhead. If your geometry is complex like this pile of boulders, render it from top view and use a blurred alpha channel instead of the 2d Ramp Texture. Remember to turn off Casts Shadows in the shadow plate’s Render Stats in the Attribute Editor. Tough, huh?

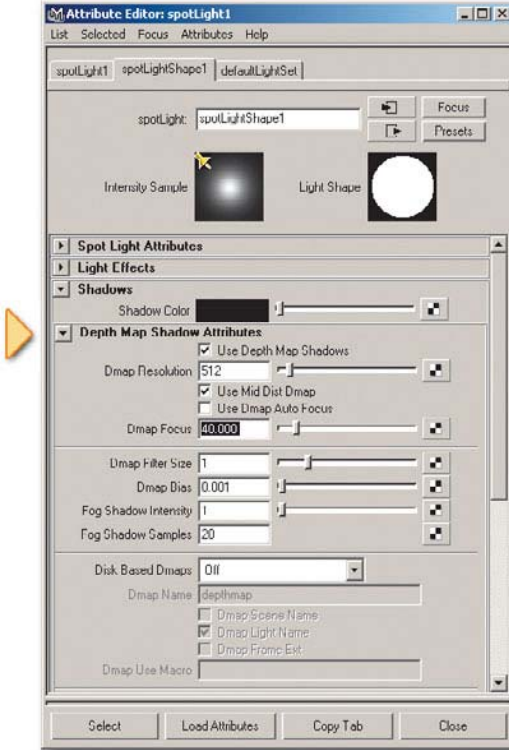


 **GLOWS, FOGS, AND FLARES, OH MY!**

Maya lighting has the unique capability to simulate optical properties such as Glows, Fog, and Flares. These are quite useful in digital sets for their capability to simulate atmosphere and add presence to a scene. The use of fog to cast a visible spread of a spot, coupled with radial Flares or Glows onto the light, adds a great subtlety that contributes to the realism of the scene. Careful use of these effects is necessary, as they do have some pitfalls. First off, Fog effects are always preferable to Glows for a few reasons. Glows and Flares are a post-process render step, which can require large amounts of RAM and additional render times. If Fog effects are set up correctly, they can often match the look of more expensive Glow effects but result in fewer problems due to their true 3D world space description. Also, Glows can flicker on small objects annoyingly due to eye space auto-exposure calculation errors. A setup combination of dummy lights not casting light but contributing Flare, Fog, or Glow components can add greatly to the scene. Often these can be pre-rendered and mapped onto a card using Incandescence Mapping. Or keyframe some animated 2d Fractal Noise into the Color attribute of the Fog, and a convincing atmosphere is guaranteed.



SHADOW MAP WOES



Shadow Maps (Dmaps) are a necessary evil in 3D. They are often fraught with instability and artifact issues, but their low impact on render times makes them necessary bedfellows. The default settings of a Spot light Dmap in Maya produce fast, soft, but not very accurate shadowing. To establish harder or more accurate shadow edges, it is necessary to adjust the parameters of Cone Angle, Dmap Resolution, and Dmap Filter Size. Typically start by narrowing the Cone Angle as small as possible, and then increase Dmap Resolution. If a softer look is required, try to increase the Dmap Filter Size, but beware of long render increases. Realize also that RAM use will rise dramatically with higher resolutions. For more accurate start points of the beginning of the shadow, or to reduce shadow artifacts, try a larger or smaller value of Dmap Bias. For greater stability in animations, always turn off Use Dmap Auto Focus and

