Chapter 7
Building Puppets

I think too many people take puppets for granted. Stop and think for a moment about how surreal and amazing the concept of a puppet is. It resembles a person or an animal but has no life of its own. It is simply an inanimate object, a lifeless lump of material. But when a real person manipulates it somehow, it brings forth the illusion of life. Puppets have been with us since ancient times, and, for me, they have always been a fascination in one form or another. Having grown up in the late 1970s through the '80s, Jim Henson's Muppets were a constant source of entertainment. I vividly remember seeing them on display at the Detroit Institute of Arts in 1981, and seeing live puppet performances from different world traditions there as well. In elementary school, we had a puppeteer who brought his marionette plays to the gymnasium every year, starring a dragon named Applesauce. Since I had toy puppets of my own, I knew how they were operated, yet at the same time I believed they were alive. Another obsession of mine from growing up in the '80s were the animatronic animal rock bands at places like Chuck E. Cheese's and Showbiz Pizza Place. These also seemed to be alive, but they were not operated by live puppeteers. Instead, they were programmed by a computer synced with audio tapes behind the stage, delivering a performance that had been premeditated to repeat itself. In all of these various forms, the same illusion was being achieved: The puppets had *anima*, but their *animators* were nowhere to be seen, hidden from view, or absent entirely.

In stop-motion animation, the same illusion of life is achieved in a different dimension of time. The animator is touching the puppet and making it move, but his work is not seen by the audience in real time. It exists only between the frames that flash before our eyes. A stop-motion puppet performance is a combination of premeditated planning and improvisation by the animator, in a thought process that takes several hours of our time, and condenses it to mere seconds of screen time. Because of the amount of control offered to the stop-motion animator over what can be achieved in this time dimension between frames, there is a wider spectrum of possibilities for naturalistic movement compared with most other forms of puppetry. A stop-motion puppet, for instance, can walk with a more realistic sense of weight, which is more difficult to achieve with a marionette. That does not necessarily lessen the challenges involved, nor does anything possible in stop-motion make other puppet art forms inferior. As always, story has priority over technique when it comes to reaching your audience.

Whether a puppet animator is moving a hand puppet, marionette, stop-motion clay figure, or a realistic creature like the kind seen in the Jim Henson/Frank Oz film *The Dark Crystal* (1982), there will always be obstacles to overcome in making the performance believable. Working with puppets in any way always requires much creative problem solving. For this reason, the design of the puppet in appearance and construction is vital to how effective it will look before an audience. There are thousands of materials, methods, and techniques that can be used when it comes to making stop-motion puppets, and it will always take much experimentation and trial and error to get them working. As you attempt this, be humbled by the words of Thomas Edison, who said, "I have not failed. I've just found 10,000 ways that won't work." There is not necessarily any right or wrong when it comes to building puppets; there is only what works and what doesn't work as well. Even professional puppet builders with years of experience come across obstacles and problems, and through their experience, they find which methods work better than others. Through experimenting with different techniques and materials, animators and puppet builders find personal preferences they continue to work with. One of the neatest things about stop-motion is the opportunity to throw things together with whatever you have easy access to in your home or school. This applies to building sets as well as puppets. It is often referred to as the *MacGyver* method of filmmaking. (For younger readers who missed out on 1980s television, MacGyver was a kind of intellectual action hero who made weapons and traps out of whatever materials he happened to find around him.) All aspects of stop-motion filmmaking are a constant challenge in problem solving, and sometimes the best solutions are found by the seat of your pants.

This chapter will help you design your own characters and build them into puppets to be animated in stop-motion, based on what has worked well for me and others in the field. I will cover several different methods for making puppets so that you can choose which method will work best for the kind of characters you want to create.

Character Design

The main difference between stop-motion puppets and other kinds is that they have an *armature* inside. An armature acts as the skeleton of the puppet and must be built so that it can hold its position without slipping for each frame captured. A stop-motion puppet must also be built in a way that will prevent it from falling over or breaking during a shoot. To prevent mishaps such as these, your puppet should be as lightweight and durable as possible. With all of these points to remember, the most important principle is that *your puppets must be designed based on what they will be doing, and what kinds of movements will be required of them*. It is the simple rule of form following function. What do your characters do? Will they be walking or jumping, or will they only be seen from the waist up? Will they speak or express their feelings solely through body language? Will they need to hold a prop in their hand? Your story or overall purpose for animating will be the ultimate factor in how your character is designed and built.

To design a character, you must first be familiar with what *design* actually means. Design really boils down to communication of an idea that is being relayed—in this case, to the audience watching your character move on-screen. Most animated characters are designed based on a set of symbols and clichés based on reality but exaggerated to emphasize certain aspects of their personality. The most basic symbols used to communicate to the audience about a character are the shapes of the mouth: If it is curved upward, the character is happy; if curved downward, the character is sad. Adding to these symbols would be the position of the eyebrows, indicating whether a character is worried, angry, or devious (see Figure 7.1).

These symbols go all the way back to the first scribbles we all made as children, so they will always be recognized by our subconscious mind. However, these symbolic facial expressions can be used by any character depending on his mood, so other symbols must be employed to suggest more about who that character is.

Figure 7.1 Basic face symbols instantly communicate various expressions to an audience.

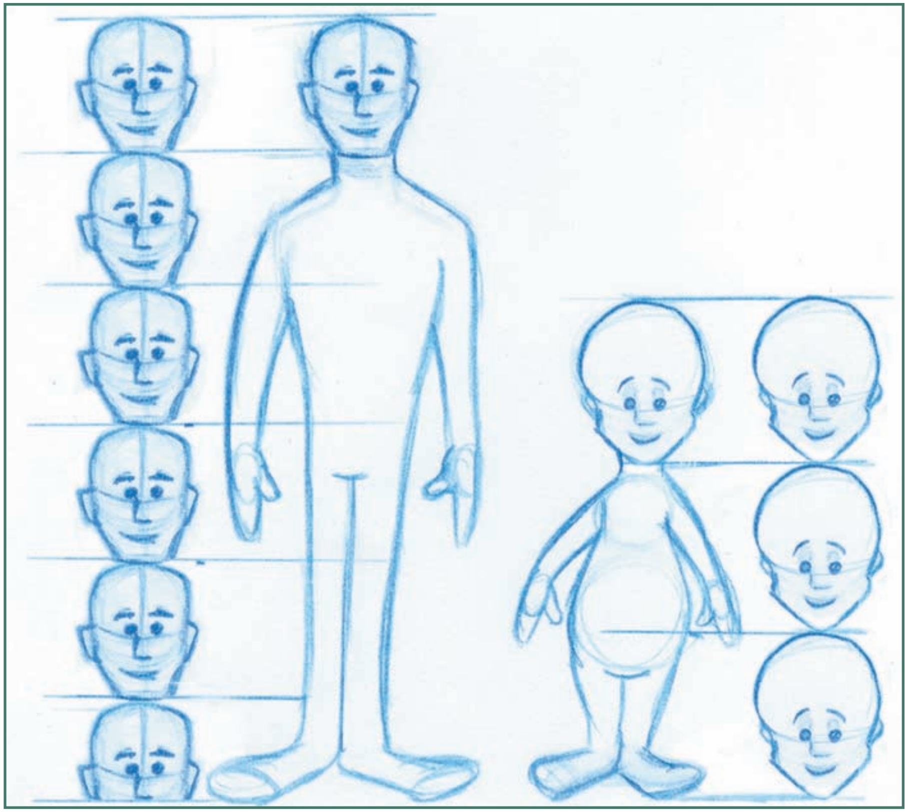

Figure 7.2 Proportions of a human figure are measured according to the height of its head.

Proportions and body shapes are commonly used to communicate certain character types to an audience. By taking life drawing classes and studying the human figure, you can learn more about the proportions that make up a human or animal figure and then exaggerate them for an animated character. The human figure is typically measured in height using the height of the head as a measuring stick. The average adult human is about seven to eight heads tall, with the head being balanced in proportion to the rest of the body. Small children, however, have larger heads in proportion to the rest of their body, and as they get older the proportions balance themselves out (see Figure 7.2).

Since audiences will subconsciously pick up on this fact, it must be exaggerated when creating animated characters, so that the age of the character can instantly be communicated through the design. By designing your character with a huge head in proportion to his body, he will look more childlike, so you would want this kind of design if you want to create a baby or child character, at about two or three heads tall. A good example of this principle in stop-motion design is in Art Clokey's *Davey and Goliath*, where Davey and his friends are designed with much bigger heads compared to the adult characters in the show.

Other character design principles related to proportion and body shape will vary depending on the type of character (see Figure 7.3). Big "tough guy" or heroic characters are designed with emphasis on the shoulders and chest to show they are strong, because in real life a strong person would have wide shoulders in proportion to the rest of his body. Fat characters will have huge stomachs and short, stumpy legs, so that the girth of their body looks even fatter in proportion to the rest of them. Often, effective character design comes from taking that one element of the character that says the most about *who he is* and making it the most central part of the design. Also think in terms of costuming and props, and how these can be used to tell the audience about your character. Whoever your character is on the inside will have a big effect on what he looks like on the outside.

At its simplest level, all animated characters are made up of a hodgepodge of circles, squares, triangles, and variations on these basic shapes. Study characters from all kinds of animated productions and analyze their silhouettes, looking for the shapes and patterns that make up the shape of their body. These principles apply to characters in all mediums, so they are important to experiment with. In stop-motion animation, there is one major difference, in that once a character is designed, it must also be realized in three dimensions and made simple enough to animate. 2D characters have much less to worry

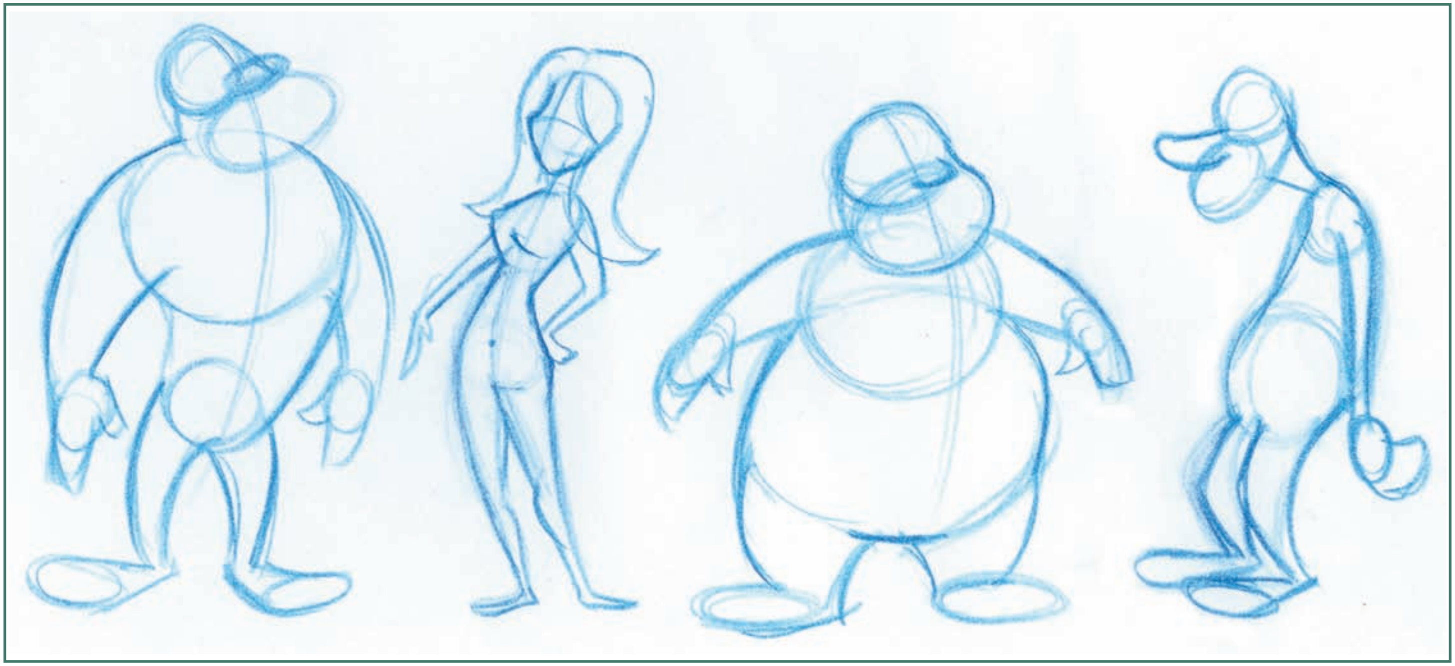

Figure 7.3 Different typical body types for animated characters.

about in terms of gravity, for instance, since they are not necessarily enslaved to it. A character with a big head and chest, but with thin legs and tiny feet, might work as a drawing, but problems could arise if the same character were made into a puppet, because it could become very top-heavy, making it difficult to maintain its balance. In this case, it would definitely need to be extremely light and be built with strong support in its feet to balance it. Your designs might need to be modified to make them suitable for stop-motion. One way to test this would be to draw your character in different poses, or, better yet, make a tiny sculpture of your puppet in solid clay and try posing it into a few different positions to get a feel for how it will work in 3D. Imagine any problems you foresee with working with it as a larger scale puppet, and plan accordingly.

