HYBRID
ANIMATION
INTEGRATING 2D AND 3D ASSETS

SECOND EDITION

TINA O'HAILEY

Hybrid Animation

Tina O'Hailey brings her real work experience from Disney and Electronic Arts to make this a solid reference for the animator or producer doing hybrid animation for the first time or a pro double-checking that they have accounted for everything in the pipeline. The book combines the best how-to specifics with the creative theory behind the best animation today. You can envision the creative and aesthetic sacrifices that are inevitable without the knowledge from the detailed industry examples in this book. Excellent breakdown of the challenges of integrating 2D and 3D animation so it all works together in the end.

—**Craig Caldwell**, Ph.D. USTAR Senior Research Professor, Digital Media Cluster Arts Director, Engineering Arts and Entertainment Film & Media Arts Dept. & School of Computing, University of Utah

Tina's experience and confident, professional hand is well represented in this book. It's hard to find a text that reads like friendly and informed advice rather than a map to a programmer's labyrinth. This is a great mix of practical, artful and anecdotal events that add up to a truly valuable book. Even if you're only vaguely interested in creating or producing hybrid animation, this book is sure to stir your enthusiasm.

—**Rob Bekuhrs**, Animation Director, SuperGenius Studio

Opening with the question of why one would use hybrid animation techniques, this book affords the reader rare insight into the creative and technical processes of merging traditional drawn and CG animation. With Tina's hands-on experience working and teaching in animation, these concepts are now presented as a series of practical exercises, supported by examples from world class animation studios where such techniques have been used. The film studio examples alone are a visual treat undocumented elsewhere. Tina's book will surely become a classic animation reference for many years to come.

—**Eric Guaglione**, Supervising Director of Rovio Entertainment

The first edition kept its eye on the ball, emphasizing the notion that no matter the combination of tools or techniques animation is always about the performance! This new edition expands on that tradition by bringing updated and refined examples and discussion to bear. A must-read for anyone involved with hybrid animation.

—**Marty Altman**, Professor, Savannah College of Art and Design (SCAD)

Hybrid Animation

Integrating 2D and 3D Assets

Second Edition

TINA O'HAILEY

Professor and non-professor friends, amazing students, patient family; I thank you.

   … tina

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Extra special thanks to:

- Brent Morris for technical editing of every single tutorial. "Aweshum! ^_^"
- Chelsey L. Cline for amazing, thorough checking of the text from front to back and

every single button click and missed comma in between.

- Daniel Tiesling for wonderful models and rigs: on time and exceeding expectations.
- Jason Walling and Clint Donaldson for their overwhelming dedication to *Jaguar McGuire* and all of its challenges.
- Claire Almon for her amazing work.
- Dianna Bedell for work, on time and with a smile.

Cover image: Paul Tillary's M.F.A. thesis film *Thunder Cluck*
You can see the film here: http://www.thundercluck.com/

Dear Reader,

Welcome to the second edition of *Hybrid Animation.* There are a lot of changes, so my apologies if you were using this for a textbook; you'll have to update your reading assignment page numbers. The first edition of this book was based on a class I taught at SCAD, the Savannah College of Art and Design. I'm happy to say that class is no longer in the catalog. Why does that make me happy? Because hybrid animation as a concept has been woven into our complete curriculum; the concepts are taught from day one and not pigeonholed into one elective. You'll note a similar concept throughout the industry, I hope. It's all animation. It just doesn't matter anymore what you are animating with. However, there is a trick to combining mediums and that is ultimately what our journey together is to discover.

Then the questions to ask are: what are the different ways those mediums are usually combined? What techniques do you use? What problems do you need to overcome? What do you need to watch out for? Why do it at all?

In these pages we will answer these questions and more. I break things down in patterns, repeatable patterns. We'll explore different software solutions for each pattern. Then with a little practice, you can mix and match the techniques for your own films. Don't see a specific software in these pages? That's OK. I'll bet you can find a pattern or technique that matches your workflow and then, coupled with a few tutorials on how to use your specific software, you can come up with the answer. Certainly, problem solving is our biggest quest.

I can't wait to get to the fun.

Warmly,
… tina

Companion data can be found: www.hybridanimation.com
Software versions used in this book:
Tutorials are created with Maya 2014 (PC/MAC) (in most cases the Maya files are saved in 2011)

Adobe Bridge CS6
After Effects CS6
Adobe Flash CS6
Adobe Media Encoder CS6
Autodesk Smoke 2013
Corel Painter 12
Nuke 7.0
Pencil Check Pro V 7.4.0
Photoshop CS6
Toon Boom Animate 3
Toon Boom Animate 3 Pro
Toon Boom Harmony

Contents

About the Author

The author is a mild-mannered mother of two who seeks respite in the mountains with her family, on a bluff overlooking a wooded valley. Her education includes a BFA in Computer Animation from Ringling School of Art and Design. (It was called Computer Graphics at the time and the school is now called Ringling College of Art and Design, but the sentiment is still the same.) She also holds a MSCIT degree in Object Oriented Programming from Regis University. When not wearing flannel, jeans, and a floppy hat, she can be found wandering the halls or teaching in the classrooms of SCAD's campuses, both Savannah and Atlanta, and sometimes Hong Kong.

She is currently the Dean of Digital Media at the Savannah and Atlanta campuses of SCAD. O'Hailey still considers herself a professor who happens to want to schedule classes and see that the "pipeline" of learning for the students is streamlined and worthy. She enjoys being in the classroom and learning new things and making the students laugh while they learn. Her hobbies include caving, motorcycles, and baking. You can keep updated with her latest work at: http://coffeediem.wordpress.com/

Tina O'Hailey. Photograph by Mark Ostrander

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Hybrid Animation

What and Why?
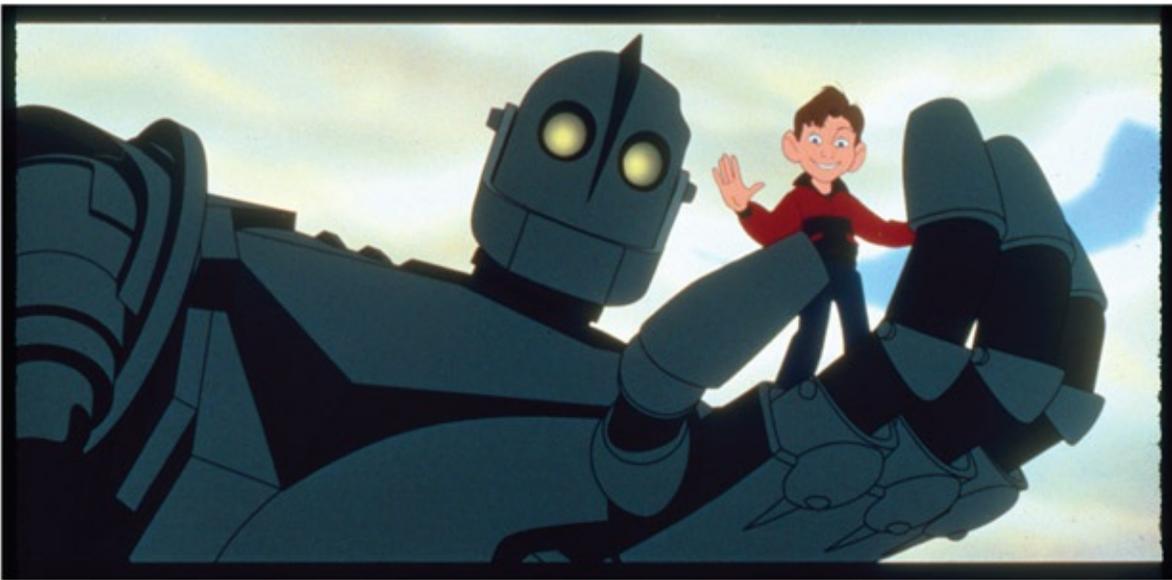
FIGURE 1.1 2D character interacting with a 3D character, *The Iron Giant*

What is Hybrid Animation?

Hybrid animation is the combination of 2D and 3D animation mediums. 2D and 3D animation mediums can be used, and are used, independently of one another. Pixar's *B.O.O.: Bureau of Other worldly Operations* or *Inside Out* are completely 3D animated films. Disney's *Little Mermaid* and Miyazaki's (Studio Ghibli) *The Wind Rises* are completely 2D animated films.

Yet, ever since the first appearance of a 3D glowing bauble in a 2D animated film, Disney's *The Black Cauldron*, artists have been finding inventive ways to combine the animation

mediums. The use of 2D/3D at Disney predates *The Black Cauldron* and can be seen in a short test done by John Lassiter titled *Where the Wild Things Are* (1983). In Japanese animation, 2D/3D can be seen as early as *Princess Mononoke* (1997) and *Ghost in the Shell* (1995) and as recently as *Berserk Golden Age Arc 3 Descent* (2013).

FIGURE 1.2 The bauble from Disney's *The Black Cauldron* (1985) was one of the first 3D elements to be combined with 2D animation

© 1985 Disney

What combinations of 2D and 3D are there? Rendering characters in different mediums is the first type of combination. Some of the earliest examples can be found in the Academy Award– nominated short *Technological Threat* (1998) and also in a wonderful short film produced at Disney's Florida Studio called *Off His Rockers* (1992). In feature animated films, probably one of the most memorable combinations of mediums is found in Warner Bros.' *The Iron Giant* (1999), in which a young boy befriends an alien robot; the robot being 3D in a 2D animated film. However, characters themselves do not need to be completely rendered in one medium or another, as was the case with the character John Silver in Disney's *Treasure Planet* (2002), or the bicyclists in *The Triplets of Belleville* (2003). In those films 2D characters were drawn with 3D appendages rendered to match the 2D portions. Most recently, the overall characters themselves can be a combination entirely of 3D and 2D as was seen in Disney's Oscar-winning short *Paperman* (2012), where the animation was created in 3D and then 2D animation was done overtop of the 3D. Lastly, the most common use of combining mediums is for non-character animation elements. This combination of 3D elements into 2D animation is seen in almost any modern 2D animation: *Mulan, The Simpsons, Family Guy,* and *Futurama,* to name a few.
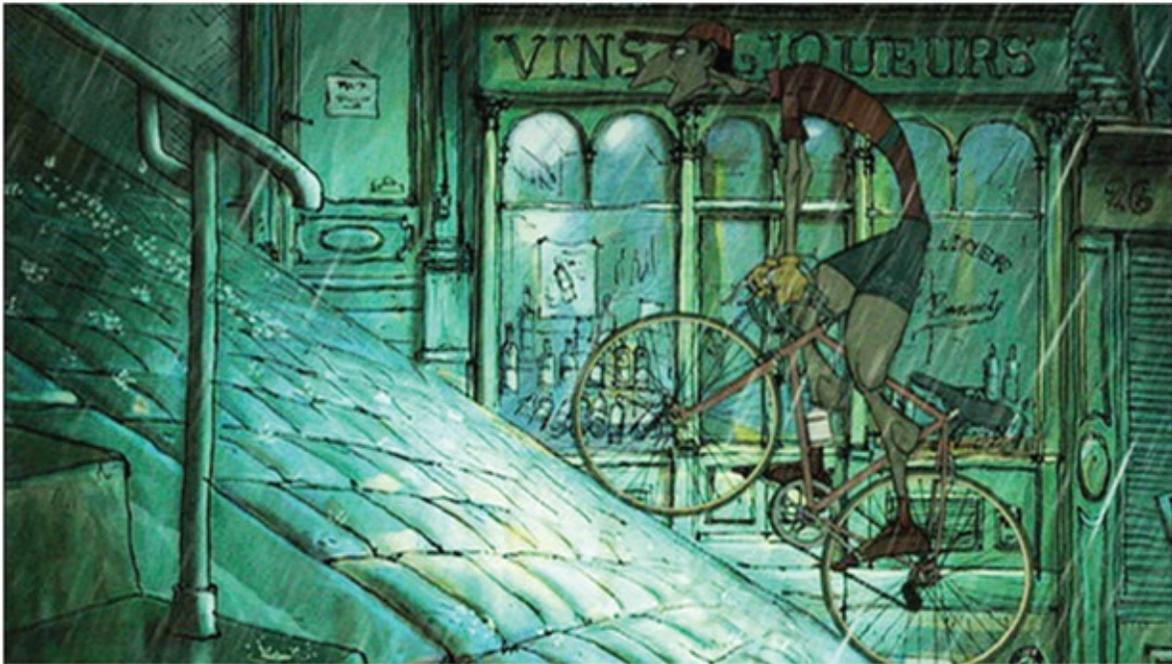
FIGURE 1.3 2D character with 3D parts riding a 3D bike found in *The Triplets of Belleville*

Now, let's clarify exactly what 2D and 3D animation assets are and how they are created, just to make sure we are all clear. You might be proficient with a few of these creation methods. During the course of this book, hopefully, you will find yourself experimenting with other methods. A large, looming goal of this book is to show you the path to fearlessness and flexibility with software, because at the end of the day, it is animation—that's all.

2D animation assets are images that exist only in two dimensions during creation; a very academic definition. How the 2D images are created is the interesting part that must be dealt with in your pipeline. These images can be created in the birth tradition of animation using pencil and paper and then scanned into a computer for compositing. Traditional animation artists have had great success in drawing their images digitally using software such as Photoshop, Flash, or Toon Boom, to name a few. Other ways of creating 2D animation images include painting on glass, drawing in sand, scratching on film, or other flat methods of creation. All of these methods fall under the 2D animation category.

FIGURE 1.4 2D traditional character "M.E.," animation (red) by Tina O'Hailey, cleanup (graphite) by John O'Hailey
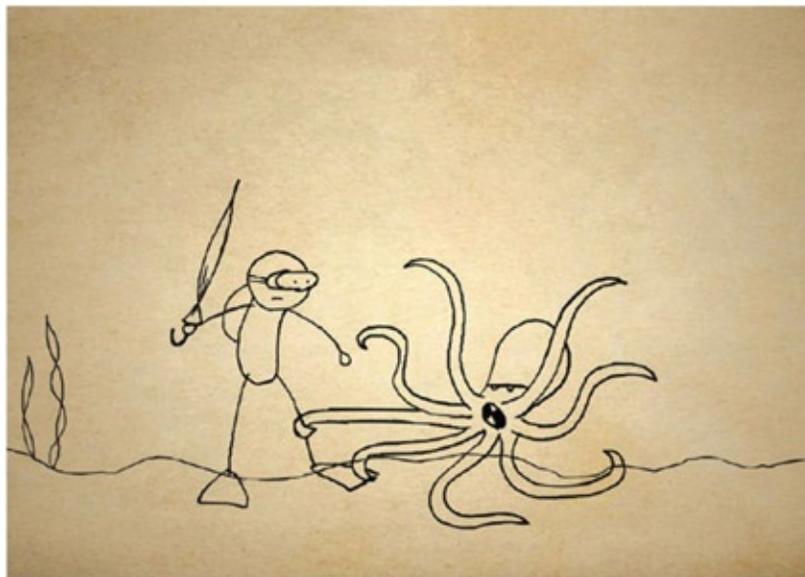
FIGURE 1.5 Image from "How to Throw a Jellyfish Party" drawn and animated in Flash by Dan Murdock, 2008, Digital Cel I Course, SCAD

3D animation assets exist in three dimensions during the creation process. More academic-speak, but look at the key phrase: "during the creation process." Live-action film would come under this category if we were not limiting ourselves to animation assets. 3D animation assets include digital and stop-motion animation. Digital animation can be created in 3D software packages such as XSI, Maya, Max, or a multitude of other lower-budget software such as Blender, Wings, and the like. Stop-motion is the process of animating tangible items in front of

a camera, usually poseable puppets made of clay, silicon, or other materials. There is a sub-category of stop-motion called pixilation, which uses live objects, recorded frame by frame, to create an animation.

FIGURE 1.6 3D character modeled by Erik Minkin, 2014, SCAD

Since we are focusing on animation and not live action, combining film or video with 2D or 3D animation is beyond the scope of this book. However, the same problem-solving concepts and compositing techniques covered in this book can be applied toward combining live action and animation.

Why Use One Medium Over the Other?

Artists' imaginations continue to grow and stretch the boundaries of animation to tell stories. It can become difficult to decide which medium is best to tell the story. Sometimes, fad decisions are made based on the newness of a medium.

To take an objective look at the decision, these following five reasons show why one medium might be preferred over another:

- Visual target not subject matter
- Line mileage
- Complexity
- Team skills versus production schedule
- Physical assets and budget

Visual Target Not Subject Matter. The visual target or visual style of a film is a large factor in deciding which type of medium will be chosen. It is no longer the subject matter that is the deciding factor. The division between what medium is best for what subject matter has become so blurred as to be nonexistent. 3D software techniques have advanced so that humans, furry animals, and other warm-looking creatures are no longer out of their grasp. Which medium lends itself best to the artists' final vision is the question to ask. This will be answered with strong art direction and experimenting during pre-production.

Line Mileage. "Line mileage" is a term meaning how much line you have to physically draw. If you were to take a traditional drawing and stretch out the lines end to end you would see what your "line mileage" is. Every millimeter more of pencil or digital line takes more time to draw. Intricate character designs may look good as still images, but the reality of animating such a character is time consuming. A character with long, curly hair, wearing a wrinkly overcoat, multiple ammo straps over his shoulders, and a striped shirt has extra line mileage. It is difficult to keep so many lines moving well without seeming to crawl, pop, or distract from the animation.

FIGURE 1.9 Line mileage is how much line must be drawn, shown here by stretching out the drawing end to end

If a traditional medium is chosen and the animation is fully animated, line mileage is looked at very closely and characters are simplified in order to minimize the line mileage. An example: on a fully animated film, such as Disney's *Lilo & Stitch*, the character Nani's t-shirt had on its front a coffee cup design. The design was simplified to a heart in order to lower the line mileage. This may not seem like a large simplification. Given that Nani was in so much of the movie, the seemingly small simplification along with many others added up to less time spent drawing. Anime characters can be designed with more detail since the animation style dictates minimal inbetweening of the characters.

A common multiplier of line mileage is crowds. If a traditional animated film calls for crowds of people, that is a ton of line mileage. In order to simplify the line mileage, many 3D crowd techniques have been used. 3D crowds were rendered to match the 2D line style in Disney's *Hunchback of Notre Dame* and with the Hun charge in *Mulan*. Another method used is to procedurally populate a 3D world with 2D animated sprites; this method was also used in *Mulan*. *The Simpsons Movie* used a similar technique of moving a 3D camera move through a 2D crowd.

FIGURE 1.10 Disney's *Mulan.* The palace scene used 2D animation, crowd placement in Maya, 3D fireworks, and compositing software to create this hybrid shot

© 1998 Disney

Complexity. 3D has successfully been used to animate complex elements that are difficult to animate *believably* using traditional methods. Objects shown in perspective or having intricate textures and details can become distorted when drawn in 2D. An early example is the magic carpet in *Aladdin.* The carpet was designed with an intricate texture that needed to bend and move as it animated. The carpet, needing to match a 2D style, was animated in 2D as a template and reanimated and rendered in 3D so that its texture moved believably. In Disney's *Brother Bear,* the moose's antlers proved to be difficult to draw in perspective. In [Figure 1.11](#) Broose Johnson and Tony Stanley animated the antlers in 3D to match their 2D moose animation. The 3D animation was then used as a template and redrawn in 2D.

[FIGURE 1.11](#) 3D antlers were animated and then redrawn in 2D using the 3D as reference. Disney's *Brother Bear*

© 2003 Disney

Team Skills versus Production Schedule. A reality is that you might have a team of artists who are not comfortable with the medium you want to use. If you do not have a production schedule that allows for training and retooling for different mediums, it will ultimately sway the medium choice. Students can relate to this as well. Often they find themselves up against a project deadline and opt for the medium they are most comfortable with instead of experimenting with new mediums. As a side note, this is a cyclical issue: the medium an artist puts on his reel is more than likely the medium he will get a job in. Unless the artist finds himself on a project that has the budget and time to allow training in a different medium, he may find jobs scarce should a fad show animation studios favoring one medium over another.

Physical Assets and Budget. Having or not having the budget to purchase the physical assets you need for a given medium will certainly sway what your production decisions are. What is the cost of a given medium? Is one less costly than another?

Physical asset costs for the different mediums, when compared, are varying. The cost of computer animation software has steadily made the software more accessible to the general public; however, 3D studios are costly to set up and even more costly to maintain. Stop-motion or model animation costs are close to that of traditional 2D animation, and traditional animation's costs can be kept low with homemade light tables and self-punched paper. As with any business, physical asset costs can be as little or as much as one wants to spend.

Ultimately, the largest cost is that of time spent on the project and the number of artists needed to complete the project. Digital processes have tried to answer this "time is money" issue. 3D studios, theoretically, can recoup part of their cost by having smaller crews. Paperless or digital 2D animation is slightly cheaper than 2D animation using paper since the digital process saves time by allowing easy sharing of art assets and bypasses the scanning process.

Once a studio is set up and running in a given medium, adding another medium incurs additional costs. For example, the small studio that creates *The Simpsons* television series (writing, story, and keys) in LA has small budgets and extremely quick turnarounds. However, they also created the larger-budget *The Simpsons Movie.* In that movie there was a large amount of 2D/3D. Naturally, after that exposure to 3D the crew began to incorporate 3D more into the television show. A traditional pipeline that has a low budget may be extremely hesitant to take on any different and possibly expensive technique. Such requests can certainly concern the accounting department due to the extra expense.

What is the Main Problem of Combining the Mediums?

Once a decision has been made to use multiple mediums, the problems of how to produce

the shots loom large. It is very important to work out the following pipeline issues so that the production can be successful:

- Style matching
- Registration
- Frame rate and image format
- Timing
- Image sizes
- Alpha channel

FIGURE 1.12 Pipeline test of 2D character walk cycle with 3D head by Claire Almon, 2007, 2D/3D course, SCAD

Style Matching. During the pre-visualization stage of production, experimentation will need to take place. Multiple software, drawing methods, combinations of the mediums, and postprocessing effects need to be compared to one another to see which pipeline will most easily achieve the visual style set forth by the art director. Do you need to use vector lines? Can you get away with raster? Can you do this procedurally?

It is important that all experiments be well documented. What was the workflow to get the artwork from the concept to the final render? Did it achieve the visual style? At times a different visual style will be achieved, one not correct for the present project but useful for something in the future. Other times a method will not work—the technology will not be advanced enough yet. Sometimes it only takes a half a year for the technology to catch up and for the next project you will have a half-developed technique that can be reapplied and tested.

Having a small team of enthusiastic risk takers who are unafraid to experiment with technology and artistic techniques with an eye toward creating stunning visual results is necessary. The techniques found in this book will help you become one of those enthusiastic risk takers.

FIGURE 1.13 Concept art for Poison Tree, 2D/3D group project, 2008, SCAD
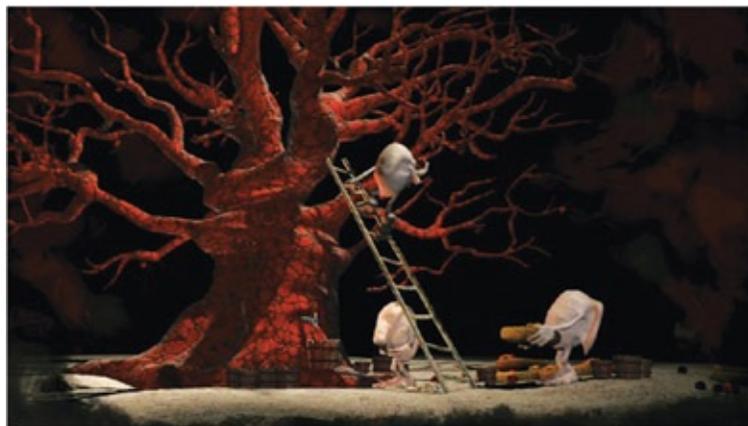

FIGURE 1.14 Final image from Poison Tree, 2D/3D group project, 2008, SCAD

Registration. Registration refers to when one object touches another in the scene. For example, when the 2D character Hogarth climbs into the 3D robot's hand in *The Iron Giant*, where they make contact is the registration line. In the past, having a 3D object contact a 2D object was a large registration issue that was nearly impossible to overcome. 3D objects had to be printed out and pegged onto animation paper. This process is error prone the moment the printer spits out the first page. The printer itself does not print a well-registered image; the pegging process cannot be perfect enough. The 2D animator must register his 2D art to this wobbly reference image. This method is what was used on *Mulan, Lilo & Stitch*, and countless other animated films. With dedication to detail it *is* possible to produce well-registered images this way, though this method is very difficult. Technology has advanced and now that Wacom tablets, Cintiq tablets, and paperless animation have arrived, the printing pipeline for registration is no longer necessary (unless you have budgetary issues).

However, even with the introduction of the Cintiq and Wacom tablets, registration is still an

issue that can belittle the 2D/3D compositing efforts. If the artists are careless in regard to the registration lines, in other words if the artists have sloppy draftsman-ship, all the technology in the world cannot save the shot.

Each combination of elements requires a different pipeline to obtain the best registration. Depending on which element "leads the movement" in each shot, the 3D element will have to be drawn first or the 2D element will have to be drawn first. In the coming chapters, as we cover the common combinations of the mediums, we will also highlight the pipeline needed for proper registration.
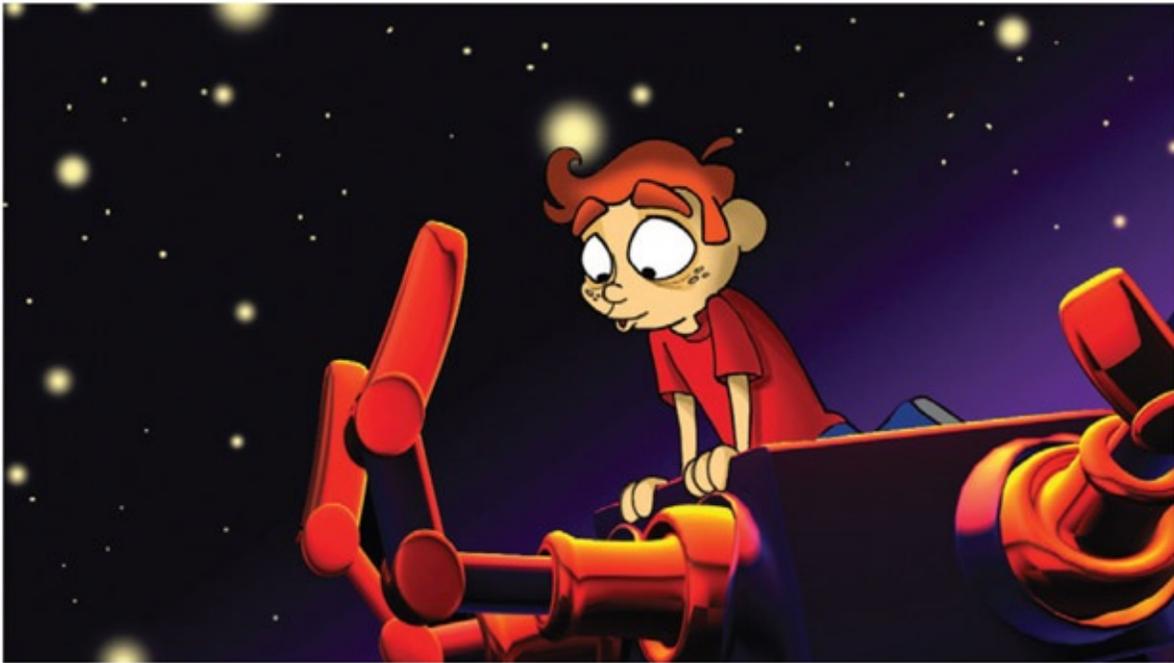

FIGURE 1.15 Example of 2D character registering with 3D character by Candice Ciesla, 2007, 2D/3D course, SCAD

Frame Rate and Image Format. It seems like a small issue, and it is often overlooked in a small studio or on student films. When combining different mediums, especially across multiple software packages, it is extremely important to agree on the frame rate that will be used and in what format the images will go through the pipeline. For example: if a 2D character is drawn and pencil tests are done at 24 frames per second, the animation is approved, and a reference .avi file is made, then that animation is brought into a 3D software package for the 3D animator to create the octopus arms that are to attach to the 2D character, then the 3D animator should, obviously, use the same frame rate as the 2D animator. Is the .avi file that he is referencing actually 24 frames per second? Did the 3D animator remember to set his playback settings to 24 fps or is he on 30 fps? Pipeline tests need to check that image formats maintain constant frame rate and image size throughout the production. All of these topics that we cover will save unnecessary redos of scenes due to animation not matching properly.

Timing. Anyone who has ever animated a character holding a coffee cup (or something similar), even in a single medium, knows that it is difficult to make sure that the coffee cup moves in sync with the hand. In traditional animation the cup is on a separate piece of paper and the animator has access to the timing chart or x-sheet and knows where the keyframes are and what type of timing was used. She can match similar keyframes and timing to the cup level. An example of this technique is depicted in Figure 1.16. If the same type of animation were to be done in 3D, then constraints could be used to help simplify the issue.
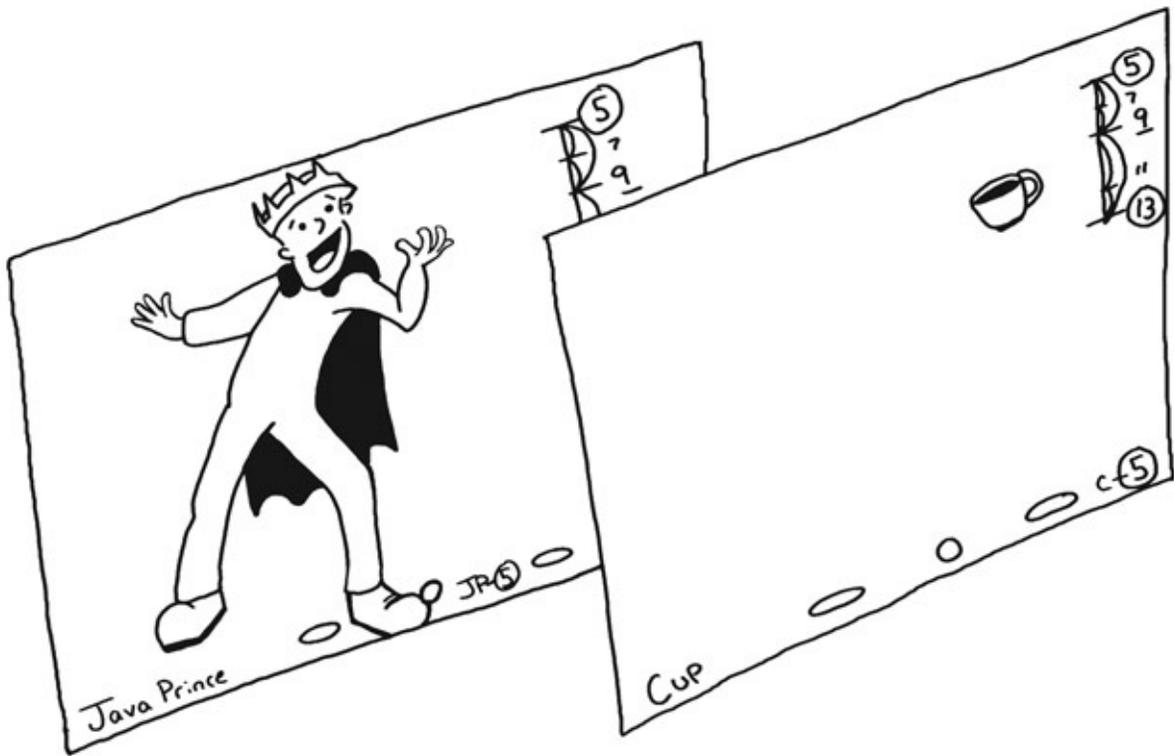
FIGURE 1.16 Example of multiple 2D elements registering

Any student who has tried to animate a hand-held object in 3D without using constraints should instantly cringe at how difficult it is to match the timing. This is what happens when multiple mediums are combined—the timing must be matched frame by frame.

In order to do this, it is easiest to know where the keyframes (extremes) are and what type of timing is being used. In the case of a traditional character leading a digital character, are the 2D character's inbetweens on halves? Thirds? Held? This is not an issue if the animation is completely done on ones (every frame is drawn); however, this is not commonly done. Maintaining an x-sheet and some style of timing chart is the solution to this problem.

X-sheets or dope sheets can be found in countless "how to animate" books. They are rarely used in 3D, which makes the inclusion of them in a 2D/3D animation process alien to the 3D animators.

Timing charts, the chart drawn on a traditional keyframe that communicates to the

inbetweener how to space the inbetweens he must draw, is another traditional technique that is not used by 3D animators. This might be the hardest of all concepts to apply to your pipeline.

It is possible to combine 2D and 3D without timing charts and x-sheets. The use of them, however, will make it less painstaking. As with all of the previous concepts, we will take care to answer this issue and its different variations in the upcoming chapters.

Image Sizes. The next to last concept that must be resolved for a 2D/3D pipeline is that of image sizes. Because scanned images, rendered images, digitally drawn images, and maybe even still photography are to be combined, in order for them to register properly you will need to make sure that you are using the same pixel ratio and have agreed on resolution and image sizes for your pipeline. Again, this issue might seem obvious to a solo artist. However, on a group project nothing is too trivial to outline. Often there are different file sizes used throughout the production to speed up workflow. For example, in the rough stages of animation, reference images need not be at full res size— that will only slow down the software package being used and transfer of images between artists. Finding ways to use smaller res sizes (all at the correct ratio so that registration stays consistent) will increase productivity. In production there might be three file sizes used; depending on the studio there may be more.

Final Res: The final render of animation assets that are then composited together. (Example: 1280 X 720, image ratio 1:77, pixel ratio: 1)

Mid Res: Used for double-checking registration and getting animation approved. (Example: 960 X 540, image ratio 1:77, pixel ratio: 1)

Low Res: Used for initial scans and rough animation. This allows for memory savings and ease of use in 3D animation packages as reference. (Example: 512 X 288, image ratio 1:77, pixel ratio: 1)

Alpha Channel: While considering how to send images back and forth to the different software packages, a complete production-stopping mistake is to fail to consider alpha channels. Because you will be compositing elements from one software package over elements in other software packages, at every step you will want auto-generated alpha channels that are of good quality. An alpha channel is a grayscale image that tells the computer which parts of the picture are transparent or opaque.

To recap, once the pipeline for reaching a visual style is achieved, then it is decided how assets will go through the pipeline to accomplish the best registration based on which asset needs to be created first. Then a test is needed to make sure that the image sizes, alpha channels, as well as frame rate and image format all flow through the pipeline and end up into a final image that is successful.

Judging the Success of 2D/3D Integration

There are a lot of things to consider when combining 2D and 3D animation. After working through the chapters in this book, you should be well on your way to having mastered some of the previous considerations. How do you know if you've done it successfully?

When researching for this book, students and colleagues brought example after example of 2D/3D combinations to add to my growing list of films. Looking through all of them, one might find that there is one measure that determines whether the 2D/3D combination was successful or not. As all hard-working visual entertainment specialists know (be they editors, VSFXs, compositors, animators, texture artists, lighters—any of us), our work is successful if it is invisible. If our visual style creates a homogeneous image that conveys the emotion of the story, if our registration is executed well and the contact points don't wiggle, if our animation timing is accurate and our media move well together, if our work is not visible and if the story is told without interruption, then our efforts have been successful.

FIGURE 1.17 Stop-motion test with digital head replacement by Chris Ellis, 2006, 2D/3D course, SCAD

Need to know More?

In the bonus online material for this chapter you will find the following:

1. **Storybeats and bull's-eyes**, which includes:
   Topic Review of many topics that are often referred to in this text
   - Hitting the emotional target
   - Storybeats
   - Visual storytelling.

   Hands-On Exercise that creates a story based on the bull's-eye method covered in the topic overview and then begins to assign the best mediums needed to support the story.
2. **Chapter One Project**, which contains a research project for students. (Insert evil professor laugh here.)
3. **Pipelines and Moments**—an extra chapter dedicated to research and development methods that support creating a worthwhile story with a strong visual aesthetic. (This is found with [Chapter 2](#)'s companion data.)

Hybrid animation examples (to name a few):

Ghost in the Shell 1995

Princess Mononoke 1997

Prince of Egypt 1998

Mulan 1998

The Iron Giant 1999

Tarzan 1999

Cowboy Bebop 1999

Titan A.E. 2000

El Dorado 2000

Spirit: Stallion of the Cimarron 2002

Lilo & Stitch 2002

Treasure Planet 2002

Brother Bear 2003

The Triplets of Belleville 2003

Steamboy 2004

Mushishi (episode 1) 2005

The Simpsons Movie 2007

Family Guy: Blue Harvest 2007

Futurama 1999–2009

Waltz with Bashir 2009

Berserk Golden Age Arc 2013

Further Reading

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Hooks, Ed. *Acting for Animators.* Portsmouth, NH: Heinemann, 2003.
Stanislavsky, Constantin. *An Actor Prepares.* New York: Theatre Arts Books, 1948, 1965

Student Contributors

Contributing students for this chapter, in order of contribution:

Dan Murdock
Erik Minkin
Claire Almon
Candice Ciesla
Amanda Powell
Chris Ellis

3D Character Leads 2D Character

FIGURE 2.1 2D/3D compositing example by Candice Ciesla, 2008, SCAD

Lecture Notes

This chapter explores having a 2D character and a 3D character interacting with one another. We examine the most important method of eliciting an emotional response from the audience, which is by including touch in our characters. The characters must touch both each other and themselves. The issues that need to be resolved are registration, timing, and line look. How do we make characters drawn in different media look like they are touching and make the line quality of the characters look like they match?

Industry Examples

Let's take a look at some memorable scenes that have shown the interaction between two characters who happened to be of different media.

Warner Brothers' *The Iron Giant* is one of my favorites. It is one of the first films in my memory to successfully present two characters interacting who happened to be of different mediums. The giant was a natural for 3D given its rigid nature and complexity. Remember the ideas of line mileage and complexity from Chapter 1? The giant has a high amount of line mileage that would have been difficult to animate in 2D and keep the rigid nature as well.

Another example of many 2D/3D accomplishments is Disney's *Treasure Planet.* We will look at *Treasure Planet* more in this book, because so much was accomplished technically in that film.

These might seem like "old" films. There are plenty of other film examples out there. The industry films we look at in these chapters had large budgets, lots of artists, and pulled off the combining of the media. We can learn a lot from the techniques that the animators had the time and money to come up with. The challenges in the pipeline are still the same, though some tools have evolved to make the process easier.

Emotion

I spend a lot of time driving and keep a portable DVD player in my truck. While driving, I listen to movie commentary and lectures I have recorded at work. (I can stand no time being wasted— even driving.) One day I found myself listening to a lecture by Bob Nicoll (Dean of Blizzard University). His lecture was on "Emotions in Animation." He would play for the audience a clip from *Dumbo*, where Dumbo goes to see his jailed mother. It is a bittersweet meeting between mother and son, underscored by a mournful song. When the clip ended, Nicoll asked the audience what they remembered most from the clip. Most often someone would comment on the touching between the two characters. To see two characters touch stirs strong emotions in us.

I'll take it even one step further. Just by *listening* to the clip (I was not even watching it—I was driving; I keep the DVD player nearly closed to avoid temptation), I could mentally *visualize* the sequence. While *listening* to the clip, I found myself thinking about my kids and wondering if I had been too harsh or too distracted with them the night before. I caught myself and wondered why I was thinking about the kids. I realized, of course, that Bob Nicoll was right. The clip of Dumbo and his mom, punctuated by the touch, had connected in my brain to the strongest of emotions, which centers around my kids. Sure enough, I started

thinking of them, which in turn stirred more emotions.

Bingo. That is the way we get audiences to feel emotions—we must connect to a memory they have in their heads. (My students are cringing. They think I'm going to talk about neuroscience. I promise, I'll hold myself back.) You might have heard that a large memory trigger is smell. Well, that one is out for now. With Smell-O-Vision aside, we'll have to look to another large sense that we use—touch. We touch our faces, wring our hands, hug our bodies; we do all sorts of self-touch to convey to others how we feel. We also, based on culture, touch others to convey friendship, intimidation, love, and a host of other emotions.

This is our first task to undertake when combining 2D and 3D animation. We have to master how to have our characters touch.

Dig Deeper

You can indeed dig deeper into why and how emotions connect in our brains. My favorite book on this subject is Joseph LeDoux's *Synaptic Self*. This is the only time I'll mention it; I swear.

FIGURE 2.2 Touch between characters, by Claire Almon, 2007, 2D/3D compositing course, SCAD

Hands-On Examples

The following section will finally let us get into putting together a scene. While going through this hands-on portion, we will cover some of the pipeline issues: registration, timing, and line look. We will also look at various ways to combine 2D animation on top of 3D images. From these methods you can find what fits your pipeline best or come up with one of your own.

Who Leads?

In the first scene we will do, a small character climbs into the hand of a larger character and is lifted. You can use *The Iron Giant* as your reference. The first question to ask, then, is, "Who leads?" In other words, whose movement is moving the other? In this case, the larger character will be lifting the smaller character; therefore, the larger character leads. Which one is which medium? The boy character will be 2D and the robot character will be 3D. So in this case, 3D will lead 2D.

3D Leads Digital 2D

Shot Description:
2D Character gets into 3D Character's Hand.
Hand Lifts. 2D Character reacts.

3D Anim

3D Stand In

Avoid overlapping for now.
Contact point is critical.
OK
NO

Mid Res

3D Ref

2D Keys

Full Res

Redo 3D Anim

Mid Res

2D Anim Clean Up

Full Res

3D + 2D = Final Image
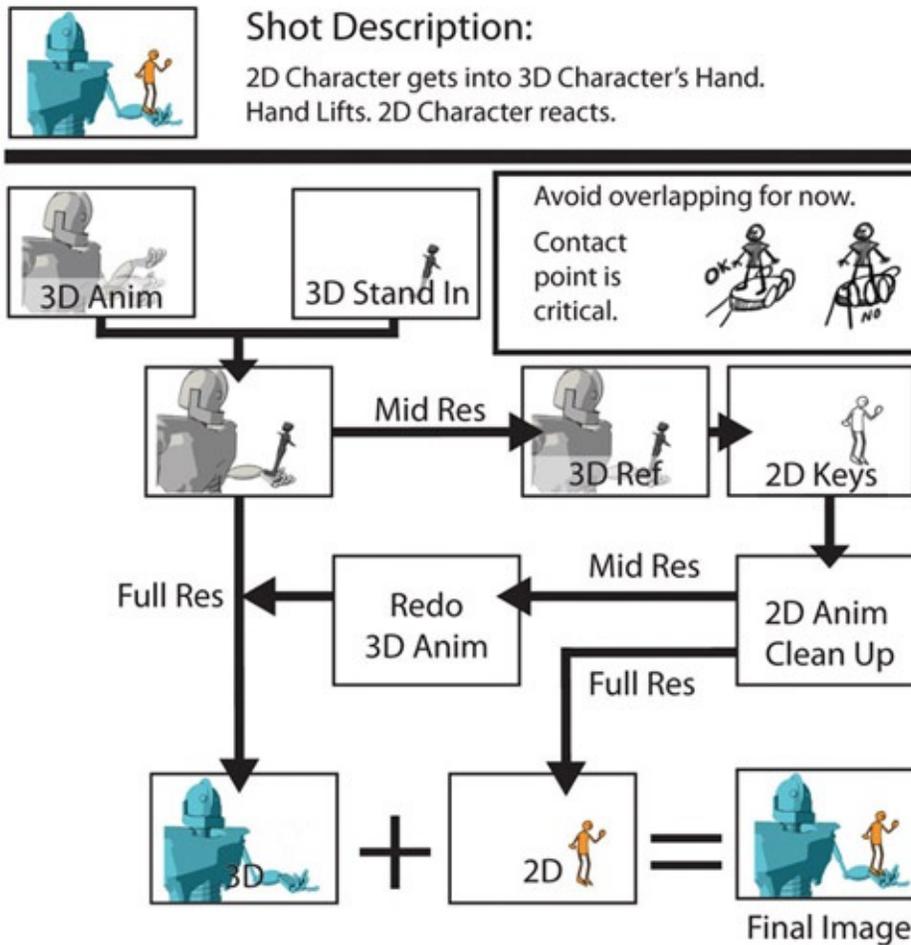
FIGURE 2.3 3D leads digital 2D pipeline

This pipeline has 2D animation being done digitally. This means using Photoshop, Flash, Toon Boom, and so on: software. You can draw with a Wacom tablet or use a Cintiq tablet. It isn't advisable to think about 2D animating with a mouse. I'm sure it can be done, but I wouldn't want to do it.

What if you do not have a fancy Wacom tablet and need to draw the 2D on paper? Then you would need to print the 3D animation, peg it up, and use it as reference for your 2D animation. It is a cheap pipeline, but it instantly causes registration issues at the printing stage. The 3D character is printed onto paper. That paper is hand-pegged, meaning someone sits at a light table, lines up crosshairs that were printed on the animation, and tapes a peg strip at the bottom of the page. One by one each page is pegged up. A pencil test is shot to see if the pegging process was acceptable. *Then* the animator can begin to animate using the 3D images as reference. Once completed, the 2D animation needs to be scanned back in to composite with the 3D animation.

FIGURE 2.4 3D leads traditional paper 2D pipeline

Take Note

Beware. The printing and scanning process adds more time to your pipeline and most likely introduces bad registration between your 2D and 3D characters unless absolute care is given to the pegging process.

You might ask, "What if the order were reversed? What if the boy character was 3D and the robot character was 2D?" Then we would need to use a pipeline where 2D leads 3D. I've added the option of the 2D being traditional paper or digital. When traditional paper 2D leads, it isn't as problematic unless the last stage of tweaking 2D to 3D is needed. In that case, there would be a printing and pegging of the 3D assets and possible registration issues.

2D Leads 3D
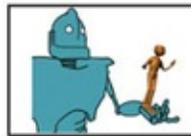
Shot Description:

3D Character gets onto 2D Character's Hand.
Hand Lifts. 3D Character reacts.

2D Anim

2D Stand In

SCAN

if traditional

Mid Res

2D Image Plane

3D Anim

Full Res

SCAN

if traditional

Redo 2D Anim

PRINT

if traditional

Mid Res

Full Res

2D

+

3D

=

Final Image
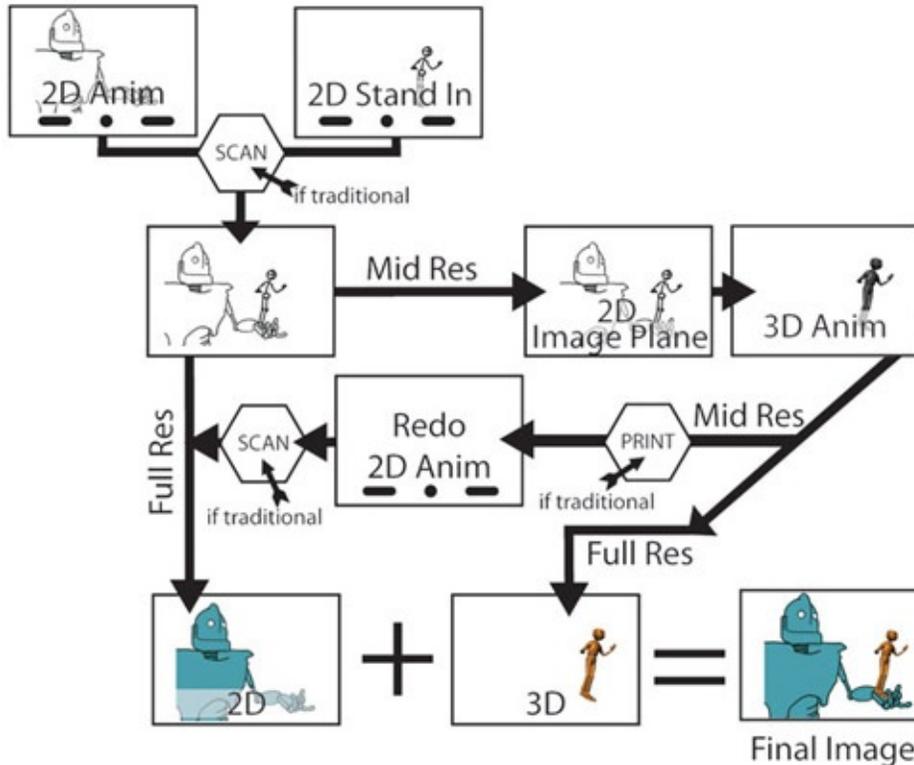
FIGURE 2.5 2D leads 3D pipeline

In scenes where one character is definitively leading the other one, it is an easy pipeline. However, what if this scene was a dance or a fight between characters? What if they had to tango? That would take more coordination between animators. More than likely one animator would lead and rough in where he or she expected the other character to be. The second animator would then take over and match where the first animator indicated the character to be. If there were any discrepancies, there would have to be a back-and-forth between the animators.

Any time the animation goes from one animator back to the other for tweaking, it can be considered a redo. It costs extra time and usually worries the art production manager. It is the first part of the pipeline to be avoided. That does mean that usually each animator has only one shot to get the acting, registration, and timing correct and hope it matches to the character's animation. However, if it is an "A" scene (a scene that is very important, like a moment scene with high emotion and story importance) or a scene where no discernible character leads the other, then the redos/tweaking should be allowed (within reason) to make

sure the animation is acceptable.

Take Note

Remember, any tweaking between media means much more time will be needed to finish the scene. Factor that in when you are budgeting time for your personal films.

We'll take a look at some different software usage. What if you don't have the software we use in this book? Here are the steps in general terms so that you can apply them to whatever software you do have in your toolbox.

1. Animate your 3D character; on twos is best.
2. Create a 3D stand-in that will serve as a reference for the 2D animator.
3. Render the 3D character with an alpha channel as an image series.
4. Render the 3D stand-in character with an alpha channel as an image series.
5. Import the 3D character and the stand-in layers into a drawing package of your choice or print and peg.
6. Animate the 2D character using the stand-in character as a guide. Note the registration points between the 2D character and the 3D character.
7. Render, export, or scan your 2D animation as an image series or raw .mov to maintain alpha channel.
8. Composite the characters together and create the final movie file in the package of your choice.
9. Enjoy your success.

3D Leads 2D: Animating a 3D Character with a 3D Stand-in Using Maya

This hands-on tutorial will walk you through the technical steps of animating our robot rig, creating a stand-in 3D object for our 2D character, and constraining it to follow the robot's hand. Then you will bring the levels into a 2D raster paint program to animate the 2D character.
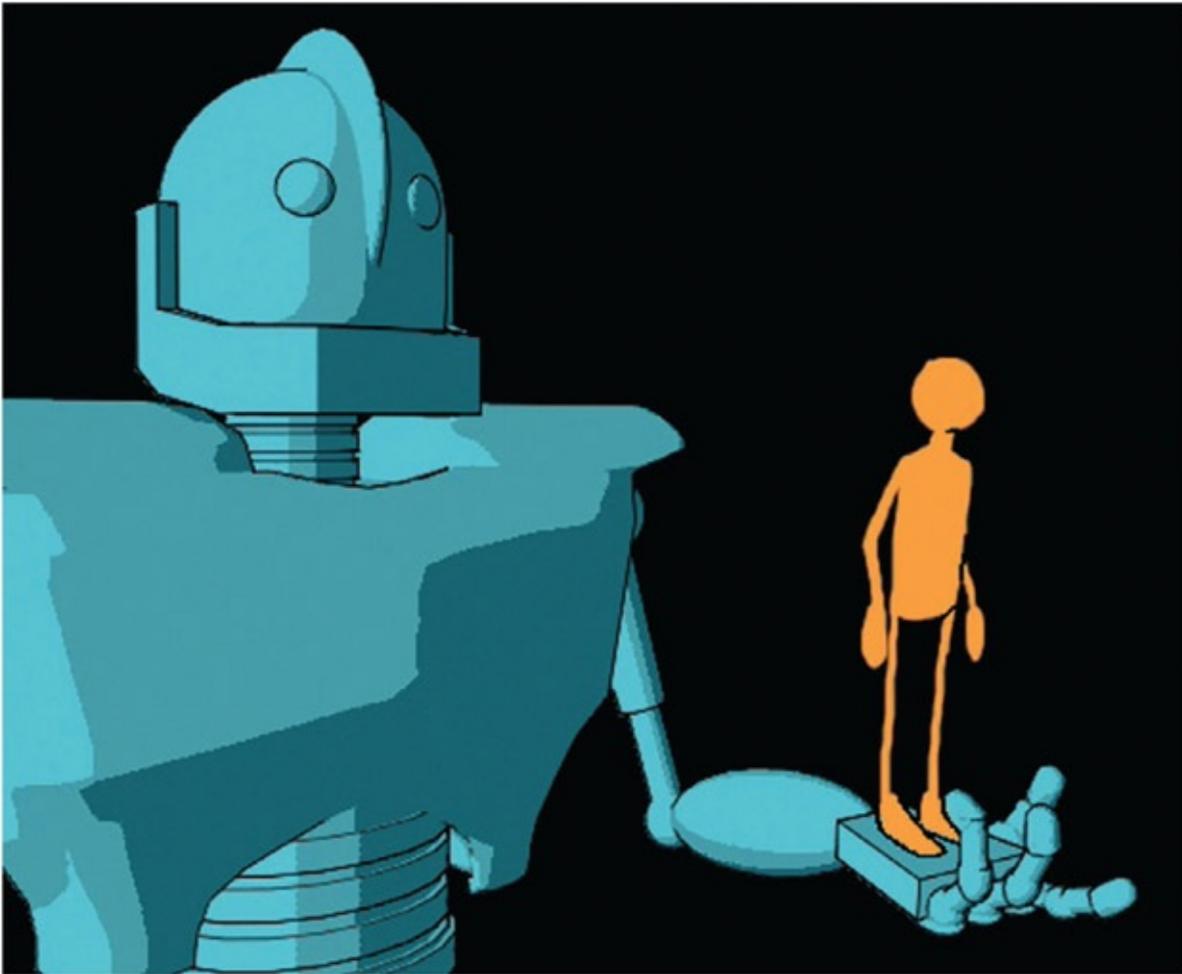
FIGURE 2.6 Our goal for this exercise by Chelsey L. Cline

1. *Create a project.* Start Maya and create a new project for this lesson. Select **File > Project Window**…. In that window, click **New**. Give it a name and a location where you will have plenty of disk space. Keep the default folder settings, and then click **Accept**. (Students, do not save directly to your flash drives. Use the local drive and back up to your network folder and flash drives at the end of your day.)

Take Note

You never want to think about losing data, and it happens to the best of us. A good rule that I use for important projects is to keep things local. Back up to a flash drive daily. Keep the flash drive *away* from your computer. Back up weekly to a network site (such as FTP or Dropbox) in another state/weather pattern.

Take Note

Maya will happily save your file even if your computer or home directory has run out of disk space. It will not even complain. You won't know you have run out of disk space (and have corrupted files) until the next time you open your scene. No amount of backups will save you from that!

2. *Open the file.* Open our robot rig. **File > Open Scene** … locate the rig **Robby_3DLeads2D_1.ma**, and click **Open**.

3. *Select the character set mode.* In the bottom right-hand corner, select the character set for this rig: **Robby**. This allows you to set keyframes and not worry about having the controls selected. If you are familiar with animating without character sets, feel free to do so. We will use character sets in this book. When the red arrow is on, you are using character sets to animate.

4. *Animating to the camera.* Because we have a camera set for this scene, we will use it to check our silhouettes. In the perspective window, click **Panels > Perspective > Render_Cam**. *Do not move* this camera. It is important to keep the rendering camera still during the animation process. Instead, we will set it aside so that we can animate to the camera. Animating to the camera means animating in the perspective, top, front, and side window with the ability to orbit around and looking at the Render_Cam to make sure the poses read well. Choose **Panels > Tear Off Copy**. Now you have a free-floating panel of your render camera. Resize it and place it so that it is out of the way but still visible. (For those fortunate animators, place the panel on your second monitor.) In the Render_Cam panel, choose the following items so that you can get a clean silhouette view:

   a. Under **Show**, hide everything but the geometry. Make sure to check off **Manipulators**.

   b. Press the **7** key on the keyboard. That puts you in lighting mode. Because we have no lights, your scene character should be in complete silhouette.
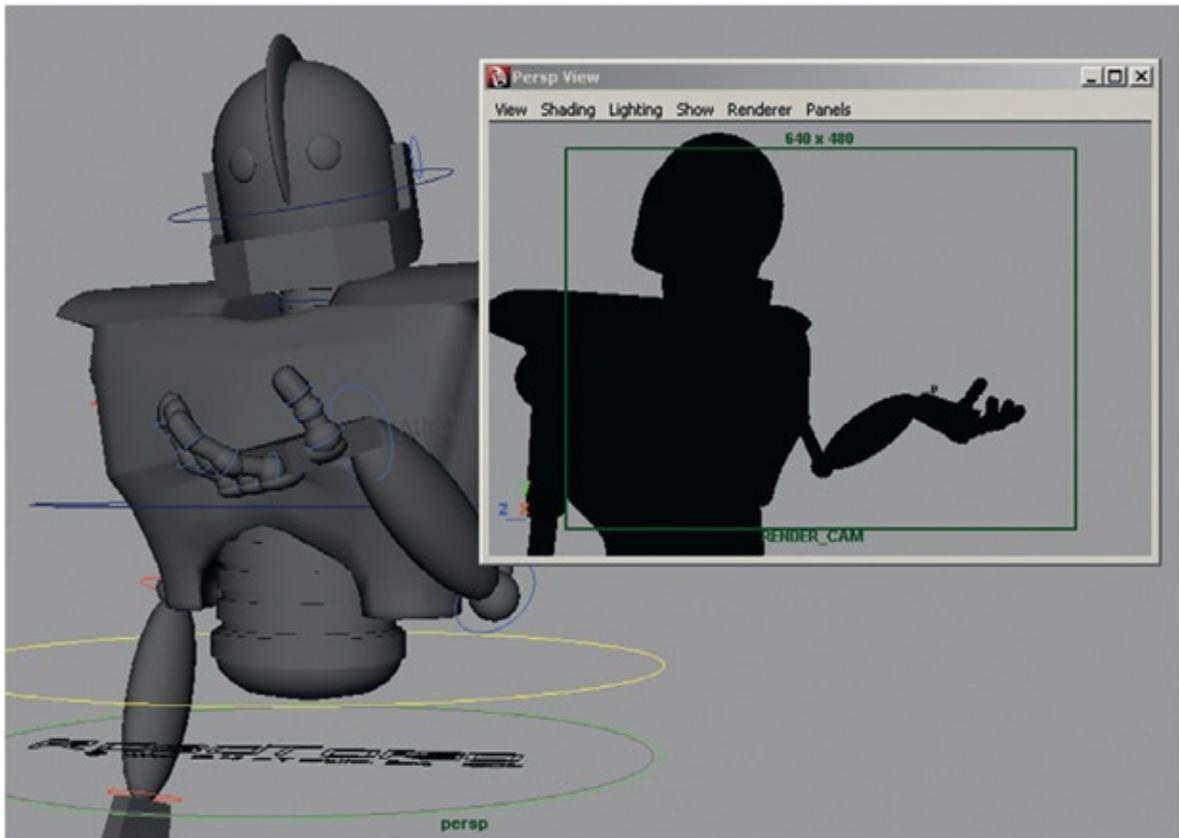
FIGURE 2.7 A torn-off Render_Cam panel, which we will use to check our silhouettes as we animate in the
Perspective view

5. *Animate.* Now you are ready to animate the hand so that it starts at the bottom of the frame and lifts up to mid-chest level. Our animation lasts 18 frames. You can open **Robby_3DLeads2D_2.mb** for an already animated version of Robby.

6. *Set frame rate.* What frame rate will you animate in? You need to make sure the time is correct and stays constant throughout the production. In other words, right here is where you can mess things up! Take a moment and set the frame rate in the **Animation Preferences** window, under **Settings > Time Slider > Playback Speed**. Ours is set to **Real-Time [24 fps**]. At each step of the pipeline, we will need to make sure this is our frames per second. (Use the Help function if you can't find the icon for the animation preferences window. Yes, this was a test.)
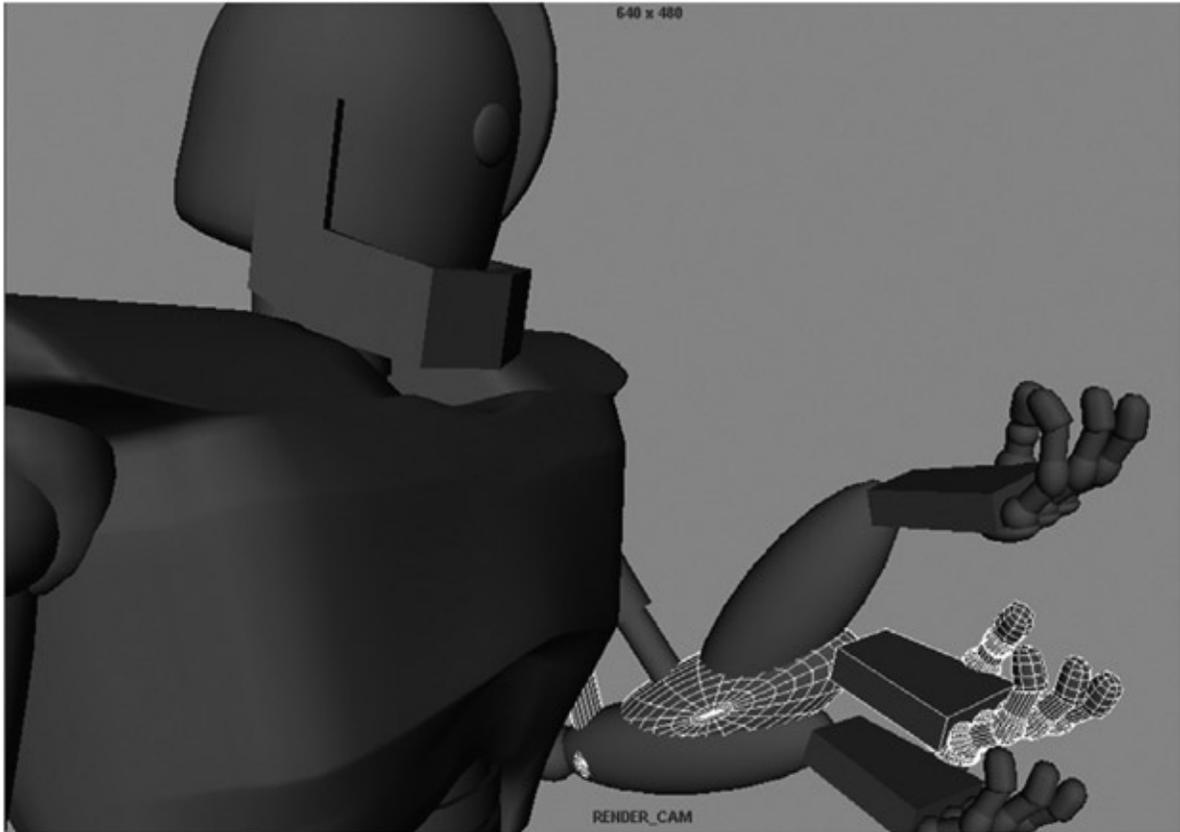
FIGURE 2.8 Keyframes of animated Robby hand

7. *Import 2D's 3D stand-in.* Now, import in the 2D character's 3D stand-in. Click **File > Import** ... and find the file **Roy_3DLeads2D_Standin.ma**. Click **Import**. Roy appears at the origin, beneath the robot. In the Perspective view, orbit around to see him.

8. *Constrain stand-in to follow the hand.* The stand-in character is a small rig itself, able to be animated in a limited fashion as reference for the 2D animator. You'll notice Roy has a few controls to move his arms, legs, head, hips, and chest. There is also a small circle at his bottom titled **PLACE_ME**.

   a. Go to frame **one**. Select Roy's "**Place_Me**" controller. Translate and rotate Roy into place in Rob Robot's open hand.

   b. To make Roy follow Rob Robot's animated hand, select Rob Robot's "**Attach_Here**" control (on the animated hand), hold **shift**, then select Roy's "**Place_Me**" control. Both controllers should be selected. "**Attach_Here**" will be white, and "**Place_Me**" should be green. This indicates that "**Place_Me**" was selected last.
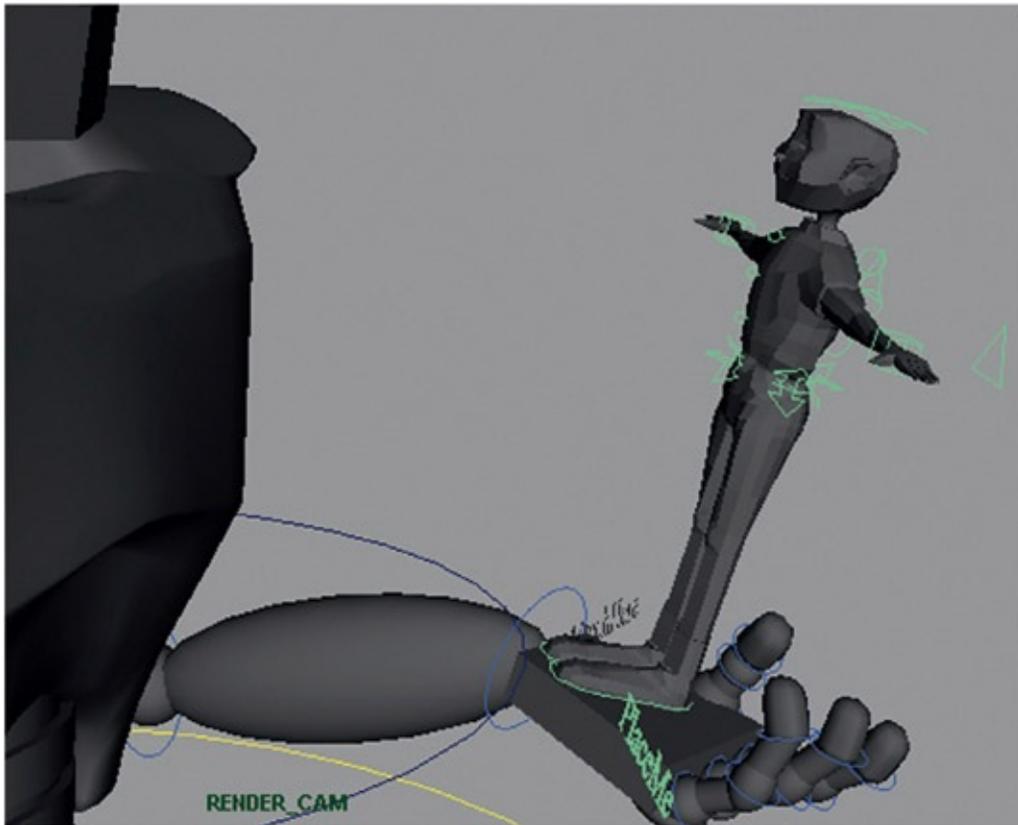
FIGURE 2.9 Roy stand-in put in Rob Robot's hand for frame 1

Take Note
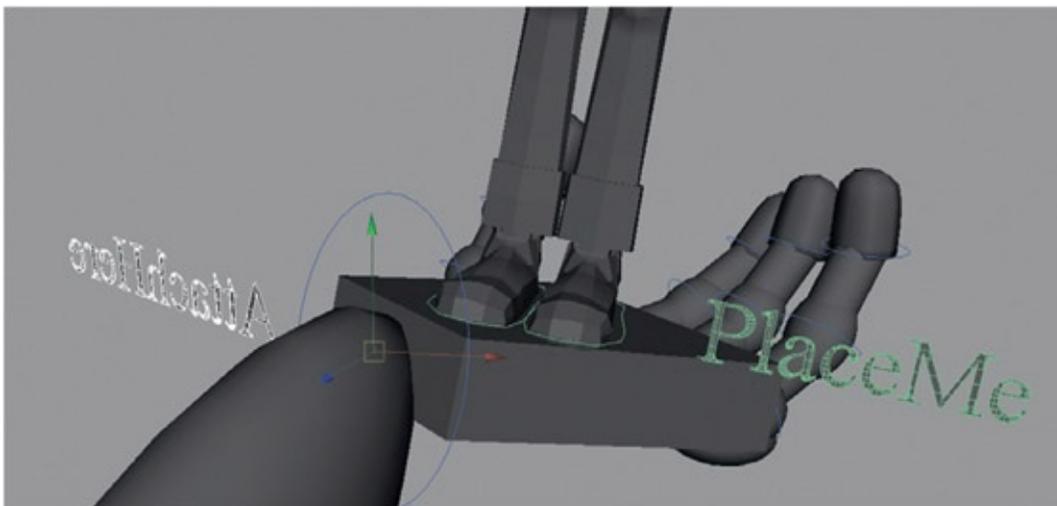
FIGURE 2.10 Select "Attach_Here" and "Place_Me" (Driver— Driven), then parent-constrain the objects together

When you constrain objects, the order in which you select things is very important. You select them as Driver—Driven. You can select objects to be constrained to other objects. In this

case, we had rigs with attaching controls that we used. If you like rigging, check out my other book *Rig It Right!*

    c.In the **Animation** menu, select **Constrain > Parent** (option box).
    d.The default settings are just fine (you can click **edit > rest settings** to get default settings). It is important that **Maintain Offset** is on.
    e.Click **Add**.

9.*See Roy move in Rob Robot's hand.* Scrub through or play the animation to see that Roy's 3D stand-in does indeed sit in Rob Robot's hand throughout the animation.
10.*To aid the 2D animator, add a few keyframes for Roy.* Remember to not overlap the robot over-top of Roy in this animation. That would complicate our composite. We'll get to that technique later.
11.*Save your file.* If you wish to see our completed file from this tutorial, view **Robby_3DLeads2D_3.mb**.

FIGURE 2.11 Roy now moves in Rob Robot's hand

Ones or Twos?

3D animators might not think of this at first. 2D animators will ask this question immediately. 2D is normally drawn on twos. This means that every frame is held for two frames. Why? There is less to draw. Drawing something on ones, or a drawing for every single frame of film, makes for very subtle movement and it is difficult to keep the 2D animating smoothly. It can be done. Certainly there are those who have used a style of animating on ones—Richard Williams, for example. There are also times when you need to put the animation on ones, such as when the movement is very fast. As a 2D/3D animator, you will want the ability to at least be able to put everything on twos and at most be able to control when things are on twos and when things are on ones.

There are many methods to convert your animation in 3D to be on twos. You can do it manually in the graph editor after all of your animation is done; you will do this by inserting

keys on every other frame and using stepped inbetweens between the keys. Although that is fine, it can make it difficult to go back and adjust your animation.

Gregg Azzopardi, one of the technical editors of this book, suggested this method to me. There is a script that can be found on Creative Crash called twos.mel. It was written by Jason Schleifer. Schleifer is such a great brain in the rigging for animation field. Enclosed with the companion data for this book, you will find a modified version of the script that works with the usage in this chapter.

Install the Script

To use this script, you will want to copy the twos.mel script into your scripts folder. Generally this is in your home directory, **maya/XXXX/scripts**. Substitute the version of Maya you are using for **XXXX**.

Restart Maya, or if Maya is already open you can type **rehash** in the command line. (Remember to hit **Enter** on the keyboard.)

Mac users, your scripts folder is in the **Library** folder, which is hidden in newer versions of Mac OS. In the finder, **Option Click** on the **Go** menu to open the library folder. The scripts folder you are looking for is here: **/Users/YOU/Library/Preferences/Autodesk/maya/201X-XX/scripts**.

Use the Script on Character Sets

If you are using character sets to animate, like we used in the example files, follow these steps:

1. Select the character set in the outliner.
2. In the command line, type **twos** and hit enter on the keyboard.

It will take a moment as the script goes through all of the animated attributes in your character, checks them, and then adds a node that controls the animation curves and sets them to run only on twos. The script will then prompt you to add the following line on your shelf: **select-r timeOnTwos**. If you middle-click on those words and drag them to a shelf, Maya will create a button. When you click on that button, it selects the node that Schleifer's script has created for you.
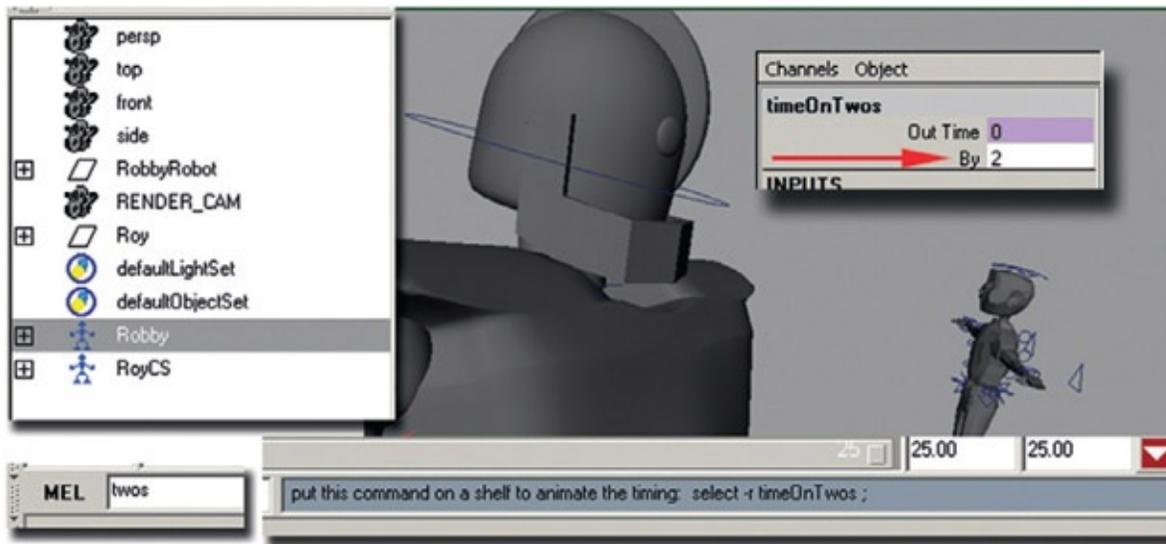
FIGURE 2.12 Jason Schleifer's twos.mel script in action

By default, the "by" attribute is set to 2. You can simply key-frame that to different step rates to enjoy your animation on twos and on ones (or other increments) as needed.

When you play back your animation in Maya and look at the timeline or graph editor, you will notice that everything still looks the same. This script does not interrupt your animation process or the sweetening process at all. (Those wearing geek hats can check out the Hypergraph Connections editor to see the node and math expression that Schleifer has created to make this as seamless as possible.)

If you wanted to go back and animate Roy to use as reference, maybe just a few key poses of how he would react to being hoisted up into space, you will want to also put his animation on twos. Currently, he is following along with the robot, so you do not need to do anything special to his timing. If you did animate him, you would want to go through the same steps as outlined earlier: selecting his character set and typing **twos** into the channel box. He will be hooked to the *same* **timeOnTwos** node and **By** attribute. This is great. That means that your reference object will stay with the same timing as the robot. That is one of the hardest things to have to worry about—making sure that the 2D animation has the same keyframes and timing as the 3D. Why? If the 2D animates on frames when the 3D is holding still (or vice versa), things start to wiggle and you give away the illusion of registration.

Also, if you are not using character sets, you can select all of the animated controls and use the script. The result will be the same.

3D Animation is done—Now What?

When do we put toon lines on our animated characters? When do we do the final 3D

render? When do we start animating our 2D character?

Good questions. In a production setting, you want to have your animation completed (and approved) first before you begin working on the final look. Iterations to a quick approval, adjustment, or a quick removal are key to not wasting time on production.

Because our 3D animation is complete and is to be handed off to the 2D department, let's also hand it off to the rendering department.

Note: you will find an overview to Maya's Toon Line usage in the companion data of this book: ChapterTwo_MayasToonLine.pdf.

3D Leads 2D: Toon Fill Shading

Here we will apply toon shading to our 3D character, Robby. We are trying to get flat color with a little shading for the paint fill and a thick and thin line to match a 2D character's cleaned-up line. Our tutorial 2D character is pretty basic to get us started.

FIGURE 2.13 2D character
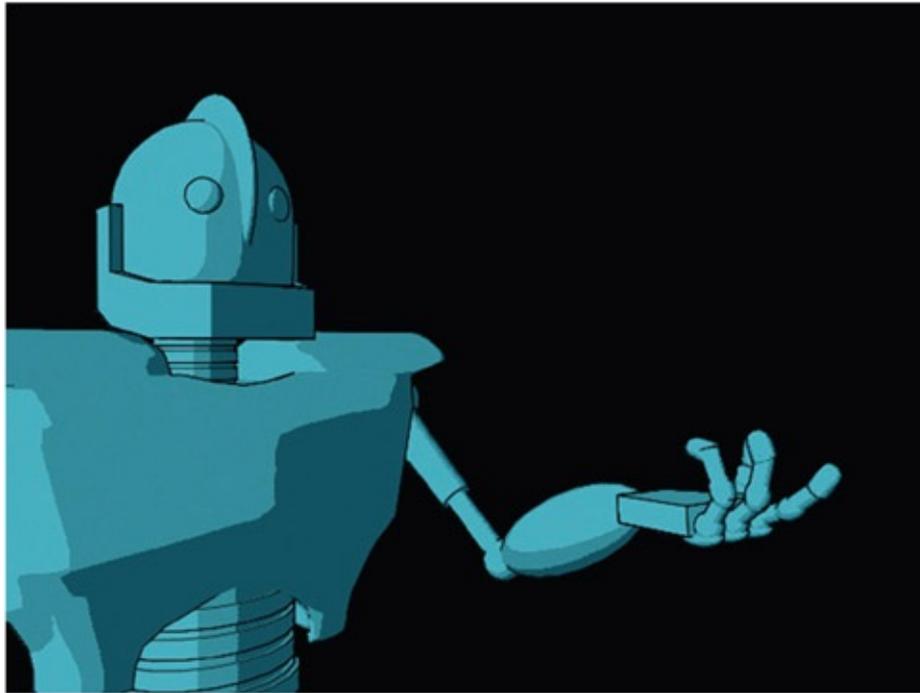
FIGURE 2.14 3D character with toon line

Open the file: open the animation file that you saved or our file **Robby_3DLeads2D_3_onTwos.mb**.

Fill Shader

First, to work with our geometry and put shading on it, we will have to be able to select it. Most modern rigs have the geometry locked down so that the animators cannot touch it and harm it in any way. (If the rig isn't locked down and the creator is in my class, that is 10 points off.)

1. In the Layer panel, locate the GEO layer for the robot and make it editable by clicking on the **R** (**R** stands for *reference*; the object cannot be selected). Once you click the **R**, it will become a **T** (**T** stands for *template*; the object cannot be selected and it is displayed as a pink wire frame). Click again on the **T** and the box will become empty. Now the contents of that layer are editable.
2. In the perspective window, select the robot's geometry and press the up arrow on your keyboard to select all of the geometry. (You can also locate the **GEO** group node in the outliner for the robot.)
3. In the Rendering area, select **Toon > Assign Fill Shader > Shaded Brightness Three Tone**.

4. Click on the **Render** icon to see what the fill shader looks like.
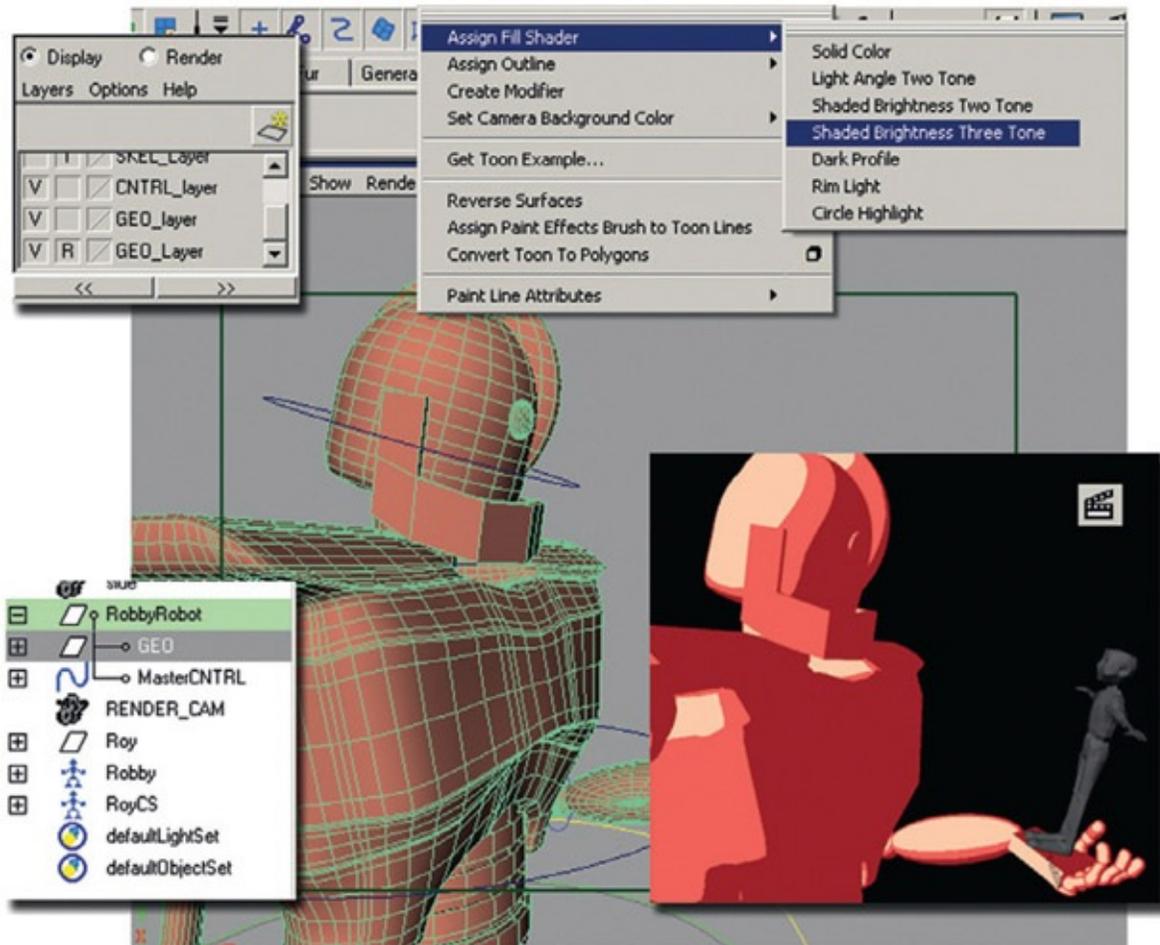
FIGURE 2.15 Render icon is clicked to see Toon Fill Shader on Robby

Take Note

If you apply toon fill to an object and it turns out very chunky, there is an easy way to fix it. Toon fill shaders will show faceting of low-poly objects unless they have soft normals. With the mesh selected, go to the Polygons area and select **Normals > Soften Edge**. Re-render the frame to see the better results.

Tweak Fill Shader

The nice thing about fill shaders is that you can adjust them using IPR:

1. Click on the **IPR** button, either in the render window that you have open or at the

top status line.

2. When the render has completed, follow the directions found at the bottom: "**Select a region to begin tuning**."

FIGURE 2.16 IPR allows you to select a region to interactively render while you adjust parameters

3. Select any of the robot geometry; open the Attribute Editor (**CTRL + A)**; scroll through the tabs until you find the **three-ToneBrightnessShader** tab.
4. The three-tone brightness shader is a ramp shader. You can click and drag on the small circles to adjust the threshold that the colors show up in. The rightmost color is the color that shows up where the light is the strongest. The leftmost color shows up where the light is the weakest.
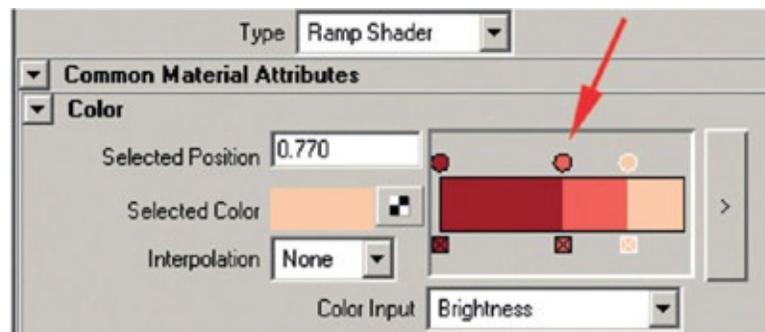
FIGURE 2.17 Use the IPR render view to quickly tweak your fill shader using the threeToneBrightnessShader tab

5. Create a **dark gray** for the left color and a **light gray** for the right color. **Delete** the **middle color** by clicking on the **X**. Let's find a midrange color using a different method you might not be aware of.

FIGURE 2.18 Delete the middle color

6. **Double Click** on the **Selected Color** chip and an expanded **Color Chooser** window

will open. In that window, open the **Blend** tab.

7. In the **Blend** tab, click on any of the four rectangles, then click on the light color; repeat for the dark color until you have created a nice gradient. See Figure 2.19 as an example.
8. Click on the ramp between the two colors and that will add a third color circle.
9. In the **Blend Tab**, select a color from the blend area. It will load into the selected ramp color. For me, this saves a lot of time by allowing me to use the blend feature to get something closer that I can work with.
10. Click **Accept** or **Done** (depending on your version of Maya) to close the **Color Chooser** window.
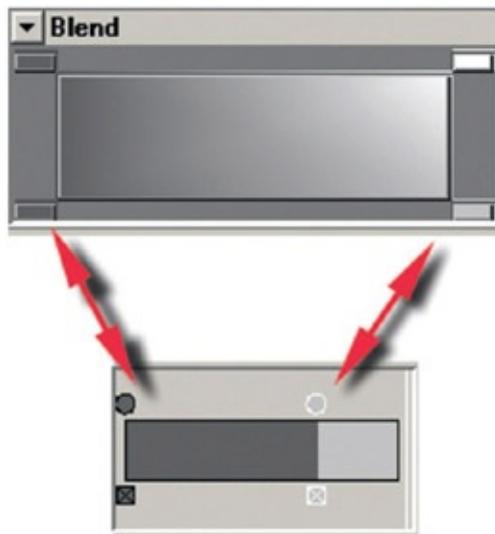
FIGURE 2.19 Add colors into the Blend tab. (Older versions of Maya auto load the selected color chip. Newer versions give you an eyedropper cursor to pick the color.)

FIGURE 2.20 Third color chosen with the eyedropper tool

This looks like a good place to save. Our completed file is saved at **Robby_3DLeads2D_4.mb**.

Toon Line

The next step is to put on a toon line that matches the 2D character's cleaned-up line. For this next section use the animation file that you saved or our file **Robby_3DLeads2D_4.mb**.

Toon Line Shader

The geometry should still be selectable from earlier in the lesson when we applied the toon fill:

1. Select the robot's GEO node in the outliner, or click on the geometry and click the up arrow key on the keyboard. (The robot should be highlighted green.)
2. In the Rendering area, select **Toon > Assign Outline > Add New Toon Outline**. In the attribute editor, change **Line Width = 0.058** or something smaller. (Don't go too small; we're about to adjust this line some more.)
3. Scroll down and open the section for **Curvature Based Width Scaling**; this will allow us to adjust the thickness of curved lines versus straight lines.
4. Turn on the check box for **Curvature Modulation**. (Where's the little green Marvin Martian? Give me the Q-36 Explosive Space Modulator.) You might have to adjust your global line width to make your lines visible again.
5. I find it hard to see the toon lines in the perspective window when they are highlighted in green. So in the camera view you can select **Show > Selection Highlighting** to hide the highlighting.

Let's look at that curvature width ramp. What happens when you move the curve? It might take a little bit of thought to figure it out. It looks like the documentation has the explanation backward (I might be reading it wrong). Here is how I see it working:

1. [**Left**] Moving the curve to the left side of the ramp affects the toon lines that are curved.
2. [**Right**] Moving the curve to the right side of the ramp affects the toon lines that are straight.
3. [**Top**] Moving the curve to the top of the ramp makes the toon lines thicker.
4. [**Bottom**] Moving the curve to the bottom of the ramp makes the toon lines thinner.
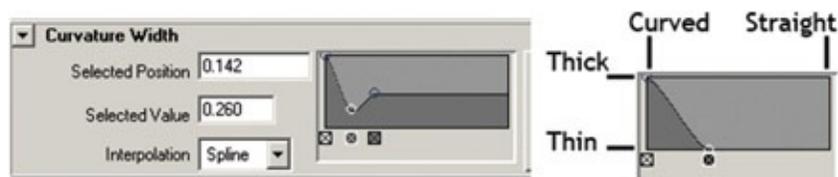
FIGURE 2.21 Curvature width ramp

It takes some tweaking. If you get your curve to look like the one shown in Figure 2.22, you can get a little thick and thin depending on how curved the object is, and the straight lines are not as thick as the thin ones:

1. In the profile tab, bring the **Profile Width Modulation** to **.3** to overall adjust the taper.
2. Adjust the **Profile Width** as necessary to get a line thickness that you like.
3. Test **Render**.
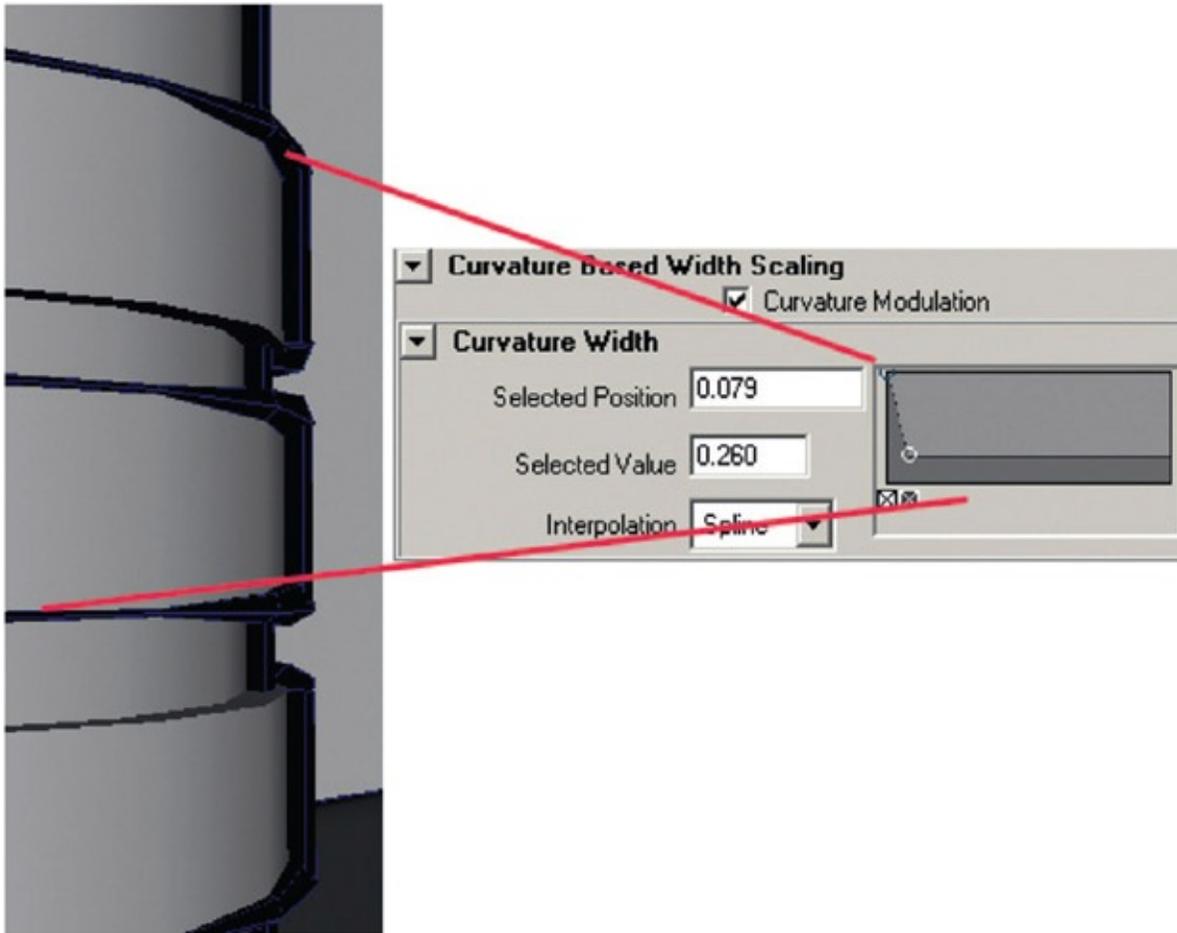
FIGURE 2.22 Snapshot of the robot's neck and the curvature width ramp

Creases

The crease in the front of the robot's chest may not have a toon line. Or perhaps there are other areas where you want to add a toon line. Let's see how to fix that problem:

1. Your first instinct might be to go to the crease lines tab, **turn off Hard creases**, and adjust the **Crease Angle Min** to see if you can dial in that specific crease in the robot.

