[d i g i t a l]
CHARACTER
ANIMATION 3

George Maestri

New Riders

[digital] CHARACTER ANIMATION 3

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Digital Character Animation 3
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Dedication

This book is dedicated to Victoria.

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Basics of Character Design

This book is about creating characters and bringing them to life. Character creation includes a number of technical tasks, such as modeling, texturing, and rigging, all of which will be covered later. Before you start building a character, however, you'll need to design it.

Design is about making choices, both artistic and technical. It means getting to know your character's personality and then making choices that communicate this personality visually. When designing, you need to make decisions about size, shape, color, texture, clothing, and many other attributes. There is also a technical aspect to character design: well-designed characters are easy to animate, making the animator's job easier and more creative.

Good character design is one of the cornerstones of good animation. Designing your characters properly will make their personalities jump off the screen. Your audience will know who your characters are immediately—and like them. When you pair a great design with a great personality, the results can be wonderful.
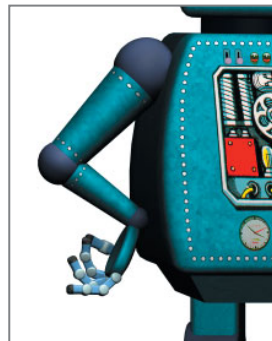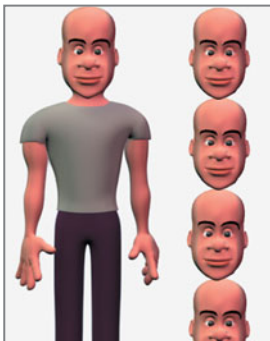
Approaching Design as an Artist

Character design is a very creative process and—as with any creative process—you can approach it from a number of directions. Your particular approach will depend a lot on your strengths as an artist. Some people like to sketch, some like to sculpt, and some prefer to design directly on the computer. Each method has its advantages, but you do need to keep in mind that your final product will be modeled in 3D.

However it's created, a well-designed character oozes personality. Your characters should be well proportioned and appealing to the eye. Even the villain should be appealing—particularly if it is in a delightfully gruesome way. If the audience doesn't identify with the character in some way, they'll lose interest.

Character design can be done for its own sake, or it can be done to meet a specific need. Many artists design characters simply to create interesting images, often without a story or a purpose for the character in mind. Because a great character can inspire all sorts of stories, design sometimes precedes all other elements of a project.

In other situations, you'll have a specific reason to design a character: to work within an existing story or sell a product, for example. In these cases, it's best to learn a bit about the character that you'll be designing before you start brainstorming.

When you're working within the constraints of an existing story, form should follow function. Understanding your character's function in the story will help you decide what form it needs to take. You might want to write down some of the distinguishing characteristics of your characters. What's the character's age? Personality? Size? How does your character relate to the other characters in the story? Is there an existing style? All of these factors play a role in the character's final design.

A character designed to sell a product may use the product itself as the starting point, such as this package of chewing gum.

The Creative Process

The design process always starts with creative inspiration, which is then refined and developed into a full character design. This design is typically a drawing or sculpture that describes the character in detail so it can be modeled digitally in 3D.

An explanation of the creative process could easily fill a separate book, but there are a few simple things you can do to tap into the creative side of your brain. Creativity is a flow of ideas that your brain connects in unexpected ways to form new ideas, and keeping these ideas flowing can be tricky. Any critique shuts down the creative flow, so try to avoid criticizing your work during the creative process. Critique is important, but should happen during revision, not creation.

Working in a medium you're comfortable with also helps. Sketching works well for me because it feels natural and I don't have to think about it. When I'm on the computer, things can get technical very quickly, which breaks the creative flow. Besides, pencils are fast and paper is cheap. It's much faster and more economical to generate ideas on paper than using a technical 3D application.