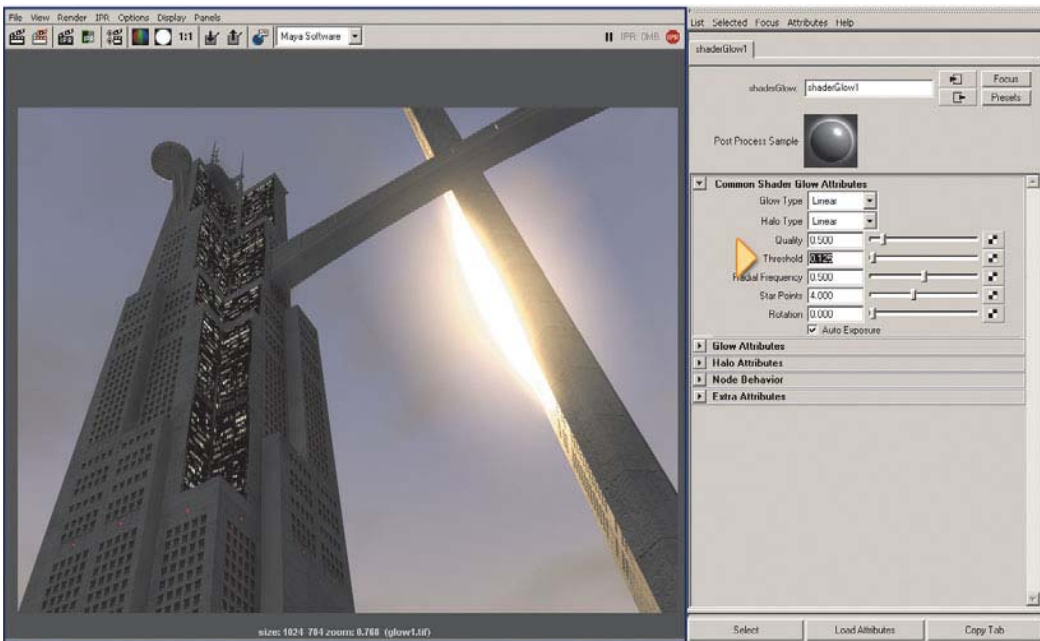
enter the cone angle value here. Often a certain combination is required with these settings, so render only on a selected few objects to test on and arrive at these settings quickly.





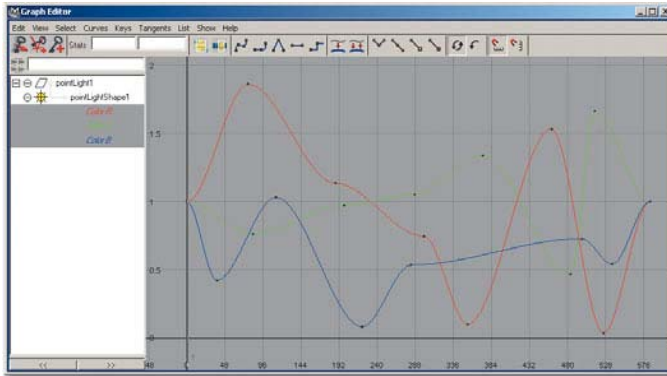
USE OF THRESHOLDED SHADER GLOWS

Shader Glow is a common effect added to a surface that aids the appearance of self-illumination, such as a glowing television screen or car headlight. It adds the appearance of the “blooming” of light due to high contrast or strong intensity. The problem arises as the entire surface equally glows by default, creating the look of an unfortunate nuclear accident on that to which you apply it. A little-known control exists in the Shader Glow global attributes, found as an extra shader ball in the Multilister or Hypershade. Locate Threshold in the Common Shader Glow Attributes, and you will find that as it is raised, only the specular highlights will then bound the apparent glow effect. The end benefits of this technique are to show a light blooming effect in your renders and impress others at cocktail parties.





DANCING FIRELIGHT

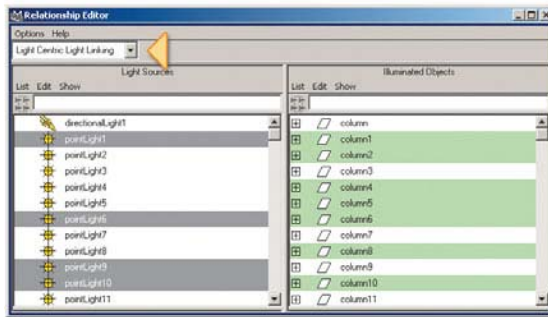


Here is a great, simple trick for animated light from a campfire or candlelight. Place a Point light in the center of your flame and keyframe a rich, saturated color for the starting frame. Advance to the end frame and set a key. Now open the Graph Editor and add multiple keys

across time in all the RGB curves present. Locate a randomizer MEL script, such as RandKey.mel found at Highend3d.com, and use it to randomize all the intermediate keys you just created. Now, because the keys on each of the curves are diverging from each other on the R, G, and B channels, the lighting will change color temperature and intensity during playback, giving an eerie life to the fire that you have rendered.