However, you end up getting a lot more creases that way, more than you want. (Keep bringing that slider down and you can do a nice wire frame render.)

2. Instead, keep the option for **Hard Creases** on. Go to edge selection mode and **select a line of edges** across the crease in the bottom of the rib cage (Figure 2.23).

3. In the Polygon area, select **Normals > Set Normal Angle** …

4. In the popup window, bring the value to **0** and click **Apply and Close**.

5. Adjust the **Crease Width** and **Crease Angle Max** as necessary.

Figure 2.23 shows the visible crease at the bottom of the chest. Using hard edges only allows you a little more control of exactly what creases are shown.
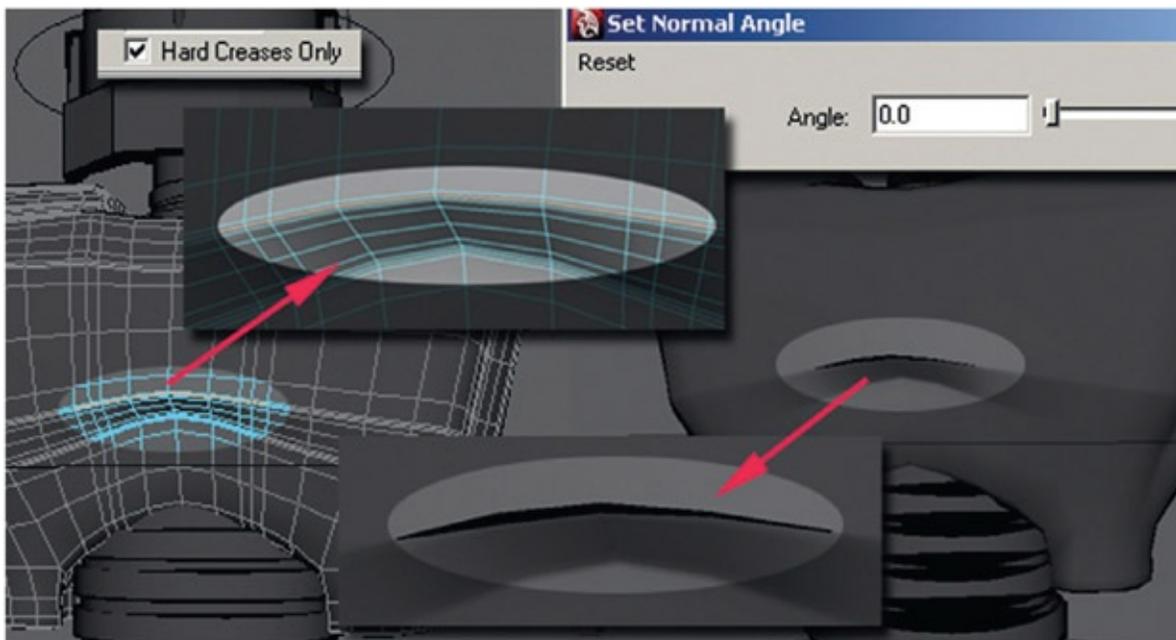
FIGURE 2.23 The Hard Crease Lines option is turned on and edges in the chest are given hard normals, resulting in a crease line
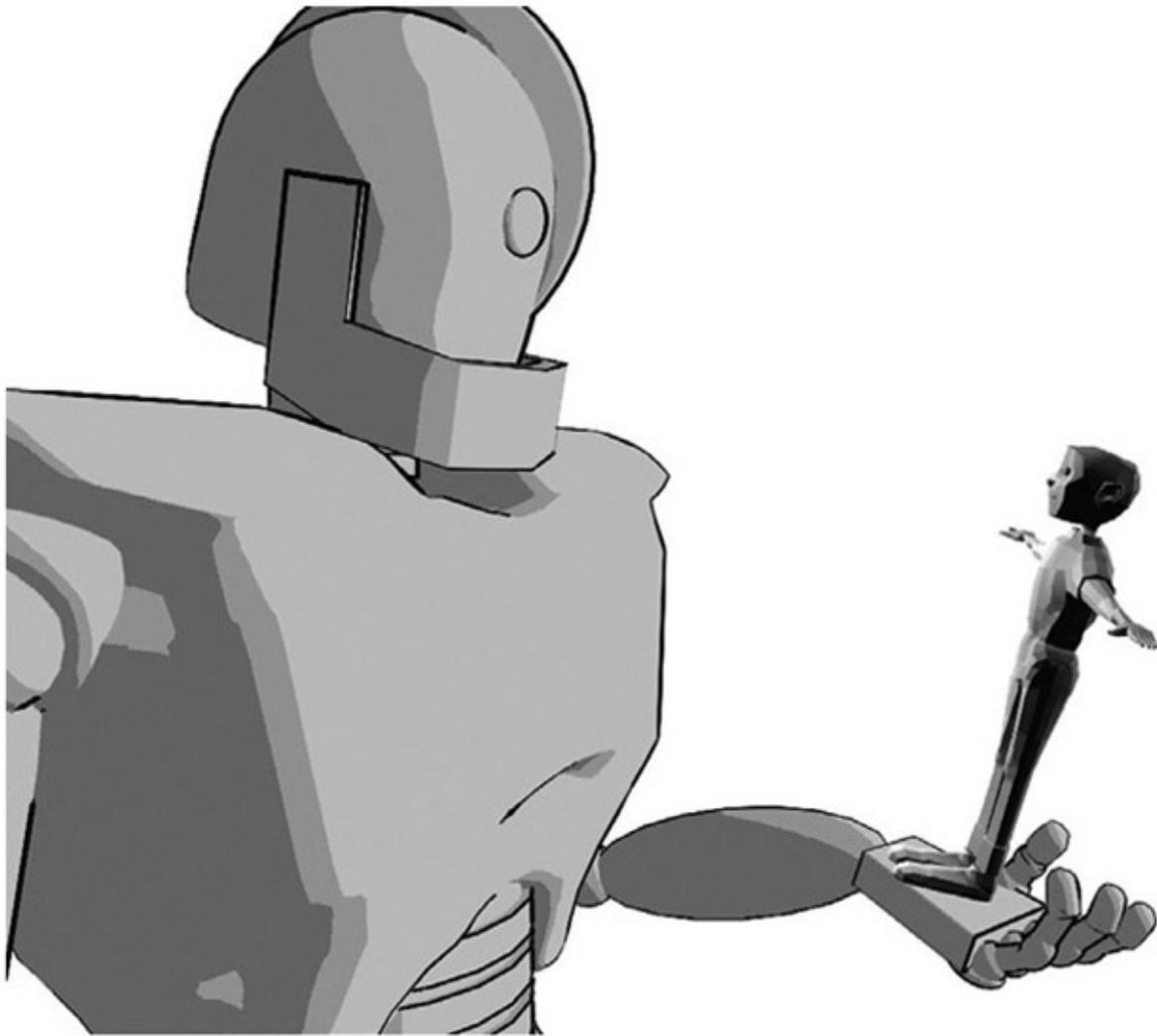
FIGURE 2.23A Robot with toon fill and hard creases

3D Leads 2D: Maya Render Layers and Photoshop

We are ready to export our levels of animation. One level will be the Robot Robby and the second level will be our stand-in character. To render out separate levels in Maya, you can use Render Layers. Setting them up is much like setting up Display Layers. In fact, be careful to note when you are in the Display Layer mode versus the Render Layer mode. The following is how to use Render Layers in Maya 2008 or older versions. We'll look at Maya 2009 as well.

1. Create render layers:

   a. At the bottom of the Channels box in the layers area, click the **Render** tab.
   b. In the outliner, select RobbyRobot, then click **Layers** > **Create Layer from Selected**.

c. Double-click on the new layer (layer1) and name it Robby_Anim. Click on **Save**. Note: only the Robby is visible.
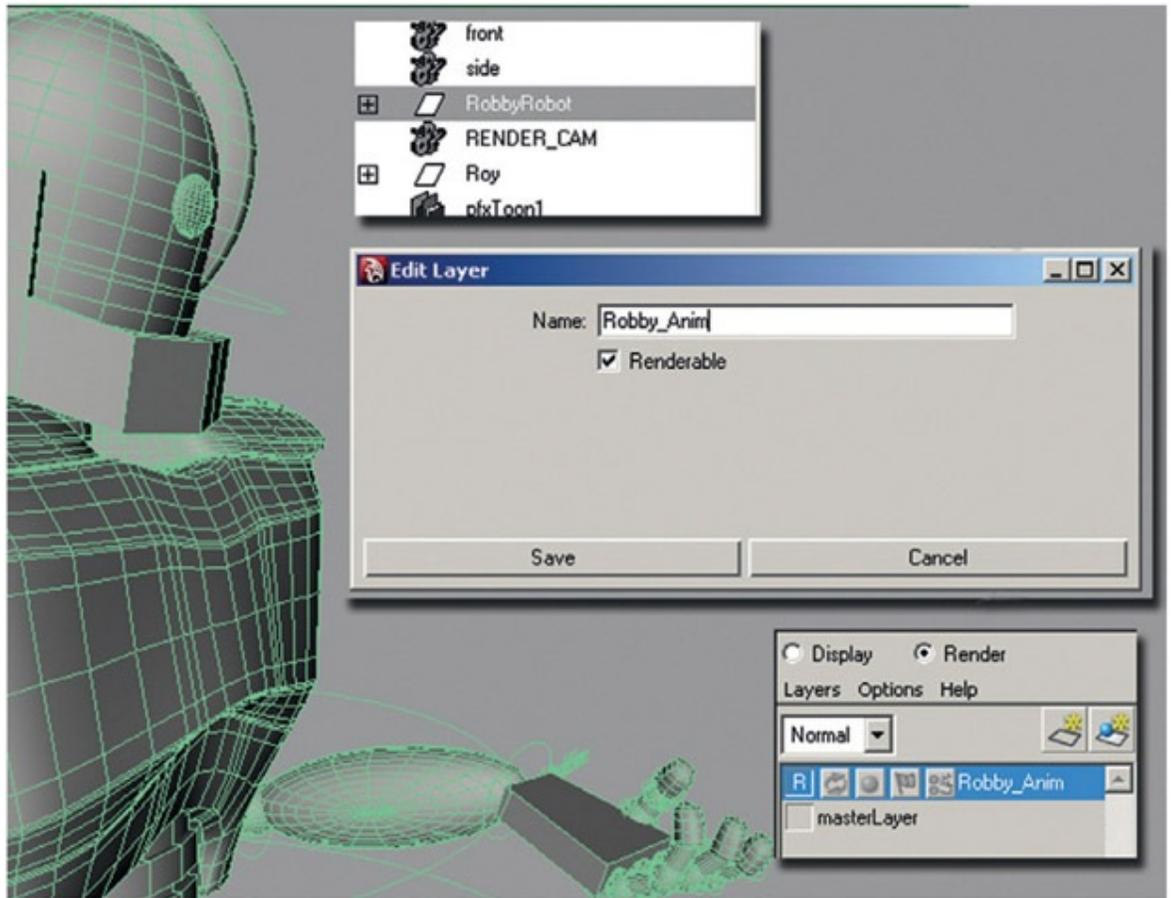
FIGURE 2.24 The Robby_Anim render layer has only the robot in it. Everything else hides (will not render)

d. Click back on the Master layer, and you will see everything again.
e. The toon lines more than likely were not added to your Robby Layer. **Select** Rob Robot's toon lines, then **right-click** on the **Robby_Anim** render layer and choose **Add Selected Objects**.

Repeat *b* through *c* for Roy, the stand-in.

f. You should have the following render layers:
    i. Master layer—shows everything when clicked.
    ii. Robby_Anim—shows only the robot when clicked.
    iii. Roy_Ref—shows only the stand-in character when clicked.

2. Rendering the images: The next thing to do is to render out these images. You can set the background color to be something other than black. The renders shown in Figure

2.26 have a white background color. Background colors can be set in the camera attributes. This does not affect the alpha channel.

   a. In the Render Layer window, choose **Options > Option Box for Render All Layers**.
   b. In the options box choose **Keep Layers**. Click **Apply and Close**.
   c. Double-check that the Render All Layers is actually checked **on**.
   d. Open your Render Settings window. (**Window > Rendering Editors > Render Settings**)
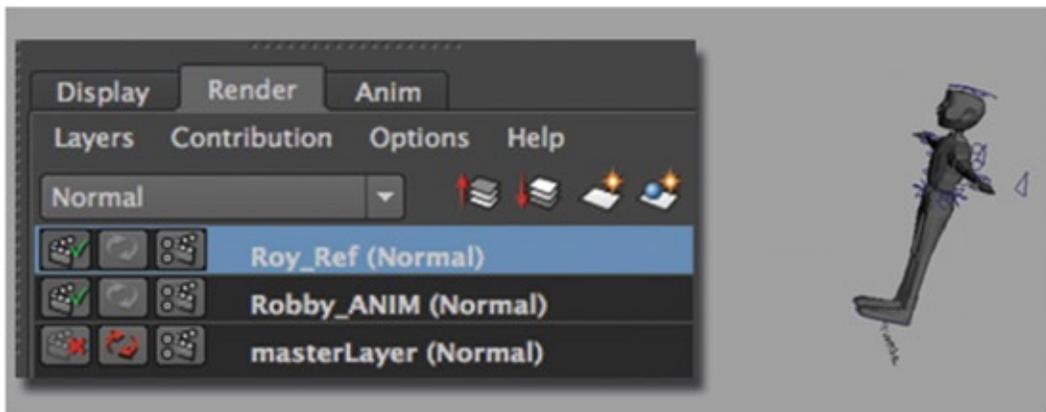
FIGURE 2.25 Roy_Ref layer with stand-in character

FIGURE 2.26 Render all layers

We will use the following settings:

1. Set the **name**.
2. Naming convention is **name.#.ext**.
3. Number padding to **4**.
4. **By Frame** is set to **1** or **2**. (One, if you want to render every frame. Two, if the animation is on twos and you want to render every other frame and save some time. No sense in rendering a frame twice if it hasn't changed.)
5. We'll use **.tifs**.

6. Choose the appropriate frame length; ours is **1 – 18**.
7. Choose the **RENDER_CAM** as the Renderable Camera.
8. *Watch out!* Make sure **alpha channels** is turned on!
9. Resolution should be your final resolution.

a. Now you can click Render > Batch Render. The renders for each layer will be placed in named folders. Look at the Script Editor to see the progress.
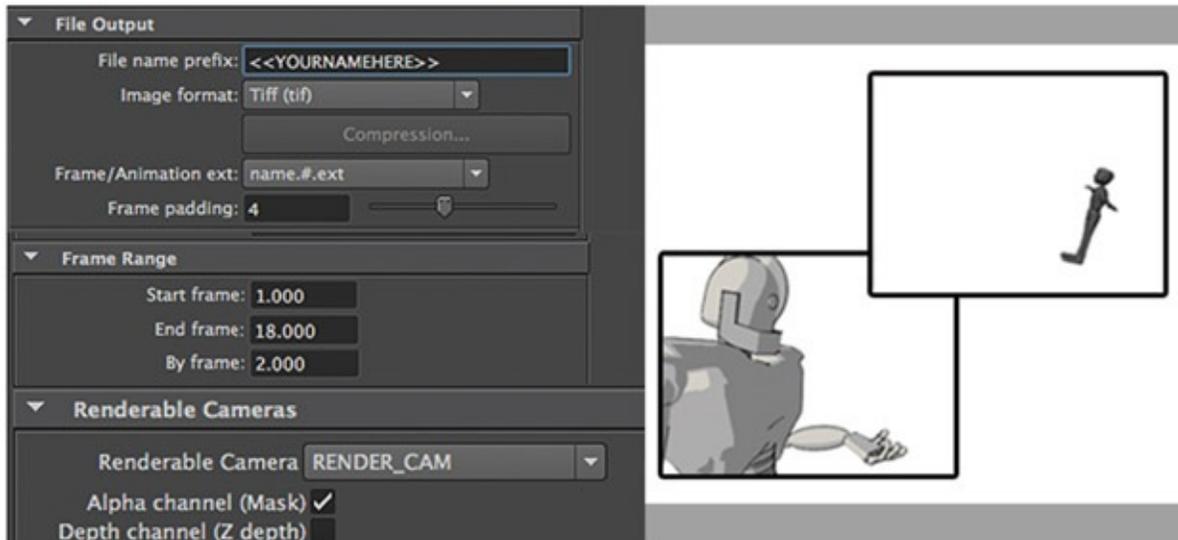
FIGURE 2.27 Render settings and expected results

Why did we go through the trouble of setting up render layers? Now we have a sequence of images for both characters. Each has its own alpha channel so that it can be composited overtop of a background or other levels as needed. Now we can take our robot's 3D render and use Roy's 3D reference render to draw the 2D animation and make sure that the registration is correct.

Dig Deeper!

A quick note on file types. Not all file types support alpha channels. Tiff does. JPG (which is also compressed) does not. Please seek help with an intro to 3D book if you are unsure of file types.

What could go wrong? I hit two possible bugs in this section both on PC and Mac (versions 2011–2014).

1. The twos script may not work with batch rendering! You may have to ditch the twos node in order to render. Select that timing node the script created by typing in the

command line select-r timeOnTwos. This selects the node. Now, delete it. Batch render as before.

2. During playback in Maya, it wouldn't evaluate the timeline! I knew there was animation there, but it would not show. I was able to turn it on again by clicking on **Modify > Evaluate Nodes > Evaluate All**. I think this was more user error—the accidental hitting of a hot key.

3D Leads 2D: Animating 2D on Top of 3D

What software do you use to draw your 2D animation on top of the 3D animation? In class we have been using many different software packages and find that each one lends itself toward different final looks. You'll want to experiment with any software programs you think might work to see how well you can animate in them. We will cover the technical aspects of a few of them here in this chapter.

Maya and Photoshop

A new feature that was put into Photoshop, as of version CS3, is the ability to edit and work on sequences of images.

Open Our Renders

To open the rendered file sequence into Photoshop, click **File > Open**, then select the first image of the Robot level. Ours is in the folder **Robby_Anim** and is named **rb.00001.tif**. Click on the **Image Sequence** option.

Oh, look—a window opens for you to set the proper frame rate (remember what we said in Chapter 1—there are many, many places to mess up frame rate); select **24 fps**.
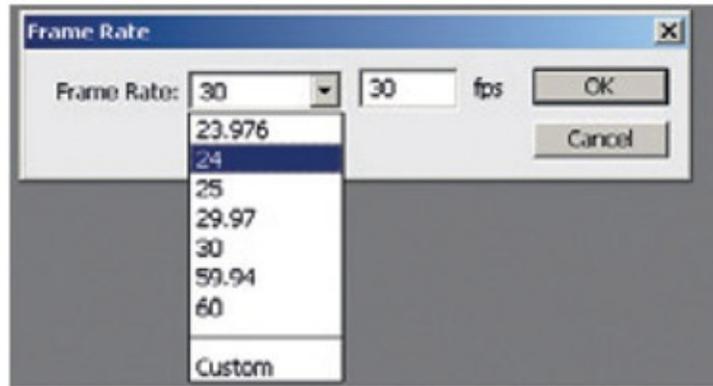
FIGURE 2.28 Remember to set the correct frame rate

Notice the video layer in the layer palette. This is no longer a normal image layer. In newer versions of Photoshop a time-line window automatically opens up. (In earlier versions, open the timeline by clicking on **Window > Timeline or Window > Animation**.)
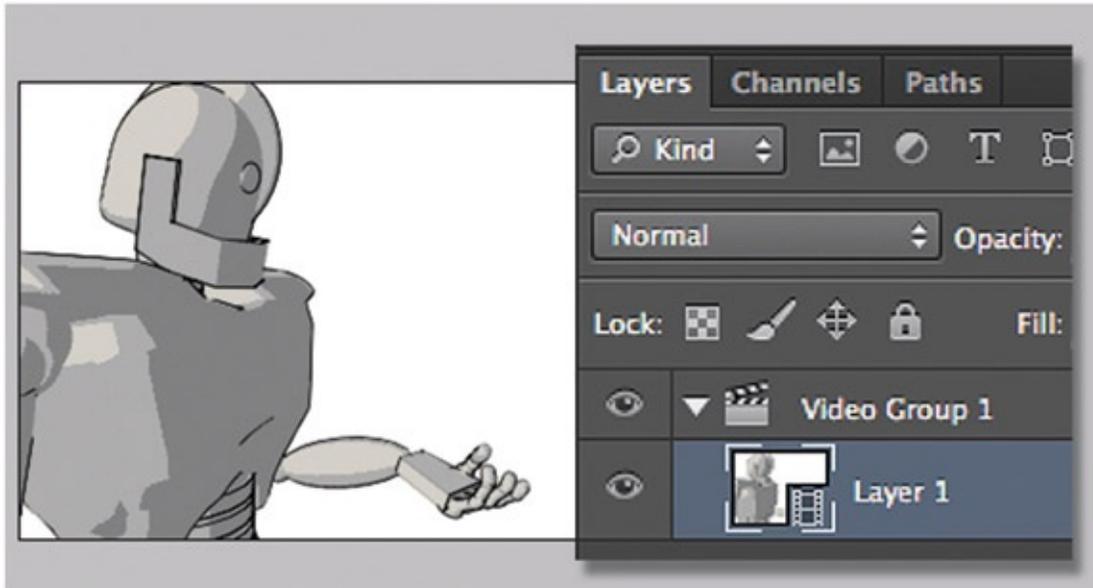
FIGURE 2.29 Robby imported as video layer

If you repeated the steps presented earlier for the Roy images, you would have a separate Photoshop file. In newer versions of Photoshop the video of Robby is in a Video Group. If you do the next step with Robby's Layer 1 selected, Photoshop will load the video clip of Roy *after* Robby.

Instead, click on the main canvas so that the Robby Layer 1 layer is deselected. Now, continue to the next step. Select **Layer > Video Layers > New Video Layer from File**, then select the first image of Roy.

You can't see both layers now, can you? There is a difficulty here. Photoshop doesn't know what alpha channel to use, so it does not use any. We can get around this. Select Roy's layer, then change the layer blend to **multiply**. Now you can see both layers.

Later in another chapter, we will learn how to work around Photoshop's video layers not seeing individual image alphas. For now, we are only using the layers as reference, so their alpha channel is not absolutely needed right now.
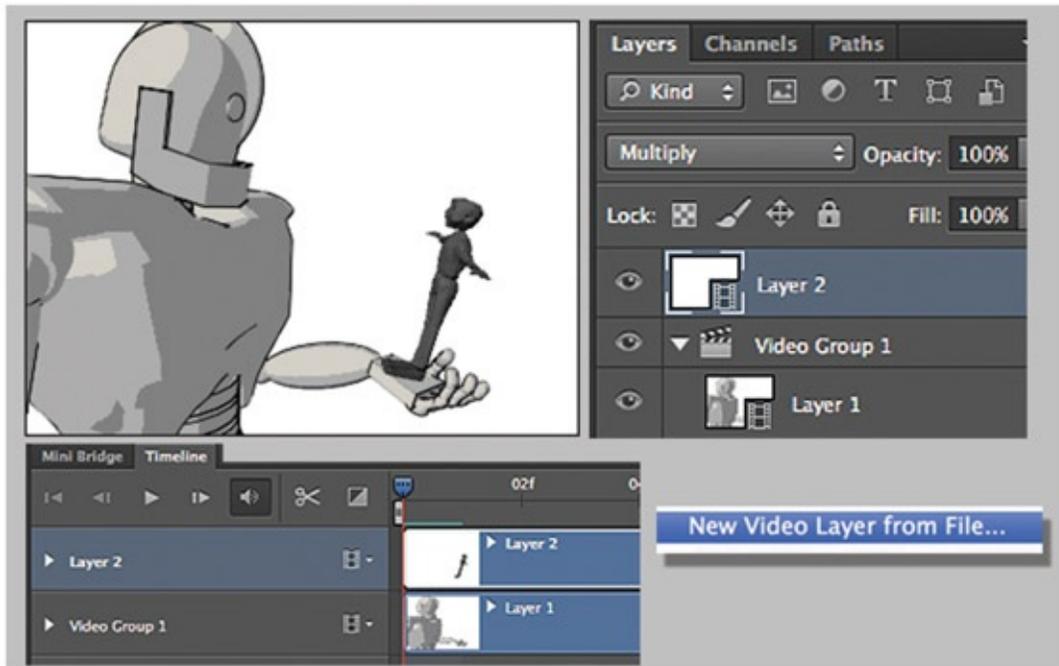
FIGURE 2.30 Multiply blend node allows you to see both layers

To Animate
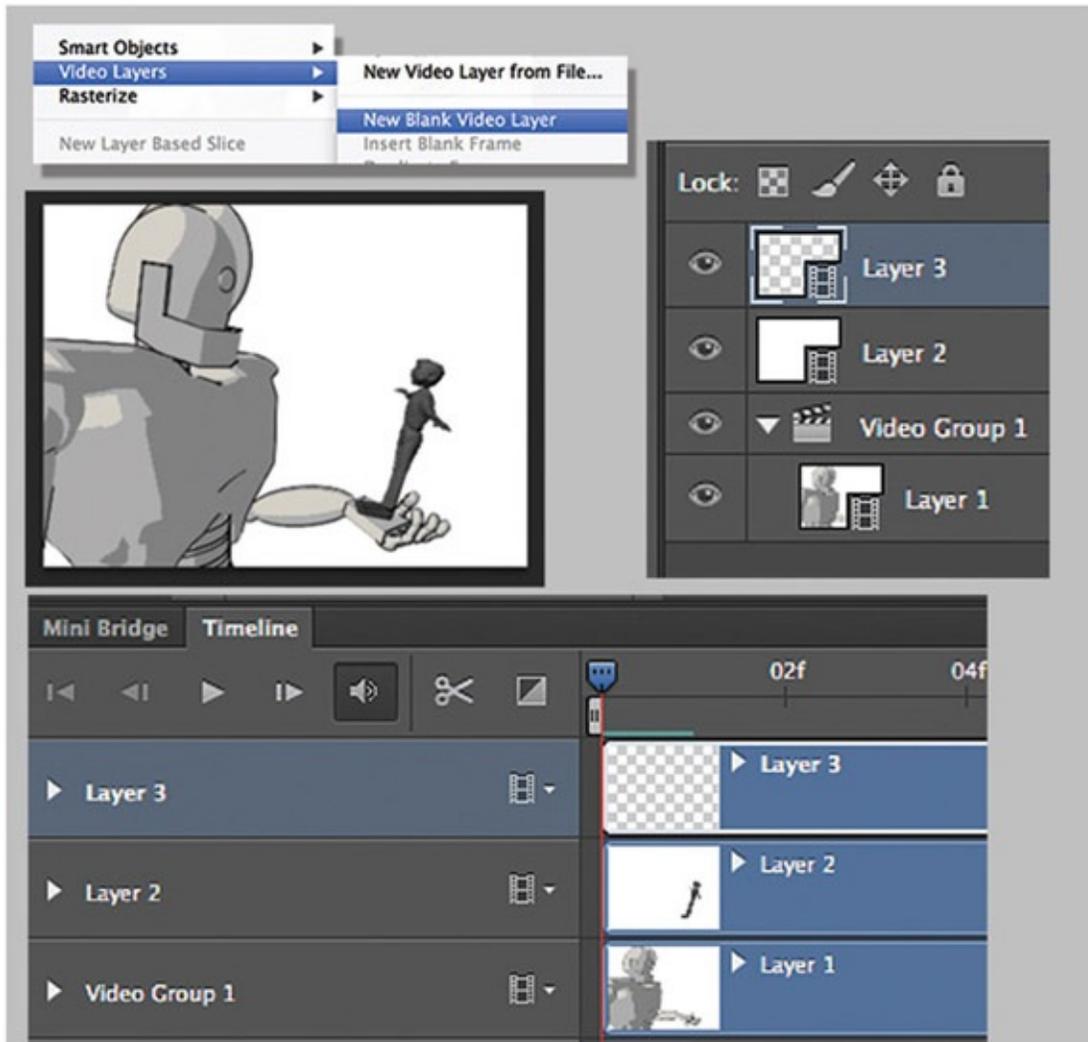
FIGURE 2.31 Blank video layer to draw on. Timeline shows Robby and Roy reference layers and the empty video layer you will draw on

To draw frame by frame in Photoshop, you will need a blank video layer on which to draw:

1. Click on the canvas to make sure no video layer is selected. Click **Layer > Video Layers > New Blank Video Layer**. Note the new blank video layer in the layer palette.
2. To see different frames, scrub through the timeline frames by clicking and dragging on the blue arrow.
3. You can do straight-ahead animation easily or do pose-to-pose animation. You will want to turn onion-skinning on so that you can see keyframes before and after the breakdown. Click on the arrow at the top right of the timeline window. Turn on **Enable Onion Skins**. Then choose **Onion Skin Settings**. Set the Frame Before and Frame After, and Frame Spacing options to 8. You should see ghosting appear in your animation.
4. Now you are ready to draw. Set brush size and style to your liking.
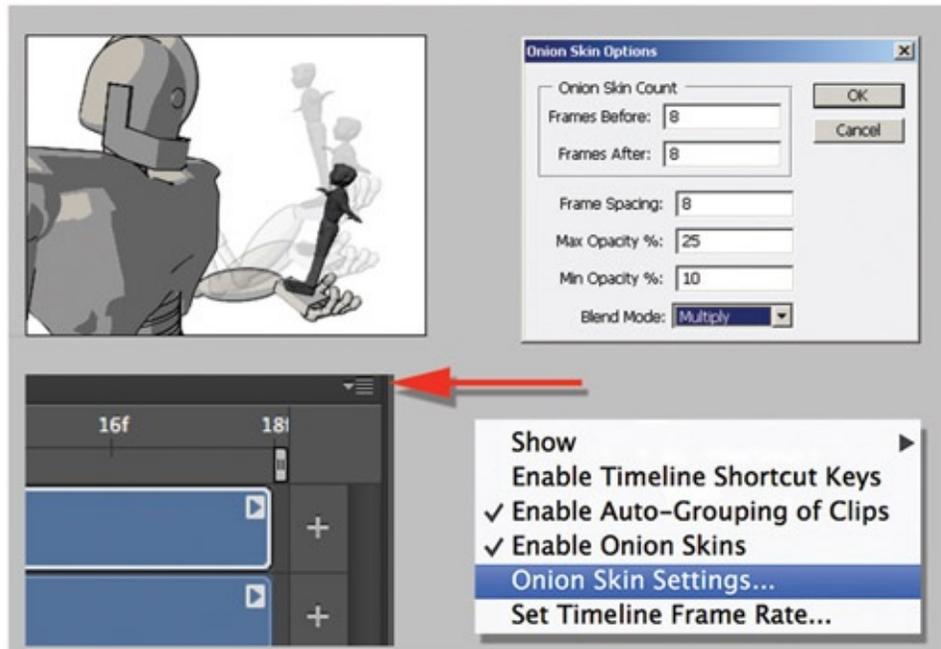
FIGURE 2.32 Onion-skinning

Dig Deeper

If you want to know a lot more about how to control the line look in Photoshop, check out *Creative Photoshop: Digital Illustration and Art Techniques Covering Photoshop CS3* by Derek Lea.

5. Make sure the blank video layer is selected. Animate by drawing on each frame. Move the blue arrow to the next frame. Continue to draw. If you have keyframes with the 3D reference character posed, it helps the 2D animator tie down the contact points more clearly.

A note on animating in Photoshop: this chapter is using **time-line keyframes**. The other method of using Photoshop to animate is **frame animation**. Frame animation is the original implementation of animation; timeline was developed later. If you wish to use the older version of animation, take a look at the Photoshop documentation.

If you are using CS4 or later, you can use hot keys to advance to the next frame or go back to the previous frame (super handy when animating). The hot keys are the arrow keys, and you will need to turn on timeline hot keys by clicking on the option arrow in the upper right corner of the animation window and turning on **Enable Timeline Short-Cut Keys**.

Rendering

When you are done animating, you will want to save out your file as individual images. These images can then be composited together with the other levels in the compositing package of your choice. The most important thing here is to get an alpha channel. These directions will help you get that. It's tricky in Photoshop.

1. First, **HIDE BOTH** reference layers. (Otherwise they will render with your drawn images. *OOPS!*)
2. Save the PSD file to retain the video layers for future changes.
3. Select **File > Export > Render Video** …

Use the following settings:

1. Set name and folder.
2. You can render out to quick time or individual frames. The *only* way to get alpha channels is to use QuickTime Movie.
3. To keep from losing render quality: Format = QuickTime **Settings**. Preset = **Uncompressed** (I would prefer to use .tifs, but at the moment Adobe packages do not seem to support .tif rgba.)
4. Set the **Alpha Channel** to be **Premultiplied with White**.
5. *Warning!* Watch out for the frame rate option at the bottom of the menu!
6. Click **Render**.

This will save a movie file of your animation with alpha channels. Note that you do not have an image for each frame. Instead, you have a movie file and that file can get quite large. It is uncompressed, which is sometimes referred to as "Animation" format in QuickTime. It is the same difference—100 individual frames or one big file. It is lossless, meaning there is no compression that can cause visual artifacts.
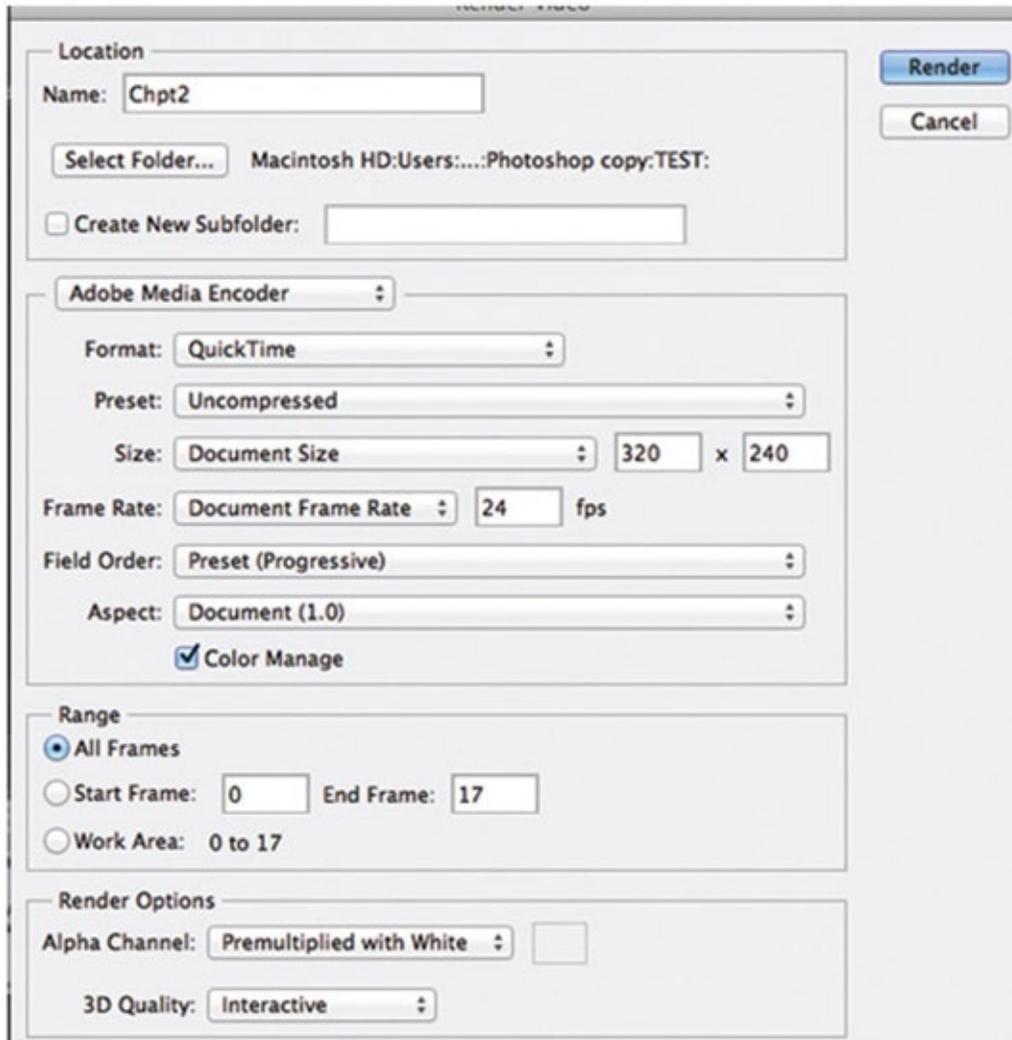
FIGURE 2.33 Rendering options

Maya and Corel Painter

I want to make a point here. Don't get all snobbish about software. (This is a reminder to myself as well.) What other software is out there? What can it do? What do we need it to do for our 2D/3D needs? Most importantly, our 2D package needs to bring in a series of images or a movie file so we can animate; needs to save out alpha channels; and needs to be able to handle the resolution of images and color depth you want. What if you want to use Corel Painter to animate in? It takes a few more button clicks, but you get the added bonus of animating in Painter. The paintbrushes and paper textures can add a great look to your animated film.

There are some issues with Corel Painter. Unlike Photoshop, you cannot have more than one reference video reference. (If you find a way to do so, contact me via the publisher's website.) Second, older versions of Painter crash when reading in .tifs. There are some concerns with bit depth in the newer versions. To avoid all of that, you may want to create a

render from Maya that is a JPG and is not using render layers.

Re-Render

You can use Photoshop to composite the Robby and Roy reference images together or re-render in Maya. It is up to you. In this chapter, we'll use Maya very quickly to re-render.

1. Open the Maya file of your completed animation or our file **Robby_3DLeads2D_5.mb**.
2. Freak out because you only see Roy and not the Robot. (I did. I thought I had lost something. One shouldn't work so late at night. It makes one jumpy.)
3. Go to the Render Layer area and click **masterLayer** so that everything shows.
4. Turn off **Options > Render All Layers**.
5. In the render layers, make sure that an **R** is only on the **master-Layer** or you will wonder why you don't have the **masterLayer** rendered.
6. Change the render settings so that you output a JPG image.
7. Batch Render.

Animating in Corel Painter

Corel Painter 12 has changed how you sketch over a movie source. Note: the online documentation for it is not accurate (at least when I was reading it). Here's how it really works:

1. Create a movie file for your 2D character by clicking on **Movie > New Movie**. Name it "**my2D.frm**". My file size is very small: **320 × 240**. Yours will be the final size that you are working at. Watch out—you could run out of memory here. Set the number of images = **18**, Onion Skin = **2**. (Onion-skinning refers to how many frames are in front and behind of the movie you get to see.)
2. Open the clone source window by clicking **Window > Clone Source**.
3. At the bottom left of the clone source window, click the icon for **Open Source Image > Open Source …**
4. Locate the Robby_Roy_together images. Because this is a sequence of images you will need to:

   a. Select the first numbered file, then click **open**.

b. Select the last numbered file, then click **open**.

c. Name the file that Painter will save: **myRef.FMP**.

d. Select the proper level of onion-skinning and bit depth (we'll use the defaults), and click **OK**.

5. Select the my2D window so that it is the active window.

6. In the Clone Source window click on **Open Source Image** and choose the reference image. It will only have the name of the first image listed—for example, **rr_together.0001.tif**.

7. To see the reference movie, click on **Canvas > Tracing Paper**. Tracing paper lets you see the clone source layer under your drawing layers.

8. The Frame Stack window should already be open. You can draw on each frame and advance forward to continue to animate.
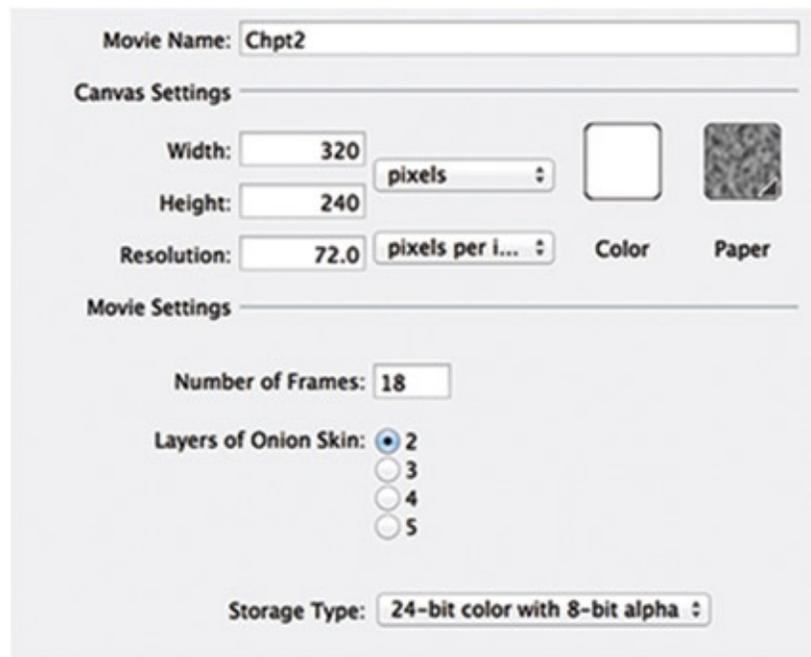
FIGURE 2.34 Settings to create new movie document in Corel Painter

What about onion-skinning? That was set in the dialog box when you first created the document. You can close the document and reopen it to set a new number of images to show for onion skinning. Why? I don't know. Let's assume it has to do with how the program allocates memory. The pointer to the reference file does not get saved with your animation file.

Oops—bug alert: The frame stack window in my version is not advancing the clone source frames. It should. Well, that's a bummer. To work around it, you can go to the reference movie, frame advance, and in the clone window add the same file again. It will continue to stack multiple images. Click on the correct image as reference. Wow—

that can go wrong very quickly. You have to be super careful to make sure the reference image is the same frame as the one you are drawing on.
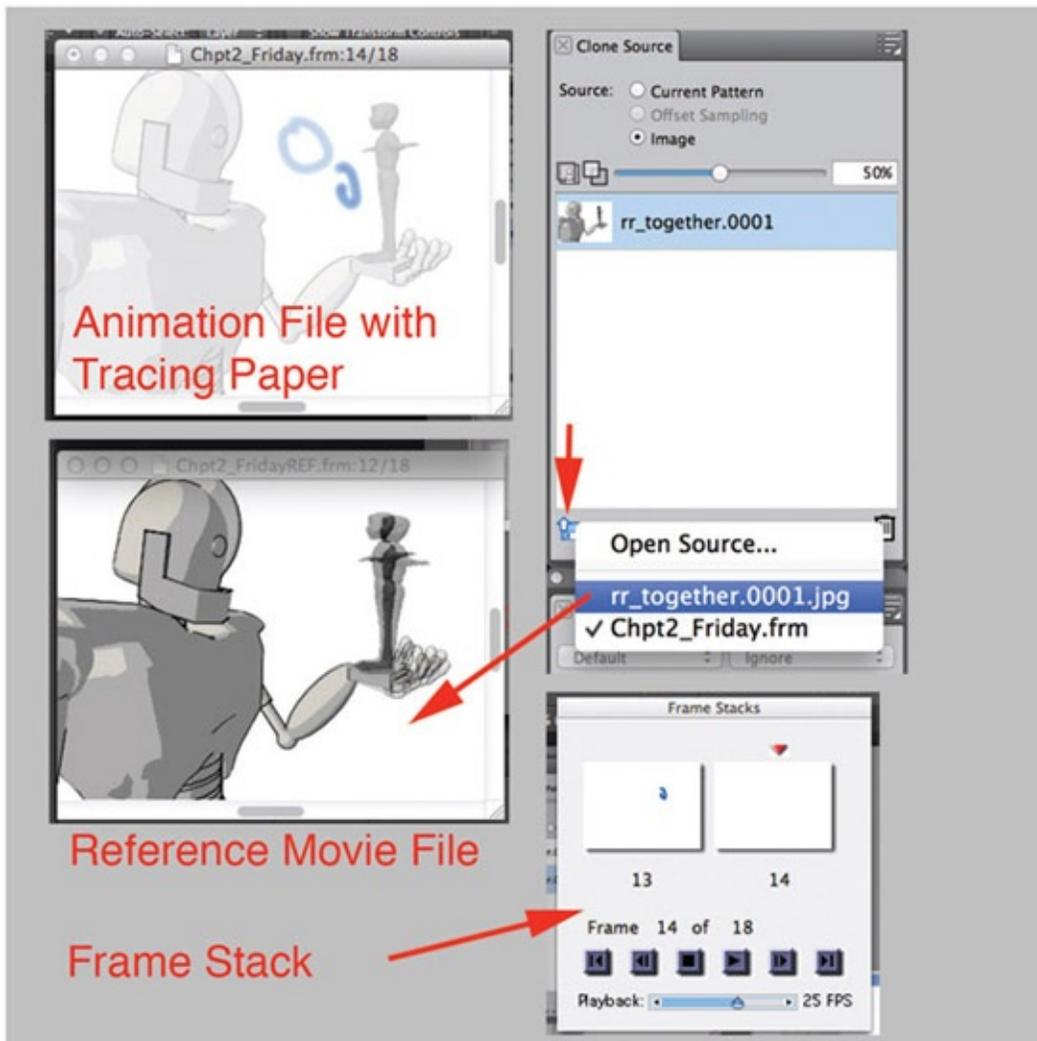
FIGURE 2.35 Animating using Movie Clone Source as tracing paper

Rendering in Corel Painter

When you have completed your animation, it is time to render out the images:

1. Select **File > Save As** ...
2. Choose Save Movie as Movie File.
3. Use the same settings that we used in Photoshop: Animation Compression and Millions of Colors. Watch out for frame rate!
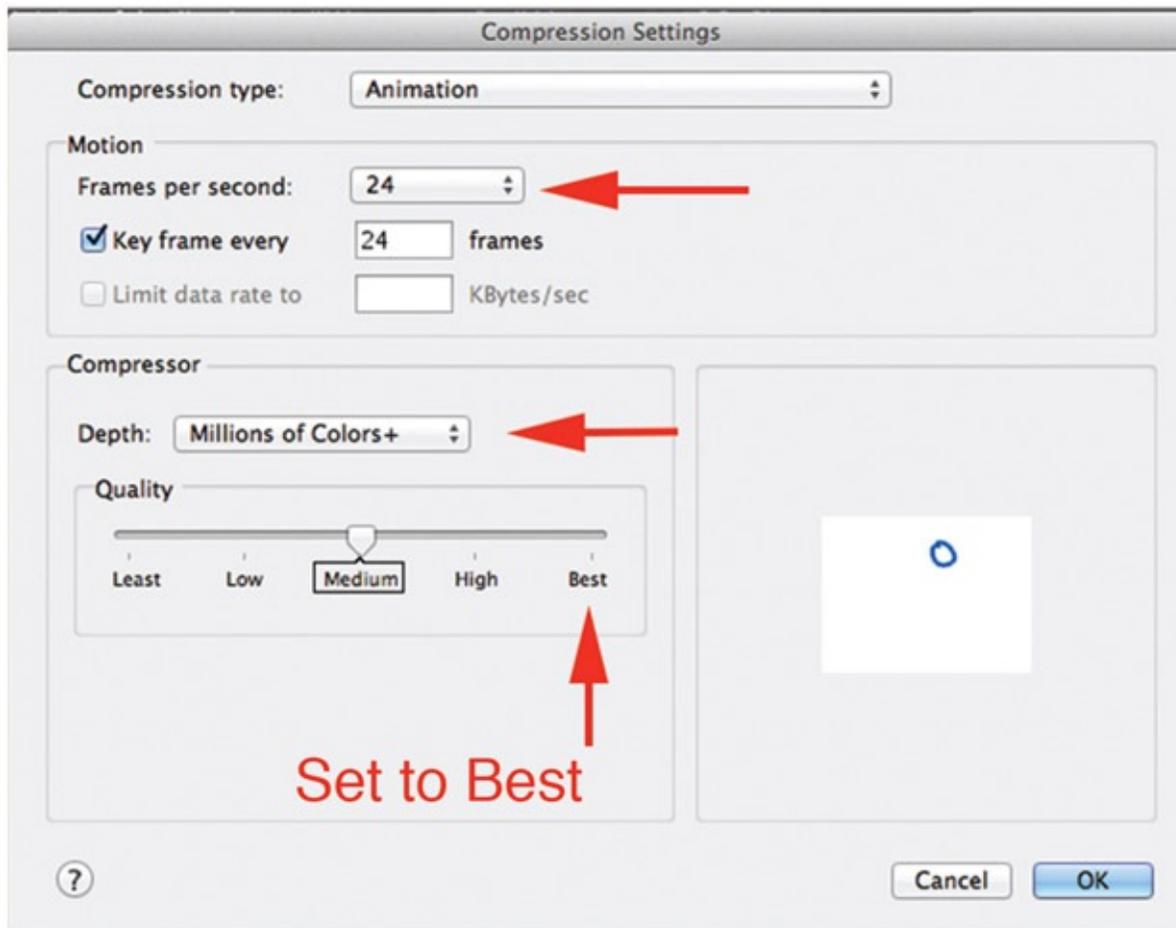
FIGURE 2.36 Rendering animation in Corel Painter

Bug: older versions of Corel Painter crashed when trying to export movie files. In version 12 it is working. When you are saving your images as a QuickTime file and you experience crashes, it might be the version of QuickTime you are using that is causing issues and not necessarily the piece of software. Try a different QuickTime version, possibly even an older one. If you are on a school's computer where you are unable to install files, you may have to find an alternative method for saving your images.

Let's consider what we just went through. There's a lot of button clicking and some things that just aren't functional. In your personal pipeline, you may want to evaluate your time versus money. If you are using cheaper software because that is all your budget will allow, consider how much time and effort each extra button click, bug, issue, crash, or bad documentation cost you. To counterbalance the time, you may find that you can only get a certain look out of a given piece of software. Corel does have extremely nice painting functionality. It's your decision.

Maya and Other Software

Of course, there are other software packages that you can use to animate in 2D. Flash might be your first choice, as it was designed as an animation package. The thing to watch is that your line *looks* like a hand-drawn 2D line and not like a Flash redrawn line. To do this you will have to hand-massage every line that you draw by turning the lines into brushstrokes (or drawing with the brush to begin with) and adjusting the vector points to smooth out the line. Figure 2.37 shows a drawing in Flash with the points selected for adjustment. To see an online example of Flash animation, take a look at Home Star Runner at www.homestarrunner.com. All animations are created in Flash, and each drawn line is massaged (or cleaned up) to be exactly what the artists intended.
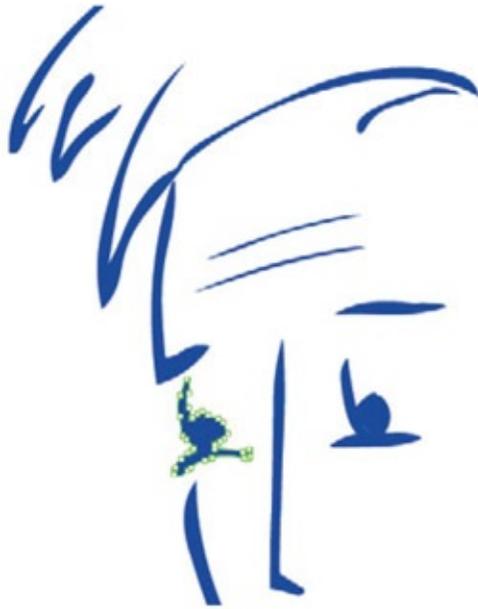
FIGURE 2.37 Drawing in Flash creates vector lines

A great package, and one that is a 2D digital animation industry standard, is Toon Boom. We'll take a look at drawing in Toon Boom later on in this book.
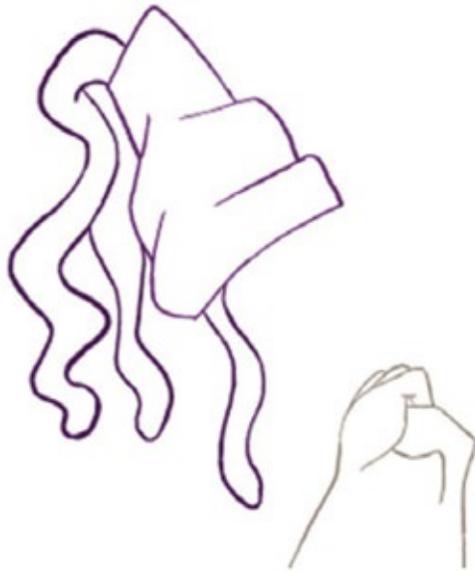
FIGURE 2.38 Drawing in Toon Boom also creates a vector image and can be used to create inbetweens

Test each software package and decide which one best gives you the style you are looking for. Remember what we covered in Chapter 1? Give yourself time to test other software programs to come up with other looks. Otherwise you risk only knowing one pipeline/technique and coming up with a limited number of visual looks.

Putting it together

You should have two levels ready to be composited together. We're going to look at timeline-based compositing very quickly, just enough to get you started.

There are two types of compositing software: timeline based and node based. After Effects, Premiere, Combustion, and other products of that price point are generally timeline based. They are good for quick workings and let those with smaller budgets achieve some great results. Node-based compositing systems such as Nuke, Autodesk Smoke, and Avid have a different way of approaching compositing. For some, they are more robust at putting together complicated shots. They are considered the high-end compositing packages, can handle larger images, and handle bit depth—oh, my, I'm starting to sound like a software demo jock; no, not that. Use what you have or what gets the job done. For animation, you do not need a super-duper compositing system; this isn't a visual effects movie we're putting together. However, there are a few things you will want out of your compositing system for putting together animations:

1. The ability to composite one image with alpha channels over another image: A over B. (If your compositing software doesn't have this, I hope it was free.)

2. The ability to create traveling masks to help register two images together.
3. The ability to use masks to color correct.
4. The ability to reuse artwork easily.
5. The ability to quickly render out the final product at different resolutions, for quick testing of the final results.

For this chapter, we will use After Effects. You will want to bring in your two levels, Robby and Roy, and composite them together to create the final output movie.

Take Note

Watch out for frame rate (again). We're working at 24 frames per second. After Effects (and most compositing software programs) default to 30 frames per second.

Set the Frame Rate

Go to the menu **Preferences > Import** … (under **Edit** on a PC) and set the following:

1. Select **Sequence Footage > 24 Frames per Second**.
2. Interpret Unlabeled Alpha As **Premultipled (Matted with White)**.
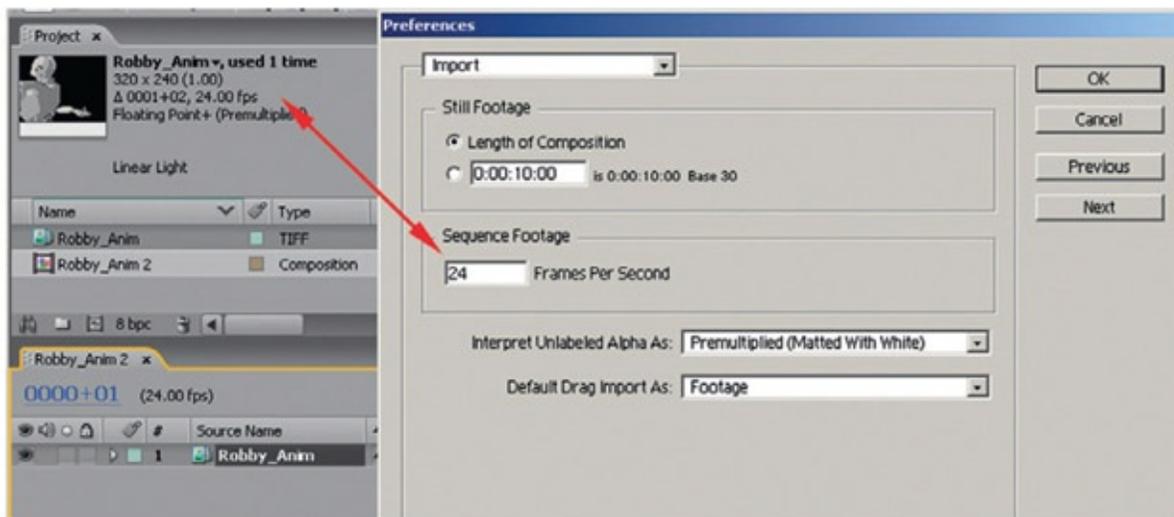
FIGURE 2.39 Settings to ensure a proper import of animation into After Effects

Import Images

1. Select **File > Import File**, and choose the robot's images. Make sure to select **.tif Sequence** and **Force Alphabetical Order**.

Take Note

What can go wrong here? If you do not have zero padding in your numbers—image-.tif, image-2.tif, image-10.tif—your images will come in out of sequence. Eeek! Don't do that, Batman! Instead, use zero padding in your image names: image-00001.tif, image-00002.tif, and so on.

2. Repeat step 1 for your 2D Roy images. If the files are a Quick-Time movie, you only have to select the file. After Effects will bring it in as you expect it to.
3. Drag the two image sequences into the composition area of After Effects. Drag and drop them with the Robot images on the bottom level.
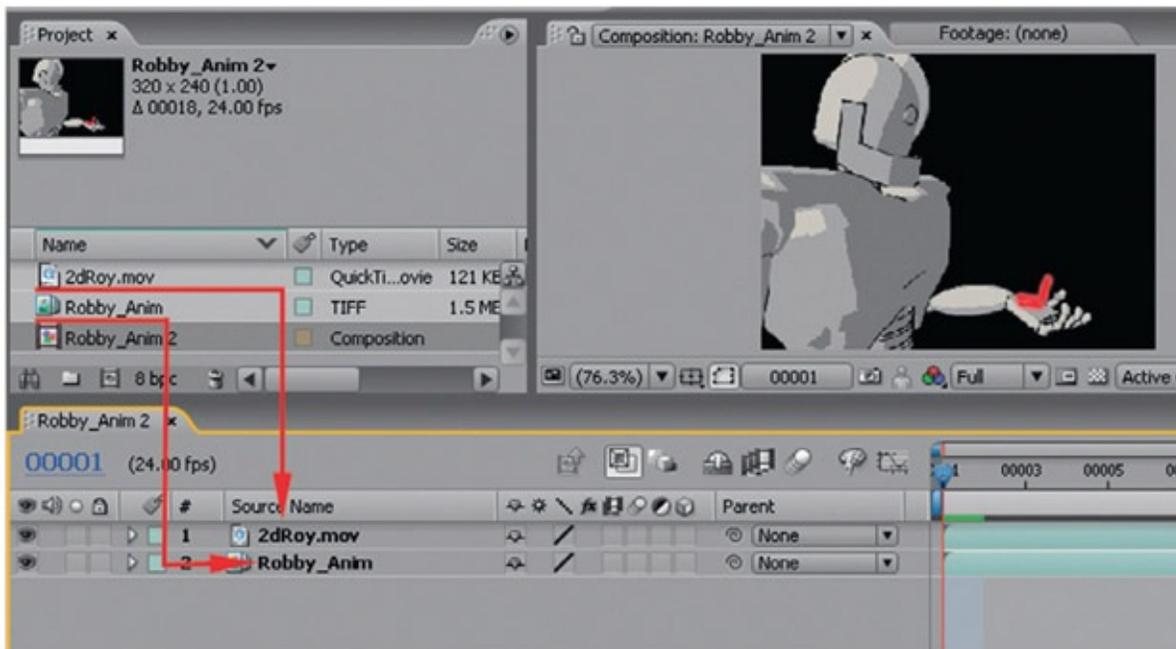
FIGURE 2.40 Drag levels of animation into the composition area of After Effects. (Apparently my Roy is only red feet and no body.)

Because of the way this project is set up, you should not have any overlap between the two characters. This means the fingers should not come in front of Roy. Well, they could. You might have animated Roy hanging on for dear life. I would. If that is the case, you need to do some matting out of Roy. There are a couple of ways to do that. We will cover the matting process in the next chapter.

Render Your Final Movie!

Render a low-resolution pass first for a quick check, then do a high-res composite. You probably guessed where to go to export out your final 2D/3D movie. In the Project tab, select the composition. Then select **File > Export > Add to Render Queue**. Click on the small arrow next to **Output Module**. This gives a list of quick rendering selections. What do you render your movie in? That is up to you. For animation classes we like to render in QuickTime, so that we can scrub through the movie frame by frame in Quick-Time. Also, a codec that has a good compression rate that doesn't degrade the image too much is useful. There are plenty of texts or websites dedicated to exhaustive comparison of codecs. I like Sorenson 3; still, it renders quickly and lets me double-check all is well before completing a lossless render. You may like H.264; it expects a certain image size.

Once you are satisfied that all is well, repeat the steps again to get the final render with a lossless compression. If you chose the quick setting of "lossless with Alpha," a peek at the custom settings will show that you are using an animation codec that saves raw images in a QuickTime file with a premultiplied alpha matte. These images you can use to put into your final edit, add sound effects, and so on.

One other note: the frame rate will now be changed to 29.97 frames per second, since only film actually plays at 24 fps. You'll note a warning notice in the custom rendering settings.
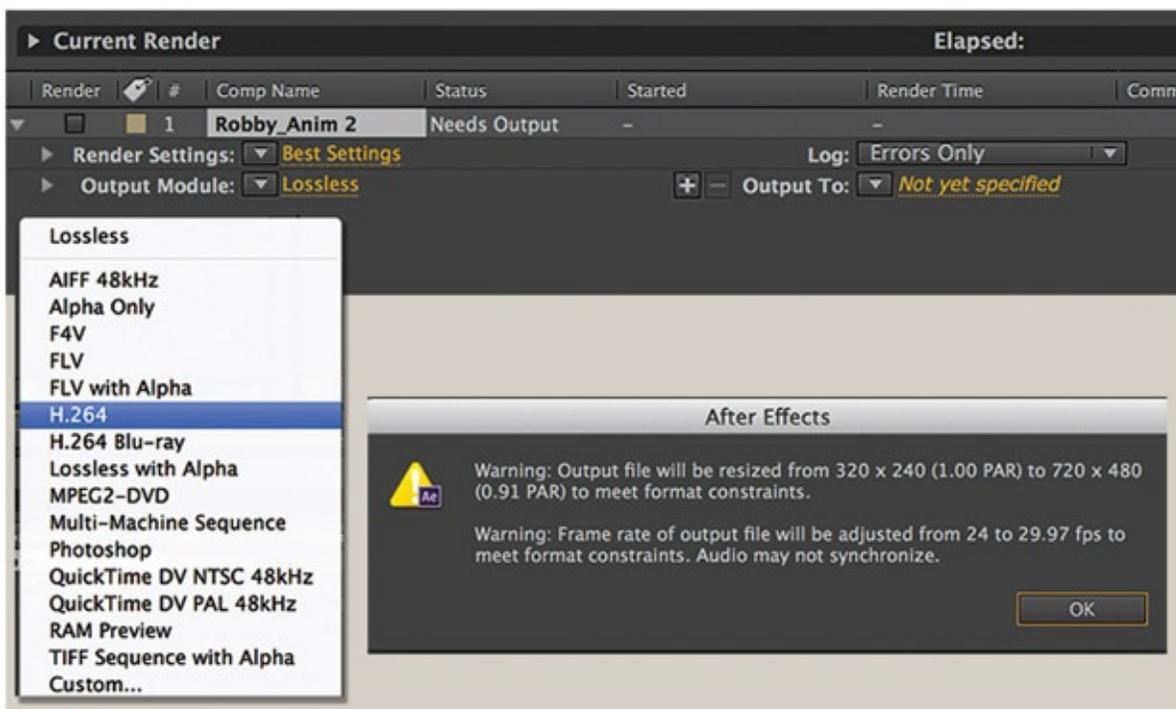
FIGURE 2.41 Compression settings for final composite
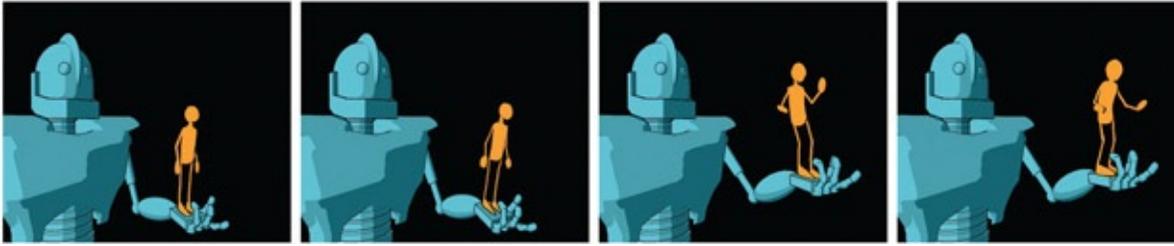
FIGURE 2.42 Keyframes from final composite

Further Reading

Lea, Derek. *Creative Photoshop: Digital Illustration and Art Techniques Covering Photoshop CS3.* Amsterdam; Boston: Focal Press, 2007.

LeDoux, Joseph. *Synaptic Self: How Our Brains Become Who We Are.* London: Penguin, 2003.

OHailey, Tina. *Rig it Right!.* London; Boston: Focal Press, 2013.

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John-Michael Kirkconnell

3

2D Characters with 3D Parts (2D Leads)
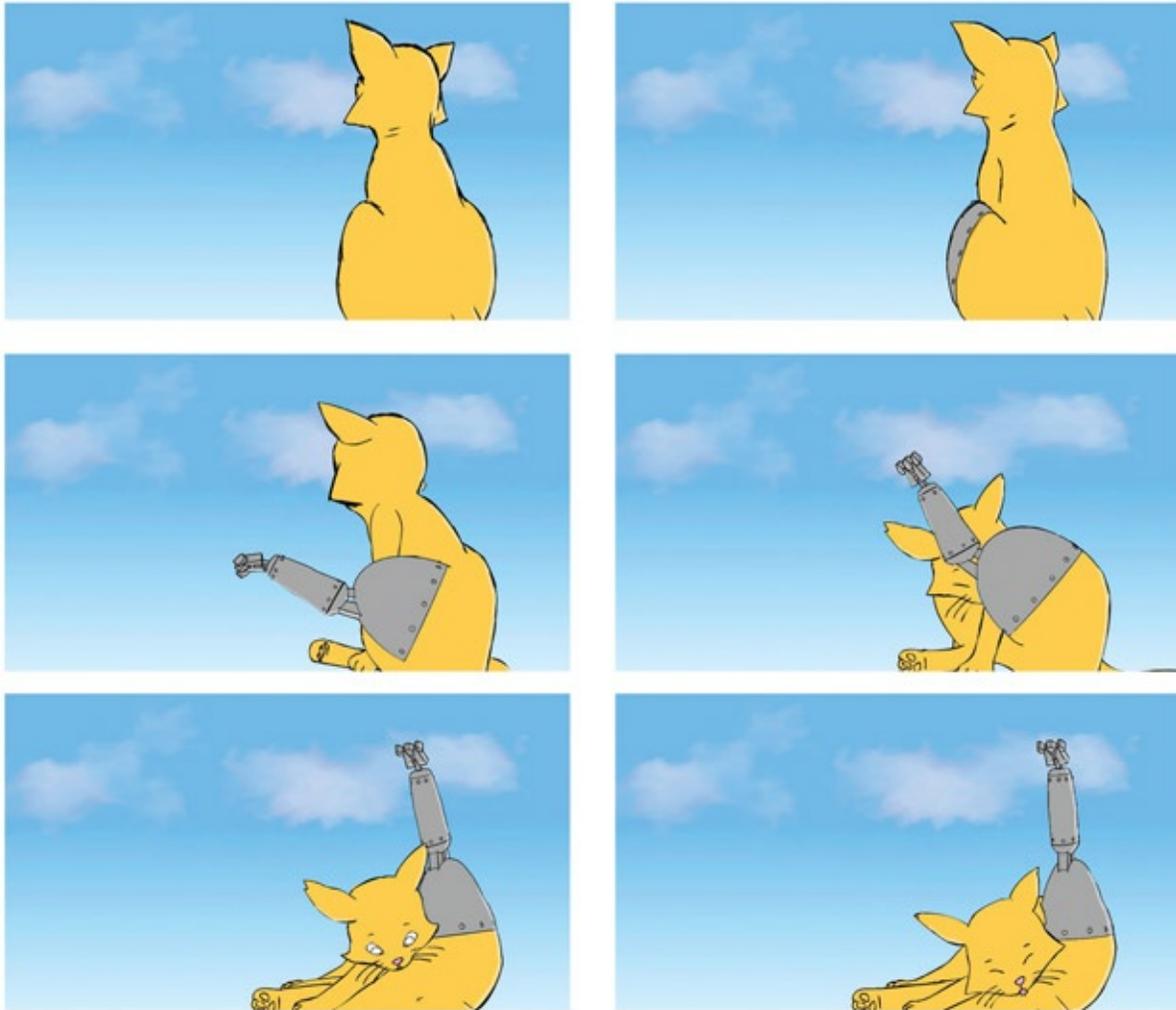
FIGURE 3.1 John-Michael Kirkconnell, 2009, 2D/3D course, SCAD

Lecture Notes

This chapter explores a true hybrid character that is 2D and 3D. In [Chapter 2](#), we looked at two characters of different media interacting. The contact point could have been skillfully hidden to avoid the issue of touch. We chose to show the touch/contact point because we were discussing how important touch between characters can be. However, in this chapter, we will look at one character in which we want the media to be seamless. We do not want the

differences in the character's media to divert the viewer's attention from the character's acting.

As with everything we have encountered, there are questions that must be answered. How do we make the two media look like each other? What should we look out for? What pipeline is best to ensure registration? What method will allow for the best animation? What method will get in the way of the animator the least?

How do We Make the Two Media Look Like Each Other?

A good answer might be that we draw everything in 2D: animate the leading portion in 2D and then animate the 3D section. Then we would take the 3D render and draw overtop of it in 3D. This doesn't help our line mileage any, but can certainly make for a uniform look.

Figure 3.2 shows an example of an animation that was done in Maya and then redrawn frame by frame in Photoshop. In this case, the animation was of a camera moving around the three characters. Doing the animation in 3D helped the animator to work out the perspective changes and drawing overtop in 2D gave it a nice organic feel.
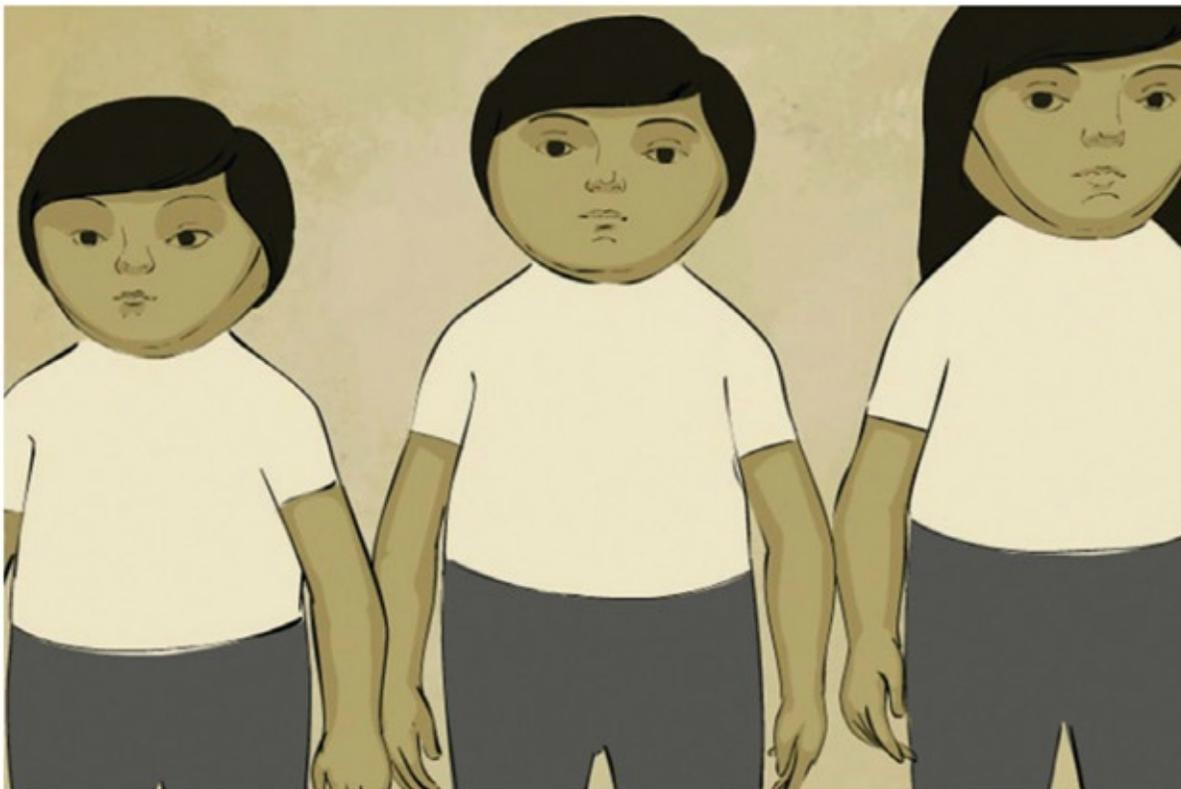
FIGURE 3.2 3D animation redrawn in 2D to create an organic feel.

Image from *3 Magicians* by Claire Almon

There are many examples of this type of line look. *The Pearce Sisters* by Luis Cook is an example of a hybrid animation created in 3D but drawn over in 2D (www.pearcesisters.co.uk/production.html). The resulting look is very stylized and was definitely influential to *3 Magicians*.

Now that toon line rendering has come so far (though it cannot completely emulate the beauty of a nice cleanup line), we can put 3D and 2D together to create hybrid characters. Later in this chapter, we will look at some industry examples of 2D/3D characters. Figure 3.3 shows a 2D/3D character from a group project class. The cast itself was modeled and toon line rendered in Maya. The organic parts of the character were drawn in 2D using Flash.
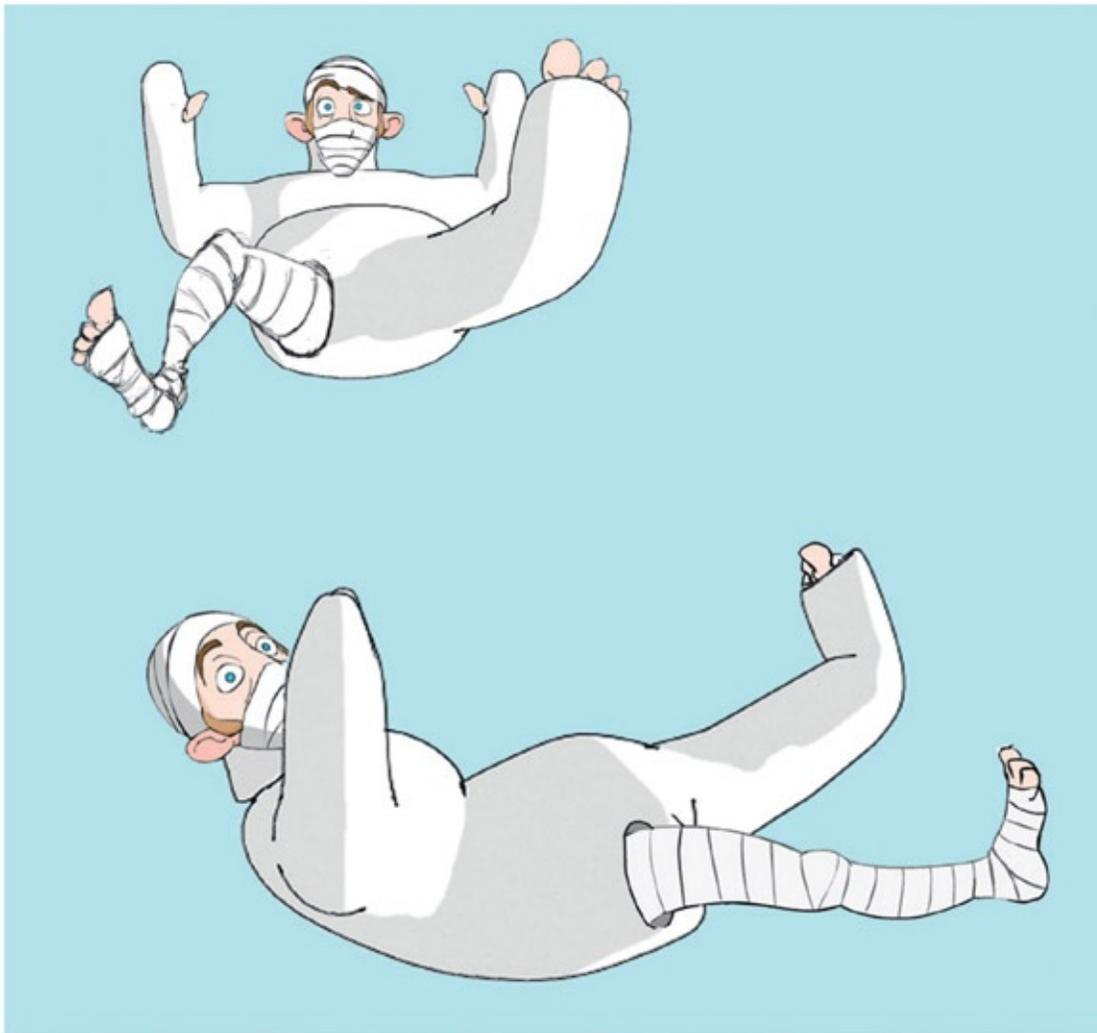
FIGURE 3.3 3D body cast with 2D character from *Jaguar McGuire* by Clint Donaldson, 2009, SCAD group project

To form a cohesive hybrid character, you will need to keep in mind the camera, lighting, shading, and movement.

Camera

The artist will want to flatten out the 3D as much as possible by using a telephoto lens (if feasible) to minimize the perspective shift of objects. This step is often overlooked as many new animators are not comfortable enough working with the camera in the 3D software; they tend to leave it at the default lens and focal distance.

Lighting and Shading

When putting the 2D and 3D portions of the character together, we will want to minimize how rounded the 3D character looks by using flat toon shading; or, if we choose a rounded look, the 2D character portion will have to have tones on it to make it seem rounded as well.

Movement

We've gotten away with timing things out in 3D and basically rotoscoping the 2D on top of reference contact points. With a character led by 2D, the 3D animator will need to have access to the timing chart and x-sheet for the animation in order to see where the 3D keys should be placed and what type of spacing should be used. It is possible to proceed without x-sheets and timing charts, but doing so can cause a disjointed feel in the animation. Also keep in mind that the 2D will more than likely be on twos.

What should We Look Out for?

When animating a 2D character that will have a 3D limb or some type of 3D appendage, make sure to draw in the placement for the limb. It will be erased at compositing time. A beginner's mistake is to forget to sketch in where the missing limb is and thus forget to put weight on it and the like. The more information you put into your 2D animation, the more you have to follow when placing the 3D portion.

What Pipeline is Best to Ensure Registration?

When 2D leads, it doesn't affect registration if you use 2D paper or digital 2D. There will be some time spent on scanning in the 2D paper animation, but this should not add any registration issues. Remember, we have registration issues the second we print, not when we scan. In short, 2D leading is easier on the pipeline than anything else. If there have to be any 2D animation fixes after 3D appendage animation is done, I would suggest doing them digitally. If you don't, then you will have to go through a printing and pegging process for your 3D appendage and then you will have to rescan. Art production managers will be looking at their schedules and grimacing.

What Method will get in the Way of the Animator the Least?

When it comes to digital 2D animation, I have kept my eye out for different techniques. Recently, on a group project, we had a handful of animators working in Photoshop, Flash, and Toon Boom. We compared notes and debated on which method we liked best. We'll cover different software and animation techniques in this book. You can choose which one fits your preferred method of animation.

What Method will Allow for the Best Animation?

Button pushing aside, there are other factors that are important to consider when choosing your pipeline for digital 2D animation:

1. *Timing.* You want the easiest method that allows you to work out your animation's timing.
2. *Playback.* You need to be able to play back your animation easily, often, and at the proper frame rate.
3. *Use of reference.* You want to be able to easily use reference images to see contact points. These can be from your 3D assets, sketches, and so on.
4. *Onion-skinning.* It is important that the methods you use allow for pose-to-pose animation so that you can see your previous and next key while working on the pose in between. The method must not be cumbersome (uh-oh, I'm slipping into white-paper, software-architecture language—"must not," "shall have").
5. *Line quality.* Can you draw in it? Does it slow your drawing process down? The hope is that it does not. This is the one main deciding factor in many of our group project/student project discussions. If the package you animate in doesn't give you

the final line quality you want, that is okay. You may have to add another software package to do the cleaned-up line overtop the animation.

In fact, given the specifications listed earlier of what an animator wants out of the production pipeline, it is not uncommon to have multiple software packages. For example, you might use Flash for the timing portion because of the ease of the timeline, Photoshop for the second pass at the animation and inbetweens, Toon Boom for the final cleaned-up line, and After Effects for the final composite. Now, the software I just mentioned is just an example; it is more from a student's vantage point of the software he or she might have available. Students might have to stay in Photoshop for the cleaned-up line if they do not have access to non-Adobe products. Other software programs that could be used include US Animation's Opus, Plastic Animation Paper, and CTP Pro, to name a few.

Is it Hard to Animate a Hybrid Character?

Creating a hybrid character does add some technical challenge. You will want to have a good reason to do it. What reasons? Those that we spoke about in Chapter 1: visual target, line mileage, and complexity. If it supports the story by supporting your visual target and minimizes either your line mileage (how much the animator has to draw) or the complexity (perspective, lots of parts, and so forth), then you have a candidate for a 2D/3D character.

The second you decide to do one character as multiple media you might find that your crew of animators cannot handle or prefers not to do both 2D and 3D. Some do, and those that do will be able to handle their shots alone. Some prefer only one medium, therefore you will have to assign two animators for one character. Did you hear an accountant just open a bottle? That does make for an expensive character. While one animator is working on the 2D portion, the other animator might have no work at his or her desk. Not an optimal situation for tight budgets.

Industry Examples

Using 2D for the character (be it traditional paper or digital) allows an artist to draw keyframes using those traditional skills that give so much personality to the character. On top of that personality, the artist is able to use 3D tools to push the character further by allowing more complex parts to be animated.

The most amazing mainstream industry examples can be found in Glen Kean's animation of

John Silver in the animated film *Treasure Planet,* and another more subtle example is shown in *The Triplets of Belleville,* where the 2D/3D integration is invisible.

I encourage you to take a look at the bonus features on the *Treasure Planet* DVD. There is so much information on there that you will have to watch it many times. In fact, it is one of the best examples of a visual commentary on a DVD. You can set it up so that you watch the film and, like a built-in lecture, the film will pause at the appropriate places, play a bonus video clip on how things were made, and so on, and then resume playback of the movie. It is a classroom on a DVD.

FIGURE 3.4 Pipeline test of 3D arm with Captain Hook animation

© 2002 Disney

If you look at the bonus features on the DVD, you will find a pencil test of Captain Hook that has his arm replaced with a 3D arm. According to Glenn Keane in his interview, they chose that scene because it had such strong acting and vibrancy. If you watch, it should become evident that the 2D character leads. The idea of 2D leading is the same with the John Silver character. This makes sense because he is the character moving around and the arm, eyepiece, and peg leg (which are 3D) follow the 2D's movement. The character design allows for an easy fit of the pieces together. I don't mean to say it is easy, just that the character design does not get in the way. The arm seam, where it fits the body, is a logical seam in the drawing. If and when the 2D sleeve comes over the 3D arm, special care must be taken when compositing these together, because the 3D would be both in front of the 2D chest and behind the 2D sleeve. This would require a matte to hold out (or not show) some of the 3D arm.

FIGURE 3.5 Close up of John Silver's arm shows a clean joining line between the two elements

2002 Disney

However, you might have not noticed the most *invisible* examples of hybrid animation. In *The Triplets of Belleville,* you might have missed the 2D/3D portions. You probably noticed some distinct 3D elements like the bicycle wheel, but did you see the 2D/3D character? Any time a character is riding a bicycle, the character's contact limbs are actually 3D. The rest of the body is sometimes animated in 3D as well to use as reference. You can take a look at the bonus features on the DVD to see examples. The 3D line was dirtied up to make it less perfect in order to match the 2D line.
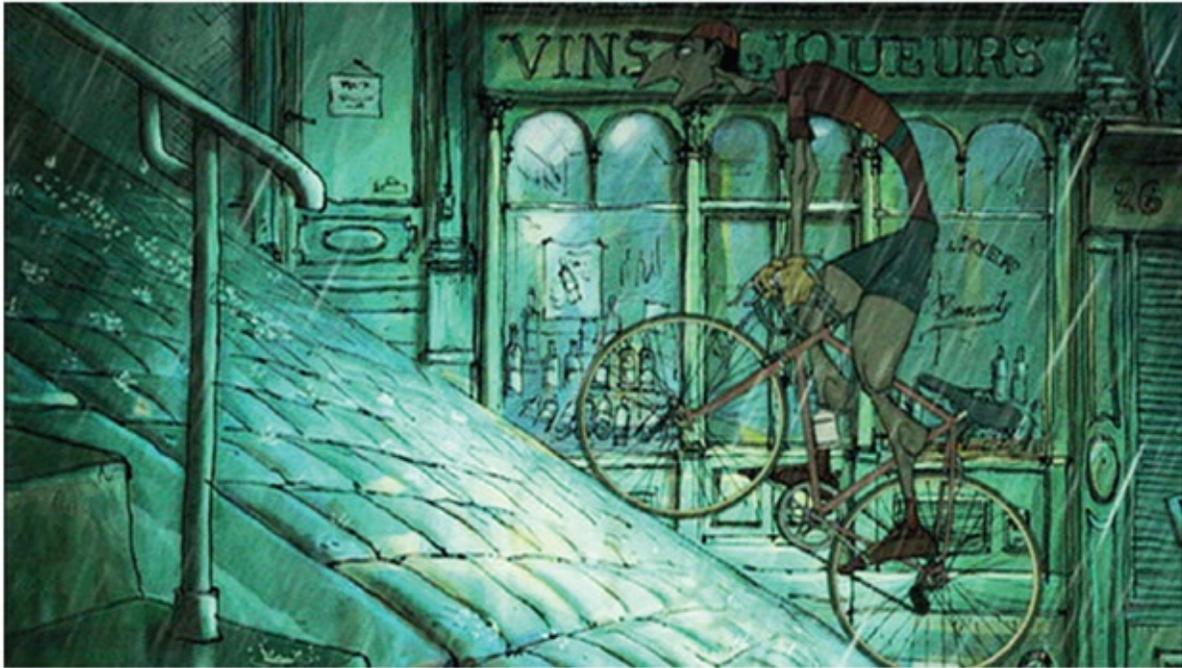
FIGURE 3.6 *The Triplets of Belleville* shows a 2D/3D character with a 3D bicycle

In Dreamworks' *Spirit, Stallion of the Cimarron,* you may not have noticed that the main horse is sometimes 2D, sometimes 3D. The same goes for many foreground and background characters in the film. It could be categorized as a 2D with a 3D part or a 3D with a 2D part because it is so interchanged. Buy that film and look at the extras on the DVD. From the beginning, Dreamworks had computers at the desks of the 2D artists. It was always treated just like any other tool. This showed in their films where they combined 2D and 3D seemingly effortlessly. Dreamworks eventually did transition completely to 3D for most of its films.

Students in my class, your homework is to go watch these three movies once for the story and once more frame-by-frame to see the 2D and 3D animation.

One last example that you probably are not aware of (there was no mention of it on the DVD) is the moose from *Brother Bear.* It might have been mentioned in the commentary. The moose were animated in 2D, and then the animators brought their 2D drawings into Maya and animated the antlers in 3D to match the 2D drawings. The drawings were printed out and pegged up, and the cleanup drawings were done traditionally on paper. I wish I had a picture of the antler rig that was made for the animators, Tony Stanley and Broose Johnson. They came to the training room one day and showed me the "make funny" button, which put Groucho Marx's glasses and mustache on the 3D version of the moose's head. You have to keep a sense of humor.

Hands-On Examples

Now let's go through the process of making an animation of a 2D character who has a 3D arm. Our main concerns will be registration and line look. As discussed previously, the line look of the two elements will need to match. To do this, you must master the rendering process and render the 3D line look or use the 3D part as a template and draw over it in the software package of your choosing. Unfortunately, the latter choice does not decrease one's line mileage.

We will take sequence 1, scene 10, from the storyboard at the beginning of this section. This is a sequence from SCAD student Dianna Bedell's senior project. The character was not designed to be 2D/3D. We will retrofit the Hoodoo priestess with a 3D arm.

FIGURE 3.7 Finished 2D character design by Dianna Bedell, cleanup by Amanda Powell, 2009, SCAD

FIGURE 3.8 3D arm by Danny Tiesling, 2009, SCAD

FIGURE 3.9 3D arm added to a 2D character

All images for this hands-on section can be found in the companion data for this book.

Timing

When working out your animation timing, there are many software and analog options for

you. I encourage my students to work in whatever method is fast and cheap. I don't mean cheap as in how much it costs. Instead, I mean cheap as in how dear it is to you. If you have to work very hard to create just one image, you will be less inclined to part with it if it needs to be changed or discarded. However, if you utilize a method that easily allows you to change an image that is not as dear to you, you are more likely to tweak. You will also want something that allows you to adjust your timing easily and go back to previous versions just as easily. This will allow you to be bold and experiment with new timing. Who knows what happy accidents might turn up?

Hopefully, you have already begun working in 2D and in this you have already begun working on the 2D animation pipeline that best suits you. In this chapter we're going to push for digital animation methods. Feel free to modify to fit the pipeline that best supports your creative process.

This chapter will not help you on your animation and acting. You'll have to bring that to the table yourself. To further push your animations, you can always refer to *Action! Acting Lessons for CG Animators* by John Kundert-Gibbs.

To begin work on your sketches, stay loose and work in your sketchbook and then scan those in. Or you can use your favorite software to draw in. Film Roman, the studio that brings us *The Simpsons,* has recently gone through a transition from paper to digital drawing. Film Roman's animators use both methods depending on the scene and need. They use Toon Boom's Sketchbook Pro to create their key sketches.

Once your main ideas are worked out, you will want to work on the timing of your keyframes. This can be referred to as a pencil test. I have a few students who use Photoshop to do their timing. I find it gets in my way because I think in x-sheets and timelines. To use x-sheets we could use Flash or Toon Boom.

Timing in Flash

For this example, we have scanned in our images using a flatbed scanner. Figure 3.10 shows an animation that has been scanned in with keyframes placed into Flash's timeline. Additional poses can be drawn easily in Flash. Keyframes can be moved. Held frames can be added or removed to adjust the timing. Playback is done easily as well.
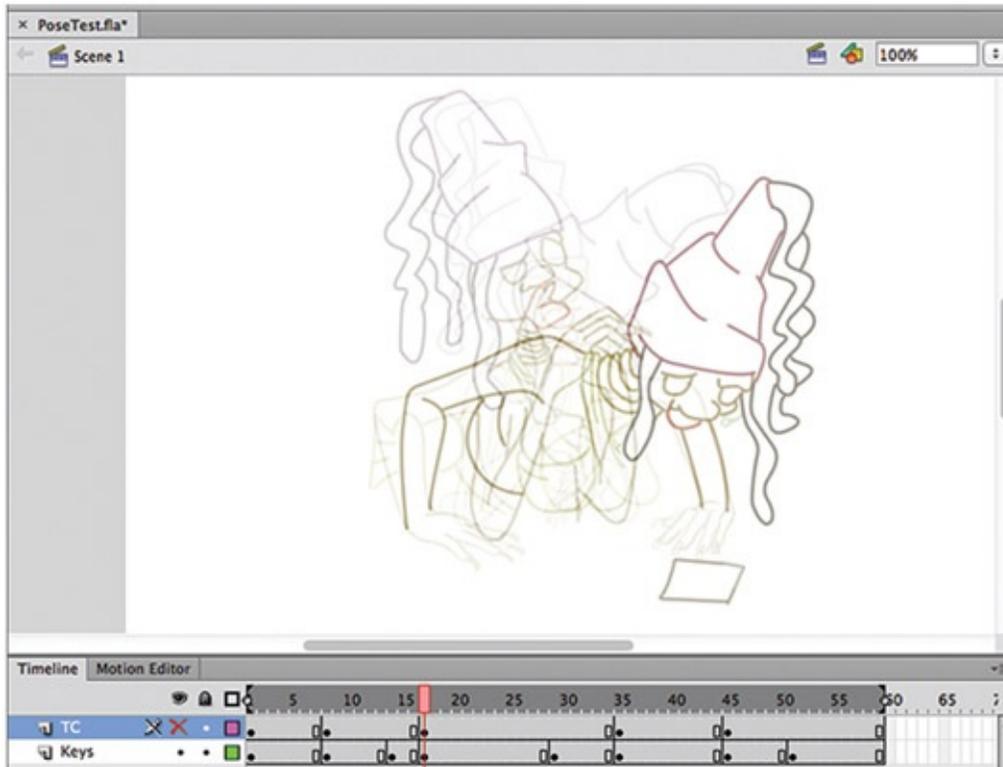
FIGURE 3.10 Keyframes placed in Flash and timing adjusted

Take Note

Remember to check your **frame rate** settings! We are working at 24 fps for this example.