Again, I must emphasize that your design will depend on what your character does in your animation. If your character must reach for an object behind or above him, make sure his arms are long enough to do so. If he is to be walking, make sure his feet are not too big or too small in proportion to his body. Puppets designed mainly for action shots like walking or jumping will need more emphasis placed on the construction of their body. For puppets that will have a stronger focus in character animation, the eyes and hands will most often be the most important element. The eyes are the first thing the viewer will gravitate toward when looking at your character, so make sure they are placed well on the face to bring the viewer into them. Study the eyes of different stop-motion characters and think about how important they are to the overall design. Eyes are especially crucial to mute characters, such as Nick Park's Gromit, who makes all of his expressions using his eyes and brow. Hands are also very important for establishing character when posing and speaking, as many of us typically gesture with our hands when we speak. One of the best animations to study for how the eyes and hands work together with character design and dialogue is in *Creature Comforts*, both the original film and the series.

Dialogue is achieved with puppets in a number of ways, and how to animate dialogue is discussed more in Chapter 9, "Puppet Animation." The most common methods are either through the construction and manipulation of one mouth or a series of replacement mouths (see Figure 7.4). A single mouth on a character might possibly be sculpted in clay and need to be resculpted and shaped for each frame, a technique commonly seen in Will Vinton's Claymation films. Alternatively, the puppet might have one mouth that is formed with wires that simply open, close, and reshape themselves for certain syllable shapes, such as the Oogie Boogie Man in *The Nightmare Before Christmas*. Replacement mouths require different individual mouths for each syllable that are removed and replaced for each frame. They are very popular in stop-motion due to their efficiency for production, and they are used in many shows like *Davey and Goliath* and *The PJs*. Replacement mouths in clay animation are sometimes blended into the face for each frame so that they continually appear to be part of the whole face.

With all of these different design elements, it all boils down to what will be most convenient to your budget and the process of animating your puppet. In some cases, the materials used for building a puppet will also be determined by the personal preferences of the animator. Keeping all of these factors in mind during the design stage will save you from the common problem of investing lots of time, money, and energy into building your puppet, only to realize it's impossible to animate what you want it to do.

Figure 7.4 Replacement mouths and puppet by Darren Lee.

Evolution of a Character: Hamish McFlea

It is very common for characters to evolve as you work with them. You might start with an initial sketch of an idea and have it go off completely in another direction, which is good, because that is typically how the best ideas come about. As an example, I thought I would show some of the process behind a character I developed for my unrealized student film *Bad News*. The original film idea was about a news report concerning a doomsday cult's prediction of an alien Clockwork Monkey coming from outer space to destroy the world. (I have always been simultaneously terrified and fascinated with clockwork monkeys banging cymbals, and I figured if anything came to destroy us, that would be it!) I thought it would be funny to have a Scottish news reporter talking about it on location, since I do have some Scottish heritage, and because I love Scottish accents and thought it would be fun to animate. So, with these rough ideas in mind, I just started sketching ideas for a character that would ultimately be created as a stop-motion puppet.

My initial concept for the news reporter, who I named Hamish, was to make him human, so I started drawing him in different poses I imagined for the animation. His personality was that of a very nervous, dim-witted character who half-believed the rumors of the alien monkey, so I drew him in poses suggesting panic and fear (see Figure 7.5).

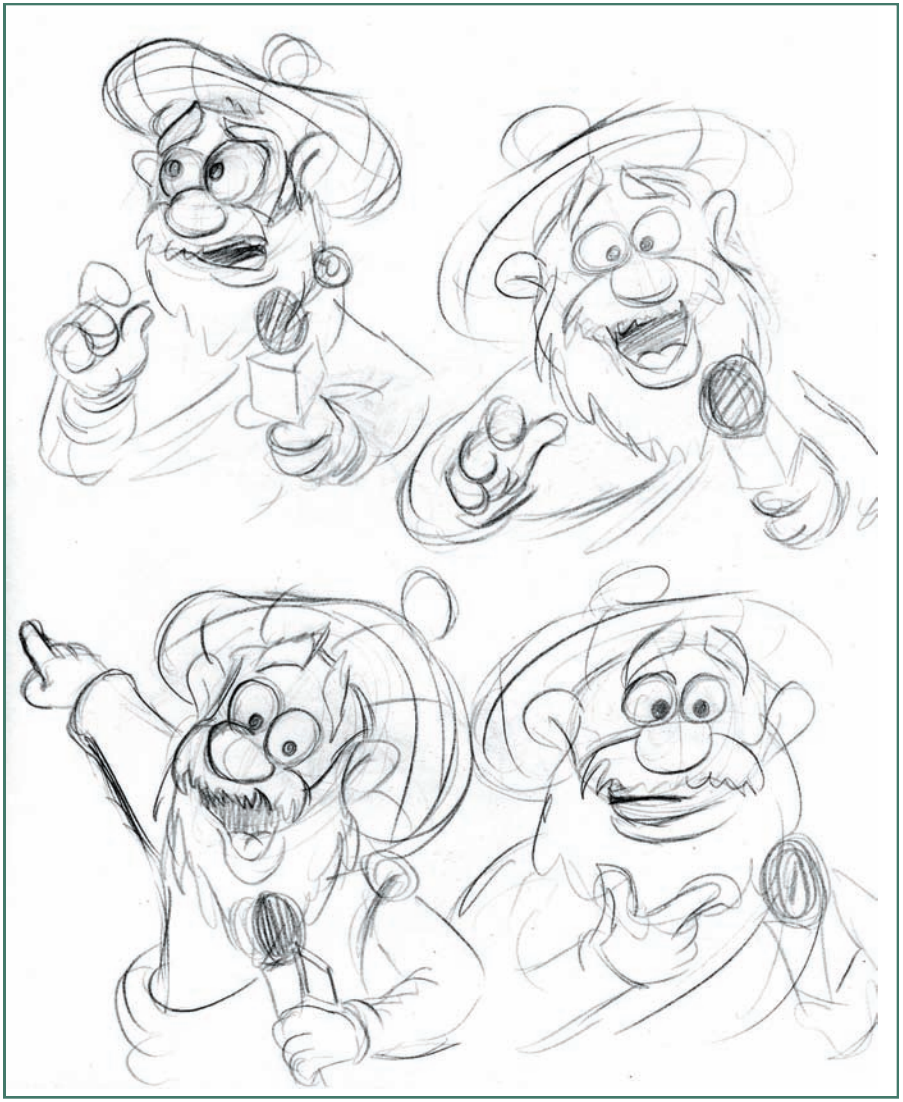

Figure 7.5 The first sketches of Hamish explore his personality.

As this project continued to evolve, for some reason I don't quite recall, I decided that all of the characters in the film should be animals, so I turned Hamish into a dog. I began experimenting with his facial expressions, still drawing him as a naïve, energetic character, but also trying some expressions of anger and smugness (see Figure 7.6). I find this to be a good method for fully exploring a character's potential. Do not limit yourself only to the moods that you envision your character displaying within your story, but show your character in every disposition imaginable. Through this process, I found myself gravitating toward the drawings of Hamish in a bad mood, and his personality transformed as such (see Figure 7.7).

Figure 7.6 Early sketches of Hamish as a dog, exploring his facial expressions.

Hamish didn't believe in the rumors at all and was annoyed at the whole prospect of being outside on location to report on it. Being a dog, I decided he should also have a flea problem; hence his last name, McFlea, which would make him even more irritable. Knowing these things about his character helped me in writing his dialogue with the off-screen news anchor, commenting about how all the police have left for the pub and how the whole situation was a load of…(you get the idea). In the middle of his rant, the monkey appears and attacks him, which adds to the comedy and suspense of his disbelief. I felt that now Hamish was a real character ready to be made into a puppet! (The finished animation of this scene is part of my demo reel on the accompanying CD.)

Since Hamish was only going to be seen from the waist up, I decided I would not waste time building him legs, but rather have him attached to a wooden base. I started by making a solid clay sculpture of him for scale purposes, to make sure he would be the right size compared to the Clockwork Monkey of the Apocalypse (see Figure 7.8), who I had already started building (more on him later).

I used a plastic beaded doll armature found in a local craft shop (David Bowes, who is interviewed in Chapter 3, "An Interview with David Bowes," had found these and told me to go check them out.) These armatures are designed for doll makers for the purpose of posing them for window displays or catalogs, and they also work great for stop-motion animation. They already come in a human body shape and hold their position extremely well, so they are perfect for simple puppets designed for medium shots and dialogue. The materials used for building a puppet will always be determined by the look you want and what the animation calls for. Hamish's head and hands would be made of clay, since they were to be the most expressive parts with the most fluid movement. The rest of Hamish's body would

Figure 7.7 Additional concept sketches developed his character further.

Figure 7.8 Hamish is built as a solid clay sculpture alongside his puppet costar.

be made of fabric, to keep him lightweight and avoid deforming his shape while being animated. Making puppets with real fabric clothing adds a great sense of texture and realism to the final look.

I pulled the legs off the armature and adhered the armature to a balsa wood base (see Figure 7.9) with epoxy putty, also referred to as the popular brand "ProPoxy." This is a two-part compound putty found in hardware stores that is normally used for masonry and concrete repair. I will explain more about using epoxy putty while describing other puppet building methods.

Because Hamish's hands would move around and his mouth need to be changed often while he talked, those parts worked best if they were removable. This way I could resculpt them or manipulate them without causing unwanted movement in the body of the puppet. At the ends of Hamish's arms and his neck, I attached small pieces of K&S tubing with epoxy putty so that the head and hands could be attached to wires that slide inside. K&S tubing can be purchased in hobby shops and cut to whatever size is needed.

To create the bulk of Hamish's body, I covered his arms and torso with mattress foam (see Figure 7.10). The foam was cut into strips, wrapped around the armature, and held in place with glue, thin wire, and a bit of tape. Extra layers were wrapped around his belly area to give his body a pear shape and indicate that he has a large gut. His clothes were then sown together, with his green shirt made of felt and his tartan sash made of a scrap of plaid flannel fabric (see Figure 7.11).

Figure 7.9 A plastic doll armature adhered to a wooden base.

Figure 7.10 The armature is covered with mattress foam.

Figure 7.11 Clothes made of fabric are sewn over the armature.

The base for each hand was a lump of epoxy putty with a twisted wire stuck into it (before it dried; see Figure 7.12). The clay was built up around it and sculpted into a hand shape. Having the putty base not only makes it possible to attach a wire for sliding into the K&S tube, but it also cuts down on the weight. The fingers were left just as solid clay, because they are thick enough to hold their position without wires inside, which would just poke through the clay and make the animation difficult.

Figure 7.12 Plasticine hand sculpted over epoxy putty base.

Hamish's head was built over a Styrofoam ball with a twisted wire stuck into it. This was also done to make the head lighter, and the wire would allow his head to tilt in any direction, once stuck inside the K&S tube. To give his ears extra stability for animating, they were built out of a wire mesh. Socket holes for his eyes, which were made out of Sculpey and painted, were gouged into the Styrofoam. Eyes can also be made with wood, plastic, or glass beads and should always have a pinhole in them so that they can be animated (see Figure 7.13).

Figure 7.13 Styrofoam head with Sculpey eyes and wire mesh ears.

Over the Styrofoam ball, Hamish's head was sculpted with a thin layer of Plasticine clay, with a Sculpey nose. For his dialogue, I would sculpt replacement mouths that would need to be changed for each syllable of his speech patterns, and his mustache provided a frame around the mouth. His hat was made of fabric over a wire frame, which had two pieces of wire sticking out of the bottom, so that they could go through his head and keep it from falling off (see Figure 7.14). Finally, his prop microphone was built out of Sculpey, cardboard, and an actual miniature foam microphone cover.

Figure 7.15 is a shot of my bringing Hamish to life, and Figure 7.16 shows him acting for the camera. See Chapter 11, "Sets and Props," to read about how I composited Hamish and the monkey into a live-action background.

Figure 7.14 Plasticine is layered over the head.

Figure 7.15 A slightly younger me at work.

Figure 7.16 Hamish McFlea on set.