LINK THOSE LIGHTS



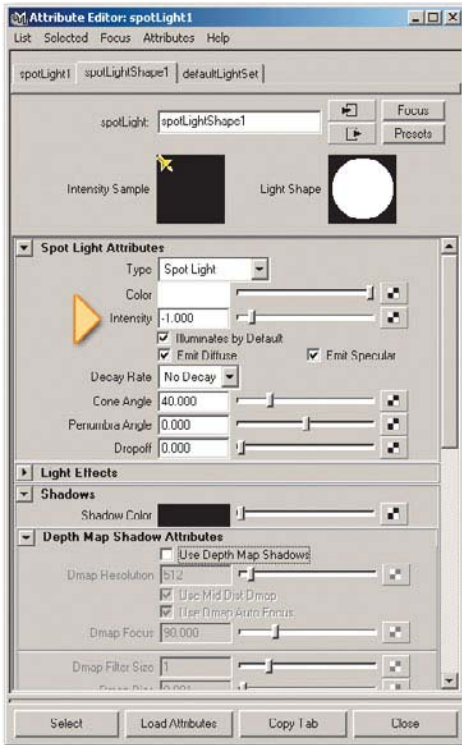
A useful technique to use for greater efficiency or just to get you out of tight places is light linking. Light linking enables a surface to be solely lit by a particular light, effectively pulling it out of the scene. This should be used judiciously, as the scene can quickly look unnatural. At times, though, it is useful for setting up a lighting effect that cannot occur with standard CG direct illumination lighting, such as light transport phenomena of bouncing or washing around objects.

To use light linking, select the surfaces and lights desired and choose Lighting/Shading, Make Light Links from the Rendering menu set. Selecting Window, Relationship Editor, Light Linking gives you the ability to inspect connections and choose Light Centric or Object Centric, enabling flexibility in which is attached to which.





SHADOW LIGHTS

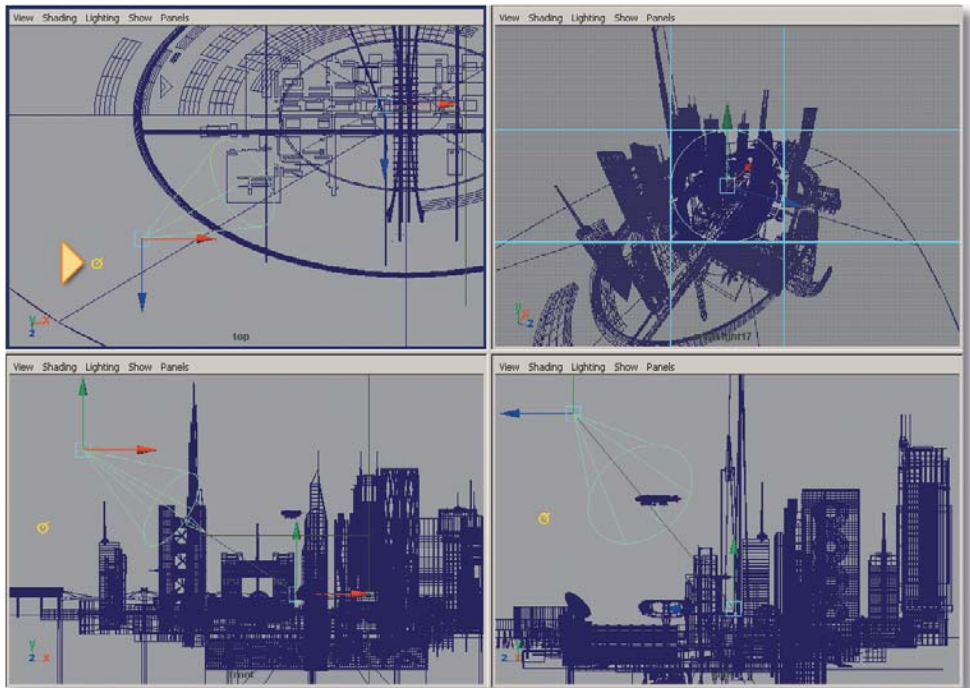


Possibly one of the most useful lighting techniques I use, Shadow lights are indispensable once you get used to them. They effectively enable you to place shadows independently of your lighting, something that a more flexible renderer such as RenderMan excels at. They also are very easy to set up and use. Start by creating a Directional light to provide the general key lighting. Next, create a Spot light of Intensity 1 and turn on Shadow Mapping. Adjust the Cone Angle and Penumbra Angle as you might want it for shadow purposes. Duplicate this light in the same position, but turn off Shadow Mapping and put -1 for intensity. The light components cancel each other out, leaving only the shadow. Group the two together and throw shadows exactly where you want them at any resolution. This is an excellent tip for large scenes where the Shadow Map gets too diffuse for the scale involved. Lastly, try Matt Wood's MWSshadowLight.mel from Highend3d.com; he has made it plug and play by writing expressions between the key Attributes of the two lights. Shadow on!