Timing in Toon Boom's Pencil Check Pro

Another software program that you can use is Toon Boom's Pencil Check Pro. Here I'll show an example of using Pencil Check Pro and a multifeed scanner. (You will be spoiled rotten if you use one of these scanners.)

In Pencil Check Pro, click **File > Capture** to scan in the pegged-up images. You'll note that there are advanced settings for adjusting peg position and field size for scanning in this software. You can also import drawings that have already been scanned. Whatever software you use, the object is to adjust the timing of the key-frames. In the x-sheet window, Pencil Check Pro has some features you might find handy.
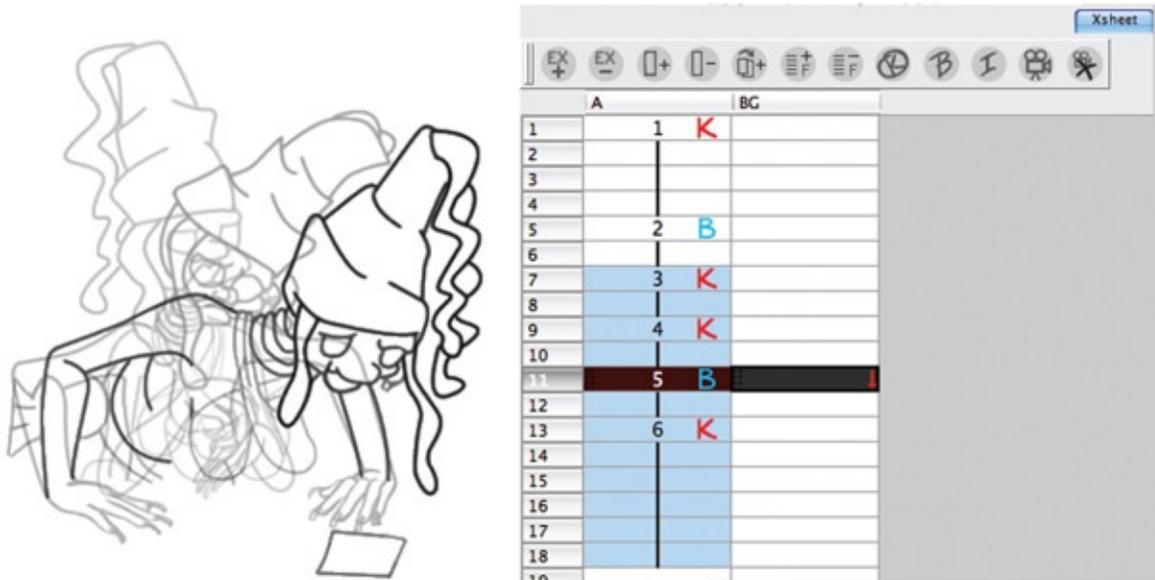
<u>FIGURE 3.11</u> Keyframes scanned into Pencil Check Pro with adjusted timing

1. *Holding keyframes.* Once you have brought your drawings into the x-sheet, select the first keyframe and click on the **EX +** icon. This extends the exposure. In <u>Figure 3.11</u> you see that the first keyframe was held for three more frames.

2. *Onion-skinning.* This one is very easy to find. There is an icon for "Show Onion Skin." <u>Figure 3.12</u> has onion skin showing. Settings can be found under **View > Drawing > Onion Skin**.

3. *Adding drawings.* To add a keyframe or breakdown in Pencil Check Pro, simply click on an empty cell in the x-sheet. Draw. Doesn't get much easier than that. You'll note that Pencil Check Pro draws in vector lines, which is resolution independent.

4. *Playback and adjusting.* Press the play arrow at the top of the canvas, and you will see your animation. Add and decrease exposure in the x-sheet as needed for proper timing.
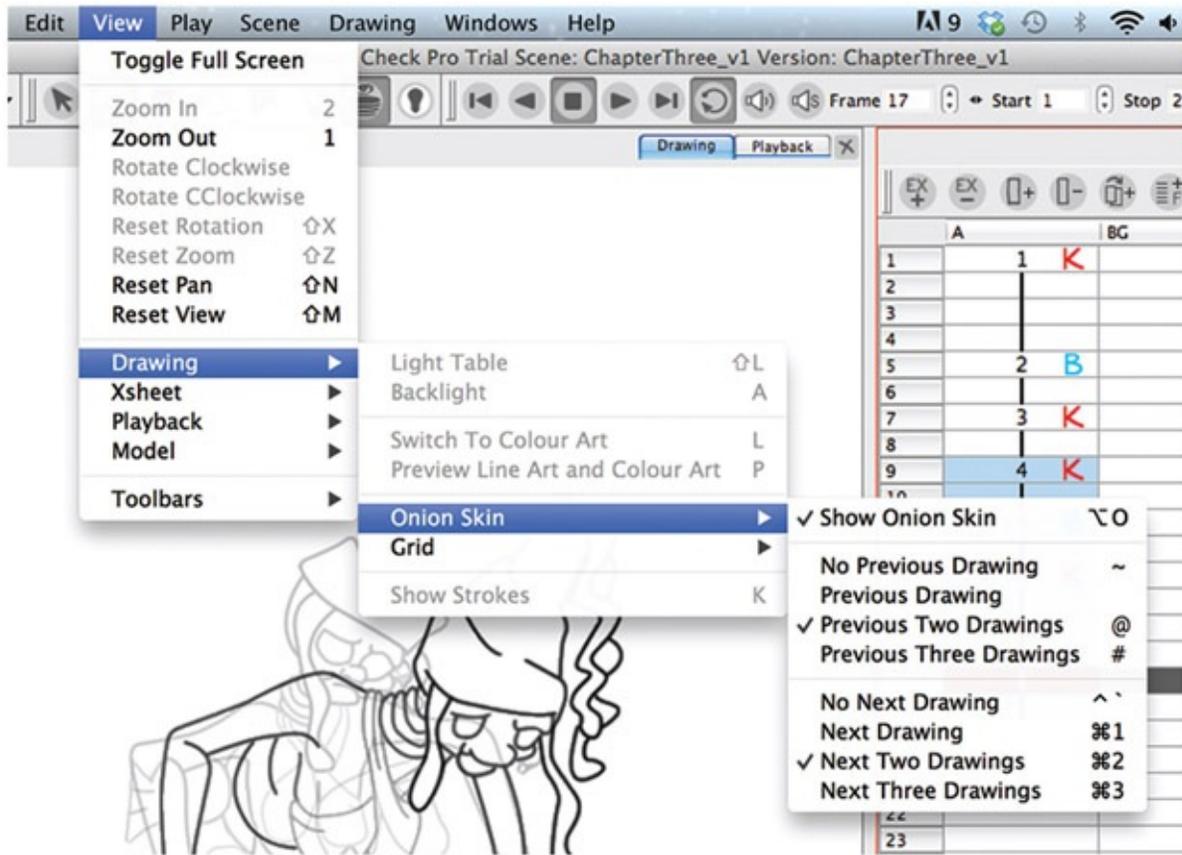
FIGURE 3.12 Seeing keyframes in onion skin

Director Approved

Once your timing is done and director approved, you'll want to save your images for the next step. If you are the director and if you are satisfied with your animation, then you are director approved. Move on to the next step.

In Flash, you will want to go to **File > Export > Export Movie...**. Because this is a low-resolution reference, we should neither be concerned with compression nor alpha channels. You can choose **JPG sequence**. This will save your animation as a series of JPG images with the base name plus the frame number in the old format of **name#.ext**. If you want a "." between the name and the frame number, add that in the base name you set. For example, you would use the base name "**jam.**" to get the final name of "**jam.001.jpg**."

In **Pencil Check Pro** you would also go to **File > Export > Export Images**. You might prefer movie or .avi files. For production, I'd rather have individual images. It is easier and faster to touch up/replace one image instead of reexporting a whole .avi file. Again, since this is reference and we aren't concerned about alpha channels just yet, .jpg will work for us. Pencil Check does not pad the frame number with zeros.
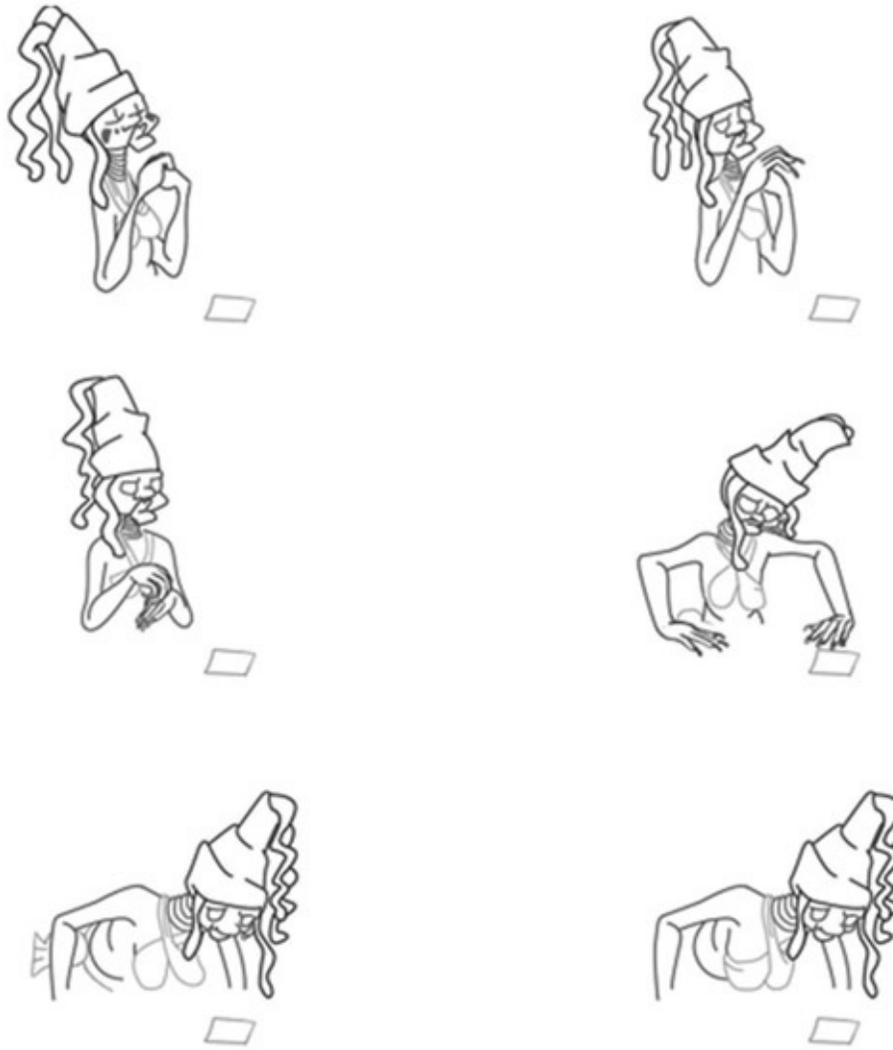
FIGURE 3.13 Pose test from Pencil Check Pro. Images by Dianna Bedell, 2009, Senior Project II, SCAD

3D Arm in Maya

Before cleaning up the 2D animation, you'll want to get the character completely animated and have that approved. We'll add the arm appendage. Depending on which 3D software program you are using, the buttons used will be different, but the process will be mostly the same. Your goal is to bring the 2D images in, set up a render camera to match the 2D image, work with the lens of the camera so that it flattens out perspective as much as you need to match your 2D, animate your 3D arm to that camera so that the image you create looks like it registers to the 2D image, and then render. Simple, right? Really, it is. Let's go through it, shall we?

Import 2D

Inside Maya, there are many ways to bring in an image plane. To make sure we are animating to the same camera as the 2D image, we absolutely need to attach the image plane to the camera. Other techniques of bringing in the image and texture-mapping it onto a polygon will not ensure that our 3D camera is accurate.

1. Create a new camera: **Create > Cameras > Camera**. Because this is a locked-off shot (the camera is not moving), we'll use a plain camera with no aim or up. Rename the camera **Render_Cam**, and give it a **Focal Length** of **150**.
2. Make sure this camera is the current camera (**Panels > Perspective > Render_Cam**). In the top of the camera window, click **View > Image Plane > Import Image**.... Select the first image of your 2D sequence.
3. But you have more than one image, don't you? You'll have to tell Maya that. Perhaps in a future version they will have a "Use Image Sequence" button right there in the open dialog box. Instead, at the top of the camera window click **View > Image Plane > Image Plane Attributes > imagePlane1**. In the attribute editor, click on the **Use Image Sequence** option.

Now in your camera view, you should see your animation. If you use movie files or .avi files, those will read in as well (if you have the QuickTime driver installed). If you scrub through the Maya timeline, you should see your animation in the Render_Cam window.
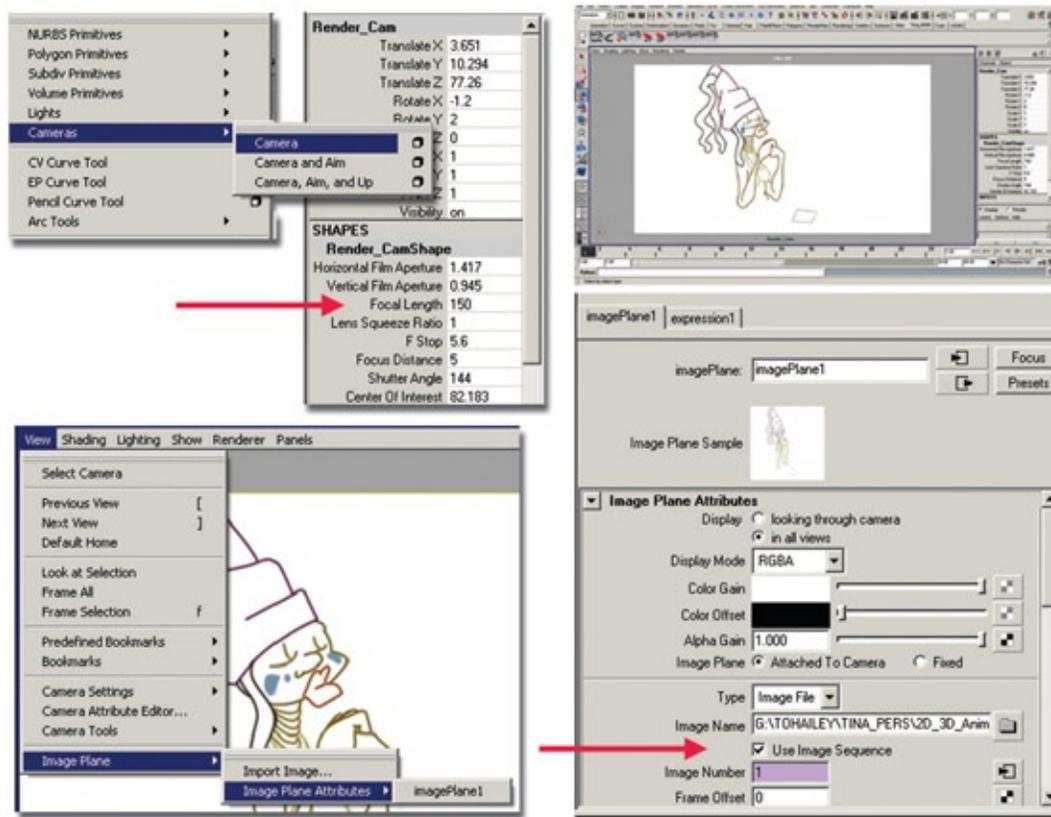
FIGURE 3.14 2D images imported into Maya

What could go wrong here? If your naming convention is not **Name.number.extension**, Maya will not be able to figure out that you have an image sequence. If you have a number in the name, Maya gets confused. For example, *kitty10001.tif, kitty10002.tif* might have issues. It should work if you instead name it *kitty1.0001. tif, kitty1.0002.tif.*

Take Note

Make sure that your Maya Render settings are the output resolution that you want! This is a locked-off shot, so the camera (canvas size) should match the 2D images that we created. A way to see immediately if your resolution is set correctly is to go to the Render_Cam view and click **View > Camera Settings > Resolution Gate**. The resolution gate (or rectangle) is hard to see because it exactly matches the 2D image that was brought in as an image plane. In the upper right corner of <u>Figure 3.14</u>, the resolution gate is being shown. As you can see, the resolution size is barely visible over the image plane. You do not see the rectangle resolution gate, because it is white and the image plane is white. If the render settings were incorrect, you would see the resolution gate as a different size from the image plane.

Here's a good question: Do they need to match? No. Actually, your 2D images can be a

separate size and you can adjust during compositing time. You would only need to globally resize your 3D image to match. But why go through that? Remember that bad habit we talked about—the "we'll fix it in post" terror, which is shorthand for "I don't want to think about it right now. Let someone else fix the problem."

Hold on a moment. I need to stop and look at this. All these button clicks; all these things that could potentially go wrong. And in a group project we'll have multiple people doing these things? Golly. Animation that goes beyond a single actor doing a vaudeville act in front of the audience is not easy. But we love it, so, okay. That was our reality check. Back to work.

Our file was saved as **2D_Leads_3D_v1.mb** inside the 3D_Arm folder.

Animate

The odd thing to get over when animating 3D on top of 2D is that you can move your camera all around to get the object looking like it is in the correct spot. The thing that matters is how the final image is going to render out. So you can do some unconventional movement in the camera placement to cheat perspective or use it to your advantage. Beware: overuse of this power can make for some odd-looking animation.
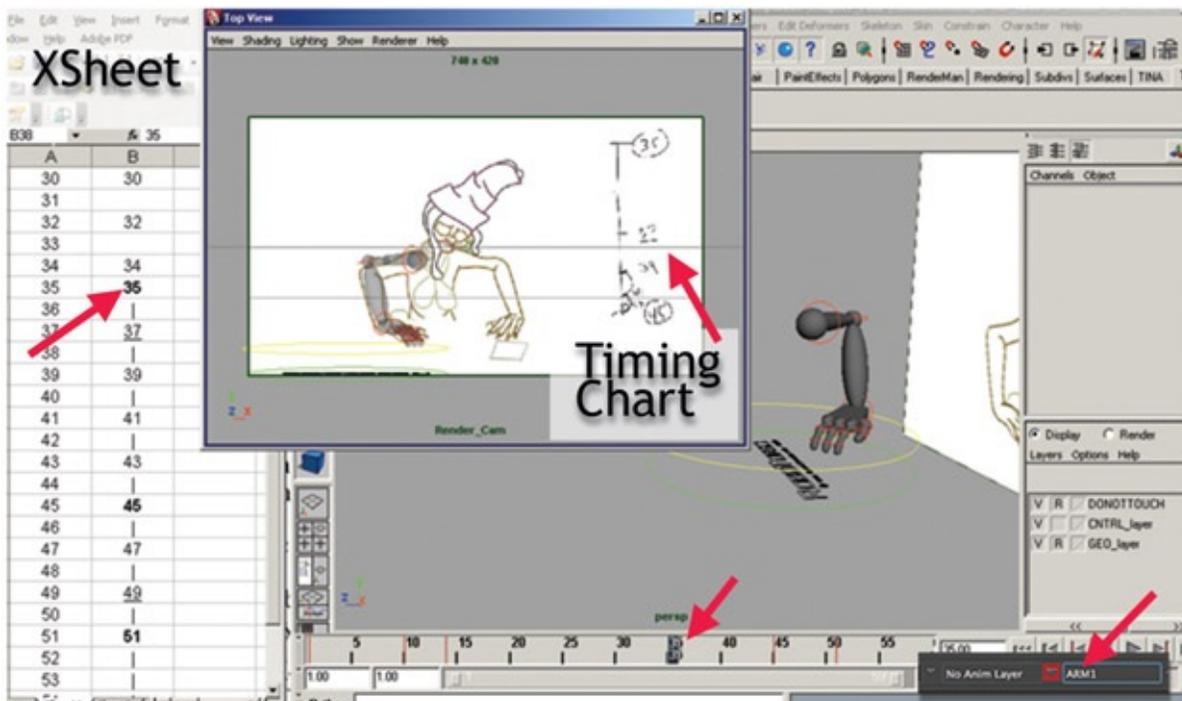
FIGURE 3.15 Keyframes set in Maya

Because we have the knowledge of what frames are keyframes via the x-sheet and we have an understanding of what timing was used via the timing charts, we have an easier time of

matching the 3D animation to the 2D animation:

1. Import in the 3D arm rig. Click **File > Import** and locate the **ArmRig_v1.mb** file. This will bring in the arm at the origin.
2. Use the **Perspective** and **orthogonal** views to position the arm so that it looks like it is in the correct spot in the Render_Cam view.
3. Find the keyframes on the x-sheet and pose your arm for those main keyframes. Our x-sheet for this example is on a simple Excel spreadsheet: **x-sheet.xls**. You can see the spreadsheet on the left side of Figure 3.15.

   > To help pose the 3D arm better, the Render_Cam has been torn off (much as we did in Chapter 2). Also, **Shading > Xray** has been chosen so that the animator can see through the 3D object to the 2D arm. If you have the 2D roughed-in arm, that will help you pose your limb. Of course, the perspective hand-drawn will not match. Look to match the contact points, the shoulder and wrist, more than the elbow.
   >
   > To set keyframes easily, this 3D arm has a character set: **Arm1**. Select the character set for the arm and hit **s** for each key-frame. As Figure 3.15 shows, keyframes set in the timeline correspond to the x-sheet. You'll note that the perspective camera is used to pose the arm in 3D space so that it looks correct in the Render_Cam view.

4. Next, look for breakdowns and the spacing they should have, and create keyframes for your arm. Again, if you have a timing chart from the 2D animation, you should be able to match the same spacing and achieve better registration with the 2D character. If you do not have a timing chart, you'll have to guess where the breakdown is and know that the next step is going to take much longer. In Figure 3.16 the breakdown 28 is halfway between the keyframe for 16 and 35. (For those truly following along with the enclosed data, frame 16 is held from frame 14, and in the enclosed example, frame 28 was moved to 29.)
5. Remember to roll through your drawings often to make sure that the arm registers in its socket. Look for jiggling at the contact point and adjust your keyframes to eliminate the jiggling.
6. Now, add your inbetweens. Use the graph editor to adjust the final spacing of the drawings to match the 2D.
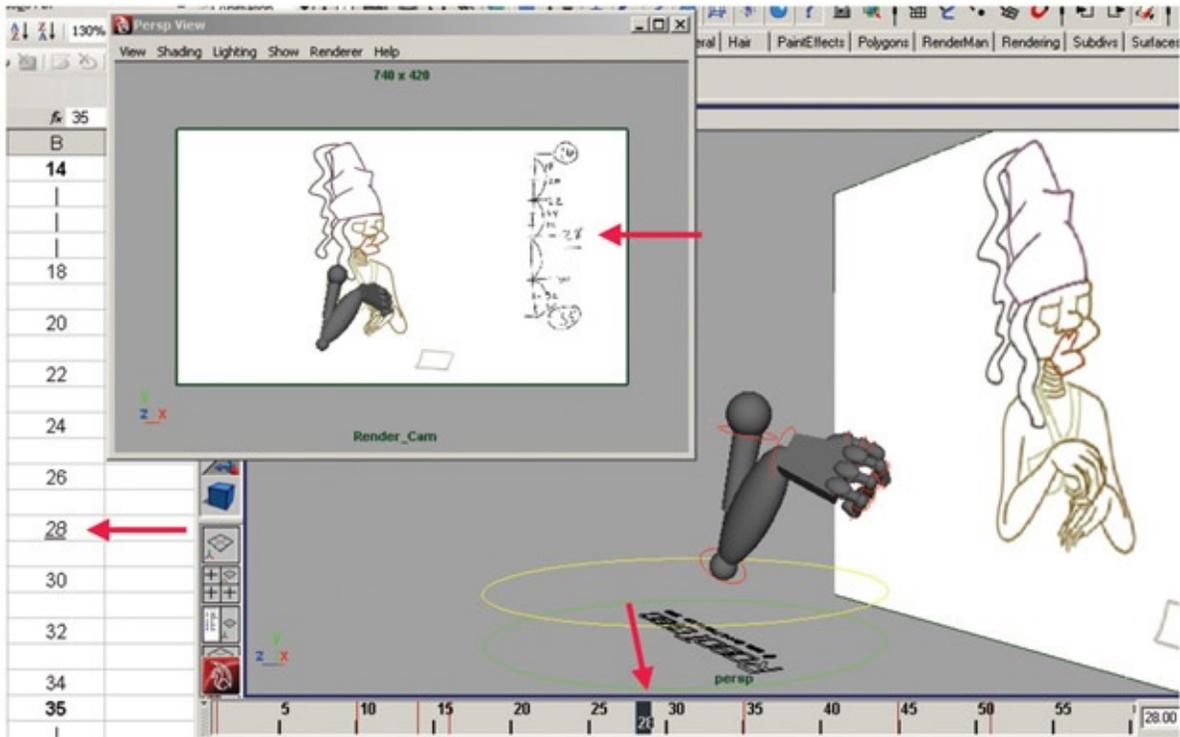
FIGURE 3.16 Breakdowns set in Maya

Take Note

A note on following the timing chart. With the timing chart showing where breakdowns are on halves, or halfway between the keyframes, you can speed up your workflow and use Maya to your benefit. For instance, the timing chart between frames 16 and 28 calls for frame 22 to be halfway between the keyframes. Set the tangents on frame 16 to be linear. Frame 22 will then be mathematically halfway between the two keyframes. Go to frame 22, take a look at the drawing, and adjust as necessary to put things on arcs or add overlapping action and so forth, then hit **s** to set a keyframe.
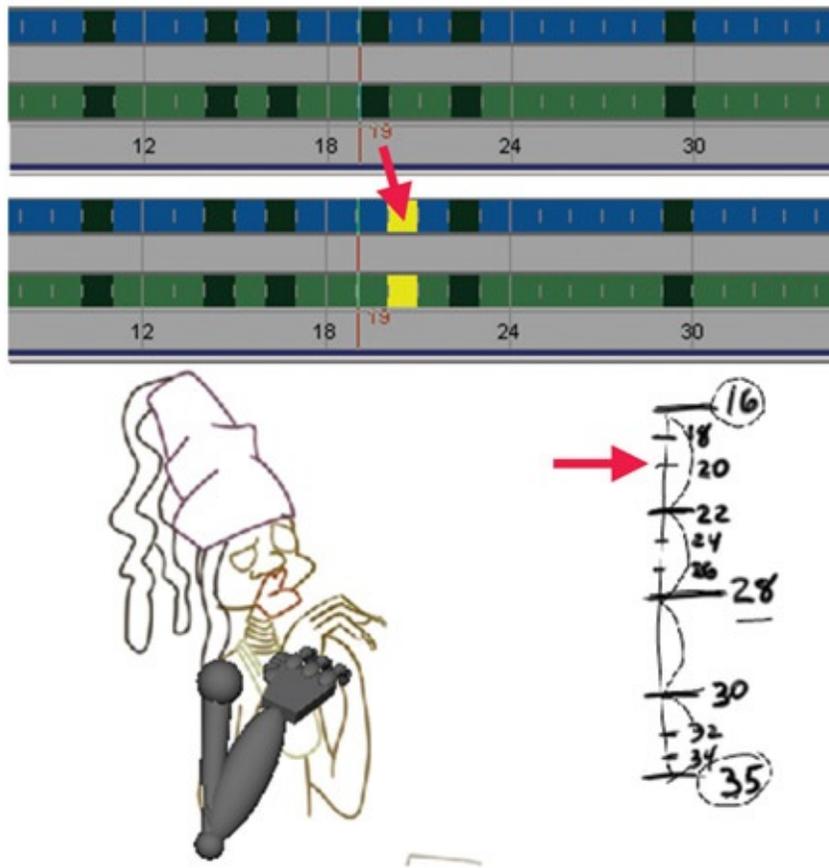
FIGURE 3.17 Using Maya's inbetweens but moving them to the correct time to match the timing chart

The next half on the timing chart is for frame 22. That drawing is supposed to be halfway between frames 16 and 22. Let Maya do the work for you. Locate the inbetween that Maya has made that is visually halfway between frame 16 and frame 22. In our example, it is on frame 19. Go to frame 19 and hit **s** on the keyboard to make that a keyframe in Maya. Then simply use the dope sheet to move the keyframe to frame 20 as the timing chart indicates. Now you can more easily go into the graph editor and adjust your spacing by moving the tangents. Your timing, where the keyframes and breakdowns are, is already in place. This method speeds up your work-flow tremendously. Use Maya to do the work for you, but control it so that you don't end up with Maya inbetweens. (The horror!)

FIGURE 3.18 Completed animation in Maya

7. We'll use your **twos.mel** script to put this animation on twos:

    a. In the outliner, select the character set.

    b. Type **twos** in the command line.

    c. You will receive the feedback. Put this command on a shelf to animate the timing: **select—r timeOnTwos**.

    d. Highlight the command **select—r timeOnTwos** and middle-mouse-drag it to a custom shelf so that you can use it later on.

    e. Scrub through your animation to see that your work is now on twos.

> What? Oh. Your animation isn't always on twos? That is the case sometimes, isn't it? Let's look again at our animation. If you have timing that is on ones at some points and on twos (or fours, whatever it may be) at others, you can animate what the script has set your timing to be. It isn't too hard, either. I like this method much better than setting every key on stepped and manually making every keyframe on twos.

    f. If you haven't clicked anything since running the script, the **timeOnTwos** node is still selected and you can see it in the channel box. If not, you'll need to click on the button you made or type into the script editor: **select— r timeOnTwos**.

    g. You can animate this attribute as needed to adjust your timing. With the time set to frame 1, right-click on the attribute and **keyframe selected**. This will set a keyframe for timing on twos.

h. Advance to a frame where you need the timing to change to ones and change the **By** attribute to **1**. Set the keyframe on that attribute.

i. This way you can adjust your ones and twos but still use the graph editor without creating a large mess.
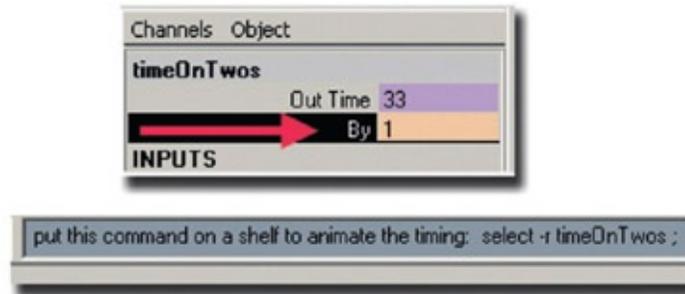
FIGURE 3.19 Using twos script to put 3D animation on twos

8. Render the animation. There is already a toon shader and ink line on the arm for you. You need only to render the arm level. This means that you do not want the image plane to render. How do you get rid of that? You can either delete the image plane at this point or adjust the alpha gain for the image plane to be 0. Then render as follows:

a. Set the render settings. See Figure 3.20.

i. Name the level
ii. Name.# extension
iii. .tif (or something that keeps alpha channels)
iv. Start and end frames
v. Frame padding
vi. Select the correct camera
vii. Make sure to include alpha channels
viii. Make sure your size is correct.

b. Click **Render > Batch Render**.
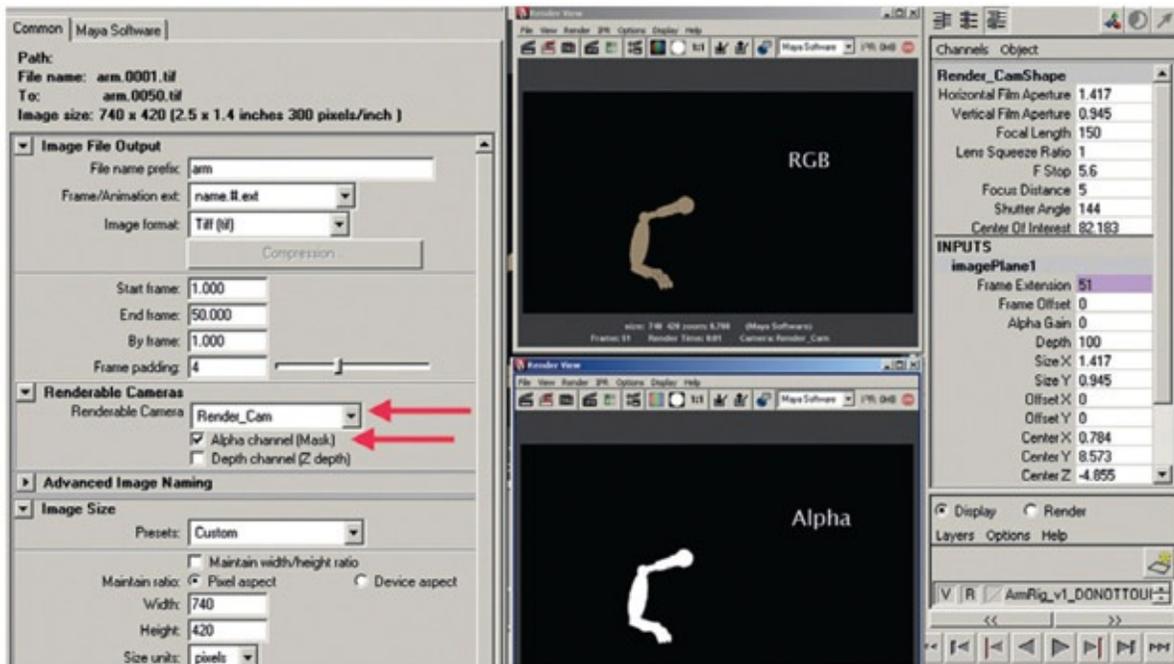
FIGURE 3.20 Render settings and example of final renders

Our arm level file names are arm.#.tif.

How did you do? Things should start to seem a lot easier now. If you did not have a good grasp on the graph editor to begin with, this might be a little tricky for you. Please, avoid keyitis. This is a horrible disease in which the animator who does not feel comfortable in the graph editor begins to compensate by setting key-frames on every frame. Yes, you can do this, *but* you start to get into stop-motion animation at that point, where everything is being moved manually and no matter how hard you try, there will be pops and jumps between images. Of course, if you are going for a stop-motion feel, don't do it that way either. There are procedural ways to adjust your timing to get the same type of feel. I can't stop you. If you have to go through your keyitis phase, go ahead, get it out of your system. If you start to miss your quotas, come back and conquer your fear of the graph editor. Kudos to my students who I have seen work hard on getting over their graph editor fear.

Take Note

Remember, if you render out .tif images, they do not read into Photoshop with their alpha channel. For every compositor that exists, .tifs are fine—just not Photoshop.

Rim Light

Something to consider when you have a 2D object and a 3D object together in the same scene is whether you want them to look very flat or whether you want them to have some dimension. Usually this boils down to the question of whether you have time, money, and human resources to make rim lights, tones, and shadows for all of your characters. These types of elements are usually produced by the Special Effects EFX department. I'll talk more about this odd brand of artists later on in the EFX chapter. (I mean odd in a great way.) For our solo project, we will include rim lights (or highlights) on our 3D arm, as it is made of metal.

We will make the rim light as a separate pass from the rendered arm. This way we can adjust it at composite time to match everything else. Our goal is to create a rim matte: a black-and-white image representing the area that will be a highlight.

This is a different way to think. As you create this image, you are not thinking of anything but a black-and-white image that represents where the highlight will be. So do not worry about the main color of the arm. I'm starting with my last saved Maya file: **2D_Leads_3D_v5.mb**.

1. To start, I have to hide my image plane. The bright white gets in my way. I'll toggle off cameras by clicking in the Render_Cam window: **Show > Cameras**. In my sample file, I have deleted the image plane.
2. Now, let's assign a special toon shader to the arm:

    a. Unlock the **GEO_Layer** by clicking the **R**.
    b. Select any part of the arm and hit the up arrow key or select the **GEO** group node in the outliner.
    c. Assign a Dark Profile Toon shader to the arm under **Animation**: **Toon > Assign Fill Shader > Dark Profile**.
    d. Create the color ramp so that its first chip is white and the second is black as shown in Figure 3.21. This will create a white area where we want to have a highlight and all else is black. Perfect.
    e. In the outliner, delete the Toon Line Shader. We do not need it for this pass.

3. Render the rim light pass.

    a. Go to your Render Settings and prepare your render. See Settings in Figure 3.22 and then Batch Render.
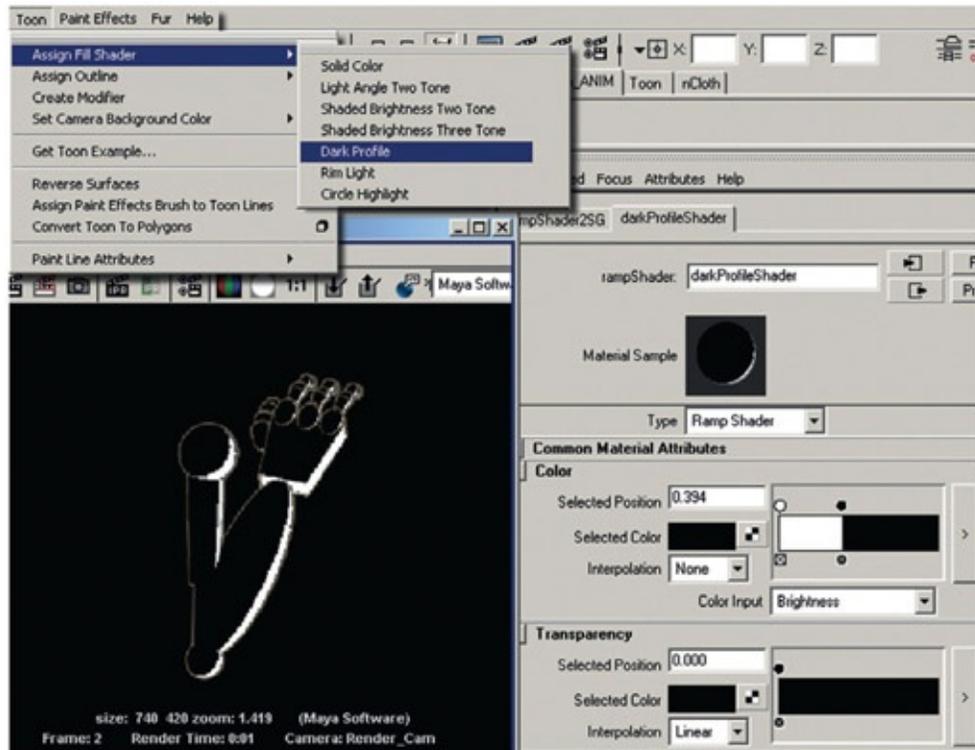
FIGURE 3.21 Dark profile added to the robot arm. This will be used as a rim/highlight matte
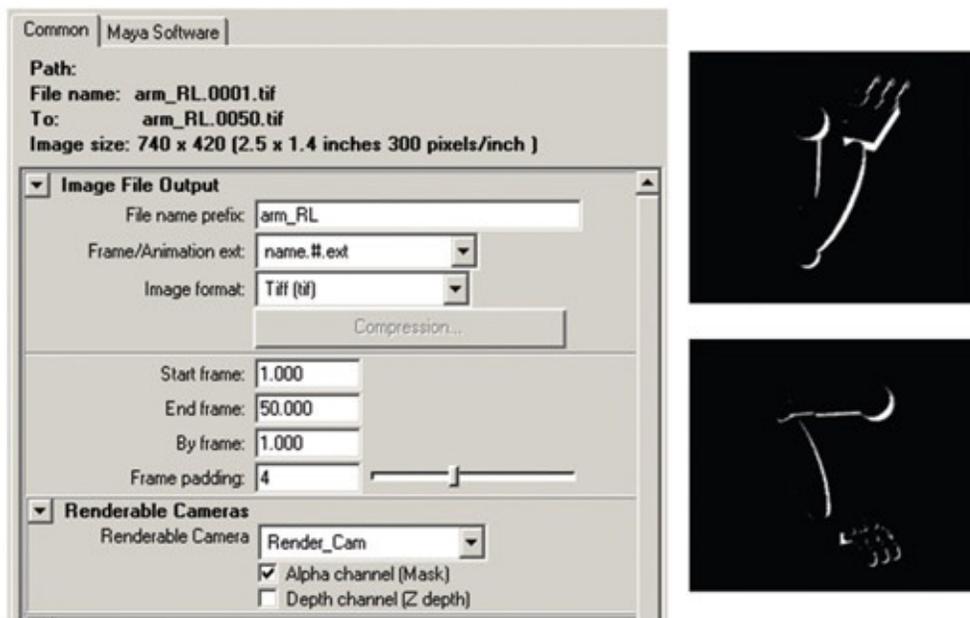
FIGURE 3.22 Render Settings and an example of final renders

Take Note

Even though we have set up the rim light as an RGB image that will be used as a mask, we still need the alpha channel for the arm. Make sure to use .tif or some format that keeps alpha

channels.

Our Rim Light file names are **arm_RL.#.tif**.

Cleanup in Photoshop

To do proper cleanup in Photoshop, you will want to use a brush that gives the best line quality. Well, how do you accomplish that? Those of us who grew up with Photoshop have seen it change from a tool that you would never dream of drawing with to a tool that has lots of potential. In fact, it has too much potential—it can be a thick forest to traverse through to get a brush that you like and fits what you need. (Those are two separate requirements. You can like a brush but it isn't what you need.)

The choices seem to boil down to these:

1. Use a built-in brush in Photoshop.
2. Create a custom brush.
3. Download one.

You might jump to the third option automatically. It sounds like the easy choice. Not any of the choices are easy, actually. You are forced to pick out one piece of candy in a nearly infinitely sized candy store. How can you do that? There could be a better-looking piece of candy in the next parameter that you tweak or in the next brush that you download!

I have watched various students go through this process as they work on the senior projects or on a group project. I have also gone through this same process myself. Just when I think I get a brush that I like, I try to draw very tightly and find that the brush doesn't work well enough for my purposes or does not draw smoothly enough for me. Once I get a brush that I like, however, I can draw my heart out. It is the process of getting that brush that I imagine is enough; when an artist finds a brush, she or he might not try any others.

What limitations are we taking on with Photoshop? This is drawing in rasters, which is resolution dependent. You are probably already familiar with the limitations of raster images. If you zoom in too far, the image will pixelate. This is avoidable if you keep drawing at a higher resolution. What do you gain? A different look than vector drawing (such as we found in Toon Boom and Flash).

Built-in Photoshop Brush

Let's start with built-in Photoshop brushes. Can you do cleanup with those basic brushes? Yes. For those who love a thick-thin cleanup line, you might not be satisfied with the results if you do not dig deeper.

I interviewed a student who had spent weeks doing cleanup on a senior project piece. A note to the concept of cleanup: we don't have an actual class on cleanup in the curriculum. We tend to focus on animation, acting, storyboarding, and the like. So students who take on the task of cleaning up, inking and painting, or otherwise completing a 2D film are learning as they go.
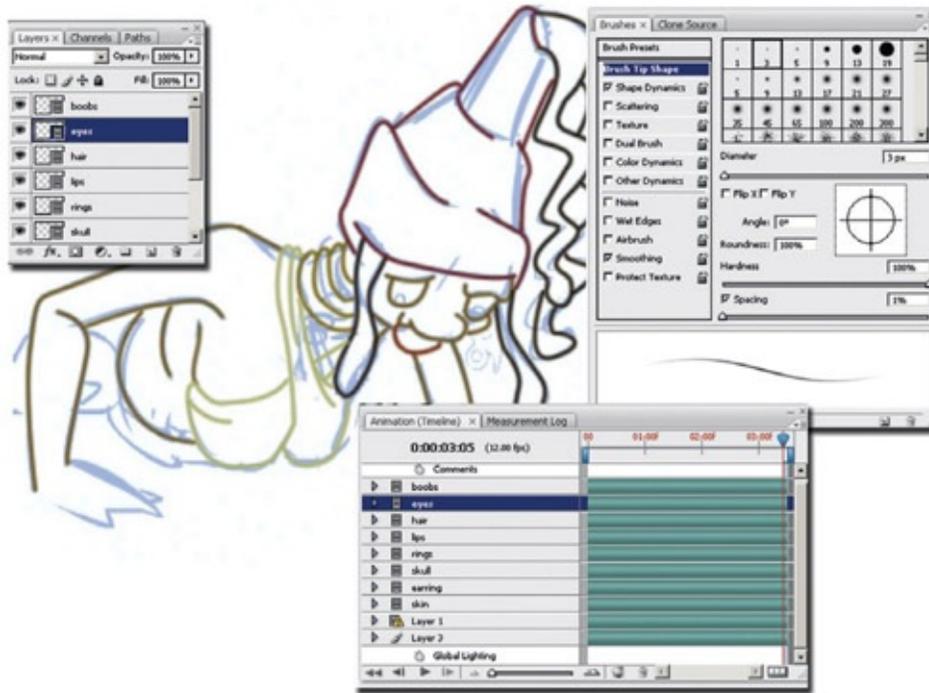
FIGURE 3.23 Cleanup using Photoshop's standard brush

You might have taken a look at the basic brushes in Photoshop and scrolled through the presets. But did you ever load the other presets? I'll admit I hadn't for quite a while, until one day I went poking around to see what else was there. If you open the options for the brushes palette, you will see at the bottom various brush sets that you can load in. Figure 3.24 shows a few brushes that come with Photoshop.
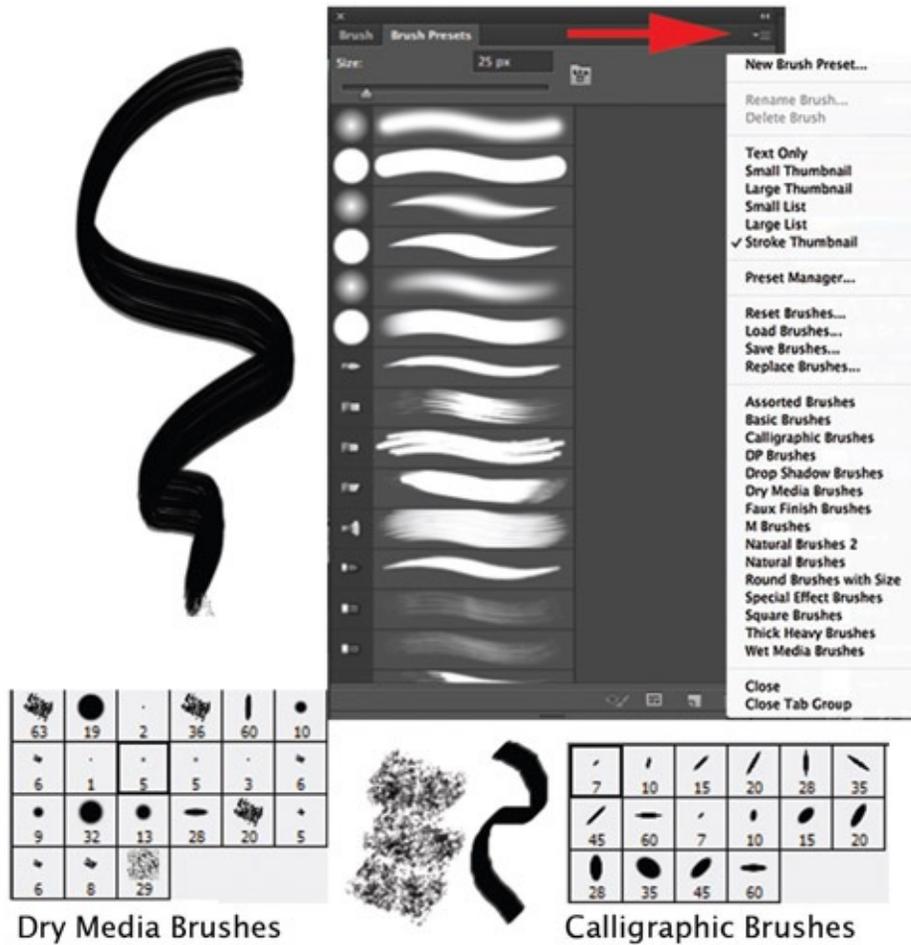
FIGURE 3.24 Preset brushes in Photoshop

When your cleanup and painting are done, you will export an uncompressed movie file to keep your alpha channels. That catches some students—and professors.
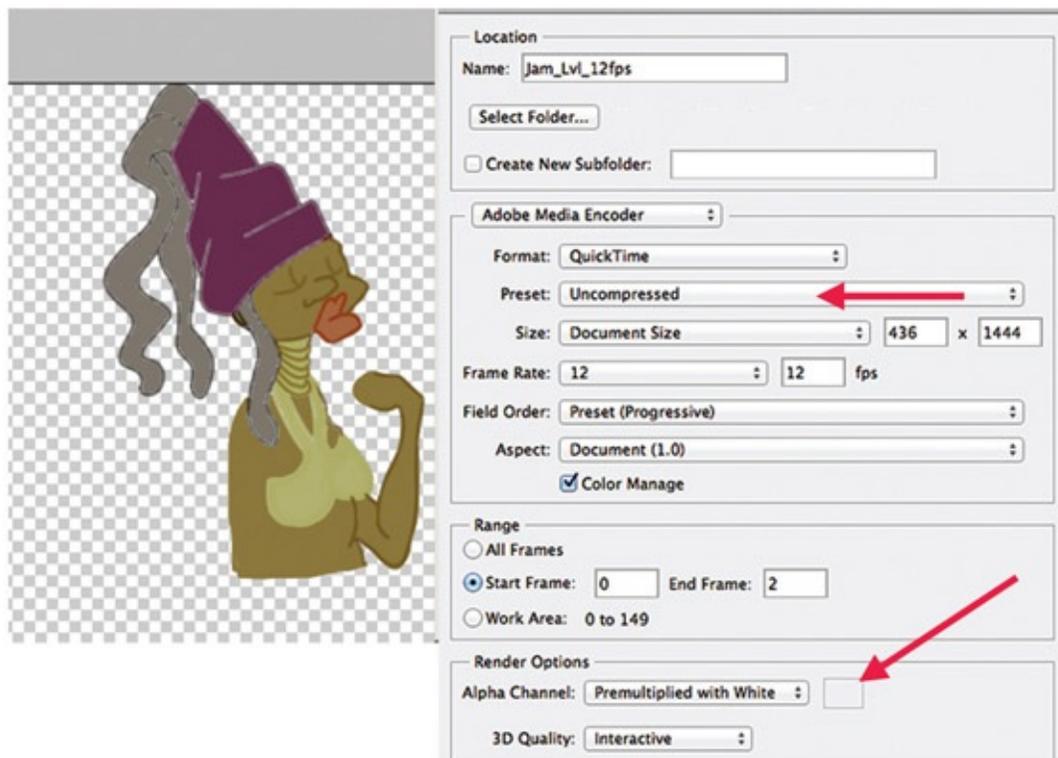
FIGURE 3.25 Exporting the final level of Jam, saving as raw QuickTime in order to have alpha channels

The cleanup file name in the companion data is **Jam_Lvl_12fps.mov**.

Custom Brushes

You can push further than the stock brushes and create your own. There is a lot you can do when you modify the attributes of the stock brushes, and you can come up with an amazing assortment of looks that are much more painterly or at least non-round. It takes a lot of time to experiment, so make sure to set someone on this task early on in your group project. If you are doing a solo project, that someone is you.

When you create custom brushes, the brush shape is based on a grayscale image. Completely black areas will fully deliver paint to the canvas, gray areas will deliver a varying degree of paint, and white areas will not paint. The brush attributes can be applied to your custom brush tip.

How do you make that black-and-white image? You can paint it in Photoshop, scan in an image, or create it in Illustrator or a similar program.

Here's an example of creating a custom brush:

1. Create the desired brush tip shape in Illustrator and save.
2. Open that file in Photoshop.

3. Click **Edit > Define Brush Preset**.... This creates a brush from that image.
4. Tweak the parameters until you get the desired results.
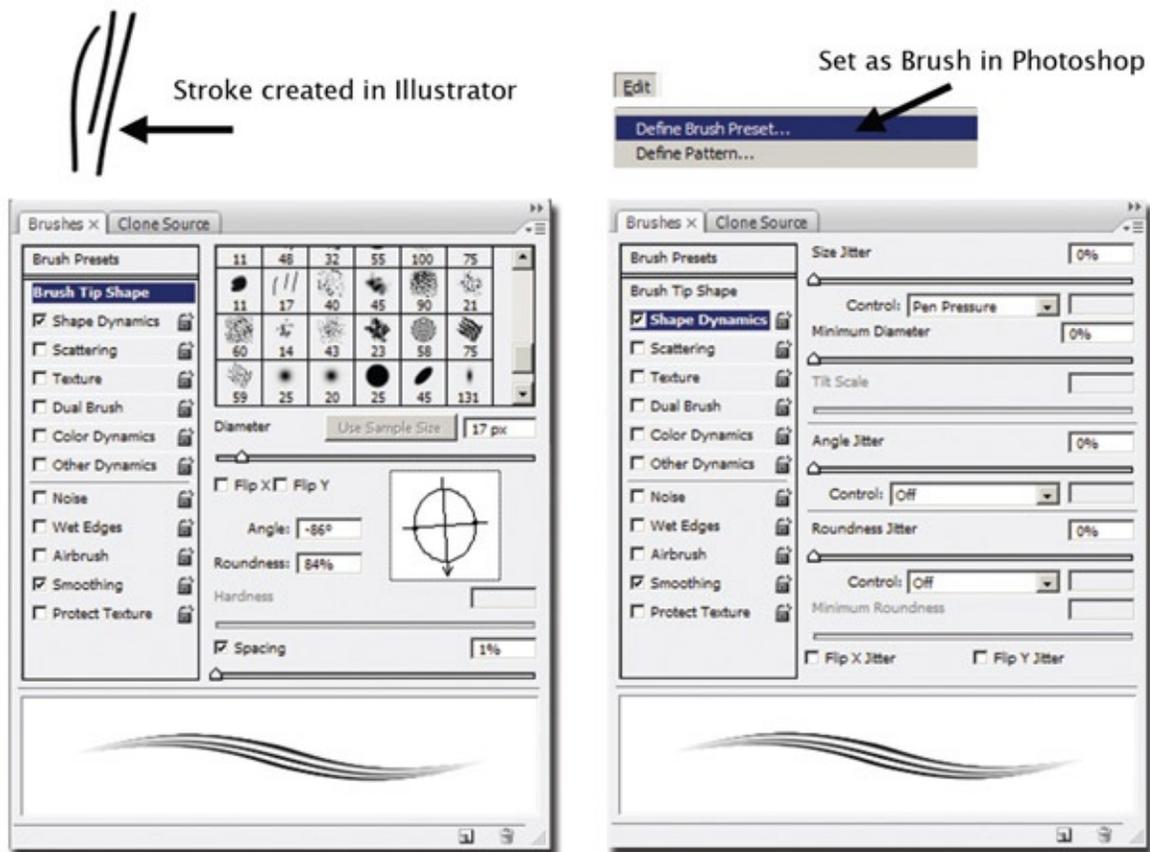
FIGURE 3.26 Using an Illustrator file to create a custom Photoshop brush

Dig Deeper

Learn how to harness Photoshop's brushes with *Creative Photoshop Digital Illustration and Art Techniques* by Derek Lea. Just reading the first chapter sent me off painting with Photoshop like never before.

Downloading Brushes

Of course, why reinvent the wheel? There are an amazing number of brushes waiting for you to download. In just doing a quick search for the group project, I found more brushes than I could ever test in one session. For example, I ran across a brush web-site: myphotoshopbrushes.com. Though there were many sets of brushes that I could have looked

at, I focused more on traditional media brushes and ran across this set called Dukal's Artistic Brushes by Alex Dukal. You can find these brushes at http://myphotoshopbrushes.com/brushes/id/248.

I downloaded these brushes and found that they were at a very high resolution, meaning the brushes were huge and contained a lot of detail. You can scale the brushes down to do detailed work and, of course, use them as large sweeping brushes as well. I then took a look at Alex Dukal's website to see what type of work he does with these brushes (www.circografico.com.ar). Lovely work. Figure 3.27 shows the Dukal brushes loaded into Photoshop and one quick use of brush, "Splat 2."
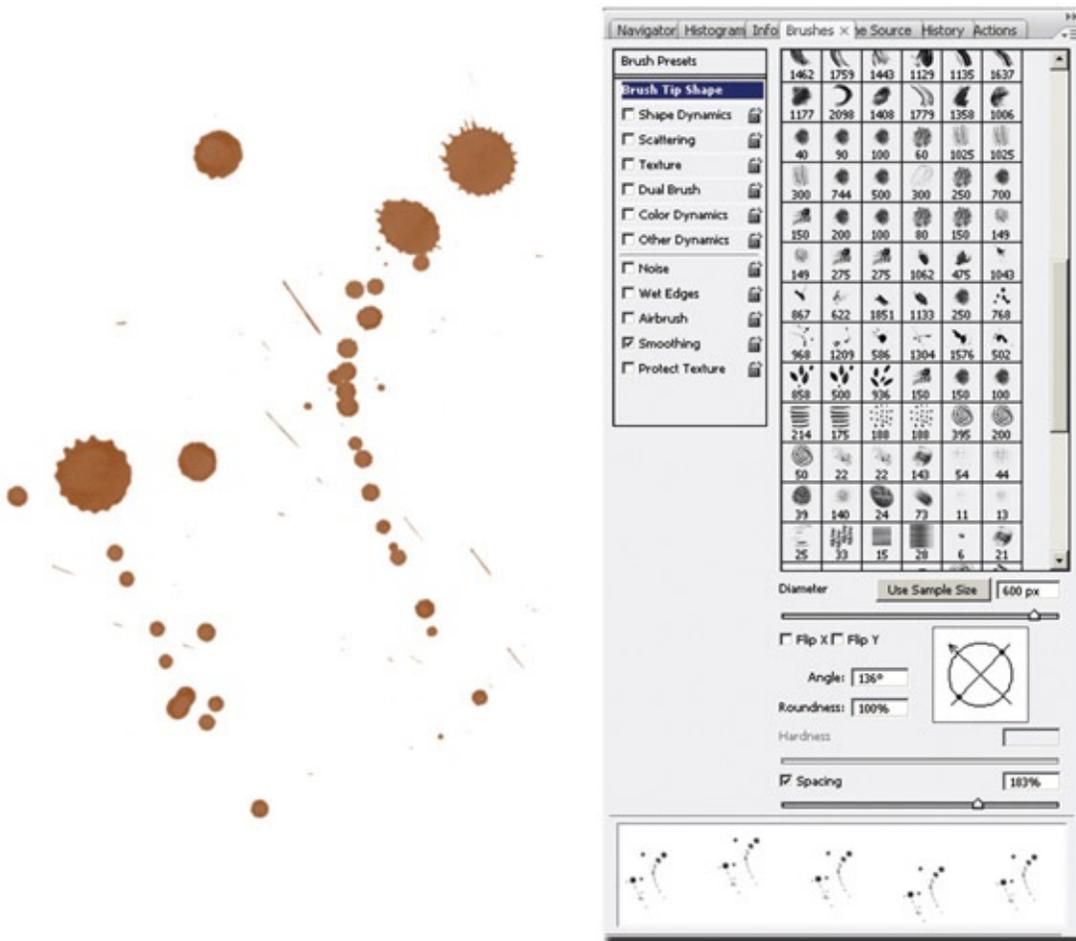
FIGURE 3.27 Dukal's artistic brushes

What can you do with brushes like these? Figure 3.28 is an illustration by Dukal using his Photoshop brushes. This originated as a doodle on a Post-it note. The background is scanned-in mag paper. The brushes he used were his collection of Artistic Brushes #2.

FIGURE 3.28 Alex Dukal's Chick of the Year

I didn't search for it, but I would bet there is a downloadable brush set of coffee stains or stains in general. I'll have to put that onto my to-do list for looking up or creating. Can you imagine it? I could put coffee stains on all of my lecture notes or PowerPoint slides.

Or Clean Up in Toon Boom

Another package that you might use to do cleanup in is Toon Boom. This company offers different product solutions. Each one has a different tool set. For frame by frame animation, we'll use Toon Boom Animate 3. (Not the Pro version—which is more for the cut-out style of animation according to the documentation.)

In Figure 3.29 you see the timeline at the bottom of the screen. The x-sheet can be found under the x-sheet tab. The keyframes that were drawn in Photoshop have been brought into one level by importing the drawings and a drawing level has been placed above the keys.
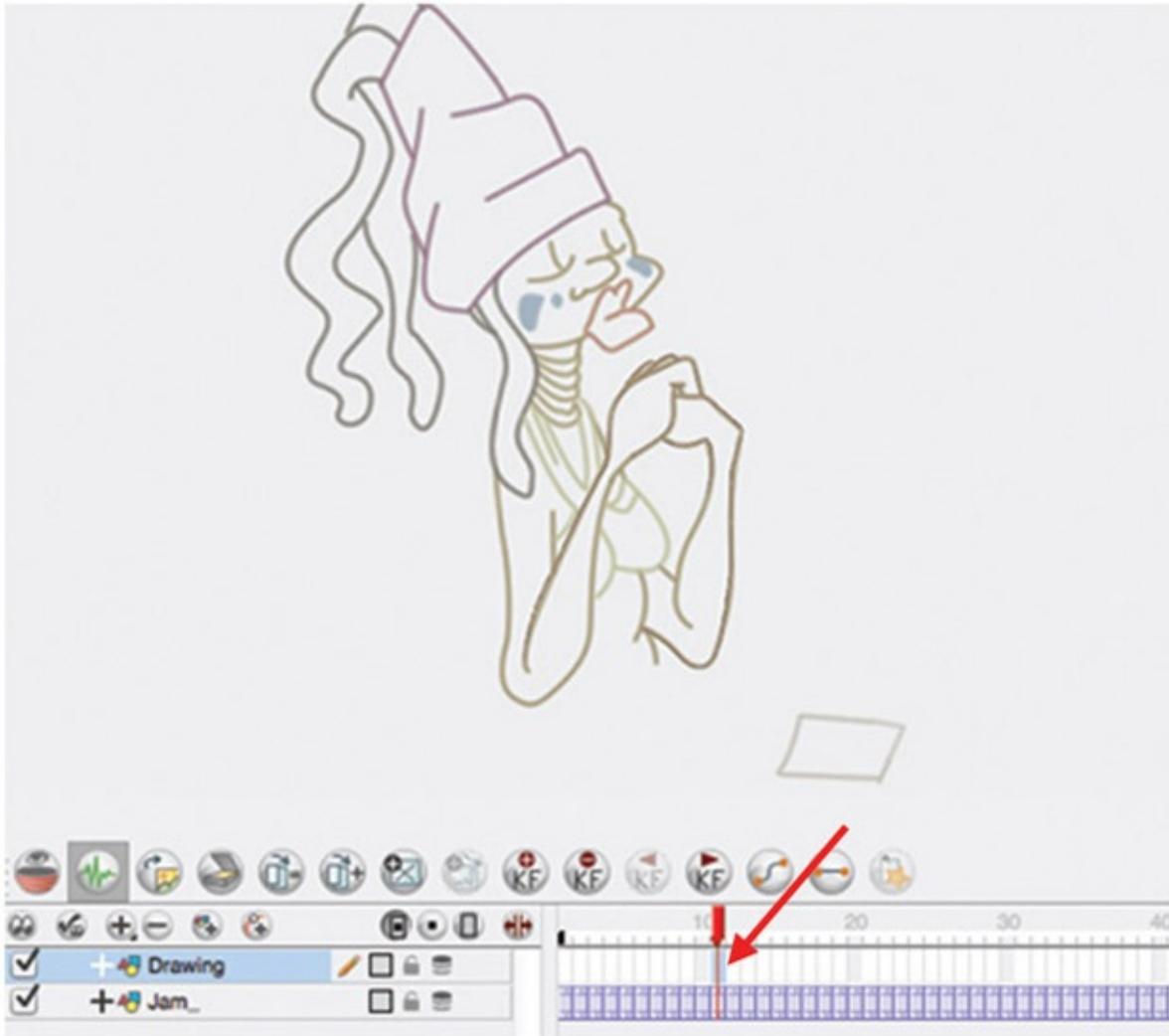
Animation brought into Toon Boom for inbetweens and cleanup

To get a tapered line in Toon Boom, you will need to adjust the settings for the brush tool. See Figure 3.30 for an example. A range between a minimum of 0 and maximum of something of your choice will vary the thickness of the line. The attribute smoothing will try to auto adjust your line. The higher the number, the more it believes you cannot draw and will try to draw for you. For some this is a bonus, for others it is a major annoyance. Bring that setting down as low as you need to for sanity. Another thing you might notice directly off the bat is that the line seems jagged when you draw. This is a vector line and you are only seeing a quick screen representation. You will have to select **Play > Render and Play**. In older versions the hot key **CTRL + ENTER** will open the playback window. In the playback window you can see the real line as shown in Figure 3.30. Note that the fine art of creating wonderful cleanup lines lies in you—not the software. Take care to draw your lines with appropriate thick and thin weights, which software does not automatically take into account as it renders.
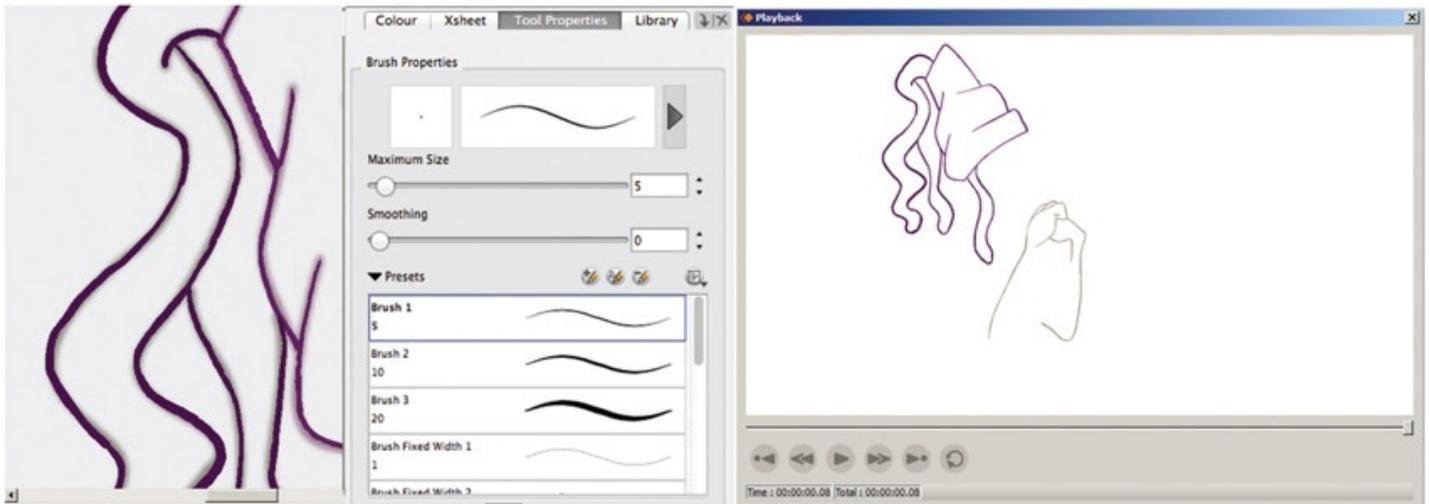
FIGURE 3.30 Cleanup line in the jagged preview and in the final render view

Final Render

In this book we'll use many different compositing softwares. For this chapter, we'll use After Effects to composite the different levels together. Later on in this book, we'll use a node-based compositor to see the difference in how you approach a scene.

Let's review the levels that we have starting from the back to the front. Refer to Figure 3.31. The bottom level is a **background**, which was painted in Photoshop. The next level up is the **character** level, which is composed of both the ink and the paint level. These levels could be separated into two levels. With them separate, there are more compositing tricks that you can do with the ink lines. Next, there is the 3D **arm** level, which also has both the ink and paint together. Above those is the RGB version of the **Rim Light** level. It is important to remember that we are seeing an RGB image of a matte and not looking at an alpha channel. (One is inverted from the other.) Lastly, we have a table level, which is titled **underlay/overlay**. It has this title because it lies over most everything but also "lies" under Jam's elbows.
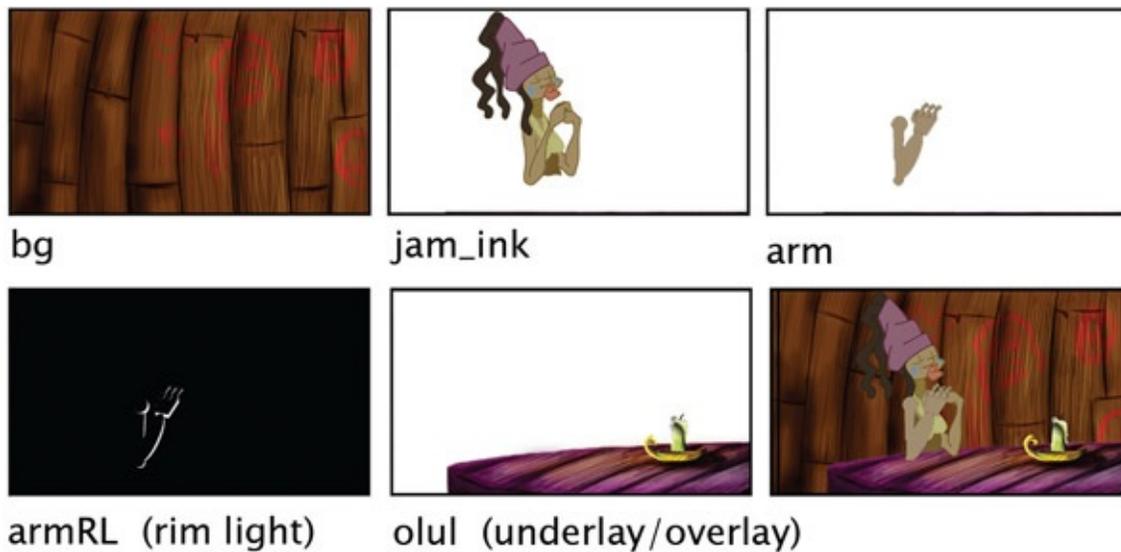
FIGURE 3.31 Levels that need to be composited together and a final composited image

Setting Up the Composition

Bring the art assets into After Effects. Remember to check your import preferences so that they match the frame rate that your project is in. See Figure 3.32 for an example.
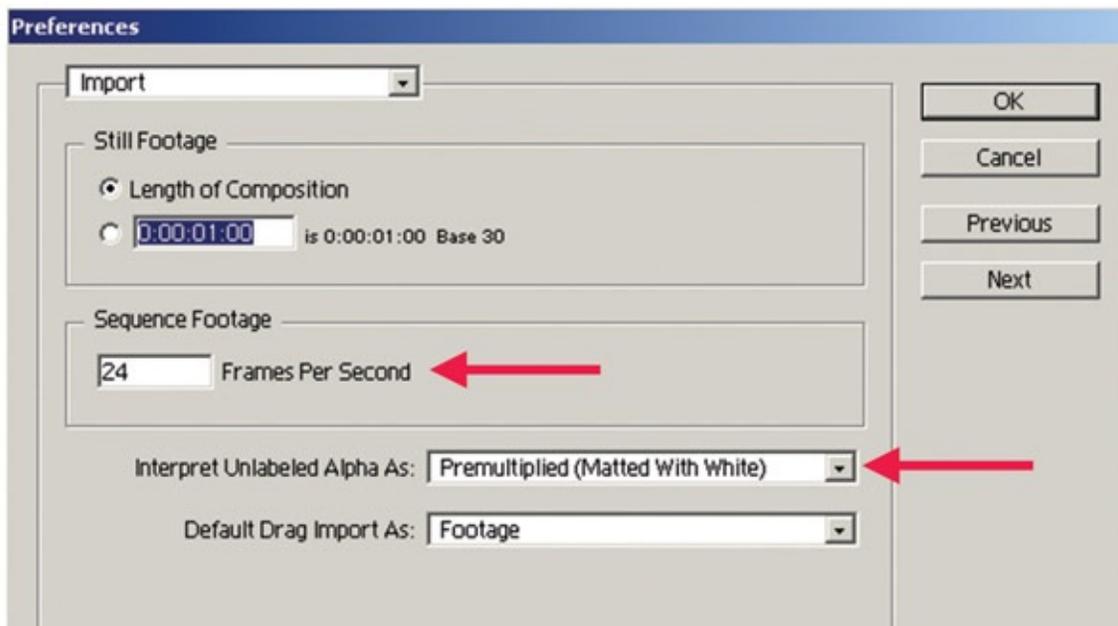
FIGURE 3.32 Import preferences should match the frame rate of the project

On newer versions of After Effects on a Macintosh, the images come in automatically packaged into a nice image sequence. Lovely. See Figure 3.33 as an example.
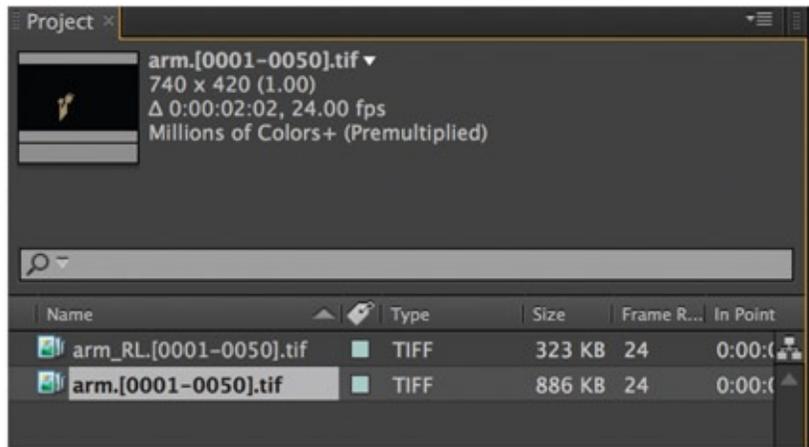
FIGURE 3.33 CS6 of After Effects on a Mac packages image sequences neatly for you. No precomp necessary

In older versions, you'll want to follow the next steps to keep things neat and orderly: create a folder for the levels that are individual .tif images. For example, the arm and the arm rim light levels would have their own folder. Then you'll want to make a "precomp" of each of those levels. First, make a composition of the arm level by selecting **arm.0001.tif** through **arm.0050.tif** and dragging them onto the **Create a New Composition** button. This will open a dialog box. To get the images to show up one after the other, you need to select **Sequence Layers** and make sure that the **Still Duration** is one frame: **0:00:00:01**. See Figure 3.34 and Figure 3.35 for examples.
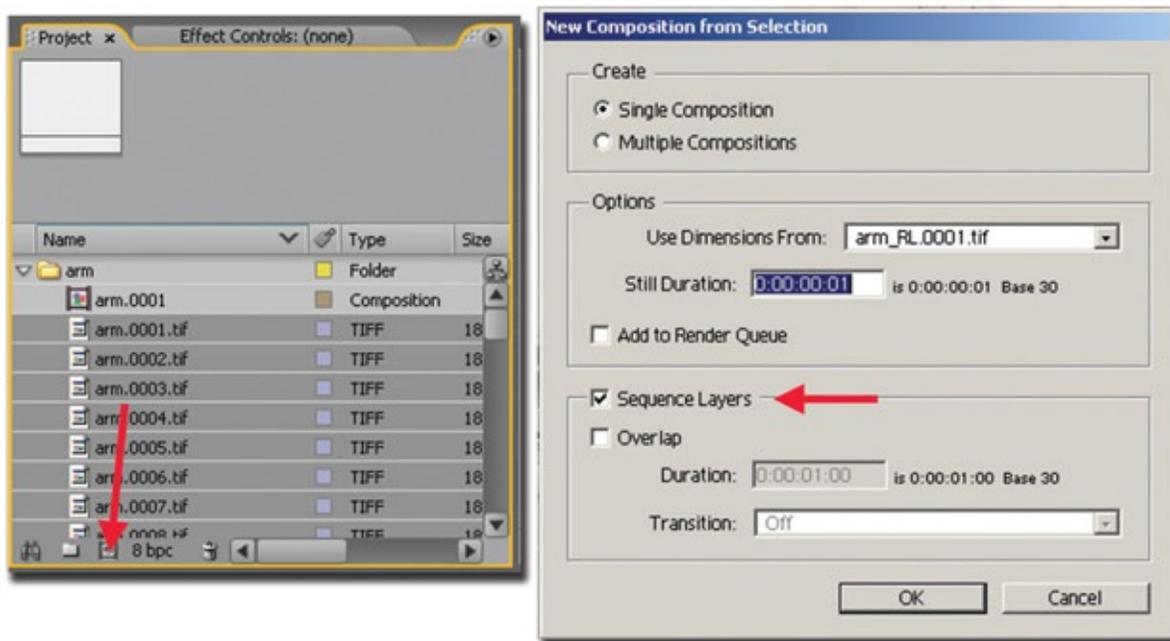
FIGURE 3.34 Creating a precomp of the arm level
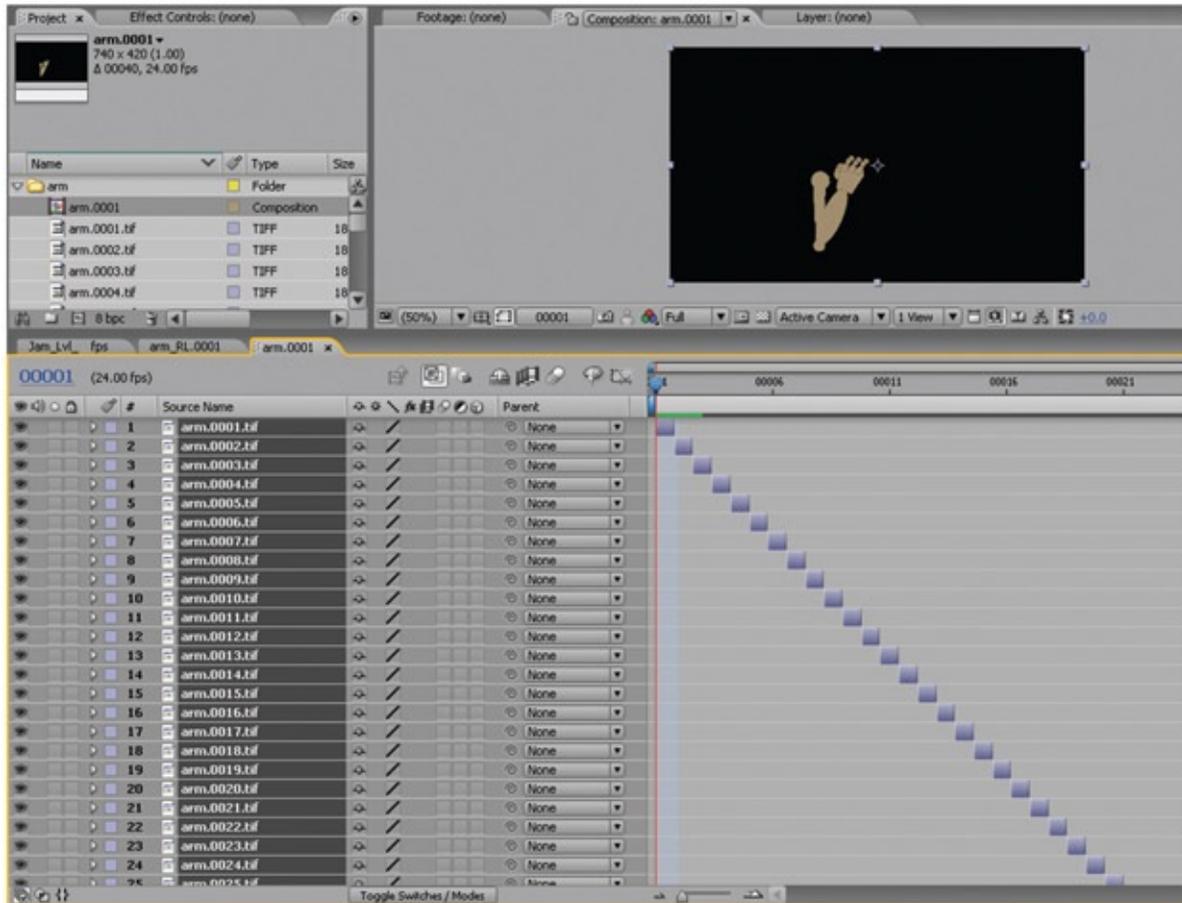
Arm composition

Create a new composition and drag in the levels in the following order starting from the bottom level to the top: background, olul, Jam. Do not drag in the arm and arm rim light just yet. See Figure 3.36 for an example of how the composition should look at this point. You'll note that Jam is overtop of the table. That is great for her hands, but her body needs to be behind the table. We'll have to matte that out. We'll tackle mattes later on in this chapter.

FIGURE 3.36 Levels in After Effects

3D Arm with Rim Light

The 3D arm is going to take just a little bit of working with to get the rim light on it. The great thing about using mattes to adjust lighting is that in this comping stage, you can see the arm level in relationship with all of the other levels.

1. Create a new composition by clicking the **Create New Composition** icon.
2. Give the composition the name **3DArm**. Make sure that the composition is the correct size, and watch out for frame rate!
3. **Drag** the **Arm** composition that we made earlier into this new composition.
4. **Right-click** in the timeline and add a **New > Adjustment Layer** above the 3D arm.
5. **Drag** in the **Arm Rim Light** composition and place it above the Adjustment Layer.
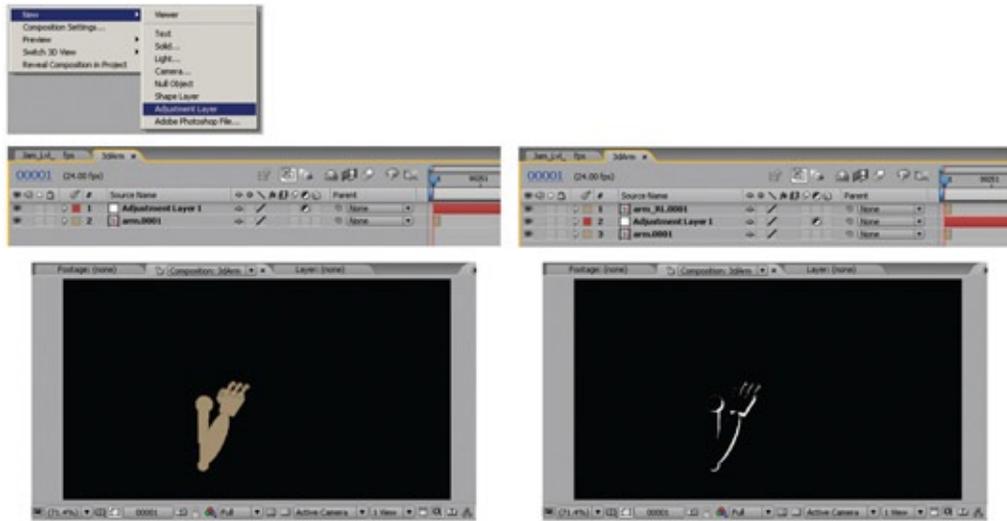
FIGURE 3.37 Arm and Arm Rim Light put into their own composition

6. Select the Adjustment Layer and from the top menu click **Layer >Track Matte > Luma Matte**. You will be able to see the arm level again. You'll notice a matte icon next to the Adjustment Layer and the Arm Rim Light level.

7. **Right-click** on the Adjustment Layer and add **EFFECT > Color Correction > Color Balance (HLS)**.

8. Bring Lightness up to the desired level.

Another great thing about having this rim light matte is that you can adjust the color of the painted object. Some tutorials might have you make a black-and-white matte, adjust the opacity, and just lay it overtop of the arm level. That is a valid method but does not give the most color correction capability.

Let's work with that matte just a little bit more.
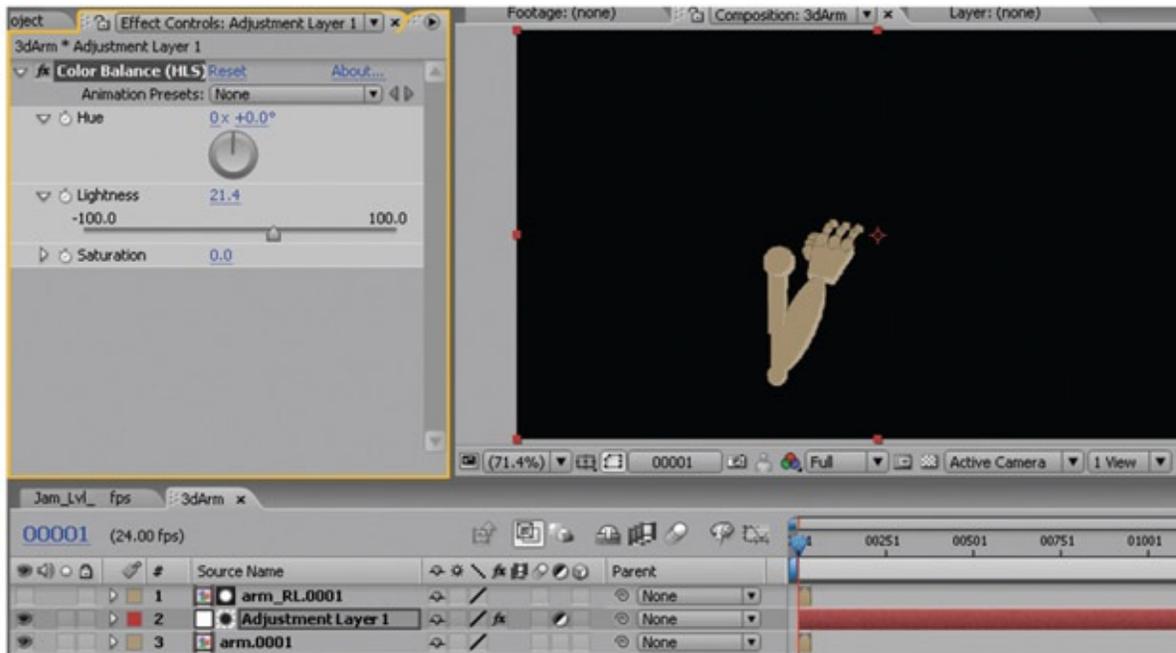
FIGURE 3.38 Rim Light matte level used to adjust the color of the arm

1. Select the Arm Rim Light Layer and click **Effect** > **Blur & Sharpen** > **Gaussian Blur**.
2. Blur the matte by changing blurriness to a desired number. Ours is set to 3. (Make sure the visibility of the layer is off.)

Back in the main composition, drag in the 3D Arm composition that we just completed. You should now have a 3D arm with rim light on top of your 2D character.
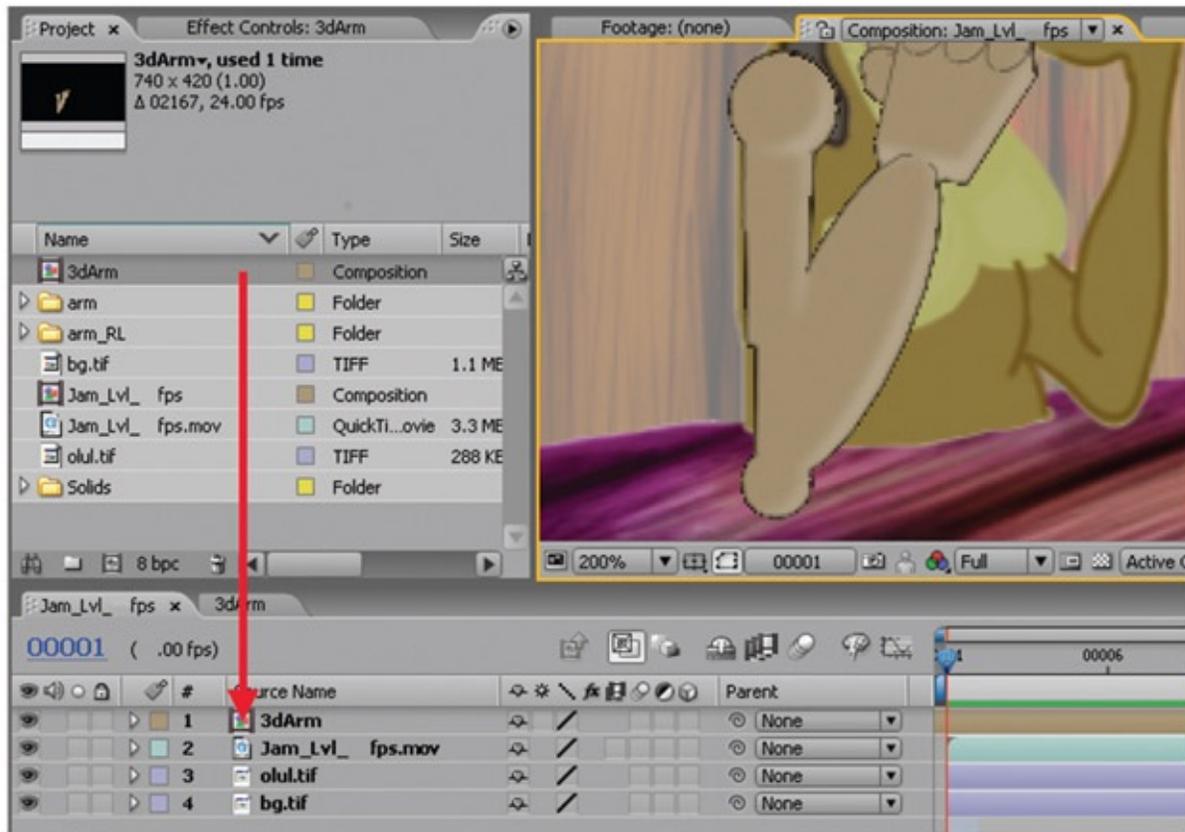
FIGURE 3.39 3D arm with rim lighting added to main composition

Masking Out Body

One last thing to do with the body is to add a matte to mask out where the table is so that the arms stay on top of the table but the body is not visible. The easiest steps to create a mask are to select the layer you want to mask out and then click on the pen tool and draw the mask. There are other ways to do it, but this way requires the fewest number of clicks.

1. Select the **Jam** level.
2. Near the top of the application, choose the pen tool (or hit **G**).
3. Draw a mask along the edge of the table. Take care to draw around the 2D elbow on the table. Click on the beginning point when you are done, and the mask will complete.
4. And it will mask out everything else but the bottom of the body. In the timeline, open up the Mask attribute that has been added onto the **Jam** level. Click **Inverted**. Your mask should now be masking out the bottom of the body as you want.

