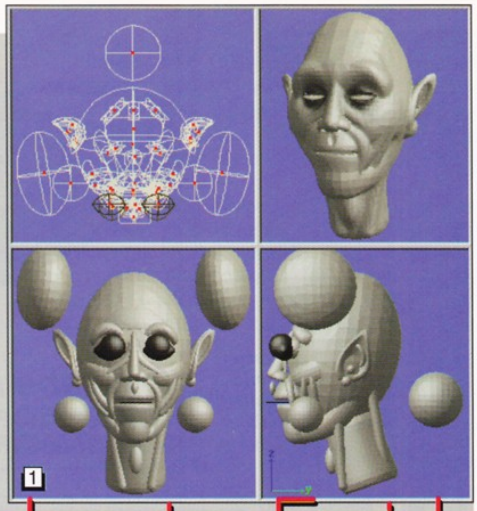
Imagine Facial Animation



One of the toughest areas for character animation with Imagine is manipulating facial expressions. Even if you understand how to navigate among a sea of bones, faces, and points, you still may not get satisfactory results. It would be easier if you could just grab a point and stretch it around, like modeling in clay. In fact, you can do just that with Imagine's little-documented magnet tool.

By R. Cory Collins
Images by the Author

Organica origin

For the example here, I began in Organica. Note how the features are exaggerated. The brow, cheeks, and chin protrude, and the lines at the corners of the mouth, and sides of the nose and cheeks, are chiseled in fairly deep. This is to offset the softening caused by Imagine's smoothing process.

The eye sockets and lids were formed by using alternating positive and negative spheres. The final shape was cut out of the bulge of the lid with a negative object that is shaped like a half-closed eye. When using this method, a more defined cut can be made by copying the shapes used for cutting the final eyeholes and pasting them directly back on top of the copied objects.

The following points apply for any application used to create the head, not just Organica.

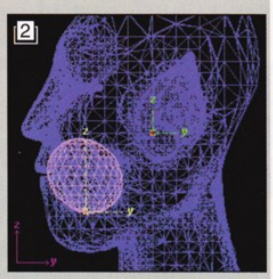
1 Make sure the eyehole shapes cut far enough into the head to accommodate eyeballs later.

2 Have the eyes be in a neutral position. Leaving the eyelids completely open or closed too far makes them difficult to animate later. Think of it as leaving enough "skin" to drag around later.

3 The mouth area should be rounded, protruding some, to make room for lips, teeth, and gums to be added later. (The opening for the mouth here is created with a thin, wide negative plane.) Leave the mouth nearly closed, without closing it fully. Opening the mouth into a natural position is easier than closing a mouth that was modeled open. The inner shape of the mouth was formed in Imagine because, in Organica, placing a negative blob inside the jaw area only draws the outer features inward, rather than creating a cavity.

Say "aah"

Figure 2 shows the model loaded into Imagine, with a primitive sphere scaled, sheared, and positioned behind the lips, leaving enough room for the lips to have depth. The cavity was formed by multiselecting the head and sphere and performing a slice operation. Some extraneous groups of faces left over had to be deleted after the slice operation, leaving only the head mesh and the part of the sphere that now will form the inner mouth. Next, I picked first the sphere and then the head object, selecting all of the faces for each, and made them be subgroups called "innermouth" and "head." This aids



Continued on page 12

As new as computer 3D character animation is, it is rooted in a tradition of more than 75 years of 2D cel animation. As you probably have observed from your own favorite cartoon personalities, "character" is a set of traits and appearances that bring out a specific personality in an animated creation. To put character into your own characters, you must build a set of expectations within your audience about how your characters will look and act in the different situations they go through in the course of an animation. You assign personality to a lifeless and inanimate object, breathing life into it. You can do this with body, head, and face design, with clothes and other accessories, and with motions and mannerisms such as a way of walking or laughing.