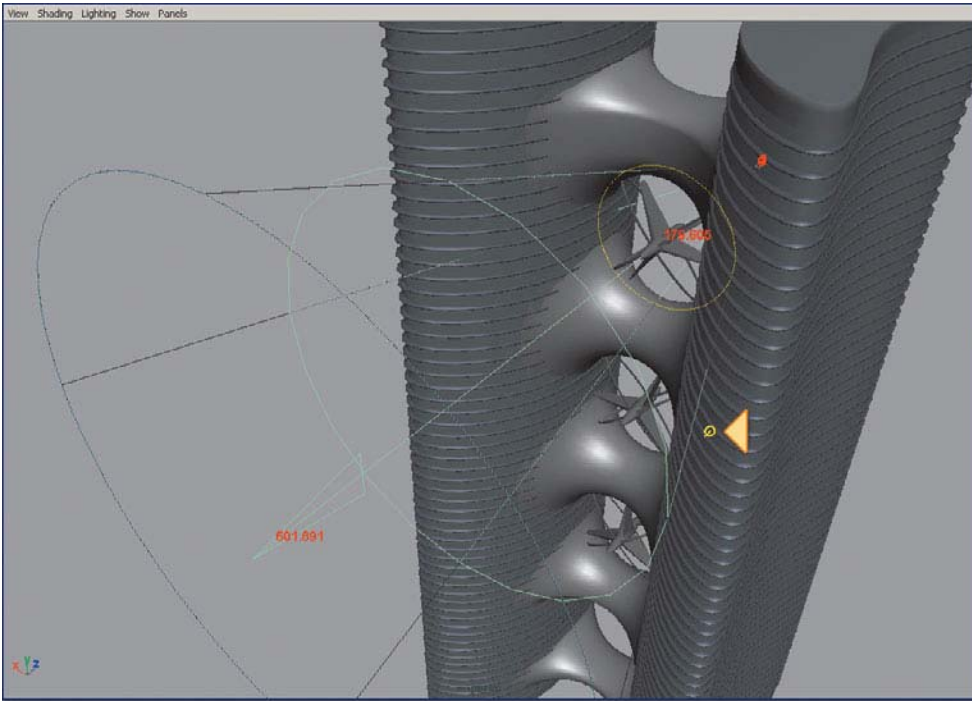
 **LIGHT CYCLES**

No, this is not a reference to *Tron* (that is if you are one of the three people who saw it) but rather a cool feature of Spot lights that may have slipped past you. Select a Spot light and hit the Show Manipulator Tool below the Scale button on the Toolbar, or better yet just hit "T." You are presented with the focus and pivot locators for the light, which is handy in itself, but you may not have noticed the tiny clock icon to the side. It is the Light Cycling Index, a fancy name for a button that cycles through different interactive adjustments for the light, from cone and penumbra width to decay regions. Now use Look Through Selected on the light and notice that it has added interactive barn door edges, making that task very speedy when lighting your homage to *Tron*.



 **SPOTLIGHT DECAY REGIONS**

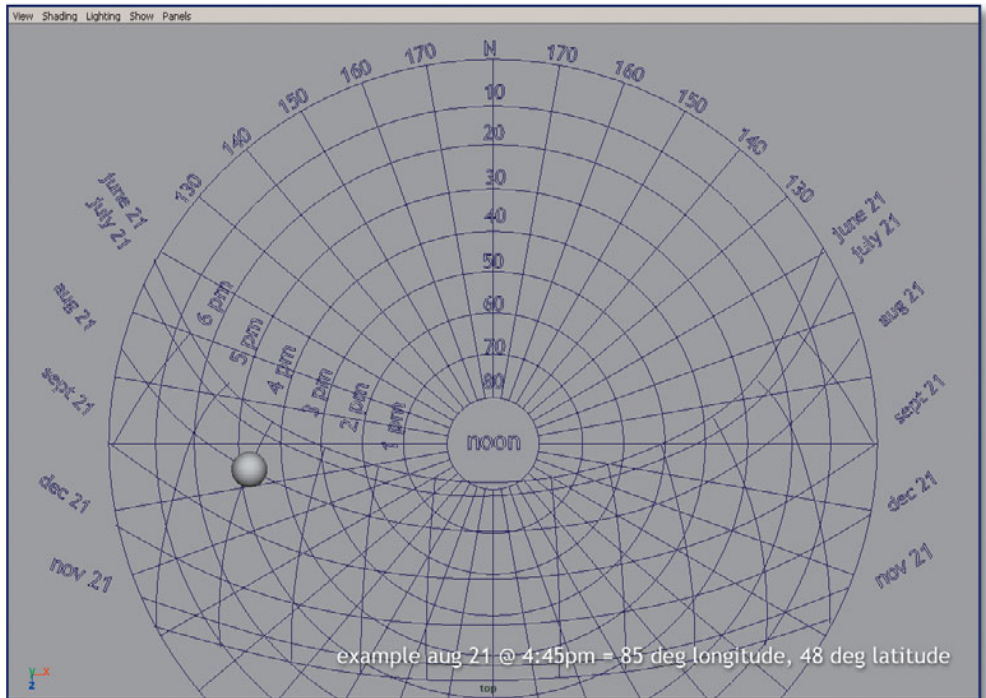
Spotlight Decay Regions are handy when you need well-defined foggy searchlights to light from lampshades. Use the Light Cycling Index mentioned in the previous Killer Tip to display an interactive series of rings that define the borders of where light will occur. Adjust them so that the light begins outward of the origin of the cone so that light and fog are not revealed until appropriate.