Random Note

The words are bugging me here, in case you couldn't tell. In my vocabulary, a matte is a noun; it is what you draw. The verb is "mask." Using these terms, a matte masks out things. However, After Effects calls the mattes *masks*. Oh, bother.
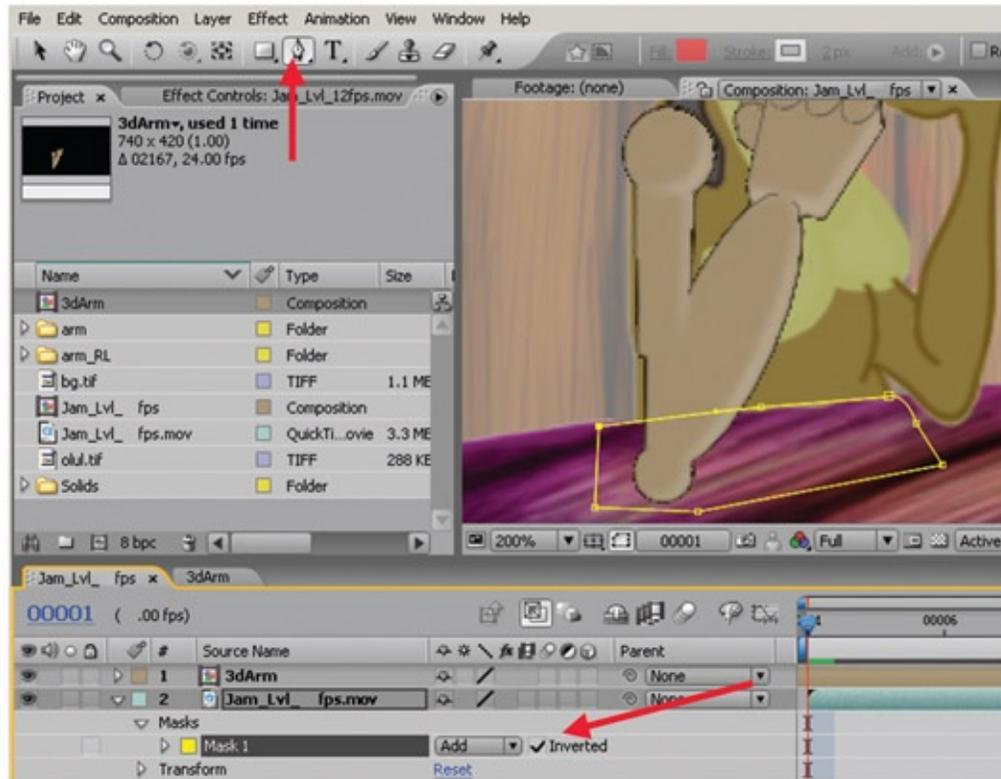
FIGURE 3.40 Body masked out so that it is not visible overtop of the table

You might have noticed that the 3D arm is overtop of the hair at the beginning of the animation. Repeat the same steps above for the 3D arm level to make it look like the hair is on top of the arm. Something different you will have to do is make it a traveling matte; in other words, animate it moving along with the hair. Simply use the **Selection Tool** (or press **v**) to move the points around. After Effects will auto-keyframe for you.
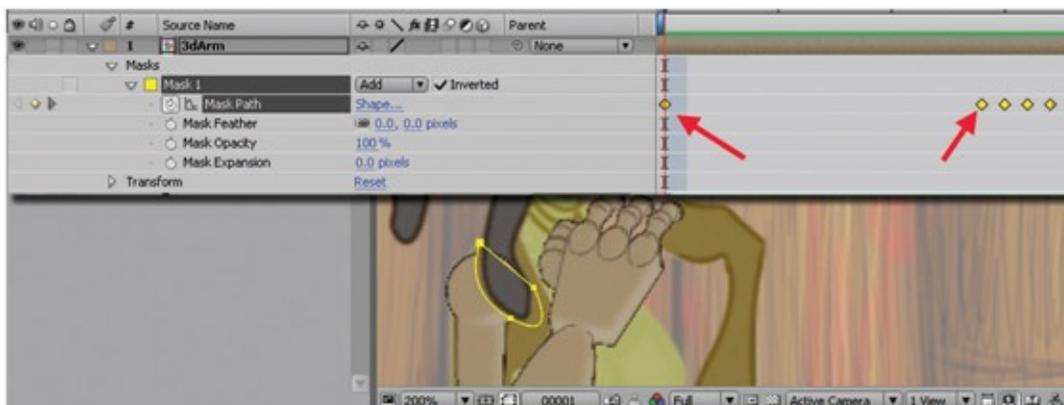
FIGURE 3.41 Traveling matte created to hold out the arm where the hair should appear on top

At every stage that we have gone through, there is room for being meticulous. To not be so is to create errors that will show up in the final stage. You can imagine in a large production, or even in your small group project, many of these steps are carried out by different people with no idea what the other people are going to do with their images when they are done with them and no idea of how the whole pipeline fits together. At every stage, you want to look for areas where you can "plus the image" and understand how those before and after you are going to work with the asset you create so that you can help and not hinder them with your work. You'll have to make mistakes to figure that out. My suggestion is to do group projects often. This will help you see those costly mistakes before your paycheck is riding on it.

FIGURE 3.42 Final comp

Interview

Name: Todd Redner

Title: Animation Director at Floyd County Productions
http://www.imdb.com/name/nm2400789/

Let's face it, we have limits in the real world and they are called "budgets." The only way we were able to make a 3D pilot and keep it under budget was to use 2D animation on 3D models. The characters were sculpted as generic people. We simply unwrapped the models and drew all the facial features, colors, clothing, and so on in Flash. The 3D animators only had to worry about body movements, while the 2D animators did all of the eye movements and lipsync in Flash. It worked really well and had a very unique look. It saved us time and money in multiple areas: we didn't have to purchase multiple workstations, render times did not kill us, and by separating the facial movements from the body animation we were able to animate faster.

The biggest help in using 3D and 2D together for us has been with backgrounds and objects. You can spend some crazy hours on building realistic backgrounds for your 3D show. One of our projects was taking way too long to draw and paint the backgrounds, so our solution was to take rough sketches and build a simple 3D background. That way we could have the model done for all angles in one shot, get the shading done faster, and the perspective was already done before the next shot was laid out! After we pick the

shot, we just render and add any texture or effects. Another show we did called for the reverse. The characters were entirely created in 3D, but we painted the backgrounds in 2D. There were just so many shots that required crazy amounts of objects and sets that would just not work for our budget to do in 3D. So we creatively blended 2D and 3D into the backgrounds. No matter what the media is—2D, 3D, or 4D (fingers crossed!)—whatever it takes to get the right look and also keep the project under budget is what we have to do. Otherwise, we are either losing money, losing work, or both.

Further Reading

Kundert-Gibbs, J. *Action! Acting Lessons for CG Animators*. Indianapolis: Sybex, 2002.

Lea, Derek. *Creative Photoshop Digital Illustration and Art Techniques*. Amsterdam; Boston: Focal Press, 2007.

Schroeppel, Tom. *The Bare Bones Camera Course for Film and Video*. Coral Gables, FL: Schroeppel, 1980.

Student Contributors

Contributing students for this chapter, in order of contribution:

John-Michael Kirkconnell
Claire Almon
Clint Donaldson
Dianna Bedell
Amanda Powell
Daniel Tiesling

3D Characters with 2D Parts (3D Leads)
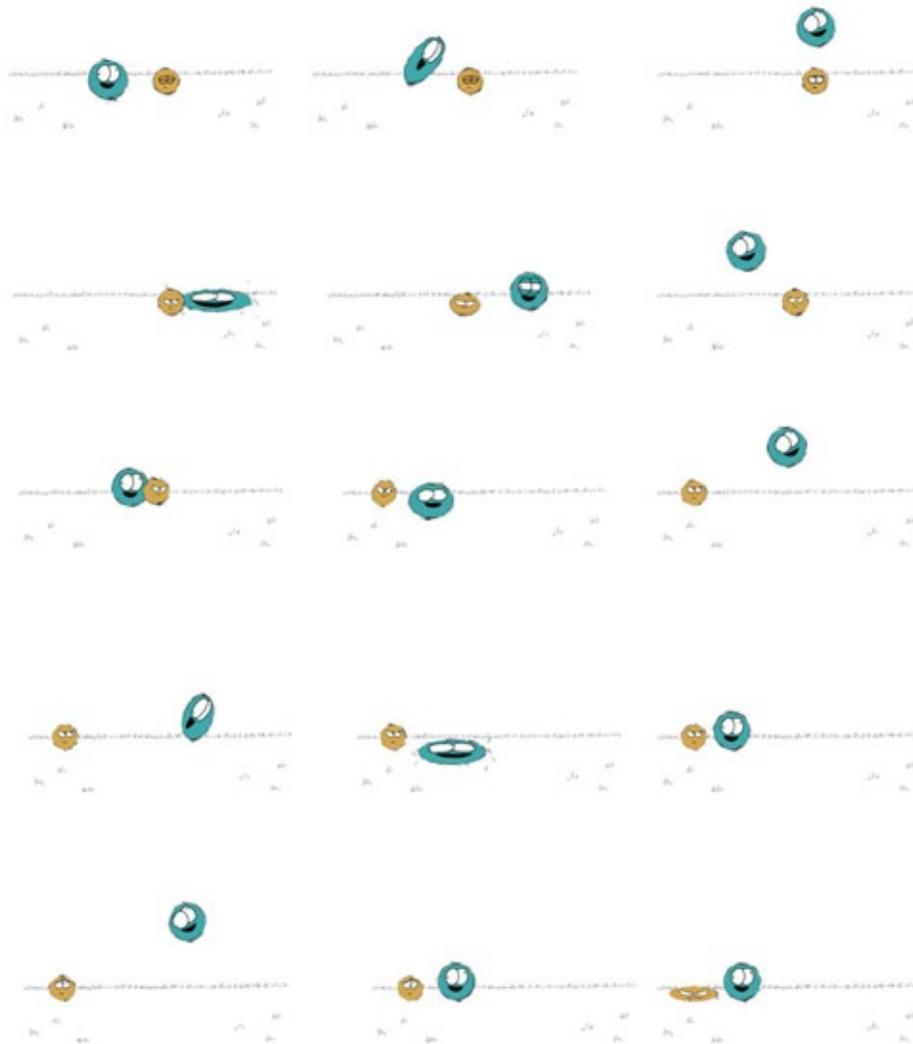
FIGURE 4.1 Bouncing 2D/3D balls, by Jessica Toedt, 2009, 2D/3D compositing course, SCAD

Lecture Notes

How are you doing so far? I hope that you are getting used to the process and thinking up

ways to combine the media and reasons why you should. Once you have everything broken down into the basic patterns of problems—2D leads, 3D leads, using cameras and textures to flatten 3D or using tones and shadows to round 2D (we'll cover that soon), rendering in layers, compositing, and using masks—then it's just a matter of finding the best ways to achieve your look with whatever techniques you need.

By now you have probably lost a little fear and do not believe that you need to stay in one package for your scenes; heavens, no. By now you should be thinking in layers of images. You should be thinking that the output of any given software package is just an image and that your character is made up of multiple passes of images. Good, you have come far.

Often in class (or even the industry) I see those who become mesmerized with the 3D package. They get stuck in that 3D Cartesian world and think that everything has to be done there. Students get stuck thinking that they need to render the whole frame in one go and overlook the concept of breaking things into levels. Breaking things into levels allows animators to use mattes in a compositing package to adjust colors and to isolate elements into levels so that if something needs to be tweaked or adjusted, they do not have to re-render the *whole* frame, just the one level. Ah, the time savings that process gives; it makes me happy.

The same thing goes for our characters, as we have found. They do not have to be stuck in one medium or software package. For many reasons, we have discovered you might want to use 3D to help along your 2D animation, whether it be to reduce line mileage or help with perspective and complexity of the character. We have focused on why one would use 3D. But why would one use 2D? Can't everything be done in 3D nowadays? If I were standing in a classroom in front of you, I would have a perplexed look on my face and would be trying hard not to let my sarcasm show. Yes, many things can be done in 3D. But should they be?

In my classrooms, the students have to produce a senior film (with a passing grade) or they do not graduate. I'm sure this is the case on many campuses: the films tend to be monomedia. It is a monochromatic sea of 3D-ishness, and it all looks the same. Of course, if it were all 2D films it might look the same too because of similar animation style emulation in the curriculum. However, more than likely, it will not all be similar simply because of the different artists' hands. I am generalizing, of course. The 3D work doesn't all look exactly the same, but there is a trap that young artists can fall into. When they create something using the 3D tools, the same 3D tools that the next 500 artists are using, they become satisfied with what they see on screen and think that it is the vision they were after, when in actuality, it is the easiest thing that the tool has offered them and the other 500 to 1,000 artists. Only the few, who know what their artistic vision is and push to make the software do their bidding, produce images that are not in that monochromatic 3D sea. Because the tools produce something that can be labeled as the 3D package programmers' artistic vision, those without their own clear artistic vision settle for the programmers' vision. Even if you do not use 2D/3D in your independent films, at least push beyond the programmers' artistic vision. I will now put away my soapbox.

On our campus, only in the past few years after introducing this 2D/3D class, I have seen the nonmono films created. It is nice to see this transition. We must break free from the monochromatic sea. (How did I get back up on this soapbox?)

We have done a 2D character with 3D parts, where the 2D character leads. Now we will turn our attention to a 3D character with 2D parts, where the 3D character leads. The question to ask, then, is, why use 2D parts?

Why indeed should we use 2D? With enough time for research and development, nearly anything can be done in 3D that can be done in 2D. Back in Chapter 1, we discussed how it is no longer the subject matter that decides. Human characters do not *have* to be done in 2D, because they can be accomplished in 3D. Fuzzy characters do not have to be done in 2D. 3D has come a long way. So it isn't exactly the subject matter that decides the medium. What was that? The student in the back row, you had an answer? Yes. You are correct. The look, supporting the artistic vision, is a great reason to choose 2D over 3D. You have been listening. Very good. This is my point: once the student or young filmmaker gets beyond the thought process that the programmers' artistic vision is a good one, simply because it is easier to push a button, then that filmmaker can grow into seeing which method will best support his or her own personal artistic vision.

Then you can start to see that sometimes 2D can be the answer. We'll look at some industry and student examples further on in this chapter. First, let's categorize some reasons you might decide to use 2D over 3D.

Line Look

What if you truly needed to have a certain style of line that currently can't be replicated with 3D toon lines? Perhaps you need a lovely cleanup thick and thin line. Perhaps you want a scratchy hand-painted line? Possibly you could create it with 3D, but that brings us to the next reason. Read on.

Time

Sometimes it takes less time to draw it than it does to do all of the research and development to figure out how to do a given thing in 3D. We'll examine the element of time in the industry examples section.

Animation Style

Another reason that might tip the scales toward 2D instead of 3D is to match a given animation style. It might be easier to animate in 2D.

Whatever the reason, it sometimes is the hardest decision to make, to add in 2D. We love our 3D shiny buttons and widgets. It is hard to stop and wonder if it would be easier, look better, or possibly take less time than it would take for the research and development department to draw the assets. Did I just say 2D could cost less than 3D? If you consider how much time it can take to test, develop, and render 3D assets to look like what you want, then yes, 2D can cost less. I'm referring to more risky 3D assets, which possibly you have not done before or that are highly technical like water, goo, dynamics, and so on.

Industry Examples

The hydra from Disney's *Hercules* (1997) is a good example of when 2D was used to get it right. When the hydra's heads grow from the stump where the previous head was severed, there is an eruption of goo. The hydra was a 3D element in a 2D film. The animators used flat shading on it, with tones and highlights. There were rendered toon lines done with Renderman. (In that day, you had to work hard to have toon lines.) For the goo that was to erupt from the stump, they investigated 3D particle systems. They spent a long time trying to get the particles to look right. It wasn't working. Finally the look development supervisor had a wonderful idea. She asked, "Can we do it in 2D instead?" It looked great. The animators did a simple 2D EFX element of goo and composited it into the shot.

Now that you are getting used to the idea of 2D/3D animation, it may not seem that odd to you to consider drawing a 2D element on top of a 3D element. Three chapters ago you might not have so easily come to the idea of putting 2D goo on top of 3D. There's no turning back now. It is just an image. Anything goes to get that animation on the screen.

Recently I wandered through a room where Dreamworks' *Spirit, Stallion of the Cimarron* was being played. It had been a while since I had looked at that film. It is a great example of 2D/3D mixtures. The sequence playing was one in which the lead horse falls into a river. (Why animal movies, both animated and live action, always have to douse animals in raging rivers, I do not know.) As the horse struggled in the 3D water, his splashes were 2D. It worked pretty well to have the 2D splashes at the contact point of the 2D horse and the 3D water. To have 3D perfect water around a flat 2D horse would have drawn attention to the contact point and drawn attention away from the action of the scene.

I have another Disney example that I lived through. For *Fantasia 2000*'s Pines of Rome

sequence, the animators worked hard to develop 3D whales. They were lovely whales; you can check out the DVD to see them. It's a cute tale about a baby whale and his adventures while trying to fly with his parents. There were a few elements in that sequence that could not be executed very well in 3D at the time. During production, in 1995, 3D was not the best at a few things. The first element that was not convincing in 3D was the eyes for the whales, and the second element was the water splashes. Both elements were done in 2D. The 3D whales were printed, pegged up on paper, and used by the 2D artist as reference. I'll assume that there was some hand-adjusting of the 2D eyes in the compositing software at the end of the process if there were any registration issues. The eyes were drawn in 2D, and the water splashes were not only drawn in 2D, they were drawn in an older style of EFX animation with the side of the pencil instead of drawing outlines. A similar style was used in the Sorcerer's Apprentice sequence in the original *Fantasia* (1940).

For months I watched these sequences as they went through animation. I didn't even work at Disney at the time. I worked at Dreamworks. After getting off work I would drive to Flower Street to take dinner to my spouse, who worked as a cleanup artist in the character department by day and did overtime in EFX at night. He was in crunch time then and was working overtime drawing those whale eyes and water splashes. It was a huge undertaking and turned out very well. I marveled at the roto prints of the 3D whales. For some shots they were printed out on 24 field paper, and the artists had to draw eyes on that large 24 field paper. I wish I knew for sure, but I'm confident that animating on 24 field paper (which is incredibly huge) had to have caused some slight registration issues. Imagine these huge pieces of paper that were twice the size of normal animation paper and the only things on them were a couple of small whale eyes. I'm not sure why they were using 24 field paper. Usually when you are drawing a small image on a large background, you can draw on smaller paper and composite the drawing into the correct place. I'm sure there was a reason.

Hands-On Examples

I run a group project class at least once a year. In 2008, the group project was very successful for such a small team. I'm proud to say we placed in the Daytona Film Festival, the Savannah Film Festival, and the Atlanta Film Festival. The group project for 2009 was of a slightly larger scope, and our team size doubled. At the start of the project I knew that I wanted it to line up to produce artwork for this book. So I put onto the group one restriction: the character had to be a 2D/3D character. At first I worried that forcing a restriction like that would hamper the creative process or it would be forced onto the story with no reason. The rule the team came up with for the use of 2D and 3D was this: organic = 2D, nonorganic = 3D.

I thought this was an interesting concept. We'll take a look at a sequence that exemplifies those rules and the 2D/3D process.

Jaguar McGuire: Cape on Fire Sequence

The short group project film that we came up with for 2009 is titled *Jaguar McGuire.* It is a story about a conflict between a cat and his owner. The cat owner is none other than Jaguar McGuire, who, the audience finds out in the opening shot, is a daredevil. They also realize quickly that he must have had bad fortune in his career as he is in a body cast. The second shot shows Jaguar looking longingly at his cape and seemingly reminiscing over his career, which, as a newspaper headline reminds him, is definitely over. Just as we are feeling sorry for poor Jaguar McGuire, we realize that his troubles are far from over as we hear the first of many hundreds of meows that come from his cat. This troubled cat owner's cat still requires the things that cats need. How will Jaguar quell the meowing? What ensues is a physical comedy that is sure to have you laughing.

During the struggles, there is a sequence where the cat climbs on top of Jaguar's body cast. Jaguar has one free leg and tries to kick the cat off. Unfortunately, the cat jumps off just before the leg connects and instead of kicking the cat, Jaguar kicks his own injured leg out of the sling. The momentum propels his leg off the side of the bed and knocks over his table, which launches a vase of water (in slow motion) through the air. The vase crashes and short-circuits an electrical outlet. The sparks, sadly, catch the hem of the cape on fire. Jaguar watches in helpless horror as the flames burst up the length of the cape. Being a daredevil, Jaguar believes he can stop the fire and uses his only free foot to try to stomp the flames.

We'll take a look at how the characters came to be in the 2D/3D process for this sequence. Many individuals were involved in the creation of this short animated film. We started with a team of 14 that met weekly in the classroom for 10 weeks and then worked with many more artists outside of the classroom as we continued through production and post-production.

Jaguar

Many designs by students were turned in for the main character, Jaguar McGuire. Our art director, Jason Walling, compiled different ideas and ultimately came up with the page of design ideas you see in Figure 4.2. The character design allowed for a 2D leg, 2D head, and 2D wiggling toes and thumbs; all else on Jaguar, being in a cast, is 3D. You'll note that the face and leg are completely encased in bandages. It took some convincing, but we finally came to the

agreement that at least the leg would not be covered in bandages. The reason for minimizing the bandages is that 2D bandages are incredibly hard to keep up with when animating, and the cleanup on them would make it difficult to manage quality control. Anyone who has gone through 2D animation classes has probably heard the evils of stripes, long flowing hair, prints on clothing, complicated ribbon work, and the like. All of these items can contribute to a more complex cleanup line, which if not managed well can cause strobing, jiggle, or otherwise distract from the animation. The bandages on the face stayed, because those were important to keep up the high level of frustration needed throughout the film.
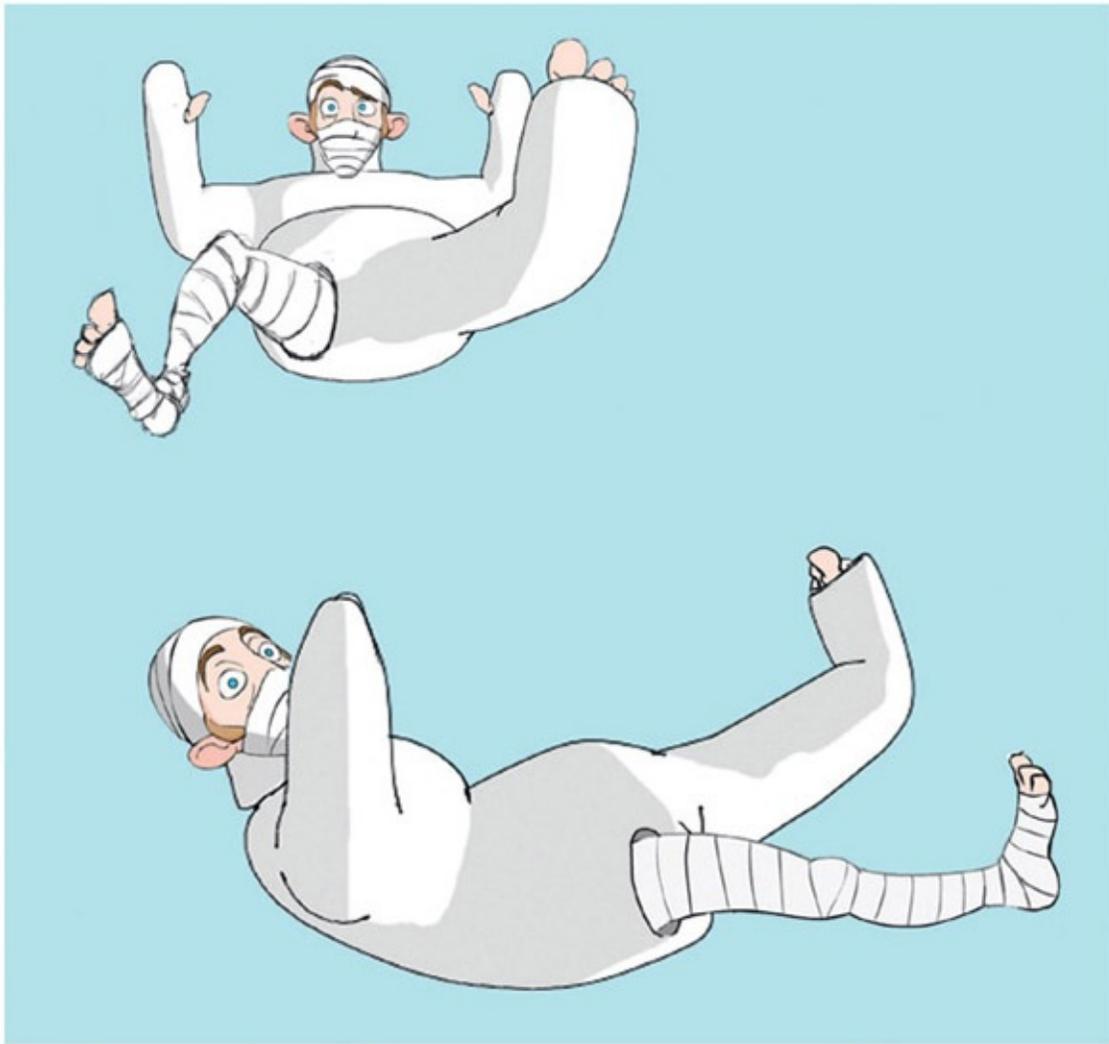
FIGURE 4.2 *Jaguar McGuire* character design by Jason Walling

Our director, Clint Donaldson, took the concept and began working on ideas of how the 2D and 3D would work together. In Figure 4.3, you see a visual target created by Clint that is our first depiction of a 2D Jaguar body inside of a 3D cast. From the very beginning, the idea of a 3D cast that was simply immovable backed our story of this trapped stuntman. It fit the story and I was pleased that the restriction I originally gave did not end up feeling like it was retrofitted into the story.
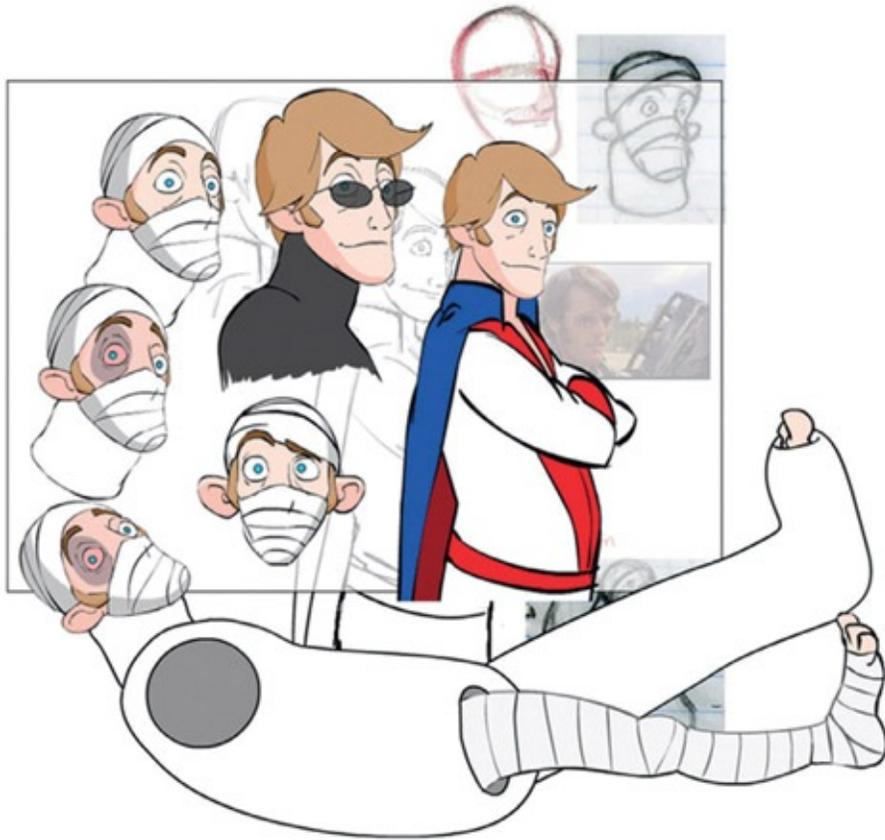
FIGURE 4.3 Jaguar McGuire's 2D/3D visual target by Clint Donaldson

For the first 10 weeks of production we had a class of 14 individuals. Many were tasked with modeling and texturing. The 3D cast rig was created along with a 3D version of the head and leg to be used as reference for the 2D animation. Figure 4.4 is a shot of the room with Jaguar's supine body on the bed. Because this was a production pipeline with many individuals involved, we utilized the reference concept for everything. The model and the rig file were all referenced into the main blocked Maya scenes. This way the scenes could be pushed through the pipeline before the models or rigs were completed. As the modelers finished the higher-resolution versions of the models, they updated the reference files. Then as the riggers finished rigging the files, those were updated. From the animator's point of view, they animated a block version of the character in a block room one day, and as the production went along the room they referenced in became more high resolution and filled out until it was a completed room ready to render.
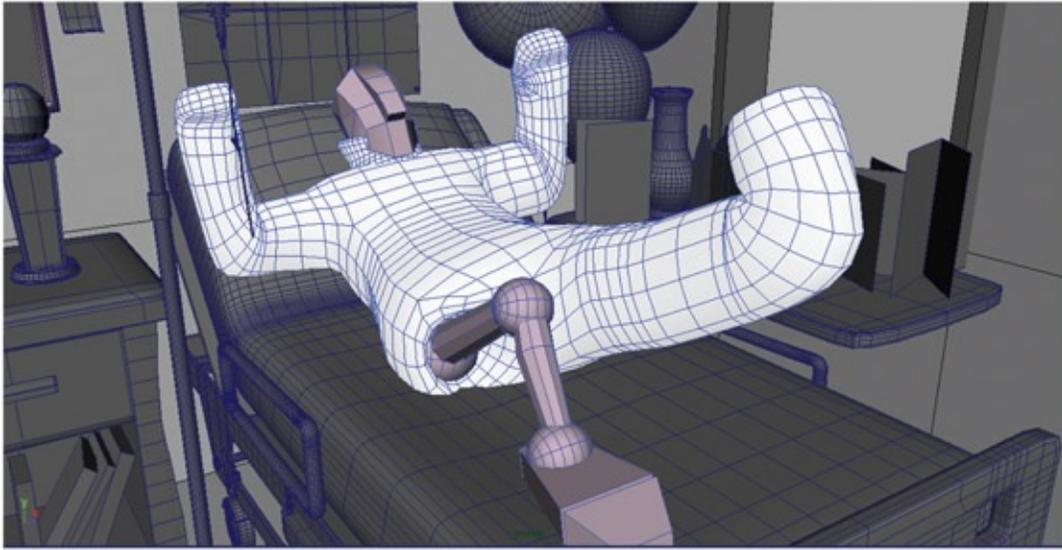
FIGURE 4.4 Jaguar McGuire 3D model. Head and leg are 2D reference stand-ins

The animation was completed in Maya. The animators chose to animate the 3D stand-ins completely to better visualize the animation. Figure 4.5 shows keyframes of the 3D animation including the stand-in leg. The stand-in for the head is a low-res version. This was the rig that was pushed through earlier in production. Later in the production, a higher-res 3D head was developed to allow more perspective help for the 2D animators (Figure 4.6). This higher-res head was necessary for other shots where we did a crazy zolly shot (a rite of passage, according to the artists). A zolly shot on a 2D/3D character, though, is very challenging. Another thing that the higher-res head gave us was the ability to cast shadows on the head and pull those shadows to composite overtop of our 2D character. We'll look at that technique in the chapter on EFX.
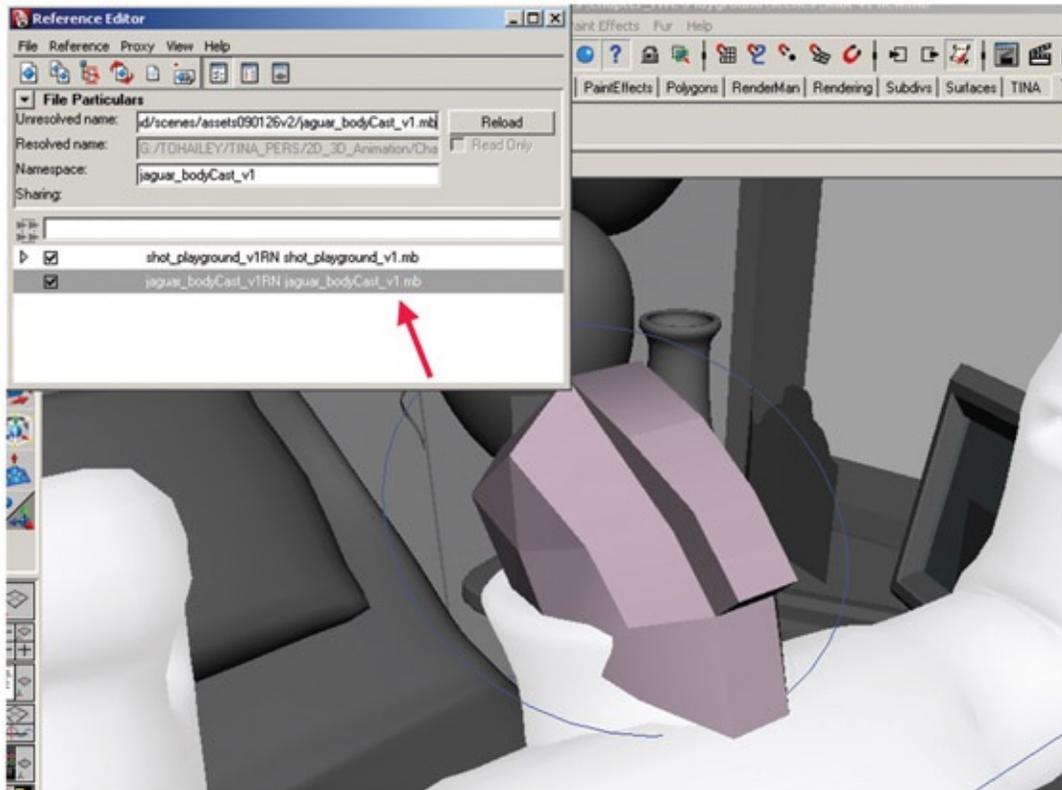
FIGURE 4.5 Jaguar McGuire's 3D low-res head referenced into the animator's scene
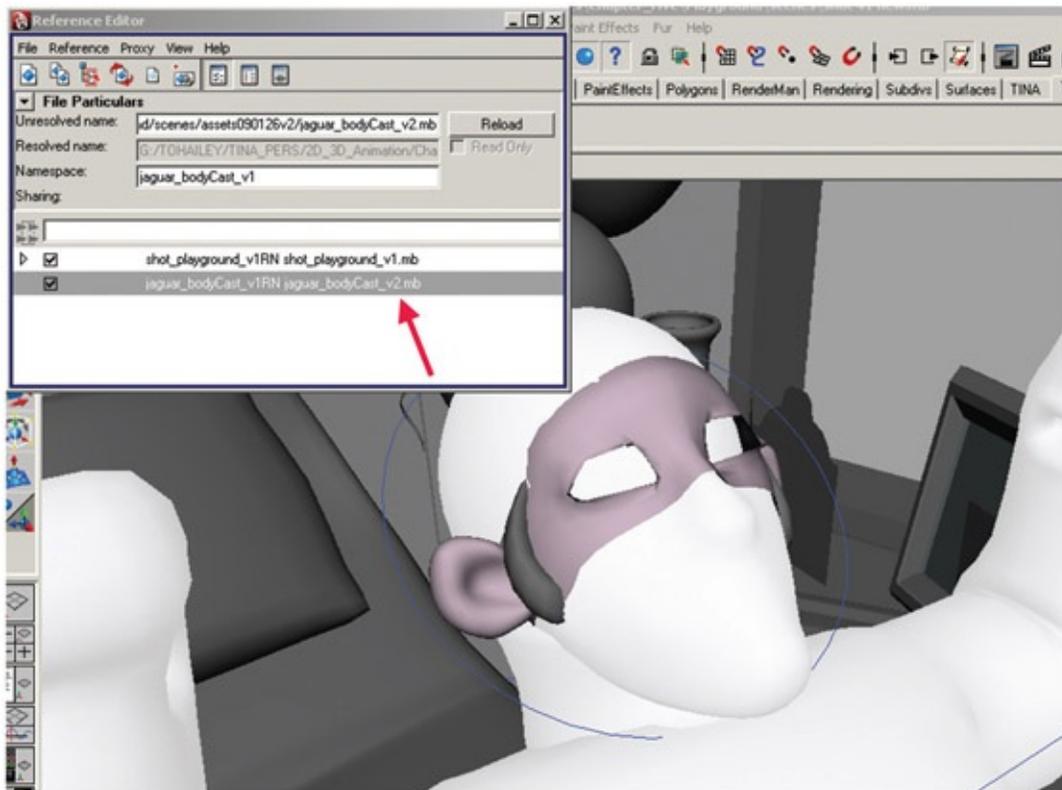
FIGURE 4.6 Jaguar McGuire's 3D high-res head referenced into the animator's scene

The animation was done normally in Maya, creating a character set and setting keyframes

as you are used to. Also, the twos.mel script was used to make sure that the animation was on twos. You can see a playblast of the animation of the 3D character in the file **3DLeads2D_3Danim.avi**. This playblast from Maya shows the controls from the rig as well. It was a simple rig, as no deformations were on the cast itself. We debated whether or not to add them. In the end we decided that for comic effect we would try it without any deformations.

Upon completion of the 3D animation, Clint brought the animation into Flash to rough out the 2D animation. Clint and Jason, the two directors of the group project, preferred creating their rough 2D animation in Flash because it is easier to set up key-frames in the timeline and adjust timing. They were not familiar with animating in Photoshop. They also liked working with the timelines and being able to adjust the timing of their 2D easily by moving keyframes in Flash. You can open the Flash file to see the layering used and the rough 2D animation drawn overtop of the 3D in the file **Shot41 – 43_2DRough.fla**, found in the companion data.
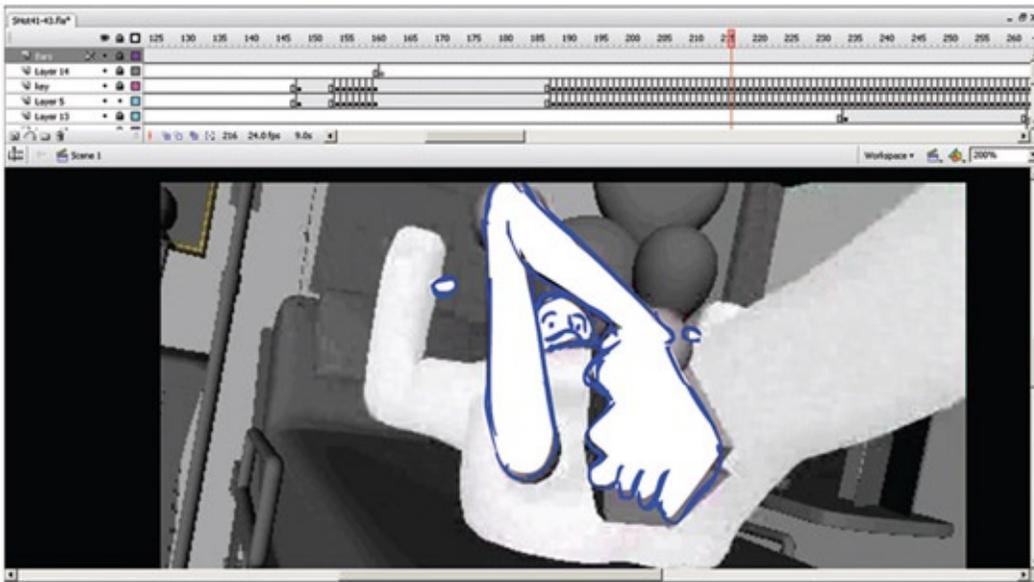
FIGURE 4.7 2D rough animation drawn in Flash

Not all animators in the group project were able to do both the 2D and the 3D animation. Clint and Jason both were able to, and they handled the total animation of each of their shots. The cleanup, originally, was to be handed off to our team of volunteer cleanup artists. Using the standard round brush inside Photoshop, they were to complete the cleanup pass of the character. However, we found that the animators had fairly clean lines in their animation. Most of the cleanup was completed in Flash with a very small brush.

Jaguar's Neck Brace

There was much discussion early on about whether or not we would break our rule of "organic is 2D" with the neck brace. Clint and I pushed for a 2D neck brace, thinking it would be easier to animate that way. I also believed that it might make for an easier contact point between the 2D and the 3D. To our art director's credit, Jason did not think we were correct and did a test to show us that a 3D neck brace would work just fine. He animated shot 9 with a 3D neck brace. The neck brace had a simple lattice deformer on it, and it worked just fine. In fact, since we rarely see the neck of the character, the 2D head can mostly be composited on top of the character with few registration issues. We all had to agree that Jason was correct. The test proved it.

Figure 4.8 shows how the 3D neck brace moves along with the high-res 3D head. A playblast of scene 9's 3D is in the companion data: **3DLeads2D_3Danim_shot9.avi**.

FIGURE 4.8 Shot 9 of Jaguar McGuire and his 3D neck brace animated by Jason Walling, our art director

The 3D animation was then brought into Flash where the rough 2D animation head was placed. The high-res version of the head in Maya helped the animator with perspective on the face and ears. When combining 2D with a 3D shot, it is extremely important that the 2D follow perspective as much as possible. Otherwise there would be a visual mismatch that would detract from the animation.

FIGURE 4.9 Shot 9 of Jaguar McGuire's 2D head, animated in Flash by Jason Walling, our art director

The Flash file for this rough animation scene is in the companion data for you to view: **3DLeads2D_2DAnim_shot9.fla**.

The scene was cleaned up in Flash using a very small brush. Then the scene was ready for final composite.

FIGURE 4.10 Cleanup draw in Flash, by Jason Walling, 2009, SCAD group project

Your Shot 4

Now it is your turn to take a shot from the project. You have been issued shot 4. This is a reaction shot of Jaguar. He has been looking at his cape and cards and the newspaper headline that pronounces his career over. Just as he sighs, a deep sad groan, his nostalgic lamenting is interrupted by his cat's meow.

3D Animation Leads

Start by opening the Maya file **Shot4_Blocked.mb**. If your project is not set, Maya will automatically call in the referenced rig file **jaguar_bodyCast_v2.mb**. If Maya cannot find it, you will be prompted to browse for the file. Once the file is loaded into Maya, you can switch views to display the animated camera for this scene, **camera1**. To do this, in the panel window click **Panels > Perspective > Camera 1**.
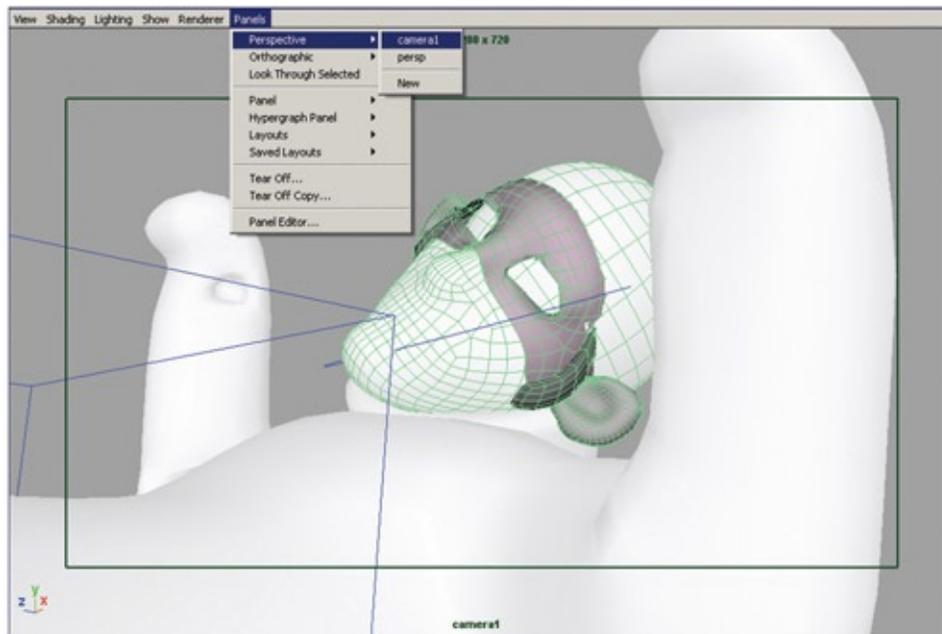
FIGURE 4.11 Blocked in Maya, this file was opened and viewed through an animated camera

The animation for the head has been blocked in already for you. The scene is **100 frames** long. The frame rate is **24 frames per second (fps)**. Our camera rendering settings are **HD720**. You will note that the blocked-in animation was not placed on the rig controls but on the head itself. Select the head so that it turns green, and you will be able to see the keyframes in the timeline. This is normally naughty rigging. In rigging classes, I teach the students to lock down all geometry so that the controls are the only thing that can be animated. Rigging this way keeps novice animators from breaking the rig easily. However, in a small group project like this one, where most of us were familiar with the outliner, we broke convention and animated

the geometry. In larger group projects or when the team issues scenes to animators who are not familiar with the rig (like you), this convention could cause confusion. In many scenes throughout the film, we had to break the rig to get the posing we needed. This is entirely to be expected in settings outside a sterile classroom. Do what you need to do to ensure that the shot is completed on time, but do not cause more issues for others down pipeline from you. Because you are being issued this scene, please note that there is no character set on Jaguar, and the head geometry has been animated.
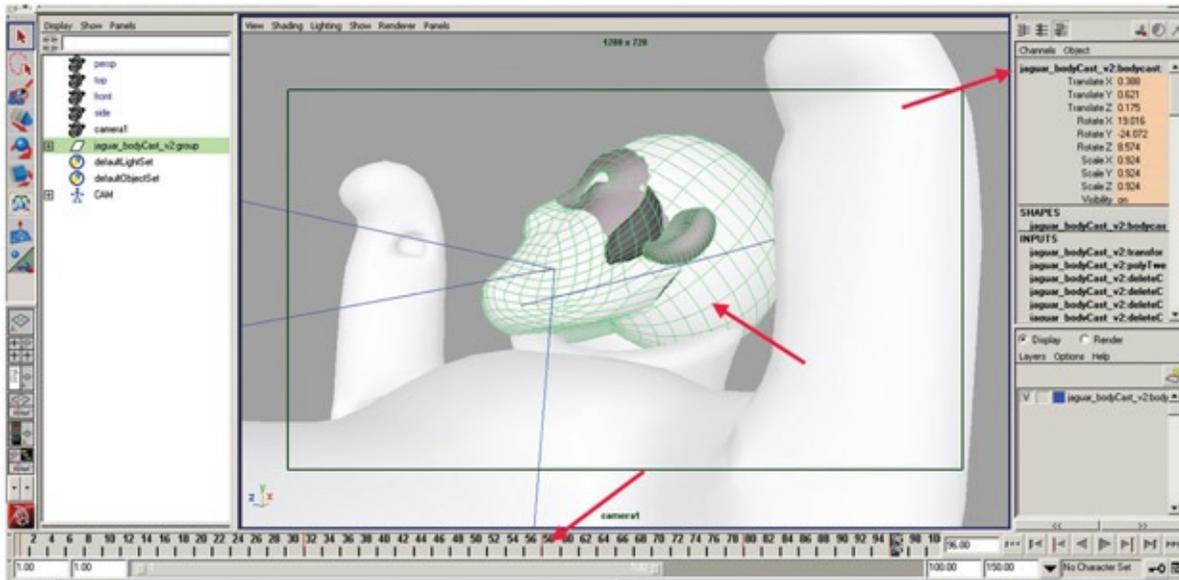
FIGURE 4.12 Animation is on the geometry—naughty rigging. (Read *Rig It Right!* for more information on the rules of rigging.)

The camera has been animated, which will likely be the case in a production environment. You are to animate the 3D character. Those who have worked in production know this to be the case; for students, this might be a new concept.

The neck brace is not rigged. You can select on it directly and rotate it as you see fit for your animation. Those who take my rigging courses know that this bothers me to the core of my being. Make a note: these students did not take my rigging class and we'll live with the unclean implications. In a perfect world, we would have a completely locked-down rig with controls in place. Breaking the rig on a shot-by-shot basis is one thing, but having a part of the rig that should have controls to be animated in every shot is another. It is simple animation for the brace, so we can animate the geometry.
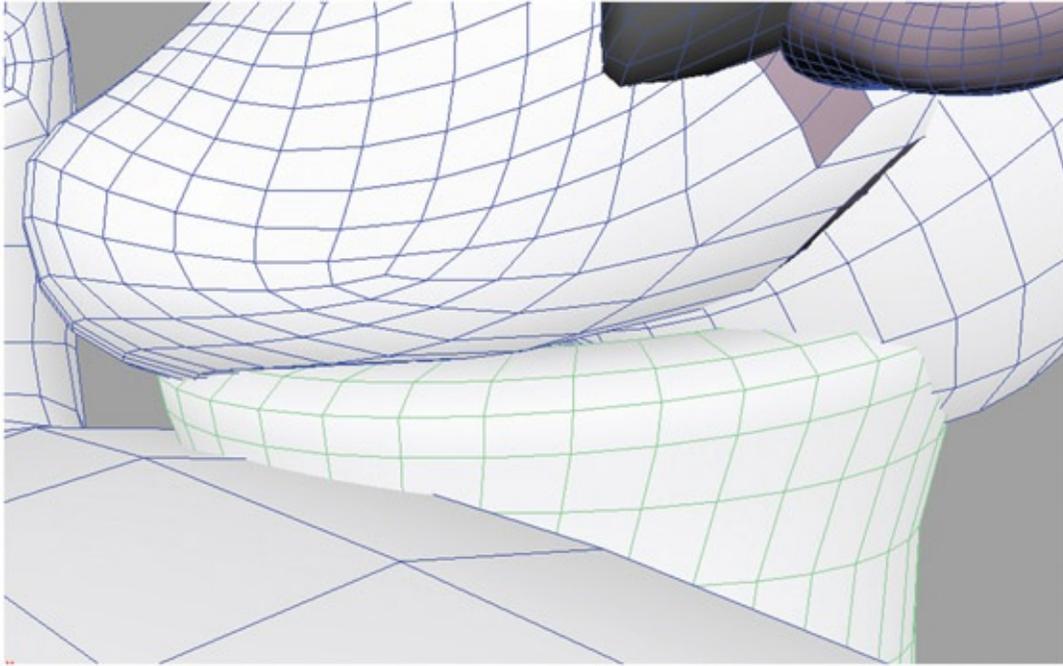
FIGURE 4.13 The neck brace can be animated directly by moving geometry

When you have completed your animation, do not forget to run the **twos.mel** script by typing **twos** in the command line. This will put your animation on twos for you, and in this scene there shouldn't be a need to change it to ones unless you feel you need to when the character quickly turns to find the source of the meow.

Render 3D Reference Images

Save your project and render out a sequence of images to bring it into the 2D package of your choice. There is no need to render out render passes in this scene because the head only needs to be composited right on top of the body. This is an easy registration scene. However, if it will make your registration a little bit easier, we can render out the head on a separate level so that when you are drawing in your 2D package you can hide the head and see only the body level. This will allow you to see if you truly have proper registration.

Create render layers as we did in Chapter 3 for the head and the body:

1. Click on the body; it should turn green.
2. In the Render Layer window, select **Layers > Create Layers from Selected**.
3. Label the layer **RLBody**.
4. Repeat for the head.
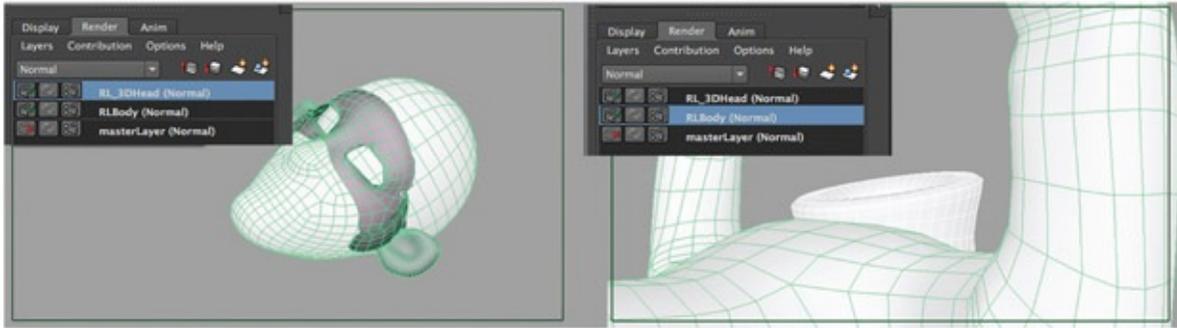
FIGURE 4.14 Render layers for the body and head

Remember the settings that you need to have in order to render layers:

1. You have to tell Maya to render all of the layers in the Render Layer area by clicking **Options** > **Render All Layers**.
2. Make sure that your render settings have the following:

    a. Correct naming and file extension
    b. Correct frame range and padding
    c. Camera1 selected and alpha channel
    d. HD720 resolution

3. Then click Render > Batch Render.
4. Your images will be placed inside folders with names matching your render layer names.

Take Note

Watch out. What if your compositing software of choice doesn't read in alpha channels with .tif image sequences? You have two options: create a raw QuickTime movie file with alpha channels or an FLV file.

Creating a raw QuickTime movie file with alpha:

1. In the package of your choice, convert those .tif or tga images to a QuickTime movie file. I will use After Effects. As we have done before, import your images into After Effects and create a composition with the proper frame rate. To check if your alpha channel is there (please check, this will save you the headache of having to come back and redo this), click on the **Show Channel** icon and select **Alpha**. You should see a black-and-white image that matches the shape of the object in your image. If

you only see white, you have no alpha channel. Go back to step 2 and make sure you are not using JPGs or some other image format that does not support alpha channels. I'll wait for you right here until you get back.

2. Once you are sure that you have alpha channels, export the images as a QuickTime movie with the compression set at Animation. This will basically be a movie of full-res images that contain alpha.
3. Repeat for the head layer.

Creating FLV or SWF files:

Here, we'll use a new piece of software found in the creative suite. In Adobe Media Encoder choose:

1. **File > Add Source** ... and select your .tif sequence. Make sure to select **TIFF image file sequence**.
2. Set the output to **FLV**.
3. Click on **FLV** to open the options. Make sure the video tab has **Encode Alpha Channel** checked on. All else should automatically match the size of your .tif images.
4. Click on the green play arrow in the upper right of the program to start the queue and render the FLV file.

When this FLV file is brought into Flash, the alpha channels will be respected.
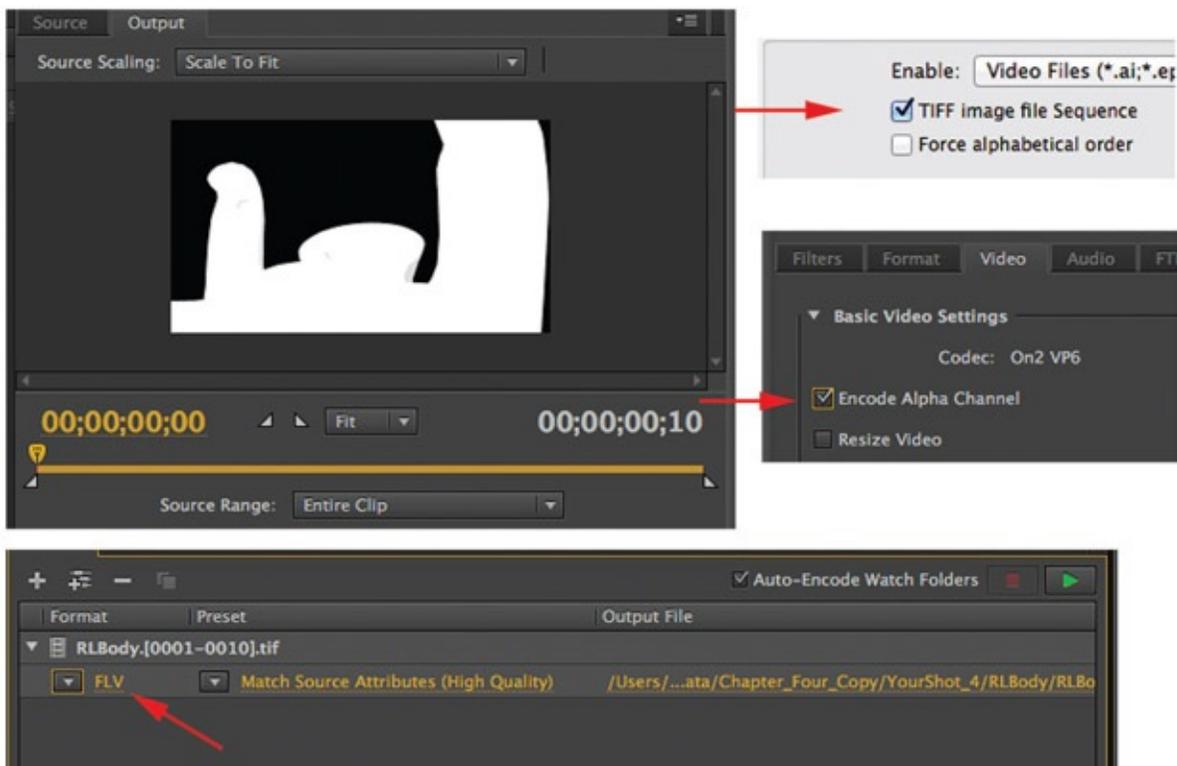
FIGURE 4.15 Using Media Encoder to convert .tif sequence (with alpha) to FLV file (with alpha). Teach Flash to respect your

2D Animation Follows

Next we will do our 2D rough animation in Flash. Create a new document (ActionScript 3.0 document) with the following dimensions: **1280 × 720, 24 fps**. We will bring the reference images into the timeline.

1. Go to **File > Import > Import Video** … and select the body level movie file.
2. Turn on **Embed video** in SWF and play in timeline.
3. Click on **next** and make sure the symbol type is **embedded video**. Click on **next**, then finish.
4. Repeat for the head reference layer.

A Note on Flash and Importing Video

Flash was never really optimized to use video. It was basically making a vector for each pixel—super memory bog. CS6 and newer versions of Flash expect FLV or SWF files. Older versions of Flash will bring in a raw QuickTime file. What would happen if we used a .tif image sequence? Glad you asked, because I did use .tif images and when I brought them into Flash they read in as an astronomically huge file that I could not see. If you try to use a tga, it will open correctly but without the alpha channel. Adobe products will read alpha channels with FLV files. After Effects will also read the QuickTime file and its alpha. Of course, by the time this prints it could change—so always check your alpha channels and image types for your pipeline.

Drawing in Flash

Insert a new layer above your video layers and choose the pencil or brush tool to draw in. The shots with rough animation shown in [Figure 4.16](#) were drawn using the brush tool in Flash. You can see that using the brush tool still creates a vector line; the outline of the brush is vector. The brush tool works with tablet pressure sensitivity as well.
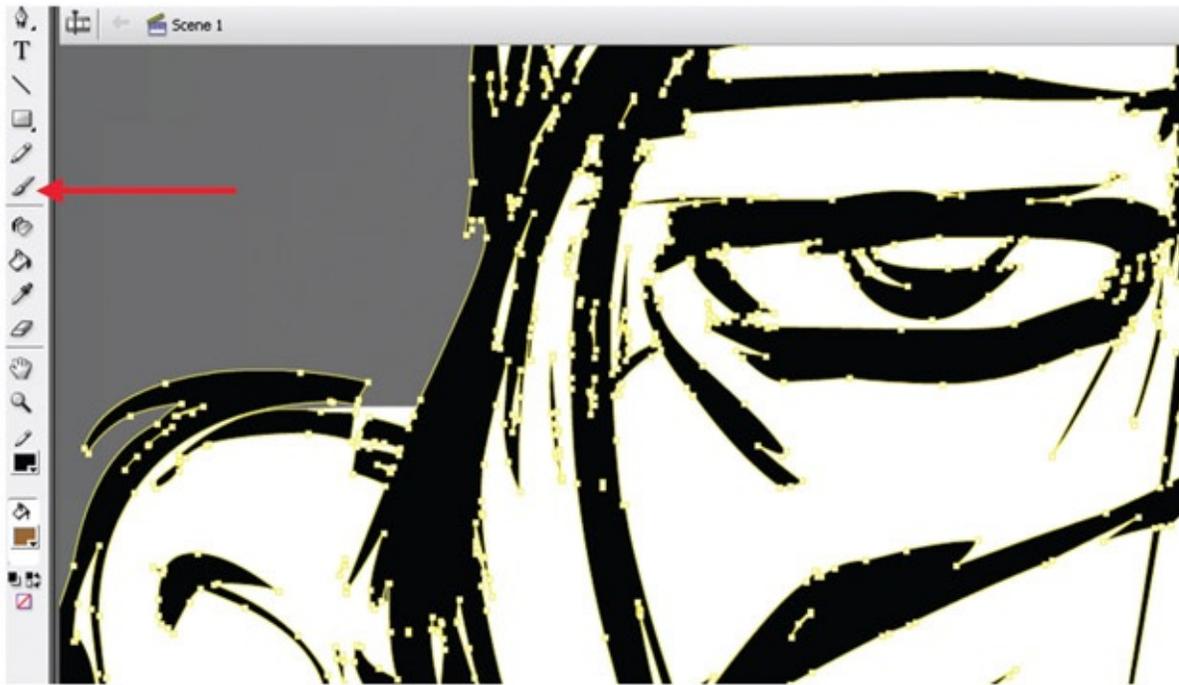
FIGURE 4.16 Rough animation using brush tool in Flash

For those new to drawing in Flash and the concepts of key-frames, here are a few tips: lock all layers that you are not currently drawing on. If you don't, you might accidentally draw on layers that you do not wish to. Also, you can drag and drop keyframes on the timeline; but beware, you can accidentally duplicate key-frames and cause a messy timeline. Refer to Figure 4.17 for the following explanations:

1. The current time is indicated by a red bar.
2. A blank keyframe, where nothing is drawn, is indicated by a white block with an empty circle. You can right-click on the timeline to insert a blank keyframe or use the hot key **F7**. Once you have a blank keyframe, or a blank piece of paper, you can begin to draw your key; the circle will fill in and the keyframe will turn gray.
3. To create a keyframe that also has a copy of the previous drawing on it, use the hot key **F6**.
4. To extend a keyframe by holding it longer, use the hot key **F5**. The end of a hold is indicated by a gray rectangle on the timeline.

FIGURE 4.17 Using the timeline in Flash

When you have completed your rough animation, you will want to export those images so that they can be brought into the cleanup package of your choice. For our production *Jaguar McGuire,* we debated using Toon Boom or Photoshop. In the end, because of its familiarity and to enable students to work on projects at home, we chose Flash for most scenes. By now you should already be thinking of the next step. If we need the alpha channel, can we output a series of .tifs or tgas? Yes, or we'll export a Quick-Time file:

1. Delete all but the rough head animation levels. Even if you hide layers, they will export.
2. Choose **File > Export > Export Movie**.
3. Give it a name, choose QuickTime Movie, and click **Save**.
4. In the export settings, make sure that the image size is correct.
5. If you want an alpha channel, make sure that **Ignore stage color** (generate alpha channel) is clicked on.
6. Click **QuickTime Settings** …
7. Make sure that the compression settings are for animation, and that the frame rate is correct.
8. Then click **Export**.
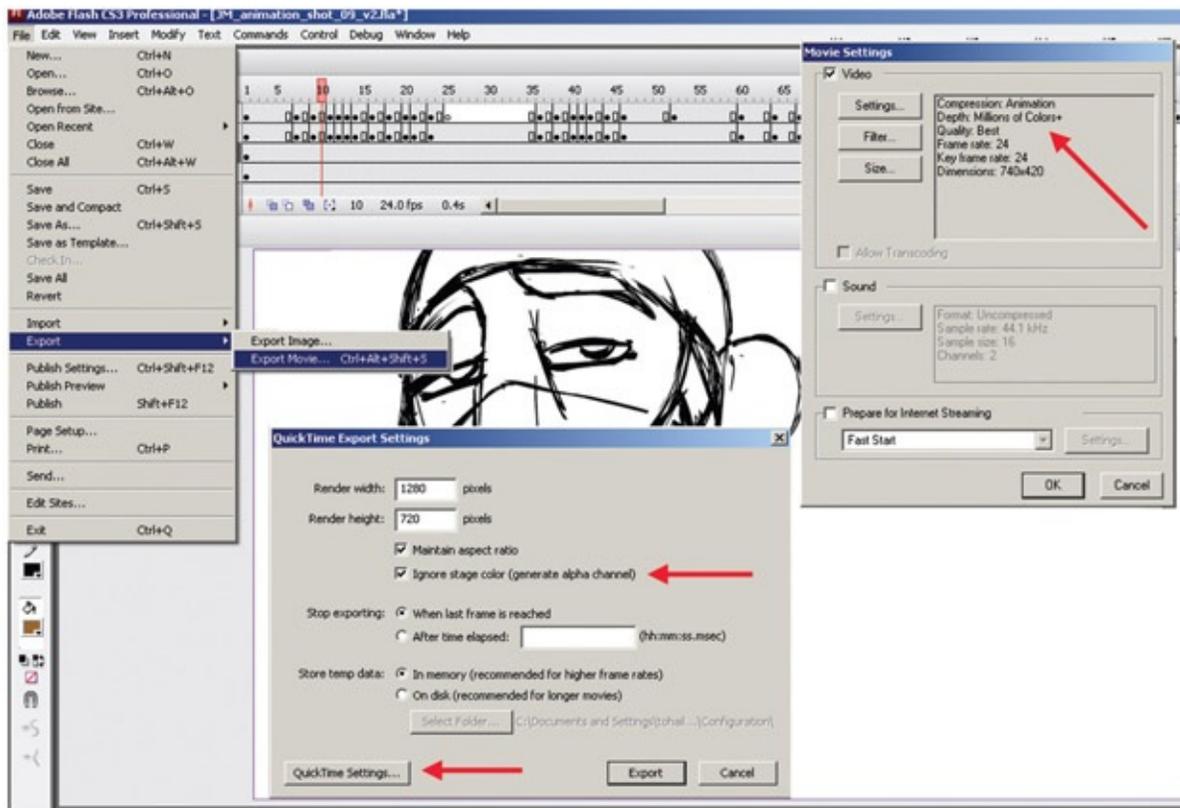
FIGURE 4.18 Exporting rough animation from Flash

It is always good to be paranoid when exporting images and always double-check that they exported what you wanted them to. All too often you get five steps down the pipeline only to realize you have exported completely blank images or images from the wrong camera. It is also good to check whether alpha channels are present and if the images are the correct size. While testing this chapter, I was happily following along until I realized that my images were not exporting out at the correct size from Flash. This is very sad. Then I remembered that the same thing happened during a 24-hour art challenge where I did a 2D/3D shot, and at five in the morning my brain could not process why my 2D image (which was drawn in Flash) was not lining up with the 3D image. Now I see why. When you export a simple line drawing from Flash, even though your export settings are the correct size, it will crop to the smallest rectangle that will encompass your image. That can be quite a shock. A way around this is to place a bounding rectangle around your canvas that is just at the cutoff size. If you make it a guide layer, it will not render. This will ensure a proper export. Warning: If the box is bigger than the output file size should be, you may have registration issues in your compositing software.

FIGURE 4.19 Placing an outline in Flash to ensure an export of the proper canvas size

Cleanup in Photoshop

The easiest way to open a QuickTime or FLV movie into a video layer and make sure that the file size is the correct dimension is to simply go to **File > Open** and open the movie file you exported out of Flash. This will open the file into a video layer and give you a document that is the correct size and bit depth. Watch out for your document's playback settings, however. During testing, our frame rate had to be changed manually. You can see in Figure 4.20 where the frame rate is incorrect.
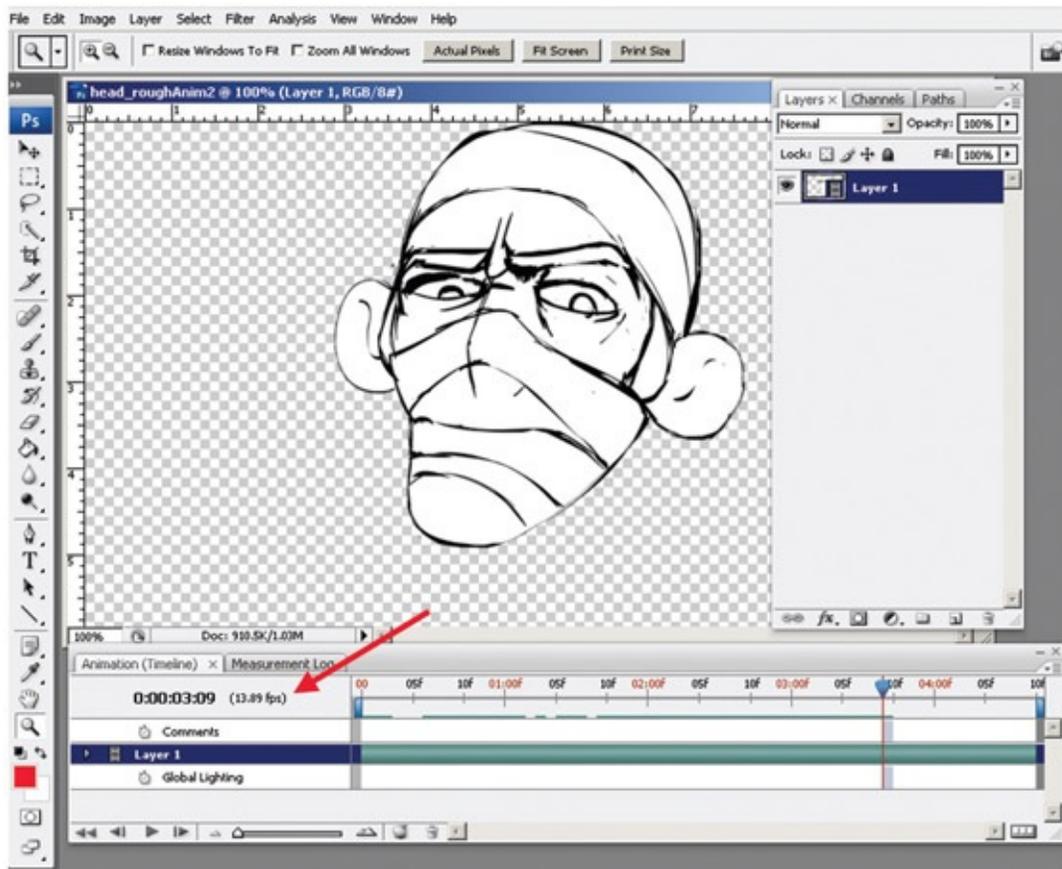
FIGURE 4.20 Using rough animation in Photoshop for cleanup

Add an extra video layer and use the brush that you wish to draw in your cleanup line, as we have in previous chapters. When you are done, export your video layer for final compositing.

FIGURE 4.21 Cleaned-up animation in Photoshop

More on Toon Lines

We haven't looked at toon lines in a while, and you were promised more. Let's take a look at some more features of toon lines. What if you wanted a scratchy, non-pencil-like line? Let's use our shot 4 scene and test out some paint effects toon lines.

Open the **Shot4_Blocked.mb** file or the file you have just animated. Select the body cast and neck brace and apply a new toon shader by clicking on **Toon > Assign Outline > Add New Toon Outline**. Now a toon line is applied to your character and you can see it in the main viewport. Next we want to work with the paint effects brushes and apply them to the toon outline. Some of these become heavy to render in the viewport; you might have to turn off **Display in Viewport** in the attribute editor. Other paint effects brushes do not display well and are only appreciated when rendered. To begin with, open the visor window by clicking **Paint Effects > Get Brush**:

1. Select the **pfxToon1** toon line node in the outliner.
2. Select a brush in the visor window > **Paint effects tab**. In Figure 4.22 the **Toon > ThickOilLine** brush has been selected.
3. To apply the brush to the toon line, click **Toon > Assign Paint Effects Brush to Toon Lines**.

You can see in the viewport shown in Figure 4.22 that the paint effects toon line is visible. Figure 4.23 is a render of the toon line composited with the rough animation.
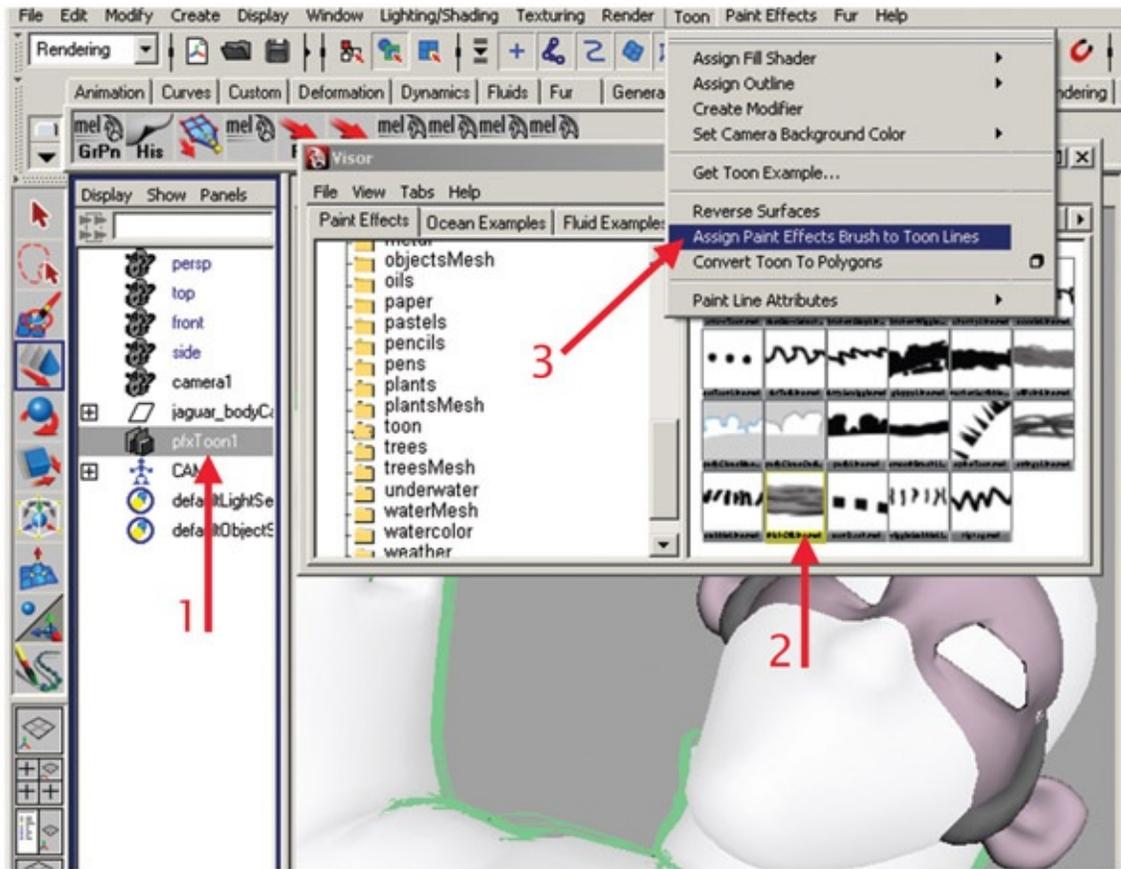
FIGURE 4.22 Assigning the paint effects brush to toon line
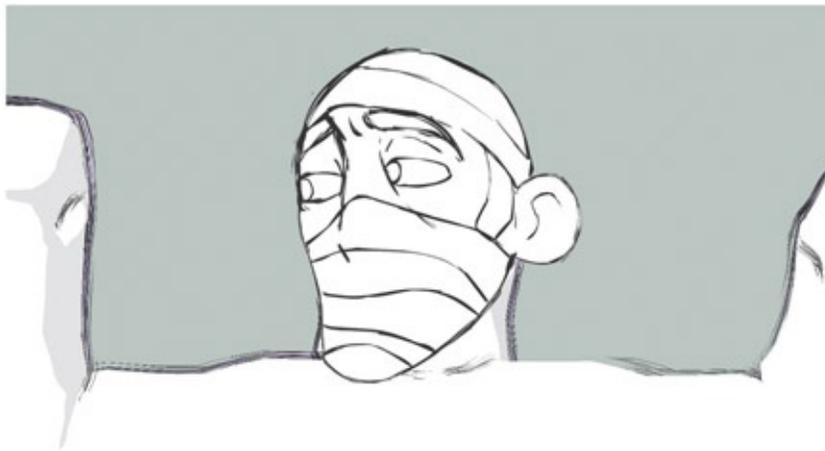
FIGURE 4.23 Composite of 3D with a 2D head

You can use the brushes with the default settings such as you see in Figure 4.24. Here the **Oils > dryOilRed** has been applied to the toon line.

FIGURE 4.24 DryOilRed Paint Effects brush

Or you can select the brush in the Attribute Editor and adjust the settings for more control. In Figure 4.25 the paint effects brush **Oils > thickOilRed** was applied to the toon line. As you can see in the image, the brush type was set to Thin Line, MultiStreaks was set to 2, and Streak Spreads was adjusted. Give yourself time to work with these attributes, as it takes time to become familiar with them. When you first begin to work with paint effects and toon lines, take screen grabs of the settings you have adjusted and the renders you come up with. These can help you navigate through good and bad adjustments.
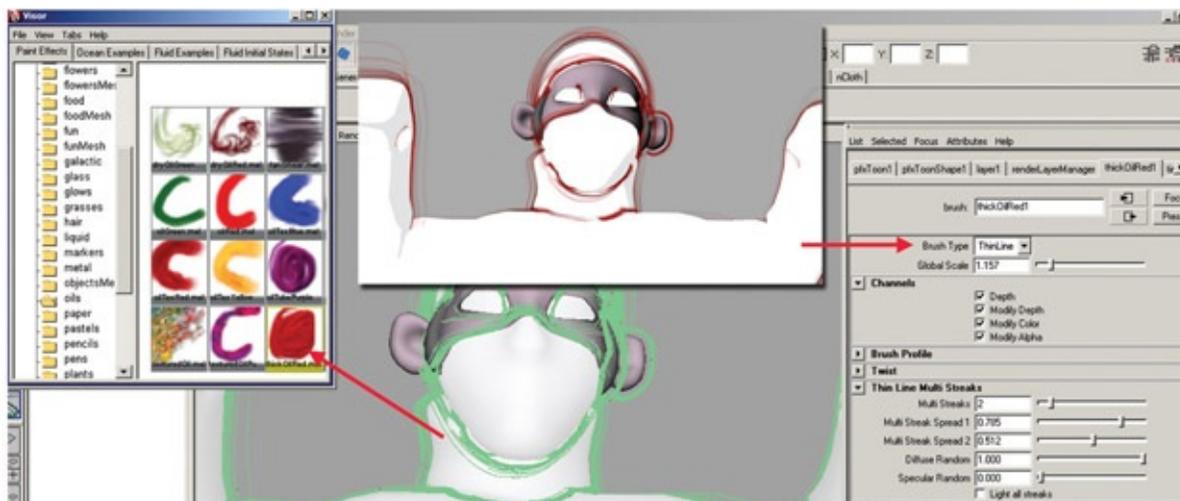
FIGURE 4.25 ThickOilRed Paint Effects brush

Don't overlook nontraditional-sounding paint effects brushes. You will be surprised by what you can use. In Figure 4.26 I took a chance and used an intestinal flow paint effects brush.
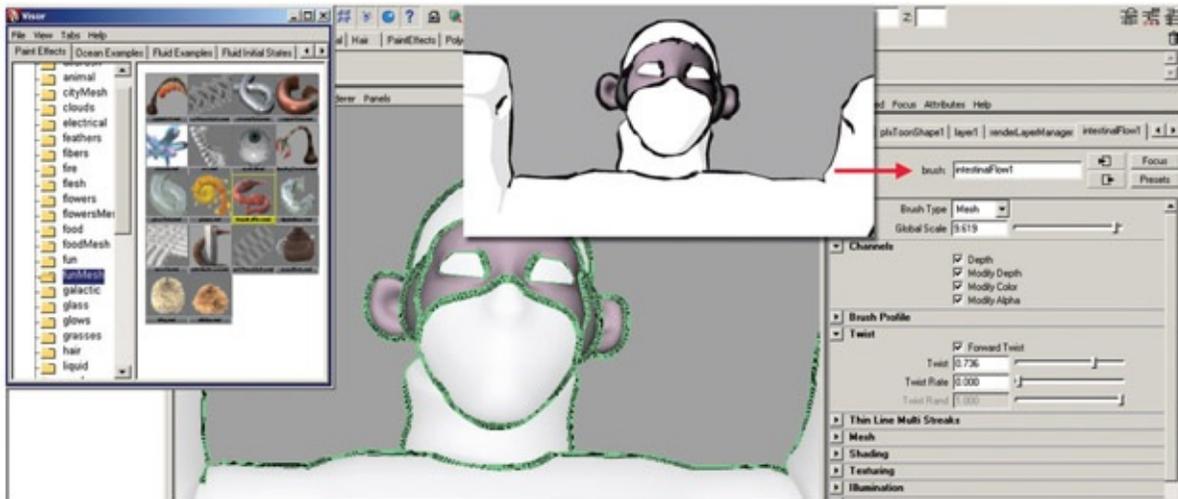
FIGURE 4.26 Intestinal flow paint effects brush

Putting it all together

Now you have some images ready to be placed together. What assets do you have?

1. 3D animated body and neck brace
2. 2D animated head

This should be a simple composite in your favorite compositor: After Effects, Smoke, Nuke, or Final Cut. Simply place the asset clips overtop of one another in separate layers and complete a final composite. What could go wrong? Alpha channels, image size, frame rate. If you do not have alpha channels in any of the layers, then you will need to go back to the originating software package and re-render with alpha channels that your compositing software will read. If you rendered a layer at the wrong size—then you will need to re-render. Lastly, watch in your compositing software that all image sequences for the layers come in at the same frame rate that they were drawn in. There was no background supplied to you for this shot. You can create an art card (color card) for your final composite.

Let's try it in Autodesk Smoke. After opening Smoke and setting a project and user name, click on the **MediaHub** tab at the bottom of the interface. Navigate to the folders with your image sequences. The first thing you want to look for is your images with alpha channels. You can see straight away if the alpha channels are being respected or not. In Figure 4.27 you can see two versions of the body layer. One is a movie file with no alpha and the other is a

sequence of .tif images with alpha. The alpha is indicated by the word "**MULTI**," which is at the bottom right hand of the image's icon. **Double click** on **MULTI** and the RGB and Alpha channel will display. You can even scrub through the clips by clicking and dragging on them. **Control click** on the clip with the alpha and choose **Import**. Repeat for the head layer as well. These clips will load into the Media Library at the left side of the interface.
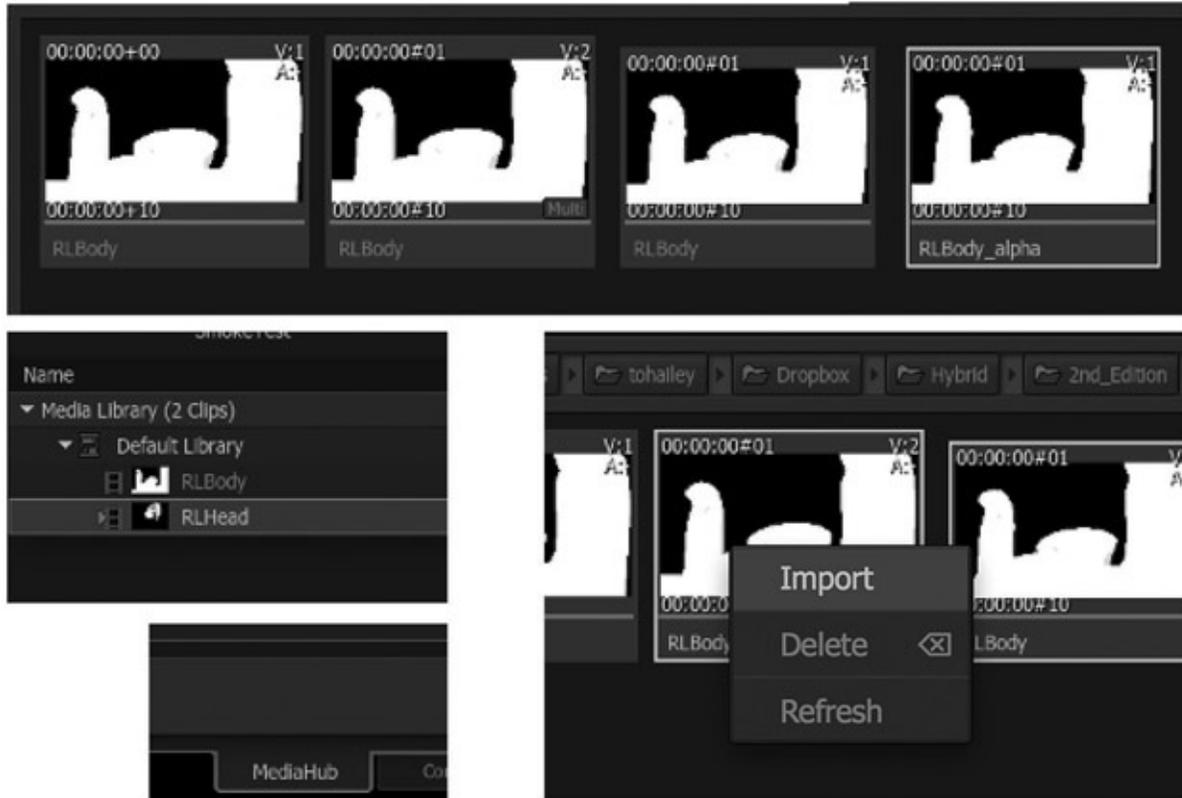
FIGURE 4.27 Importing images with alpha channels into Autodesk Smoke

There many ways to deal with alpha channels in Smoke and they have a dedicated YouTube channel to help you figure out the ways. Look up "Dealing with Alpha Video Series" in the Smoke Learning Channel on YouTube.

Go to the **Timeline** tab in Smoke and create a new sequence by clicking on **File > New > Sequence**. **Double click** on the **sequence** in the **Media Library**. This makes it active in the viewing area. Drag and drop the body layer into the empty video channel. Create a new video track by clicking on **Sequence > New > Video Track**. Drag and drop the head layer into the new empty video channel. (You could have set the sequence to have two video channels in the option box when you created it. Did you? Good job. You saved a click.)

But the composited image isn't showing? Well, Smoke is more than a timeline editor. It uses the timeline to sequence the video clips, but you can do more under the hood with them. If you compare this thought process to Maya, in a way, it is similar. Smoke isn't a simple node-based compositor either. (We'll learn about those later.)

Select the **head** layer, then locate the small **FX** button at the left of the screen in the

timeline pane. Click that, then click on **Axis**. This will tell the two layers to composite.
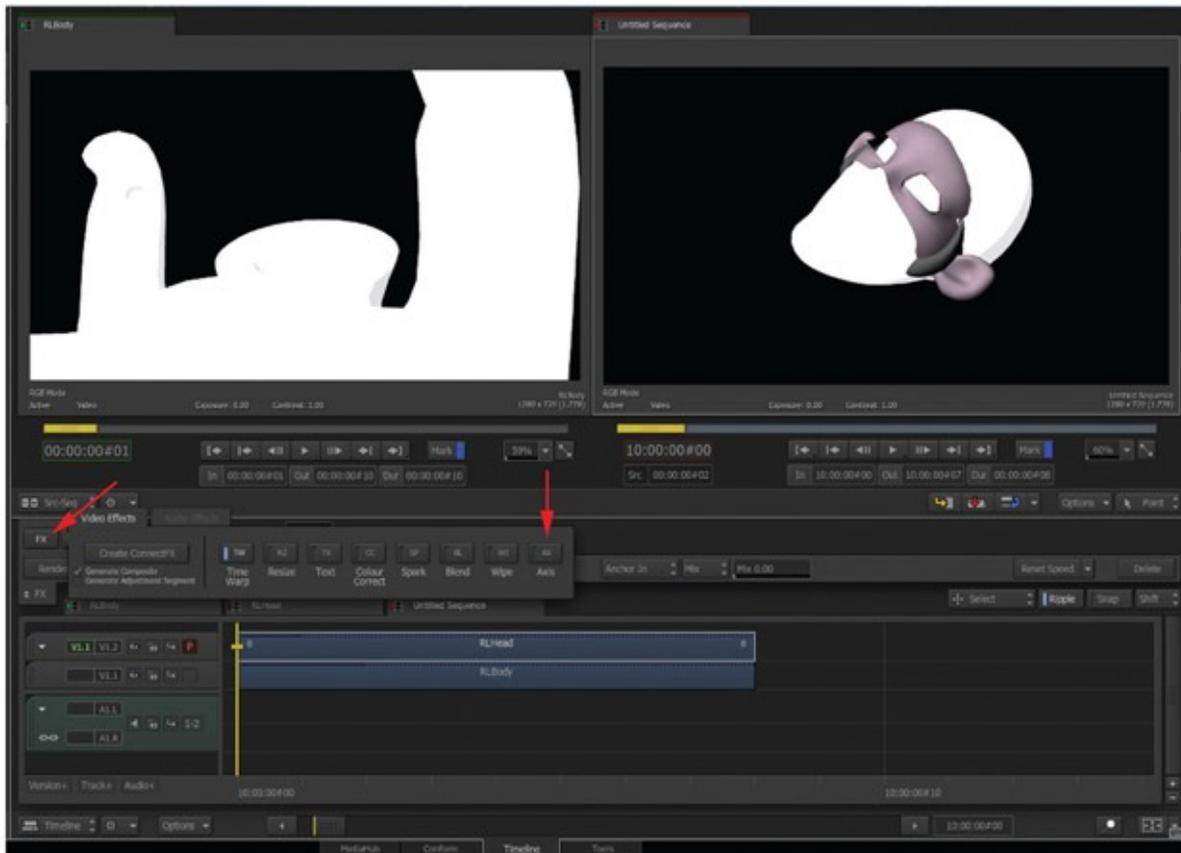
FIGURE 4.28 Using Axis FX to composite the two clips over one another

In a way that is similar to most packages, make sure that you have the sequence selected in the media library and select **File > Export**. Give the file a name and the desired format, then click on **Export**.

You'll note that in the example above, I used the 3D head reference to show the pipeline. You'll use your 2D animation completed in Flash, Toon Boom, Photoshop, Gimp, or whatever you chose to animate in.

By now, you should really be getting a feel for moving around in the different packages. You don't have to use a compositing software if your animation/cleanup software does compositing as well. For example, Toon Boom Animate Pro would allow you to do the cleanup animation and composite all in one package. See Figure 4.29 for an example. (Note: this is what drawing with a mouse looks like!) The default import settings brought in the correct alpha channel information.
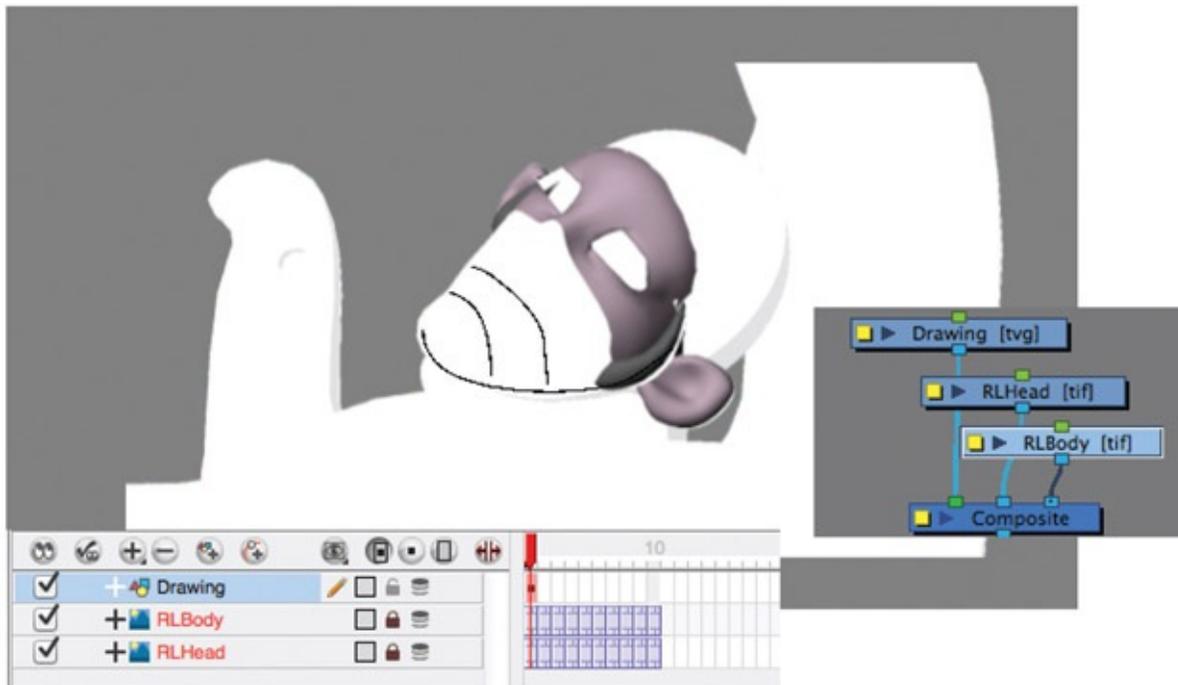
FIGURE 4.29 Body and head layer brought into Toon Boom Animate Pro. Cleanup and compositing can take place in that same package without having to use After Effects or Smoke

Congratulations! We're moving along at a steady pace now. Are you using these pipelines with multiple software packages? Do you know where your alpha channels are now? Excellent. I wonder what is next.

Interview

Marty Altman

Former CGI Technical Director, Walt Disney Feature Animation

The convergence of all things "digital media," the ever-growing demand for content, and in particular shrinking budgets and time frames, means the mixing of approaches and techniques is becoming more prevalent. Progressively more examples appear almost every day now, but this trend started years ago. Some specific examples of hybrid approaches from the not-too-distant past help tell this story.