Idle sketches can inspire new character designs. Always be on the lookout for new ideas for characters.
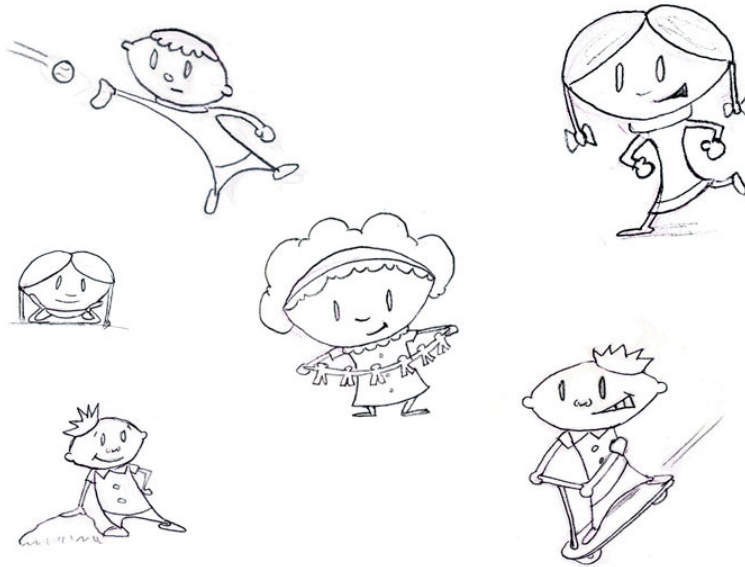
Technical Considerations

As you design, you do need to keep technical considerations in mind. Someone designing for a game, for instance, will need to limit designs to a specific number of polygons so the game engine doesn't choke. This technical limitation fundamentally affects the design and forces it to stay simple. Adding details like realistic hair and clothing will create additional work, increasing the production budget and extending the schedule.

Use the strong points of your software to your advantage, and design around its limitations. Make sure your character is easy to deform and animate; a character that's hard to animate can blow a budget very quickly.

A solid understanding of the technical issues involved in 3D animation is gained through experience. When you're starting out, you'll probably need to ask a lot of questions of more experienced animators. For your own initial projects, it's best to keep your designs simple so you don't get bogged down in technical problems.
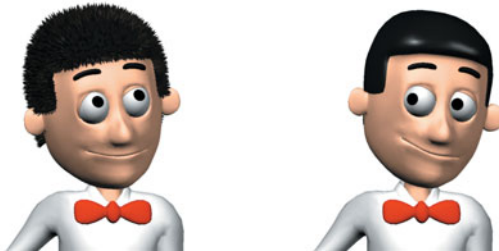
The simple hair on this character took a few minutes to render. These minutes can add up significantly when rendering a long scene. Changing the hair to a stylized design cut the render time down to a few seconds.
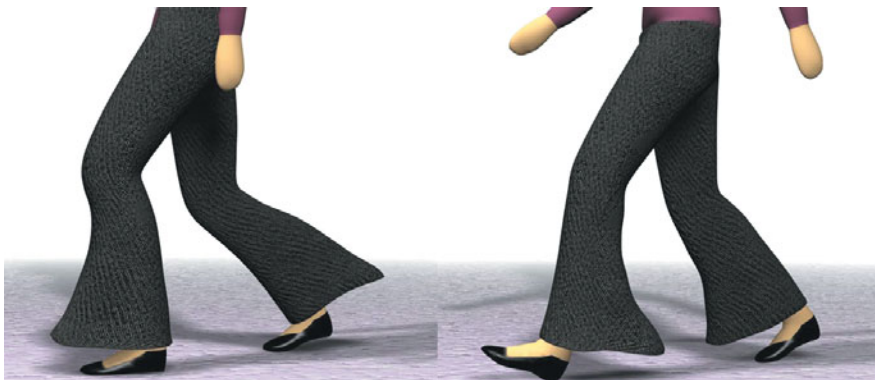
Realistic clothing can be another big technical challenge.

Using Reference

Good reference is always handy during the design process. Get outside into nature or look at other design, art, and film for inspiration. If you're designing a creature, you may want to take a trip to the zoo to find animals to use as reference. The Internet is also a terrific resource. A Google image search, for example, can produce all sorts of great reference images to use as inspiration.

Refining Your Design

Once you hit upon a good idea, you'll need to refine it into conceptual art, which then needs to be refined further into a final character design. You may need to redraw or resculpt the character many times before it works for the production. This is also the point where you need to ask whether the design is feasible in terms of budget and technical requirements.

Designing a giraffe? A trip to the zoo with your camera or some Internet research can get you plenty of inspiration.