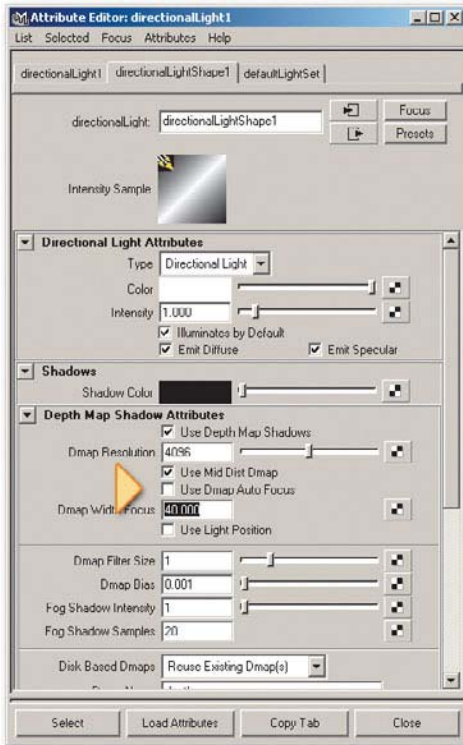
CONSULTING SUN CHARTS

In film work, we are constantly combining CGI with photographic backgrounds, or “plates.” Matching up the lighting so that it is seamless is the real work. It all starts by determining where the sources were during the shoot. On a stage, this can be found by analyzing all of the measurements and survey data usually recorded. But what if the shoot took place outdoors, with the sun as the primary available light source? Some packages have coded in the ability to enter time of day, year, and location to re-create the sun vector direction, but Maya has not added that feature yet. In the meantime, use what architects use to determine solar angles—a sun chart. These can be found online or in solar energy guidebooks. Follow the time of day and year to locate the associated bearing and azimuth angles, and then use those to set the rotation of your key light. Shadows and highlights should now play well with each other. This is an inevitable MEL script to be written—any takers?