Other Characters with Doll Armatures

The plastic doll armature (see Figure 7.17) is a fantastic tool for creating a very durable puppet that will last you a long time, and these armatures have grown to be a favorite tool of mine. Surprisingly, they are not very popular or widely distributed (at least no longer here in Vancouver). The local craft stores that used to carry them where I live stopped selling them, so I ended up buying them in bulk from the original distributor. They cost only a few dollars a piece, and different versions of them can also be ordered from a few distributors on the Internet. They have always been extremely popular and convenient in teaching my stop-motion course over the years, already made and ready to be dressed and animated, so they are great for kids as well. For new animators, doll armatures are particularly suitable, because they eliminate the extra step of making an armature from scratch, so that the focus can immediately be on just animating. Unlike wire armatures, which run the risk of breaking during animation, the plastic beads can be popped back together again if they come apart. Although doll armatures come premade as a body shape, they can also be cannibalized for extra parts such as tails, tentacles, or other appendages. You can also shorten their arms or legs for more stocky characters (see Figure 7.18, built

Figure 7.17 Plastic beaded doll armatures.

Figure 7.18 Leprechaun puppet by Nicole Tremblay.

on a plastic doll armature with felt clothing and head made of Sculpey on a Styrofoam ball) or use them for four-legged creatures (see Figure 7.19, built on two plastic doll armatures with papier-mâché head, beads for eyes, and wires inside the fingers).

The Clockwork Monkey in *Bad News* was also built on a plastic doll armature, using the full figure. After designing him with a series of concept drawings, I built the bulk of his body with mattress foam just like Hamish: cut into strips, wrapped around the armature, and stuck on with glue. (Hot glue or spray adhesive glue will work fine, reinforced with a little bit of strong tape here and there.) I found a furry brown fabric and glued it onto the foam and made some felt clothes for him (see Figure 7.20). His hands were ready-made plastic doll hands painted the same color as his feet. My friend Meeka's dad is an award-winning metalsmith/jeweler, so she was kind enough to have him fashion some homemade cymbals for me. He also had a tail made from more beaded plastic armature pieces and covered with furry fabric.

Figure 7.19 Centaurette puppet by Stephanie Mahoney.

Figure 7.20 The Clockwork Monkey in progress.

The Clockwork Monkey's feet were made of baked polymer clay that I pressed the ends of his legs into before baking, so that there would be an exact indentation to hot glue the armature to afterward (see Figure 7.21). To make his head, I used a Styrofoam ball and attached different pieces of mattress foam (covered with fabric and paint) to make his ears, face, and muzzle. His muzzle was covered with a thin layer of Plasticine so that I could make him curl up his lips in a sneer or move the corners up for a wider smile. The teeth were made of baked polymer clay and glued to his foam muzzle, and his bottom jaw was attached with wire so that he could open and close his mouth.

The eyes were wooden beads painted white with a pinhole poked into them, so that a toothpick or thumbtack could be used to animate them moving around. The foam eyelashes on only one eye were a play-on-words homage to the Alex character from Stanley Kubrick's film *A Clockwork Orange*, since he was, after all, a Clockwork Monkey.

I wanted Hamish's head to be removable, so the wire sliding into the K&S tube was the best option for serving that purpose. In the case of the monkey, there was no need to remove his head, so it needed to be firmly attached to the body. I have found the steps in Figures 7.22–7.25 to be the best method for creating a puppet on a doll armature with a permanently attached head.

Figure 7.21 The Clockwork Monkey's feet and head, in progress.

Figure 7.22 Break off three beads from another doll armature and attach them to the top with epoxy putty for a neck piece.

Figure 7.23 Gouge a hole into a Styrofoam ball with the plastic neck piece so that it creates a hole exactly the right size.

Figure 7.24 Fill the hole with hot glue.

Figure 7.25 Attach the head by sliding the neck piece into the hole, and let it sit for a few minutes to cool off.

You can put some epoxy putty around the neck joint if it needs some extra stability. You can then cover the neck piece with fabric, Plasticine, or whatever flexible material will match the look of your head, and you now have a puppet with a head that will be able to rotate, tilt, and hold its position extremely well.

I used this same method of attaching a head for another puppet I built for my current film-in-progress, *Storytime with Nigel*. Nigel (see Figure 7.26) is a children's storyteller who narrates a story told in 2D animation and is voiced by Academy-Award winning animator Bob Godfrey. He was built on a plastic doll armature with a Styrofoam head and wooden beads for eyes. I covered his head with a material called Rigid Wrap, which is basically a roll of gauze caked in plaster. Rigid Wrap can be found in craft stores, cut into strips, dipped in water, and layered onto the head. When dried, it will be rock solid and ready to be painted. Nigel's dialogue was done with clay replacement mouths, which were placed onto a pinhead sticking out of the middle of his muzzle. The only elements that moved on his face were his mouth, eyes, and eyebrows (stuck on with Sculpey), so his head was simply a solid object that would move in sync with the inflections in his dialogue.

Figure 7.26 My Nigel puppet, also built on a doll armature.

Nigel's hands were built on a poxy putty base adhered directly to the doll armature, which would allow them to move in any direction. Wires for the fingers were stuck directly into the putty before it dried, and they were covered with felt gloves that were sewn together and stuffed with fiber fill to give them some bulk. His clothes were made of felt.

All of these puppets were built with the plastic doll armatures because they proved to be the best kind of armatures for the size needed and suited themselves well to the design. These methods may not necessarily be as convenient for other character designs. The important point here is that the puppets were designed based on what would be required of them to perform in front of the camera, which was mainly dialogue or simple character animation from the waist up. I would highly recommend getting your hands on a few armatures like this for your first puppet experiments. Here are a few resources, and you can always Google search for more or scope out your local craft store:

- **www.varietydistributors.com.** This is where I tracked down the armatures that stopped being distributed in Vancouver craft stores, and I began buying in bulk for my students. They may not have many more in stock but still may be worth contacting to find out. The item number is 17130.
- **www.modularhose.com.** This new site sells the beaded armature pieces that can be used to custom-build a doll armature. For an example of the armature design on their old site, go to the "Loc-Line Doll Armature" link in the "Workshop" section under the Library at StopMotionWorks.com.
- **www.miniworlddolls.com/TS9Armature.htm.** This is a site from which to buy plastic doll armatures, in different sizes and design styles.
- **www.crawforddesigns.net/acces.html.** This is another site from which to buy plastic doll armatures.

Ball-and-Socket Armatures

In studio productions, the most popular kind of armature is the ball-and-socket (see Figures 7.27 and 7.28), whose use goes all the way back to the original *King Kong*. Ball-and-socket armatures were also used by Ray Harryhausen and Phil Tippett, and for the puppets in films like *The Nightmare Before Christmas* and *Wallace and*

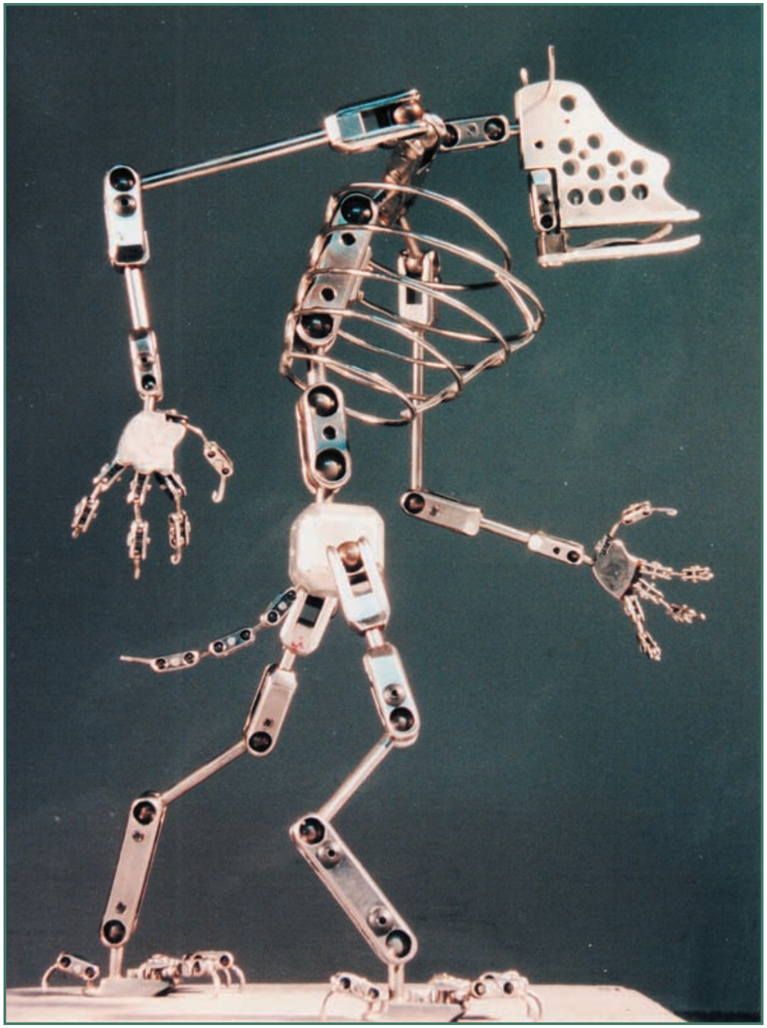

Figure 7.27 A complex ball-and-socket armature for a fantasy creature in Ray Harryhausen-esque tradition. (Copyright Stop Motion Works.)

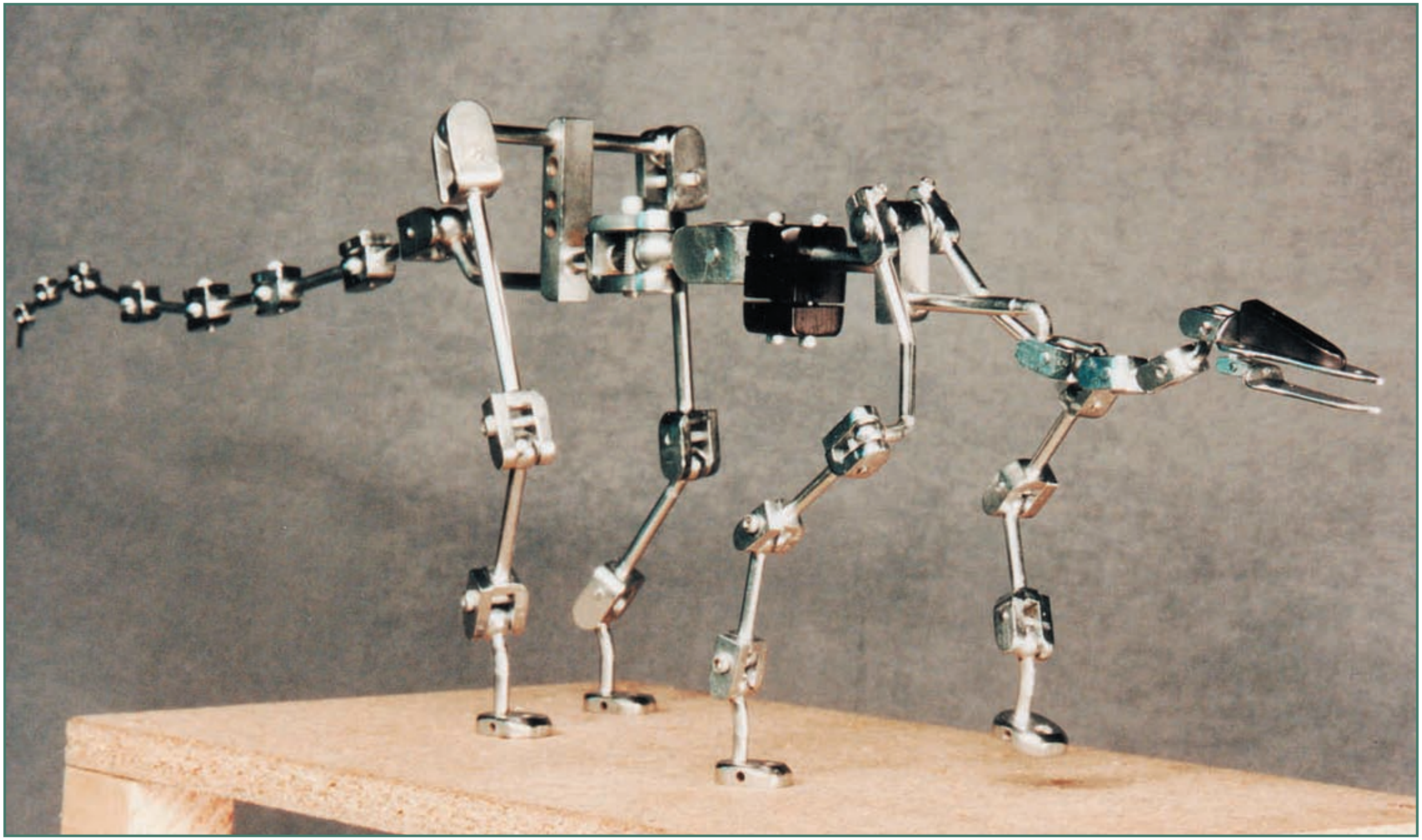

Figure 7.28 Four-legged ball-and-socket armature for a Stegosaurus. (Copyright Stop Motion Works.)