Design Styles

Design falls into two very broad categories—realistic and stylized—with a lot of gray area in between. Realistic designs mimic nature as closely as possible, while stylized designs caricature reality. Your decisions about how realistic you want your characters to be will affect every part of the filmmaking process.

Realistic Characters

If you want to create characters that closely mimic reality, then digital animation is certainly the medium you should choose. Feature-film animators and special effects teams can create characters and creatures that look completely real and integrate them into live-action environments.

Realism, however, comes with a price tag. The rule of thumb is that the more realistic something is, the more difficult it will be to animate. This is particularly true for realistic humans. Audience members interact with people every day and are experts in human behavior, so they will pick up on anything even slightly "off" about a realistic human character.

Getting a still 3D model to look real is a much different task than getting the same model to move convincingly.

While you might be able to get away with realistic humans in crowd scenes and as virtual stuntmen without a lot of extra effort, the more screen time the characters get, the more work you'll have to do to sell a realistic character to the audience.

When considering realism, make sure you don't bite off more than you can chew. Nothing looks creepier to an audience than a realistic character that doesn't move realistically; that last 10 percent of realism takes more than 90 percent of the effort.

Stylized Characters

Stylizing a character avoids some of the problems involved with realism. If a character doesn't look completely photorealistic, the audience will be more willing to accept unrealistic movement and expression. This gives you the opportunity to write your own rules for the character and the world.

This stylized dog doesn't really look like a canine, but the audience will accept it.

A good example of stylized designs can be drawn from the classic cartoons of the 1940s. Daffy Duck hardly looks like a real duck, but he's certainly a very real character. Daffy moves in a very stylized way, and his body can stretch to cartoon extremes, but the audience accepts these wild motions because that's how Daffy's world works.

3D animation can certainly mimic reality, but animation is always at its best when it creates its own reality. A caricatured design, however, is not a license to animate your characters poorly. Good animation will make even the simplest character seem to live and breathe.

Stylized doesn't have to mean cartoony. A creature for a science fiction movie may look photorealistic, but is stylized in its own way. Even if the designer is inspired by nature, the end result is a new, stylized version of reality. This is the gray area between stylization and reality. Since the audience has never seenz this creature, you can decide how it will behave—but if the character looks realistic, its behavior should feel correspondingly realistic to the audience.

Cartoony characters can squash and stretch to extremes without losing audience acceptance.

Designing a Character

A character's design will depend largely on the character's personality and its role in the film. A character that is big and mean might have broad shoulders and beady eyes; a character with big eyes and a potbelly will seem meek in comparison. The relative proportions of your characters can tell the audience a lot about them.

Head and Body Proportions

Perhaps the most important proportion in a character design is the ratio of the head to the body. An average adult human is seven to eight heads tall, while an infant may be only a few heads tall. If the character is taller than average, it may look more lithe, graceful, or powerful, like a fashion model or superhero.

Stylized characters can have larger heads in relation to their bodies. One reason their heads are often larger is that the head and face communicate a lot of information about the character's mood and personality, and a bigger head makes these features more readable to the audience.
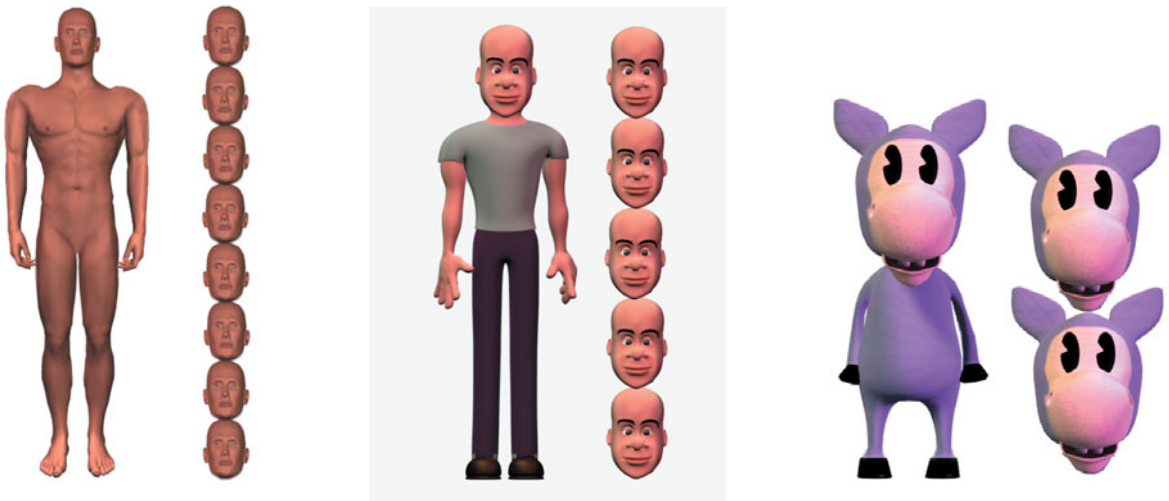
A **realistic human** stands about 7 to 8 heads tall. Exaggerated characters, such as body-builders, superheroes, and fashion models, may be as many as 9 or 10 heads tall. A **stylized human** usually has a slightly exaggerated head, making the character 4 to 5 heads tall. This makes the face bigger and more readable. A **highly stylized character** may have a head that's almost as big as its body.