DIRECTIONAL SHADOW MAPS

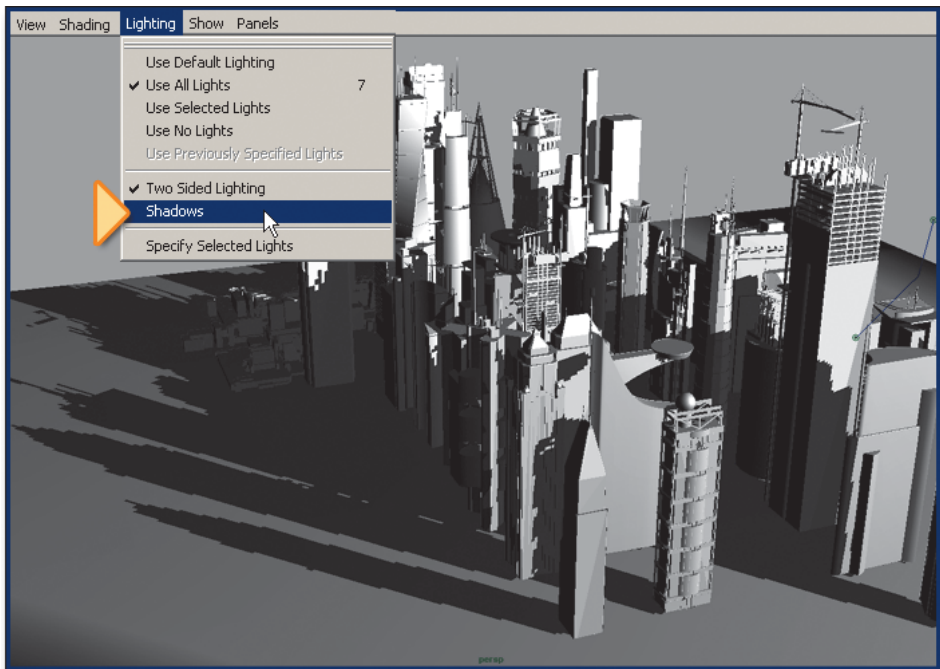


The use of Shadow Maps with Directional lights poses a problem. They look good, as the shadows look more uniform and parallel, but it is often very hard to get decent resolution. It is not hard to see why if you realize that the spread of the map is applied based on the largest object in your scene. It you are rendering a still life of a bowl of fruit, that is fine, but if you are rendering the island of Manhattan, one shadow pixel may spread across a street. Luckily, Maya gives us an option to apply a reduced cone angle to the spread, Use Dmap Auto Focus. Uncheck it and key in a smaller number, based in degrees from the centerline of the directional. The Directional light now begins to act like a Spot light, so position matters for proper application of shadows. The Use Light Position switch uses the location of the light to determine if objects behind or in front are considered in the shadow map. If lack of resolution still poses a problem, consider using the Shadow light technique described in a previous Killer Tip in this chapter instead.

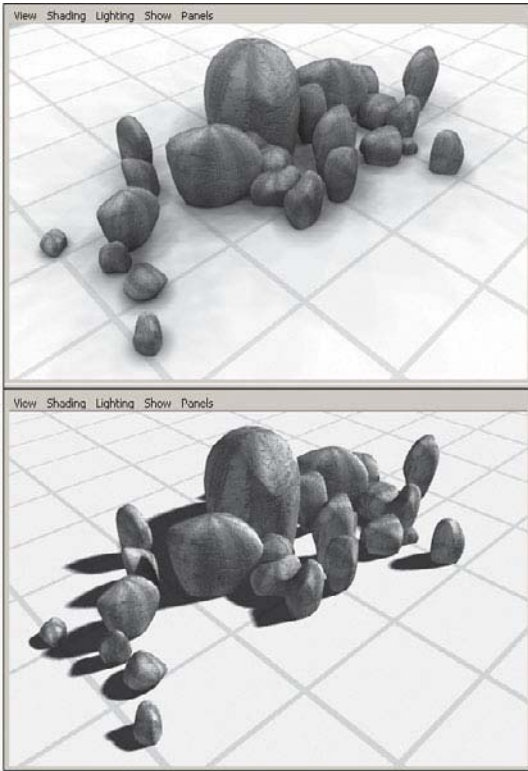


 **SEE YOUR SHADOWS**

When lighting a scene, it's often difficult to see how your lights are behaving in your actual scene until you go to render it. More often than not you will have to readjust your lights because the shadows being cast are working against your well-earned composition. How great would it be if you could see your shadow in real time in your viewport so you could make all those crucial adjustments beforehand? Look no further, hit 7 (use hardware lighting), then choose Lighting, Shadows from your Panel drop-down menu. Your graphics card will do the rest, and project hardware shadows from your lights, thus eliminating all the guesswork from shadow composition. Now swing your lights around in real time for the real fun. Just remember that more expensive cards will really come into play here.