The palace crowd element in Disney's animated feature film *Mulan* was an interesting mix of 2D and 3D approaches. We utilized a slightly modified version of the proprietary

crowd simulation, which was used for the wildebeest stampede in *Lion King*, the crowds in *Hunchback of Notre Dame*, the whales in *Pines of Rome* in *Fantasia 2000*, as well as the Hun charge in *Mulan*. We also used a modified version of the editor written for the Hun charge. The simulation placed the characters in 3D, and behaviors were simulated as before. The editor was a 3D application with certain 2D capabilities.

The 2D approach really came in with the palace crowd characters themselves. All the crowd behaviors, both cycles and transitions, were traditionally animated characters converted to an interesting system of animated textures and mapped onto individual polygons. Colors for some portions of the textures, in this case skin tone and hair color, were locked. Other portions of the textures, such as clothing, used a false-color technique and art-directed color palettes to increase perceived variety.

This hybrid approach not only matched the traditional style of the film but provided a wide range of usefulness for the characters—they could appear full screen as could any other animated character in the film, and the same system could place 30,000 characters in a single scene. While still a good bit of work to traditionally animate the crowd characters, a pure 3D approach would have taken significantly more calendar time to meet those same requirements. If pure 3D had been the only option, we likely would have lost the palace crowd element due to budget and time constraints.

The Pooh's Hunny Hut attraction at Tokyo Disneyland provides examples of integration issues going beyond just 2D and 3D, because of the practical aspects needed for a theme park attraction. One involves traditional painted backgrounds, a 2D character (Tigger) bouncing across three large screens, and a swarm of 3D characters (bees). It also has a big multiplane camera move incorporating both the projected artwork and several levels of practical elements placed between the viewers and the screens. For the multiplane shot to succeed, all these levels have to work together.

Another Hunny Hut example makes use of projection onto a half-silvered mirror, so viewers see themselves with a 3D character. Several issues made this challenging. A special projector was shipped straight from the factory to Tokyo, so we never had the chance to test our imagery directly and instead had to make adjustments based on phone conversations with the Imagineers in Tokyo looking at the screen. The heffalump is a semitransparent 3D character that fills up with semitransparent honey, and since the projector was fed with an NTSC source, we had to anticipate color issues. Of course, the heffalump's primary color was red (arguably NTSC's least favorite color).

The short time frame and increased logistical issues required a different thought process. The heffalump element was broken down into several more rendered levels than would ordinarily be used to provide maximum flexibility for controlling the final look in the composite. We also borrowed a bracketing technique from traditional photography to further cut down the need to go back and forth between Orlando and

Tokyo to resolve the final version. A comment like "a third of the way between number 2 and number 3" meant one tweak of the parameters in the composite and we were done.

The convergence of animation, film, visual effects, broadcast, games, web and interactive, and other related industries is leading us to a place where the true power user not only prefers to have many tools in his toolbox but also has an insatiable need to learn more. The rationale is straightforward. The more tools and techniques you have at your disposal, the better your chances of seeing connections that lead to higher aesthetic quality, greater efficiencies, or both. Better quality gets you noticed and is always good. Efficiency, as in getting the job done on time and within budget, helps ensure you get the next call.

Further Readings

OHailey, Tina. *Rig it Right!*. London; Boston: Focal Press, 2013.

Student Contributors

Contributing students for this chapter, in order of contribution:

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Jessica Toedt
Shani Vargo
Jason Walling

5

EFX

FIGURE 5.1 Melting Man, by Troy Gustafson

Lecture Notes

In the previous chapter, we discussed 3D characters with 2D parts. One of the examples we talked about was goo on a three-headed hydra. For this chapter, let's take a look at the art of special effects (EFX). It is a worthy topic that is more than often left out of animation discussions.

When training the different departments in feature animation studios, I found that the EFX team was composed of odd, quirky individuals, more so than the other departments. In a building of more than 150 artists, who are normally slightly odd and fun loving, these individuals looked at things completely differently than the character animators. Where character animators look at the body mechanics and acting as a whole large unit, the EFX animators look at the subcomponents of the character. EFX animators look at the self-cast shadows on the body, the highlights from a key light, water dripping down the hair, goo (if any), incidental props, and the like. In other words, they see the world completely differently than do character animators, and in my opinion they are underappreciated and lack appropriate representation in animation tomes. Of course, that is understandable, as few EFX animators have written anything, although a few books have been published on the subject. We will not be able to do the topic justice here. We will only be able to gain an overview and apply it toward our 2D/3D adventure.

Dig Deeper

If you want to dig deeper into the topic of traditional EFX, read Joe Gilland's book *Elemental Magic: The Art of Special Effects Animation.*
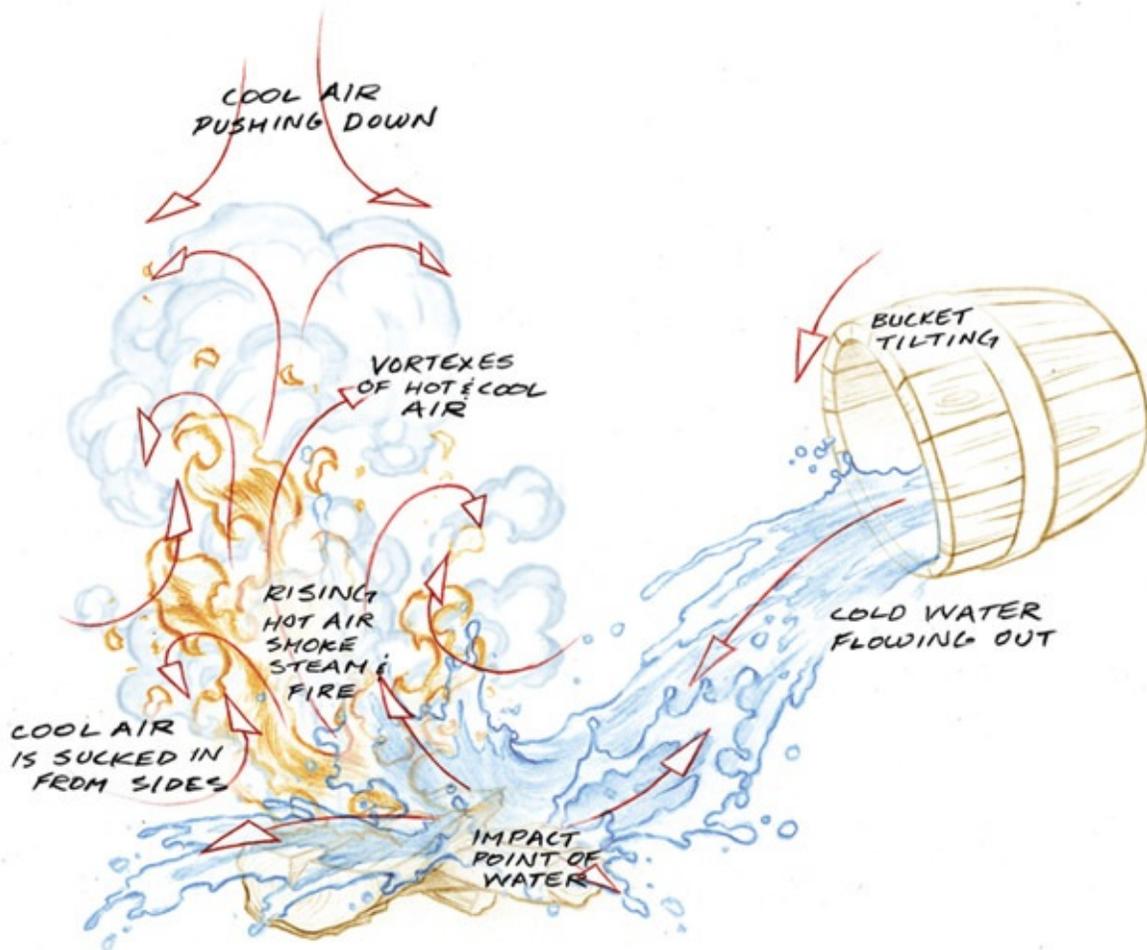
FIGURE 5.2 EFX example by Joe Gilland in his book *Elemental Magic, The Art of Special Effects Animation*

Let's try to categorize the types of EFX elements to give you a better understanding of what to look for in your scenes. The constant rule throughout all EFX elements is that usually these are nonacting, or noncharacter, elements in the story. However, there are exceptions to that rule, which we will discuss later on in this chapter. When discussing this topic with many individuals, we have come up with the following categories for EFX animation and example elements:

1. Solid shapes

    a. Props with contact points: leading the character or led by the character
    b. Moving manmade objects without contact points to a character
    c. Moving organics: trees, flowers, rocks

2. Abstract shapes

    a. Liquid: flowing, contained, drops, or streams
    b. Fire: small, large, linear, billowing

    c. Smoke/vapors: linear, billowing, wispy

    d. Wind/weather: rain, snow (while in the air)

    e. Earth particulates: dust

    f. Magic/sparkles

3. Light

    a. Highlights

    b. Shadows

    c. Tones

No matter how you dissect the subparts of EFX elements, there are at least two separate groupings: a solid shape group and an abstract shape group. Solid shapes are, if you remember your science class, solids. They have definite form and shape and can usually be broken down into smaller shapes. The abstract category includes liquids, gases, and plasmas. We define them as abstract because the shapes they form, when drawn, include a certain level of design that is inspired by nature but does not mimic it exactly. There are those who prefer to animate the solid shapes and those who prefer to animate the abstract shapes. For either category, 3D tools, particle systems, fluid simulators, and procedural shaders have been designed to aid in the creation of these EFX. The third category, light, could arguably be placed under either the solid or abstract category based on the property of light being observed. The thing to note is that in EFX, we are thinking of the shape of visible light or the absence of it. We are not looking at light as in 3D lighting and rendering. We'll look at each of these categories more in depth.

Solid Shapes

FIGURE 5.3 3D BMX bicycle modeled by Jeff Dutton and Michael Spokas

In our listing of solid shapes, our first item is props with contact points. These are things that the character moves (coffee cups, cigars, pipes, forks, newspapers, etc.) or things that move the character (bicycles, cars, spaceships, etc.). The second listing is objects that move but have no contact point to the character. This can include just about anything you see in an environment that is man made: trash, road signs, garden gnomes, and wind wheels, for instance. The next category is moving organic objects such as trees, flowers, and grass. Depending on animation style, the amount of movement to these items may be kept at a minimum because it can be extremely time consuming to create this movement, even when done in 3D. Rocks and boulders are in this category because they are solid shapes that can fall and react to gravity. If we must continue to categorize, you would want to include ice and glaciers into this category as well, because they are solid in shape.

Abstract Shapes
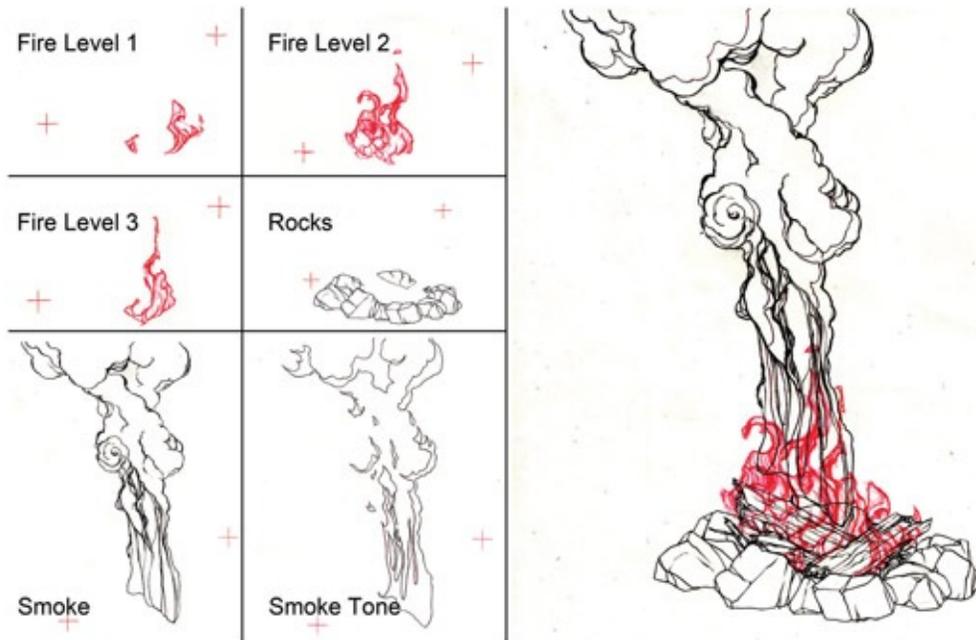
FIGURE 5.4 Fire and smoke example, by Troy Gustafson

In calling these elements abstract, we do not mean that their shape or movement is abstract, because there is reason for their form and path of movement. However, as stated earlier, these elements are more able to be designed and are actually a designed form *abstracted* from their observance in nature. Each element— liquid, fire, smoke, wind, earth, magic, and so on—has its own law of movement, reaction to gravity, loss of energy, entropy, and volume that the animator must adequately study in order to reproduce.

Light
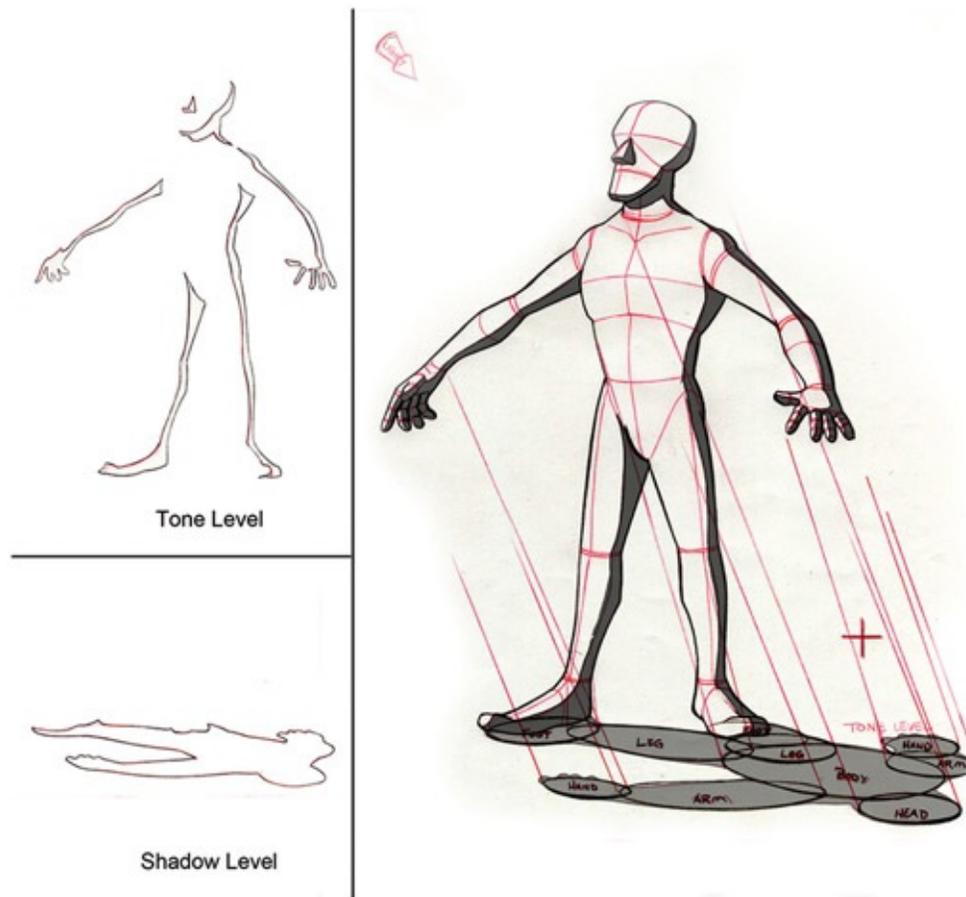
FIGURE 5.5 Tones and shadows on a character, by Troy Gustafson

In 2D EFX, light must be drawn. It is usually drawn as animated mattes that are used at compositing time to affect the coloring of the character and environment. An artist can also pull animated mattes from a 3D render and use them when compositing to achieve different lighting and shading effects. There are three visible elements to lights when drawn in this manner. *Highlights* are the bright areas on a character. They are usually caused by a kicker light, or rim light. *Tones* are the darker areas on a character where the light is not illuminating the character. Tones add great depth to a character, especially when combining a 2D character with a 3D character. However, beware: drawing tones on every character in every shot takes a lot of time. During a time crunch, this is usually the first element to be removed. *Shadows* are, obviously, the shadows that a character or object casts upon the environment. All three elements are usually blurred and minimized in movement so that they do not distract from the main action of the story.

Exceptions
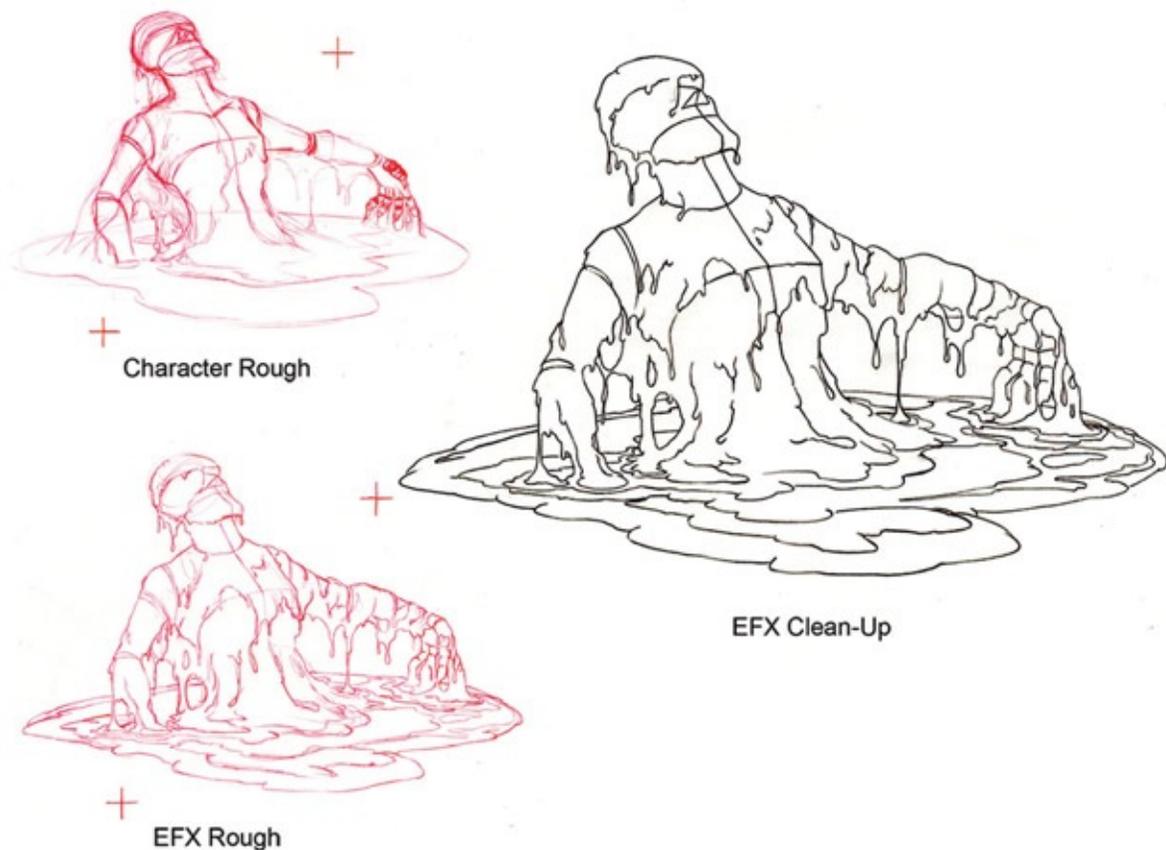
FIGURE 5.6 Melting character with rough character level, rough EFX level, and final cleanup EFX level, by Troy Gustafson

There can be a blurry line between character animation and EFX animation in certain cases. What if the shadow is telling the story? In that case, it is a character and may be taken over by the character animators. What if the character is made of wind or fire? (Think about the element characters in Disney's feature animation *Hercules*.) What do you do with a character who is basically composed of an EFX element? Something like that might be roughly animated by the character animator, and then the EFX animator adds his or her expertise of fire/wind/ice to the animator's expertise of character movement. What if the prop that the character is holding is intricate to the acting? Depending on the character animator, he or she may rough in the placement of the prop or even animate the complete prop. The EFX animators would do what was needed to finish the prop's animation.

Trench Note

All of these examples are based on studio culture and the artists found therein. This information is based on the general pattern that I witnessed in the two studios where I have worked. Both studios were large. In smaller studios where individuals have to wear many

hats, of course, these ideas can be very different based on the talent found there.

Contact Points and Pipeline

The questions, as always, are these: Which element leads? Where are the contact points? What media will be used?

Usually the prop animation is the first one to be considered. Props either lead the character or are led by the character. As in our earlier discussions, props themselves can become complicated in line mileage and perspective. So using 3D props has become popular.

After considering props, the next factors to consider are the environment and the elements. Most elemental items react to the character; therefore, they follow after the character animation. Even when the environment and elements to do not react to the character, they are still usually done after the character animation so that they do not accidentally obscure the important story points we are trying to convey in the scene.

The last element that is usually drawn is light. This is the light that is cast upon the characters, props, water, goo, and so on.

Trench Note

You can imagine that after the character animators are done and having their celebratory "animation is done" parties, EFX artists are still bent over their desks working on the light, props, and abstract shapes that are in the very scenes whose "doneness" is being celebrated. The same can be said for the other departments that follow EFX. These departments are referred to as the "back end" of production. At the Disney studio, these departments were called scene planning, scanning, color models, ink and paint, compositing, and final check. The departments and the breakdown of tasks vary from studio to studio. The takeaway here is that the waterfall of "doneness" is never complete until the wrap party.

Industry Examples

You do not have to look very hard to find plenty of examples of props leading 2D animation *: Futurama, Family Guy, The Simpsons, Lilo & Stitch, The Triplets of Belleville, Mulan, Atlantis, Treasure Planet, Sinbad, The Road to El Dorado, Pokemon* movies, *Macross*

Zero, and the list goes on and on.

You might have noticed the heavy use of 3D spaceships and environments in *Futurama.* I've had students comment that they did not notice it until taking my class, where they were told to go look. The flat shading and toon shading did not cause the 3D to stand out too much, which we know from [Chapter 1](#) is a sign of success. Other examples that students have commented on include the obvious use of 3D in the *Family Guy* movie, *Clone Wars.*

Other films have used 3D and you might not have even noticed. *Mulan,* for instance, used a large amount of 3D for both character and EFX. One complicated shot comes to mind where Mushu is looking for Mulan while riding a shield down a 2D avalanche. The background was a traditional painting. The snow avalanche was done in 2D. In this case, the 2D EFX avalanche was leading, so an animated grid was created to help with the perspective of the sloshing snow. A 3D shield holding a 3D reference Mushu was also created. The 3D shield was the only 3D element that was to be used in the final composite; all else was reference. The Mushu character was so small for some of the shot that they kept the 3D stand-in for that section, much to the happiness of the 3D animator. The 2D avalanche was added along with snow chunks, snow particulates, tones, shadows, and a Hun head. This scene itself was extremely challenging because it contained a traveling pan across so much 2D snow, and this was done before we had Cintiq tablets. Lacking a way to do digital 2D animation meant that a printing/pegging process had to occur so that the 2D animators could use the 3D reference. Because this was a large camera pan, the paper that was used for printing was extremely large: 24 fields, the printing/pegging days. Come to think of it, wouldn't that be a great shot to recreate as a homework assignment? Note to self: maybe for the advanced version of this class.
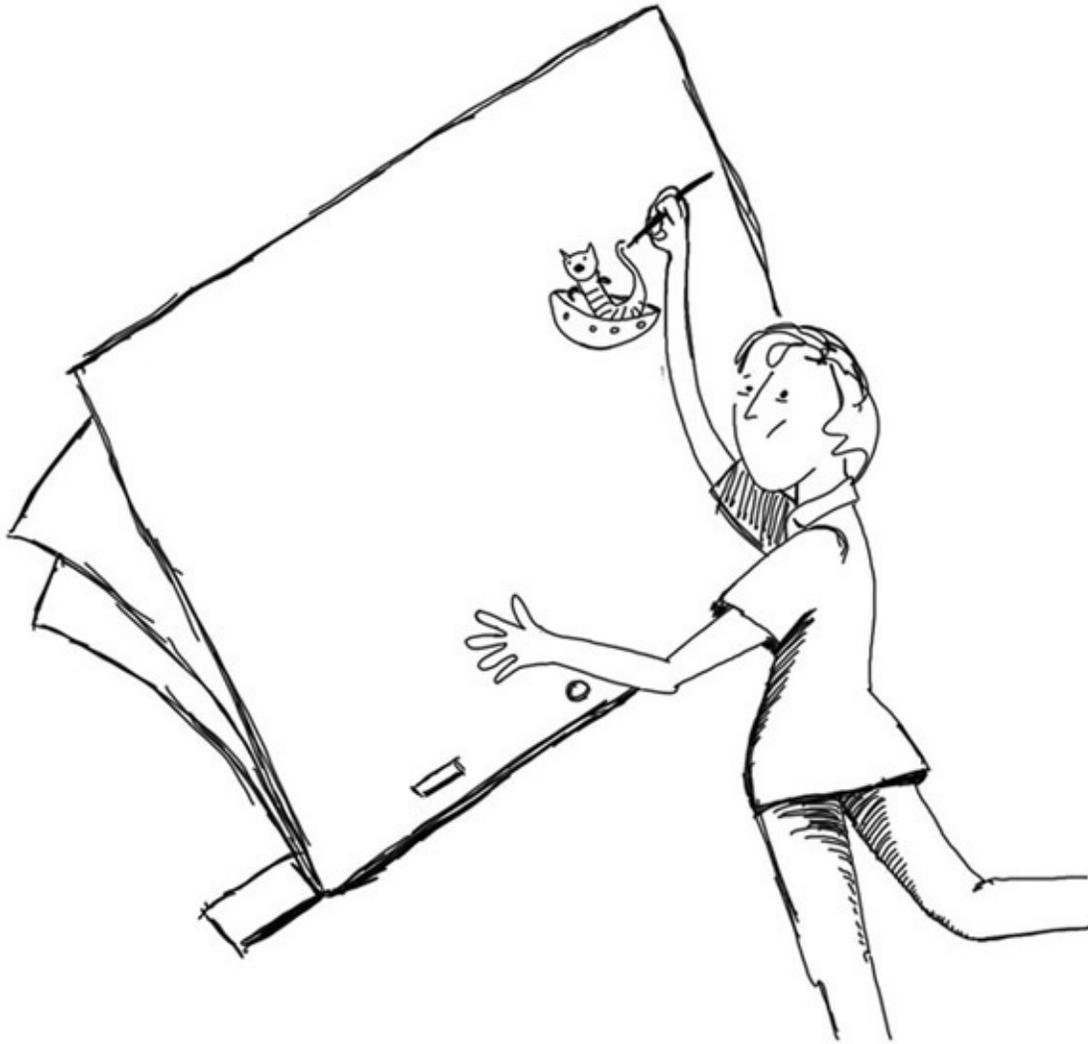
FIGURE 5.7 Drawing on 24 field paper

Using 3D for props and environments, if not having contact with the 2D character, is relatively easy, and therefore the use of 3D props is widespread. As we have found, once the different elements begin interacting, things take on a bit more complexity. The trick when combining the 3D prop with the 2D character is making sure that their dimensionality matches. Either the 3D prop needs to be flattened visually to match the 2D, or the 2D needs to be made more rounded by using tones and highlights to match the 3D. If the 2D appears to be very flat and the 3D appears very highly rendered and round, the styles may clash considerably. In the last chapter's assignment you may have already found some of your own examples of good and bad 2D/3D that might show this style mishmash.

Using 2D animated EFX on top of 3D usually would not seem cohesive if the style were a highly rendered 3D look. However, if the visual style is flat or toonish, then 2D EFX elements can be used. We examined the goo used on the hydra's head in the previous chapter. We also took a look at shots from the group project *Jaguar McGuire.* Next we will examine a few shots that have 3D props, 2D EFX elements, and some interaction between both.

Hands-On Examples

We will now examine five EFX issues that might need to be resolved in a 2D/3D film:

1. 3D props leading 2D
2. 2D leading 3D
3. Tones
4. Shadows
5. Compositing tricks with ink lines

3D Props Leading 2D

In previous shots, Jaguar McGuire has tried to kick the cat as it sat on his broken leg. Instead of connecting with the cat, Jaguar instead kicks his own broken leg, which propels it out of its sling and causes it to hit a nearby table, sending a vase filled with flowers through the air (in slow motion). Please see the companion data for the storyboard displaying the following sequence. Our shot, 39, shows the vase of flowers hitting the floor. Upon hitting the floor, the flowers and water splash out. The water, unfortunately, splashes into an electrical outlet. The outlet short-circuits and shoots a fiery spark to land on Jaguar McGuire's cape. The cape must be old and dry, or soaked in kerosene, for it instantly bursts into flames. Jaguar, being a super daredevil and still believing himself inhuman, tries to stamp out the fire with his free foot.

The elements in shots 38 and 39 are listed here, along with the software that was used to create them:

3D background	Maya
3D vase	Maya
2D water	Photoshop
2D flowers	Photoshop
2D spark	Photoshop
2D fire	Flash and Photoshop
Ink and paint	Toon Boom
Final compositing	Toon Boom
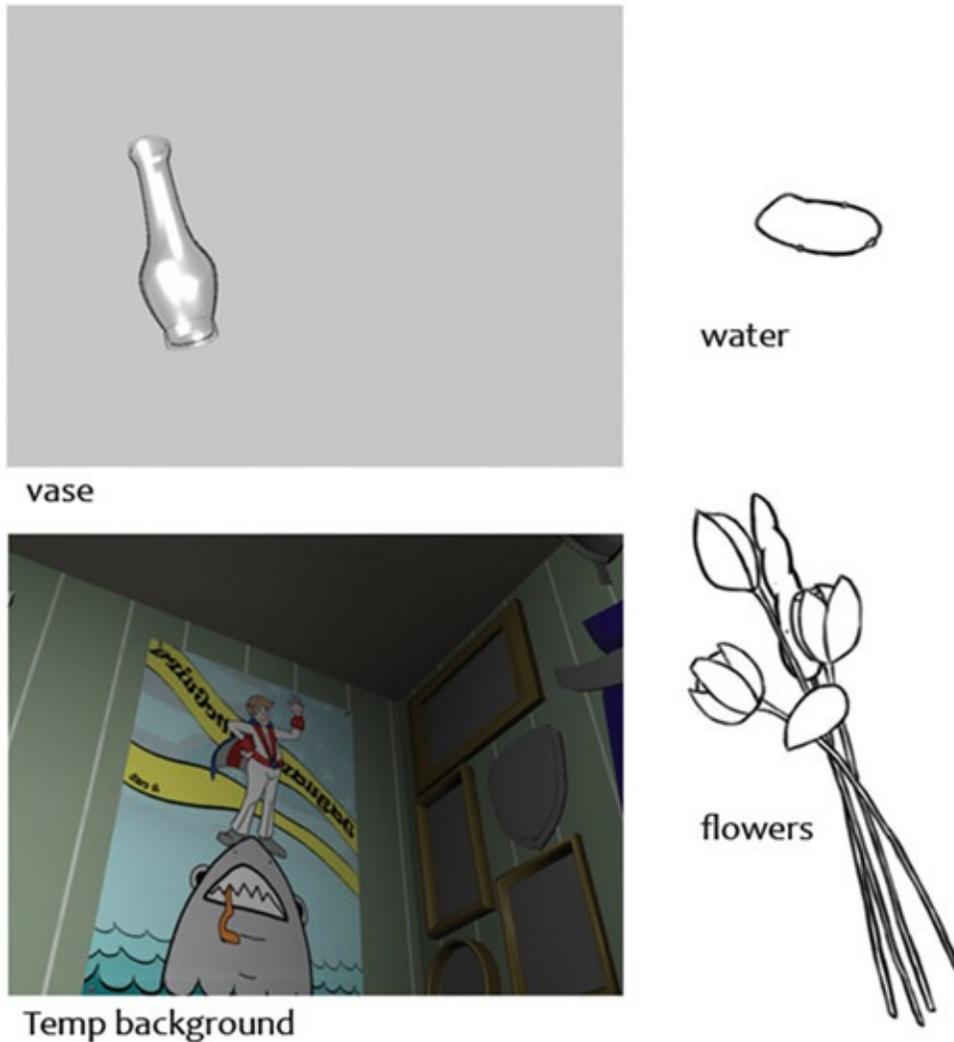
FIGURE 5.8 Elements from shot 38: temporary 3D background, 3D vase reference, 2D water, and 2D flowers

The pipeline for 3D prop leading 2D is the same as a 3D character with 2D parts. This should be getting familiar now.

Begin by setting up your camera in the 3D package of your choice and animating the 3D prop. In the example shown in Figure 5.9, you see the camera placed in the 3D room and the key-frames of a 3D vase. This is the shot we were discussing earlier in the industry section of the lecture notes. Clint Donaldson, the director of *Jaguar McGuire,* did the animation of the 3D vase.

In this example, the render size is HD720, which has a pixel size of 1280 × 720 in Maya's render settings. Because we are only rendering out a reference image for the 2D animator, we can simplify things by rendering out the vase layer only. Also, the alpha channel is not necessarily needed here. We can add a gray background to the camera's environment setting so that we do not get a black background.

To set the background to be gray for this reference render, follow these steps:

1. In the rendering camera's viewport, click **View > Camera Attribute Editor**.... This

opens the Attribute Editor for the camera.

2. Open the **Environment** tab and change the **Background Color** to the desired color.
3. Render a series of images as usual. Remember to select the rendering camera. If you need the alpha channel, then remember to select it, and as we have learned, to keep that alpha channel you will need to create a QuickTime animation compression file. For this example, we do not need the alpha channel, so we will stay with a series of .tif files.

A quick check in Adobe Bridge shows us that the images are rendered correctly: from the right camera, named with frame padding (leading zeros), correct background color, and correct version of animation. We've already talked about it before, but I cannot stress enough that it is a great timesaver to check your renders before proceeding. It is an even better work habit to do a spot check on one frame before kicking off a render that might take a long time. Once you lose a couple of hours' worth of time to a silly oversight and almost miss a director drive by approval time, you'll start developing "rules you should live by" too.

The render mentioned previously has been included in the chapter companion for this book. Look inside the folder **Chapter Five** > **3D leads 2D** > **vase**.

2D Animation in Photoshop

Open your .tif series of images in Photoshop by clicking **File > Open**.... Select the first image of the sequence and click on image sequence. Don't forget to set the correct frame rate.

This will automatically create a canvas with the correct image size and load the image sequence into a video layer. Note: in newer versions of Photoshop, the video layer will be inside a video group as seen in Figure 5.9.
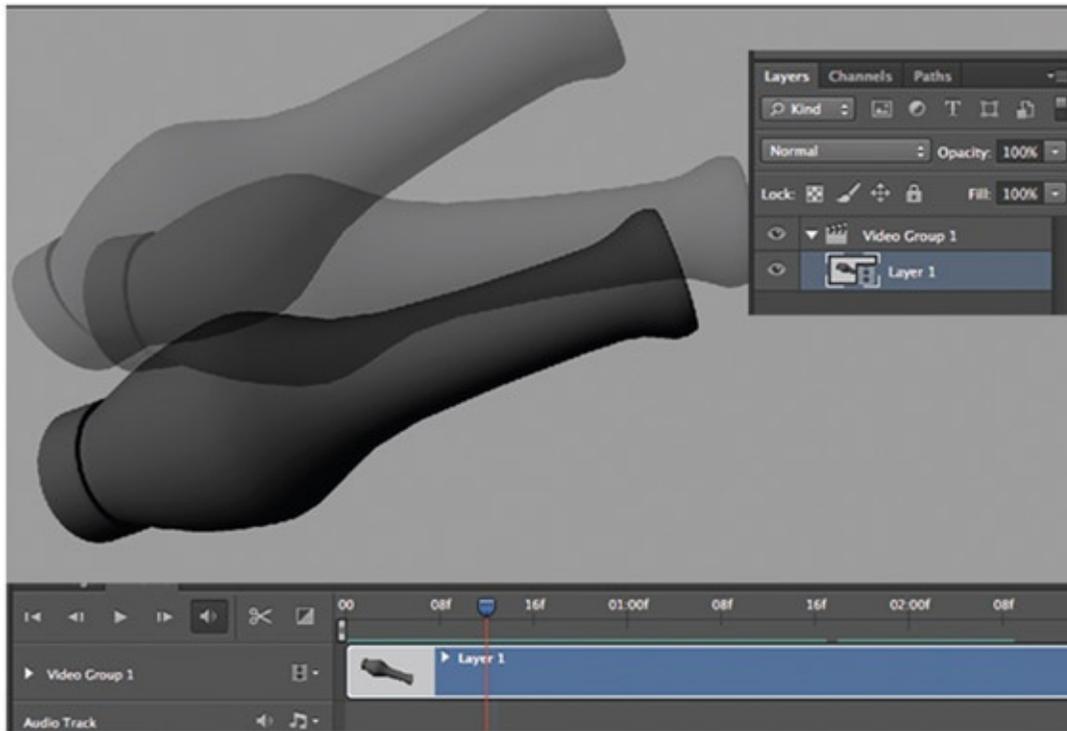
FIGURE 5.9 A reference loaded in as a video layer in Photoshop

As we have done before, you will want to create a video layer to draw your EFX layers in. In newer versions of Photoshop, if you have a video group, click in the layers window to deselect that group before creating a new video layer. We have many EFX elements to draw in this shot: water, flowers, sparks, and flying copper bits. We'll start with the flowers. If you remember back to our lecture at the beginning of the chapter, flowers would come under our solid shapes category.

In Figure 5.10 the vase reference layer is in the bottom layer position. A flower animation layer is also visible. As a note to my students, notice that the flowers are extremely roughed in. This is a great way to animate through your shot quickly so that you can test out various versions or, as was the case with this example, get the animation supervisor's feedback and approval. A great guideline is to work rough and fast; show early; show often.
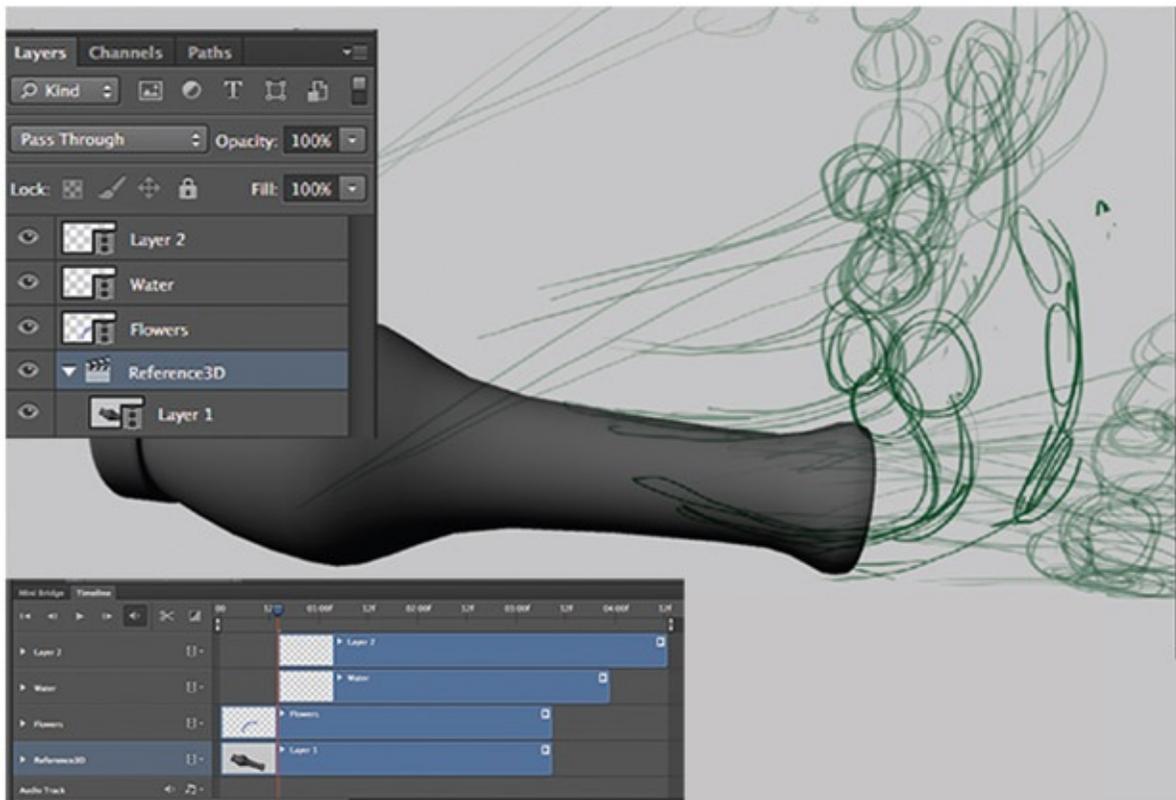
FIGURE 5.10 Rough pass of a flower animation

All of the flowers were created on one video layer. Was this a great idea? Remember that the video layers will be exported out for ink and paint and compositing. If all of the flowers are on one layer, that makes for one sequence of images that will be inked and painted. It might make inking and painting easier to have the flowers all on one layer, but that makes it more difficult for the animator to keep track of the stems. Animating using video layers sometimes causes bad habits of putting elements all in one layer. It is quite common for elements to appear on one layer and then move to another layer so that they have proper leveling. Ultimately, do what is right to get the proper animation, but keep in mind how the leveling is going to happen during compositing. Keep those x-sheets handy. As you gain more experience with creating shots, you'll start to see how to break apart the levels.

Once the flowers' rough animation was approved, a more polished version of the animation was completed.
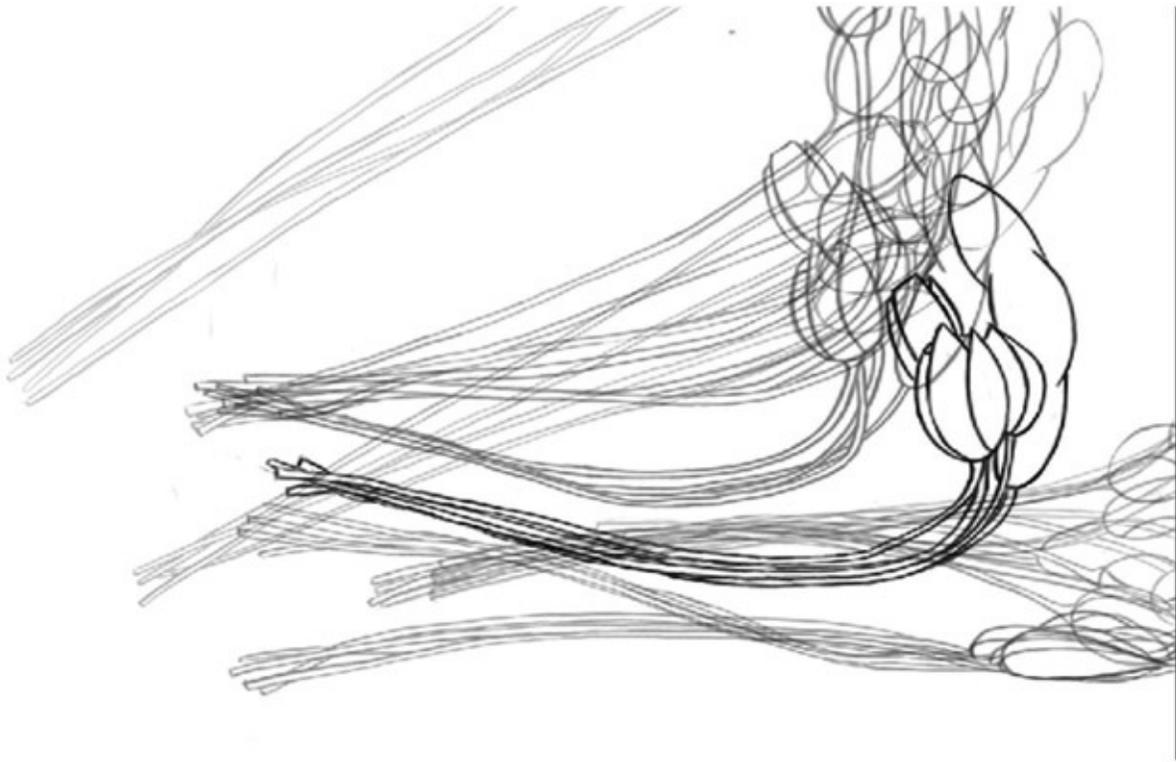
FIGURE 5.11 Final animation of flowers

A special note on animating in Photoshop: in shot 39, the timing of the vase movement was worked out in Maya, and that dictated the main movement of the 2D flower and water elements. The water element was easy enough to animate in Photoshop because it was mostly animated straight ahead. Animating pose to pose in Photoshop is difficult when using video layers. It can be done, or the animator can choose to use the older method of animating in Photoshop: using the frame method versus using video layers. Why is it difficult to animate using video layers? When there is a keyframe on frames 1 and 7 and you want to create a breakdown on frame 5, all of the other blank frames on the video layer get in the way of rolling through your animation (see Figure 5.12). For animators who like to flip back and forth between the drawings instead of using the onion-skinning, the blank frames can cause the eye to lose where the previous drawing was. It is still possible, with some duplicating of layers, to use a familiar flipping or rolling method.

The following method can be employed when doing cleanup in Photoshop or animating pose to pose:

1. Draw the first and second keyframes in a video layer, as we learned in previous chapters.
2. Duplicate the layer.
3. In the timeline, open the layer and notice the blue boxes on the altered video line. You cannot move these keyframes (drawings), but you can move the duplicate layer itself so that the keyframes line up where you want them visible.

4. Repeat as needed so that you can see your keys in the correct order to roll or flip the images as desired while you draw the needed breakdown drawing.
5. When you are done, delete the duplicate layer(s).

In Figure 5.12 three flower keyframes have been drawn. The layer has been duplicated and moved so that the two keyframes show up at the same time. In order to roll the drawings, the duplicate would be moved back one frame in time.
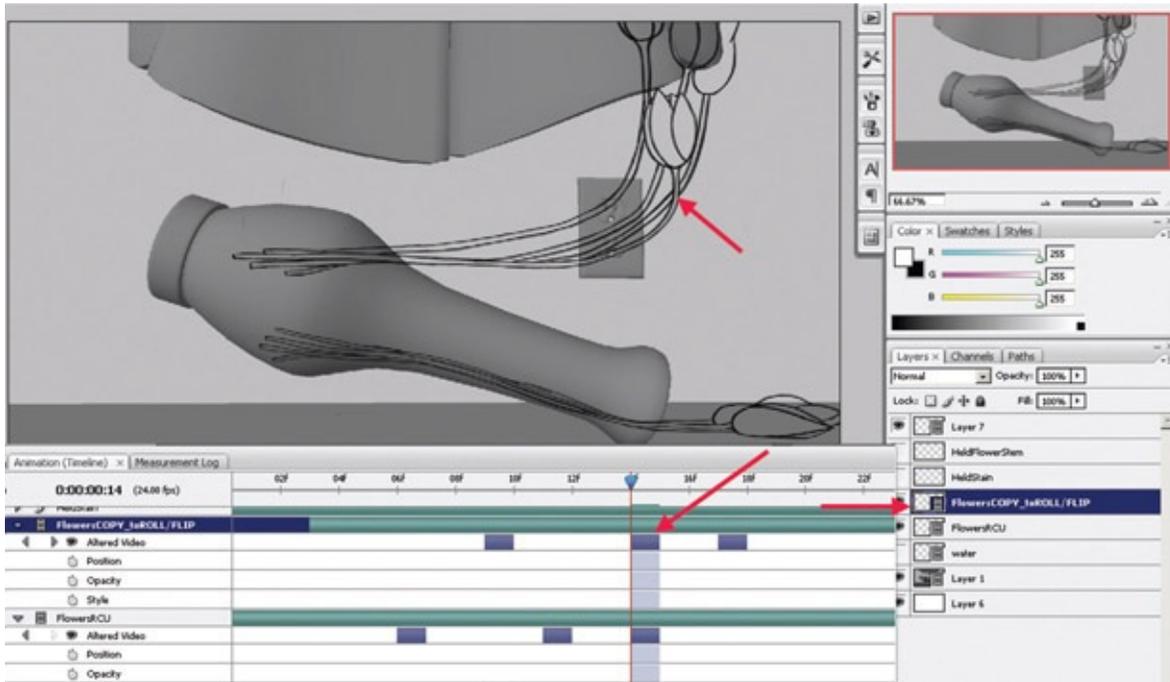
FIGURE 5.12 Using duplicate layers to roll through keyframes without blank inbetweens

To flip or roll images has a different definition based on what studio/country one is in. In some U.S. studios, to flip images means the animators stack their papers in such a way as to look at the first key, look at the breakdown that they are currently drawing on, and then flip back a page to the second key. It is called "flip" because you end up flipping forward and backward to see the motion. To roll, in the United States, is to stack the papers in order and to roll through the frames with the first key on the bottom, the breakdown on top of that, and the second key on top. Depending on one's dexterity, one can roll up to five drawings at once. These terms have to do with paper and what one has to do in order to keep the drawing one is currently adjusting on top for drawing. In our digital animation pipeline, you will mostly be rolling or you might hear the term "scrub" (which comes from the digital editing field). However you manage it or whatever you call it, it is imperative for the pose-to-pose animator and the cleanup artist to have the ability to roll through their drawings without seeing the blank inbetweens.

Another type of EFX element that we discussed was abstract elements. Water can fall into

this category because it is purely drawn in as an abstraction of its natural form. Liquid, water, and smoke are all abstract elements. Our shot 39 depicts a vase filled with water flying through the air. The vase hits the ground and the water splashes out onto an electrical outlet in the wall. The same method of roughing in the animation with video layers was used. You can see an example of the rough and final animation in Figures 5.13 and 5.14. You'll note that the rough animation is extremely rough, with nothing more than bouncing balls to indicate direction and volume.

FIGURE 5.13 Rough animation of the water in the vase
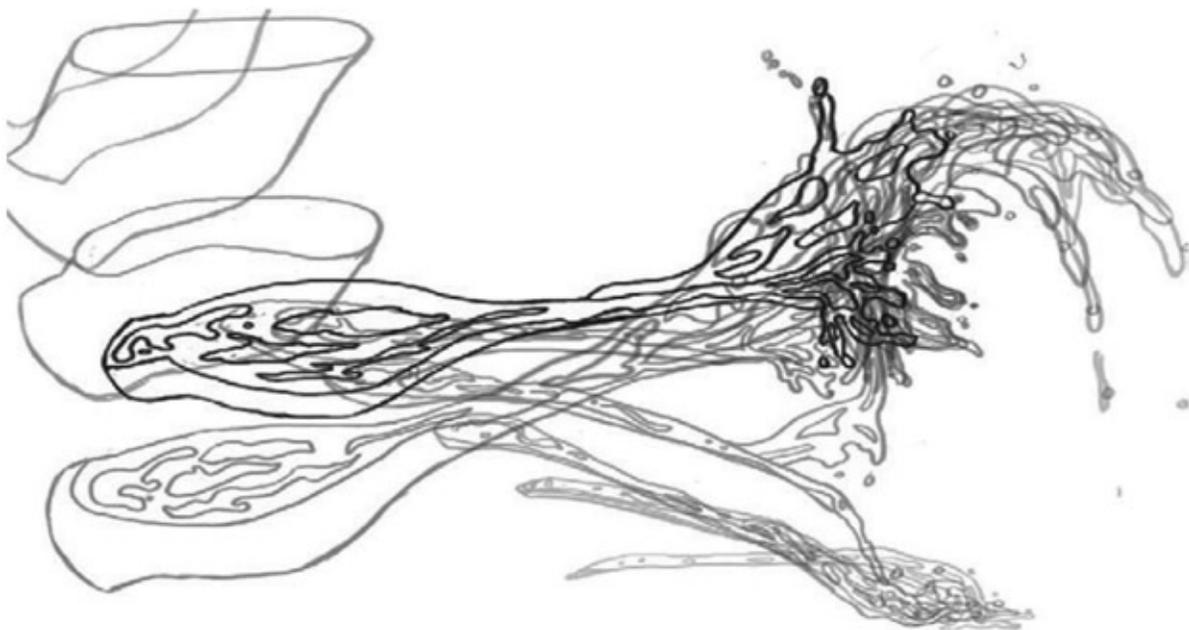
FIGURE 5.14 Final animation of the water EFX element

Ink Lines

Once the animation and cleanup are completed, you will want to add color to your artwork. There are many ways to do it and many different software solutions. Let's look at the things you might want to do with your ink lines before we deal with the button clicking and different software programs.

The first thing we will do is make sure that the ink line stays separate from the paint. Why would we want to have the ink line separate from the paint? We can reuse the ink line in our compositing software to create various visual compositing techniques.

With the ink line separate, you can easily change the color of the ink line if your paint package lets you fill in color and keep alpha channels. In Photoshop this can be done by selecting **Edit > Fill** and making sure that the **Preserve Transparency** option is turned on.
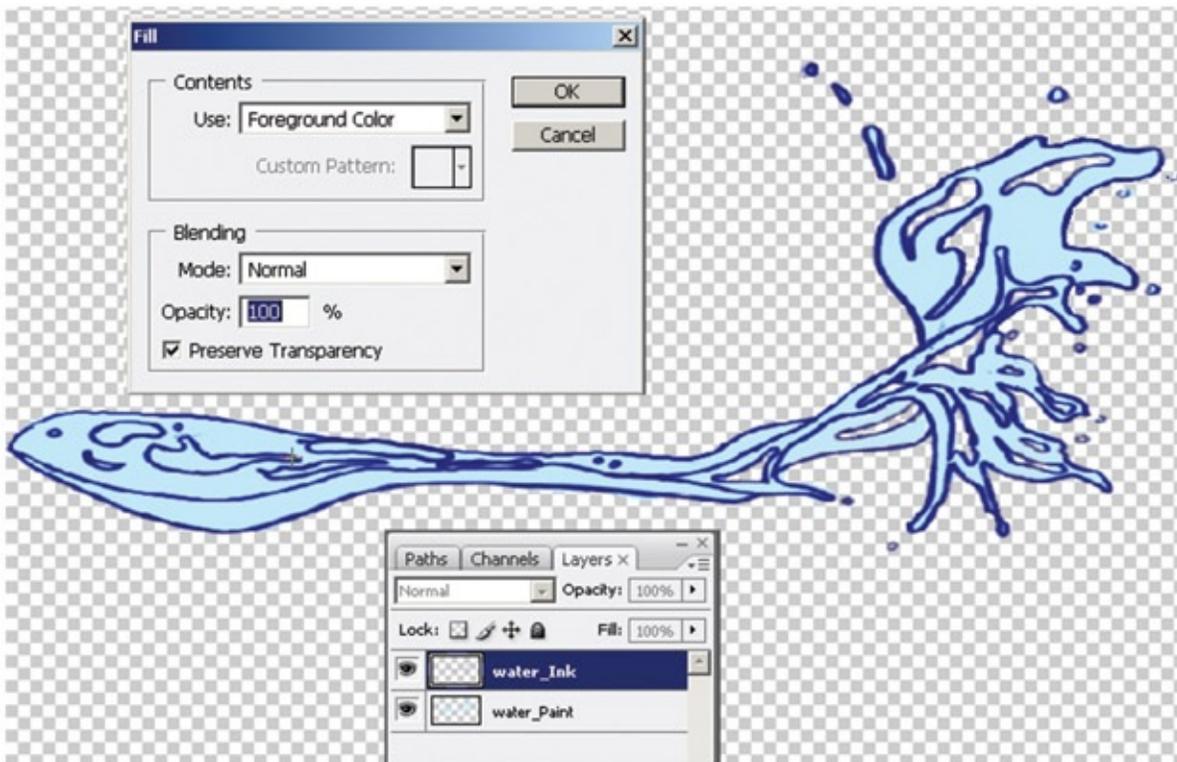
FIGURE 5.15 Using Fill to color ink lines easily

A simple example of how ink lines can be finessed is shown in Figure 5.16. The ink line has been duplicated and blurred. This blurred ink line was clipped (or masked out) by the paint layer. This way the blurring did not extend on the outside of the water, giving the water an unwanted halo. The harsh edges of the blurred ink line are never visible because the original ink line is layered on top of it, as you see in the top portion of Figure 5.16. The paint layer is also transparent, though that is not visible in this image.
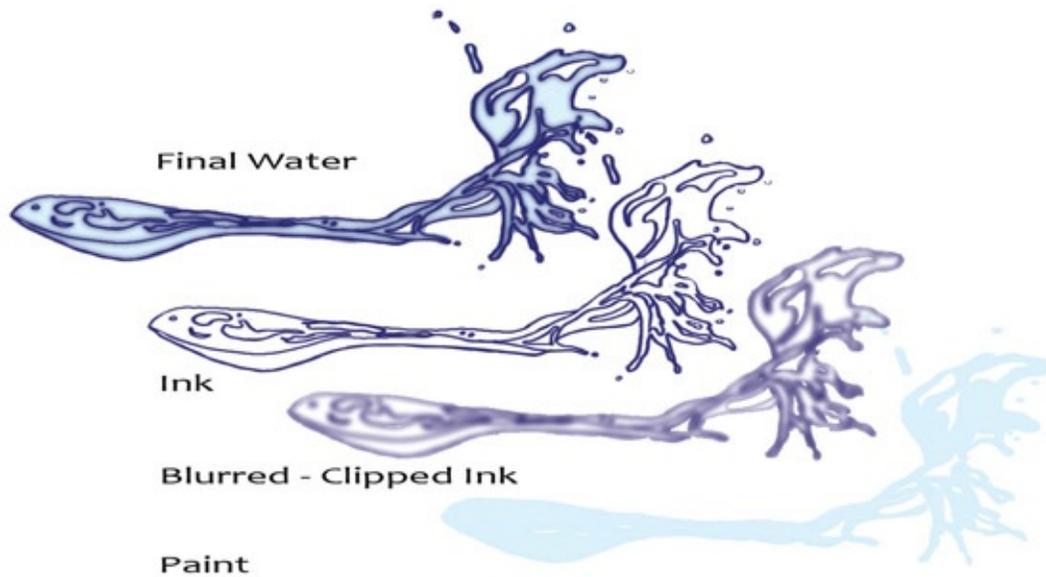
FIGURE 5.16 Ink line sample

Figure 5.17 is similar to the previous example, except that there is not the addition of the original ink line on top. The blurred ink line is also colored to be similar to that of the paint. This is a useful technique when combining 2D elements with 3D elements that do not have strong toon lines. Just because there is a drawn line for the 2D element does not mean that it has to stay visible in the final composite.
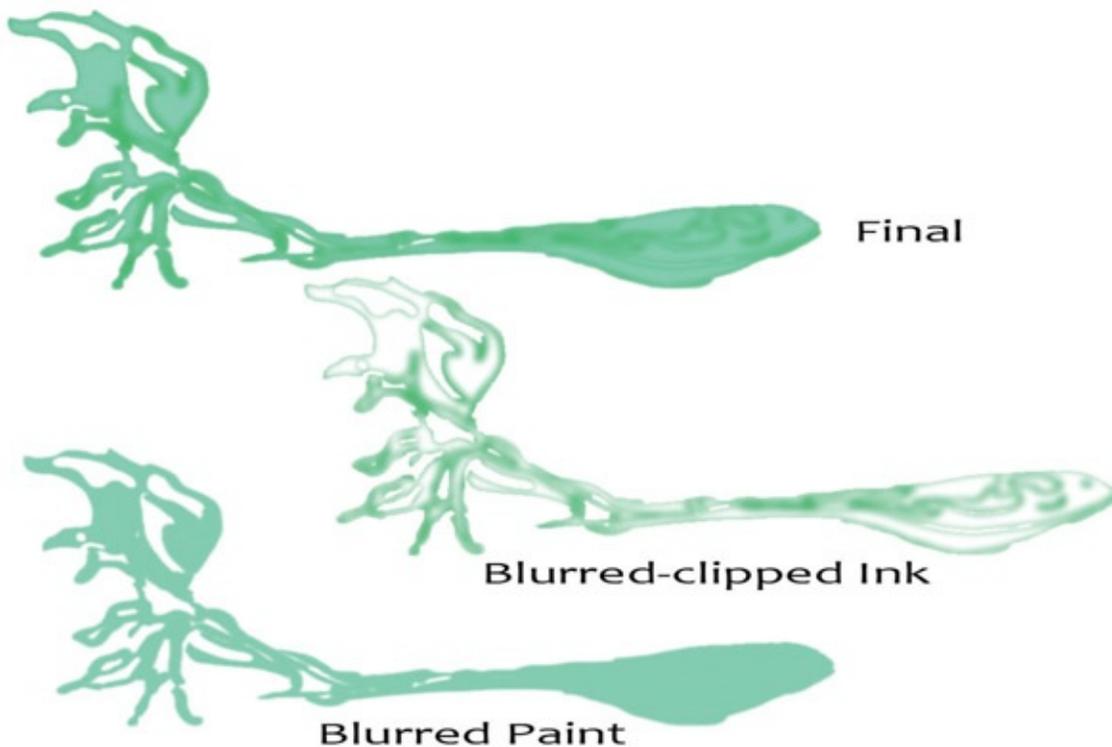
FIGURE 5.17 Ink line sample

If you use Photoshop or any painting package in which you use something like a paint

bucket tool, a good technique to use for painting is the following:

1. Place the ink line on one layer.
2. Create the paint fill on a second layer.
3. Paint using the paint bucket and brush tools. Don't worry about coloring outside of the lines too much.
4. Using a magic wand tool, select the paint that is outside the lines. In Photoshop, make sure to have **Sample All Layers** turned on.
5. Delete the extra paint. Touch up any missed areas.

FIGURE 5.18 Creating paint fills on a separate layer in Photoshop

Node-Based Compositors

Nuke

My favorite compositing method is node compositing. I first learned node compositing on Eddie, an old system, and Flame/Flint. (I used Flame for barely more than a week, so don't be too impressed.) I used Shake quite a bit and then it was replaced with Nuke. As we stated earlier, there are two main types of compositing systems: node and layer (timeline) based. Smoke, as we have seen, is something in between: a timeline editor with a node compositor under the hood. Once you know a node-based system, it is fairly easy to pick up another node-based compositor. I'll admit, I prefer node systems. They seem more organic and fluid for how I work/think. I would encourage you to become familiar with both types of systems. Were you to find yourself in a visual effects (VSFX) house as a compositor, you would have to learn proprietary compositing systems; knowing both types will give you a head start on learning how the pros do it.

If you have ever worked in Maya's Hypershade or Hypergraph Connections Editor, then you have worked with node networks.

We'll do this water composite in Nuke. I won't go through the Nuke interface too much; you can read the documentation for that. As with most software, the install comes with a

manual and plenty of tutorials. Students, please familiarize yourselves with finding answers in the documentation. This is a skill I see lacking in students. (I'm putting the soapbox away.)

   If you want to follow along, images can be found in the companion data in <u>Chapter Five</u> > **Ink**.

1. Locate the **image** icon and click on the **Read** button. Select the **water.####.tif** image sequence and click open. This will load your images and it will create an Image Read node in the node graph window.
2. To see the image you have to connect it to a viewer. Connect the arrow from the **Viewer1** node to the **image sequence** that was loaded in. You'll be able to play the sequence.
3. Select the **image node**; locate the **Properties** tab; rename the node to **WaterInk**.
4. Select the **Filter** icon and click on **Blur**. This will add a Blur node to the output of the **WaterInk** node.
5. In the **Properties** tab, you can adjust the amount of blur to be used.
6. Deselect all nodes. Select the **Merge** icon and click on **Merge**. This will create a merge over the node with two yellow arrows yearning to be connected to something. Connect the **A** arrow to **WaterInk**. Connect the **B** arrow to the **Blur** node.
7. To see the result, connect the **viewer's yellow** arrow to the bottom of the **Merge1 (Over)** node.
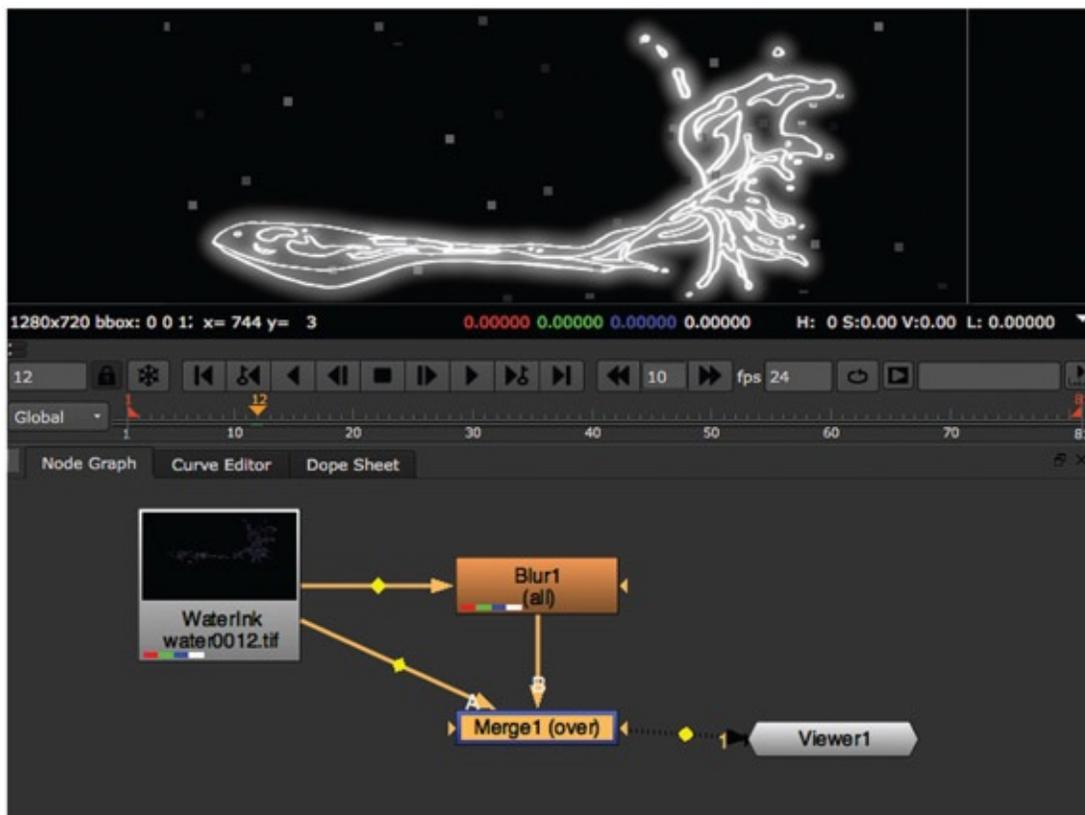
FIGURE 5.19 Ink line over blurred ink line in Nuke

The preview image now shows a blurred ink line underneath a nonblurred ink line. There are two things left to do: (1) add the paint, and (2) cut off the blurred line so that it doesn't extend outside of the edges of the ink line.

1. From the **Image** tab, click on the **Read** button and load a series of the paint level. (For this example, the ink and paint lines were done as separate layers in Photoshop and exported out as separate file sequences.)
2. Select the **Merge1 (Over)** node and the **Water_Paint** node. The first node you select will be layered on top in the next step. We want the paint to be on the bottom, "B." *(We didn't do this earlier with the blur node, because it would not have acted correctly. It would have disconnected the Blur node, or at least in my version of Nuke it did.)*
3. Create a **Merge** node by clicking on **Merge > Merge**. It will be called Merge2 (over) and the viewer should update to show an ink layer on top of a blurred ink layer on top of a paint layer.
4. This is the extra fancy step. Click and drag from the **right side** of the **Blur node** to the **paint layer**. This will read the paint layer as a **mask** and will only show the blurred ink line wherever there is paint. This way the ink line does not blur outside of the lines!
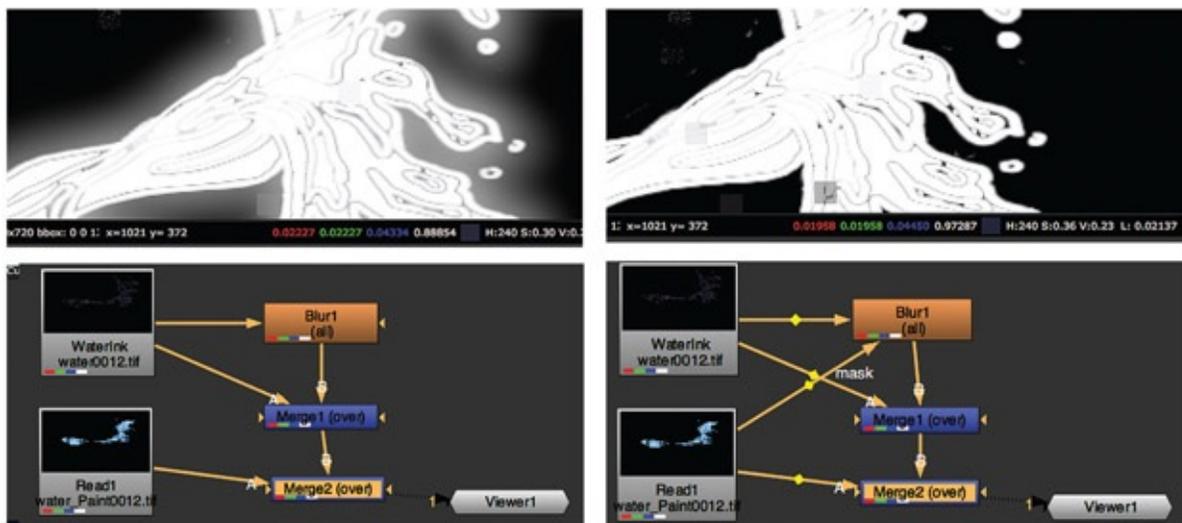
FIGURE 5.20 Adding the paint and containing the blurred line. Image shown with alpha channel to better illustrate the blur. (Fuzzy blocks are artifacts from learning edition of Nuke.)

Now you have gone through a crash course in node compositing. The great thing about using node systems is that you can reuse series of images easily and hook everything together, if you are prone to thinking this way. In fact, if you compare this page to the page from the

previous edition of this book you will note that it is almost the same steps with only the names of the nodes changed. Those who have not adopted the usage of node compositing should challenge themselves and step up to a higher-end compositing method, even if using a learning edition of software. You'll be glad you did.

Toon Boom

Toon Boom has a wonderful assortment of softwares. The type of pipeline you are using determines which software you use. Luckily, most of the Toon Boom products have a learning edition so you can test out your pipeline before purchasing. The newest version, Toon Boom Harmony, allows for 3D models to be brought into the scene directly, much like you can with Photoshop. There is no learner's edition of that version of the software, though. There is an educational discount for Harmony. One other thing to note is that scenes animated in Toon Boom Animate or Animate Pro are not able to be brought into Harmony. Harmony is utilized by larger companies, more for its database structure for asset management.

Lately, the industry has been switching from Flash to Toon Boom Animate Pro and Harmony. We added it to our classrooms so that the students could gain exposure to it. We do not use the auto lipsync functionality of the software. However, that feature is probably useful for those in a short turnaround, small-budget situation. You'll find ample training material out there if you want to learn more about the software.

Here are two websites that can help you get started with the package:

www.toonboomtutorials.com

http://toonboomcartooning.wetpaint.com
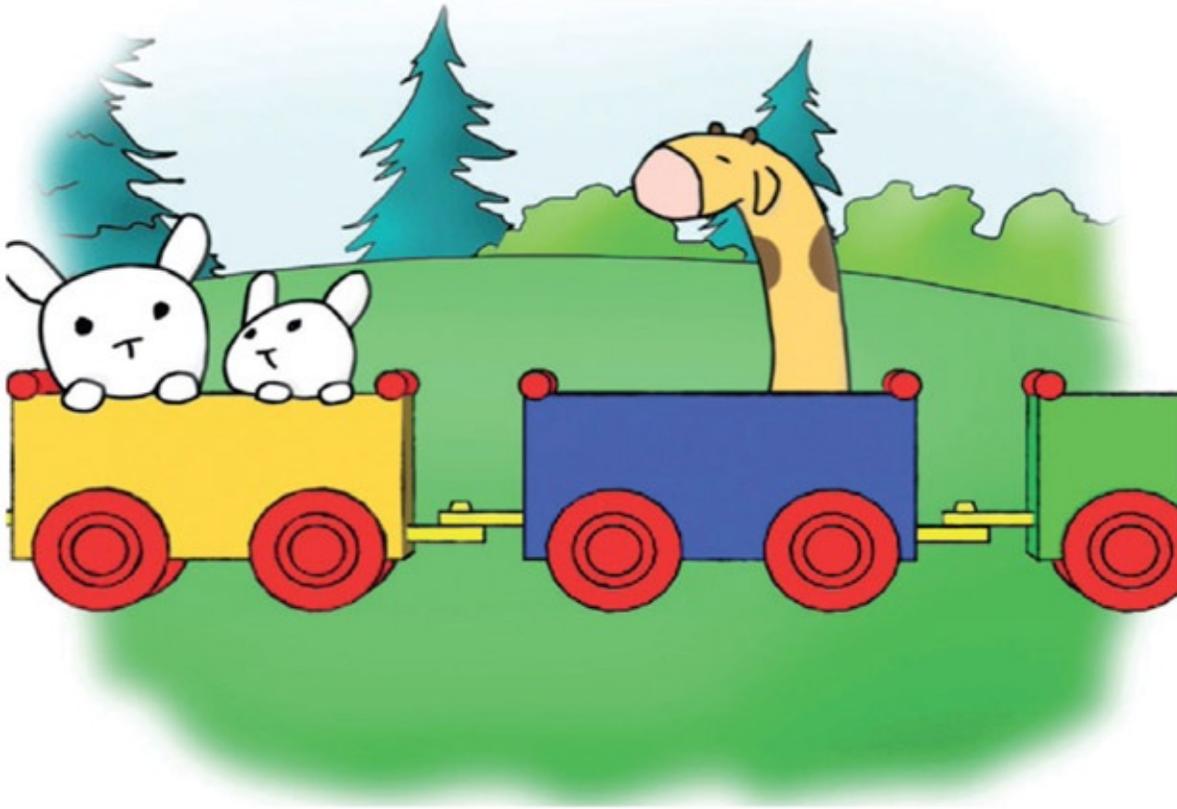
FIGURE 5.21 2D characters drawn in Toon Boom Animate over a 3D train animated and rendered in Maya. By Jessica Huang, 2009, 2D/3D compositing course, SCAD

The bottom of it all is getting comfortable moving between the different packages. Render 3D in Maya, animate 2D in Photoshop, composite in Toon Boom. Or, based on artists' talents, render 3D in whatever 3D package you use, rough animate 2D in Photoshop, cleanup animate in Toon Boom, composite it all in Nuke or After Effects.

Let's cover the basics of bringing some images into Toon Boom. For this we'll use Toon Boom Animate Pro. First, we'll export out of Photoshop; things should be getting familiar now. However, each software package you use brings a different set of button clicks, and with each version those button clicks will change. All is based on how the software reads the alpha channels and what file formats the software works with. The more back-and-forth between multiple software packages that you gain exposure to, the easier time you will have at problem solving these pipeline issues.

Here's how to export from Photoshop to Toon Boom:

1. Hide all but the layer that you want exported out of Photoshop and select **File > Render Video**.
2. Newer versions of Photoshop can export sequences of images, including .tif images, with transparency. Else you can export an uncompressed movie file.

Use these settings for a series of .tif images: **Photoshop Render Sequence**.

Format: **TIFF**. Make sure to set **Settings > Save transparency** (else it will not!). Alpha Channel: **Straight unmatted**.

Use these settings for a movie file: **QuickTime/Raw** (to keep the alpha channel), alpha channel: **Straight Unmated**. Make sure your frame rate matches and that you have number padding on. Click **Render**.
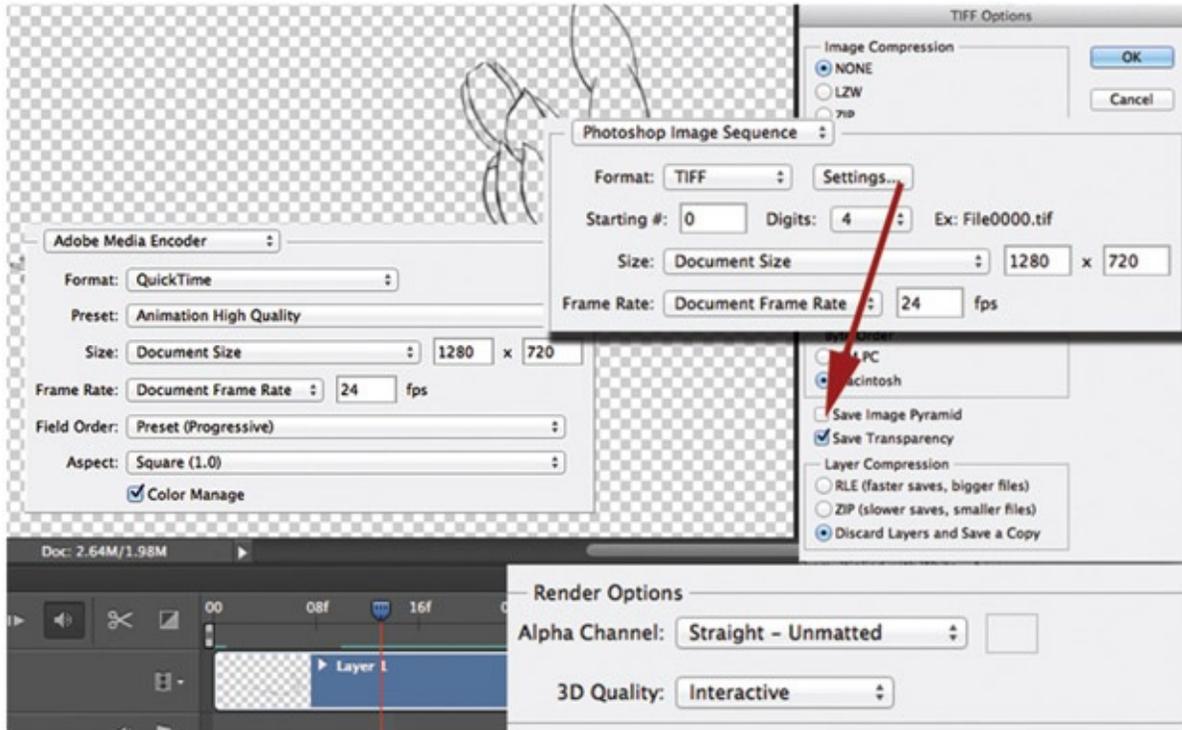
FIGURE 5.22 Exporting animation from Photoshop

Note: it is important to double-check how your alpha channels are being read between the different file formats. You'll want to test that out before proceeding. You'll find that many softwares, depending on version, may not read .tif or .mov files and their alpha channels as expected.

Now you are ready to import your image sequence into Toon Boom.

1. Open a new project in Toon Boom Animate Pro; make sure that the canvas size is correct.
2. Select **File > Import > Images** ... (or movie, based on what you have exported from Photoshop).
3. In the file browser window, select the **tiff** image sequence or the **movie** file. Make sure the alpha channel matches what you used to render in Photoshop.
4. Chose the options for **vectorize** the images in **color**. In fact, unlike in past versions of Toon Boom, you now have to vectorize if you wish to ink and paint the animation. (If you read the first edition of this book, vectorizing is now very good in Toon Boom,

especially in color.)

The images are added to the exposure sheet and visible in the preview area. Do not be scared by the pixilated line. This is a preview. As a note, graphics cards may react oddly, I have found. On a MacBook Pro, only selected layers will show the black ink line. Else they show in white. This is an OpenGL issue. Creating a test of the scene will show the actual line quality. Also, you can toggle between Open GL view and Render view with the buttons at the bottom of the canvas. They look like flowers.
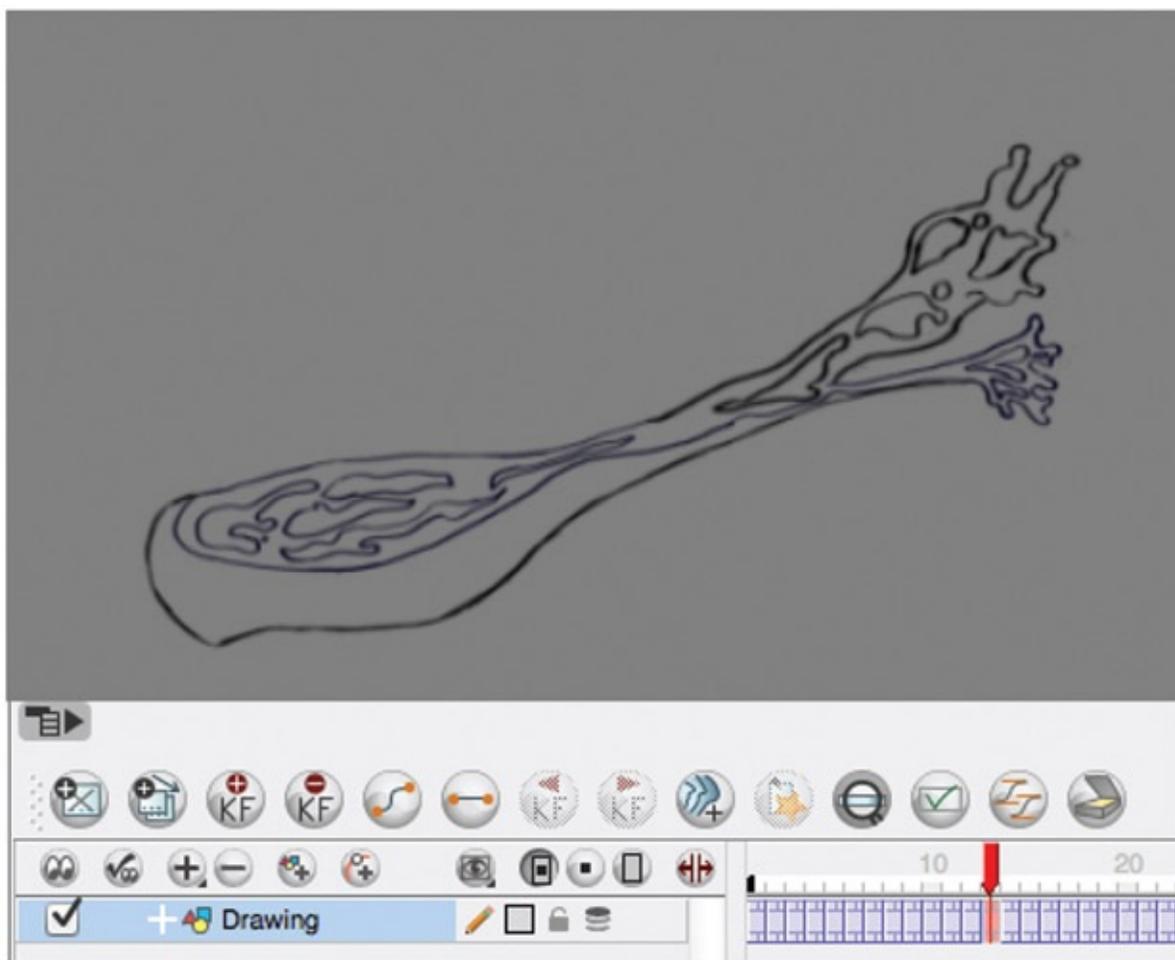
FIGURE 5.23 Water drawings in the exposure sheet

To create the same type of compositing effect in Toon Boom as we did in Nuke, we will explore the Toon Boom method of node compositing.

Toon Boom Animate Pro

1. Locate the **Timeline** tab. **Right-click** on the ink level and duplicate. Name the top

level **Ink**, and the bottom level **Paint**. The Ink level will be the used as normal unblurred ink level and will have a version of it that will be blurred. The paint level will be on the bottom of the image stack.

2. In Figure 5.24 you see the paint level. The paint bucket tool was used to fill the ink with paint. The ink lines were self-painted (though garishly for this example).

3. Temporarily add a white color card to the bottom of the stack of images, else it will preview over black, making it difficult to see the ink lines. To get a color card, click on the small plus icon and chose **Colour Card**. Click and drag layers to stack them correctly.
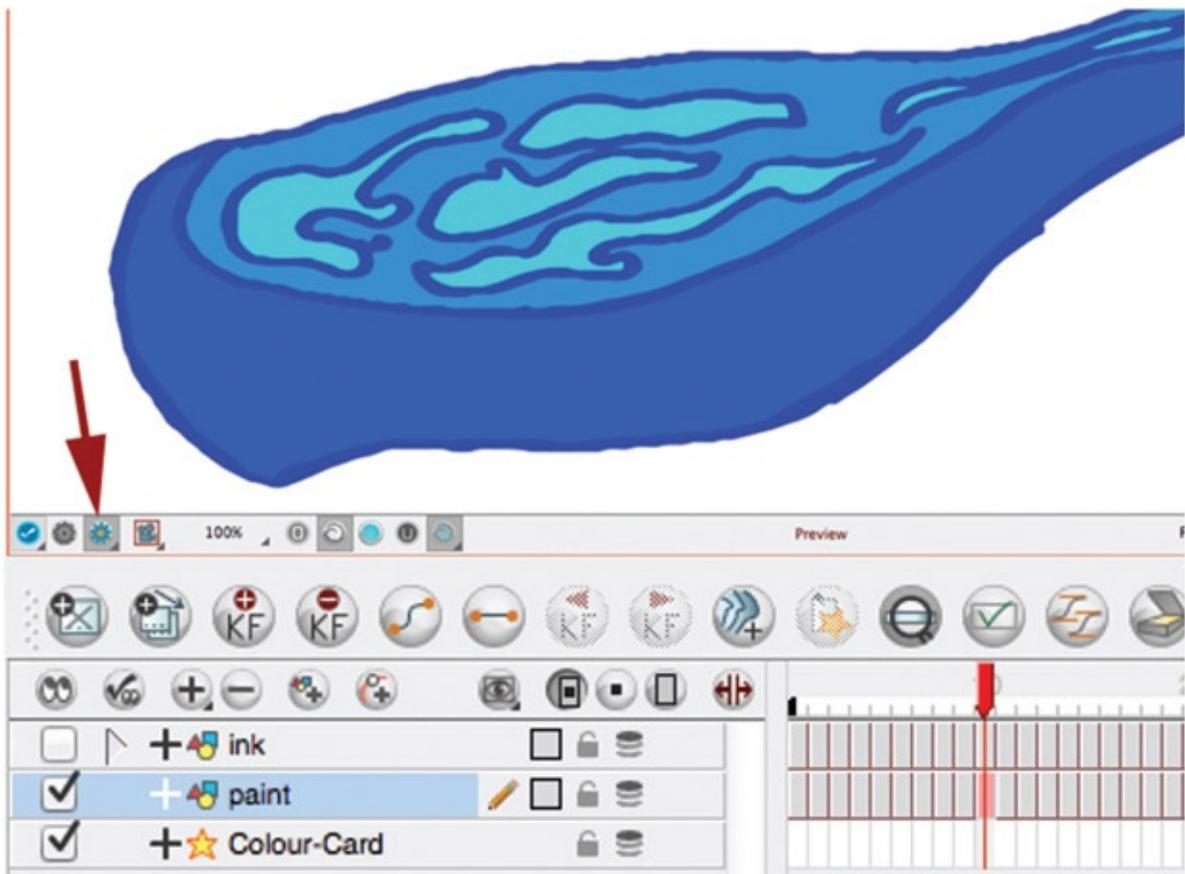
FIGURE 5.24 Ink level duplicated and painted

4. To blur the ink layer: locate the **Module Library (Windows > Module Library)**. Drag it into the node window. To connect it, hold down the **option key** and drag the **Blur-Radial** node onto the **line** between the ink node and the composite node. This will automatically plug it in between the two. See Figure 5.25.

5. Select the **Blur-Radial** node and in the **Layer Properties Window** (or click the small yellow square on the left of the **Blur-Radial** node) change the **Radius** settings to **5**.

6. Create an unblurred version of the ink artwork that will sit on top of the composite by dragging another line from the **ink** node to the **composite** node. This line should

be to the **left** of the blurred ink line. To see the results, locate the **Render View** button (it looks like a little flower at the bottom of the camera window) and click it on. This will show all of the levels together. See Figure 5.25.

7. To get rid of the blur outside of the clean ink line, add a **Cutter** node to the Network Window. Next, **option** drag the **Cutter** node onto the line between the **Blur** node and the **Composite** node. This will automatically plug it in. To create the mask, drag a line from the output of the **paint** node and hook it up to the **top left** of the **Cutter** node.

8. Lastly, click on the yellow square to open up the **Cutter** node's **properties**, and select **inverted**. The blurred inlines will only be visible on the inside of the water. See Figure 5.26.
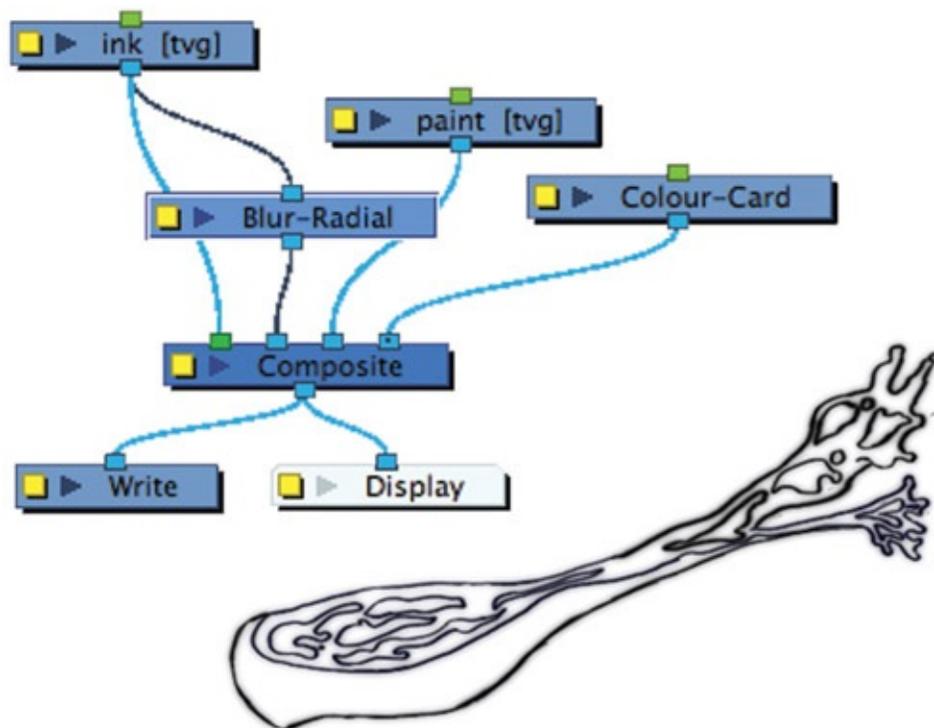
FIGURE 5.25 Blur added to the ink layer. (Paint hidden for clarity.)
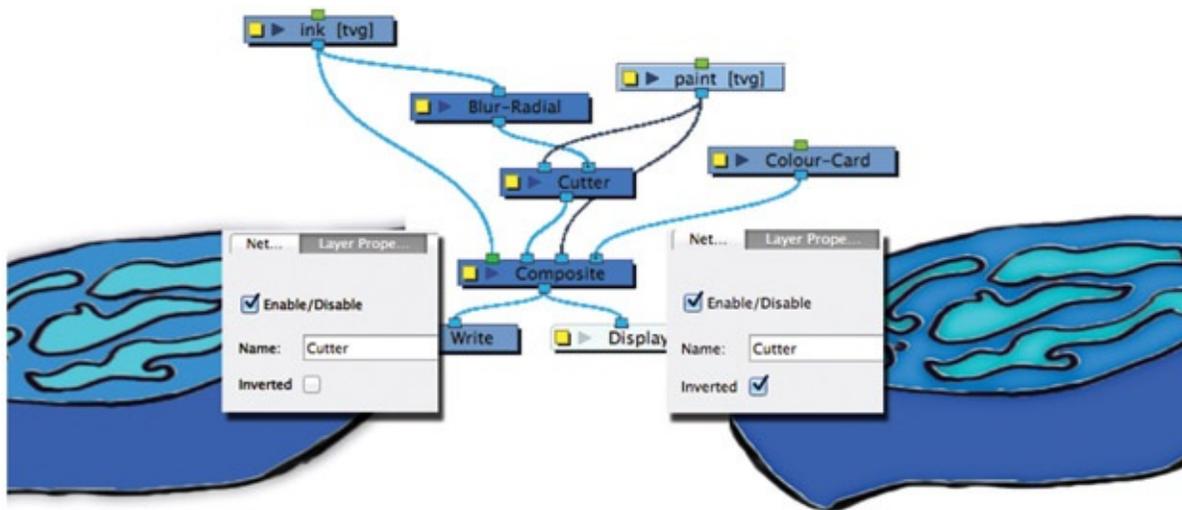
FIGURE 5.26 Blurred ink level cut to only show on the inside of the paint areas

2D Leading Prop in Photoshop

Another area for the effects artist is that of putting props into 2D characters' hands. The prop itself can be in 2D or 3D. Many times it is in 3D. The hand placing of 3D props in a 2D character's hands can be tedious and is prone to having jiggle because the 2D animator does not animate her or his 2D character holding a spatially perfect prop. The easiest method is to bring the 2D animation into a 3D software package as an image plane and place the 3D prop visually so that it seems to match the character's contact point. Another method that is now becoming available is the limited ability to bring 3D objects into Photoshop, After Effects, Flash, Toon Boom, and other 2D packages.