Faces

The face is the very center of your character, and a good design will instantly tell the audience who the character is and what the character is feeling. Faces can take on a huge variety of shapes, and achieving this flexibility is a formidable design task as well as a technical and modeling challenge.

Make sure your character has enough room for the features to move around within the face. Some characters have an expression fixed on their faces; if your character is perpetually sunny or grumpy, don't hesitate to put this into the design.

Eyes

The eyes are the windows to the soul, and your character's eyes will give the audience a lot of information. Because eyes are so important, many designers make them quite large so the audience can see them more clearly. This is particularly true in genres like anime, in which the eyes can take up almost half the head. The size of the eyes in relation to the face also gives clues to the character's personality. Typically, larger eyes are cuter and more childlike, whereas small, beady eyes may indicate a villain.

Eyes express emotion mainly through the lids, which can narrow or widen to change the shape of the eyes. Many characters have eyes modeled as part of the face, but some use "clamshell" lids: essentially half-spheres used much like a puppet's eyes. Other characters simply use replacement animation, in which different expressions are swapped in as needed, to create the eyes.

The eyes of your character can also change shape. If your character has cartoon eyes, you can bend and flex the eyes dramatically to indicate the character's emotions. If your character has eyes that sit inside the head and behave more realistically, you won't have as much freedom in changing the shape when it's animation time.

Animal eyes can be tricky to design because many animals have eyes on the side of their head. This can make the animation task of conveying emotion difficult because the audience can see only one eye at a time. Many designers stylize animal eyes by "humanizing" them and moving them toward the front of the face.
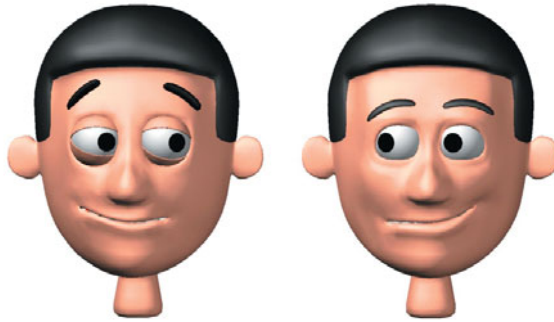
The eyes on the left use clamshell lids, which are easy to construct and animate but not as realistic as the lids on the right, which are part of the face.
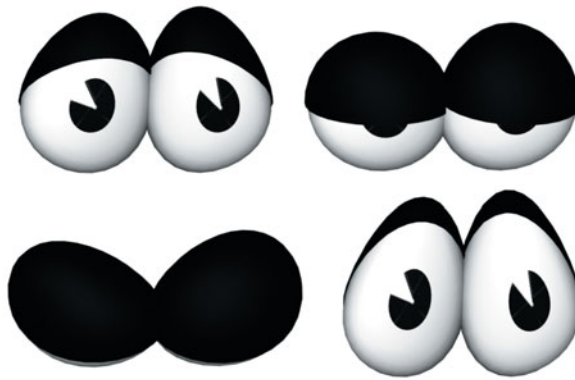
This simple set of eyes can squash and stretch for more cartoony effects.
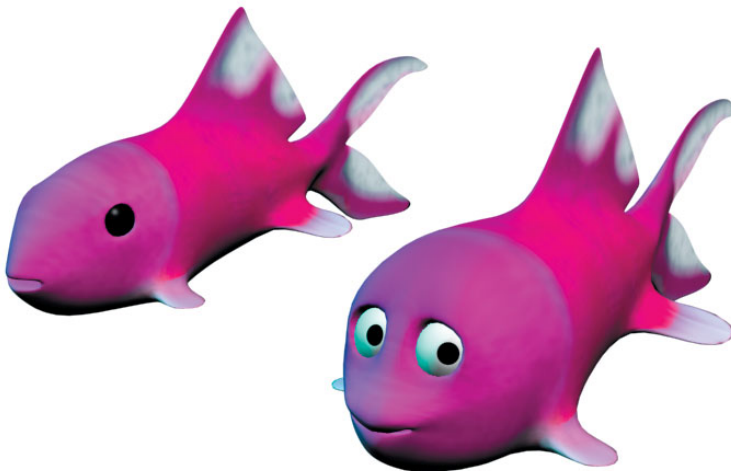
In the real world, many animals have eyes on the side of their head, such as the fish on the left. To design eyes that are more expressive, move them toward the front to "humanize" them.