 **HARD OR SOFT LIGHT**



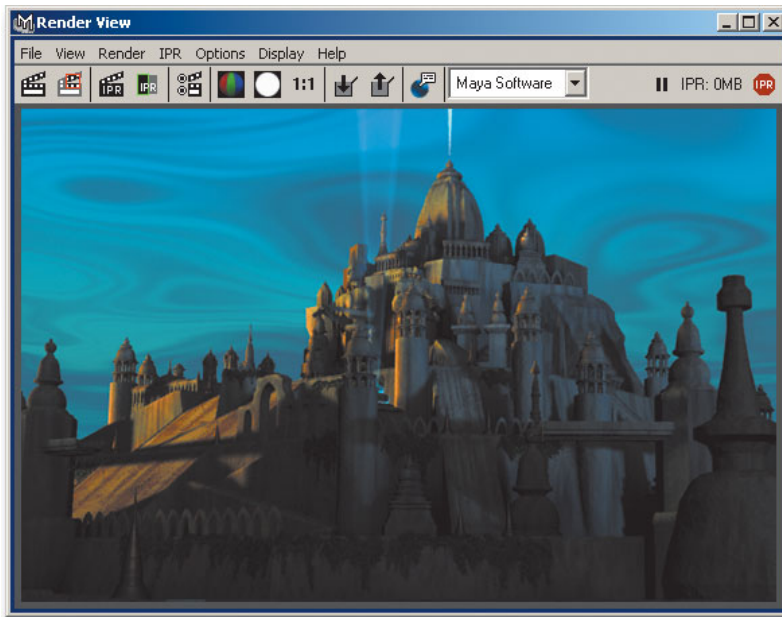
One of the primary tasks of a Director of Photography, aside from setting proper film exposure levels, is to define the feel and quality of the light, in order to reflect the emotional intentions of a script. The primary way this is done is to establish whether the light is seemingly soft or hard in its behavior. In CG terms, this relates to a sense of diffuse or specular light. For physical stage work, this can be controlled by gobos, cookies, scrims, and diffusers. You don't have the luxury of such devices, but certain Maya 6.0 tricks can mimic these qualities. The earlier tip "Cookies and Gobos" in this chapter describes ways to mimic a gobo light distribution, but these do little for a sense of softness. There are a number of ways to achieve soft qualities with normally all-specular CG lights: First, you can manipulate shadow maps; next, you can play with light decays, area lights, or light domes; last, you can

use the correct simulation of true global illumination. GI can still be prohibitive, so let's look at standard CG lights. For basic softer shadows, shadow map resolution can be turned down, but there will be an innate loss of accuracy and aliasing. It is better to turn Dmap Filter Size to 3 or 4 in the Depth Map Shadow Attributes, but be ready for a hit in render time. This will also not establish a transition of hard to soft at a shadow's terminus, so use of an area light may be in order. Area lights are nothing more than a close-knit group of point lights, so the shadow implications are severe (see the tip "Fear of Point Light Shadow Maps" in this chapter). A great alternative to area lights are cubic arrays, explored in the tip "Cubic Point Arrays," also in this chapter. Next down the line is the use of light domes (see the tip "Poor Man's Global Illumination" in this chapter), which is usually a good solution to general soft illumination. For the brazen and bold, true raytraced GI using Mental Ray or the like is the most accurate and convincing, but nothing comes for free, especially GI, come render time.