Gromit. A ball-and-socket armature is typically made of metal—either brass, steel, or aluminum—and can be relatively simple or extremely complex. Its popularity comes from the fact that it is extremely durable, holds its positions well, and can be custom made to accommodate nearly any character design. The level of subtlety in movement that can be achieved is also quite remarkable, in that the tiniest movements can be animated to cushion in and out of holds with ease. Certain joints can be tightened or loosened to provide the best movement for the animator's liking. One of the most prolific ball-and-socket armature building studios in the world is MacKinnon and Saunders, based in the UK, which has built armatured puppets for productions ranging from *Bob the Builder* to *Corpse Bride*. The fabrication costs for many of their puppets go up to several thousands of dollars!

In a ball-and-socket armature, there are different kinds of joints that make up the parts of the body that connect. The logic behind them is based strongly on actual human anatomy. Ball joints (see Figure 7.29) are universal joints that consist of two metal plates with ball bearings fit snugly between them, allowing for any kind of movement: left-to-right or diagonally for easy posing. Hinges, another kind of joint, bend only in one linear direction. A human knee or elbow joint can bend only in one direction, so it's common for a hinge joint to be used for these parts of a human armature. The whole armature, and the different joints associated with it, should be planned carefully against diagrams of the character and its anatomy (see Figure 7.30).

My reference in the Introduction to Ken Southworth's description of an animator being an artist/actor/engineer is especially relevant in stop-motion animation when it comes to building a ball-and-socket armature. Building an armature such as this from scratch requires the skills of a machinist engineer, but it is also a delicate art in itself. A great deal of studio space and equipment may be required, and the tools needed such as mills, lathes, saws, drills, and a blowtorch can get rather expensive. An easier route to take would be to purchase a kit that has all of the pieces you need and just put it together. Kits are not cheap either, but they save you work building all of the pieces yourself. If you want to specialize in puppet building, getting hard-core into ball-and-socket armatures is a good area to consider, since most studio puppets are built this way. It is usually done by a special department of skilled machinists who communicate with the animators to make sure they are adjusted for the best kind of fluid movement. The process is so involved that people who specialize in building these kinds of armatures from scratch *and* animating them are a unique breed. But if you have the cash and the patience of a technician,

Figure 7.29 Hip joint designed by Tom Perzanowski, with a notch in the socket for greater freedom of movement. (Courtesy of Larry Larson at Center for Creative Studies.)

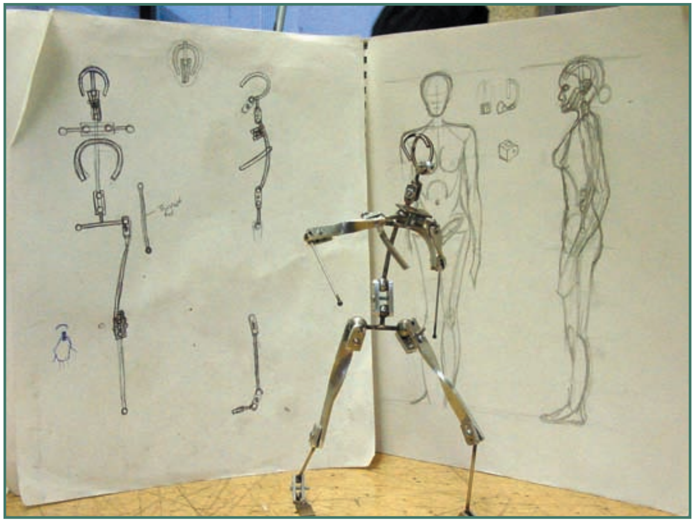

Figure 7.30 Full body armature and plans by Tom Perzanowski. (Courtesy of Larry Larson at Center for Creative Studies.)

the results will give you the best kind of armature for fluid animation. Lionel Ivan Orozco has some helpful tutorials for building your own ball-and-sockets in the Workshop section of www.stopmotionworks.com, and the links page at www.stopmotionanimation.com (see Chapter 8, "An Interview with Anthony Scott") lists many suppliers for armature kits and assembly sets. As always, plan your character design well so that you know that the armature will best suit the animation you want to create.

Wire Armatures

One of the most popular methods for building a custom-made armature for stop-motion, for beginners, hobbyists, and some studio professionals, is to use bendable annealed (or softened) wire. The wire must be strong enough to support the weight of whatever covers it and be able to hold its position without slipping. Wire is made out of many different materials, and in different thicknesses. Generally, wire comes made out of aluminum, lead, or steel. Steel wire, as long as it's not too thick, can be bent into any shape to hold its position but will often have problems with springing. This means that if you move a piece of steel wire into any position, it will often spring back slightly, which is difficult for animation if you are trying to capture precise movements. Lead wire, which is commonly used for soldering, is also very flexible, but it breaks very easily and is also toxic. Lead will come off on your hands when handled and will create a dirty mess when mixed with clay or any other materials. So, these inconveniences related to lead and steel wire leave aluminum as the champion wire material among stop-motion animators everywhere. Wire can be bought at your local hardware store, but make sure it says aluminum on the packaging somewhere. You will need to build a wire armature if your character design is smaller or thinner than what a plastic doll armature will allow you to create, or if a ball-and-socket armature is outside of your price range or preference.

Aluminum alloy wire that is at least 1/8 inch in diameter will work as a single strand for making the limbs of your wire puppet. Any wire that is thinner, say 1/16 inch or less, will need to be doubled up by twisting to give it more durability and longevity. It's likely that your wire, no matter how strong it is, may eventually break after much handling through the animation. The point is to build it so that you can prevent that breakage as long as possible. I have tried different kinds of wire found in craft and hardware stores, and some of them have worked well, although certain kinds of utility wire from hardware stores tend to be too brittle for animation. Another source is sculpture supply houses, which may carry a brand of wire called "Almaloy," used for clay sculptures but with the right properties for animation puppets as well. Marc Spess' online shop at www.animateclay.com sells very effective brands of aluminum wire that can be trusted to work well for stop-motion animation. I find that online resources such as this, which are specifically geared toward stop-motion, will often provide you with very good products. Buying materials from hardware stores is useful (particularly for constructing rigs, sets, and props), and it's inevitable that you will need to buy things from them, even if what they sell for puppets is not necessarily with stop-motion in mind. Again, it's all about experimentation, and looking for the right materials can sometimes be like a scavenger hunt, scouring out different things at craft stores, hardware stores, dollar stores, etc., and the Internet. Unfortunately, you cannot find a one-stop Quick Mart for stop-motion.

Building a Simple Wire Puppet

Let's build a basic human puppet from scratch! There is no ready-made armature in this case, so in a sense, you are creating something out of nothing, which is a creative privilege. Be proud! These steps demonstrate how to build a character out of simple, cheap materials.

Start by making a drawing of your character standing straight up in a generic position. This drawing will be used for scale purposes and to make sure you build your armature with the right proportions. Make your drawing roughly the right height you want your puppet to be. A few millimeters here and there won't matter; it's there as a guide. In this case, the puppet is going to be about 8 to 9 inches tall, which is a good size to work with.

Use your drawing to estimate how long of a wire piece to cut, starting with a loop for the legs, for instance. Take this length and fold it into itself so that you have two sides the same length (see Figure 7.31). Give yourself a few extra inches, as it's always better to make your piece too long and then crop it if you need to. Making your piece too short will be a waste of wire.

For your wire pieces, slide the cut ends into a power drill, so it can be evenly twisted to make it stronger (see Figure 7.32). On the looped side of your wire, you need to anchor it somehow. Leave a good-sized loop at the end, and grip the wire tightly with some pliers, clamp it into a vice, or place the wire under a heavy object. Once the wire is secure, slowly rotate the drill forward so that the wire will twist good and tight. Don't go too fast or too far, or the wire will start twisting over itself and get tangled. For really small wire pieces, you can simply hold the looped end with pliers and twist it with your hands. Now you should be able to bend the twisted wire and lay it over your drawing (see Figure 7.33). Adjust the length of your wire and where it bends so that you can leave at least an inch bent upward for the feet.

If your puppet is being designed so that it can walk, the feet are very important and are one of the most difficult problems to solve in stop-motion puppets. You want the feet to be able to flex their shape slightly, as a real foot does while walking. A simple method and material is foam, which in this case is cut from a foam finger commonly seen at sporting events (see Figure 7.34). Cut the foam so that it has a hole where the ankle joint would be. Bend the wires for the feet downward and gently poke the wires through the foam, so that it can be bent back into a right angle (see Figure 7.35). The wires should be glued firm and snug in the foam to provide a good ankle joint, as there may be times when the ankle supports the weight of the puppet. Try to avoid the wires poking through the top or bottom of the foot. The foam can then be carved into a shoe shape.

Continue measuring cut pieces of wire for the torso and the arms, and use smaller pieces of wire or hot glue to hold the various limbs together (see Figure 7.36). For this puppet, I want the head and hands to be removable so they can be manipulated independently from the body if need be. Wires can be attached to the head and hands and slid into holes in the armature. To achieve this, use K&S tubing from a hobby shop, which is typically sold in one-foot pieces. Cut some pieces about an inch in length for the neck and hands. The best tool for doing this is a tiny saw with a miter box (see Figure 7.37) that will help you cut in a straight line for a clean cut. To keep the wires adhered to each other, you can cover the places where they connect with epoxy putty. Epoxy putty comes in a tube, so tear off a chunk and knead it until the two compounds blend together into a uniform gray color. The putty is very bad for your skin, so always wear latex gloves (cheap disposable ones are fine) when working with it. Work in a ventilated area, and try to avoid breathing the fumes; it's stinky stuff! You will need to work fast at kneading it and applying it to the armature (see Figure 7.38), as it will starting drying right away and will be rock solid within 20 to 30 minutes. You can also use the epoxy putty to create "bones" for the armature in those places where there should not be bending, leaving the exposed wire to serve as your joints. Place the K&S tube pieces into the putty as well, before it dries completely (see Figure 7.39).

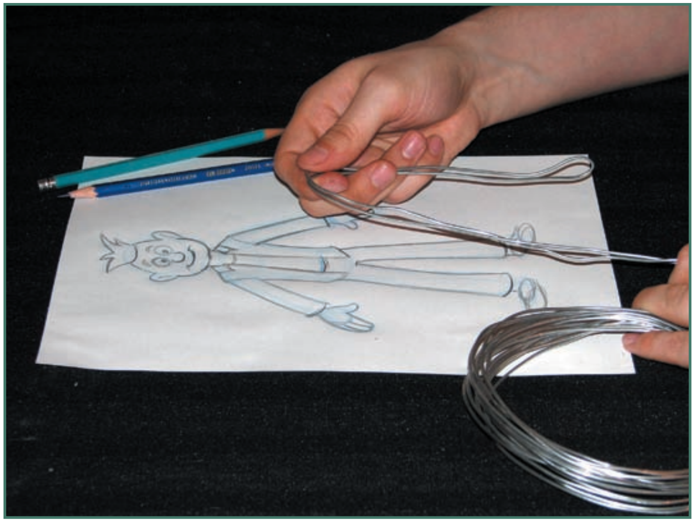

Figure 7.31 Cut pieces of wire to create your puppet's limbs.

Figure 7.32 Twist the wire with a power drill.

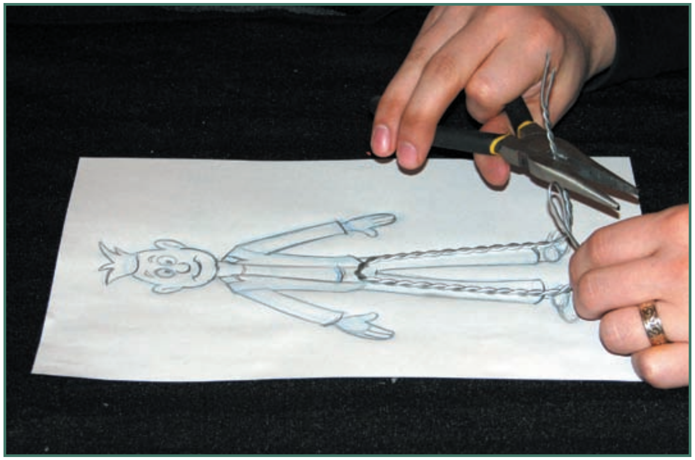

Figure 7.33 Bend and cut the wires into shape using your drawing as a reference.

Figure 7.34 Feet can be made from pieces of foam.

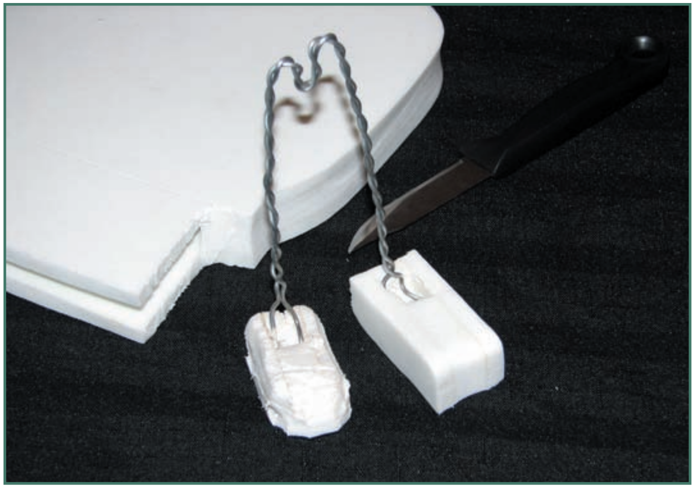

Figure 7.35 The wires are glued into the foam feet, which are carved into shape.