Realistic eyebrows are modeled as part of the surface of the face.

Brows

A character's brows work in concert with the eyes to convey emotion. Raising the brows might indicate surprise, while lowering them might indicate anger. Creating good brow motion is very important, and your design will affect the way your brows work.

Realistic character designs model the brow as part of the surface of the face. To manipulate the brows, a modeler may need to create a number of different shapes or "morph targets" that can be blended or morphed together to create animation. Other characters use design to work around this complexity, creating cartoon brows that float on the surface of the face—or, in extreme cases, float above it.

Mouths

The mouth can be highly expressive and take on a huge variety of shapes, so proper design is very important. Most characters have mouths that are integral to the surface of the face. As with eyes and brows, this makes the creation of proper shapes and morph targets a significant modeling task. Some characters sidestep this issue and use replacement animation for the mouths, which isn't realistic but can lend the project a stop-motion feel.

Stylized brows can be modeled as separate geometry that floats on the surface of the face.

Extremely stylized brows don't even have to be attached to the face.
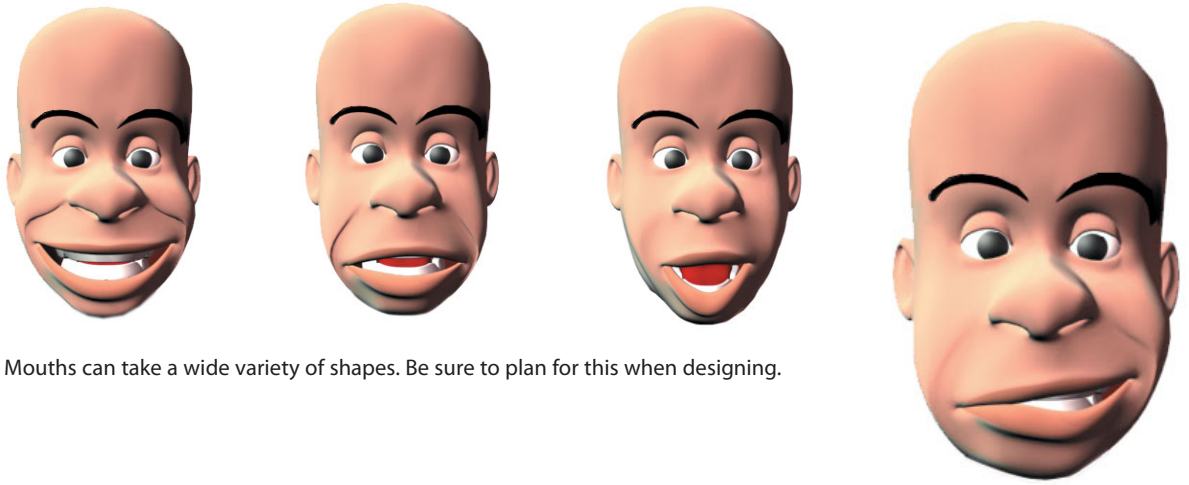
Mouths can take a wide variety of shapes. Be sure to plan for this when designing.