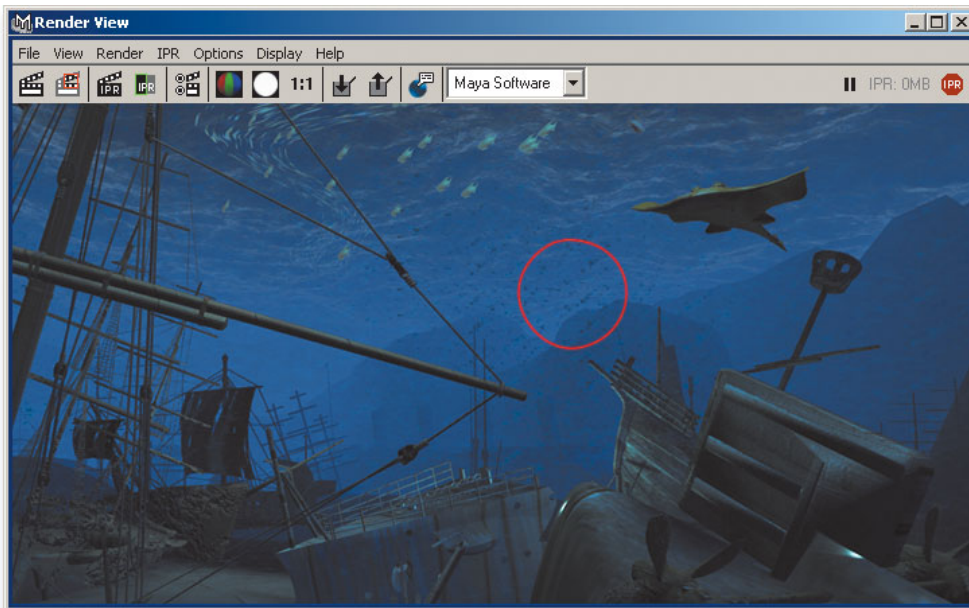
 **BE WARM AND COOL**

This is one tip where we can learn from the boldest and simplest graphics in commercial art, comic books. Comic artists are limited in the range of color or tonal options they have to work from, so they rely on the oldest principle in art, that of warm/cool color opposition. This approach states that the key light should be warm in hue, while the shadows should go cool. This diametric opposition psychologically establishes a feeling of depth to an otherwise 2D image. The nice thing about applying this principle in CG is that you have lots of avenues in which to integrate it. The easiest is to add a yellow-orange hue into your primary key, and cool blue into your fill sources or shadow color. This is certainly something to always add to your scenes to some degree, but much more subtle ways of implementing this dynamic hue shift exist. To give your specular sheens much more life, map a basic 2D Fractal Map to the Specular Color in a shader's Attribute Editor. Turn the UV repeats down to 0.12, 0.12 for better scaling, and then turn the fractal Amplitude to somewhere around 0.4 to reduce contrast. Now open Color Balance and open the color editor for Color Gain. Put a saturated warm hue on it and a saturated cool hue on Color Offset. Now the specular highlight will maintain to white, but will transition into warm then cool, creating richly hued specular behavior when the object moves. Another area to implement warm/cool is in global illumination, where the HDR fill lighting sphere is held cool, while an added key light can be made warm.



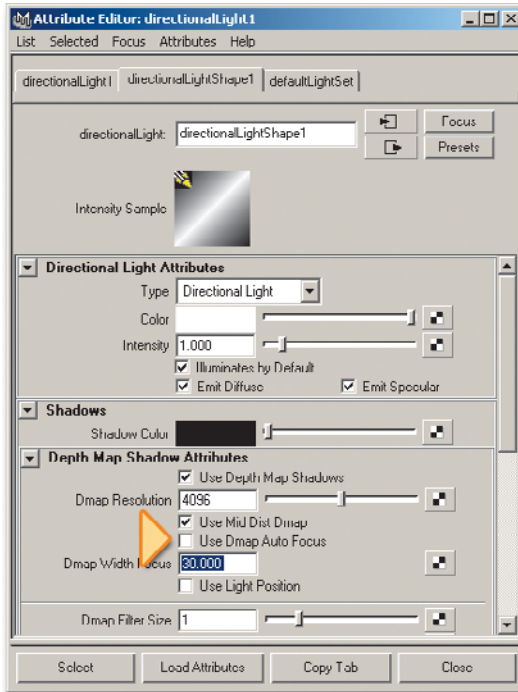
 **CHEAPO FOG PARTICLES**

Here is an age-old hack (er, highly advanced technique, that is) to add a sense of volume to underwater scenes. Underwater appearances require a strong sense of environmental fog with a fast dropoff, caustic light rays, and particulate matter to animate and convey a sense of current and movement. In regard to the latter, particles can be used to convey the particulates, but a much easier method uses foggy point lights. Start by establishing the basic environmental fog appearance and caustic light rays. Now drop in random point lights around and near the camera, switching off *Illuminates By Default* in its Attribute Editor. Put *Decay Rate* to *Linear*, and add *Light Fog* by pressing the checkered *Texture Map* button next to that field. Now edit the *Fog Color* to a blue-green similar to your environmental fog coloration and map a *2D Fractal Map* to *Density*. Map a *2D Fractal* to the *Density* in the Attribute Editor, and raise the *Threshold* to a value of 0.8 to 0.9. IPR render the scene to adjust quickly. There should now be a good simulation of discrete particles just from the randomness of the thresholded fractal noise. Complete the trick by gently animating a sway and bob to the point lights, then add fish and shipwrecks to suit.





DIRECTIONAL LIGHT SHADOW MAPPING



One of the advantages of directional lights is that they can cover vast areas of a scene very easily. One of the disadvantages is that they are a lousy way to cast a shadow map. They evaluate the full extent of the entire scene in order to calculate how to spread out the map across everything. The problem arises if you are modeling a cityscape of large worldspace; one shadow map pixel may take up the size of a building or car, even with an 8000 pixel resolution. Maya provides one way around this by unchecking Depth Map Auto-Focus in Depth Map Shadow Attributes. Now an angle of view can be input into the Depth Width Focus field in order to narrow down the spread of the width considerably and get more resolution where you need it. Note the check box for Use Light Position to help center the position of

the map. Better yet, use Shadow Lights (tip of the same name in this chapter) to put shadows exactly where you want them, independent of key light position.



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