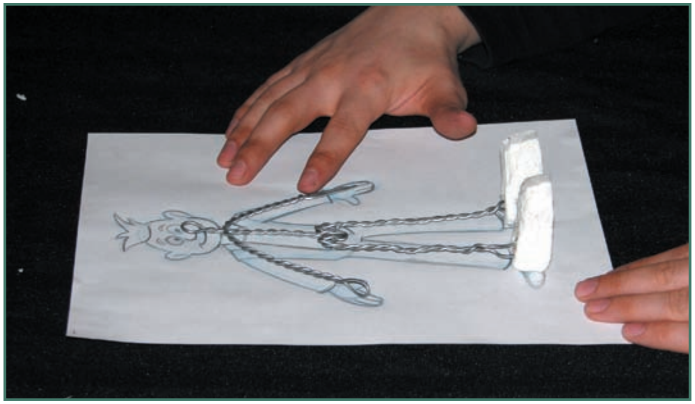

Figure 7.36 Lay the other wire body parts over the drawing.

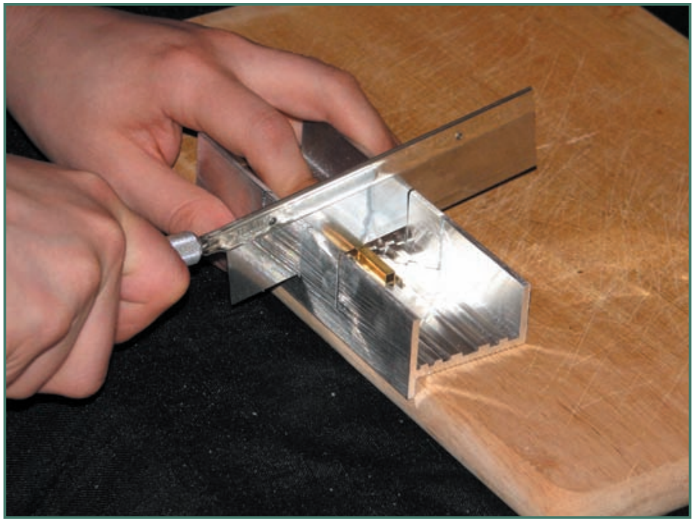

Figure 7.37 Cut pieces of K&S tubing for the head and hands to slide into.

Figure 7.38 Adhere the wire pieces together with epoxy putty.

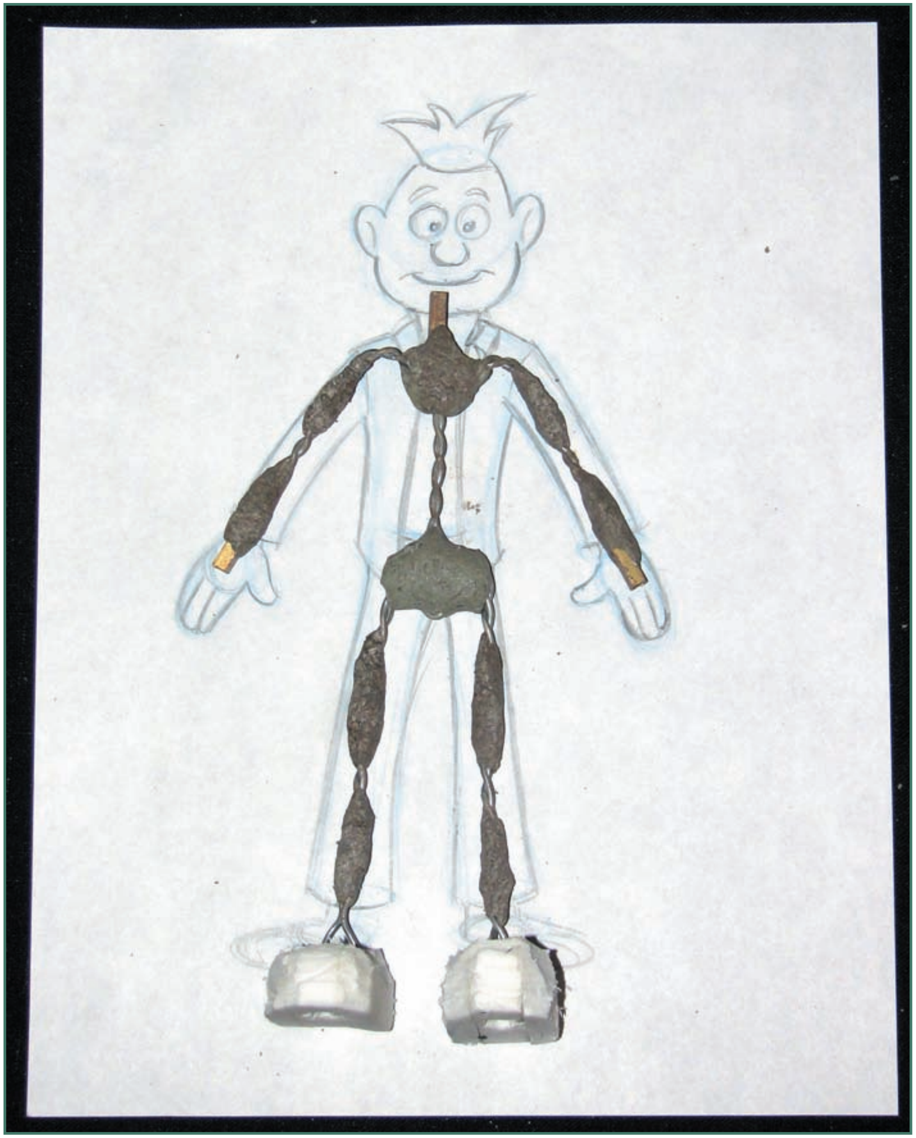

Figure 7.39 The final armature with all of its epoxy bones.

The puppet's feet, especially if it will be standing or walking full-figure on camera, will need tie-downs built into them. Tie-downs allow the feet to be firmly anchored to the ground and prevent the puppet from falling over. Carve holes into the foam feet and superglue nuts into them, making sure they are flush with the bottom surface of each foot (see Figure 7.40). When animating, bolts can be screwed through holes in the set, up into the nuts in the feet. More on this in Chapter 9. The head and hands can be sculpted out of clay, but to use solid clay would make the puppet too top-heavy, so it should be built around something lightweight. A Styrofoam ball can be sculpted itself by pressing it into a head-like shape (see Figure 7.41). Eyes are gouged into the Styrofoam, and a twisted piece of wire is stuck into the head where the neck joint should be. Use epoxy putty to firmly attach the wire to the head. The base for the hands is a piece of epoxy putty built around a twisted wire (see Figure 7.42). Begin layering thin pieces of clay onto the foam head, lining it up directly with the eyes. Then add additional facial features, keeping in mind that you want to avoid weighing down your puppet with too much clay. Build clay around the hands, leaving the fingers as solid clay (see Figures 7.43–7.44).

To build the bulk, or "muscles," of your puppet, cut strips of mattress/cushion foam (found at craft stores or specialty foam shops) and wrap them around your armature. The foam can be held in place by wrapping and twisting pieces of floral wire around it (see Figures 7.45–7.46). The foam should be wrapped around tightly enough to allow the armature's joints to be able to bend. The feet can be painted black (see Figure 7.47), or any other color you wish.

Figure 7.40 Tie-downs are glued into the bottom of the feet.

Figure 7.41 Sculpt a Styrofoam ball into a head shape.

Figure 7.42 Eyes and a wire neck are added to the head, and hands are made of putty and wire.

Figure 7.43 Build up a thin layer of clay over the head.

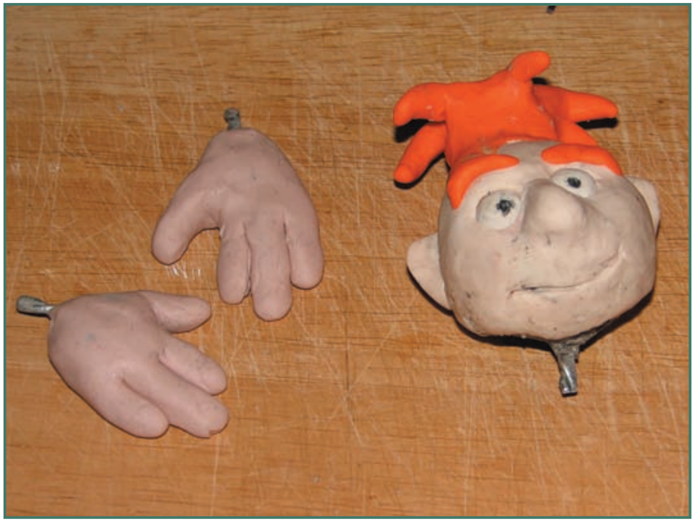

Figure 7.44 Head and hands are completely sculpted in clay.

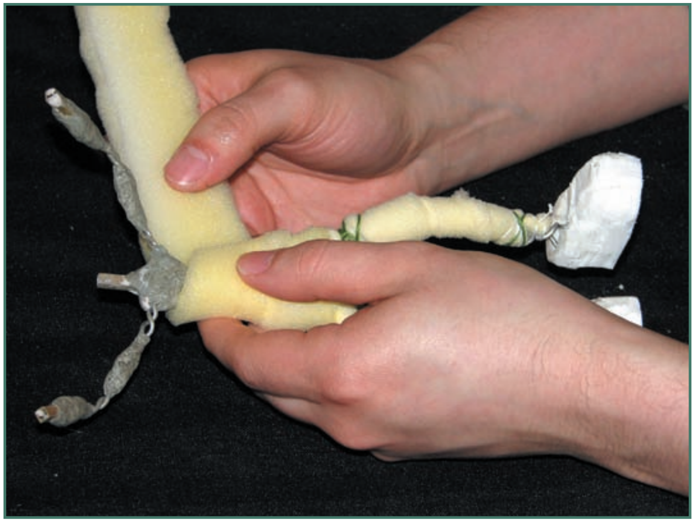

Figure 7.45 Wrap strips of cushion foam around the armature.

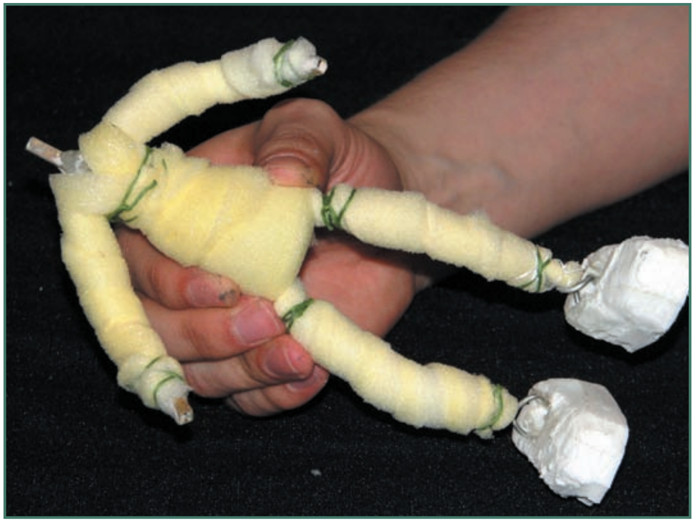

Figure 7.46 Floral wire will keep the foam in place around the armature.

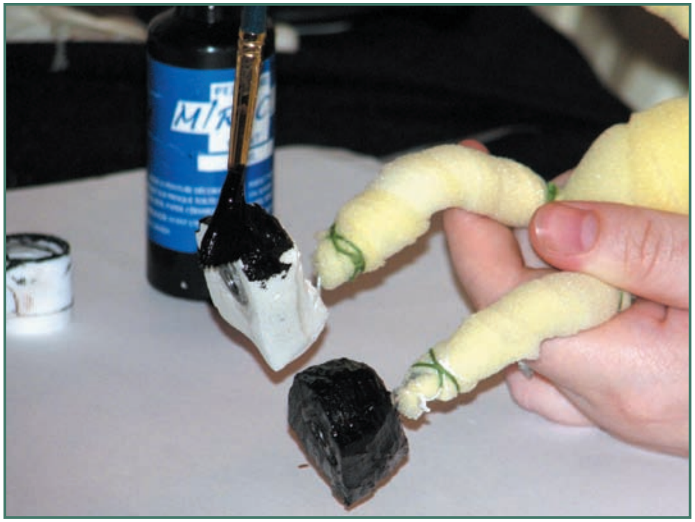

Figure 7.47 Paint the feet black to make them appear like shoes.