Some animators use replacement mouths that simply replace the character's entire mouth, a technique used frequently in stop-motion, cut-out, and clay animation.

Hands

Outside of the face, the hands are probably the most expressive part of the body. Many characters gesture a lot with their hands, and a well-designed hand will allow your character to express itself more clearly. As with heads, you can use slightly oversized hands on a stylized character for a cartoony look. If your design is more realistic, you'll want to proportion the hands realistically as well.

Here we have a character whose hand and body are one seamless mesh.

One challenge with hands is attaching the hand to the arm or the wrist. This is an extremely flexible joint, and proper deformations can be tricky. A long sleeve or wristband can be used to hide a seam, which allows you to create the hand separately and avoid this technical problem.

If you want, you can give your character cartoon gloves for hands. In the 1920s and '30s, animators found that white gloves made their characters' hands easier to see and therefore more expressive. For a 3D animator, cartoon gloves can serve the same purpose, while also hiding a telltale seam.

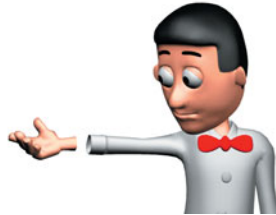This character hides the seam under the sleeve, which may simplify deformation and rigging of the character.

Segmenting Characters

Many characters are built using a single mesh. Although this is a natural way to create a character, it forces you to deform every part of the mesh when you animate the character. Mesh deformation is always a little problematic and can be resource-intensive, so sometimes breaking your character into manageable parts can simplify the rigging and animation process. It's very easy to design collars, clothing, and other accessories to help hide seams for your characters.

Some characters are designed from the ground up as segmented characters. A character such as a robot would actually be built with body parts as individual objects and might not even need mesh deformation at the joints. This makes the setup and rigging of the character very straightforward.

A cartoon glove is stylish, and it helps you design around the tricky problem of seamlessly attaching your character's hand to the wrist.
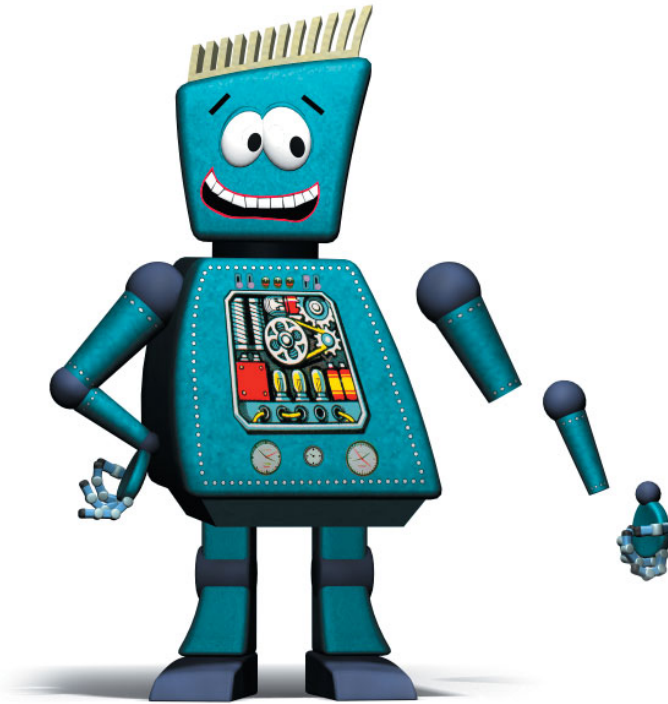
A segmented character like this robot is built out of individual parts, eliminating the need for mesh deformation.
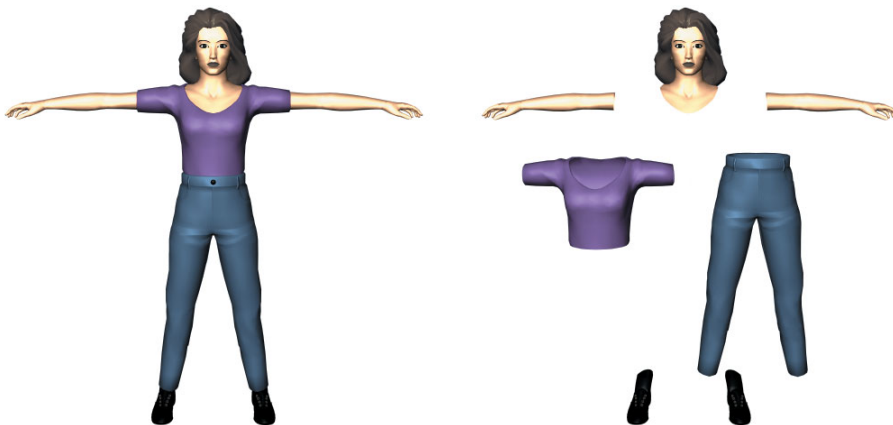
Even organic meshes can be segmented. A neck can be hidden under a collar, while clothing can hide other joints.