With this ability, the animator does not have to leave the 2D package to animate the 3D to follow the 2D. If the 3D is to have any larger animation ability beyond translate, rotate, and scale, then the artist will need to use a 3D package to do that advanced animation. Simple prop following animation could be limited to translate, rotate, and scale. However, this limited animation for the 3D may make it stand out as 3D if the 2D character is squashing and stretching in a cartoony way. If that is the case, or if there are large perspective cheats that must happen to match the 3D to the 2D, then a 3D package will need to be used.

During production, prop requirements for a film can be large. Hundreds of props may be needed. If a team or student does more than one film, sometimes props can be reused or revamped to use in multiple shows. Having a good system to store and reuse props can help speed up your process.

We'll briefly cover using 3D objects in Photoshop. Photoshop can read in many types of 3D objects files. Some of these file types are simple to write out and have been around for ages;

others are relatively new. File types that read in are as follows:

3D Studio	.3DS
Collada	.DAE
Flash 3D	.FLA
Google Earth 4	.KMZ
U3D	.U3D
WavefrontOBJ	.OBJ

Export Your 3D Object

For this exercise we will work with a simple, blocky hat that has been created out of polygons in Maya. It has been UVed and even has a checkerboard texture on it just to show the UVs. The file is found in the folder named **2D_Leads_3DProp** and is called **Hat. mb**, if you want to open it and look for yourself. The checkerboard texture will actually not be saved with the OBJ texture because that is procedural. You can convert a procedural texture to a file, and then it would be exported.

To export an object out of Maya as an OBJ object, you will first have to turn on the plug-in **objExport.mll**:

1. Open the file **Hat.mb** in Maya.
2. Click **Window** > **Settings/Preferences** > **Plug-in Manager**.
3. In the window that opens, turn on the **Loaded** and **Auto-Load** checkbox for the **objExport.mll or objExport.bundle** (.mll or .bundle depending on which version of Maya you are using).
4. Select the hat object. It will highlight in green.
5. Click on the Option Box next to **File** > **Export Selection**.
6. Under **General Options**, select File Type: **OBJexport**.
7. Click **Export**.

This has given us the exported files **hat.obj** and **hat.mtl**. You can find these files in the folder named **exportFromMaya**.

Import OBJ File into Photoshop

In Photoshop CS4 or later, open up the sample file that we will use by clicking **File > Open**, and locate the file **DanMurdock_Big-Gulp_Section.mov** inside the **2D_Leads_3DProp** folder.

FIGURE 5.27 DanMurdock_BigGulp_Section.mov in Photoshop, by Dan Murdock, 2009, digital cel I course, SCAD

Wavefront is one of the original 3D packages that was ultimately bought and incorporated into Maya, thus you have the .OBJ exporter built in. OBJ is a universal object description. If you wanted, you could open the obj file in a text editor and look it over. It is geek readable.

Import 3D OBJ Object

In Photoshop, locate the 3D menu. *This portion of Photoshop will not work with older Macs or graphics cards.* To bring in the obj object from Maya into Photoshop, do the following:

1. Make sure that the movie layer is not selected. **Click** on the **blank** area in the layer

editor to deselect the video layer. If you don't do this, the hat will not show up in some versions of Photoshop!

2. Now you can bring in the hat: **3D** > **New 3D Layer from file** …
3. Locate the **hat.obj** file. Select the file and click **Open**.
4. Click on the **Move** tool ("**v**") to switch to move 3D mode. Use these tools to position the hat so that it looks to be on top of the character's head.
5. If you click directly on the object you can adjust its local scale, position, and translate properties.
6. Create a position keyframe in the timeline editor so that the hat stays in position.

You'll note that new 3D tools show up at the top of the screen. These are similar to camera attributes.

Rotate the 3D object in XYZ space
Roll the object in front of the camera (using all axes)
Drag the 3D object (in X and Y, up and down)
Slide the 3D object (in Z and up and down)
Scale the 3D object (which is really scaling the whole universe that it exists in)

All right, 3D people, the camera controls are a little different than you are used to. Note that in the property window you can change to 3D coordinate system to type numbers in. Also, Apple-click in a field to get a virtual slider.

In Figure 5.28 you see arrows indicating the 3D hat, the 3D layer, and in the timeline editor a keyframe that has been added to the 3D positioning of the object.
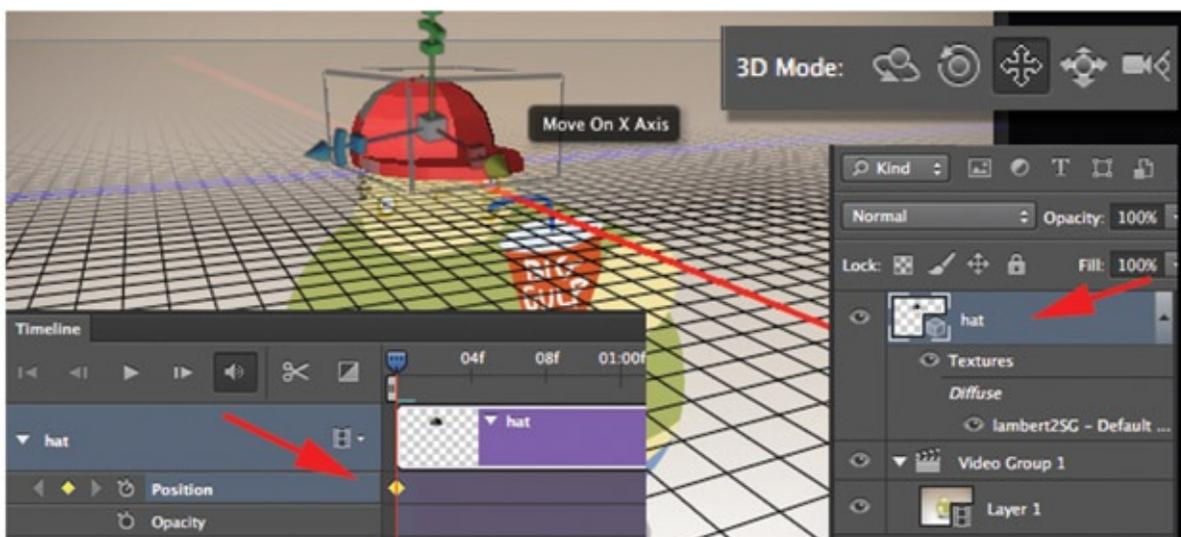
FIGURE 5.28 OBJ loaded into a 3D layer

You will want to turn off the shadow that is happening on the universe's ground plane.

Click on **Infinite Light** icon (in newer versions of Photoshop) and turn off the **Shadow** option found in the **Property** window.

You can even paint the 3D object in Photoshop. Figure 5.29 shows the hat in various stages of being painted. The normal paintbrush was used. Remember that paint job; we'll see the texture that was created in just a moment.

FIGURE 5.29 Painting a texture for the 3D object

To set keyframes, turn on the stopwatch for the **3D Object Position**, and use the move tool (**v**) to position and rotate the hat for the keyframes needed. You can see an example of a finished animated obj in the Photoshop file **DanMurdock_BigGulp_Section.psd**. Figure 5.30 shows a keyframes set for the hat obj.

FIGURE 5.30 Keyframes in Photoshop

The last portion we will cover as we explore the 3D capabilities in Photoshop is exporting the object file and the texture that we painted. Feel free to explore the 3D paint capabilities in Photoshop.

To export 3D objects out of Photoshop, simply select **3D > Export 3D Layer**…. This will save the obj file, a material file (mtl), and a texture (psd).

If you are using the obj file in Maya, you can load in the psd texture that was created in Photoshop. Select the hat object, create a material shader, lambert, for example. Then create a **PSD file** node in the color channel. Figure 5.31 shows the texture loaded into Maya. This is great news for Photoshop texture painters, because this shows a different workflow for painting the textures and using the familiar tools of Photoshop painting.
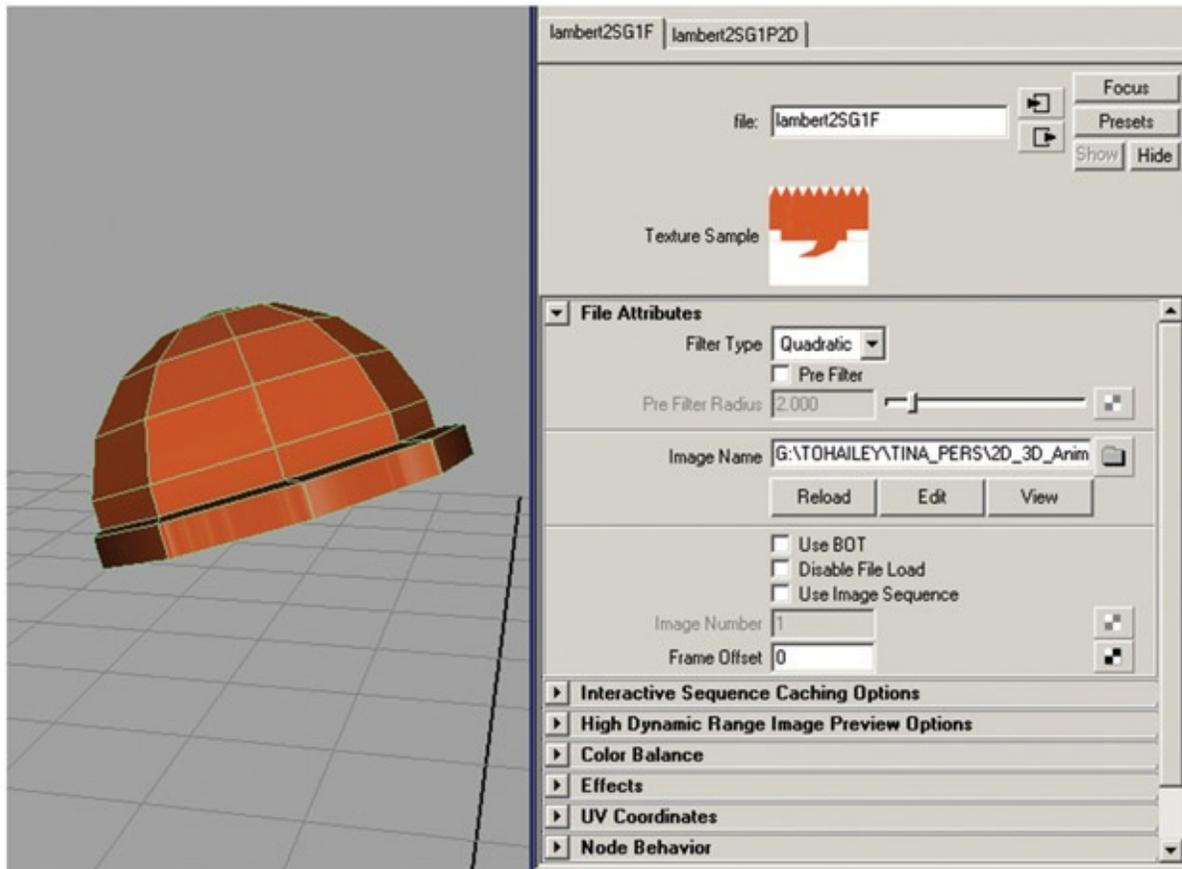
FIGURE 5.31 A psd texture loaded into the Maya scene

The exported files are in the companion data in a folder titled **exportFromPhotoshop**. This is just the beginning of working with 3D in Photoshop and the beginning of Photoshop's 3D capabilities. As new versions of Photoshop are created, the feature set will continue to grow.

Import OBJ File into Toon Boom Harmony

If you have access to Toon Boom Harmony, you will find that you can bring 3D obj files into there as well. There is also a Maya plugin for Harmony that can be used. To import objects in Harmony, go to **File > Import > 3D Models**.... The model comes in with the transformation handle corresponding to where the origin was in Maya. The model can be moved, rotated, and scaled in Harmony. It can even be animated in this fashion, just as in Photoshop. Remember to turn the Animate button on for keyframes to register.
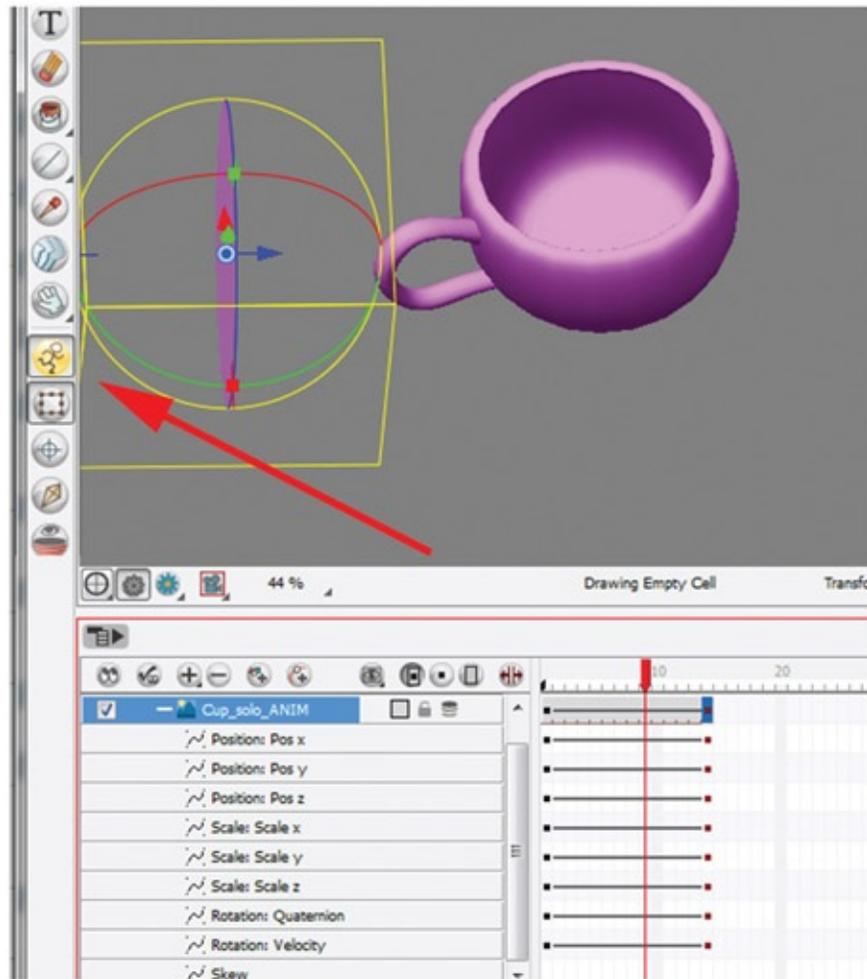
FIGURE 5.31A Importing 3D models into Toon Boom Harmony

Tones and Shadows

These two terms come from 2D animation. Because we are dealing with the compositing of elements to make a final image and not rendering everything in 3D for one final frame, we will continue to use these 2D terms for our 2D/3D pipeline.

The term "tones" refers to the area on a character that the light does not fully illuminate, the area in shadow. This dark area can be caused by self-shadowing or cast shadows from other characters, props, and the like. Although it is technically a shadow, when this shadow area is on top of a character, in animation it is referred to as a tone. The term "shadows" refers to the shadow cast from the character onto the background elements.

In 3D animation, the artist must only think about setting the light up for good illumination and the rendering engine takes care of the tone and shadow portion of the image based on the materials applied to the objects. The person in charge of lighting looks to make sure that the tones are not covering the character in a distracting way.
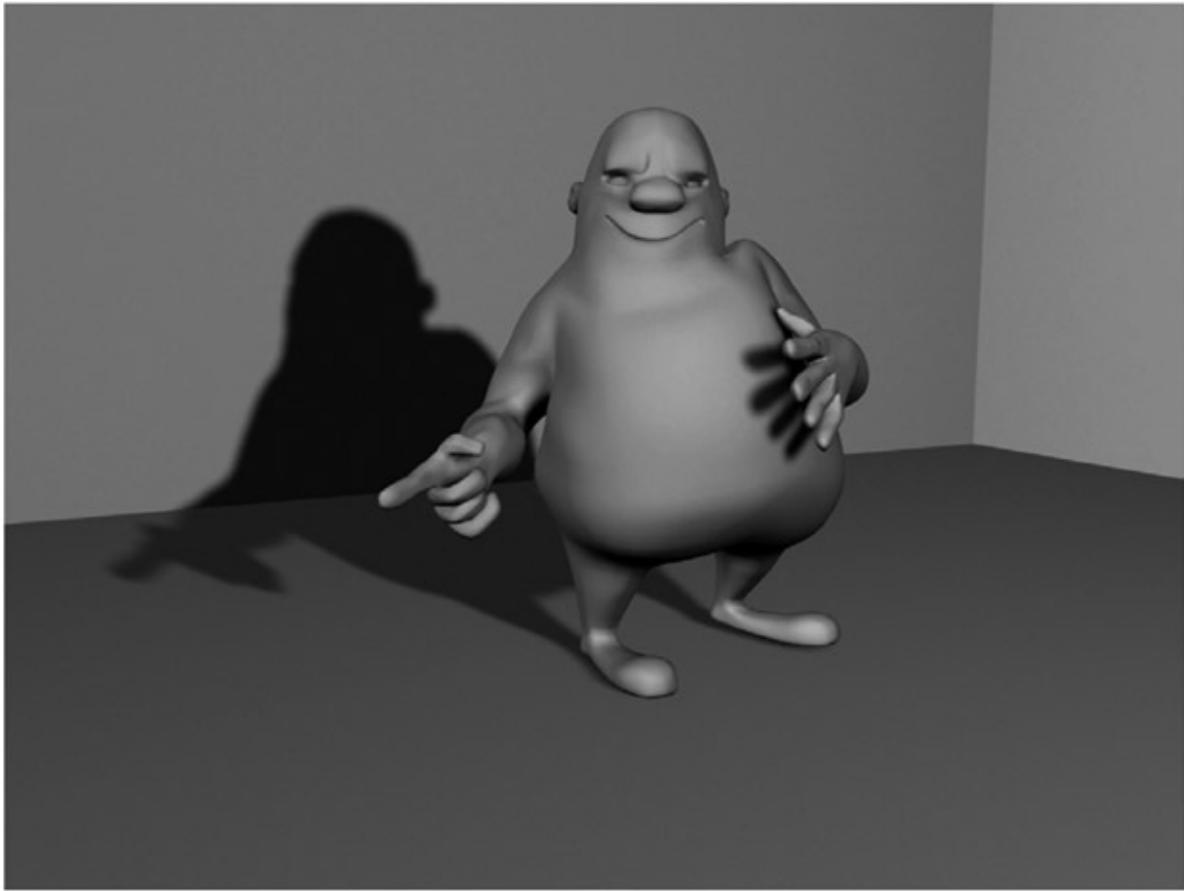
FIGURE 5.32 Example of 3D tone and shadow. Model and rig by John Vu, 2009, 3D character and setup animation course, SCAD

In 2D animation, the artist must draw the areas where the light is not visible. This 2D representation of dark areas—tones and shadows—is used in the compositing stage to darken the character's painted colors.

FIGURE 5.33 Example of 2D tone, shadow, and highlight. By Dianna Bedell, 2009, Senior Project II, SCAD

The difference in the representation of light can cause issues when putting 2D and 3D images together. If the 3D element is rendered with 3D lighting and shadowing, the 2D imagery cannot match because it will be flat and at most have a slight shadowing from hand-drawn tones and shadows. We have examined many films, both in this book and as part of chapter projects. In your research, you have seen examples of extremely rendered 3D imagery combined with very flat 2D imagery. This combination can be somewhat jarring.

What do you do with light and shadow if the media look at them differently? How do we make them match? The answer is to choose a lighting/shading model to use for both media. You can choose to light and shade using 3D methods for any elements that are in contact with one another or light and shade using 2D methods for touching elements.

There's a key concept in this approach. It is only when characters of different media are in contact with one another or when a character itself is made up of different media that the lighting models must match. A character and the character's background can have different lighting models.

FIGURE 5.34 Example of a 2D character without tones and a highly rendered background. Model and pose by John Vu, 2009, 3D character setup and animation class, SCAD

3D Tones and Shadows

In the previous chapter where we discussed creating a 3D character with 2D parts, we set ourselves up for the perfect example of a character that could use 3D tones and shadows, even on top of the 2D. Because the stand-in 3D character is so highly modeled and basically used as reference for the 2D, we can pull tones and shadow mattes from the render and use that in our composite.
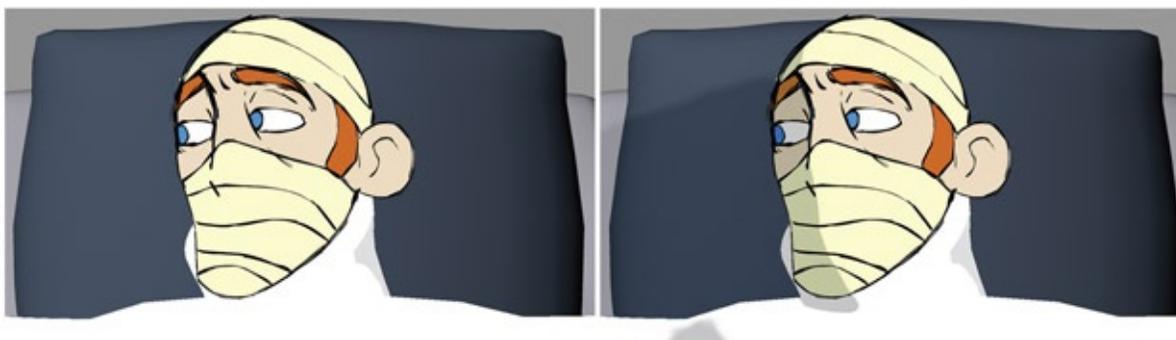
FIGURE 5.35 3D character with 2D parts without tones or shadows (left); using a 3D lighting model to tie the elements together (right)

In <u>Chapter 3</u>, we used a toon shader to create a rim light matte for our 3D arm. We will use the same technique here, but we will apply the output to our 2D *and* 3D images during our composite.

Tone Matte

First we'll create our 3D tone matte for both the 3D portion of our character and the 3D reference geometry: Jaguar McGuire's body and head.
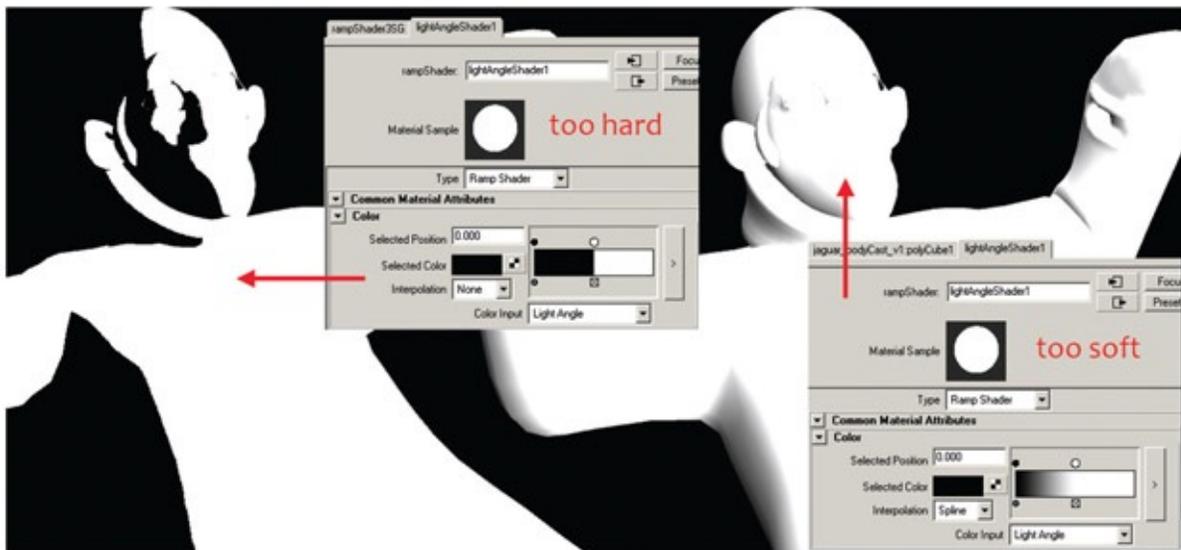
FIGURE 5.36 Using interpolation type to adjust edge of black and white tone

1. In your 3D package, create a light and shine it at your 3D character. A spotlight has been created to shine on Jaguar McGuire by clicking **Create > Lights > Spot Light**. In Maya, to see lighting only, use the lighting display mode (hot key: **7**) so that a hardware view of the lighting and shading can be seen.
2. Remember, for our mattes we want a completely black-and-white image to use during compositing. Select the whole object and apply a toon fill shader in the Render section by clicking **Toon > Assign Fill Shader > Light Angle Two Tone**.
3. The default color of the shader is gray, so it is not very useful to us.
4. Change the first chip color to **black**. This produces a tone that is too hard to use.
5. Change the interpolation type to **spline**. This produces a tone that is too soft to use.
6. Click in the black area to create a third color chip of black and move it toward the

white area of the ramp shader. This should produce a smaller threshold between the black-and-white color change.

7. To adjust the parameters and interactively see feedback, you can use the Interactive Photorealistic Rendering (IPR) window. Click on the IPR button in the render window and follow the directions to draw a box around the render region. As you adjust the sliders to the toon shader, it will interactively update in your window until you get the shader just right.
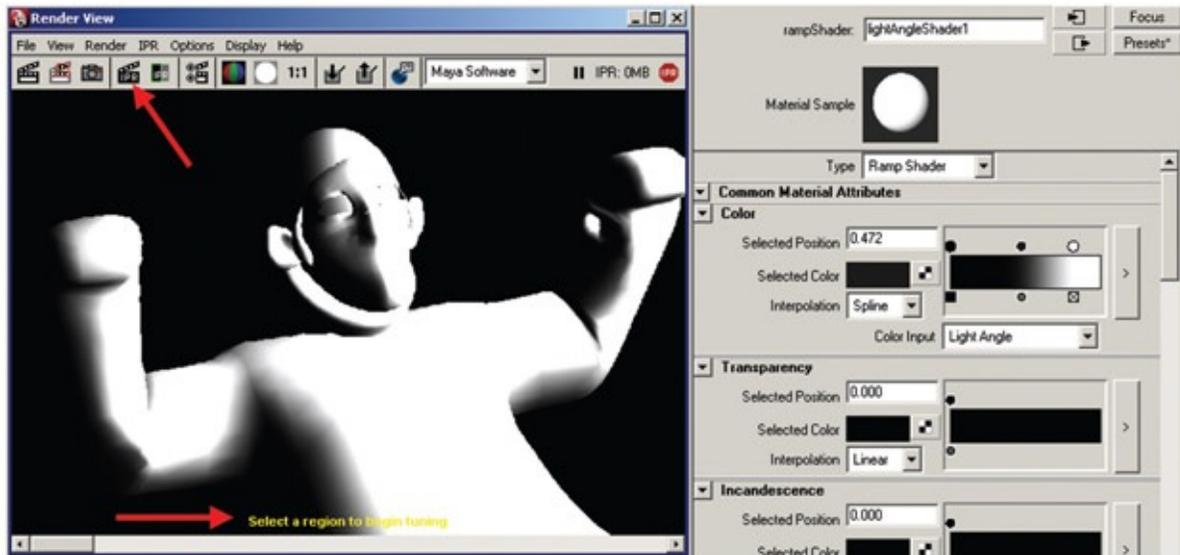
FIGURE 5.37 Using the IPR window to interactively see toon shader adjustments

Once you have the settings you think are correct, take a moment and go through your animation to check for any unwanted tone effects. A quick way to do this is to use the **Keep Image** feature of the **Render View** window.

Render the first image in your animation to look at the tones. In the **Render View** window you can save images by clicking the **Keep Image** button at the top of the window. Then render another frame later in your animation at a key point of the movement. You can use the **slider** at the bottom of the **Render View** window to scrub back and forth between the images and check for unwanted popping in the tones or shapes that obscure important features of the character. If such things were to show up, you would need to readjust the lighting in your scene.
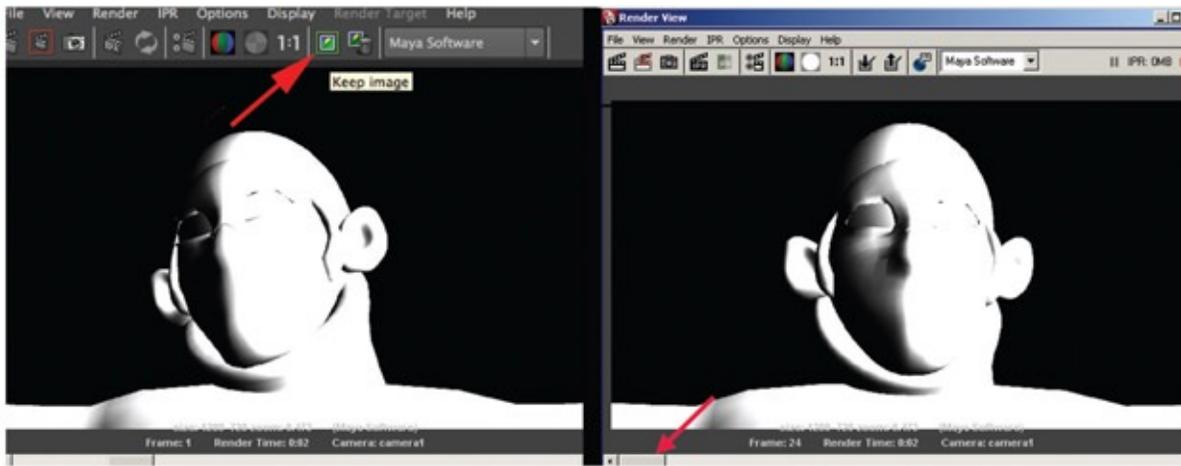
FIGURE 5.38 Using the Keep Image feature of the Render View window to check the tone matte. Shown in Maya 2014 (left) and Maya 2011 (right). Even though the version changes, the buttons stay pretty much in the same place

Once you are satisfied that your tones will render correctly, you can render your tones. Steps like these can help you catch errors before you kick off a render, walk away to get coffee, and come back to a surprise. Of course, this is not to say that after you return from getting your coffee you still won't be surprised. That is the nature of the medium. Those who have been around the digital block a time or two, feel free to ignore these musings. Students, take heed.

When rendering the tone matte, we can use .tifs because this is now going to final compositing. Remember to use **alpha channels** and **frame padding** (Figure 5.39).
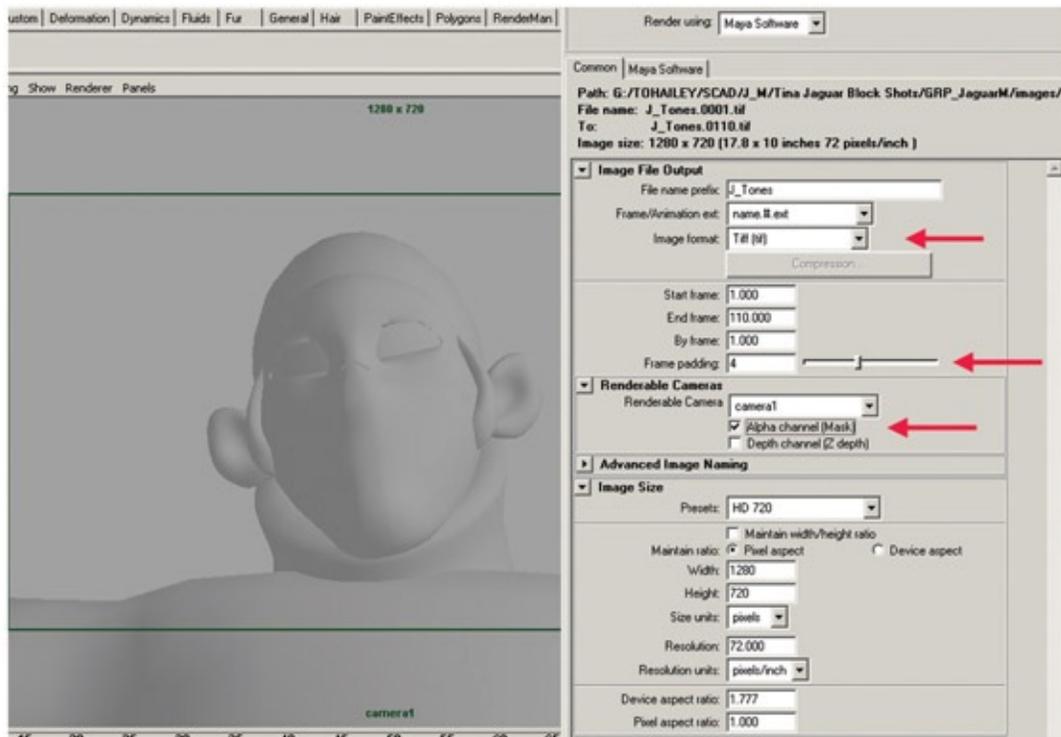
Rendering tone matte

For the *Jaguar McGuire* shot, we rendered out the background element as one image, because the elements are not being animated and the camera is locked (no camera movement). Maya will happily let you render 110 frames of something that isn't moving. Take an extra moment before you hit the render button to contemplate: do you need all 110 images? Normally you will not need an alpha channel on a background.
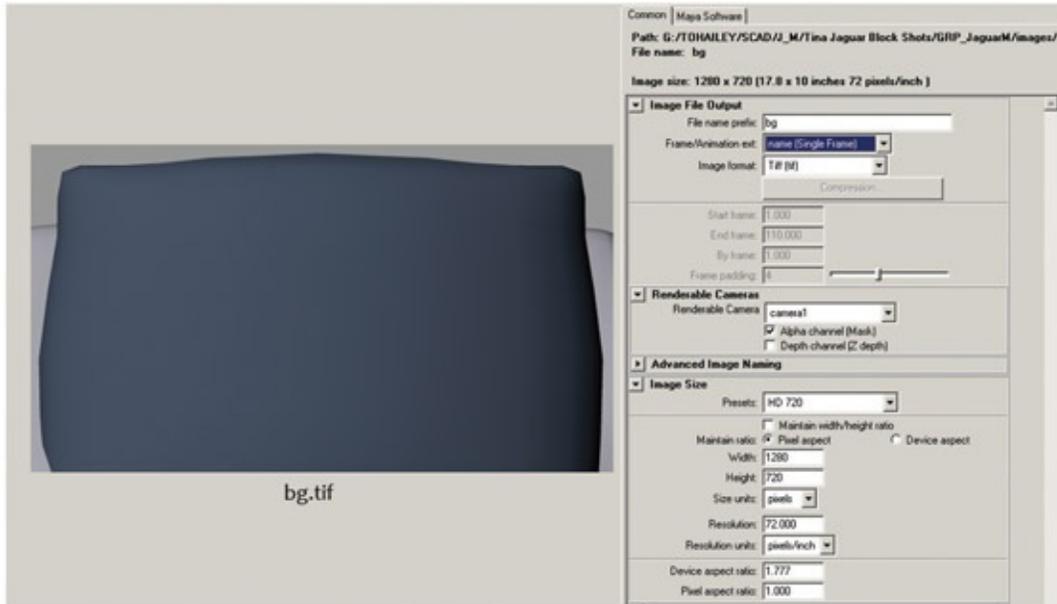
FIGURE 5.40 Rendering held background element

Next we'll render the cast layer much as we have done previously. The reference head has been hidden. It is a good idea to do a quick test render of one frame and make sure that the alpha channel is there. You might find that you haven't hidden everything. This was the case during the making of the following image. The background wall was the same gray as the perspective window, so we thought it was hidden when it was not. Only after the render was completed did we notice that the alpha channel was a pure blank rectangle of white. A quick render test would have shown that was the case and caused the animator to investigate more and discover that the wall had not been hidden. Didn't we just say that students were to heed the importance of test renderings? It is so easy to click that render button without thinking to check. Remember!
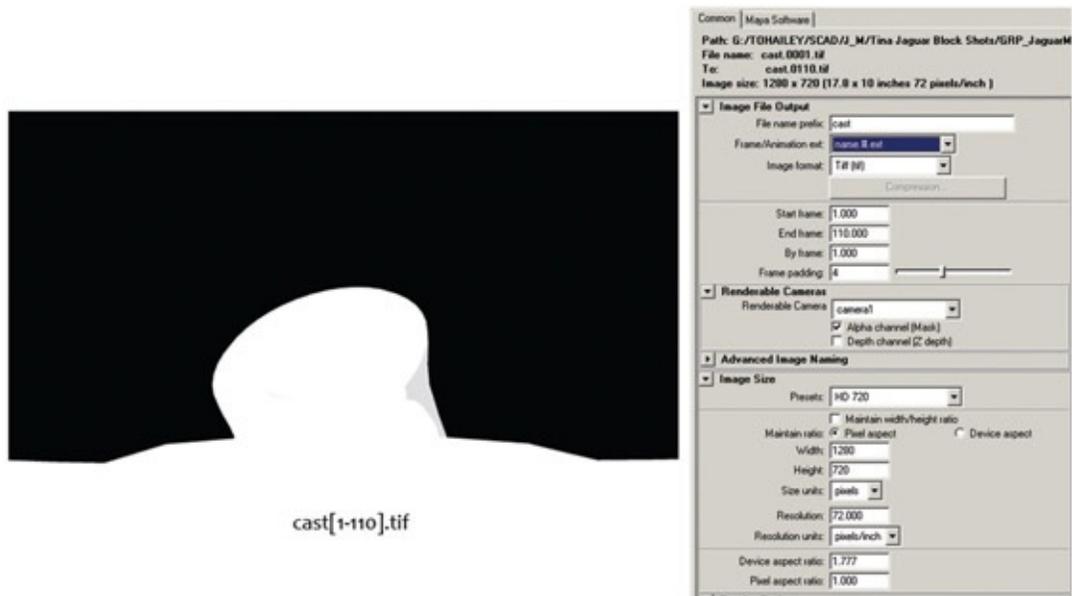
FIGURE 5.41 Rendering an animated cast element without a head

As we saw in Chapter 4, the head has already been drawn in Flash. We have already inked and painted the character in Flash. See the additional online chapters for more about inking and painting images.

To have a rendered frame for every frame (which can be easier when compositing if the render time is not an issue), we will select all of the keyframes and right-click to select **Convert to Keyframes**.

FIGURE 5.42 Prepping 2D animation to export for final composite

Once this is done, there is a keyframe for every frame of animation.

There is not an option to export a series of .tif images in Flash. Depending on the software that you are using, you might be able to use the swf file itself. If that format does not work for your compositing software, then you will have to use a QuickTime format. Remember to use

animation (no compression) export settings.

To export a swf file, there are not many file settings that you need to change. We turned off any compression settings. In a production setting, I would test between QuickTime and swf files to see if there was any loss of image quality before proceeding. We tested only slightly during one quarter's class and found that exporting Quick-Time out of Flash created a slip in frame rate! Instead of exporting out at 24 frames per second, it was exporting at 24.9, with no obvious way of correcting the error. The slippage showed up at the compositing stage when we were running a frame short in anything that came out of Flash. My students reported that they were using the animation compression, which should not have created any slippage, yet it was there. We chose to use swf instead. Test. Test. Test!

You can use any compositing software to put these images together. We'll use both After Effects and Nuke so you can see the differences between the two types of compositing systems: time-line and node based.

First we will use After Effects. Bring your elements (bg, cast [1–110].tif, head.swf, J_tones[1–110].tif) into After Effects by dragging and dropping them or importing them. You can find the elements in the companion data **TonesNShadows > Shot**. In newer versions of After Effects, you can drag and drop the folder of .tif images and it will bring in the whole sequence. See for an example of elements brought into After Effects. In this example we used a swf file for the head.
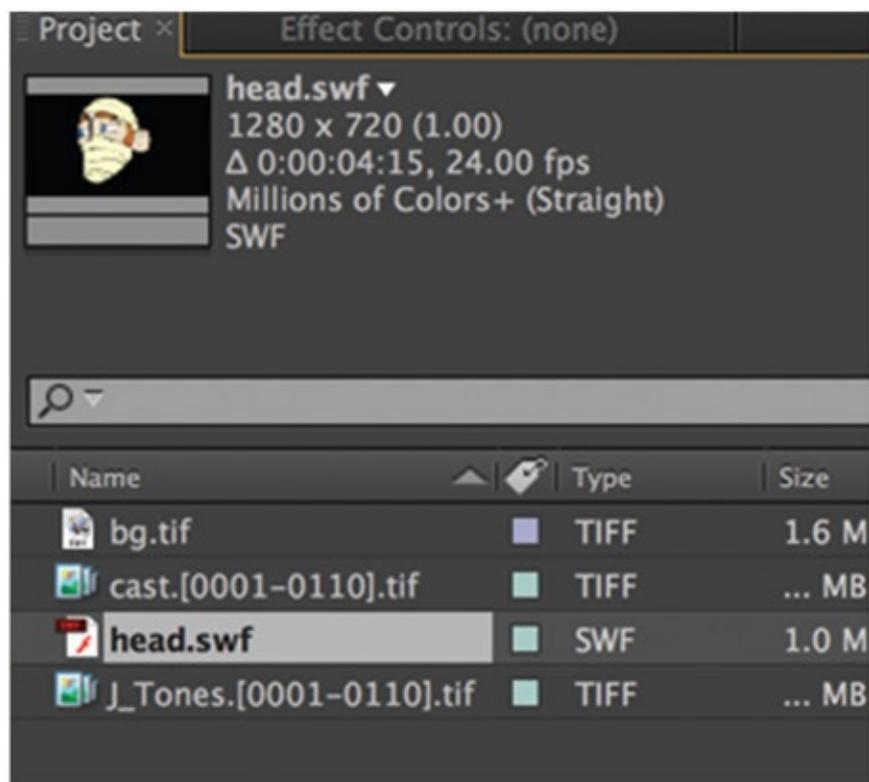
FIGURE 5.43 Animation elements brought into After Effects

If you have a group of individual images, then you will need to create a composite for each element layer. In our example, that is the cast element and also the tone matte. To create a composite:

1. Select the cast images 1–110.
2. Drag them to the composition icon.
3. Make sure the settings are for a duration of **one** and that the **sequence layers** option is turned on.
4. **Repeat** steps 1–3 for the **tone** element.
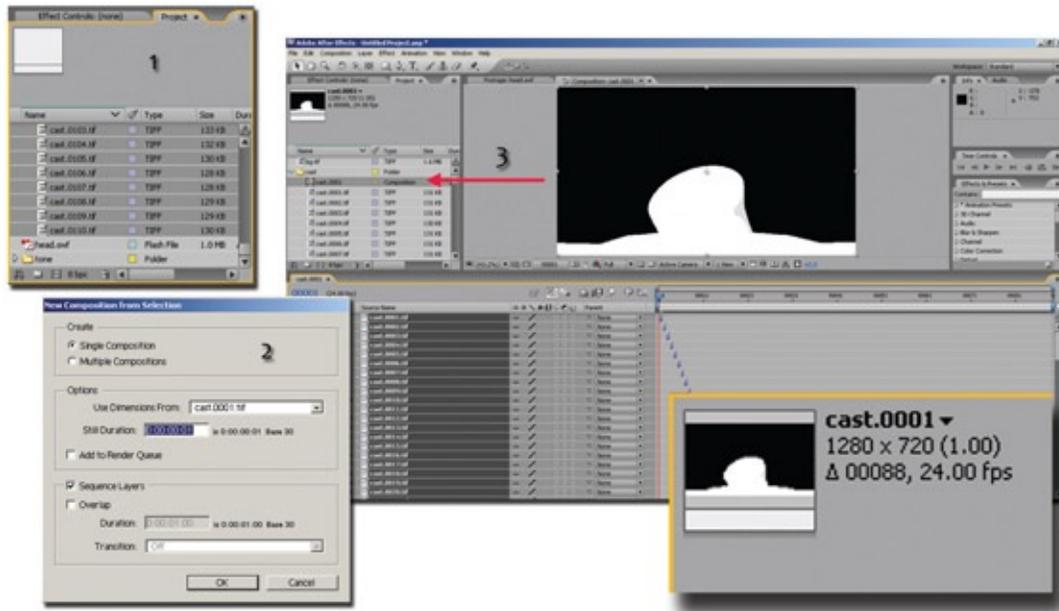
FIGURE 5.44 Creating a precomp of the cast element. Each .tif is treated individually as in older versions of AE

You will only need to do those three steps if you are in an older version of After Effects or the images are being treated individually due to importing issues. If your images were brought in as a sequence (if you drag-and-dropped the folder) they should already be in 24 fps and show up on one timeline. You'll see in Figure 5.45 that the composition is indeed made at 24 frames per second.
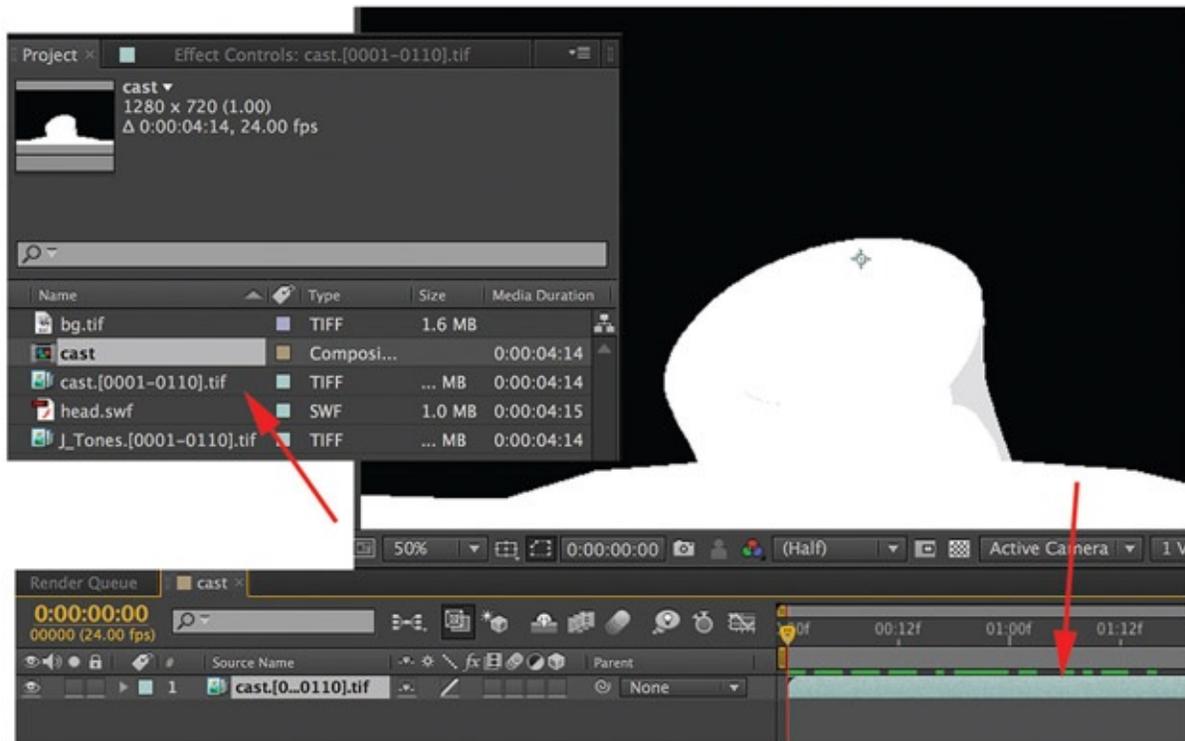
FIGURE 5.45 Tif image sequence of the cast and tone are treated like a video clip if you drag-and-dropped the folder of images into AE

Now we will affect the body with the 3D tone that we created. We will use the same method from Chapter 3. We will use the tone matte to adjust the color of the head and the cast levels:

1. Create another composition, and drag in the **head** and **cast**. Label this **head_cast**.
2. **Right-click** in the timeline and add a **New > Adjustment Layer** above the head level.
3. **Drag** in the **tone** composition and place it above the adjustment layer.
4. Select the Adjustment Layer and from the top menu click **Layer > Track Matte > Luma Inverted Matte**.
5. **Right-click** the Adjustment Layer and add **EFFECT > Color Correction > Color Balance (HLS)**.
6. Bring lightness down to the desired level.

You'll note the red arrows point out the errors that can result from this method. The 2D animation did not exactly follow the 3D head that was used to generate the shadows. The tones can still be used. A separate cleanup pass will need to happen to extend the mattes to better match the 2D animation. If your team has many junior effects artists, or in our case new sophomore students helping out on a group project, using 3D tones can help the artists have something to go by and help with quality control. If your 2D animation matches very well to

your 3D animation, then your tones will match correctly. This process can even go the other way. You could animate in 2D, then roto match a 3D stand-in just to cast tones on. Do whatever helps you to attain the shot.
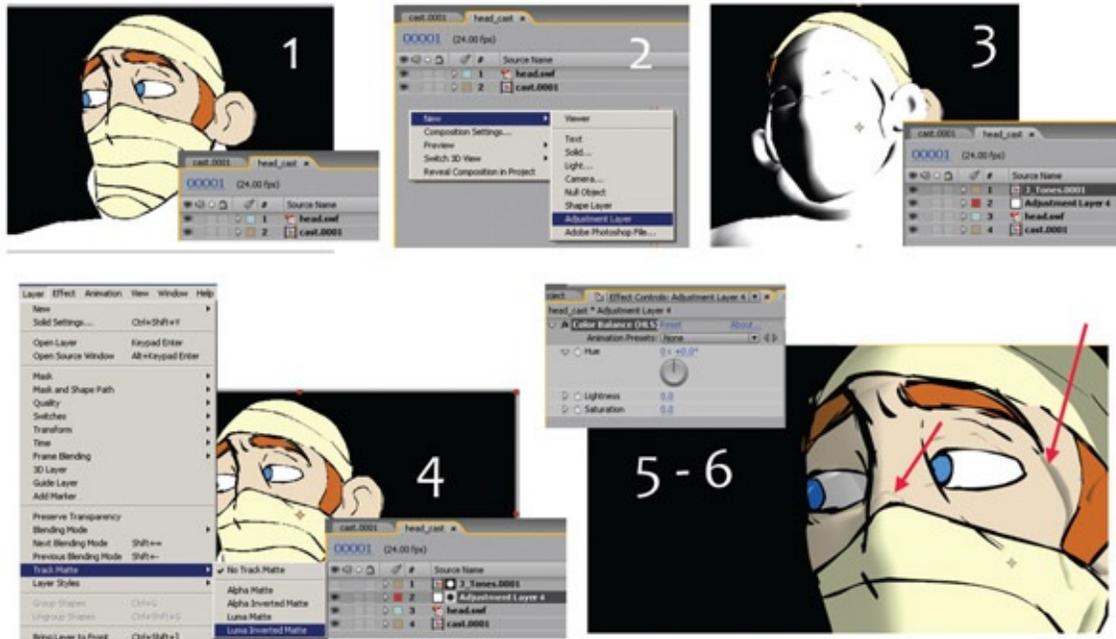
FIGURE 5.46 Adding the tone element in After Effects (steps 1–6 listed later)

Just one way of fixing the tone mattes is to bring them into Photoshop or any paint package and to simplify them there. Remember, do not hand-blur the edges. If you hand-blur edges across multiple frames, they will not animate very well and they will cause boiling in the final composite. It is better to have a hard-edged matte and blur it in the compositing package than to try to hand-blur each image. In Figure 5.47 the matte has been simplified. All of the areas around the eye facing the light have been removed, as well as some shadowing on the jawline. Note: you are seeing the RGB layer of the matte.

FIGURE 5.47 Simplifying the tone matte in a paint package

Shadows

We'll use the same technique of creating a 3D shadow in Maya and compositing it in After Effects.

To create a shadow matte in your 3D package, you'll need to be able to render a shadow pass. In Maya 2008 or earlier versions, you can use render passes. In Maya 2009 +, the company changed how you create render passes. We'll show both methods. The concepts are the same; only the buttons are different.

We'll continue using our *Jaguar McGuire* shot. The first step is to set up a light that will be used to cast the shadow. This does not necessarily have to be exactly the same as the light used in the main render. Remember, your goal is to create a shadow that ties the 2D and 3D elements together. In this shot we have a 3D head that will cast the shadow for the 2D head layer.
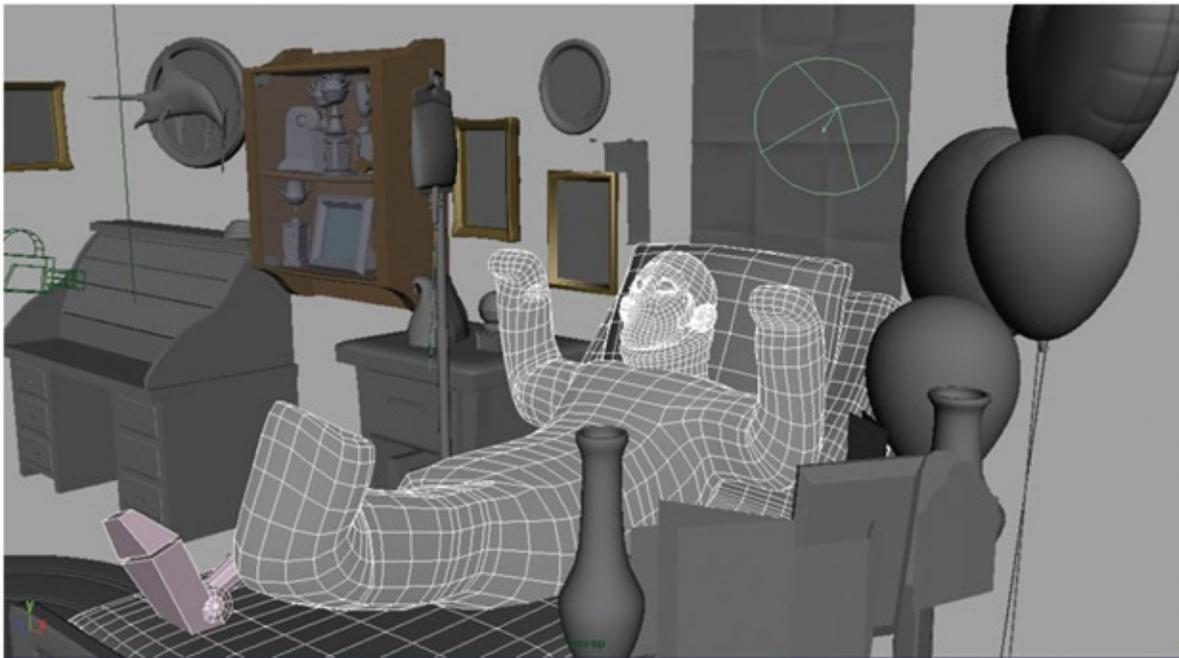
FIGURE 5.48 Spotlight added to the room to cast a shadow

Before kicking off a full render, it would be prudent to do a few test renders just to make sure the shadows are going to be to your liking. For instance, in our shot the character's right ear was not used in the 2D animation, so it needs to be hidden. Of course, you won't see that in the following image because the author did not follow her own advice and kicked off a render without checking, resulting in the need to re-render the images. I break things for you.

You are welcome.
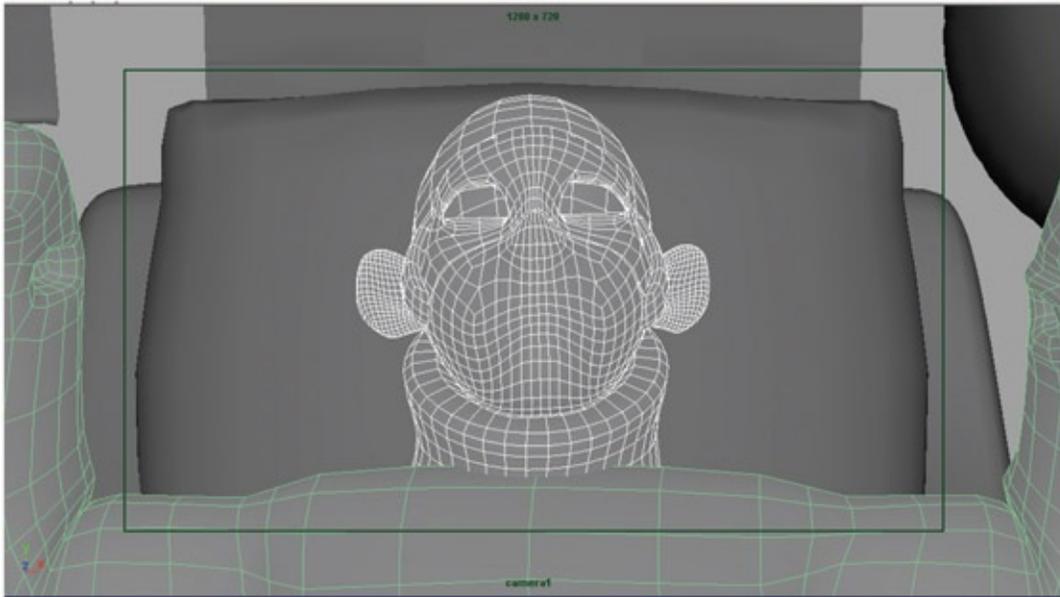
FIGURE 5.49 View of character though the camera

To create a shadow layer, you should isolate only the objects that are casting or receiving the shadow as well as the light that is casting the shadows. Figures 5.50 and 5.51 show the room before a render layer is created. Create a layer by selecting **Render (layer) > Layers > Create Layer from Selected**. Remember that when a render layer is selected, as you see in Figure 5.51, only those objects are visible.
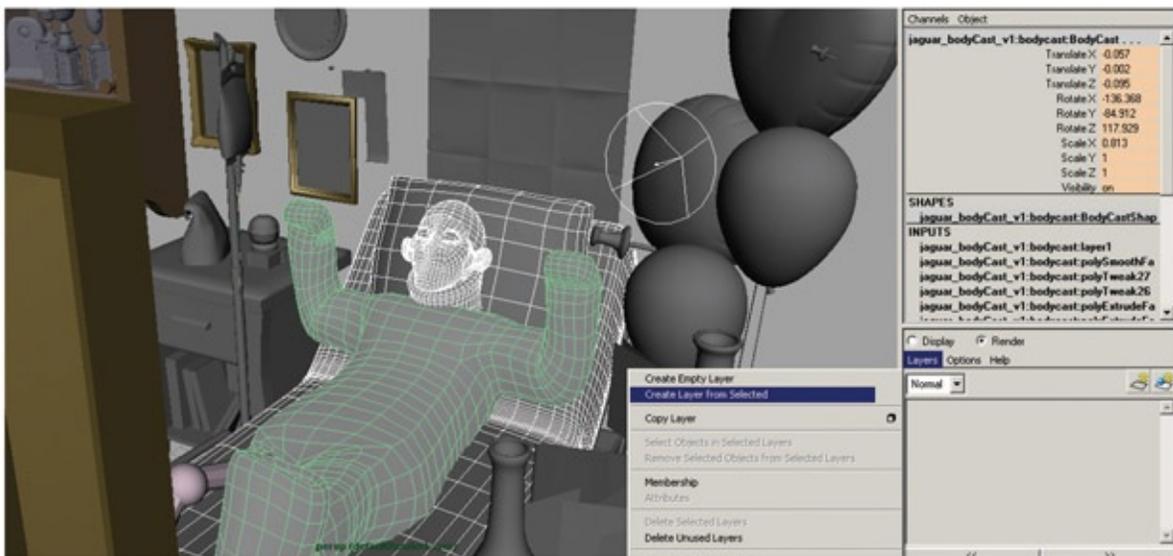
FIGURE 5.50 Creating a render layer
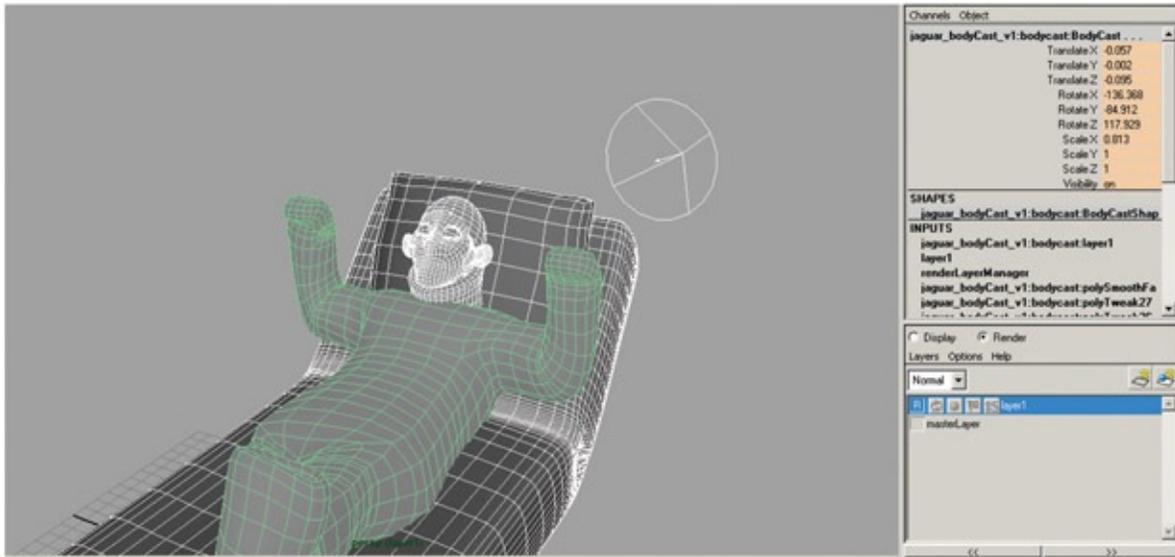
FIGURE 5.51 Render layer shows only what is in the layer

Before you go on, is your light set to cast shadows? Make sure the light that you have included in your render layer is indeed casting shadows. (Not that the author has ever made that mistake before. What gave you that idea?)
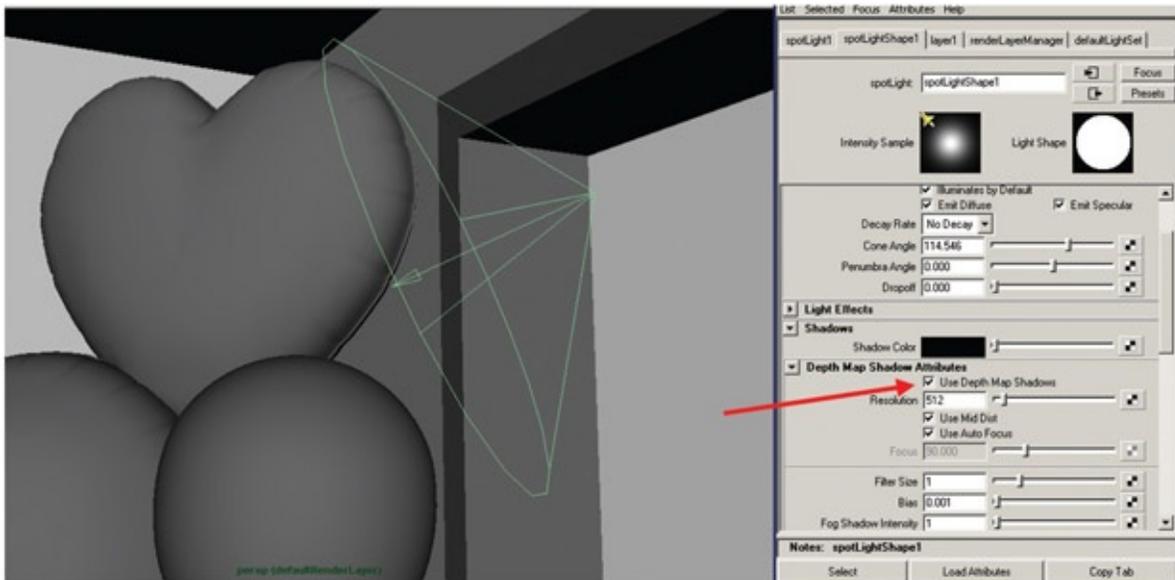
FIGURE 5.52 Spotlight is set to cast depth map shadows

Creating a Shadow Pass in Maya before Version 2009

To create a shadow render pass, **right-click** on the render layer and select **Preset > Shadow**. You will see that the render layer's second button turns red (Figure 5.53). This render layer does not include parts of Jaguar McGuire, in order to simplify the cast shadow.
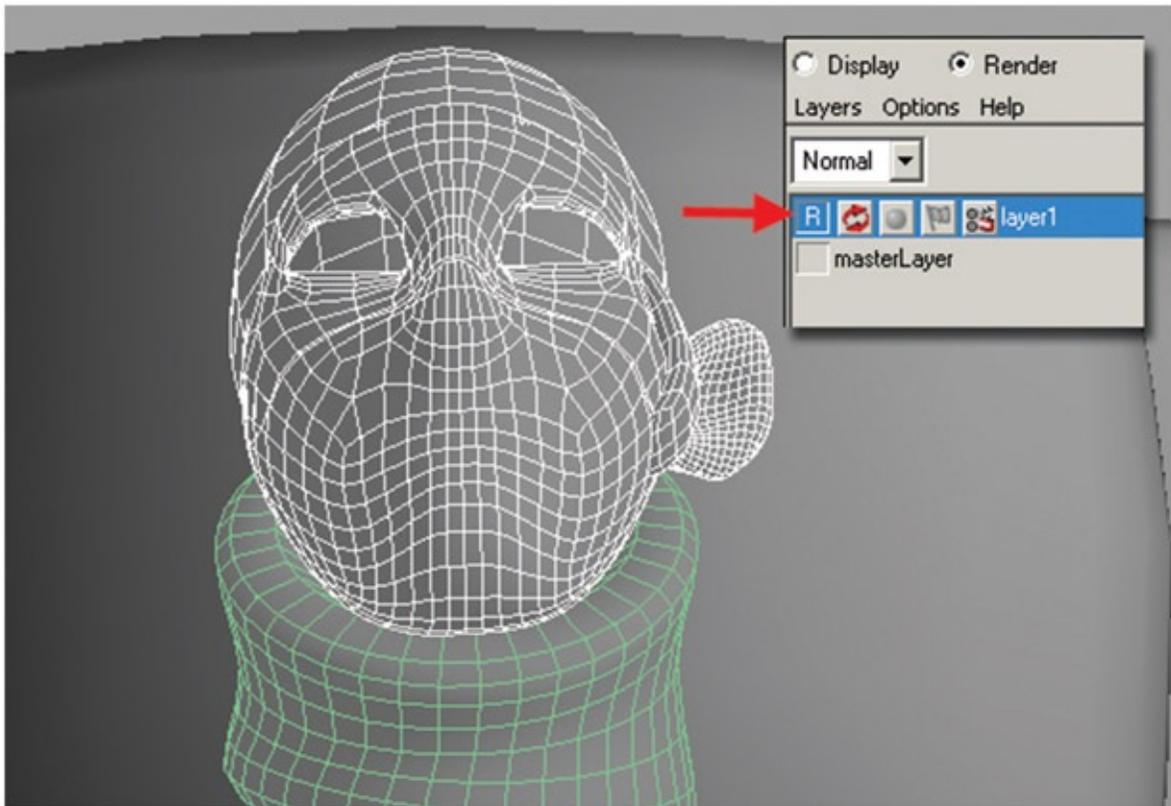
FIGURE 5.53 Render layer shadow pass created in older versions of Maya

Render as normal. For a shadow pass the render is not creating an RGB image; it is only creating an alpha channel. This is different than what we have done before where we actually used the RGB created by the toon shader as a matte. This time we are using a true shadow matte. It can be slightly disconcerting the first time an artist opens the shadow matte and sees nothing in the RGB channels. Do not panic. Look in the alpha channel.
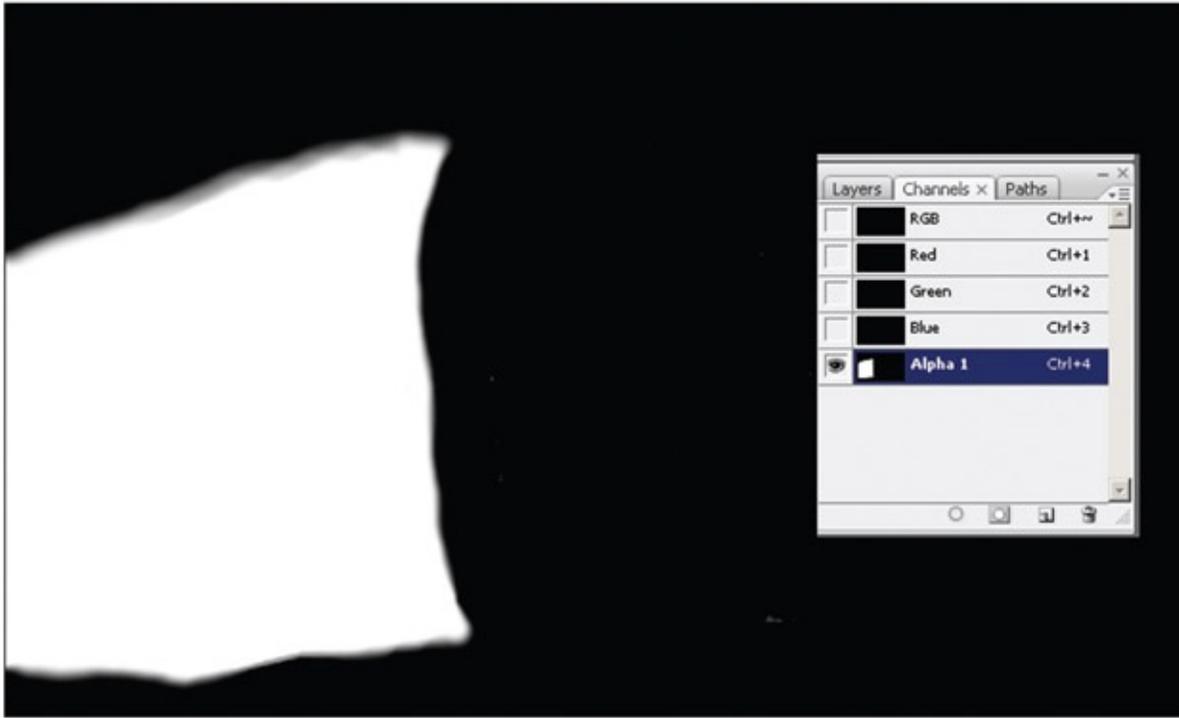
FIGURE 5.54 Alpha channel of a shadow pass

Creating a Shadow Pass in Maya 2009 or Newer

A few features were added in Maya 2009 to add more functionality to render passes. At first testing, I couldn't figure it out without finally giving in and reading the documentation. I used what was there to figure out how it really worked. Here's a quickie overview of using render passes in Maya 2009+.

The previous steps will work if you have Mental Ray selected as your renderer. You *must select Mental Ray as your renderer* in order for the list of passes to show up. I was unable to include a screen grab of the passes: there are plenty of them to choose from.

1. Select your object and in the Render Pass window choose **Render (layer) > Layers > Create Layer from Selected**, as we did previously.
2. Choose Mental Ray as your renderer in the **Render Settings** window.
3. Right-click on the render layer and click **Add New Render Pass**. Select **Shadow** render pass from the large list presented.
4. If you look at the **Passes** tab in the **Render Settings** window, you will see your render layer listed there.
5. Render as normal and wonder where your render layer is.
6. In the render window, select **File > Load Render Pass**. This will open your render

layer. Remember, this is an alpha channel, so display the alpha channel to see your success.

Read the documentation for more information, including movies on how to use the new implementation of render passes.
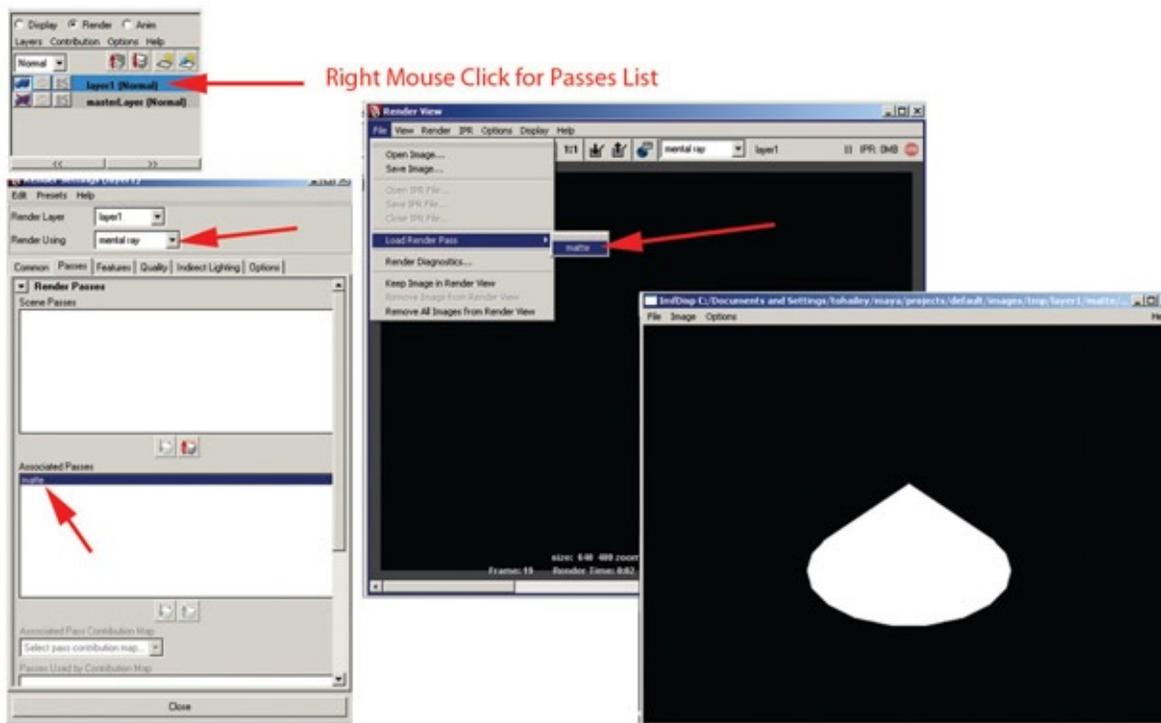
FIGURE 5.55 Render layers in Maya versions 2009 or newer

Compositing

We'll bring the shadows into our After Effects composite. Here is a different way to bring in images. For these shadows, we'll bring all of them in as one piece of footage. (The rendered shadow and other assets can be found in the companion data.)

1. Click **File** > **Import** > **File**.
2. Select the **first image** in the shadow sequence.
3. Make sure that Tiff Sequence is checked and Interpret as Footage is selected. (In newer versions of After Effects, you can't adjust the footage setting.) Click **OK**.
4. This will bring all of the images in as a footage clip. You can see them listed as one piece of footage in the project tab.

Once the footage has been brought into After Effects, you can drag the shadow layer

between the head and the bg (background) layers. See [Figure 5.56](#) for an example. It doesn't matter if the shadow is bigger than you need because the character will cover it. However, if there are any gaps where the shadow does not quite meet the character, you will need to extend the shadow in Photoshop or a painting package. In the image on the companion website, the shadow area (the white area of the alpha channel) has been extended and simplified.

A shadow image placed between the character and the background

Depending on your art direction, you could simply adjust the opacity of the shadow layer and call this shot finished. However, just adding a black shadow does not give you a rich color palette. Instead, we will use the same method that we used previously for the tone to use the shadow as a matte to adjust the color of the background image(s):

1. **Right-click** in the timeline and add a **New > Adjustment Layer** above the background level.
2. **Drag** the **shadow** layer above the Adjustment Layer.
3. Because this is truly an alpha channel that we are using, select the Adjustment Layer and from the top menu click **Layer > Track Matte > Alpha Matte**.
4. **Right-click** on the Adjustment Layer and **add EFFECT > Color Correction > Color Balance (HLS)**, **Brightness and Contrast** or whatever color correction method you desire.
5. Adjust the color correction settings until you receive the correct shadow level.

FIGURE 5.57 Final composite in After Effects

3D Tones in Nuke

To carry on our tradition of using multiple types of software to achieve the same look, let's take a look at how to achieve this composite in a node-based compositor. We'll use Nuke. As we have pointed out, node-based compositors are somewhat similar. You'll be able to apply the same ideas to the software of your choice.

1. Locate the **Read** button in the **Image** tab and load in the assets. (Hot key **R.**) In this example, the following image sequences were loaded:

a. bg.tif	Maya Render
b. shadow[1–81].tif	Maya Shadow Pass
c. J_tone[1–81].tif	Maya Two Tone Shader (RGB)
d. cast[1–81].tif	Maya Render
e. head.mov	Flash swf converted to mov (Animation settings)

You'll note that the head.swf file we used in After Effects does not read into Nuke. Therefore, the raw movie file or an image sequence needs to be used. In [Figure 5.58](#) the images were loaded and show up in the node view tab.
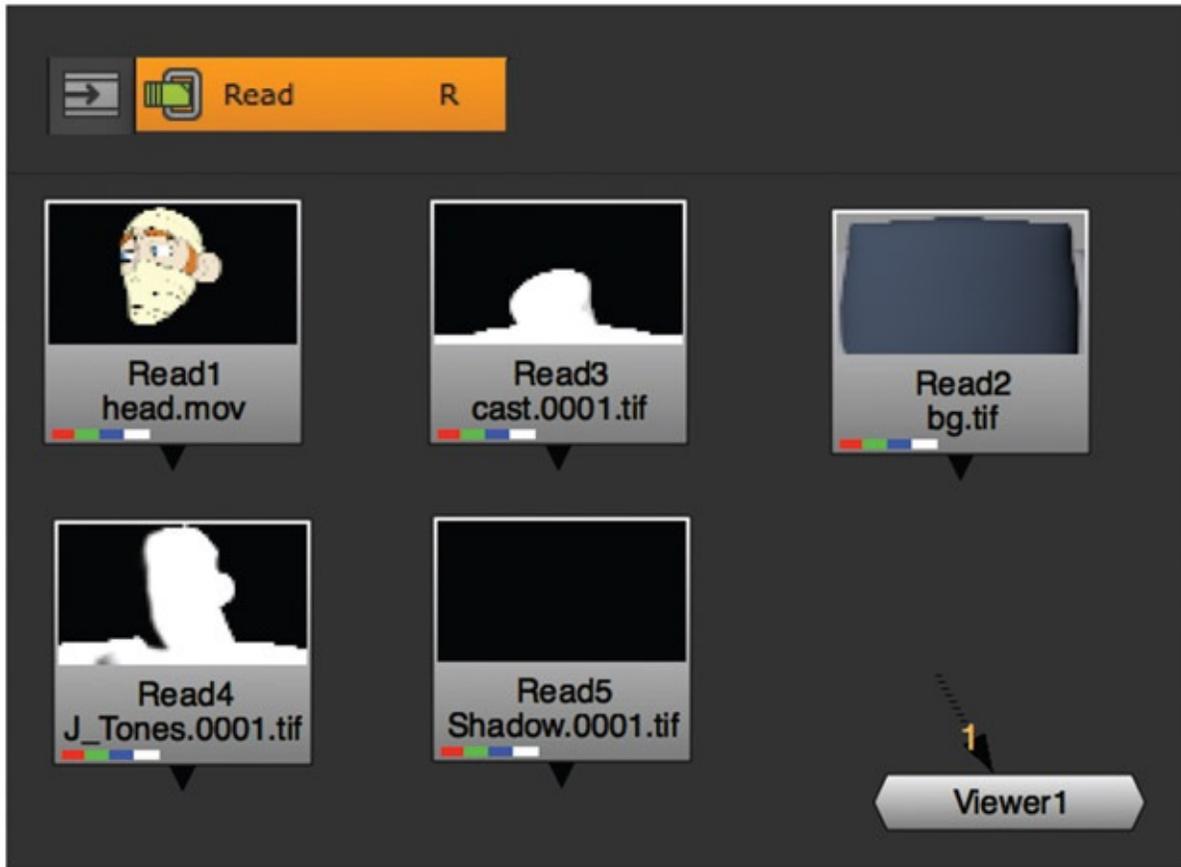
FIGURE 5.58 Shot assets loaded using multiple File In nodes

2. First we'll composite the **head** overtop of the **cast**. Select the head, then the cast, and select the **Merge > Merge** icon (Hot key **M**.) It should automatically plug the head as **A** and the cast as **B**. (**A over B**).
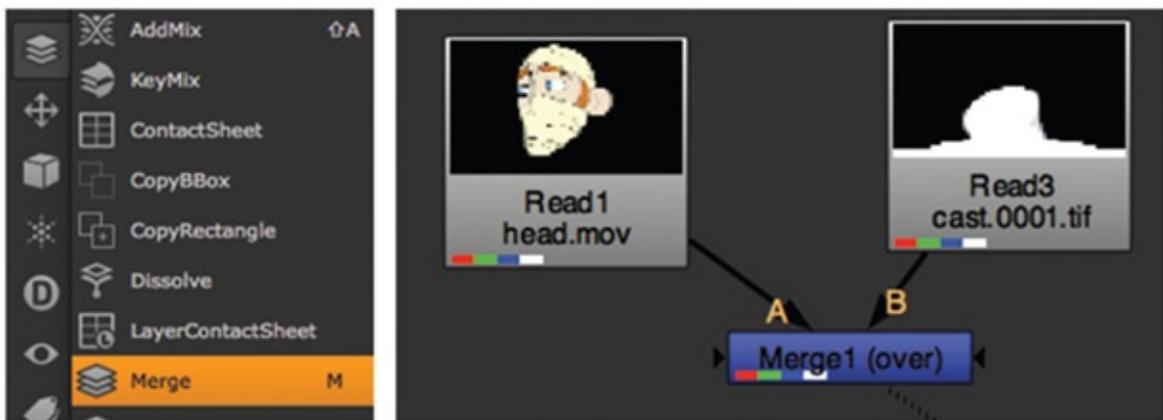
FIGURE 5.59 Compositing the head over the cast

3. Select the **Merge1(over)** node and add a **Color > Grade** node. (Hot key **G**.) This will automatically hook the output of the head/cast merge into the color tool. This will give an overall color correction to the head/cast merge. Adjust the **white-point** number to

see it working.

4. To limit the composite to only the tone area, hook the **mask output** (found on the right of the Grade1 node) to the **Tones** node. You'll know if you have the correct output—it says "mask." Can't miss it.

5. You'll note in Figure 5.60 that the tone matte is working but it is giving the opposite effect. Anyone know why? Look back at the hint located in the listing of assets (step 1). Do you see it? The tone is in RGB, which means its alpha is actually the opposite of what we want to use. Mattes use the alpha channel.

FIGURE 5.60 Tone matte used to brighten the head/cast. This tone was created in RGB. The alpha is what the matte input uses

6. To correct the issue, double-click on the **Grade1** node in the node view tab. This will load the preview image into the preview tab (if it wasn't already there) and load the adjustable parameters into the parameter tab.

7. Locate the **Mask** option. Click on the **invert** check box to turn it on. It will turn **orange**. As you can see in Figure 5.61, the area that is being darkened is the correct area.
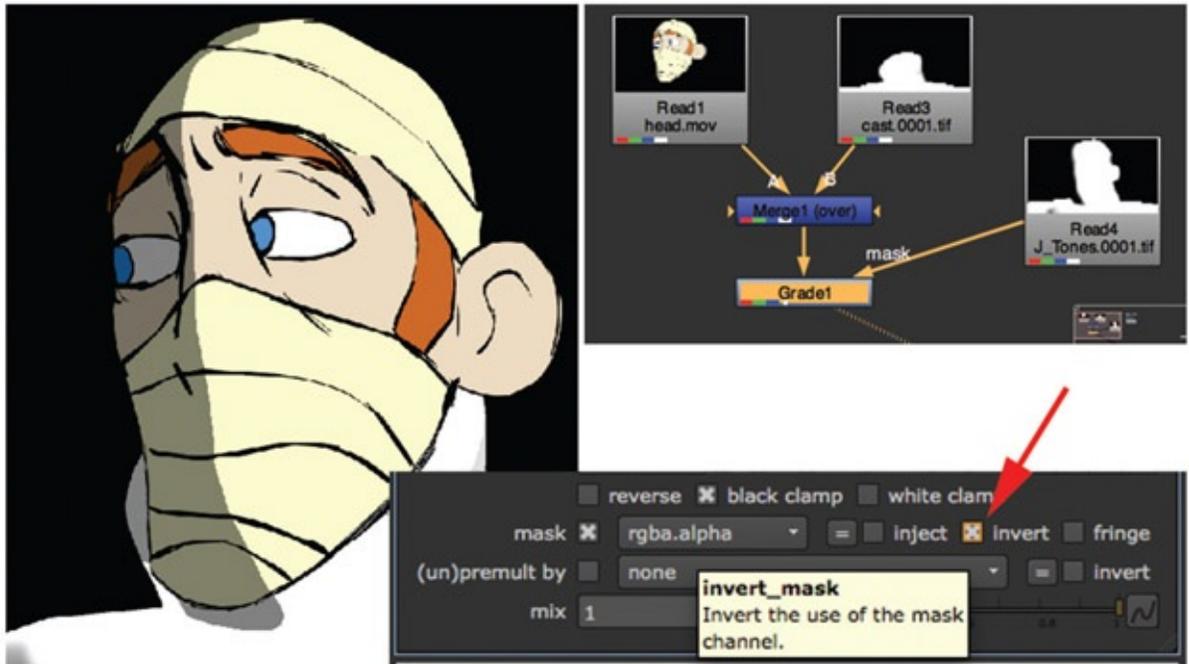
FIGURE 5.61 Inverting the tone mask

8. If you want to add a blur (or anything else) to adjust the matte, you can add that to the node network between the tone and the Grade1 node. In Figure 5.62 you can see the addition of a **Blur** node.
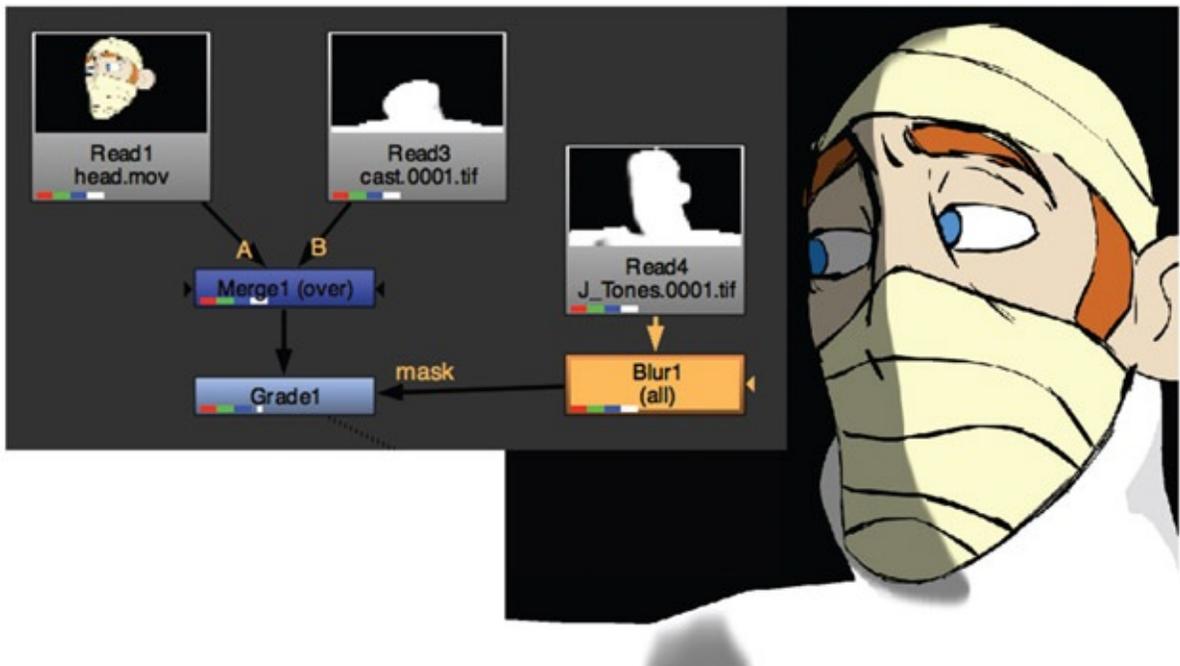
FIGURE 5.62 Blur node added to the matte before the Grade1 node

9. Continuing to the background area of this composite, select the background node and add another **Grade** node. (Found in the **Color** tab, hot key **G**.). Hook the **right** side of the **Grade2** node to the bottom of the **Shadow** node. This will use the shadow as a

matte. Because the shadow pass was rendered out as an alpha channel, it will work as intended without any additional button clicks (Figure 5.63). Adjust the **whitepoint** value to taste.
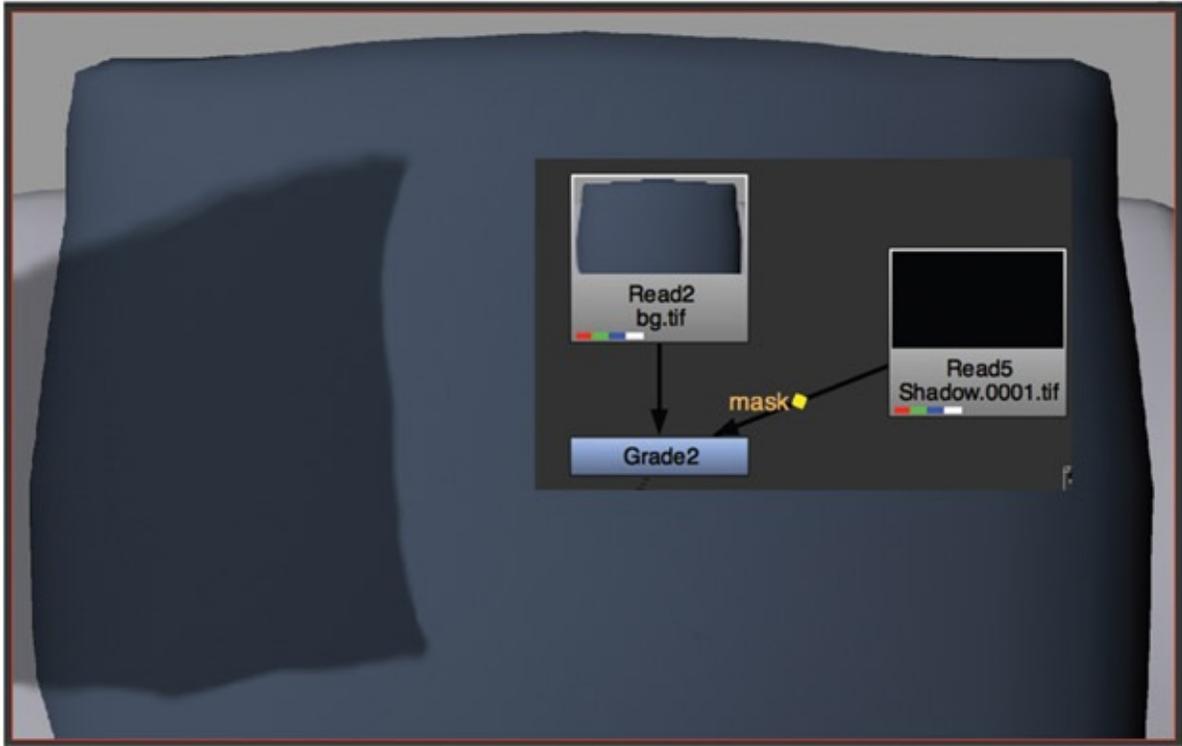
Shadow matte used to darken the background image

10. The last step is to put the two parts together. Select **Grade1** node and **Grade2** node. Add a **Merge > Merge** node (Hot key **M**.). The output of this merge node, called **Merge2 (over)**, should automatically connect to the **Viewer** node. (Figure 5.64).
11. To export your final movie file, you add a **Write** node to the last node in the tree. Actually you can put a Write node anywhere if needed. Select the **Merge2** node. In the **Image** tab, click on the **Write** node.
12. In the **Write** node's parameters, add the path and file name of your final output (for example, **JM_shot6_Final.mov**).
13. To kick off the final render, make sure that the **Write** node is selected (it should be orange) and click **Render > Render Selected** …
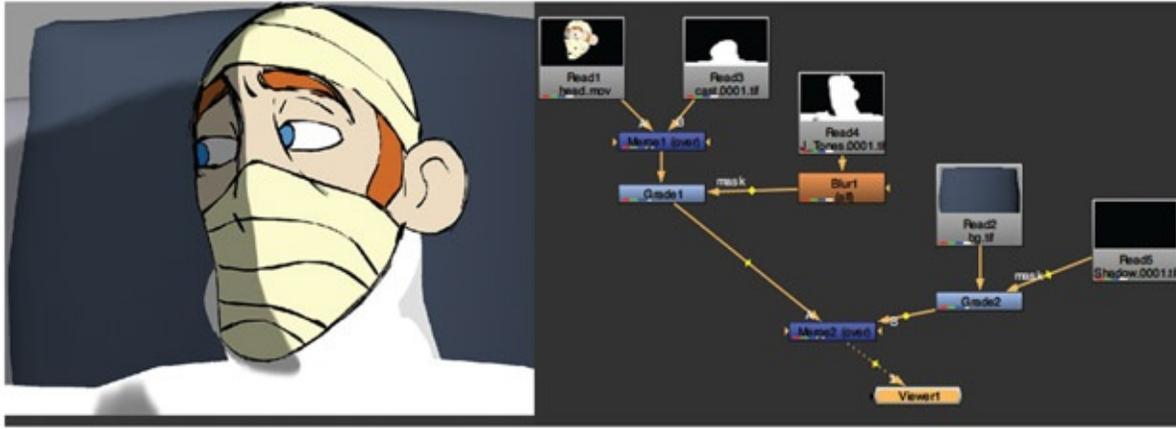
FIGURE 5.64 Final Composite Tree in Nuke

2D Tones and Shadows

When drawing tones in 2D, the artist has to calculate where the light is hitting the character or object and draw this 2D matte. It is essential that these mattes flow along the character's surface and react to the volumes of the character as it moves in the light. When drawing the shadows, the artist draws a stylized representation of where the shadow falls on the background. The mattes should not pop or wobble and draw attention to themselves; however, the mattes are usually blurred, so some wobbles will be minimized.