The foam is hard to get perfectly smooth, but a dark color will hide most of the roughness of the feet and still give them an interesting texture. Cut out pieces of felt or any other kind of fabric, front and back, for the puppet's clothes, and stitch them together over the armature (see Figures 7.48–7.49). Felt has a great texture and hides seams pretty well, so it is a good solution for clothing your puppet. Then the head and hands can be slid into the tubes, with some additional clay added to make wrists and a neck, and your puppet is complete (see Figure 7.50)! If you find the head to be wobbly, or the hands having issues with falling out of the tubes, stick some clay inside the tubes to give them some extra firmness. Refer to Chapter 9 and the accompanying CD to see this guy in action!

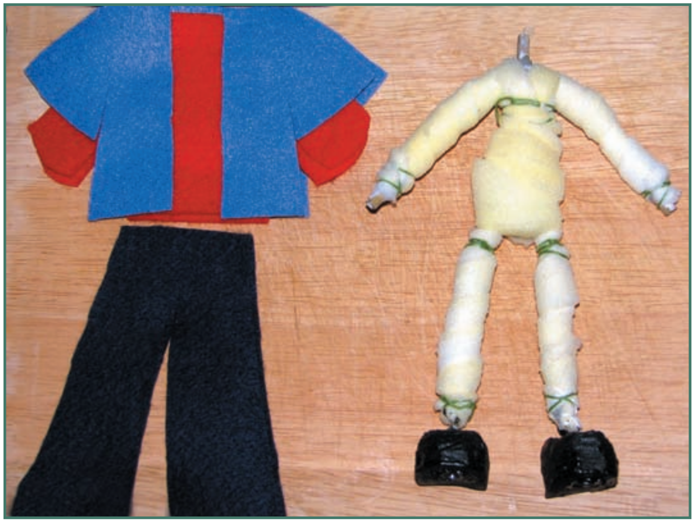

Figure 7.48 Cut out fabric pieces for the puppet's clothes.

Figure 7.49 Stitch the clothes together over the armature.

Figure 7.50 The fully clothed puppet.

Molds and Foam Latex Methods

For student films, independent projects, or commercials, most puppets are a one-shot deal that are built once, animated once, and then moved on to the Retirement Home for Stop-Motion Puppets. For a stop-motion studio production, *lots* of puppets are needed, often several different copies of the same character (see Figure 7.51). A feature film or television series might have many different scenes with the same characters being animated on separate sets at the same time. This is part of the reason why creating puppets with molds is very popular in the industry. The technique ensures that any puppets created as duplicates or back-up versions (in case an armature breaks) will look the same, so that the character's appearance does not change throughout the show. Another common practice is to create the same puppet in different scales—large-scale for close-ups and tiny versions for extreme long shots. No matter which scale, the only way to guarantee that a puppet will look exactly the same twice is to use molds of one kind or another. Since many stop-motion hopefuls look to the big-budget productions to learn about how these films are made, there is a common misconception that this is the only way to make puppets. As you have seen in this chapter already, it is not the only way, but for studio productions, it usually works best. Independent filmmakers can use these techniques, too, of course, but a word of caution to the beginner: It is an extremely time-consuming and expensive method that must be learned through a lot of trial and error to get right. Many different skills are involved, and to do it conveniently, you should have a dedicated studio space for it. Much of the process is messy and deals with poisonous materials, so I would not recommend attempting it in your kitchen or anyplace else with food around. Adequate ventilation is a must, because the molds are typically filled with foam latex, which is toxic and extremely potent. If you want to specialize in puppet building, I encourage you to do your research and get yourself equipped to try it, and after much experimentation and persistence you will find it rewarding. But if you have a limited budget and want a quicker fix for making a puppet, I would suggest using one of the other simple methods in this chapter.

Figure 7.51 Painting duplicate puppet heads. (Courtesy of Zung Studio.)

The advantage of making a foam latex puppet from a mold is that you can create a puppet with an outside surface that will not flutter or lose its shape when touched during animation. If a puppet's arm, for instance, is covered in clay, then it may squish and lose its shape after many nudges by the animator and will need to be constantly resculpted. If the arm is covered in fabric, there is the possibility that the texture or any loose edges will flutter in the resulting animation. With a foam latex covering, the arm can be squeezed tightly but will then spring back to its original shape. The latex can be painted so that it has an appearance similar to clay, so it is commonly used in clay animation for parts of the puppet that will have less movement. The head and hands/arms may be made of Plasticine clay, but the torso and legs are foam latex, and the two materials work together for a seamless appearance. It is also a popular alternative to clay because it keeps down the weight of the puppet. Aardman Animations, makers of *Wallace and Gromit*, uses this technique for many of their puppets.

The technique of making puppets out of molds in foam latex must be mastered over time with much practice, and there are many different skills to learn throughout the whole procedure. The best way to learn it is to do lots of research and consult some good resources. Taking a sculpture class will help give you some hands-on experience in some of the mold-making steps involved. If you are a visual learner, you may find one of the best resources to be Kathi Zung's excellent DVD tutorial *Do-It-Yourself Puppetmaking 101*, available through her studio Web site, www.angelfire.com/anime4/zungstudio/. For the purpose of this chapter, I will give a basic overview of the process so that you may be inspired to take your research further.

The first step is to make a *sculpt* of your puppet out of oil-based clay (see Figure 7.52). The sculpt should be as smooth as possible with all of the details you want showing up in your final latex version. It can be smoothed out with alcohol or melted clay to ensure there are no unwanted cracks, holes, or lumps. For details on your sculpt, such as the edge of a jacket, sleeve, or collar, anything that is raised up as an extra shape must be sculpted in a way that avoids an undercut. An *undercut* is any texture that will cause problems when it is molded and needs to be separated from the mold. Any raised shape should be sculpted at a 45-degree angle that slopes toward you, not away from you. A shape with an undercut will cause the mold to get stuck underneath it.

Figure 7.52 Kathi Zung refines a puppet sculpt in oil-based clay. (Copyright Zung Studio.)

The sculpt is then laid up inside a bed of potter's clay (the kind that air-dries, not oil-based clay that never hardens) that comes up to its halfway point (see Figure 7.53). Imagine your sculpt is floating on its back in a pool, and make sure the clay bed fills around the entire sculpt without air pockets, as if it were a pool of water. Keys, which are little notches in the clay, are also created on the clay bed (see Figure 7.54) to help the mold stay together with the other half, which will be created later.

Plaster (a common plaster-like substance used is Ultracal-30) or gypsum is mixed and applied onto the sculpt in its clay bed. A common practice for some is to build a wall around the clay bed (out of foam board or milk cartons) so that the mold will have a smooth, uniform shape to it. Many layers are built up over it, inside the wall if there is one, and mixed with sheets of burlap. This is creating the first half of the actual mold. After it dries, the clay bed is ripped apart, and all of the excess clay left on the mold must be washed away with water (see Figure 7.55). Coat the mold, especially the keys, with Vaseline. Then the mold, with the sculpt still inside it, must have another layer of molding material applied to it, to create the second half of the mold (see Figure 7.56). Ultracal contains lime, which can eat away your skin, so wear latex gloves to protect your skin while using it.

When both sides of the mold are dried and finished, they are pulled apart and the sculpt is removed, leaving an exact impression of its front and back. The armature, typically made of wire or ball-and-sockets, is laid inside the mold, ready to be cast in latex (see Figure 7.57). Brass will eat away at latex, so try to avoid any brass pieces in your armature; aluminum or steel is better.

Figure 7.53 Building up a clay bed around the sculpt. (Copyright Zung Studio.)

Figure 7.54 Another example of a sculpt inside its clay bed, with keys sculpted into it. (Copyright Stop Motion Works.)

Figure 7.55 The first half of the mold with the sculpt embedded inside. (Courtesy of The Clayman's 3D Cartoon Communications.)

Figure 7.56 Applying a gypsum material to the mold to create the second half. (Copyright Stop Motion Works.)

Figure 7.57 Both halves of the open mold, with armature laid inside. (Copyright Stop Motion Works.)

Foam latex typically comes in a kit, as it must be mixed together with different agents and solutions to work properly (see Figure 7.58). The kit will have instructions explaining how to mix it, which should be read carefully along with all safety instructions. This whole procedure *must* be done with strong ventilation in the room, as latex contains ammonia and gives off a strong smell that is bad for inhalation and eye contact. The latex base comes in the largest container, because this is the main substance making up most of the solution, with smaller portions of the other agents mixed in. The exact measurements will vary depending on how big of a batch of latex you are making. Mixed with the latex base are the foaming agent and curing agent, which are first measured out and combined in an electric mixer at low speed. For the foaming stage, switch to high speed, then medium speed and lower speed for the refining stage. You might mix at each speed for about 3 to 5 minutes, but the whole process is also dependent on the humidity and temperature of the room. This process may cause you to go through several different batches to get it exactly right. The consistency of the foam should be like thick cream. At the end of your mixing stage, add the gelling agent and let it continue mixing for another minute or so.

Once the latex mix is complete, it is applied into the mold over the armature. The latex can be applied in a number of ways. One way is to clamp the mold tightly together and inject the latex through a hole in the mold with a giant syringe (see Figure 7.59). Another way is to brush a thin layer inside the mold, place the armature inside, and pour the rest over it straight from its mixing bowl.

Figure 7.58 A foam latex kit: base with foaming, curing, and gelling agents. (Courtesy of the Clayman's 3D Cartoon Communications.)

Figure 7.59 Injecting foam latex into the mold. (Copyright Stop Motion Works.)

Once the latex inside the mold has started to gel, it is placed inside an oven for baking and curing. *Do not use the same oven you cook your dinner in!* For making puppets, you need a separate oven that can handle the fumes from the latex, typically referred to as a convection oven. It might be a good idea to check out some local thrift shops or garage sales to possibly find a used one. After a few hours inside the oven, the mold can be removed and pried apart, and you will then have a soft, spongy foam latex version of your original sculpt, with the armature fit snug inside (see Figure 7.60). The latex that has spilled over from being inside the mold will still be attached to it, so it will need to be snipped away with a pair of fine scissors (see Figure 7.61). Then smooth out the seams along the side with a wood-burning tool or soldering gun, but open the window to ventilate the stench it will create. The puppet can then be painted with special brands of acrylic paint suited for latex (see Figure 7.62). When it's all said and done, your puppet is ready for shooting! (See Figures 7.63–7.64.)

Figure 7.60 The mold is pried open to reveal the latex puppet inside. (Courtesy of the Clayman's 3D Cartoon Communications.)

Figure 7.61 Paul Moldovanos snips away excess foam from his puppet. (Courtesy of the Clayman's 3D Cartoon Communications.)

Figure 7.62 Special paints suited for painting foam latex puppets. (Courtesy of the Clayman's 3D Cartoon Communications.)

Figure 7.63 Foam latex puppet. (Courtesy of the Clayman's 3D Cartoon Communications.)

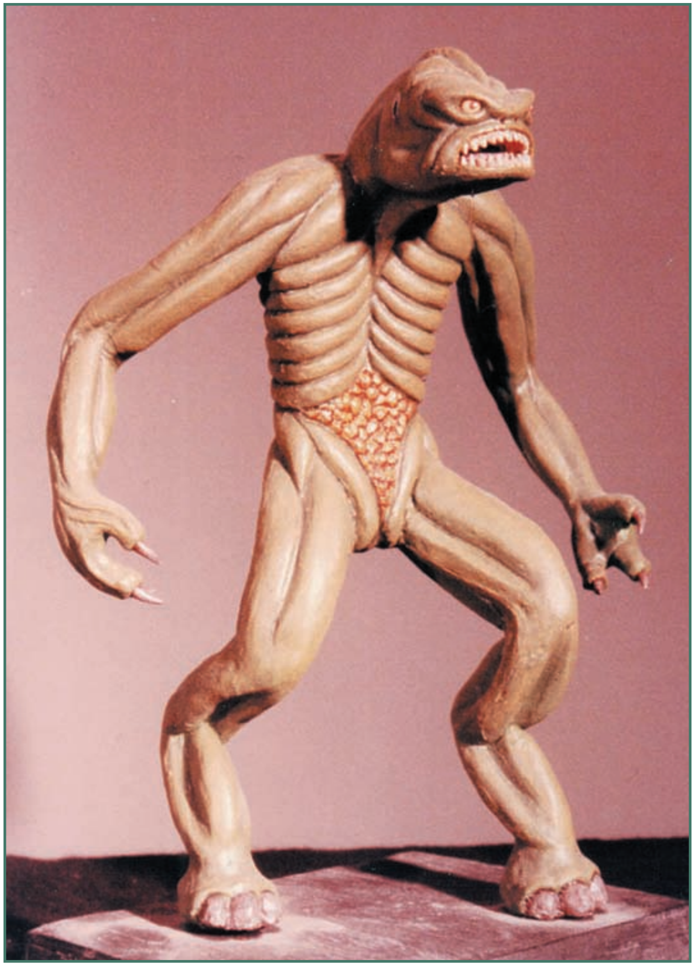

Figure 7.64 Foam latex puppet. (Copyright Stop Motion Works.)