Finalizing Your Design

The ultimate goal of the design process is to create an image or sculpture that can be used as a reference to model the character in a 3D application. 3D modeling can be a very technical pursuit, so the art you create must be technically precise. Think of technical drawings used in industry and architecture; this is essentially what you will be creating. To model a character, you will need at least two orthographic views: side and front. These can be created using drawings, sculptures, or photographs.

Drawing Your Characters

People who draw often "cheat" the third dimension. This little guy looks fine on a flat sheet of paper, but he might not transfer well to 3D.

The simplest way to finalize your character designs is to sketch them on paper. A pencil is a wonderful thing, because it allows you to very quickly block out the size and shape of your character. If you know how to write your name, you can most likely draw a character.
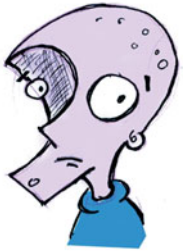
If you spend much time modeling characters on the computer, you'll develop a visual sense that will translate to paper as well. The act of modeling characters seems to improve your drawing, while drawing characters improves your modeling. Another way to improve both skills is through a life drawing class, which is the single best way to understand the aesthetics of the human form.

The Problem with 2D

The one problem with drawings is that they are 2D representations of a 3D world. Many artists "cheat" the third dimension when drawing, and while this works within the drawing, translating that to 3D can be difficult. When creating drawings for modeling, you need to make sure they don't cheat and are accurate to 3D.

Finalizing Your Drawings

The final drawings that prepare your character for modeling need to be very accurate technical drawings that work in 3D. Creating accurate front and side views of a character is not as easy as it sounds. Each view must line up precisely with the other drawings once they're scanned into the computer.

The drawings also need to have very specific poses. At a minimum, you'll want a front and side view, but top and back views can also be helpful for some characters. Draw your characters with the arms outstretched in the front view, to assist in modeling and rigging the arms. If your character is symmetrical, be sure to make the drawing symmetrical. One way to ensure that your character is symmetrical is to draw only half the character on paper, scan it, and then flip it in Photoshop to create the other half.
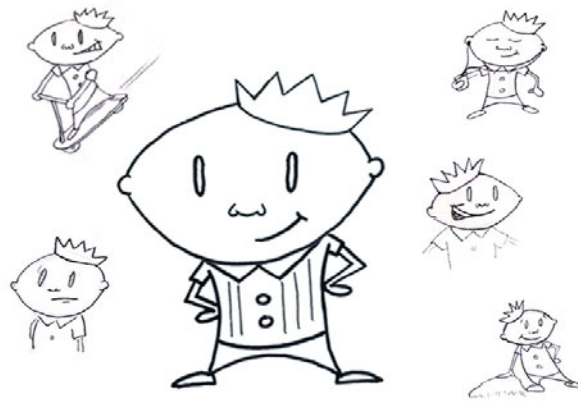
These are nice drawings, but they do very little to help the modeler realize the character.
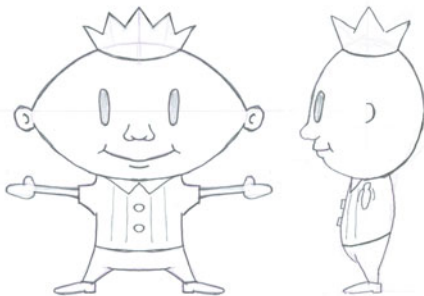
This is much better. The character has front and side views, the arms are extended, and the front view is symmetrical.
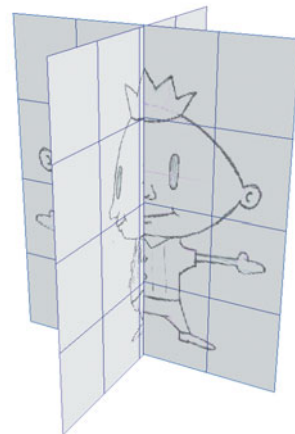
These images can be mapped onto planes in a 3D application and used as a reference for modeling the character.