Shadows and tones do not have to be exact representations of what they should physically be. If they were, they would become too distracting, which can be the case with 3D tones and shadows. The mattes should be simplified ideas of the shadowed areas.

Figure 5.65 shows a coffee cup standing in the light. The light direction has been drawn in. You can see where the light rays have been extended through the coffee cup and onto the ground plane. This is the shadow area. Where the light hits the cup creating self-shadow areas, this is what is called tones. The tones follow the volume of the cup. Of course, this is a simple object. If your character has lots of dangling hair, eyeglasses, and so on, the tones and shadows could be extravagant. When creating 2D tones and shadows, you have the option of simplifying these elements so that they do not detract from the main animation.
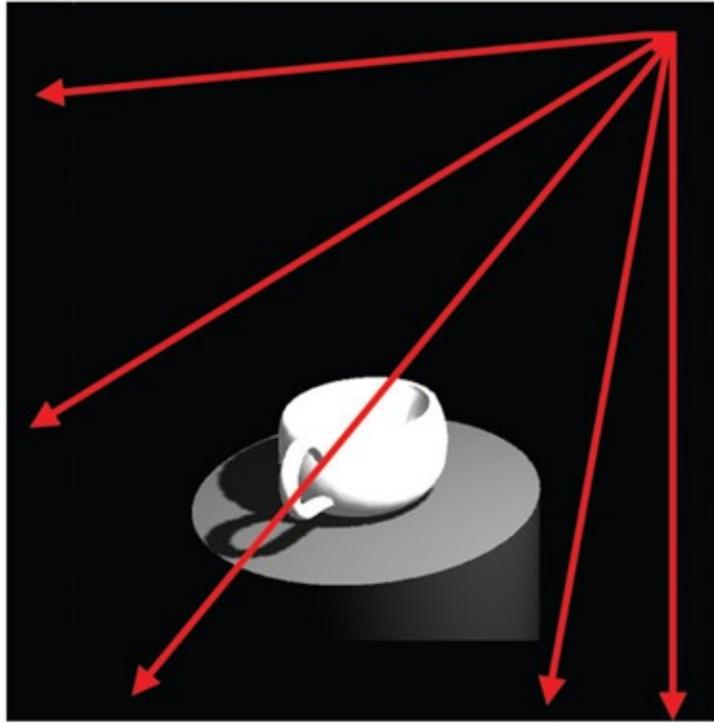
FIGURE 5.65 3D coffee cup showing tones and shadows

To draw 2D tones and shadows, you can use any method we have covered so far in this book: paper, Photoshop, Toon Boom, Corel, and the like. Paper would be the most difficult to keep registered because you would have to go through a printing process. Figure 5.66 shows four levels of images broken apart so you can see what each looks like. The cup and background level are 3D renders. The tone and shadow are drawn in Photoshop.
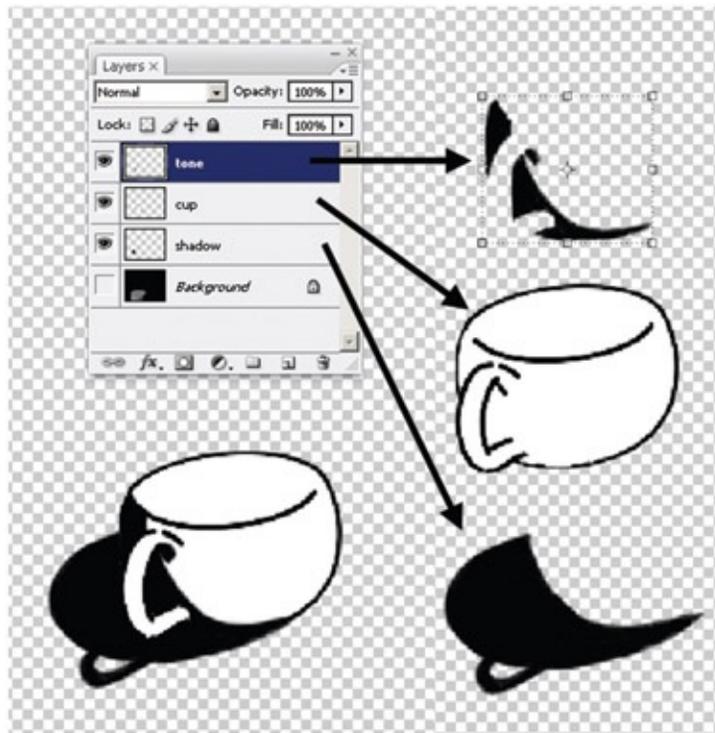
FIGURE 5.66 3D cup and background render and 2D tone and shadow drawing

You can follow the same processes we used before to composite the 2D tone and shadows into your scene. A tip to keep in mind when creating tones and shadows, especially with 2D, is that generally tones and shadows are blurred. 2D tones and shadows tend to be blurred more to help make them feel softer, much like you would get with a 3D tone or shadow. If you over-blur the mattes, they will pull away from the character (or coffee cup), as you see in Figure 5.67. When drawing 2D mattes, it is best to overdraw them so that they overlap the edges. In other words, draw outside the lines. Because we are using them as mattes on top of the character and tracking them as luma or alpha mattes, they will not be seen. So overdrawing the mattes will not cause any harm.
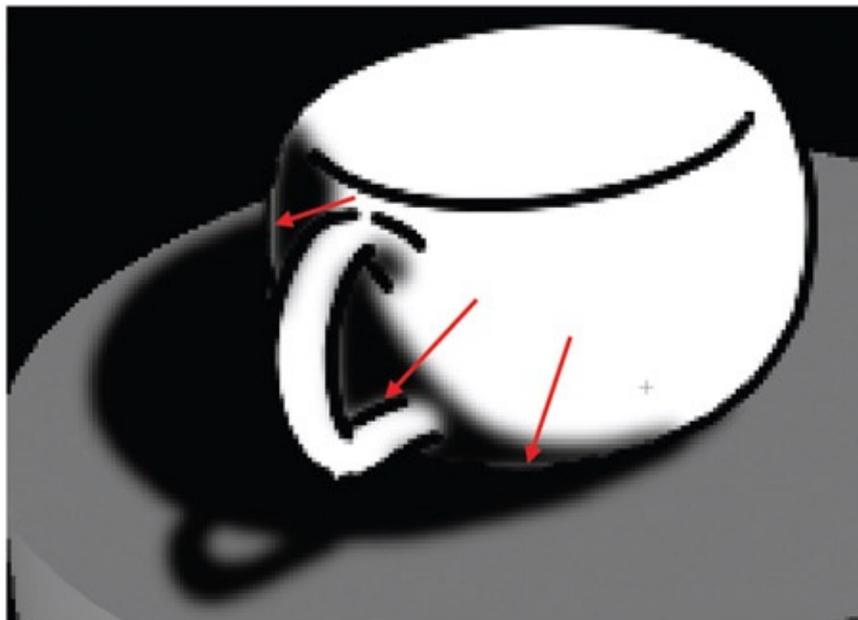
FIGURE 5.67 Overdraw mattes to keep them from pulling away from the edges when blurred during compositing

Further Reading

Gilland, Joseph. *Elemental Magic: The Art of Special Effects Animation*. Boston: Focal Press, 2009.

Student Contributors

Contributing students for this chapter, in order of contribution:

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Dan Murdock

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Jason Walling

Alston Jones

Daniel Tiesling

Camera

Flat, Limited, and Deep Space

FIGURE 6.1 Example of flat to deep space by John-Michael Kirkconnell, 2009, 2D/3D compositing class, SCAD

Lecture Notes

You, dear reader/student, now have examined working with 2D and 3D art. When combining animation media, the artist must create a world that houses these media. The next topic to explore is how to look at the world where these images come together.

The most common method (not that we are saying it is the best) is to put everything into a 3D world. Surely this has been the case as 3D objects and environments have crept into 2D animated films. In fact, the history of animation has seen a steady progression from the use of flat, to the use of limited, to the use of deep space environments. Mostly, in 2D animation we were accustomed to flat-space camera work until the multiplane camera was invented and we began to see limited and even the beginnings of deep space usage. Then a mismatch of the space usages began. We would find ourselves watching a flat-space film with some usage of limited space; a 2D character would be happily telling his story while moving left and right across the screen and sometimes coming toward the camera for added depth; and then, wham, we would come across a scene where the camera was suddenly liberated and moving through a 3D environment that possibly had a few 2D characters in it. Those who respond to titillation would exclaim, "Wow!" Those who respond to the story, would retort, "Oh, Boy! That was a failure." Why? We made the audience say, "Wow, look at the shiny thing," instead of feeling the story point more.

An example of such an incident came about when I was still in college at Ringling School of Art and Design (now Ringling College of Art and Design). At the time, the head of the training department at Walt Disney Feature Animation's Florida studio would visit the college every year looking for the next round of internship candidates for Disney feature animation. During the visits, Frank, the Disney representative, would treat us by giving a sneak prescreening of that year's animated film. At that time, it was a great treat in the lost end of Florida to see movies before they were released. Students nowadays can barely understand how special this was, given their current ready access to bootleg videos. (Oh, and if you think you can enjoy a movie on your iPhone, please skip this chapter. It is not for you.) Frank, who is a lovely, energetic man, screened a number of films during my stay at Ringling. One was *Beauty and the Beast.* I was studying computer animation at the time, so I was very tuned in to any use of 3D, as we all were. In the center of the film, of course, there is the great ballroom dance scene where the characters walk into a ballroom and the camera follows them. The camera then swoops up and around the ceiling of the ballroom, revealing all to be in glorious 3D and textured, and then it comes back down to swoop around the dancing 2D characters.

Many of us were stunned. What a lovely example of 3D usage. Wasn't that beautiful? Did you see that? They were really pushing the envelope. We all marveled together.

It wasn't until years later, when I worked at Disney and was more educated on the process and art of animation, that I realized some considered the scene a miserable failure. In one swoop, it took the audience out of the moment and showed off the technology.

The point to take away from this is that we shouldn't show off our technology, our

pipelines. There should be reasons for everything we do, including the world we create and how we move our camera about. It shouldn't take the audience away from the story—which is why we started this book with the question, "How do you know if it is successful?"
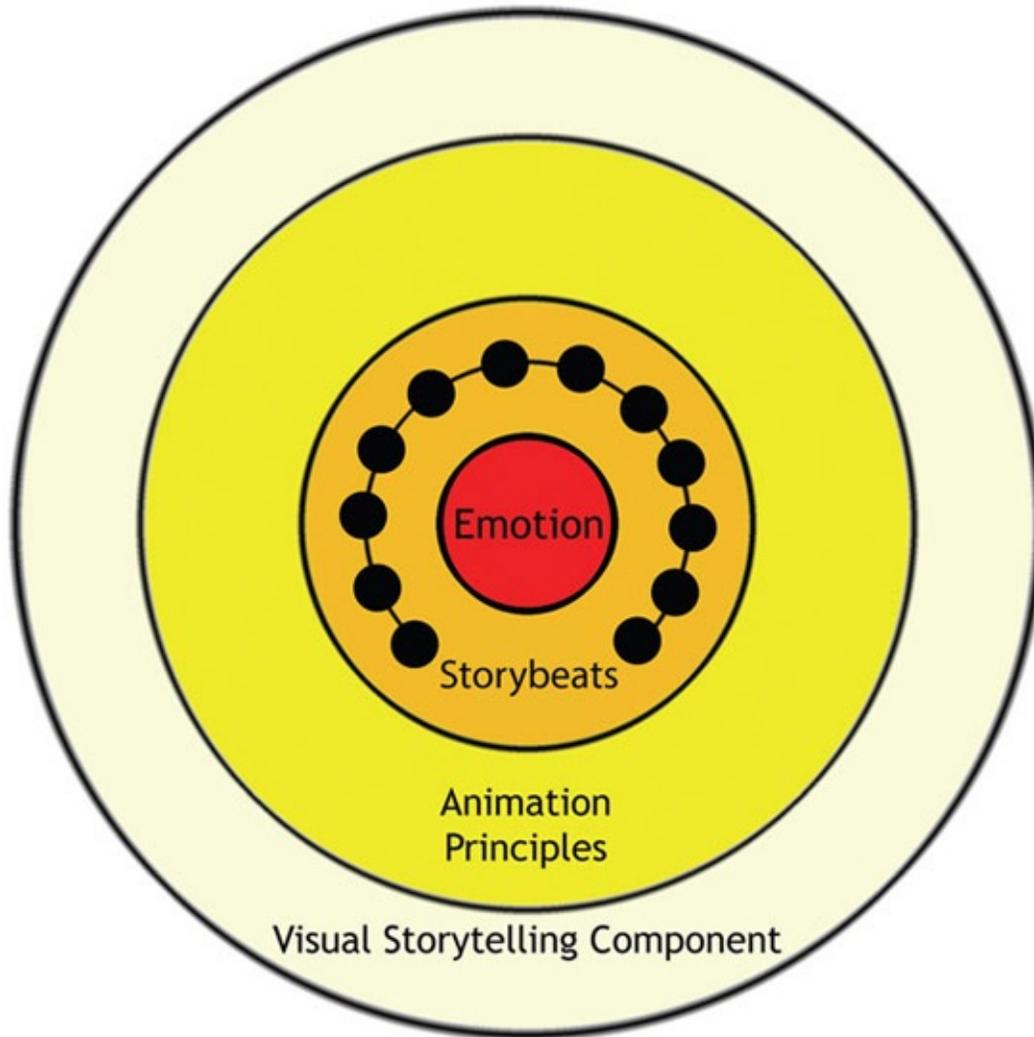
FIGURE 6.2 Bull's-eye to keep us focused on why we set up shots

We have come full circle, then. (I'm sure there is a pun there.) In Chapter 1's online companion data of this book, we discussed Bruce Block and the outer ring of the bull's-eye: visual storytelling components. If you haven't read that extra chapter or are not familiar with Bruce Block, please go reference that online chapter now: "Storybeats and Bull's-eyes." Block, in his teachings, reminds us to tie the intensity of our visuals tightly with our story. We know this; it is usually something we do instinctively. However, you might have noticed in your research that there is a fine line between adding visual intensity to a film when the story needs it and adding visual intensity to a film at every chance. The problem with the latter is that ungoverned intensity will become numbing and ultimately lower all intensity. If you have ever seen a visual effects film where one unit shot all of the exposition and talking heads and another unit executed all of the whiz-bang fight sequences, you might have felt this problem

profusely. It might have felt like this: talking heads = flat, flat, flat; fighting = wow, wow, wow. But possibly the fighting was over-wowed with each shot so that by the end you were thinking to yourself, "Is it over yet?" So to help us govern our usage of visual intensity, Block gave us the tool of charting the storybeats to the visual intensity.
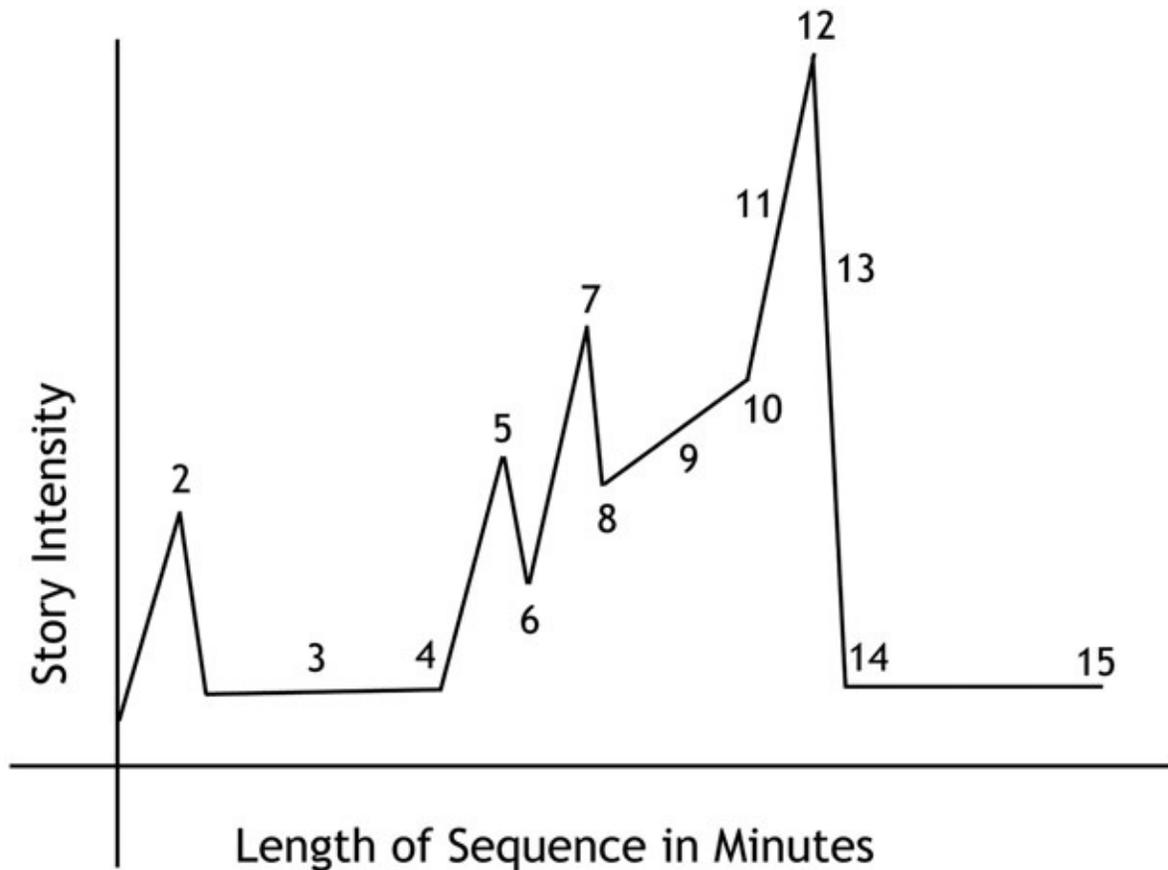
FIGURE 6.3 Block's intensity chart

Block's book covers all of the actors that can be used to display visual intensity. You will want to read and understand his text. We cannot cover all the ways to apply the different actors in this book. We have room only to discuss the actor called *space.* We will only be looking at the placement and movement of the characters and cameras in this chapter. You will have to pursue the other subcomponents of space in your supplemental readings of Block's book.

It has been rumored throughout the student body that any student who takes a class of mine should not move the camera. Students give each other the advice to always have the camera locked down. They explain, "Professor O hates camera moves." On the contrary, I love them. Yet they must be well done and have a reason.

When trying to understand where cameras should go and why, I found myself on a journey of exploration into many ideas, methods, glossary terms, and ideologies. Many cinematography books explained how certain camera positions would make the audience feel.

However, I found that some of the books were talking about single shots and not looking at the whole film and how the shots related to one another. If you want to gain a holistic understanding of using the camera, I would suggest a reading list that includes the best cinematography book you can find, along with Bruce Block's book, plus a concise book about camera mechanics, and something on the placement and movement of camera blocking. I suggest the following:

1. *Cinematography: Image Making for Cinematographers, Directors, and Videographers* by Blain Brown, for better appreciating why shots are set up the way they are.
2. *The Visual Story* by Bruce Block, for learning more about how to focus on the whole structure of the film as it relates to the story.
3. *The Bare Bones Camera Course for Film and Video* by Tom Schroeppel, for understanding what a camera actually is.
4. Hollywood Camera Work, which is an amazing resource of tutorials and includes an exhaustive set of tutorials on where to put the camera and how to actually move it. See the companion data and the website (www.hollywoodcamerawork.us) for more information.

Of course, reading books such as these helps to float glossary terms, rules, things to avoid, things to remember, and the like in your head during the creation process. However, you then need to have hands-on time in order to put these ideas into practice and develop them into a reality and not just an abstract idea. So before we continue on to techniques and methods that are being taught away from the larger context of a full story, please remember to utilize the Intensity Chart from Figure 6.3 and heed Block's teachings when you apply these methods to your story. Do not simply apply tutorial knowledge to your films without understanding the whole of it. I mean it, or I'll have to start lecturing to you on the neuroscience of it all. Don't make me do it.

Dig Deeper

If you wish to understand how the audience's brain is working as viewers watch your film and how to use that information to your advantage when trying to elicit emotional responses out of the audience, read *Synaptic Self: How Our Brains Become Who We Are* by Joseph LeDoux and view the numerous videos out there that focus on this topic, even those shown on YouTube.

Space and Camera Moves

Four types of spaces can be created in your film's world.

1. Flat space
2. Limited space
3. Deep space
4. Ambiguous space

We create these worlds and control them by our placement and movement of characters and cameras in relationship to one another. The following is a brief overview of a few of the subcomponents of space. Of course, refer to Bruce Block's book for a complete understanding.

Any of these spaces can be created in any medium. However, some media traditionally have lent themselves to certain special relationships.

Flat Space

Character placement. On the same vertical plane, similar size, move parallel to the camera.
Camera movement. Parallel to the characters, pan, tilt, zoom.
Parallax between levels. None.

The visible symptoms or subcomponents of a flat-space shot can be seen in how the characters are placed and move, how the camera moves, and how little parallax is shown between the elements. Basically, all depth cues are removed from a flat-space scene. Characters can be placed on the same vertical plane and be shown at similar sizes. If there are big and small characters, their size difference can be minimized by seating them or showing close-ups of the characters and not showing them standing next to one another. If the characters move at all, they should move in front of the camera and never toward it. If the camera moves, it should move parallel with the characters so that they stay a similar size throughout the shot.

Think about Charlie Brown for a moment, as he walks down the sidewalk into the front door of his house, out the back door of his house, and approaches the doghouse upon which Snoopy sleeps. If you have seen the comics or the television cartoon shows, you have seen an example of absolute flat space. The characters, in addition, are all just about the same size just to add to the flatness. It is the style of *Peanuts.* This style is allowed to be broken mostly when Snoopy fights the Red Baron. Okay, that's an old reference. Let's look at something that is in

the same realm but more modern: Calvin and Hobbes. Yes, that series probably never will be animated, yet a similar idea can be found in those comic strips.

In fact, 2D animation is easiest when created in a flat space. It is the perspective and parallax of movements that make it more difficult to draw. On the other hand, it is more challenging, yet rewarding, to make 3D worlds into flat space. This can be done by paying careful attention to the placement of characters and the movement of the camera as well as applying a mindful usage of tonal separation and textural diffusion. (You know where to go to read more about that.)

Camera movements for a flat space shot are pans, tilts, and zooms. Basically, the camera does not move. This keeps the parallax of elements down to a minimum. This is an easy space to achieve by locking the camera and characters in one position or, if they move, moving them together. If it is so easy, why is it not done in 3D very often? Because it is also just as easy to fly that camera around for no reason whatsoever. Remember, you must have a reason to move the camera and a visual rule to describe why you are choosing to pan instead of track, or zoom instead of dolly.

Pan

To pan a camera is to stand in one place and basically pivot the camera on its stand from one side to the other, usually to follow a character. As Figure 6.4 illustrates, when you pan the foreground elements and background elements, move across the screen at the same rate. How far apart are the foreground and background levels? You do not know, because the special clues have been removed. Note in Figure 6.4 that the distance between the branch and the boy's head never changes.

FIGURE 6.4 Camera pan

Tilt

Tilt is similar to pan in that the camera is held still and pivots on its stand. For a tilt, the

camera tilts up or down to follow an object. Usually something motivates the camera to move. That topic is beyond the context of this book; pity. Tilting, like panning, moves foreground and background elements up and down the screen at the same rate. Note in Figure 6.5, as was the case in Figure 6.4, that the distance between the branch and the boy's head never changes.

FIGURE 6.5 Camera tilt

Zoom

The act of zooming is done by a push of a button or a twist of a lens to change the focal distance. (In Maya, this is the focal length.) This action scales all characters, foreground and background, at the same rate.

FIGURE 6.6 Camera zoom

If you aren't quite sure about what a 3D world would be like in flat space, think about your grandfather holding the video camera. Not all grandfathers, but many, do not move much when they hold the video camera. They stand in one place watching the soccer game. They pan the camera from left to right across the field, tilt the camera up to watch the ball as it flies into the air, and use the zoom to gain a closer look at their prize grandson playing defense. As long as the soccer players run across the field and do not run toward the grandfather, you have an example of flat space.

Before continuing, please note that flat space does not mean that you must use the 2D medium. The same space can be created in 3D or live action. Students who are new to the concept of defining space sometimes confuse medium with spatial relationships.

In the hands-on section, we will take a 3D world and compress it to create a flat-space scene that has been inspired by the Coen brothers being inspired by Busby Berkeley in *The Big Lebowski*.

Limited Space

The following is a list of common attributes found in limited space:

Character placement. On distinctive foreground, midground, background planes
Camera movement. Track, multiplane
Parallax between levels. Parallel parallax

The visible symptoms or subcomponents of limited space are seen in how the characters and elements are placed in relationship to one another in front of the camera. Their placement is typically in distinct levels that will show off the distance between them as seen by the camera. You can think of these levels as a foreground, midground, and background. There may be more levels than this in actuality, but they are still usually grouped psychologically into a foreground, midground, and background area. Character movements usually stay within their given level with limited interaction back and forth around other elements in their level. In the purest version of limited space, there is no Z-depth movement of the characters or elements. The camera does not move toward the characters and elements, nor should the characters and elements come toward the camera. They are locked into their horizontal level. Perspective is generally still squashed as much as possible and vanishing points are hidden in this linear-space world.

Camera movement in a limited-space world is tracking the camera from side to side to give the depth cue of parallax between the levels. An example that you can look up on watchthetitles.com is *Teeth of the Night*. These titles use limited space and multiplanes throughout the sequence.

Track

To track is to pick the camera up and move it horizontally in front of the levels or, inversely, to pick up the levels of artwork and move them underneath the camera, depending on how you are compositing your shot. The object is to show off the parallax of movement between the characters. To do that you must understand the next concept: multiplane. In Figure 6.7 the camera is moved left in front of the characters. The characters that are farther from the

camera move across the screen at a different rate than the character closer to the camera.

FIGURE 6.7 Track shot

Multiplane

Multiplane is not really a camera move—it is the name of a camera designed in the early 1930s and perfected by the Walt Disney Studio. Now the term is used as a verb, meaning to set artwork up in such a way as to show the parallax between levels. This was originally accomplished by using the multiplane camera, which allowed artists to stack up glass plates and move them at varying speeds to simulate parallax of movement from left to right under the camera. The main idea is that the artwork is set up at different depths away from the camera and all of the elements move at varying ratios in relation to one another to display parallax.
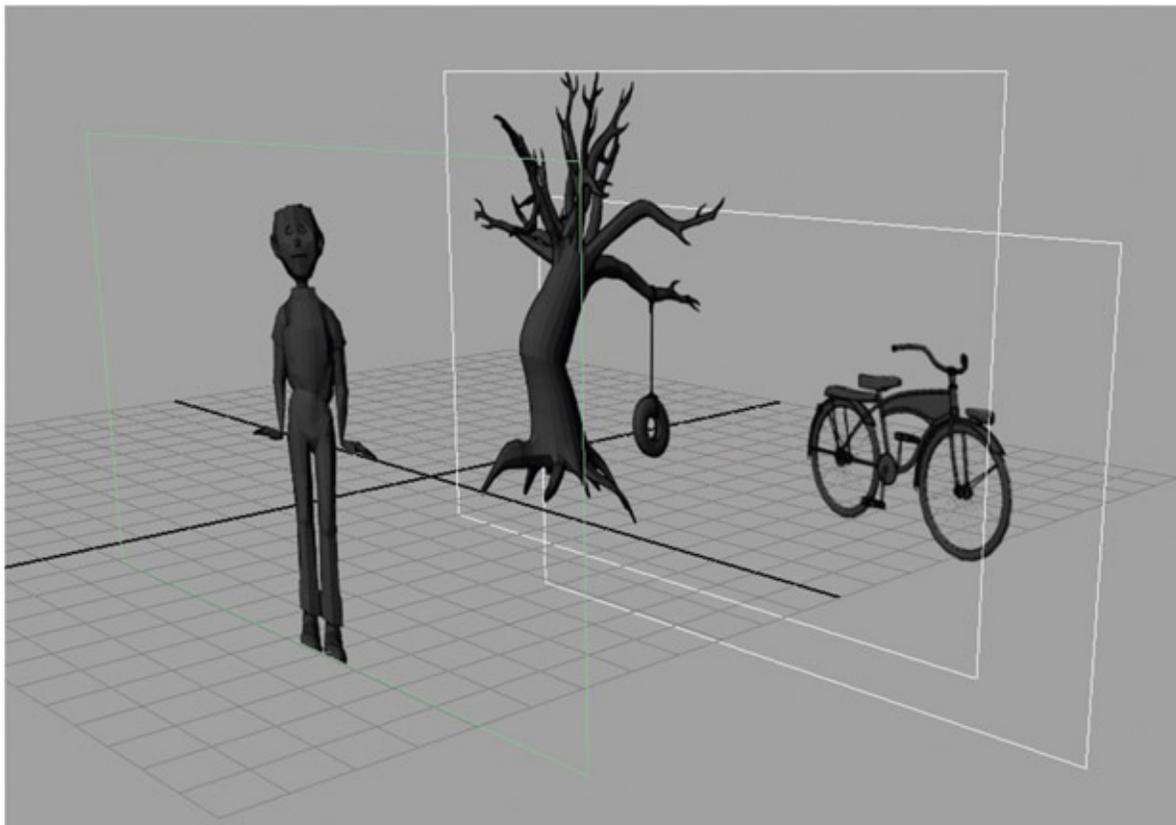
FIGURE 6.8 Multiplanes in a 3D space

You are probably most schooled in limited-space setups. This is the traditional setup for 2D animation. Foreground elements, background elements, and characters are set up into their individual planes. To break away from the flat space that comes with basic animation setups, tools such as multiplane cameras were created to help move the planes in relation to one another, causing parallax between levels. This was the case with many of the 2D feature animation films. Remember that just because something is in 3D does not mean that it has to be in deep space. You can set up a limited-space shot in 3D and live action as well. Think of a theater stage and the different fly areas in that stage. (If you've ever looked at the different levels of curtains on a larger stage and seen that they hide, you have seen the fly areas.) Early musicals and early films were vaudeville plays that had a camera set down in the audience's seat. Those films were most commonly in limited space. This can still be seen in the theater today. Why use it in 3D? As Block has suggested, it is a good way to emphasize the emotional center of your film. If you keep your characters jailed in limited space and then finally release them into deep space at a strategic point, the emotional impact will be all the greater. To emphasize this point, I like to show my students Chapter 16 from *Little Miss Sunshine,* in which the brother character, who has been held in limited space for a very long time, learns he is color-blind and finally escapes into deep space. Check it out—it is very powerful.

In the hands-on section, we will create a traditional multiplane scene using some wonderful imagery from a SCAD student's puppet theater. Because you are not in my classroom, I won't be able to play a song from my favorite musical to inspire you. It's a shame. "Little shop, little shop of horrors."

Deep Space

The following is a list of common attributes found in deep space:

> *Character placement.* Exaggerate size difference, move toward the camera
> *Camera movement.* Truck, dolly, boom, and other free movements of the camera (Steadicam, wire track, helicopter, etc.)
> *Parallax between levels.* Showing perspective, has vanishing point

Deep space is the most modern of world spaces. Most advances in camera usage have pushed this specific type of space. Even in animation, it wasn't long before the jump from multiplane limited-space scene setups became deep space, just by moving the camera toward the artwork and adding Z-depth. Compositing software packages were created that allowed

for these multiplane-type shots to have unlimited numbers of layers and to move beyond parallel parallax, and they added the ability for the camera to move in Z-depth through the flat levels easily. Z-depth camera moves are the definition of deep space, obviously.

Characters in a deep-space shot are placed to exaggerate the size difference, and dynamic compositions can be created. They are free to move toward the camera and the camera is free to move toward them. When using 3D, it is easier to create deep space than any other type of space.

An example that you can look up on watchthetitles.com is *Gruesome School Trip.* Though the titles are 2D flat planes, deep space is applied to them.

Track

For deep space, the camera can track, or move from left to right. The difference between a track in limited space and one in deep space is the exploitation of perspective. Limited-space shots do not have vanishing points or use three-point perspective, whereas deep space shots do.

Dolly/Truck

To dolly is to pick the camera up and move it toward the characters. As a result, the characters visibly scale at different rates. The opposite of this is a zoom (see the section on flat space), in which the characters scale at the same rate. In Figure 6.9 the boy character scales up at a slightly different rate than the background elements.

FIGURE 6.9 Dolly camera move

Boom

A boom is an interesting camera move. The camera is physically moved up or down. Sometimes it is combined with a pan or pivot, where the camera pivots on its moving stand to

continually face the character. This changes the perspective planes of the character, and all characters in view move at different rates (parallax). In Figure 6.10 the boy moves out of the frame more quickly than the background elements do.

FIGURE 6.10 Boom camera move

Multiplane with Perspective

If you take the concept of multiplane and add forced perspective onto the actual planes themselves, you create a world with deeper space. This is a method that has been explored in 2D/3D animation. It is achieved by taking what would normally be limited space, with different levels placed in Z-depth, then adding dimension to the planes to augment the parallax in the images themselves as the camera moves through the planes. Some might think this is a concept novel to animation; however, similar concepts have been used for years in theater stage design, live-action set design, and stop-motion stage design.

This type of deep-space multiplane with perspective was used throughout *Mulan, Lilo & Stitch, Prince of Egypt,* and many other films. Many "making-of" specials found on DVDs will show you how these shots were put together. You will have to use your well-developed eye to sort out more modern examples of 2D/3D multiplane with perspective usages, because most of these are found in short films. Some filmmakers, however, are kind enough to post their making-of videos on their websites. For example, take a look at the fabulous 2D/3D film titled *Le Building* and its making-of video at www.le-building.com.
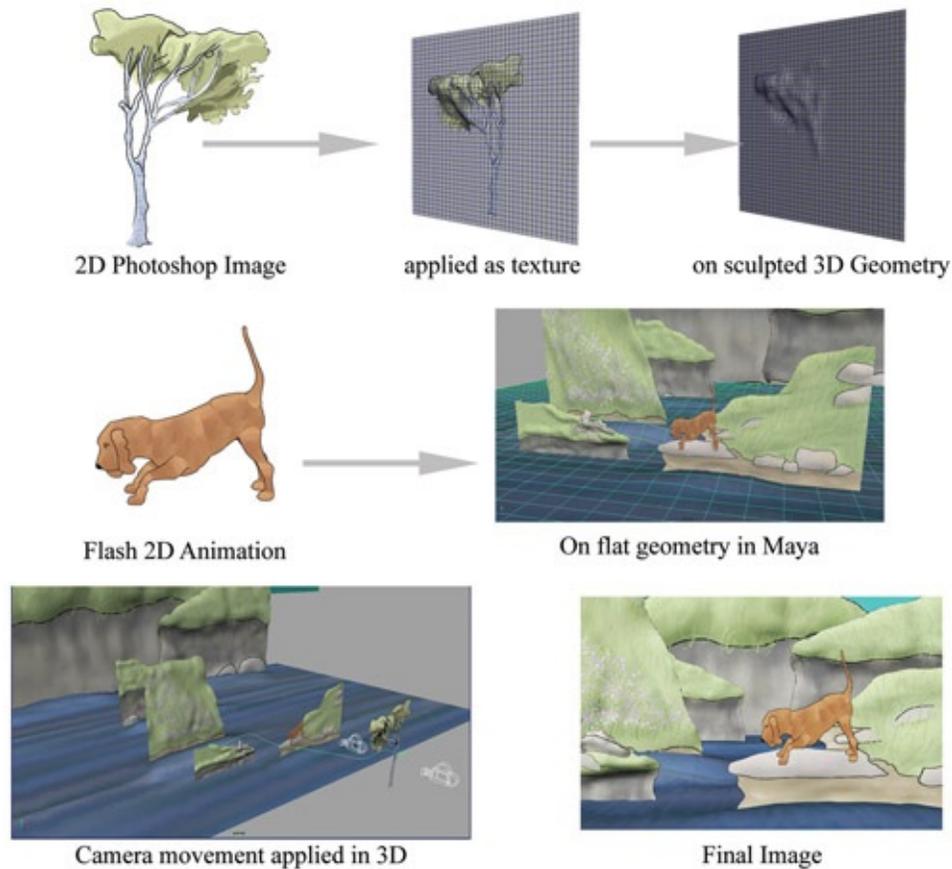
FIGURE 6.11 Multiplane with added perspective, by Jennifer Chandler, 2008, 2D/3D compositing course, SCAD

Fly-Through and Helicopter

We'll briefly discuss other types of camera moves that exploit the world in all axes. There are many ways to move the camera freely about the gravity-less world of a compositor or 3D Cartesian set. A fly-through is one way of exploring the set and is generally what it sounds like. The camera flies through the set, revealing parts of the environment. A great example of a 2D/3D fly-through is in the vine skateboarding sequences of *Tarzan.* Here, the fleet-footed Tarzan leads the camera as he barefoot-skates through the vines of the jungle. The camera moves all throughout the environment as this 2D character moves through the 3D vines.

A helicopter shot is one where the camera revolves around the character in a circle, sometimes for the whole 360 degrees. The focal point of the camera's movement remains the character for most or all of the scene. You have seen this shot in hundreds of films. In *Brother Bear,* for instance, there is a sequence where Koda and Kenai are sitting on a rock bluff. Kenai is about to break the news to Koda about the true reason for his mother's demise. The camera starts behind the bears and wheels around them. They are drawn in 2D and placed onto a background, which in my memory is a 3D rock. You can also see a great helicopter/360-degree shot of the horse in Dreamworks' *Spirit, Stallion of the Cimarron,* and even a good showing of

the 3D/2D in the making-of feature on the DVD. That example is absolutely seamless.
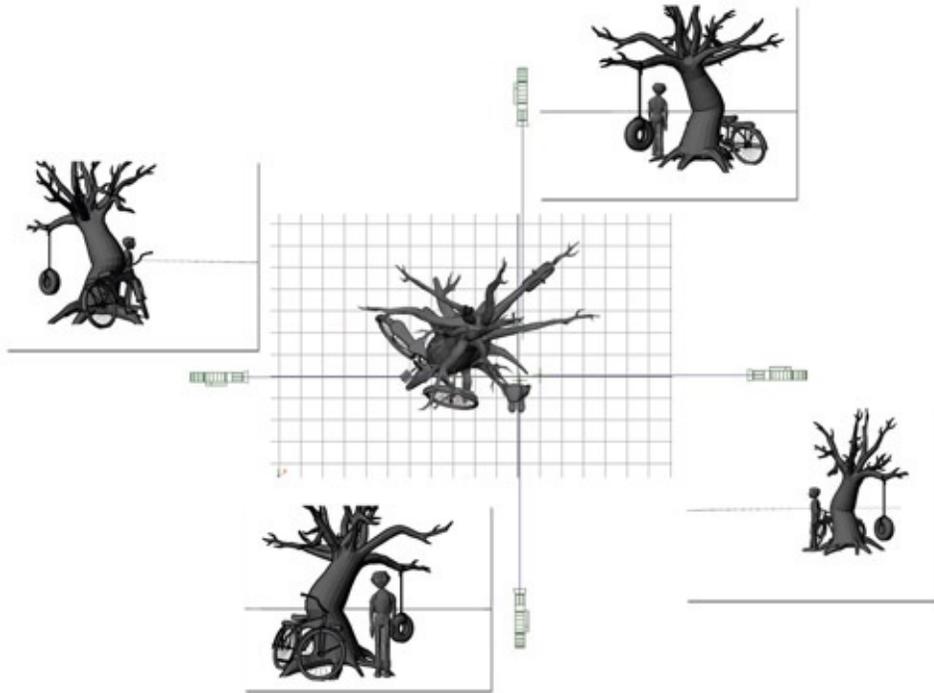
FIGURE 6.12 A 360-degree shot or helicopter camera move

Moving a camera around in a 3D world is easy and easily abused. In this chapter we will learn how to push a deep-space shot using multiple media and adding perspective to what would traditionally be a flat plane.

Ambiguous Space

The following is a list of common attributes found in ambiguous space:

Character placement. Anything to make the subject unidentifiable or to unsettle the audience

Camera movement. Anything to unsteady the audience: upside-down shots, reverse relationship to character movement

Parallax between levels. Anything to create a space that is off kilter or indefinable

Ambiguous space is often used or abused in horror films. It is hard to give it any other emotional center than that of confusing the audience, as it is mainly defined as a space in which the viewers do not know what they are looking at or where they are. Maintain a scene like this for too long, and the audience will lose interest. Use it sparingly, and you instantly increase the visual intensity.

There are varying degrees of ambiguous space, however. We'll put the zolly shot in the category of ambiguous space, because it is meant to be off-putting to the audience. It is a camera move that has a reverse relationship to the character's movement. A zolly is a zoom and a dolly combined. You have seen it used, surely. Pop quiz with extra credit for those who can name the person who first created the zolly camera move and what famous shot was it used for. To push the shot, you can also move the character away from the camera at the same time the camera moves in and zooms in. You'll note in <u>Figure 6.13</u> that the boy scales toward the camera while the background elements stay relatively the same size.

<u>FIGURE 6.13</u> Zolly example

All of the normal things to watch out for exist here: style matching, frame rate, timing, image sizes, and registration. Remember what we learned in <u>Chapter 2</u> ? Show contact points judiciously, focus on those that further your emotional focus, and hide everything else. Feet contact points are usually not highly emotional, just gravity at work, so they can be hidden most of the time to avoid giving away any bad compositing. If your characters are sitting and the camera move is a helicopter shot, hide the point where they are seated on the ground. Put a bush in front of them, another rock, something. That type of contact point between 2D and 3D is one of the hardest to keep from giving itself away. Again, where buttock contacts ground is not highly emotional, just weight. Save the stress of getting contact points perfect for the moments that support the emotional center of your shot. Now, if the buttock contacting the ground is amazingly intricate to the story being told, because the character's life was just saved by a wedged rock and the camera moves around in a sweeping arc to show the gravity of the situation, then yes, show that contact point.

Hands-On Examples

Four examples will be used: example art will be used to walk you through using compositing packages to create a flat space, limited-space shot, deep-space shot, and a forced-perspective shot.

Flat space. In the hands-on section, we will take a 3D world and compress it to create a flat-space scene that has been inspired by the Coen brothers being inspired by Busby Berkeley in *The Big Lebowski.*

Limited space. In the hands-on section, we will create a traditional multiplane scene using some wonderful imagery from a SCAD student's puppet theater.

Deep space. We will take a look in this chapter at how to push a deep-space shot using multiple media and adding perspective to what would traditionally be a flat plane.

Occasionally, students in my class confuse the idea of medium with camera space. They think that flat space must be done in 2D and deep space must mean 3D. Just to prove the point that it is camera space we are dealing with and that deep space can be created with 2D and flat space can be created with 3D, we will do just that in our hands-on examples.

Flat Space

The files for this hands-on project can be found in the companion data. The files are as follows:

- Maya_Files/**FlatSpace_HatPinLadies.mb**
- Maya file with animated objects
- Maya_Files/2 psd textures
- Image_Sequence/pinGirls.[1–80].tga

If you open the **FlatSpace_HatPinLadies.mb** file in Maya, you will see that two cameras are set up for the scene. The **persp** camera is set up for the flat-space shot. The **persp1** camera is set up for a deeper-space shot. Let's look at what makes this scene flat space.
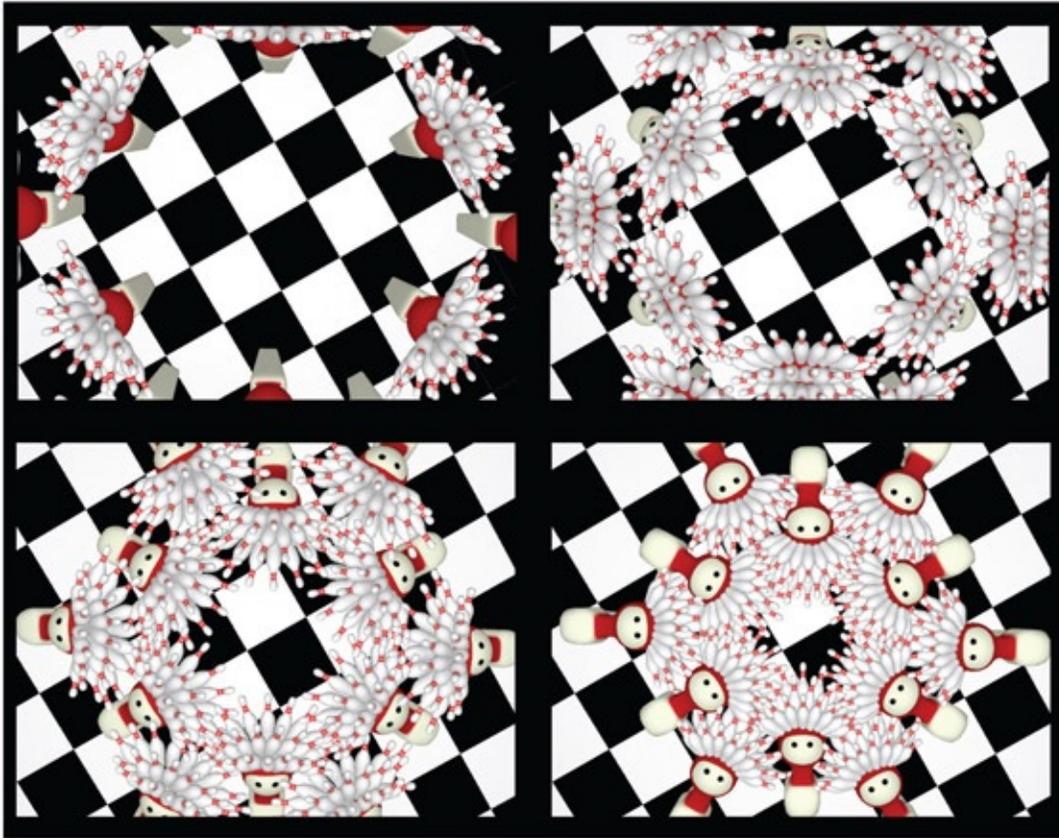
FIGURE 6.14 A flat-space shot

The points to remember when creating a flat-space shot can be broken down into the following elements:

1. Camera: placement, lens, and movement
2. Lighting
3. Texture

In this project, you will note that the camera has been placed looking down directly at the characters. There are no perspective lines, and horizon lines are hidden or minimized. The camera lens is an important aspect when planning a flat-space shot. In Maya, the focal distance is what you would adjust to get a narrow or wider lens. A telephoto lens is simulated by having a large focal distance. A wide-angle lens is simulated by having a small focal distance. You have probably learned something about cameras and know that a wider-angle lens exaggerates your perspective and basically creates a deeper space in your shot, whereas a telephoto lens compresses space and minimizes the perspective shift in your shot.

In <u>Figure 6.15</u> the original persp camera is looking down at the characters. The focal distance is a very large 197. In <u>Figure 6.16</u> the second camera in the scene, persp1, is in a similar position, looking down at the characters, but this camera has a focal distance of an incredibly small 9. You can see the difference in the exaggerated perspective lines of the

characters.

Horizontal Film Aperture	1.417
Vertical Film Aperture	0.945
Focal Length	197
Lens Squeeze Ratio	1
F Stop	5.6
Focus Distance	5
Shutter Angle	144
Center Of Interest	883.813
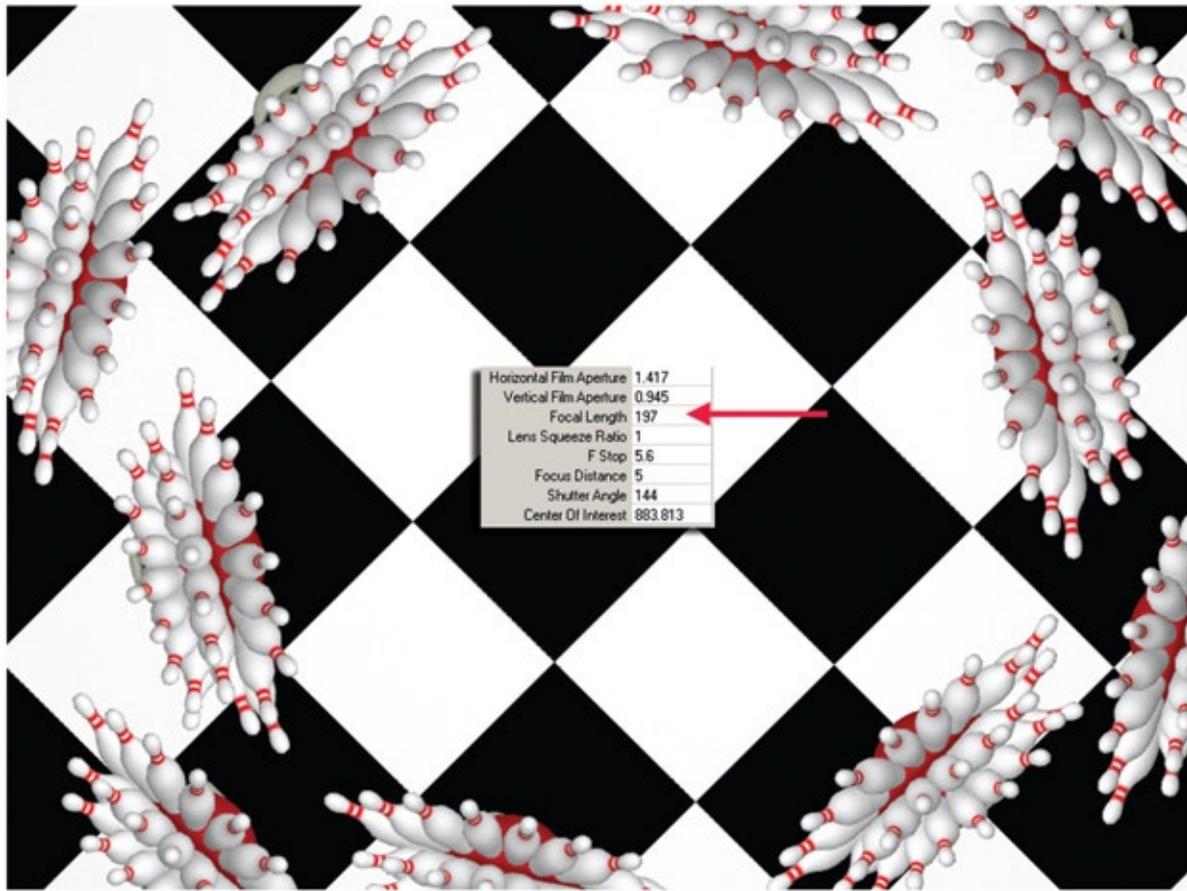
FIGURE 6.15 Camera with focal length of 197
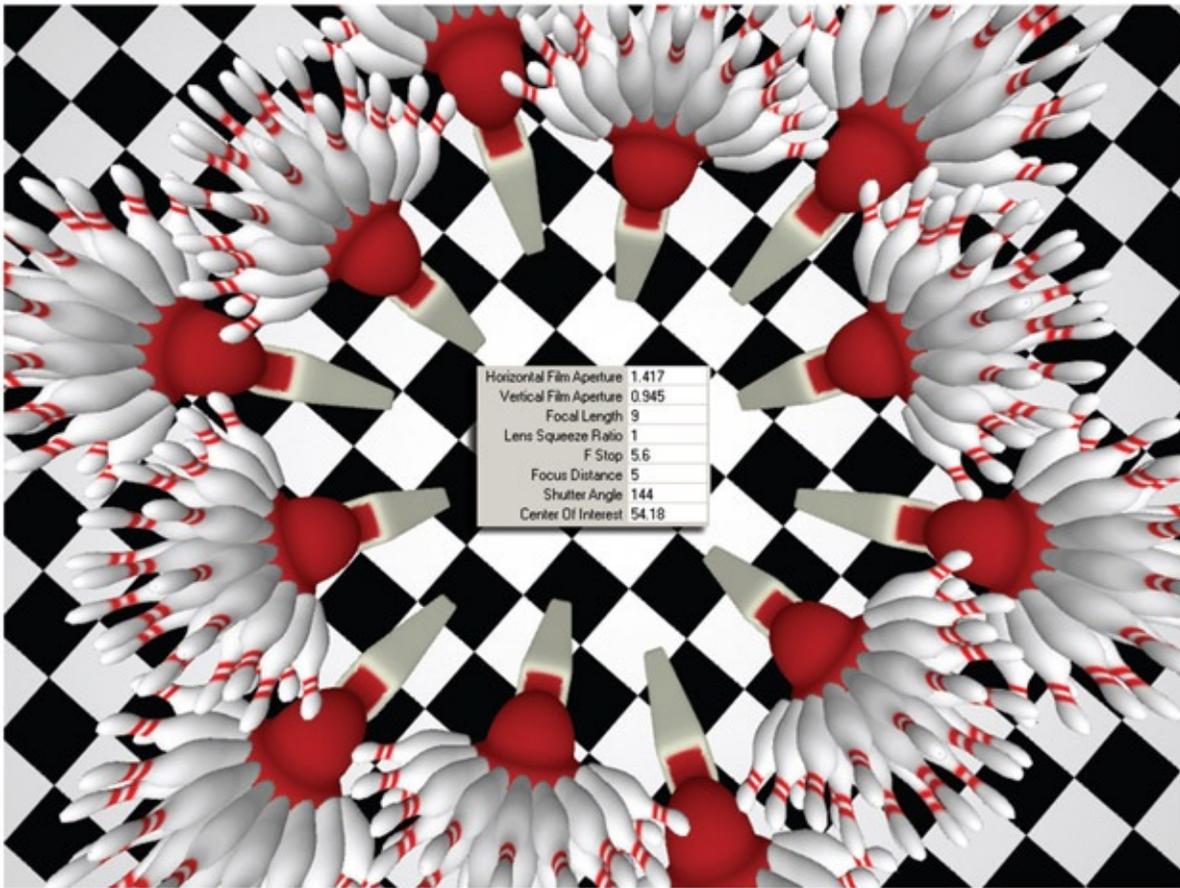
FIGURE 6.16 Camera with focal length of 9

To make the shot as flat as possible, lighting should be used to limit the tonal range seen. In other words, you do not want a high level of contrast in the lighting. You do not want tones and shadows, or, if they are present, they should be close in tonal range. I once saw a great example of a live-action set that looked like a Japanese pen-and-ink illustration except that there was a live model standing amidst the stylized set. The final image looked completely flat and lovely: a young woman in a kimono stood framed in pen-and-ink (at least in my memory they were pen-and-ink) cherry blossom trees and flowering bushes. However, a picture taken from the side of the set showed exactly what was going on to accomplish this amazing flat image: the stage was tilted toward the camera, and there was indeed depth in the shot. However, there were *dozens* of lights positioned all around the stage to illuminate everything and absolutely abolish shadows. The result was a lovely flattened space. That model had to have been extremely hot under all of those lights.

The same is true in your digital 3D space. You will need to light to get rid of shadows and flatten the image out. Welcome your friend the ambient light. I know, I know. Students of mine have just raised their hands to state, "But you said never to use ambient lights." Yes, this is true. "But you said they just washed out the scene." Yes, I admit it. But this is *precisely* what we want for this type of shot. We want to wash out all darkness. We have ultimate control and do not get shadows unless we ask for them; try doing that on a live-action set. Yet we still

need to make sure that the darker areas on an object's materials are minimized. Ambient light will help with this.
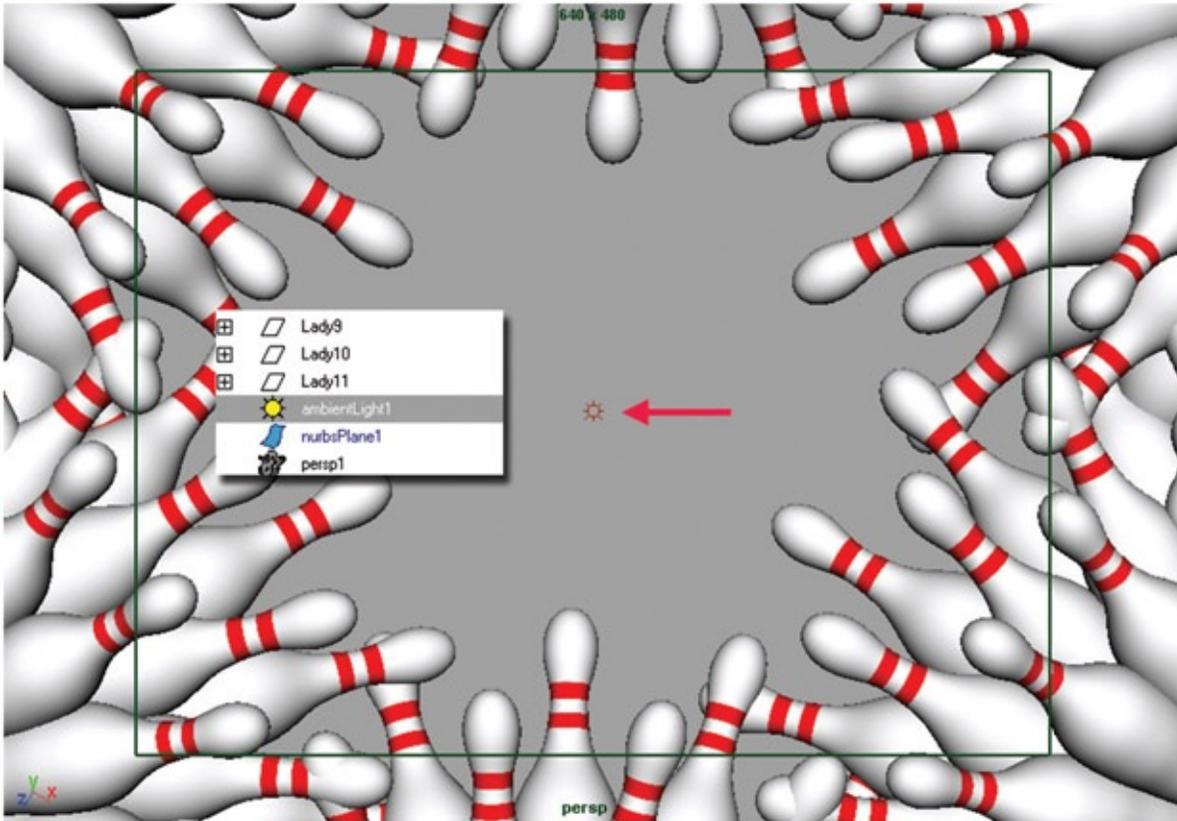
FIGURE 6.17 Ambient light added to the scene to flatten out the lighting

For the material and texture aspect of flattening your scene, the first idea is that the levels of texture detail should be the same throughout the image. If textures lose detail as they fade in the distance, this is a depth cue and starts to deepen the space. You might become annoyed with any darkness in the material color. If you are not using toon shading (which we realize does not react to light and flattens the 3D character), you can adjust the ambient color in the material. Let's do this together:

1. Open the Maya file from the companion data: **FlatSpace_HatPinLadies.mb**.
2. Open the **Hypershade** window either by clicking the button on the toolbar or by going to **Window > Rendering Editors > Hypershade**.
3. Locate the **PinMaterial**. Middle-mouse-drag it into the **Work Area** tab of the **Hypershade**. With that node selected, click the **Input and Output Connections** button. This will display the textures that are connected to the material node. You will see that a Photoshop file is being read into for the specular channel and color channel.
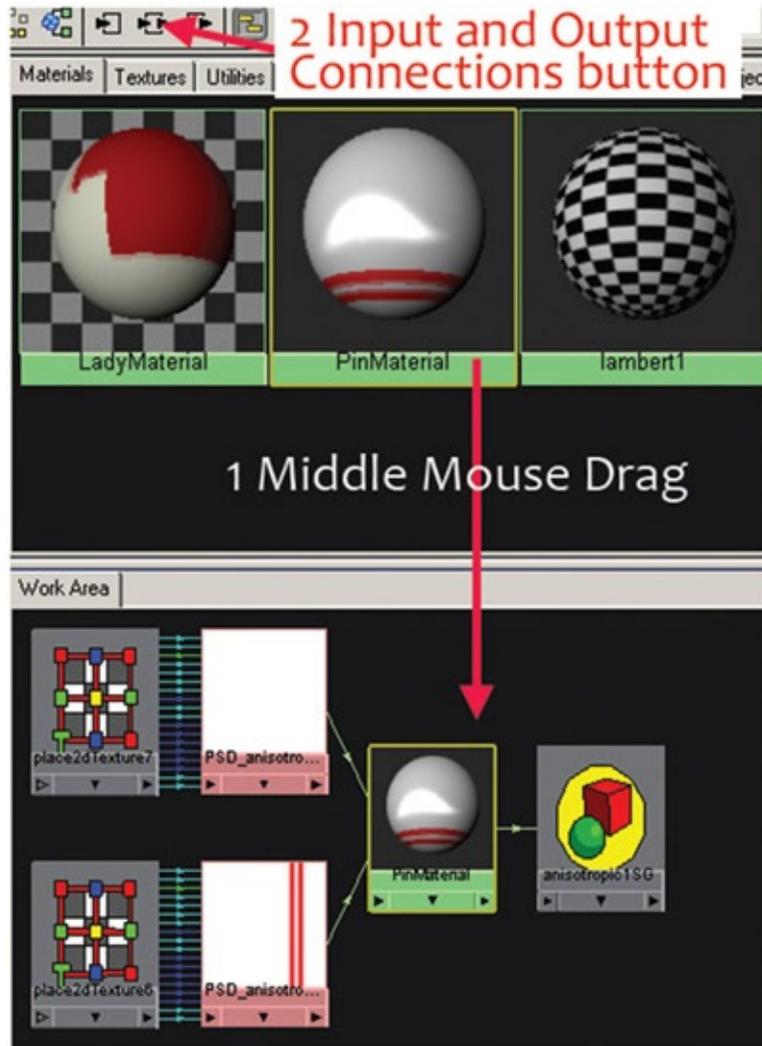
FIGURE 6.18 Seeing the input connections to the material node

4. In the fold-down tab menus on the left of the **Hypershade** window, locate the **Utilities** fold-down tab. Click the **Blend Colors** node. This will add a blend colors node to your hypershade work area.
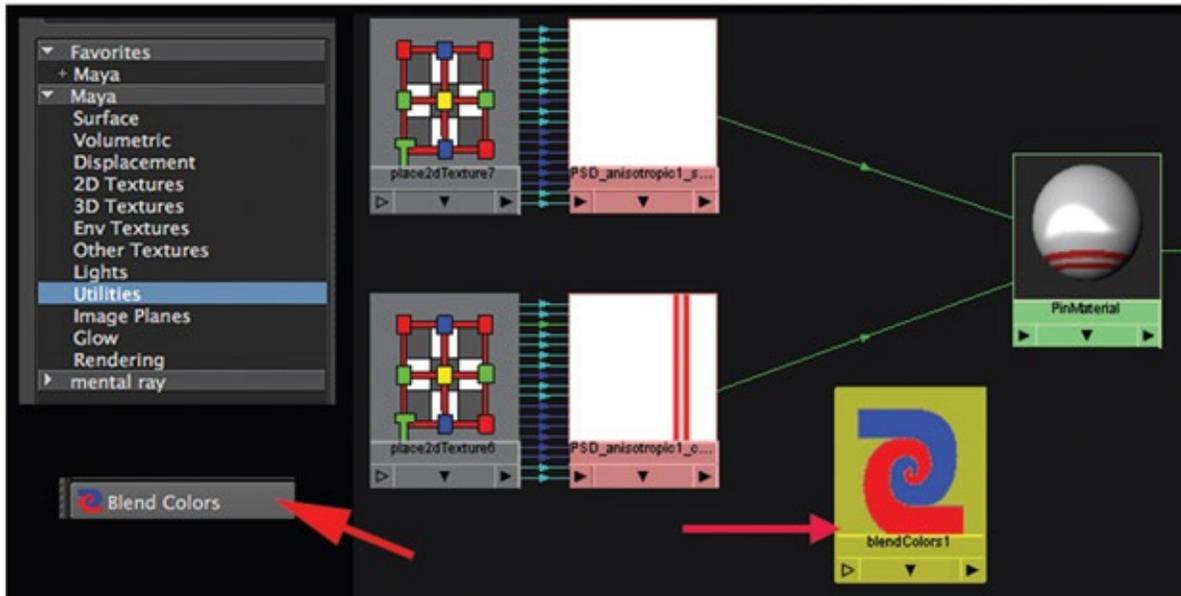
FIGURE 6.19 Adding a blend colors node

We want to add the color texture to the ambient channel. However, if we add it straight in, it will *completely* wash out any 3D shading. That might not be what you want. Let's look at that possibility first before we continue with how we'll do it in this tutorial.

An easy way to hook up the texture directly to the ambient channel is to double-click on the **PinMaterial** node. This should open the Attribute Editor for the **PinMaterial**.

Then middle-mouse-drag the **color** texture on top of the **Ambient** color chip in the Attribute Editor. You will see the connection is automatically made in the **Hypershade** window's work area. Figure 6.20 presents an example of this connection. The images at the top of the figure show what the material looked like before the addition of the ambient texture and afterward. You can see that the shading is completely flat, maybe too flat for our needs.
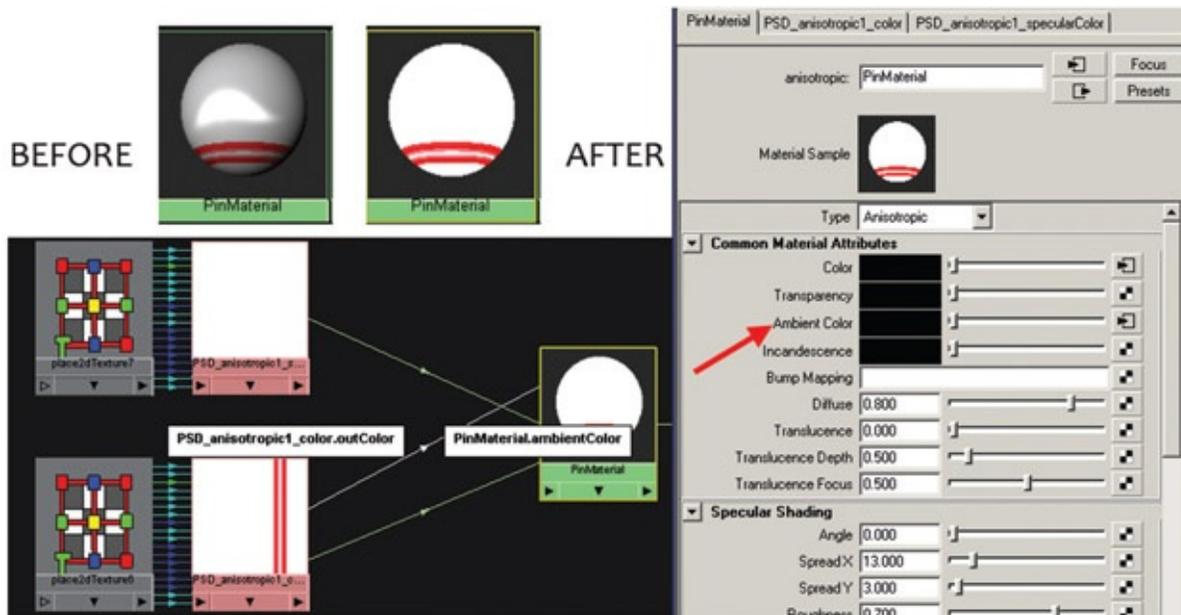
FIGURE 6.20 Adding the color texture directly to the ambient color

Instead we will carry on with our method. What we want to do is use the same color as the texture but knock it back a bit. In step 4 we created a blend colors node. We'll use it now.

5. **Click** the **Blend Colors** node so that it opens in the Attribute Editor. **Middle-mouse-drag** the **Color** texture to the **Blend Colors** node's **Color 1** color chip.
6. Add a **gray** color to the **Blend Colors** node's **Color 2** color chip.
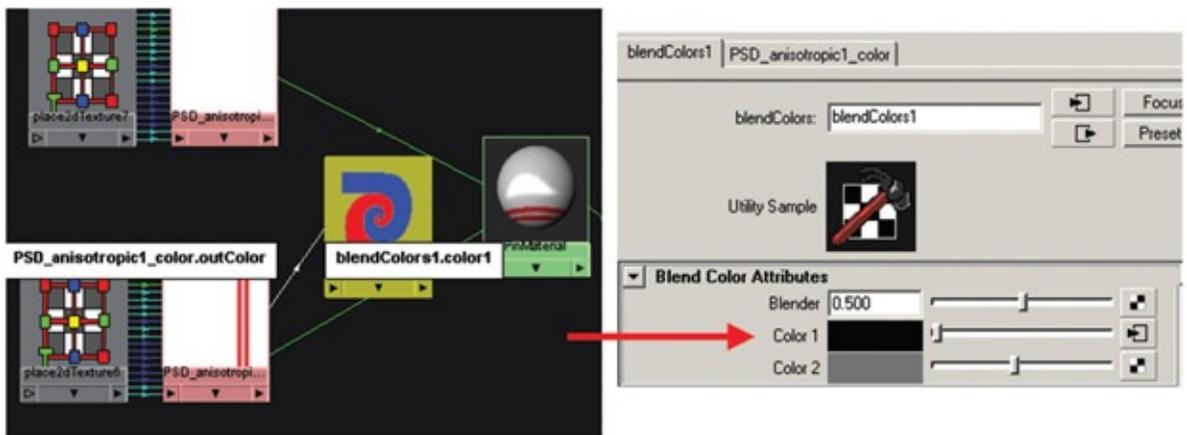
FIGURE 6.21 Adding color texture to the **Blend Colors** node

7. Click on the **PinMaterial** so that it appears in the Attribute Editor. **Middle-mouse-drag** the **Blend Colors** node to the **Ambient** color chip in the Attribute Editor. The connection will update in the **Hypershade**'s Work Area tab. The image preview of the Attribute Editor shows a small amount of shading but not a lot.
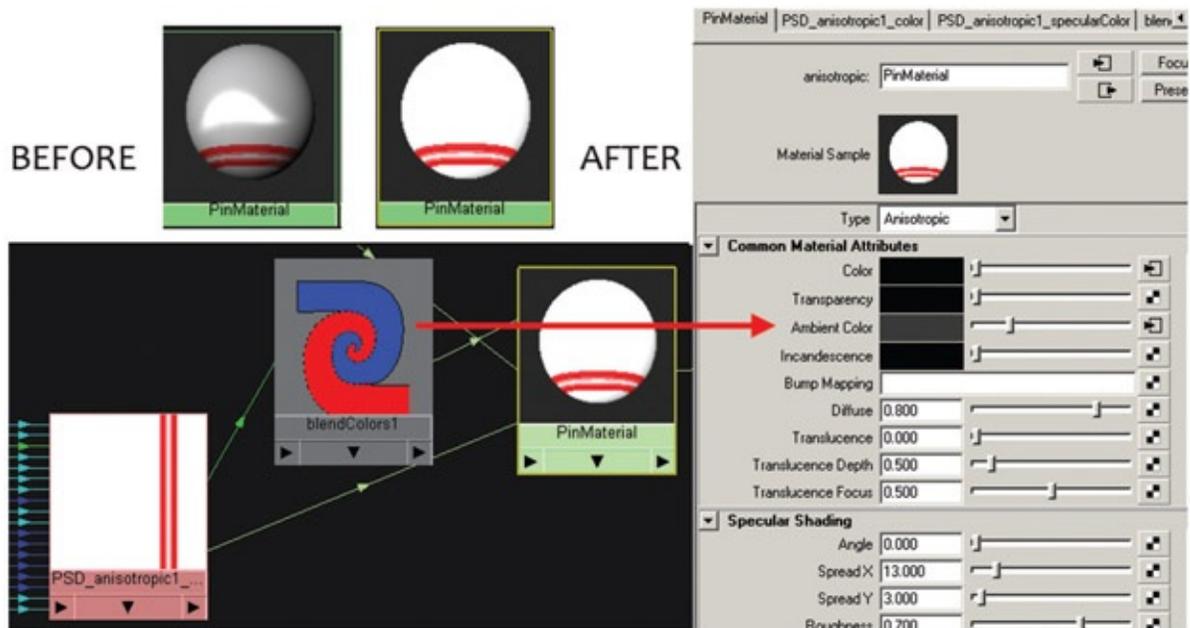
FIGURE 6.22 Connecting the Blend Shape node to the ambient color

8. Click on the **Blend Colors** node and adjust the **Blender** attribute in the Attribute Editor. A value of 0 will give an ambient color of gray (or whatever Color 2 is). A value of 1 will give the texture as the ambient color. Anything in between is a mixture of the two.

Figure 6.23 presents four material previews. The one in the top left is the original anisotropic material that we started with. The one in the top right is with the color texture used directly as the ambient color; it gave a completely flat look. The bottom chips use the Blend Colors node to blend between the color texture and a gray color. This allows some shading but still keeps the render looking flat.
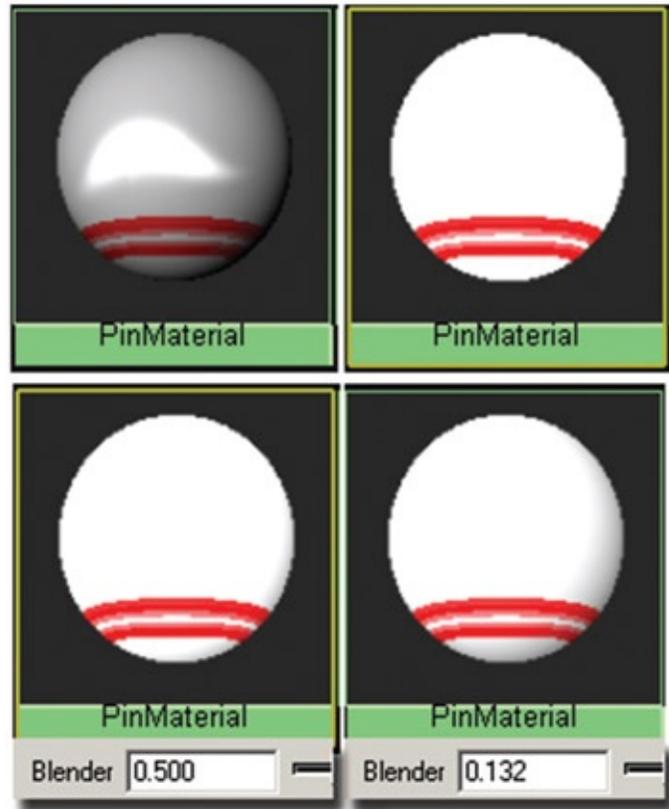
Materials with and without ambient color

The final project for this tutorial is saved in a file named **FlatSpace_HatPinLadies_v2.mb**. In this file, a similar Blend Colors node technique has been applied to the ladies as well.
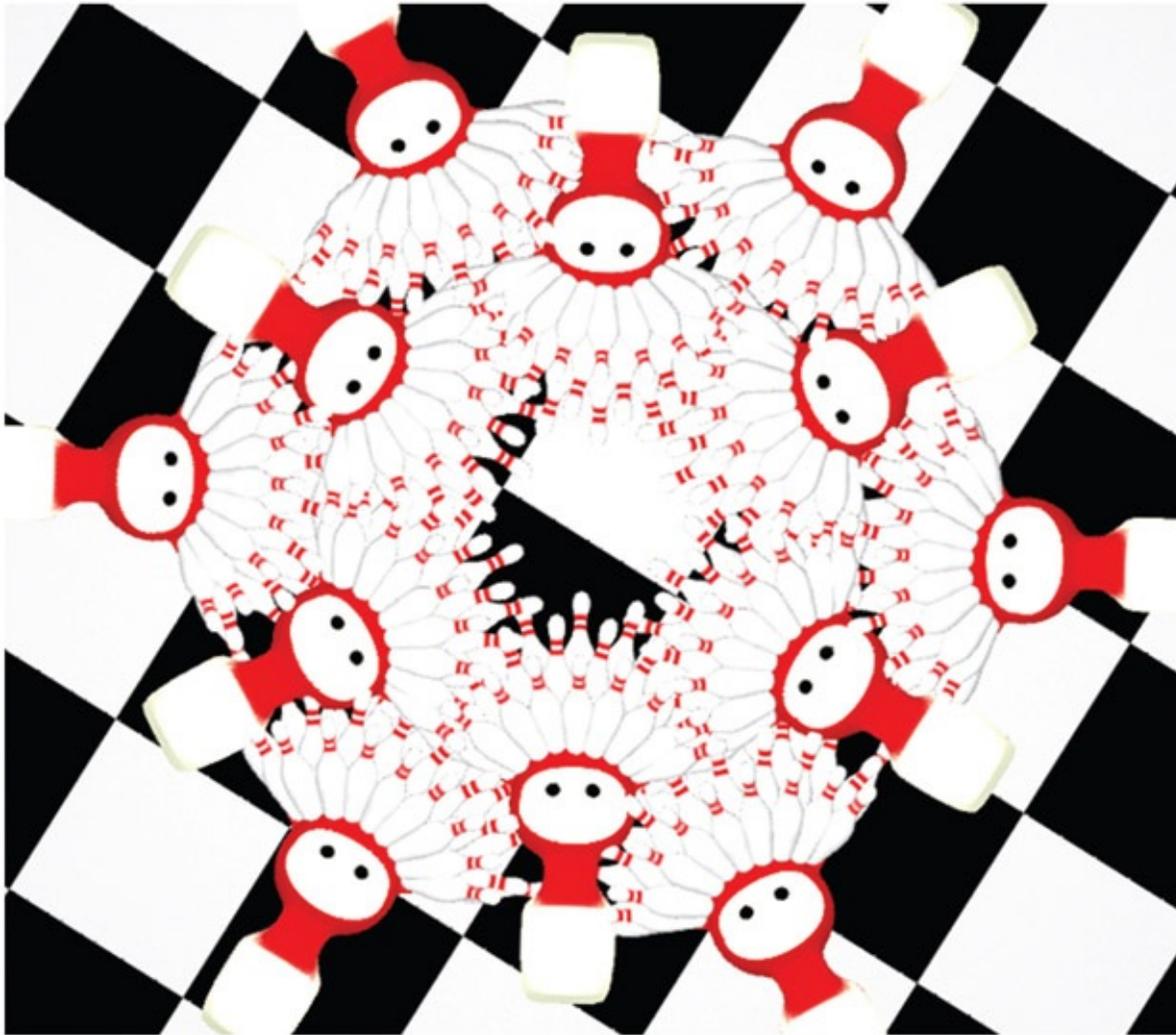
FIGURE 6.24 Flat space scene with flat lighting

Limited Space

Limited space is what you experience in theater and in 2D animation. Most equate this type of space with multiplane setups, where the background moves at a different rate from the middle ground, which moves at a different rate than the foreground. The levels can have parallax of movement, but to maintain limited space and not become deep space, there should be no movement toward the camera.

The points to remember when creating a limited-space shot can be broken down into the following elements:

- Artwork placement in relation to the camera
- Movement of the artwork parallel to the camera
- Movement of the camera parallel to the artwork

The files for these hands-on projects can be found in the companion data. The files are as follows:

FIGURE 6.25 The main under-the-sea levels

FIGURE 6.26 Character one by Yossaya Aisiri, 2008, SCAD

FIGURE 6.27 Character two by Yossaya Aisiri, 2008, SCAD

FIGURE 6.28 Character three by Yossaya Aisiri, 2008, SCAD

FIGURE 6.29 Character four by Yossaya Aisiri, 2008, SCAD

FIGURE 6.30 Character five by Yossaya Aisiri, 2008, SCAD

We will use the 3D camera in After Effects to set up the artwork into varying depths, then we will move the camera to show parallax between the levels: a basic multiplane camera move. You can accomplish this move in software that does not have multiplaning capabilities by moving the artwork at different rates. We will also recreate this shot in Flash to show that technique. Once you see the two most common methods for accomplishing this type of shot, you should be able to re-create it in any software. Oh, we'll go ahead and try our hand at Toon Boom too, while we're in the neighborhood.

Using a Compositing System's 3D Camera

Nuke, After Effects, Toon Boom, Smoke, and many proprietary software packages that I have worked on have implemented some type of 3D camera that figures out the depth of the artwork in relationship to the camera when either is moved. Most of the systems I have seen have been extremely similar. The only difference in the proprietary software packages that does not show up in off-the-shelf software is the capability to set the artwork scale relationship so that when a piece of artwork is moved back in depth, it automatically scales to visibly stay in the same scale relationship to the other drawings. I'll bet we could come up with an After Effects expression to do that. Extra credit, anyone?

Our first example uses a normal 3D camera for multiplane setups in After Effects. In version CS3 of After Effects or later, you are able to bring in Photoshop files and maintain the layers. This is an extremely useful feature. Of course, if your production pipeline needs .tif files or tga, you can still use those individually. Using a psd file allows us to create the levels in Photoshop, see the relationship of the layers in their composition, and save them all in one file for safe transportation. It is up to you what your pipeline needs. For this example, our Photoshop file is a static image. There is no animation in these files.

As an aside, this is only one method for working on projects that use both After Effects and Photoshop, and as you have noticed, this text is not the end-all/be-all text on how to click every single button in these software packages. After Effects, Smoke, Nuke, Photoshop, Illustrator, Flash, Corel Draw, Toon Boom, and any other packages we might have touched on are huge software packages. With hope, this text has been a great "getting your toes wet" opportunity, and you will be fearless in picking up some great texts that explore the packages in depth. There are even some great concepts in the help documentation, and if you read the documentation you will note that Adobe has some wonderful online video tutorials as well. How's that for information when you need it? For example, here is a great video to watch for more information on using Photoshop and After Effects together: www.adobe.com/go/vid0252. This link can be found in the help documentation along with many others.
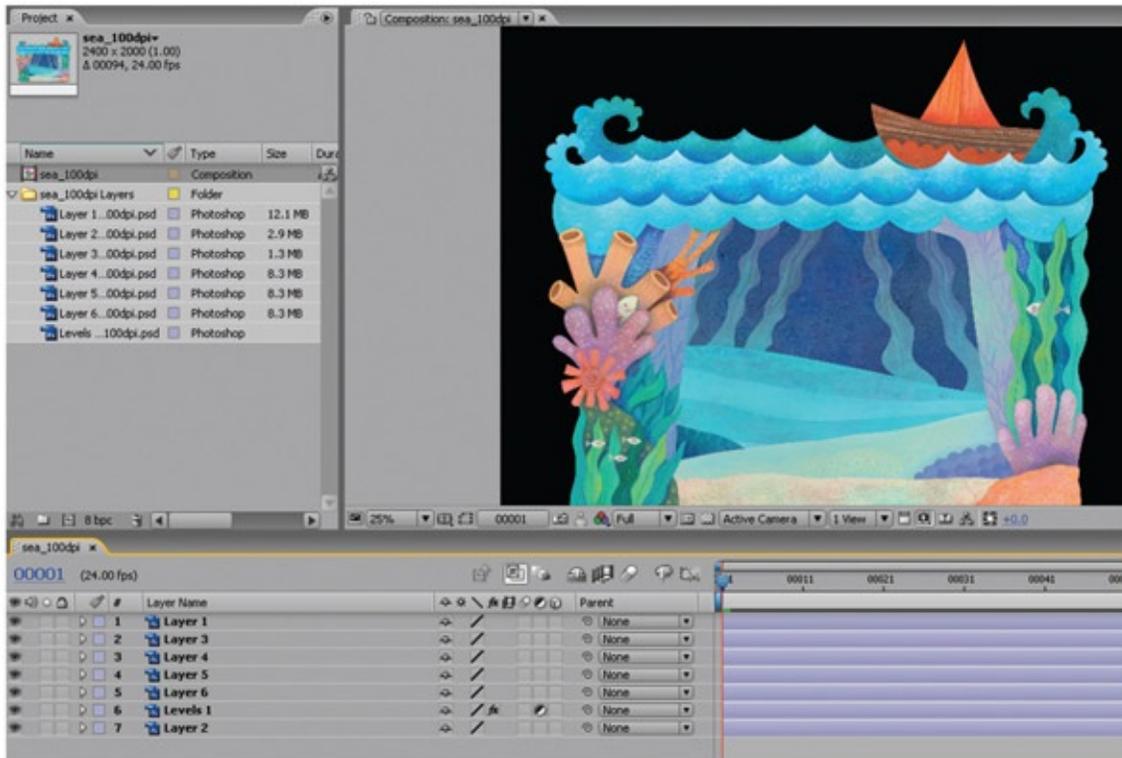
FIGURE 6.31 Composition that was automatically created

Follow these steps to create a multiplane shot in After Effects:

1. Click **File > Import File** (or double-click in the project tab).
2. In the file browser window, select the Photoshop file **sea_100dpi.psd**, found in the LimitedSpace folder.
3. Select **Import as: Composition** (in older versions of After Effects, choose **Composition—Cropped Layers**.) Leave the default setting of Editable Layer Styles on.

> You might ask, what is the difference between the different "import as" options? The video link mentioned earlier actually explains it. You might be familiar with the way footage merges the layers together as one image or lets you choose which layer you want to use. We want to use all of the layers, so our choices are Composition or Composition with cropped layers. If you bring in the Photoshop file as composition, it will bring in each layer with the same size as the document. The pivot point will be at the center of the whole image. If you bring in the Photoshop file as composition with cropped layers—you guessed it—the layers are cropped and the pivot point is at the center of the layer itself. All of the layers are still positioned as they were originally created, only their cropped size and pivot point are different.
>
> The layers are brought in and placed nicely in a folder, and a composition is

automatically created. That saved many button clicks, didn't it? Anything that saves a click or two is great! Those clicks and drags add up to precious time saved.

4. Double-click on the composition titled **sea_100dpi** to see the layers together.
5. To help remember what layer is what, take a moment to rename the layers in the composition. **Click** on the **layer** so that it highlights, and hit **Enter** on the keyboard to rename the layers.
6. To place these layers in depth, we will need to turn on the 3D icon. It is located on the layer itself and looks like a cube. Click each layer on.
7. **Right-click** in the Composition tab and select **New > Camera**. For this hands-on project, we will use the default camera. Feel free to experiment on your own for the chapter assignment. Click **OK** in the camera options window. You will notice that a camera has been added to your composition. It doesn't matter where it is in the timeline. I prefer to have the camera at the top of the timeline for easy access.
8. To make it easier to see what your camera is seeing and where the artwork is in front of the camera, change your viewport to have **two views**. Have the left view show a top orthographic view by clicking once in the left port and making it the active port (you will see yellow triangles at each corner). Then change the view drop-down to **top**. Have the right view show what the camera is seeing by clicking once in the right port, making it the active port. Then change the view drop-down to be **Camera 1**. See Figure 6.32 for an example.
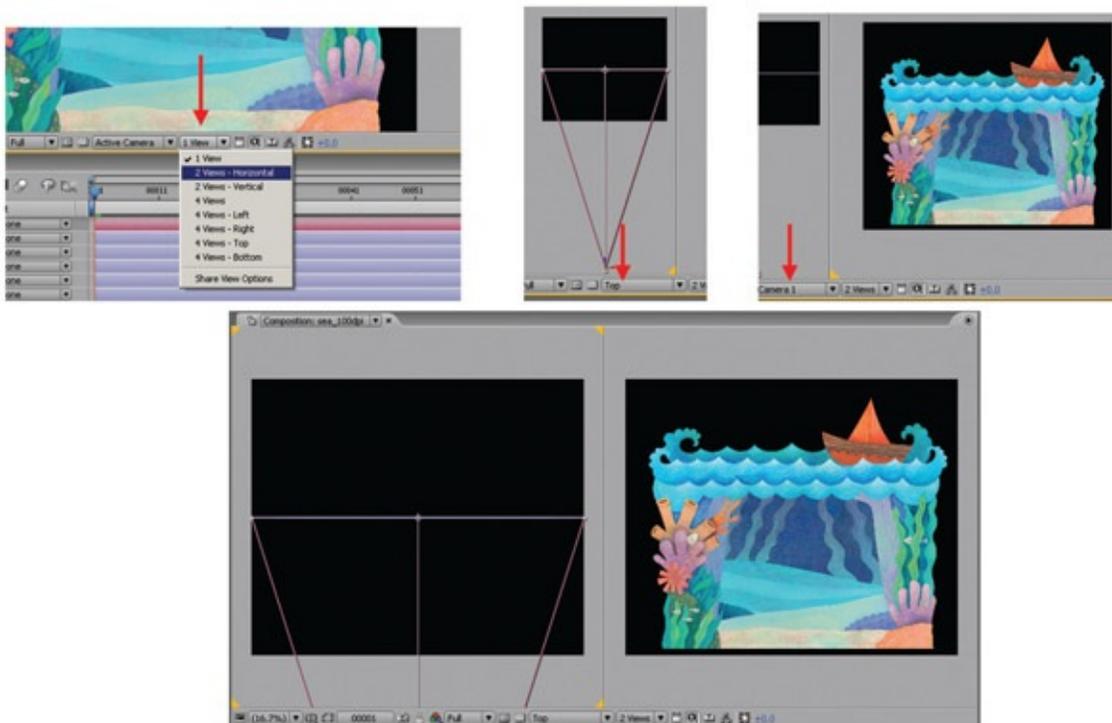
You can reposition the image in the viewports by using the **space bar** and click (pan) or zooming in and out with the mouse's middle roller ball (should you have one) or using the hot key **z** (zoom in) **alt + z** (zoom out).

Next, you will want to position the artwork in front of the camera.

We have turned each layer into a 3D layer. This has added another dimension to the transform attributes. We can now simply move them back in Z-depth:

1. Select each layer, and locate the **Position** attributes. (You can show just the position attributes with the hot key **p**.) Start by moving the **bg** layer back in Z away from the camera. You can drag on the Z attribute with your mouse button, or in the preview window, click and drag on the Z translate manipulator.

   You will notice that the background layer looks smaller now that it is moved back in space. Perhaps on the website we'll have a special trick on how to put in an expression to hook up scale to the Z position so that it automatically scales. For now, follow this step.

2. Scale the **bg** layer so that it matches visually the size of the other layers when viewed through **Camera 1**. You can show just the scaling attributes with the hot key **s**. In our example, the **bg** image was moved back to about 4000 in Z, and the scale was adjusted to 200.