A puppet made of foam latex, which is a soft material when cured, requires a hard mold for casting. On the opposite end, any material that is intended to dry hard requires a soft mold for casting (see Figure 7.65). A hard-sculpted object may be a head, or it may be a prop. The process is very similar to the procedure I just described. The original sculpt is done in polymer clay or oil-based clay and laid up in a potter's clay bed. A wall can be built around it and covered with silicone rubber or RTV rubber material, which has a consistency like pancake batter. If the mold has two sides to it, then the first half has more rubber poured onto it to create the second half. The mold will cure itself by air-drying, and can then have a poly resin material poured into it. Within 2 minutes, the resin will harden, creating a hard version of the original sculpt, which can then be sanded down and painted.

Figure 7.65 Soft rubber mold with poly resin sculpture. (Courtesy of the Clayman's 3D Cartoon Communications.)

Latex Build-Up Puppets

If you do not have the time, money, or inclination to make a puppet with a latex skin using the molding method, there is another way to achieve a similar look. The latex build-up technique involves applying the latex skin onto the puppet rather than casting it in a mold. This is the technique that was used to make the original 1933 *King Kong* puppets, of which there were several different ones made for the film. It is not easy to make exact duplicate puppets using this method; in fact, the different original *Kong* puppets varied slightly in their appearance. Latex build-up is a common technique used for humans, creatures, or animal puppets that have a rough, scaly, or wrinkly appearance to their skin (see Figure 7.66). For more detail-specific work and control, the muscles or skin pieces of the puppet may be sculpted or casted in open molds separately and applied onto the puppet in pieces, with liquid latex holding it all together. This process still involves some mold making, but in other cases, the latex may simply be brushed or poured onto the armature.

Figure 7.66 Latex build-up puppet. (Courtesy of Nick Hilligoss.)

The following illustrations show the steps I took to make a goblin puppet using the latex build-up technique. Start by building or preparing your armature. Any kind of armature can be used, including ball-and-sockets, but in this case I made another wire one (see Figure 7.67), based on the shape of his body. I took a different approach to the goblin's feet (see Figures 7.68–7.69), making them out of polymer clay and sculpting holes for the wires to stick into, and for tie-downs to fit inside. Then I baked them and filled the holes with glue to affix them to the puppet. Heels were sculpted with epoxy putty. The wire between the heel and the rest of the foot, which would allow the foot to bend, was covered in scraps from a pair of doll tights, an elastic material.

The head (see Figure 7.70) is based on a traditional European puppet approach, with very little facial movement. His face is not able to change expression, but rather stays in a permanent grin. (There is something inherently creepy about characters who grin all the time.) The only movement in his face will be subtle changes to his eyebrows and mouth, so I built them out of two pieces of pipe cleaner. (The eyebrows are one continuous piece bent into two brows.) Pipe cleaners are often a nice alternative to aluminum wire for features like this, because they are easy to grip and hold their shape well without ripping through the Styrofoam. The rest of his head was sculpted in polymer clay. I lightly removed the Styrofoam head from the polymer clay "mask" and positioned it as best I could on a tray so that it maintained the same shape, then baked it, along with his chin and horns (see Figure 7.71). Pieces like this can go into a toaster oven for 10 minutes at 285 degrees Fahrenheit. Wooden beads for eyes were painted and filled with hard black Fimo polymer clay, with a hole poked through for easy animating. For detailed work such as heads and eyes, or holding your puppet in place, get yourself a "helping hand" rig from a hobby shop (see Figure 7.72).

Figure 7.67 A wire armature is built against a reference drawing.

Figure 7.68 Feet are sculpted in clay with tie-downs built into them.

Figure 7.69 Putty and elastic material are added to complete the feet.

Figure 7.70 The head is built of Styrofoam and polymer clay.

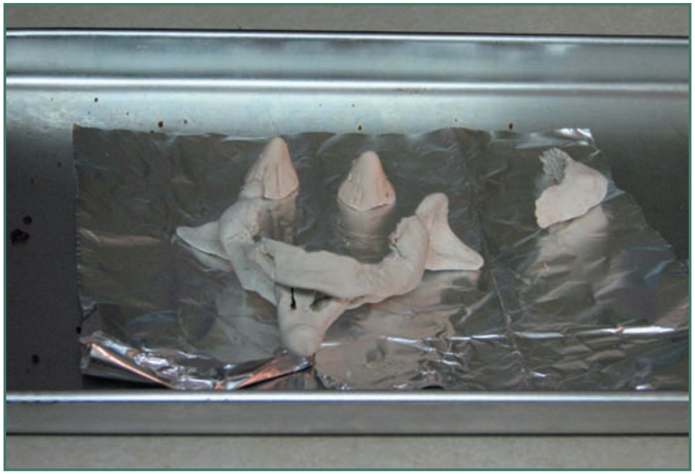

Figure 7.71 Clay face pieces are baked in an oven for hardening.

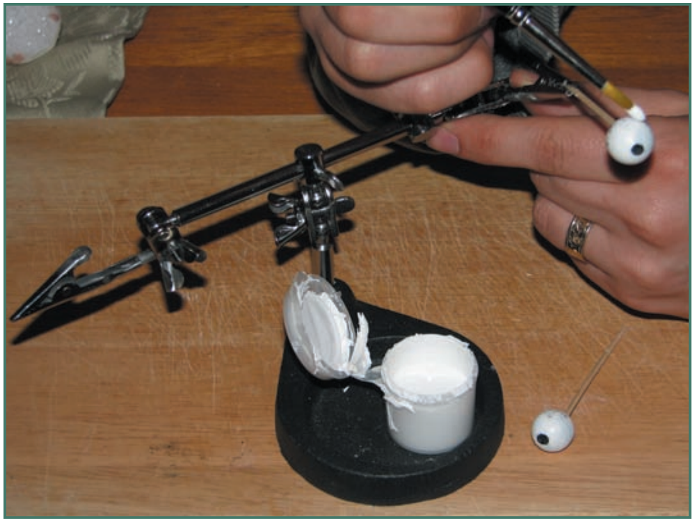

Figure 7.72 Eyes are held in place with a rig for easy painting.

A helping hand is built out of the same joints used for ball-and-socket armatures and is extremely useful. Doll stands will also help for holding up your puppet while working on it.

The rest of the armature was built up with epoxy putty bones, and links of plastic doll armature were used for the neck (see Figure 7.73). Aside from ball-and-socket joints, I think the doll armature pieces provide the absolute best mobility for a universally movable neck joint. Hands were made out of epoxy putty, with single strands of aluminum wire stuck in while still wet. Cut your finger pieces before affixing the putty to the arm, making them longer than you want them, so they can be trimmed later. Use some pliers to make sure the putty is affixed tightly around each wire before it dries (see Figure 7.74). If the wires are too loose, they will slip out. Your armature should be ready for covering at this point (see Figure 7.75).

To begin preparing for the latex build-up process, cover your armature in strips of cotton (see Figure 7.76). An entire roll can be found in your local drug store. Wrap it tightly around your armature in such a way as to suggest muscles or other shapes of your puppet's body. The ends can be tied down with floral wire or tiny bits of hot glue. The cotton will adhere itself to the armature well for a good deal of control over the shape of your body (see Figure 7.77). Pieces of foam could also be used to bulk up your armature more or create more specific shapes than the cotton will allow. It's all going to be covered up anyway.

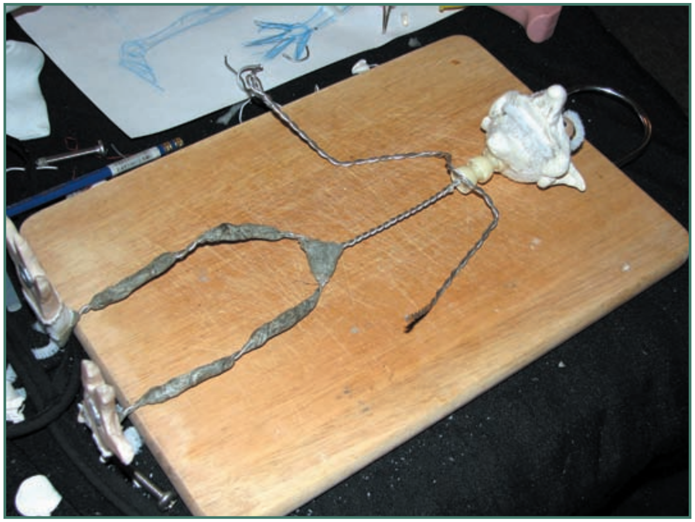

Figure 7.73 Epoxy putty and a doll armature neck are added to the armature.

Figure 7.74 Hands are built with putty and wires.

Figure 7.75 Here is the finished armature, front and side.

Figure 7.76 Strips of cotton are wrapped around the armature.

Figure 7.77 Your covered armature should look something like this, depending on your design.

Figure 7.78 Liquid latex rubber is brushed onto the puppet.

Now you are ready to start brushing liquid latex rubber over the cotton (see Figure 7.78). The particular product I used is called Mold Builder from Castin' Craft, which can also be used to create rubber molds, but in this case I used it to mix with the cotton to create skin for my puppet. Add more pieces of cotton and mix with the latex for any parts you want to be bulkier. Do this in a ventilated room, or outside, as the mix contains ammonia and can be hazardous to your skin, eyes, and lungs. Apply tiny pieces of cotton to your hands and over the wires, mixing it together with the latex in layers (see Figure 7.79). To create some abdominal muscles, I found these cotton face cleaning pads that already came with a ribbed shape, much like the muscles I wanted to create (see Figures 7.80–7.81). Continue applying small pieces of cotton to the face and any features that will animate, including eyebrows and mouth pieces. The space between the creature's head and brows will be filled with cotton and latex, so that when the brows are animated, the skin over the top of them will flex slightly (see Figure 7.82). Once your entire puppet is covered in latex (as in Figure 7.83), let it dry overnight.

Once the latex dries, your puppet is ready to be painted (see Figure 7.84). You can use acrylic paint, and either brush or sponge it on, depending on the texture you want. One or two light coats should be enough, so that the texture of your latex skin still maintains its character. Cover any clothed parts of your puppet with fabric, and your puppet is ready to come to life (see Figure 7.85)! As he moves, his skin will flex, bulge, and wrinkle in a realistic fashion.

Figure 7.79 Tiny pieces of cotton are mixed with latex.

Figure 7.80 A facial cleansing pad can be used for abdominal muscles.

Figure 7.81 Covered with a layer of latex, my goblin is now looking very muscular indeed.

Figure 7.82 More tiny cotton pieces are mixed with latex for facial features.

Figure 7.83 Here is the goblin with his feet, body, hands, and head completely painted in latex.

Figure 7.84 The puppet is covered with acrylic paint.

Figure 7.85 The finished goblin puppet.

Clay Puppets

If you want your entire puppet to look like clay (see Figure 7.86), you can use it to create the whole character, much like Will Vinton did with his Claymation work. Depending on your design, it can be all one color or a combination of colors. Clay is a fun medium that can give you lots of freedom in animation, but it also has limitations. Unlike foam and fabric materials, which are lightweight, clay is extremely heavy. If you want to animate walks or jumps, the weight of the clay has potential for problems in fighting with gravity. Clay also gets dirty as you handle it over time, and it will pick up the dirt and oil from your fingers. As your animation progresses over time, the clay might start to lose its cleanliness, resulting in color shifts. To avoid this, it helps to have some baby wipes handy to keep your fingers as clean as possible, and you may also need to lightly scrape off the top layer of clay from your puppet if you notice it starting to get dirty. Keeping your hands clean is also important if your puppet has many different colors, because you don't want the colors running together or causing unnecessary smudges. Clay requires a lot of re-sculpting of your puppet, as it is difficult to retain its original shape and keep it consistent. After being on a set under hot lights for several hours, it also starts to soften and continues to get messier. Because of this, making good-quality clay animation can be a very time-consuming method compared to other materials, but the effort is worth it in the end. If you really want to see what clay is capable of in the hands of a wild imagination, check out the work of Bruce Bickford (Frank Zappa's *Baby Snakes*, *The Amazing Mr. Bickford*, and Brett Ingram's documentary *Monster Road*).

Figure 7.86 "Toyabah" puppet in clay over wire armature. (Copyright Michael Stennick, Space Monster Pictures, laserblast.multiply.com.)

To get around many of the problems involved with clay puppets, you may want to have an armature inside, depending on the design. An armature will give you the freedom to move your puppet into many positions. The stronger and looser the joints are, the less pressure you may need to put on appendages like arms and legs while moving them. You don't want an armature that is too hard to move, because that means you will have to push harder on the limbs, which will cause the shape to squish more. There will always be a certain level of squishing and resculpting of the clay, but any way to keep it to a minimum will be welcomed. You can also combine your armature with other light materials such as Styrofoam to keep the weight down, and place a thin layer of clay over the top so that it still keeps its clay appearance (see Figures 7.87–7.88). Other materials can be combined with clay as well, such as wire or fabric. I would recommend continuing to use beads for eyes, as clay eyes are very hard to move without losing their shape and becoming a big mess.