Sculpting Your Characters

Another way to design characters is to sculpt them in clay. A 3D clay sculpture is much closer to the final character than any 2D drawing can get. Clay, however, is messier, more difficult to model accurately, and certainly a great deal more time-consuming than sketching.

Like drawing, sculpting is an art. Plenty of books and classes are available to teach the finer points of sculpture. If you understand 3D modeling, you should take to sculpture quite easily, and you'll probably find the interactivity of clay far superior to that of any computer-driven interface.

Once you've created an acceptable sculpture, there are two methods for getting it into the computer for modeling. The first method is simply to take a photograph of the sculpture. The second is to digitize the actual surface of the model, using a 3D scanner or digitizer. The method you choose will depend on your needs and also your budget. Laser scanning is very accurate and makes modeling easier, but the process can get expensive because it's usually done by an outside service. Digital cameras make photographing a subject very easy, and good reference photos are typically enough to create an accurate model.

The camera needs to be placed so it is shooting perpendicular to the subject.
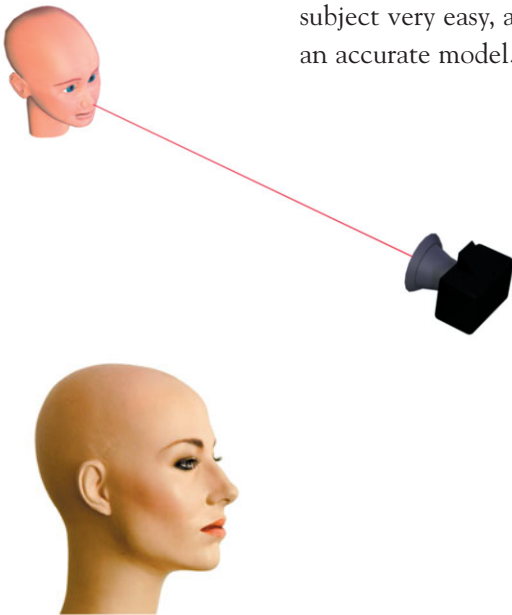
This shot is not perpendicular, and the result is a less than perfect profile.

This shot is dead-on and will make modeling the profile much easier.

Photographing Sculpture

You can photograph a sculpture for reference, but you can also photograph just about anything else: if you want to model a likeness of real person or an animal, for example, you can photograph them instead of sculpting or drawing them. Regardless of the subject, the process is pretty much the same. Like making a technical drawing, taking an accurate photograph that can be used for 3D modeling requires a bit of care.

When photographing a 3D object for modeling, you will always need to get accurate front and side views. The photographs you create will need to mimic the front and side orthographic views in your 3D program. To accomplish this, position the camera so that it is level with and pointing straight at the object being photographed. If the camera is too high or low or off to one side, the object will be distorted, making it difficult to model. When photographing a head, for example, it's usually best to center the camera on the subject's nose. You also need to maintain a uniform distance between the lens and the subject for each view. The best way to do this is to put the camera on a tripod and back the subject up against a wall to create a fixed distance between the two.

Another important parameter is the focal length of the lens. A long lens flattens your subject, mimicking an orthographic view and providing a more accurate modeling reference. To better understand this, think of a fisheye lens, which is the opposite of a long lens. A fisheye intentionally distorts the subject, making modeling harder. If your camera has a variable zoom, zoom all the way in and move the camera back to frame your subject.

This front view was shot with a wide 28mm lens, which distorts the perspective, causing a slight fisheye effect.

Moving the camera back and zooming the lens to 100mm flattens the perspective, making the image more accurate and more like the orthographic viewpoints used in modeling.