3. Repeat for the next layer. The reeds layer, for example, has been moved in Z to 3500 and scaled to 190. In the companion data, you can see an image in which the reeds layer is a little bit in front of the background layer but still visibly the same size when seen through the camera. You'll note that the position and scale attributes are the only attributes visible. You can achieve this effect by using the hot key **p** and then holding down **shift** and then the hot key **s** to show the position attribute; then add the scale attribute.

4. Repeat for all of the layers. See for an example. You'll note that the way things are placed in the timeline has no correlation as to what is in front or behind another object in Z position. In fact, the boat and TopWave are at the bottom of the timeline yet closest to the camera in Z.
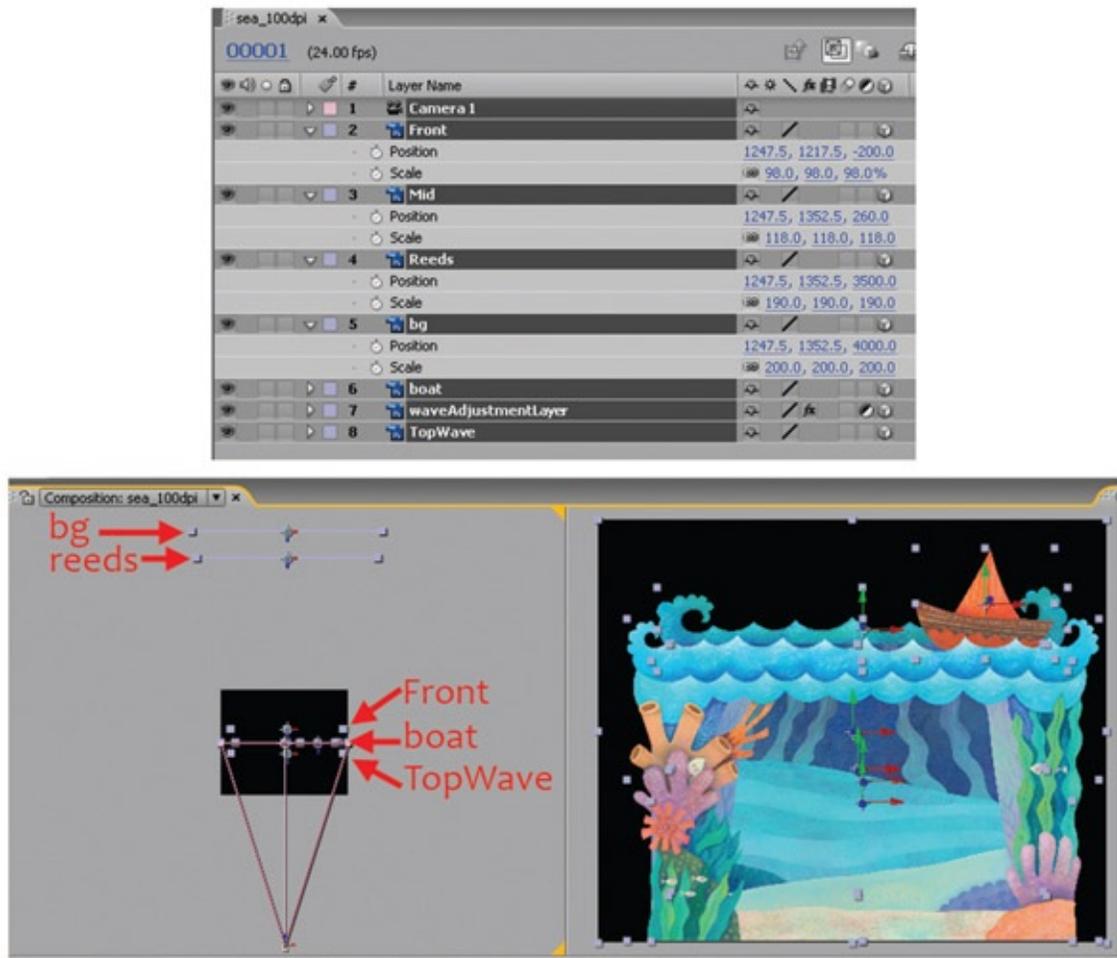
FIGURE 6.33 All levels moved in Z. The boat and TopWave are the closest to the camera

5. Make sure that you are on the first frame of the timeline and adjust the camera's zoom to get the opening view of the underwater stage.

After all of that, you are ready to set two keyframes to see the parallax magic. We'll move the camera up to reveal the boat. When you view the playback, you should be able to see the parallax between the layers. The closer the layers are to the camera, the faster they will move across the screen. The farther away the backgrounds, the more parallax (different rates of movement) you will have.

1. On frame 1, create a **keyframe** for the **position** *and* the **point of interest** for the camera by clicking on the stopwatch icon. If you only set a keyframe for the position, the camera will move up but pivot down to continue to look at the center of the images.
2. On the last frame, move the camera **position** and **point of interest** up in Y so that the boat is visible. A keyframe will automatically set.
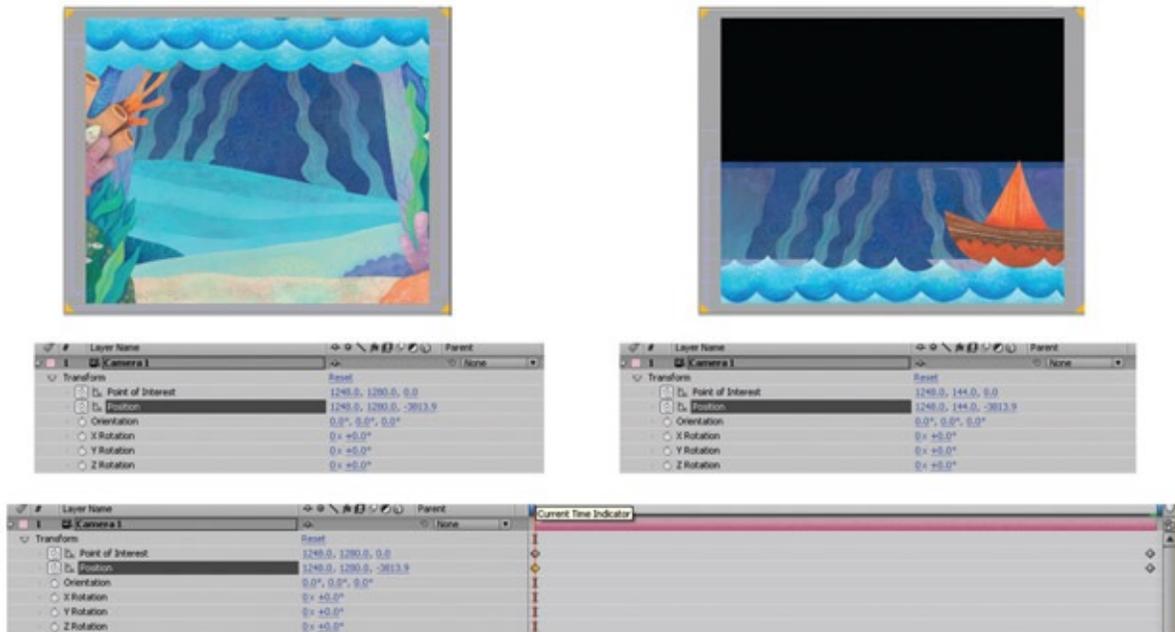
FIGURE 6.34 Camera with keyframes position and point of interest

Press play to play back a preview and notice the different rates of movement. Some touchups can still be done. You'll notice that the background layer is visible when you don't want it to be. Do not be afraid to move the artwork to exaggerate the parallax and use traveling garbage mattes to hide unwanted levels.

For the background and reed layers, we will add a mask to hide these levels when the camera moves above the sea level. For both levels, the same steps will go as follows:

1. Right-click on the reed or bg level and select **Mask > New Mask**.
2. Under the image in the timeline there is now a Mask parameters area. Open this area, change the setting to **subtract**, and click on the **stopwatch** icon for **Mask Path**. This will allow us to animate the matte.
3. Make sure you have the selection tool active (or use the **v** hot key). Go to frames midway through the camera move and at the end. It might be best to start at the end and work backward. Adjust the matte as needed to hide the reeds or background. Keyframes will automatically be set. In <u>Figure 6.35</u> three key-frames were set to adjust the matte during the camera pan.
4. To further tweak the animation, you can move/slide the image layers to get more parallax or a better composition. In <u>Figure 6.36</u> a few keyframes were added to the position of the Front-Wave and TopWave images.
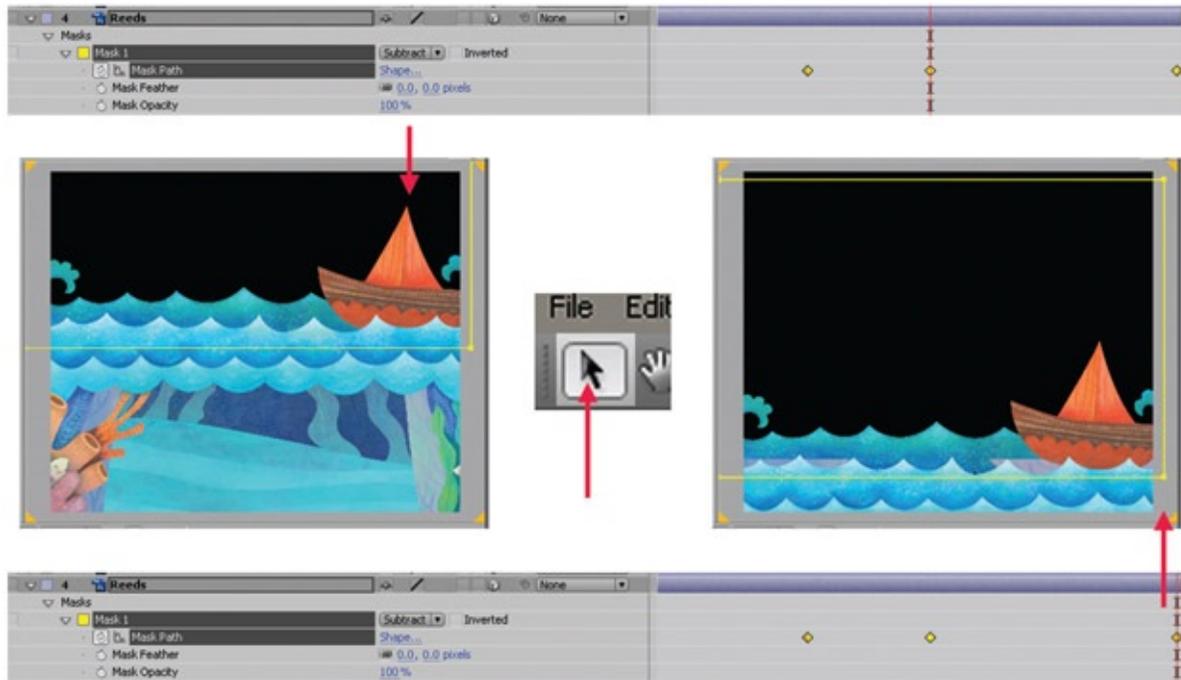
FIGURE 6.35 Moving the mask to hide the reeds and background levels during the camera movement
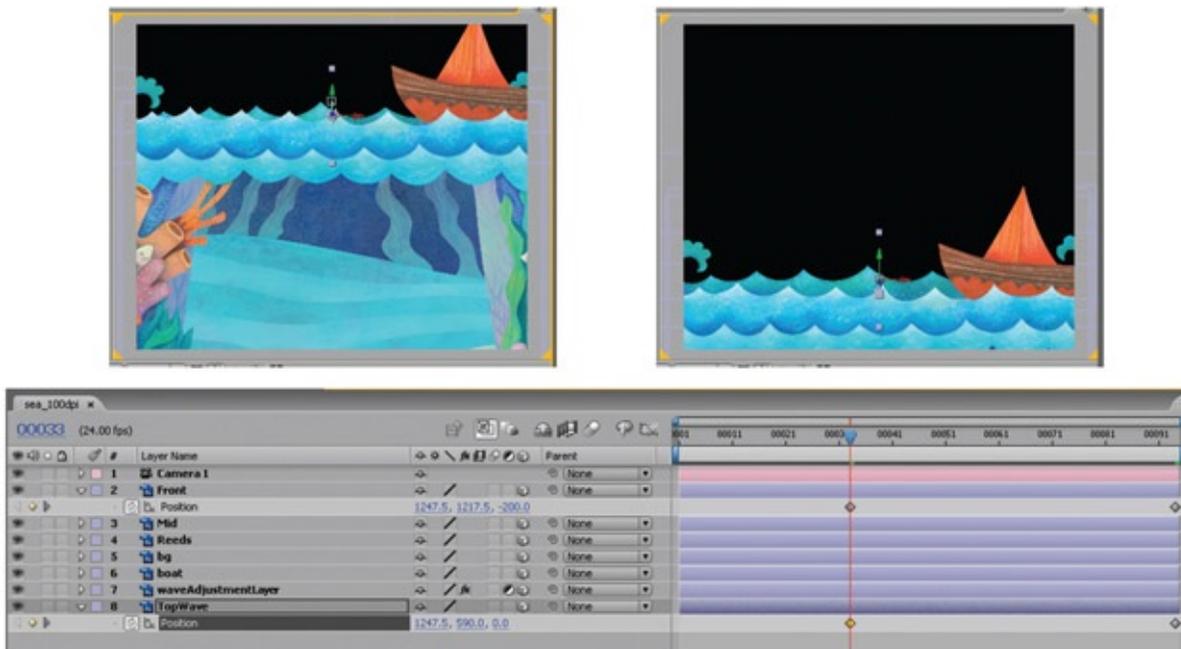
FIGURE 6.36 Keyframes can be added to the artwork levels themselves to increase parallax or obtain a better composition

Take Note

You will note that the image size is very large. When exporting out movie files, it is important to watch your file size so that you maintain a good playback speed. In this book we have learned that the compression setting **animation** is not actually a compression at all. It is

all of the frames in their full res state packed into one movie file. You will not receive a good playback rate with this. As an example, I have exported a movie file from this exercise. You will note that with a **Sorenson 3** compression, this **2400 × 2000** pixel movie is only **3 MB**. There are other compression types. Sorenson is pretty old but serves me well for quick compressions. H.264 is more popular now.

Multiplane in Flash

What if you are using a piece of software that does not have a 3D camera? Well, then you are going to have to simulate the experience the old-fashioned way: by moving the artwork itself at different ratios. The camera itself will not move, because there is no camera to move. Instead we will move the artwork. By moving the artwork at different rates, we can establish what the camera is focusing on, what is in the foreground and moves faster and what is in the background and moves slower. First, we'll choose the main 100% level that stays with the camera. Everything else either moves faster than that level or slower. For example, if it is in front of the 100% level, it can move 150% faster, or if it is in back of the main level, it can move 80% of the speed of the main level.

We will use the characters and some of the images we have already used in our hands-on exercise.

Open Flash and import the character assets:

1. Click **File** > **Import to Library**. Select **sea01.psd**; click on open.
2. A window will open showing each layer in the Photoshop file. The character layer is selected. That is correct. Click **OK**. We do not need the composited layer of the character over a white background.
3. This will create a folder in the library and place the character inside of it.
4. Do the same for the other characters (**sea02.psd—sea05.psd**). You can shift select all of the character psd files and they will load in. Because they are unnamed in Photoshop, we need to take a moment and name them appropriately here. Name the characters and organize your library.
5. Once again, click **File > Import to Library** and select the **sea_100dpi.psd** image. We'll only use layers **2, 4, 5, 6**, and **7**. You can bring them all in to experiment with.
6. Once the layers are imported to the stage, organize them as necessary.

FIGURE 6.37 Organized library with all assets loaded

To animate these assets, we will have to turn each item into a symbol. While we are doing this, we will go ahead and load them into layers and scale them—they are huge images:

1. Rename the first level in the Flash timeline to **bg**.
2. Drag the blue square background into frame 1 of that layer. It will fill the screen.
3. With the bg selected, click **Modify > Convert to Symbol** or use the hot key **F8**.
4. Name this symbol, and make sure it is a **graphic**.
5. Using the **Free Transform Tool** (hot key **Q**), scale the background to be much longer than the Flash canvas is. In our animation we could move it slightly and need room to pan it under the camera. Please view the companion data to see an example. In our example, the background is shown at the top of the image, and at the bottom it is shown in wire frame so that you can see its size in relationship to the canvas.
6. Repeat these steps to add a reed level, a character, and a wave. See <u>Figure 6.38</u> for an example.
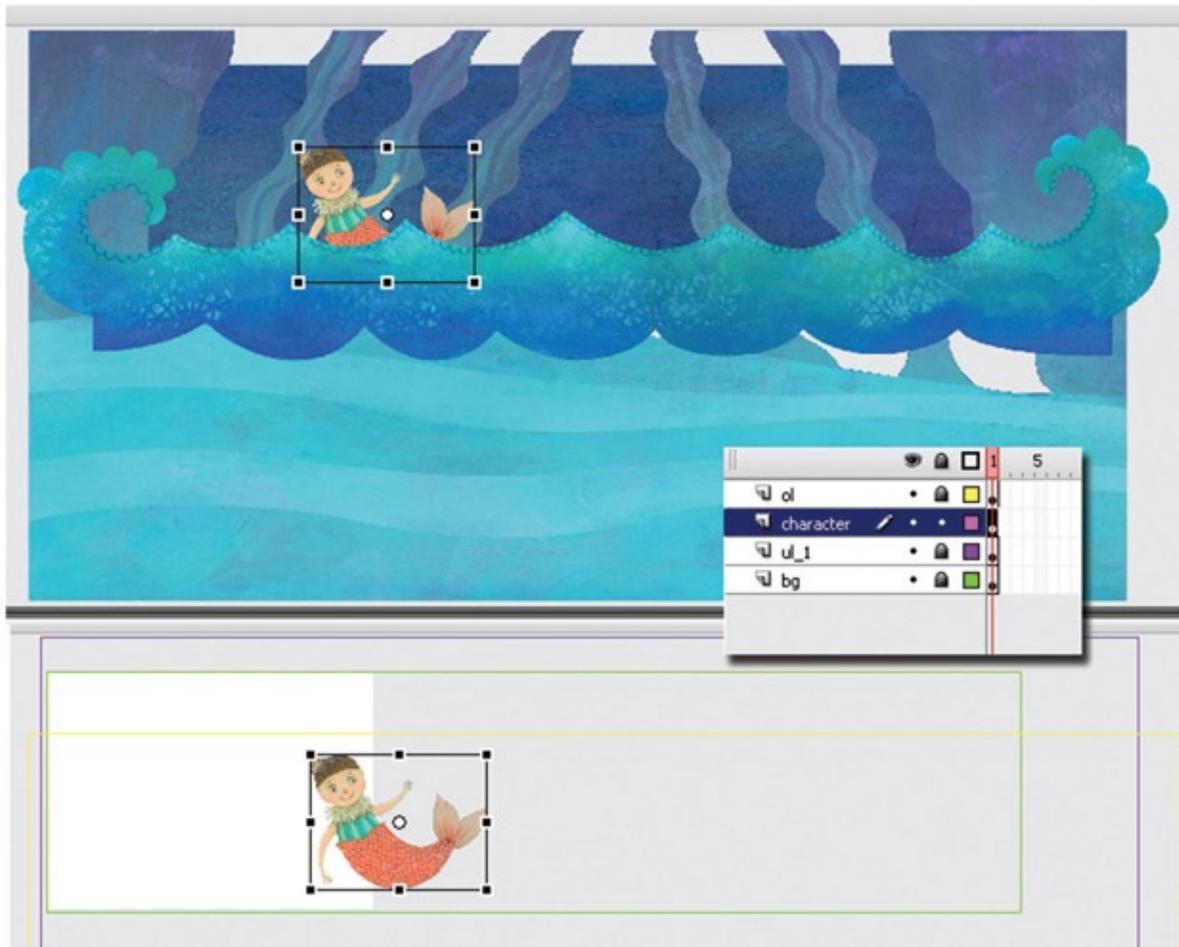
FIGURE 6.38 Symbols added to their own layer and scaled into place

You might find it useful to lock layers when you are not working on them—anything to help avoid putting the symbols on the wrong layers. It is very important that each symbol be on its own layer. We are going to add motion tweens to these. If you have worked with Flash before, you may know that you can only have one pivot point per motion tween; each symbol or group of symbols has one pivot point. If you have any more than that, the motion tween will not work.

Instead of pulling out the mathematical formula, we are going to move these items using those pivot points to help us. First we'll start with the 100% layer, because this layer will be the basis by which all of the other layers will move. Although it is tempting to do this via action script (I'll leave that explanation to those who are bent that way to figure out), we'll do it by hand:

1. Select the character and on frame 1 place the character on the right-hand side of the screen.
2. In the timeline, right-click on the keyframe and select **Create Motion Tween**. This holds the exposure of the keyframe for a second on the timeline and moves the current time to the end of that exposure.

3. Move the character to the **left-hand** side of the screen. You'll see a line extend from the first position to the second position of the character. In the timeline, you can click and drag the last frame to end at a later frame, if desired.
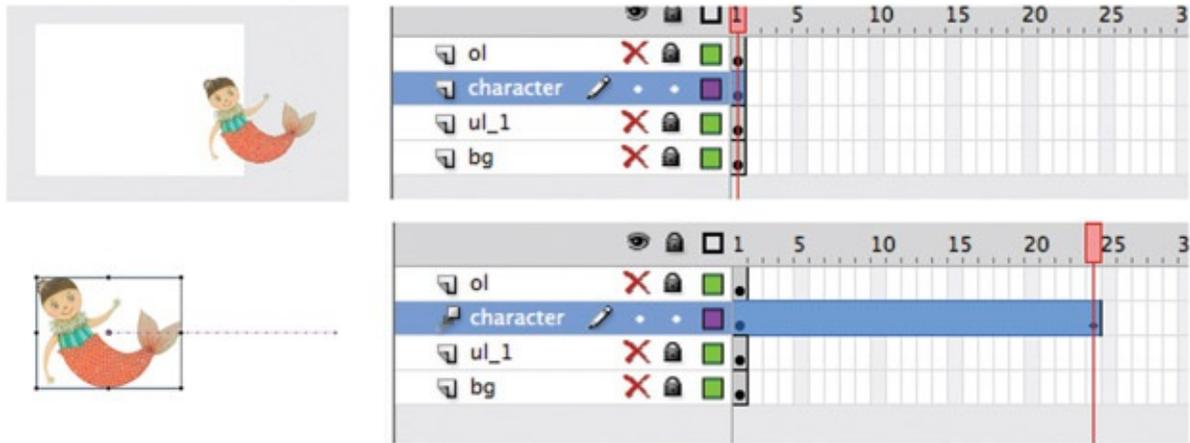
FIGURE 6.39 Characters' animation keyframes set

Flash (CS6 and newer) shows a line indicating the path. Older versions of Flash need to use onion-skinning (and a different method of adding motion tweens). The wave that is in front of the girl should move faster than she does—150% faster. If we click and move the wave from where the girl was in frame 1 and move it to where the girl moved to in the last frame, then keep moving it farther (about half the amount we have already traveled), we have 150% movement. It is easier to see this in an image. See Figure 6.40 for an example. The black arrow indicates the amount of the character's movement. The red arrow indicates the amount of movement for the front wave. In the accompanying Flash file, this is labeled as an OL. Anyone remember why? It is an overlay, meaning the front wave is lying overtop of the character.

FIGURE 6.40 Move the front layer 150% faster than the character

1. Select the first frame of the **wave** element. Create a motion tween as you did with the character. At the end of that motion tween exposure move the wave farther to the left than the character moved. Refer to Figure 6.40 for amount of movement needed.

2. Next animate the **reeds** level. Those keeping notes may remember that this is a UL, meaning it is an underlay. This level lies under the main character. It has a "1" next to it in case we were to add another underlay that would have a "2" behind it. The same can be done for overlays. The interesting thing about this naming convention is that it indicates the order of levels and simplifies the constant questioning of "What was in front? Was it the waves or the reeds?" Imagine if this were 100 levels deep! Create a **motion tween** on the first frame of the reeds level.

3. At the end of the motion tween exposure select the **reeds** element. This element will move only 50% of the character, half as much. Move the reeds level halfway to the left; see Figure 6.41 for an example. The black arrow indicates the amount of the character's movement. The red arrow indicates the amount of movement for the ul_1 reeds.

> The bg does not have to move; we can add a little movement of 5% to see if it looks okay. Remember, if it looks right, it is right; hang the math. (Don't let my high school geometry/programming teacher, Mr. Erdly, read this.)

4. Animate the **bg** using motion tweens as you have above. Once again, measure how much movement should be allotted to the bg. See Figure 6.42 for an example. The black arrow indicates the amount of the character's movement. The red arrow indicates the amount of movement for the bg, which is 5%.
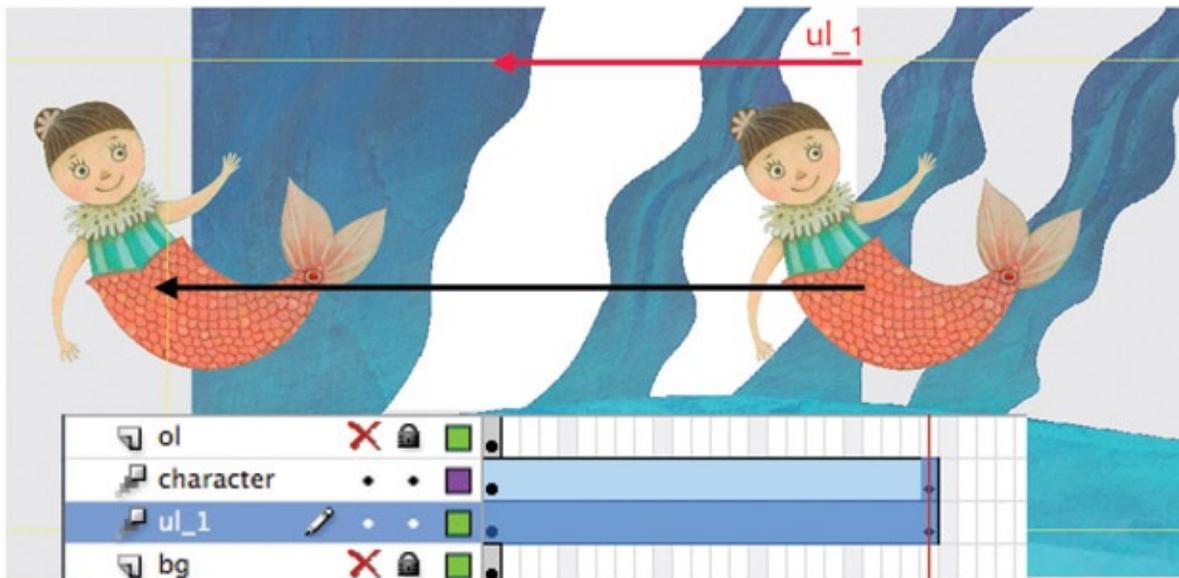
FIGURE 6.41 The ul_1 movement of 50% of the character's movement

FIGURE 6.42 The bg movement: 5% of the character's movement

Using this idea, you can continue assigning amounts of movement for levels that are farther behind the character or closer to the camera. This is the same concept as if you were traveling down a road in a car. Imagine that the cows in the pasture are the 100% level. (I grew up past a dairy farm that was also past the sausage factory. So you can also hold your nose while thinking of this picture. I could have my eyes closed as a kid and known when we were five miles from home by the smell.) The cows are the 100% level. The barbed-wire fence in front of them is moving 150% faster than the cows across your field of vision. The telephone poles in front of the fence are moving maybe 170% faster. The bicyclist on the road is the closest to the camera (your eye) and might be moving 200% faster. The barn in the back of the field is moving 50% slower than the cows and the mountain even farther back is barely moving at 10% the rate of the cows. The sun never seems to move. Thank heavens the stink is gone before we get to my house.

Go back to the last frame and adjust the amounts of movement until the parallax feels right. The levels should all seem to move without any one level seeming to stick slower or slide faster than the others. Remember to show your friends and get their feedback. Sometimes you work on your shot so long and have so much emotional investment into it that you cannot see the errors. Your friends have no such emotional investment and it will not cost them any time to fix anything. So they are more likely to see the errors that your brain simply will not see because it wants the shot to be done.

An example of this exercise is presented in the companion data: **Multiplane.fla**.

Multiplane in Toon Boom

By now you should have a handle on importing images and layering things. Toon Boom has 3D capability, much like you have seen in After Effects. You can bring in your images, place them into the timeline and then in 3D space, move them apart in Z depth. Then set keyframes as you are used to doing. But, there's one very cool feature that is very much made for animation: **Maintain Size**. In Toon Boom you use a **Perspective** window to move the layers in Z-depth. (Or any direction, X, Y or Z, for that matter.) If you select the Maintain Size tool, then the image will scale up or down as you drag it closer to or away from the camera. That means that in the compositing camera, the image will look like it is always the same size. Yet, you are moving it in Z. This is so that animators can draw their layout compositions and you can adjust the Z-depth without bothering that original composition.
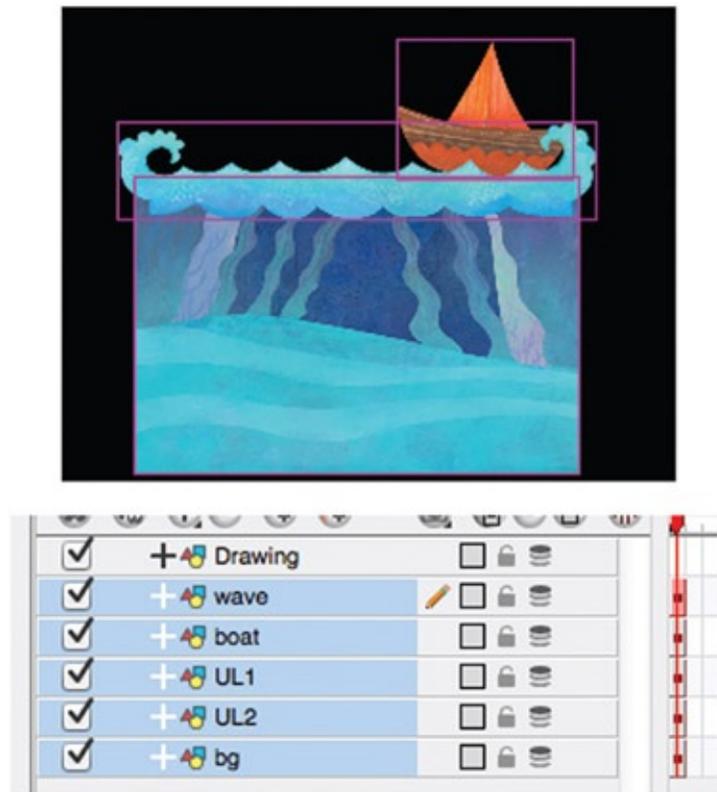
FIGURE 6.42A Toon Boom Animate Pro—images in the main composite window and timeline. Composition remains the same
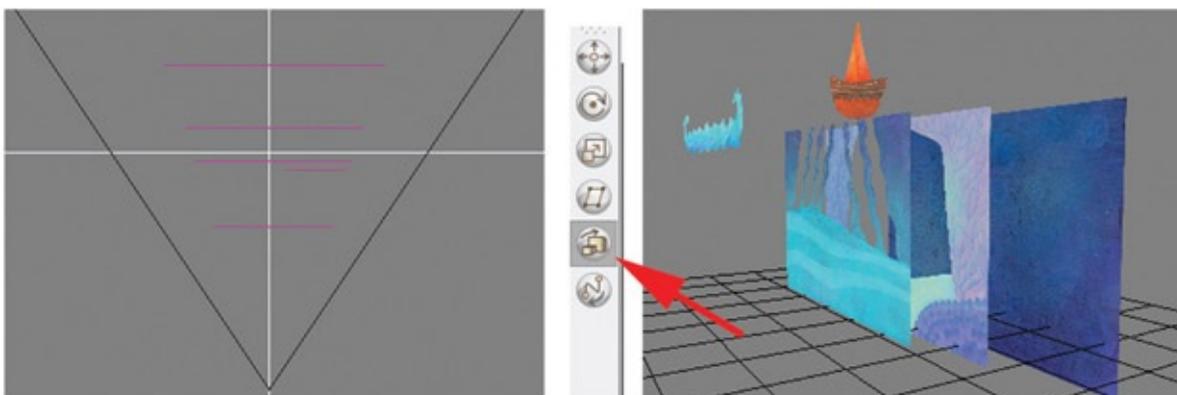
Deep Space

It should come as no surprise to you that deep space allows for the camera to move toward the shot elements and characters, or they move toward the camera. Perspective cues are used to help deepen the space. These cues can include a one-, two-, or three-point perspective, vanishing points, and diffusion of textures as they diminish into the farthest reaches of the eye. (Of course, there are other symptoms of a deep-space shot. You'll have to read *The Visual Story* to learn more.)

Deep-space shots are "easy" in 3D. Pick the camera up and move it. It weighs nothing. You do not have to build a track for it. You do not have to strap it to you or others. You move the camera around the world and shoot what comes in front of it. Right?

My students know better, and they know a trick question when they hear one. Although you have a virtual 3D camera, you should maintain the idea that the camera is expected to behave like a physical camera. It can do fly-throughs and move places that a physical camera cannot. However, the camera should always move with slow ins and slow outs as if it had weight and needed to take effort to move and effort to stop. You have likely dug deeper by reading recommended cinematography books to understand why a camera would be placed at the floor versus at the ceiling or closer to an actor's field of view. You have read *The Visual Story* to understand how the camera setup in one shot relates to the story as a whole. If you have not, fear not. We can continue with these exercises to learn what buttons to push and what pipelines to use. However, make sure to gain more exposure to reasons for moving the camera. I'm putting the soapbox away (apparently, I have a closet full of them).

2D Characters in a 3D Camera Move

So far in this chapter, we have just been talking about 3D characters in a 3D world and 2D characters in a 2D world; for a few pages, we did not talk about 2D/3D. Of course, any medium or mixture of media could have been used in the previous exercises. Now we return to our originally scheduled program of 2D and 3D media.

In all of the previous chapters, we purposefully held the camera still. What happens if you want to use 2D characters in a 3D camera move? When you have a 2D character in a 3D world and have a 3D camera move, the concept of registration becomes extremely tricky. You can use the pipelines that we have explored, create the 3D first, then animate the 2D to match.

Maintaining good contact points will be difficult, yet it can be done. Drawing the 2D to match the 3D either digitally or using print and peg pipelines will require studious attention to matching those contact points. To that idea, we have also explored the concept of always hiding the contact points unless they are absolutely tied into the key emotion and storybeat of the shot. Keep that in mind as we go through this next exercise.

This exercise is basically a multiplane setup, except that it is in 3D. Also, instead of having flat planes, they will be in a sphere. In class I have lovingly called this a multisphere setup. This type of a camera move starts to edge us into a deep-space world.

You have possibly seen something similar to this before. In *Tarzan,* when Jane, the Professor, and Clayton follow Tarzan to the gorillas for the first time, there is a realization shot where the characters recognize that they are surrounded by gorillas. Jane stands up, and the camera shows the gorillas in the trees around her.

If you watch the extra content on the DVD, you will learn about Deep Canvas, a software program that allowed the background painters to paint their canvases in 3D. Most might confuse this with typical texture painting or 3D paint systems like ZBrush or Mudbox (great tools to learn, by the way). You might know how to texture paint or use ZBrush already. Deep Canvas differed from 3D paint packages. It held each paint stroke in space, layered the paint strokes on top of each other (much like painting on glass, except in 3D), and then allowed those paint strokes to respond to the scene's lighting. It was a wonderful piece of engineering that was truly remarkable and different. I've never seen anything like it since. The software was originally created for *Tarzan,* then it was used for *Treasure Planet* and even on *Brother Bear.*

Besides the use of Deep Canvas, the biggest thing to note is that the gorilla realization shot (among others) is a great example of a deep-space shot with 2D characters in 3D worlds. You will note that the gorillas in the trees are all 2D. Of course, Jane and company are 2D as well. The environment itself is 3D painted with Deep Canvas. The 2D gorillas are perched in the tree with their contact points hidden as the camera moves in 3D space to reveal them.

When faced with a problem such as this, it is probably best to bring the 2D artwork into the 3D system and composite it there. We will use the mermaid characters from before as an example and set up a multisphere shot. This is a quick exercise; feel free to expand on it for the project portion of this chapter.

Our Assets

For this shot we will take the output of our Photoshop characters that have been quickly animated in Flash (as an example of using animation, not as an example of animation), create

image sequences, map those sequences as textures inside of Maya, and do our camera move there.

We've already covered the process of bringing the characters from Photoshop into Flash. Just as a review, we'll make a .tif sequence with alpha channels.

In Flash

1. Export a swf file by selecting **File > Export Movie**.

FIGURE 6.43 Exporting a swf of the characters

In the companion data you will find a swf for each of the characters. The animation is minimal. These would be great candidates for taking into Flash and adding IK (inverse kinematis) to. Extra credit goes to the students who do this in their project.

You could export out a gif sequence directly from Flash; it would maintain the alpha channel that you need. However, compression is not your friend, so we will use After Effects to create the image sequence. There are other ways to do this. You can have scripts that do this automatically for you. Obviously, this is a step that is done often. Maintain a lossless compression and keep your alpha channels. A subject we have not even discussed in this book is that of lookup tables and color space. That topic is beyond the scope of this book.

In Older Versions of After Effects

1. Load the character .swf file into After Effects
2. Select **File > Export > Image Sequence** …
3. Choose the .tif file format and uncheck "insert space before number."

4. When you type in the base name of the image sequence, add in three zeros: "000." This will add zero padding. See Figure 6.44 for an example.

Exporting an image sequence with an alpha channel from After Effects

In After Effects CS6

1. Select **File** > **Export** > **Add to Render Queue**.
2. In the **Render Queue** tab, click on **Output Module Lossless**.
3. Choose the .tif file format.
4. When you type in the base name of the image sequence, add in three zeros: "000." This will add zero padding.
5. Click on **Render**.

Now we are going to want to bring this image sequence into Maya as a texture. However, Maya will not read anything unless it has a Name.#.extension. We need a period between the name and the number. Using whatever means you have, you will want to change the name of the sequence.

We have used Adobe Bridge previously in this book. We'll use it again. You could use Shake or even script shake to do this. (See www.fundza.com for information on that process, and thank Professor Kesson for his selfless contributions to better the lives of would-be technical directors everywhere.)

In Adobe Bridge

1. Select all of the images (from 1 to 19) by clicking on image 1, holding shift, and

clicking on image 19.

2. Right-click on any of the images and select Batch Rename.
3. Enter in the text to get a basename a "." and start the numbering at 1.

I know—that was a lot, right? Imagine having to do that with thousands of layers and images! Go hug your TD (technical director) who will make scripts and streamline this process for you in production. If you are doing this on your own, this process of moving images around, keeping the alpha, keeping it lossless, and making sure the name will read into the next software package is tedious. I'm sure you can come up with your own methods to get it streamlined.

Now we are ready to begin putting our 2D animation into Maya. A note to mention here is to remember resolution. When you bring images into Maya and are going to render them, you will want to keep in mind how big those characters are going to be on screen and how big your final render is going to be. If you are rendering a high-definition 720 image and these characters are going to fill the screen, you will want to make sure they are at a high enough resolution (have enough pixels) to be viewed well.

In Maya

The object is to position your levels inside Maya, move the camera in Maya (as well as the artwork), then render out the final image. You can also render out multiple passes of precomps and composite them together in your compositing package of choice. It doesn't have to be one final render—whatever makes the shot.

Let us remember alpha channels for a moment. In order to have anything seem see-through, you must have an alpha channel. By this chapter, this step should be routine, but you would be surprised how it can still trip you up if you're not reminded. Figure 6.45 shows that the wave level from **sea_100dpi.psd** has been saved out as a stand-alone .tif image. The actual image itself has transparency around it in Photoshop. You are able to see the checkerboards around the wave. However, Maya will not know this is supposed to be an alpha channel unless an alpha channel is specifically created. In many cases you will need to select the image with the magic wand tool (or select the empty space then go to **select > invert selection**). In the channels tab, you can see that an alpha channel exists. If you do not have one, you can create one from the selection by clicking on the **Save Selection as Channel** button at the bottom of the tab.
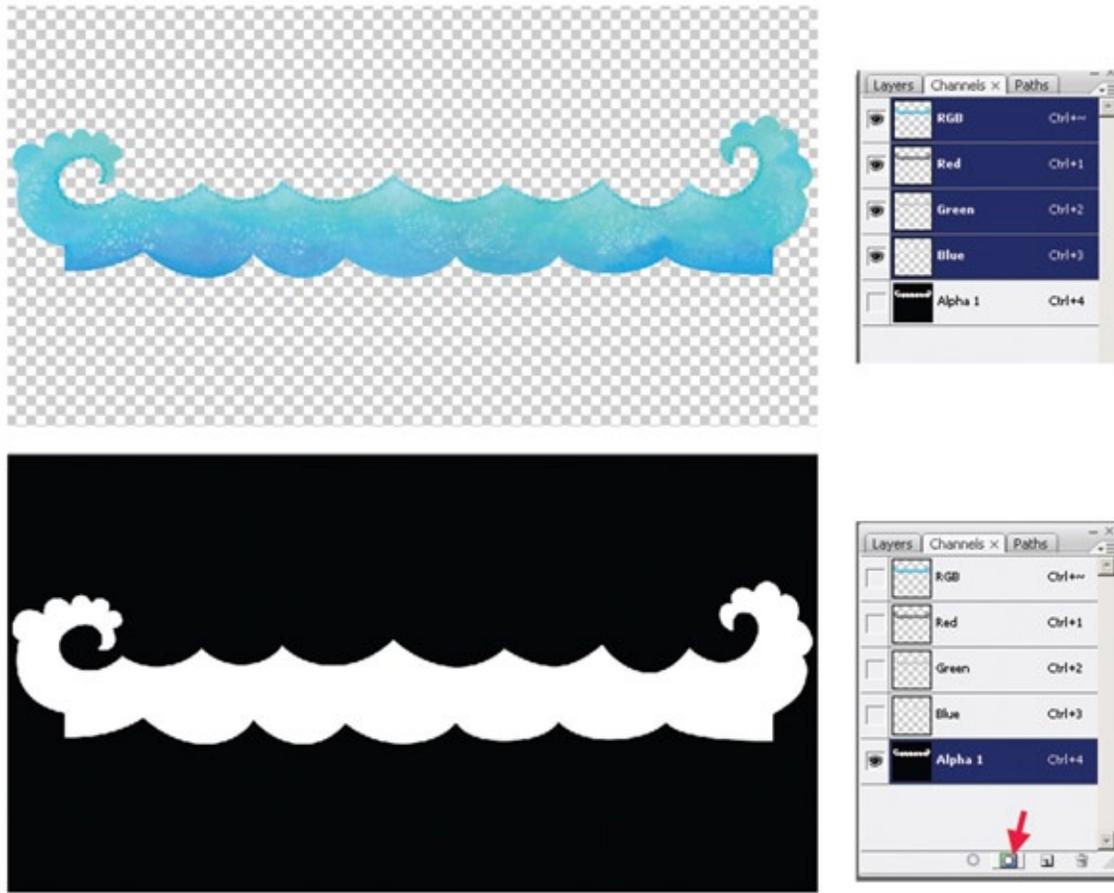
FIGURE 6.45 Alpha channel in Photoshop for the Wave element

At first it was hard for me to remember which was the alpha channel and which was where the pixels would show up. Maybe this will help: the color black has a value of 0. If you think of a zero value as nothing, then that means nothing shows: alpha. The color white has a value of 1 (on); everything shows. That is only when you are looking at the alpha itself. Just when you think you have it, remember that in some cases in this book we have created mattes in the RGB channels. When using RGB mattes, it is just the opposite—create an opposite alpha channel. If in doubt: test. The image in Figure 6.46 shows a plain white canvas in Photoshop with an alpha channel. If this were brought into Maya and placed as a texture, it would show up as a circle, shown in the insert. As a note, the file is brought into the color attribute and the transparency attribute of the material. This is usually done automatically. However, sometimes you have to do it manually.

Take Note

Make sure that your Photoshop texture is saved as an RGB and not CMYK. If it is saved as CMYK, the fourth channel will be read as the alpha channel, which more than likely will lead

to undesired results. (Not that the author did that by accident.)
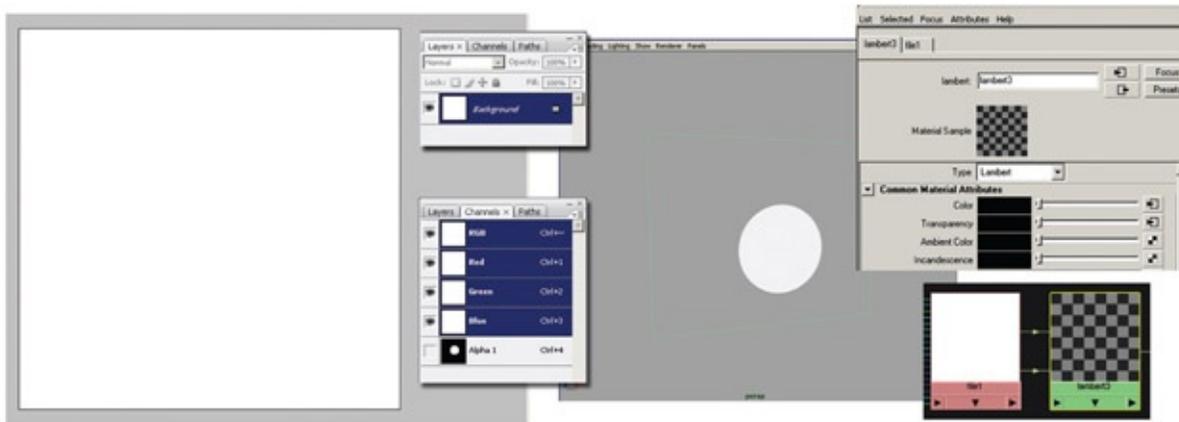
FIGURE 6.46 Alpha channel in Photoshop with RGB shown as plain white

The wave texture has been cropped to a square size. Why a square? This is now going to be used as a texture. Texture space is defined in a square that is numbered from 0 to 1 across the top and down the length of the image. This is how textures are used in almost all packages. While on the subject of UVs, because this is now using our 2D images inside of a 3D space, you will need to become familiar with UV unwrapping. We'll look at examples together.

You can follow along in Maya with the file **MultiSphere_setup.mb**. Inside this file, a sample scene has been created that has a few textures already loaded and properly uses alpha channels. (If the textures do not show, Maya doesn't know where they are. Reload the textures in the Hypershade window.) We will create geometry to hold our animated character textures and make sure that those texture planes face the camera for the final render.

First, let's examine the spheres with textures already applied. The outer sphere, labeled "OuterSphere," is the background level and it has a background texture applied. The next sphere in is labeled "MiddleSphere" and has the reeds texture applied to it. You can see that the alpha channel of the reeds texture is being read in, and you can see through that sphere to the background sphere— hemispheres, actually; to better show what is going on the spheres have been reduced to hemispheres. Your project can have spheres or any type of geometry that wraps around the camera.
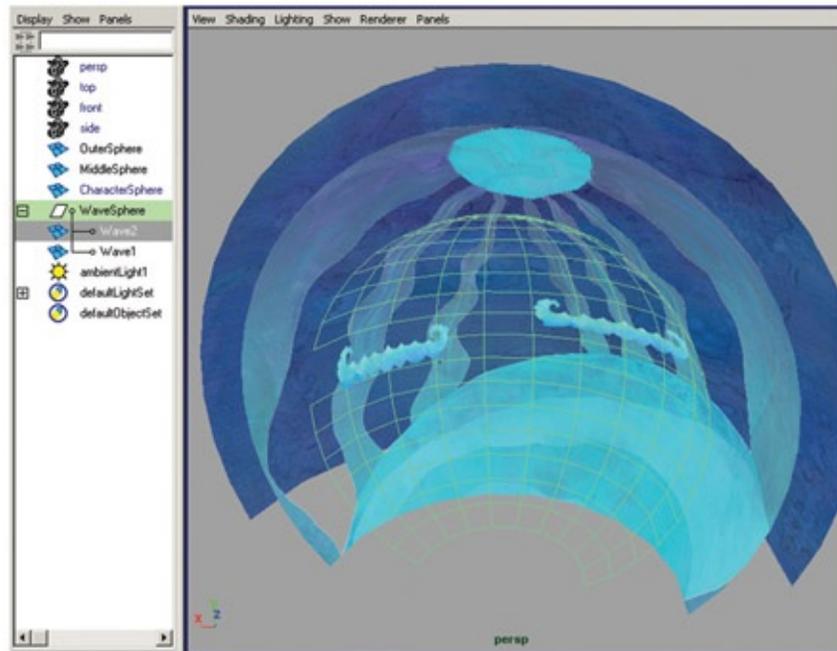
FIGURE 6.47 MultiSphere_setup.mb

The next sphere in is a CharacterSphere and it has been hidden for the moment. We will come back to it.

The smallest sphere has been adjusted to hold the wave textures. It has been labeled "WaveSphere." You will note that the WaveSphere has been broken up to hold the wave texture in two different ways. One is the normal use of UVing in the hemisphere to apply the wave texture (Figure 6.48).
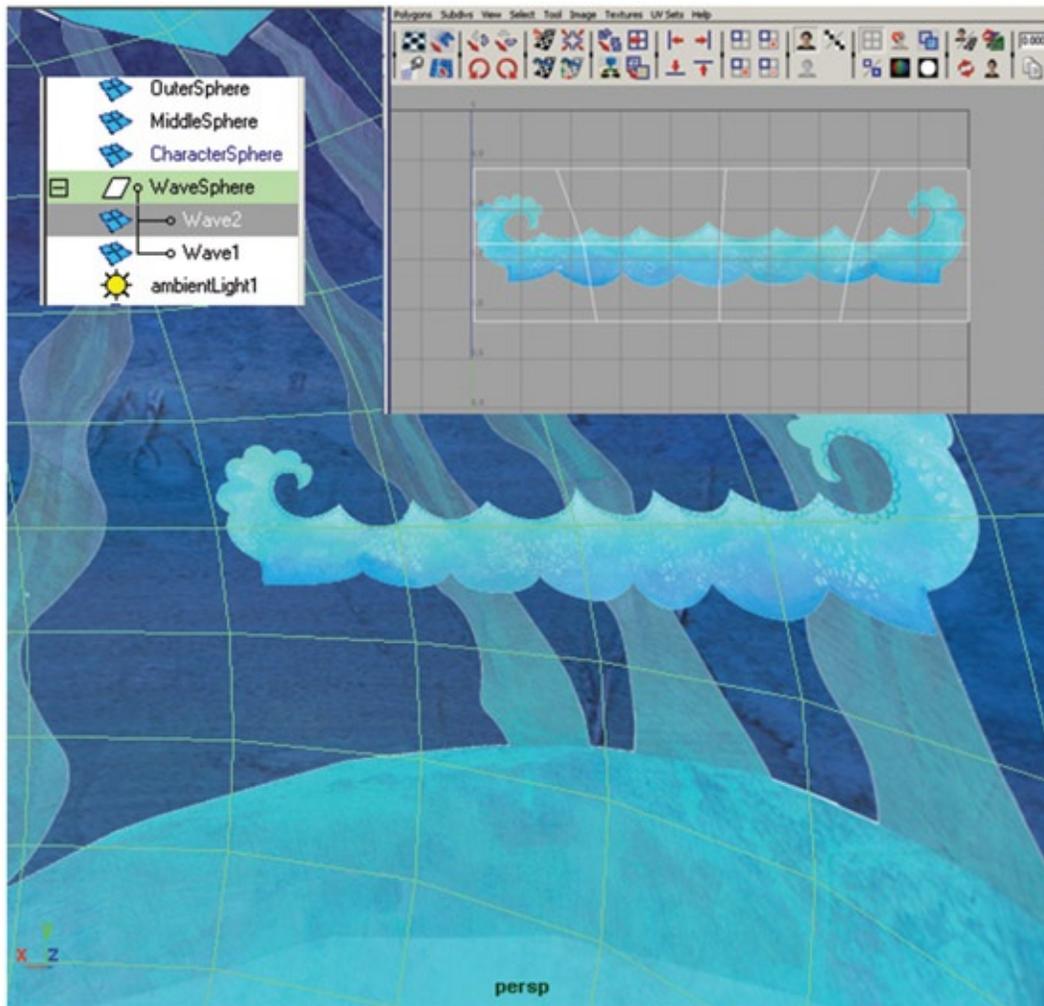
FIGURE 6.48 Wave texture applied to a polygon hemisphere named Wave2

The second way that the texture has been applied can be seen in Wave1. Wave1 is a separate piece of geometry. A section of the sphere was extruded. That extruded section was extracted and then separated into its own object. (History, of course, was deleted.) This way the object itself can hold the texture but still maintains the curvature of the sphere. It was important in the UVing process to make sure that the tops and sides were UVed to be in the right quadrant of the UV editor so that they received the alpha channel information to become transparent. If the UV gets to the edge or outside of the texture, gray will show up in the rendered image. You might see a small bit of that in the example file. To fix this problem, open the UV texture editor and move the UVs to be inside the quadrant. If we had U and V wrap turned on in the texture placement node, it would not be an issue. However, usually in cases like this we do not want texture wrap on.

We have kept everything in a sphere shape so that it wraps around the camera much like an IMAX screen wraps around the audience. It doesn't have to be in a sphere, but in this case we will keep the sphere shape in order to push the fisheye lens appearance of the levels.
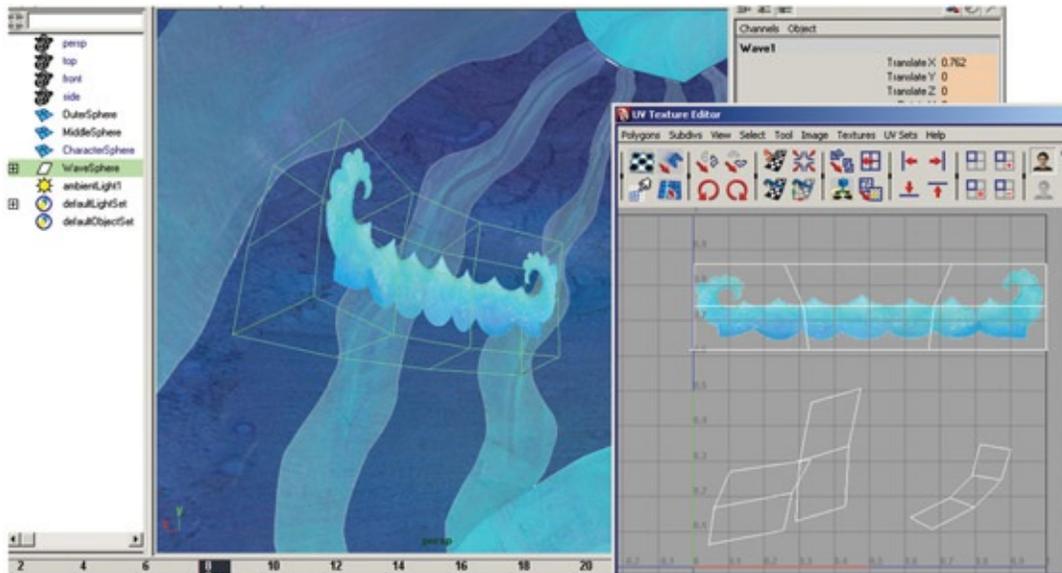
FIGURE 6.49 Wave texture applied to an extruded/separated portion of the polygon hemisphere named Wave1

Take Note

As you orbit the camera around to look at the spheres, you might notice that the wave level appears to go behind the reed level. This is only a hardware shading (viewport preview) issue and will not show up in the renders. However, to make the transparency sorting work correctly, in the viewport select **Shading > Polygon Transparency Sorting** so that it is on.

To create geometry planes for the characters, we will select an area of the CharacterSphere and create it into its own piece of geometry:

1. In the outliner, select **CharacterSphere** and turn its visibility **ON** in the channel box.
2. Use your favorite method of selection to select a rectangle of faces behind one of the waves.
3. In the Polygons area, select **Option Box** next to **Mesh > Extract**. Make sure that **Separate Extracted Faces** is turned **off**. (If it is left on, every face you selected will be divided from the others.) This has put the group of selected faces into its own "list," but it is not separated from the object yet. You will note that in the outliner there is still only one object named CharacterSphere.
4. Next, select **Mesh > Separate**. This should separate the extracted polygons into their own named object in the outliner. However, there is still history attaching them to the main CharacterSphere.

   Note: depending on your version of Maya, you may receive an error: *Separate works on selected objects or on faces from one single object.* This message may

appear even if you do have faces selected, just not exactly what Maya wants. To get to the faces that Maya wants selected, **right-click** in the view-port window and hold down the **CTRL** key. This will open a hot box window. Select from the bottom hot box: **To Face Path**. This will select the faces correctly and you can continue with step 5.

5. Make sure to delete the history by clicking **Edit > Delete by Type > History**. You will know you were successful when that pesky Transform node is gone from your outliner.

Now that the plane for the character is ready, apply a material and the texture by doing the following:

1. Select the newly extracted plane. In the figure ours is renamed to **CrabKid**. Apply a lambert material to the plane. One way is to **right-click** on the plane and select from the hot box menu **Assign New Material > Lambert**.
2. In the Attribute Editor, select the **checkerboard** button next to the **color** chip and add a **file** node.
3. For that file node, in the Attribute Editor click the **browse** button and find the first frame of the crabkid image sequence, **crabKid.0001.tif**, and click **open**.
4. In the Attribute Editor, make sure to click on the **use image sequence button**. This will automatically read in an image to match the frame that the timeline is on. (Why, back in my day we had to write an expression for that.)

If you look back at the material node, you will note that the transparency has automatically been loaded from the alpha channel for you. If not, you'll have to do that manually in the hypershade.

Some things can go wrong when you do this on your own:

- If you use a CMYK image instead of an RGB image, alpha reads it incorrectly.
- If you use a naming convention that Maya cannot understand, like crab0001.tif or crab_0001.tif, you will get a purple message about a node not existing.
- You will have problems if you forgot to have an alpha channel.
- You will have problems if you saved the image as a .jpg or in a format that does not hold alpha channels.

Now, as you look at your CharacterSphere you will think something has gone terribly wrong and you might start thinking of the items in the preceding list as possible candidates. There is nothing wrong, only something that has not been done: UV mapping. If you open the

UV Editor by selecting **Window > UV Texture Editor**, the problem should become apparent. The UVs are nowhere near the image of the crabkid's smiling face.
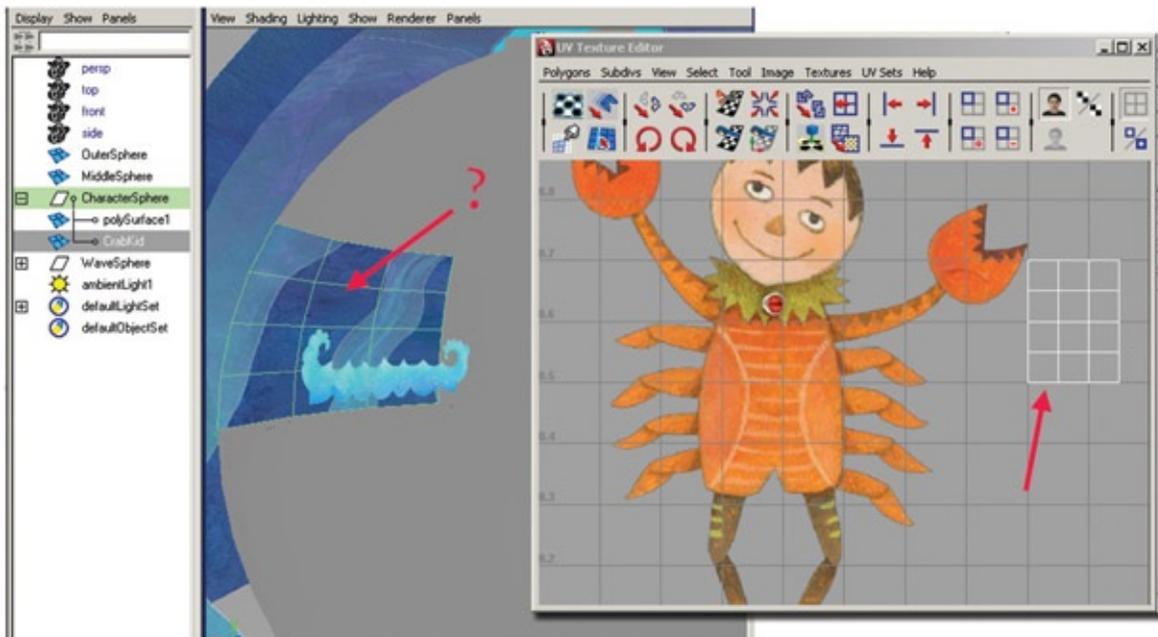
FIGURE 6.50 UVs are not correctly mapped to show character texture

If you are unused to UVing, it is small tasks like these that will help you gain confidence in the fine art. In an example on the companion website, the UVs have been moved around (by selecting them and using the move and scale tool) until they fit within the upper right quadrant and display the character. Also, the U wrapping and V wrapping have been turned off inside the file 2D texture placement node. You can locate these nodes in the hypershade window.

Repeat these steps to create texture planes for the other animated textures. My students, remember to name as you go. In Figure 6.51 the merman image sequence has been loaded onto a small polygon area behind the other wave element.

FIGURE 6.51 Two characters loaded as textures

Take Note

Take note: you want to make sure that you have enough 2D images to match the time in your Maya timeline. If you advance past frame 15 in our example file, the crabkid texture does not have any more images. It either will go blank or, oddly enough, load in a different texture! Oops. That is going to be a gotcha at render time if you don't plan for it now!

The last step is to place a camera in the scene by clicking **Create > Cameras > Camera** or whatever type of camera you prefer. Then animate the camera as desired. Please see the companion data for an example in which a camera has been placed at the base of the spheres looking up at these god-like merfolk.

Very important: you will notice that the lighting in this scene is **ambient** to make everything appear flat and the materials are **lambert** so that there is **no specular highlight**. Of course, you could add in 3D objects that have their own type of lighting. You'll want to use light linking to make sure that the 3D lighting does not affect the 2D imagery and vice versa. Extra effort points to the students who include that step in their final project. You can find more information on light linking in the Maya help documentation.

Forced Perspective

What if you want to add a little more dimension to your scene? There are two things you

can do. One is to have the character's plane follow the camera. Doing this will enable you to move the camera without giving away the secret: that the character is only a pixel deep. Another thing you can do is much like the idea we explored by creating spheres. You can add dimension to your texture planes, push perspective, and force more parallax to happen.

First, having your character planes face the camera is a useful technique to know. Because we created these characters as spheres, it may not be necessary. But if the camera were to move or if the character were, say, a driver in a UFO that moved past the camera, you would want the character to always face the camera. To accomplish this, do the following:

1. Select the **Camera** and then the character's plane. This is a driver/driven relationship, so it is important that the camera is selected first.
2. Under Animation, select the **option box** for **Constraint > Aim**.
3. You want the aim vector to match the axis you want to point toward the camera. In our example on the companion website, the X axis is pointing away from the camera. Therefore, the aim vector is set to –1 in the **x** box. (You might have assumed that the three unmarked boxes stand for X, Y, and Z.) Then click **Add**.
4. If you want to adjust the offsets in any way, select the object, locate the aim constraint in the inputs area of the channel box, and adjust the offsets to get the positioning you desire. In Figure 6.52 the clouds are being adjusted to be framed better in the camera view.

FIGURE 6.52 Adjusting the Aim constraint offset as needed

Things to watch out for when using Aim constraints:

- Make sure that the constraint is added correctly. The camera should not whiz away. If it does, you have constrained the camera to the character. Oops.
- Make sure that your planes are getting enough ambient lighting. They may turn from the light and become dark in your render. You may want to parent constrain an ambient light to follow along with your camera to always illuminate the characters.
- Remember, if it looks good in the final render camera, that is all you care about. Move things, scale things; it is okay. If you are working for an art director, though, that person might change his or her mind about the camera move. If that happens, then you have some extra work to do.

To push the idea of adjusting these levels even more, look for opportunities to create more parallax by adding dimension to the texture planes themselves. Many packages now allow for pushing of simple textured polygon planes. Toon Boom is one we will look at next.

Using our current example, we added a slight extrusion to the MiddleSphere so that the bottom portion of the texture would have parallax with itself during the camera move. For this process, you would do the following:

1. Select **Edit Mesh > Split Polygon Tool** or, in newer Maya versions, **Edit Mesh > Interactive Split Tool** in the Polygon area and click on the edges of the MiddleSphere to cut a line running along the bottom blue area of the texture.
2. Use your favorite selection method to select the bottom area of the texture plane that corresponds with the blue ocean floor.
3. Select **Edit Mesh > Extrude**, and extrude the features so that the element juts out from the rest of the texture.
4. Place your camera and move it. You should see parallax of the texture plane with itself and other elements.
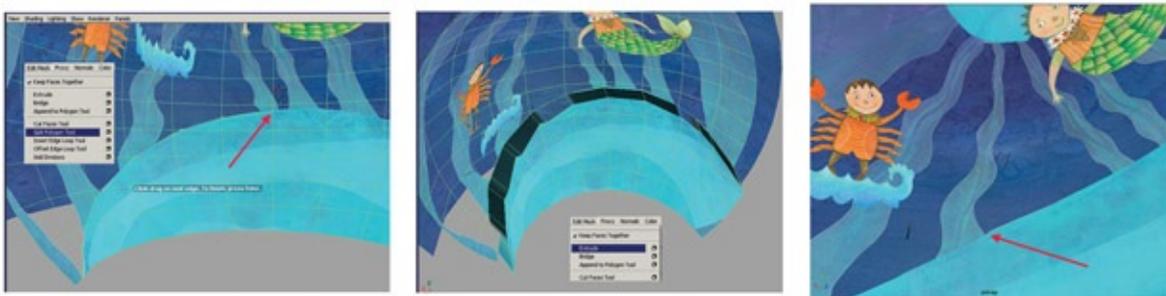
FIGURE 6.53 Adding dimension to the texture plane by extruding areas

This technique was actually used in *Mulan* and *Atlantis,* among others. You can see it in *Mulan*'s opening shot of the Great Wall of China, after the wonderful painting with animated mattes and compositing tricks fades into the actual animated shot of the Great Wall. As the

camera pulls back to show the wall, you might notice parallax going on between the segments of the wall itself. A technique of forced perspective and a lot of creative compositing was used to create that shot. I believe that was when Maya was available as a beta. This method of creating deep space with 2D artwork was used throughout the film with varying degrees of deep space. A more notable shot would be from sequence 19 shot 24, where Mulan runs into the crowd and the camera booms up to show fireworks bursting in the sky. That is a 3D shot full of 2D imagery with forced perspective on many of the palace elements, and don't forget crowds and particle fireworks.

Further Reading

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Student Contributors

Contributing students for this chapter, in order of contribution:

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Brent Morris
Yosssaya Aisiri
Daniel Tiesling

Completed Works

We've covered how to get the shots done, which types of pipelines and software combinations might be used, and how the use of camera might be addressed in each shot. We need to take a step back and spend this chapter going over some completed works and looking at the overall methods used.

Disney's *Paperman*

This is a lovely story with a refreshing animation style that combines many of the methods you have learned in this book. There are SIGGRAPH papers presented about how they achieved the film and the tools created (http://siggraphencore.myshopify.com/products/2012-tk141). You can also read an article written by the director, John Kahrs: http://www.cgmeetup.net/home/the-making-of-paperman/.
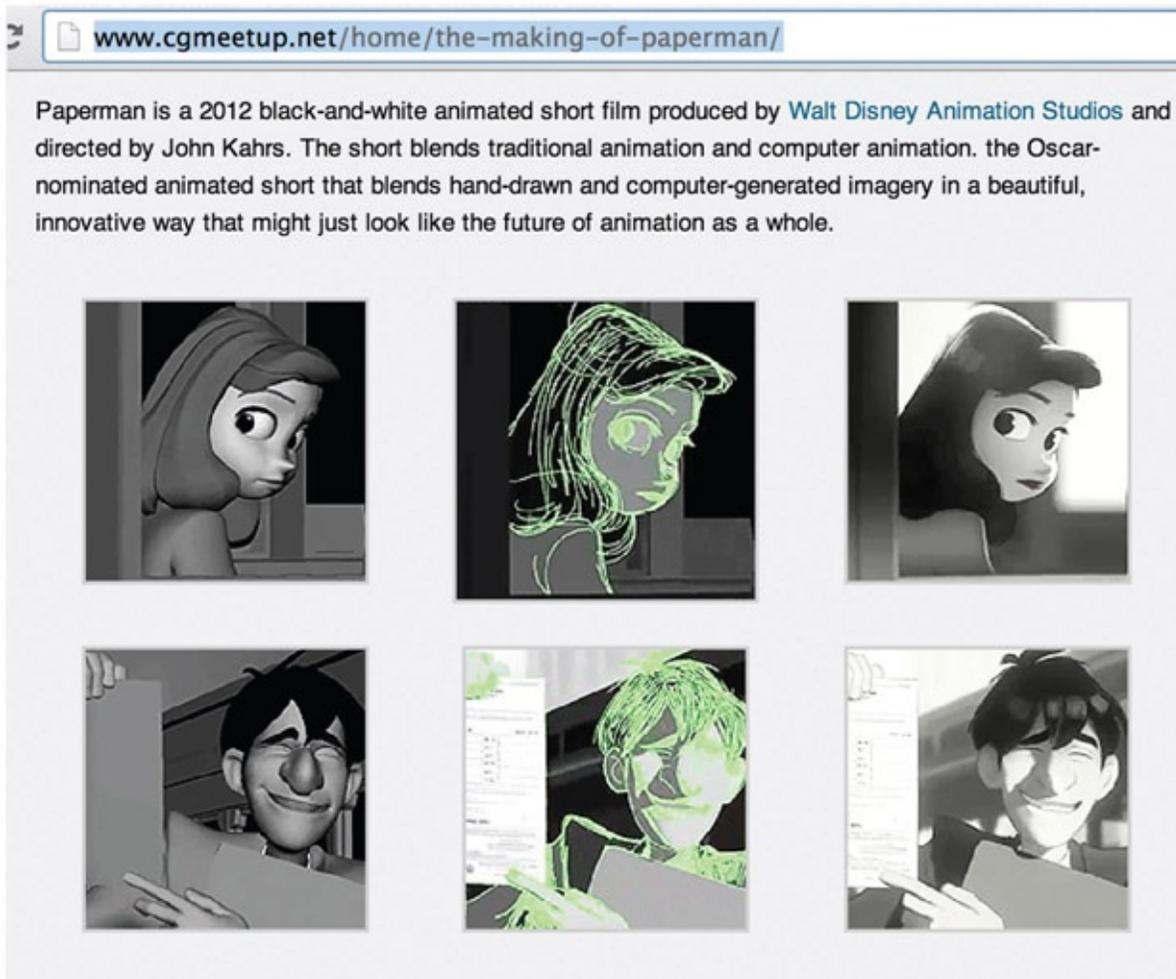
FIGURE 7.1 Making of Paperman from http://www.disneyanimation.com/projects/paperman

What was the process? First everything was animated in 3D. Then they created 2D lines overtop of the 3D imagery. The 3D was shaded very flatly. The aesthetic was very stylized. This method is used quite frequently, mostly. You can almost re-create it with the tools you have read about in this book. The difference comes in how the 2D line was created. There is some magic here that you won't be able to re-create completely. It is worth studying. "Computer-Assisted Animation of Line and Paint" is the name Disney gave to the process in their SIGGRAPH 2013 presentation. Here are the basic steps they did to create *Paperman*:

The 3D Animation

1. Created the normal 3D character and animated it.

So far, so good—you know how to do that. The next part may be new and you'll need to do some research.

Create a 2D Texture that will Move in 3D

2. Ran a process over the Z-depth information of the image and created a motion vector.
3. Used that motion vector to create a paper texture for the line and paint that respects the 3D space and movement of the character.

You can create motion vectors with Mental Ray. Motion vectors are images that look at the previous image and the current image, then create an image in between that only represents the movement vector of each component of the image. You can get a crash course in them here: http://www.youtube.com/watch?v=F9rW17naKUQ. The tips in that video for creating motion vectors are to make sure to change the shutter angle to 360 for easier offset ability and add a render layer override that renders frame 1.5 instead of 1, and so on. Then when compositing you can offset the motion vector.

Create 2D Lines that Move in 3D

4. Did a motion vector pass for all the vertices of the character, render it as an image, and extend it for compositing needs later on.

You can do all of this with the toon line and paint effects engine. It does steps number 4 and 5 for you. But now things are starting to get tricky. You may have watched the Motion Vector 101 video listed above. Step 6 is something that you need to do with vectors to extend beyond the character or you'll get hard edges. This is to texture the lines eventually in compositing. But beware, you cannot create motion vectors of toon lines or paint effects in Maya unless you convert them to polygons first, or do a post-compositing trick.

5. Created the 2D keyframes.

Ah, here we are at the real difference. We can achieve animated 2D line results, but not as elegantly as the proprietary tool that Disney created and not as beautifully, given that we cannot do some of the processing on the toon line. Thank heavens Disney shares the processes at SIGGRAPH so that creative programmers out there can help make tools available to other artists. So what can we do?

We can attach paint effects brushes to curves, and we can animate curves. Well, it isn't easy to animate cvs. You want to draw the lines like an animator—that's where the proprietary tool excelled. We can:

1. **Create > CV Curve** or **Pencil** tool and draw the ink lines. Watch out if you are drawing in the perspective camera; who knows where the line will go. This is reason number one why this method will be a pain to control.
2. Select the surface and the curve; click on **Surfaces > Edit NURBS > Project Curve on Surface**. This positions the curve on the surface based on the camera view. Note: the surface needs to be a NURBS surface for this to work.
3. Select an appropriate paintbrush; make sure the curve is still selected: **Paint Effects > Curve Utilities > Attach Brush to Curves**.
4. Go back to the curve itself, select cvs and animate them.
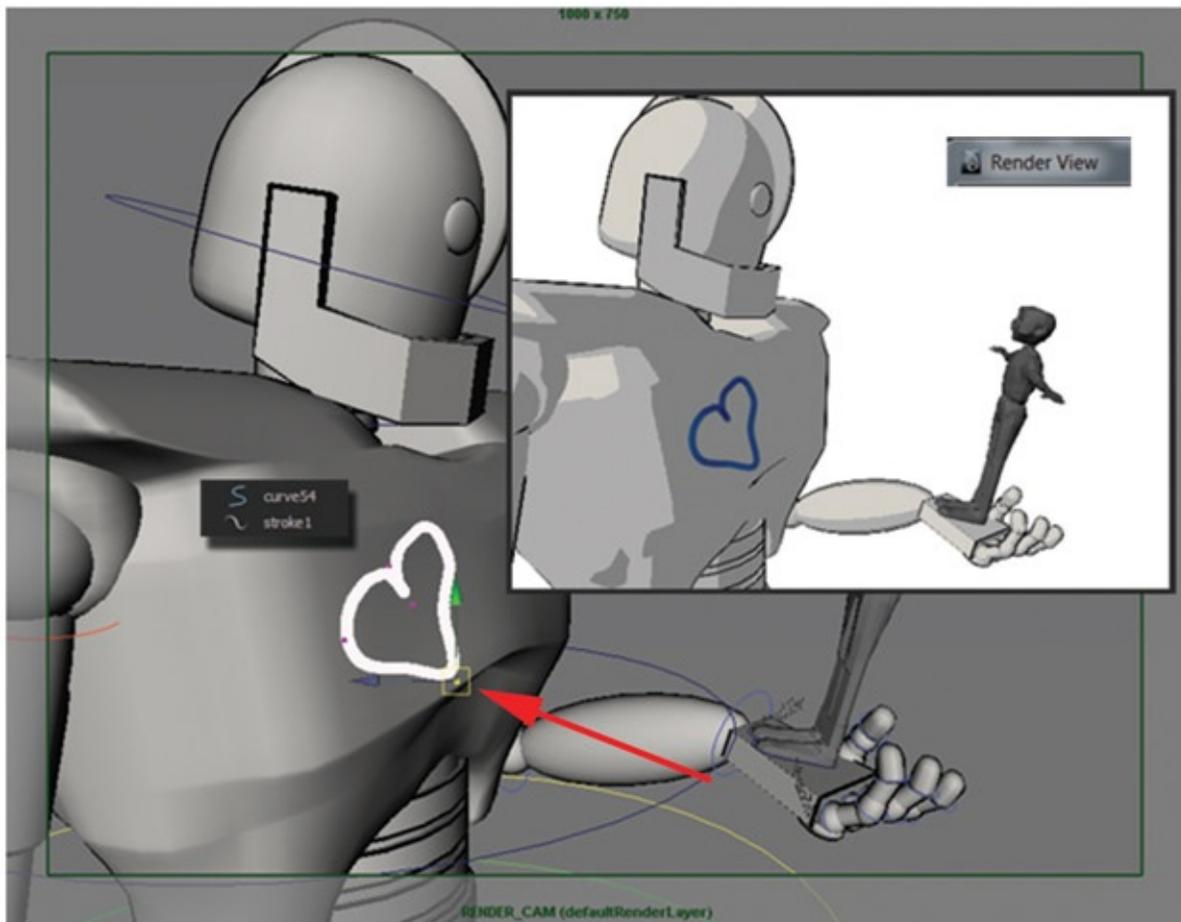
FIGURE 7.2 Animating curves with paint effects applied to them. (We had to see Robby one more time before the end of this book.)

Well, that wasn't elegant, was it? Now we know why the proprietary system was needed. Of course, there are other ways to manually draw in 2D over the character, and that is what we *can* do.

"Package Whispers" by Monira Kamal
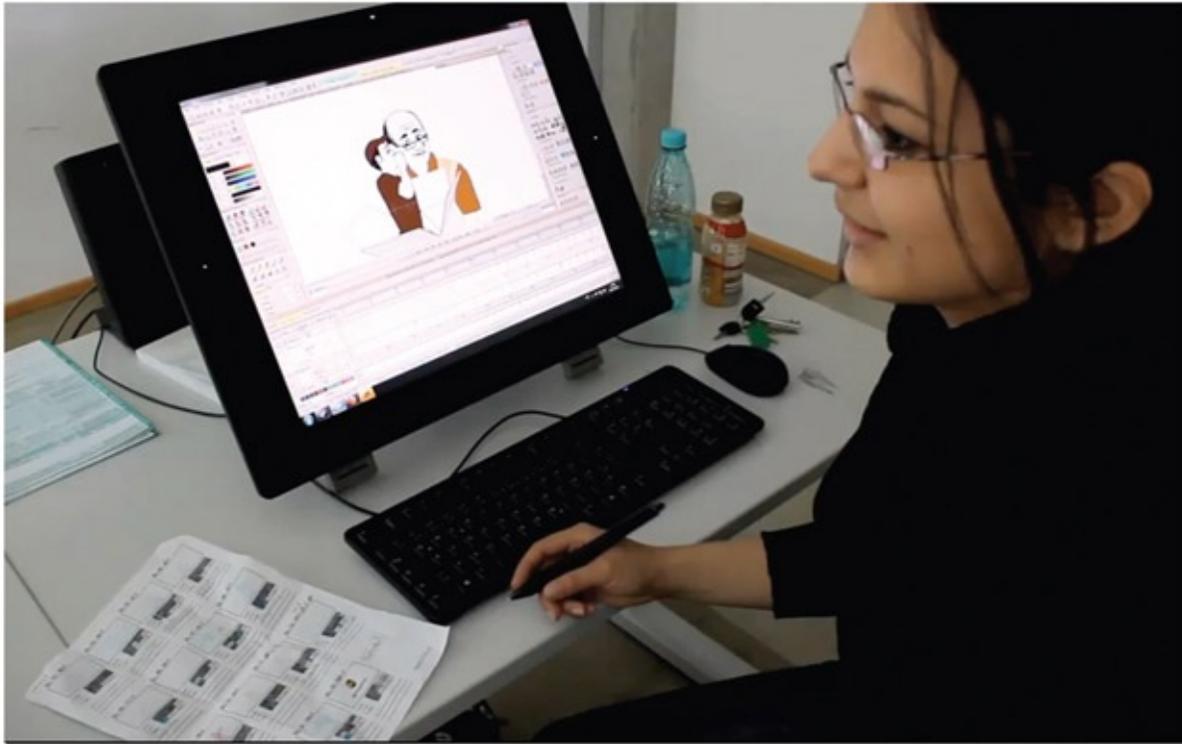
FIGURE 7.3 Monira Kamal working on a scene of "Package Whispers," 2012

Production: Konrad Wolf University of Film and Television in collaboration with UPS, "We Love Logistics"

Let's take a look at the animated short "Package Whispers," created by Monira Kamal of Germany. This film was created for the UPS challenge "We Love Logistics." The art direction was clearly indicated by style frames inspired by artist Stina Persson. You can see how the style frame pushed the animation to have a clear aesthetic in Figure 7.4. (Read further in Chapter 2's online material about "Iteration for Developing a Pipeline and Nailing the Moment.")

FIGURE 7.4 Style frame of "Package Whispers"
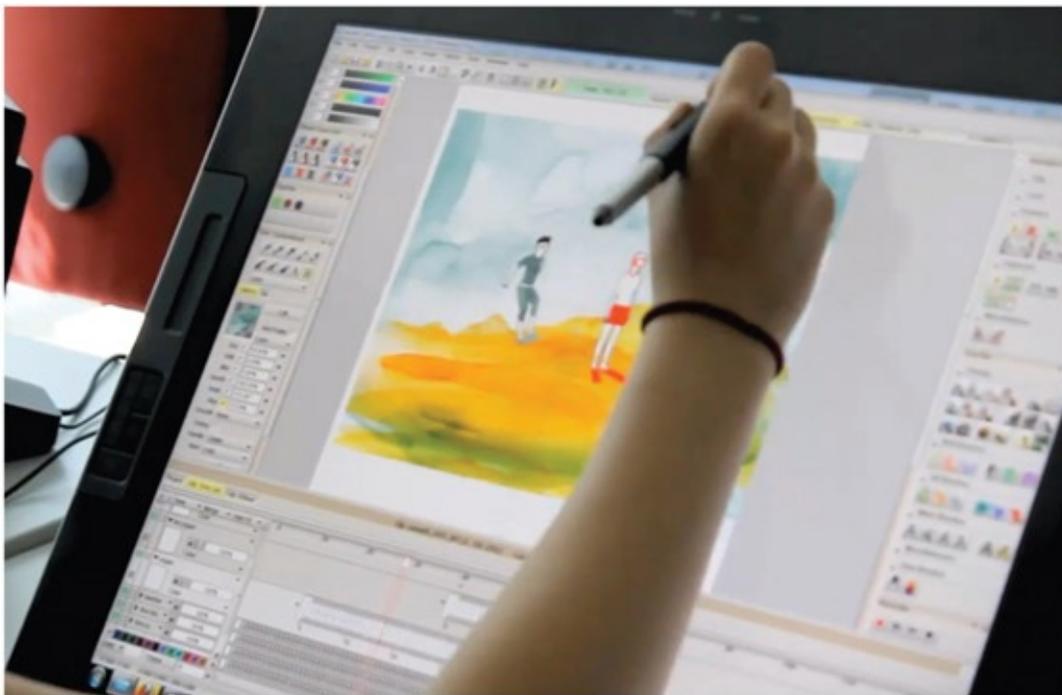
FIGURE 7.5 Digital 2D animation in "Package Whispers" using a Cintiq monitor

The animators worked in 3D to animate the characters in their scenes. The characters only had three different body types, but look to be good models and rigs to work with. These shots are not mixing different characters of different mediums like we did in Chapter 3. Instead they are starting with 3D (see Figure 7.6) characters and then flattening out the characters and adding toon shading. You'll note in the style frames that the characters are designed to not have skin tone, so the flat shading adds to the story of this piece. (See Figure 7.7.)
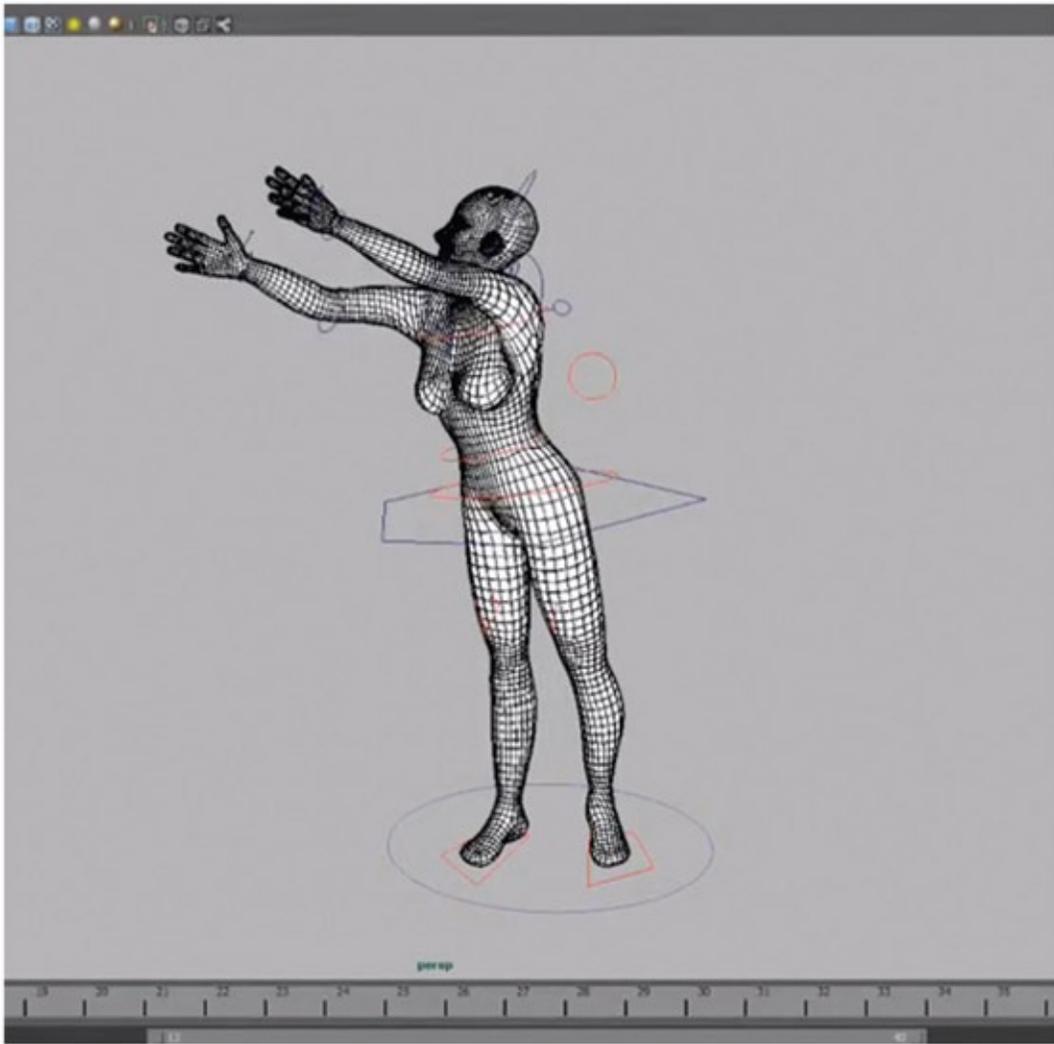
FIGURE 7.6 3D animation in "Package Whispers"
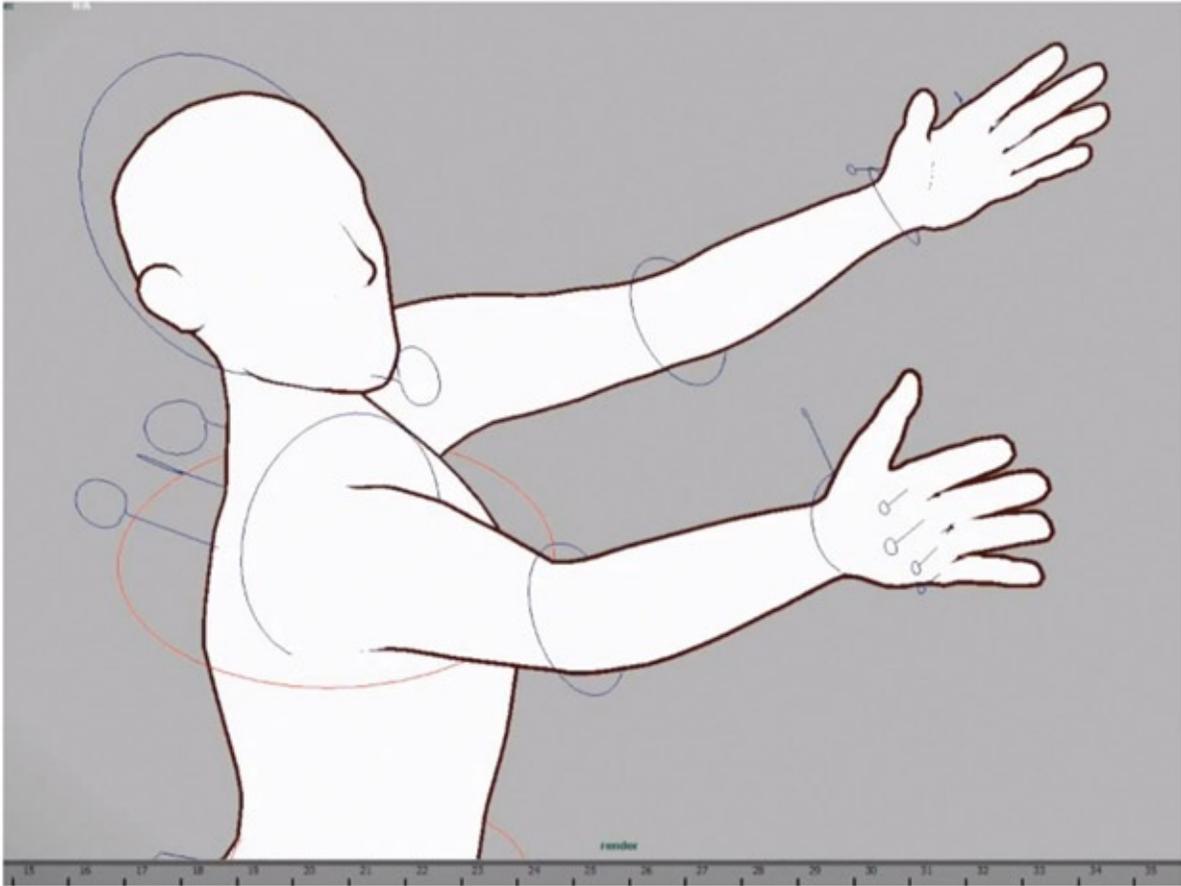
FIGURE 7.7 3D animation with toon shading in "Package Whispers"

The next set of images shows the process of the character broken apart. The characters are animated in 3D with toon lines (Figure 7.8), then digital 2D animated cloth and accessories are added on top. Oh, isn't that 3D leads 2D? You know that already. Then the features of the character are added as well. Finally the animation is composited over watercolor backgrounds. Note: the backgrounds themselves are composites of different water-color elements. (See Figure 7.9.)

FIGURE 7.8 3D model with toon lines, Digital 2D animated cloth, and animated features in "Package Whispers"

FIGURE 7.9 Character composited over watercolor background in "Package Whispers"

Please go here to view the completed short film:

http://www.hff-potsdam.de/de/filmeprojekte/hff-filme/detail/package-whispers.html.
The making-of video can be found here: https://www.youtube.com/watch?v=kHDdxQcdc0Q.

These grad students did a great job pulling off a great short animated film. Congratulations!

What Next?

Well, everyone, we have reached the end of our printed journey. Surely, as you have read this book you have thought of different ways to approach the problems we have faced. Maybe there are different methods you have used or want to test out. There will be new software, new versions, scripts, and methods to be explored. On top of it all, there will be examples of animation that we all want to look at to learn from or be inspired by.

What other things can you work with? IK bones in Toon Boom or Flash? What happens if you bring live elements into your animation? I wonder where Photoshop and its 3D capabilities is going to go? How can this apply to sprite animation and game engines? (Oh my —that's a whole 'nother world.)

What a lovely journey this has been. My only wish is that you will not get bogged down in one method, one medium, one aesthetic. Instead, while making beautiful art, I hope you keep fearlessly asking, "What does this button do?" and "Will it help tell my story?"

Warmly,
… tina

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Page numbers in italic indicate figures and tables.