Most clay animation is done with Plasticine or other brands of oil-based modeling clay, but you can also experiment with animating Sculpey. (The Super Sculpey brand works best.) Sculpey is polymer clay, intended to be baked, but due to the fact that it's less greasy and not as mushy as modeling clay, it can still end up being a convenient material for animation. Or, you can combine them, using the Sculpey for the parts that don't move as much, either baking them or leaving them unbaked. A student of mine recently came up with a neat idea for making a monster puppet completely out of Sculpey (see Figure 7.89). It was created for a dialogue exercise, so the only parts that really needed to move were the eyes, eyebrows, and mouth. Using a ball of tin foil as a base, most of the puppet was built up on top of it and baked so it was hard, then the parts that needed to animate were blended in with unbaked Sculpey and left that way. The mouth was animated through, which means it was resculpted for every frame rather than replaced with different pieces. Since most

Figure 7.87 Armature built with Styrofoam and plastic doll armature pieces, by Katie Nielsen.

Figure 7.88 Finished puppet covered in clay, by Katie Nielsen.

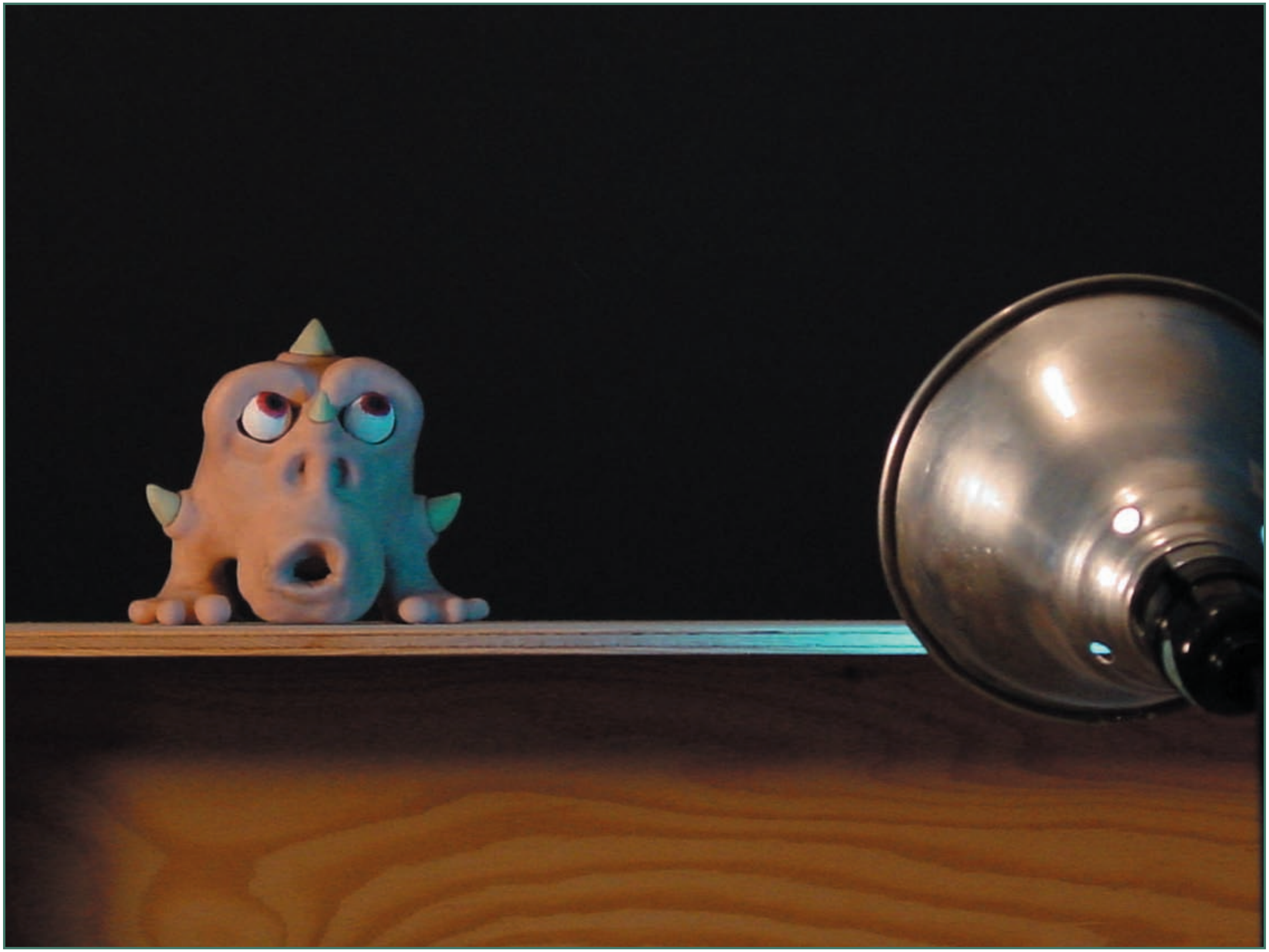

Figure 7.89 Monster puppet created in Sculpey by Matt Hooker. (Photo by Jason Vanderhill.)

of the puppet was baked solid, it prevented the snafu of getting nudged during the animation and causing unwanted jitters. It looked great in the end and was relatively simple to animate.

For some character designs, you can get away with creating a clay puppet in solid clay, without armature. The Booger character in my film *Snot Living* (see Figure 7.90) was simply designed as a blob with arms that slid around the floor and made subtle gestures and facial expressions. For the purpose he served, solid clay worked just fine, so he was a great character to work with and became very real to me. I'm not too sure of his whereabouts now…last time I saw him he was packed away in a box somewhere, which is sad, really. I am not proud, as he deserves more respect than that. Clay puppets are not the most durable or convenient for keeping safe and secure, since they get dirty and stinky over time. But I was glad to have worked with him.

Figure 7.90 The Booger from *Snot Living*. (Copyright Ken Priebe 1998.)

Other Techniques

Stop-motion animation is an art that involves taking elements of the natural world and rearranging them to create the illusion of life. Since the natural world is so rich and varied, so are the possibilities for creating puppets. Anything can potentially be made into a puppet, even a plastic knife and fork (see Figure 7.91)! A valuable pastime is to wander through dollar stores, hardware or craft stores, and just look for materials that might be useful or could be combined with other things to build a puppet. In 1959, Disney animator Bill Justice directed the stop-motion short *Noah's Ark*, which featured puppets made out of regular tiny household objects like pencils, corks, and pipe cleaners.

Through invention and experimentation, my students over the years have come up with many unique methods for making puppets out of different materials. Some of the ideas I've seen include Puppetoon-style replacement heads carved out of votive candles, skins made of a discarded mail bag, and tearing teddy bears open to put armatures inside them. So long as you have a good idea, any object you can find could be made into a puppet, rigged with wires or other materials, and animated. Toys such as action figures, dolls, and Legos have been made into successful stop-motion films, and even series like *Robot Chicken* have been created around the whole premise of poseable action-figure animation. The important thing is to keep the points mentioned in this chapter in mind, regarding weight, appeal, and durability.

Cutout animation is a close cousin of puppet animation, where the puppets are created as flat 2D characters and typically animated on a tabletop with the camera pointing downward. Cutout puppet shapes can be created with joints fastened together with string or paper fasteners, and the drawings can be glued over them so that they do not show. You can also create replacement effects by cutting out different mouths for dialogue or using different cutouts for complete body parts. Television series such as *Life with Loopy* and *Phantom Investigators* by Wholesome Productions have used puppets that are a combination of 3D and 2D. The bodies were made of 3D armatures, but with flat 2D replacement heads and mouths.

Another experiment in combining 2D and 3D elements was created in 1997 by Oscar winner Daniel Greaves (*Manipulation*, Best Animated Short 1991), in a short film called *Flatworld*. In this film, characters were animated entirely in 2D, and every drawing was cut out and mounted on cardboard. 3D sets were built, just like for a stop-motion production, and the 2D cutouts were placed into the set standing straight up and replaced for each frame. *Flatworld* inspired a couple of my students to try the same effect of 2D cutouts on a 3D set (see Figure 7.92). By setting up a glass plate in front of the cutouts, they achieved the illusion of the characters tossing a 3D box back and forth, by sticking the box to the glass.

No matter what you use to build a puppet, the challenge is in making sure that it will not only look good on-screen, but also be easy to animate. Experiment, have fun, find techniques that work for you, and make sure you have something entertaining or important to say with your puppet. A beautifully made puppet will hold the audience's attention for a few seconds, but eventually they will want a good story, a good gag, or beautiful animation to keep them riveted. At the very least, create something original that nobody has ever seen before. If you believe in your idea and see your puppet as a real interesting personality, so will your audience.

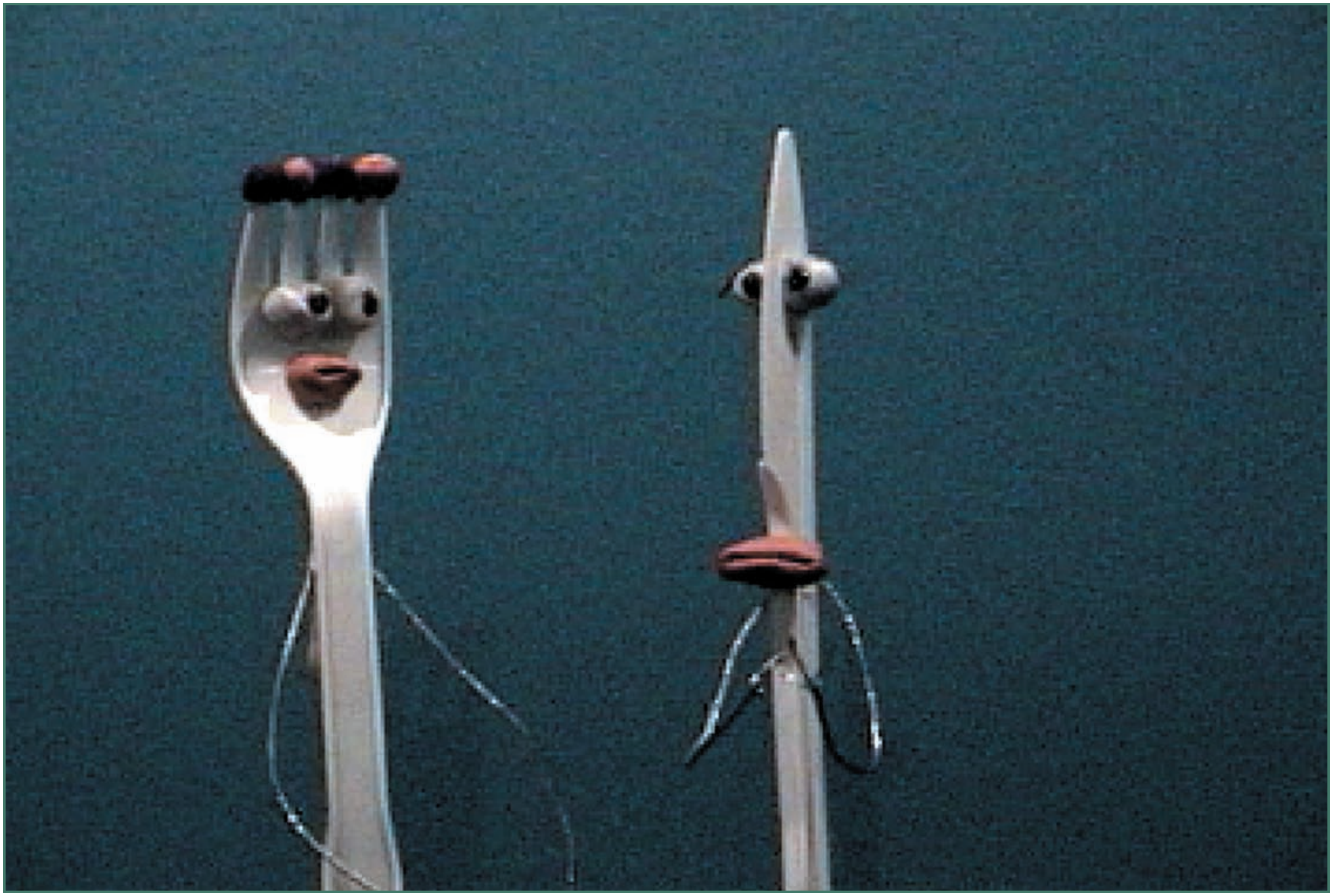

Figure 7.91 Puppets by Junko Ogawa.

Figure 7.92 2D cutout puppets by Dharmali Patel and Yatindranath Shinde.