By R. Cory Collins / Images by the Author

The character's body type should fit the preconceived notions of your audience to achieve the proper appeal. For instance, the bad guy, or "heavy," usually needs a rather large, barrel-shaped torso with a short, thick neck and limbs, and with short, squat fingers for doing the dirty work of snatching up and pummeling his opponent (Figure 1).

Cute characters, like babies, small children or adults, and small animals, usually serve as the victims of the heavy's aggression. The torso will be small and slope downward and outward from the shoulders, like an elongated pear. Arms and legs should be short and diminish in size towards the hands and feet (Figure 2).

The hero's body will probably exhibit a large chest and broad shoulders that taper down to a thin waist—the classic V shape of a body builder. The legs should be longer and more defined than those of the heavy. The feet should be large enough to support the body, but not so large as to be humorous (Figure 3).

The evil mastermind's body should be angular, and thin, with little tapering up or down along the torso. Sharp angles at the elbows, shoulders and knees give this character a hard-edged, mean look. A thin neck to support the brainy skull would be appropriate, and long fingers on small hands round out his body shape (Figure 4).

These are just a few examples of body design reflecting a character's personality and purpose in an animation. There are certainly more, and designs can be formulated through observation of real-life characters you come across. Look around for the jokester who always

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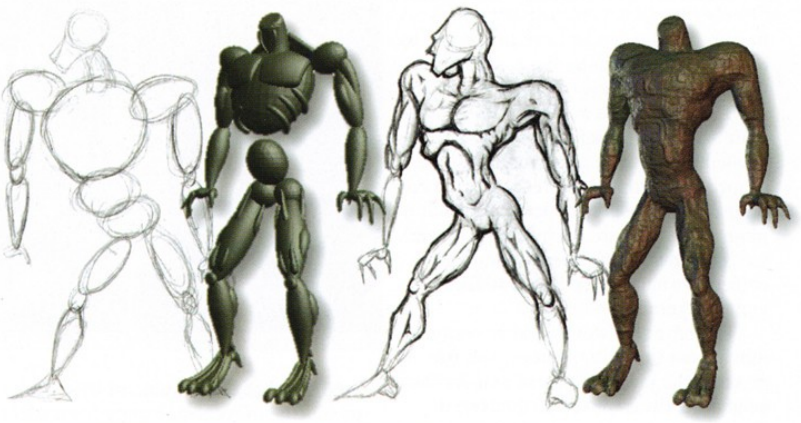
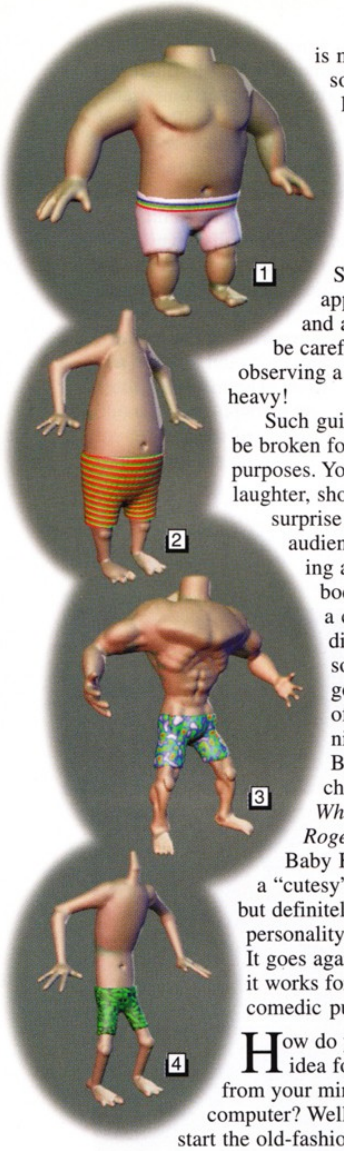


BUILDING CHARACTER



is making someone laugh, brainiacs deep in thought, and shy, quiet types, for instance. Study their appearances and actions, but be careful if you are observing a bad guy or heavy!

Such guidelines can be broken for special purposes. You can elicit laughter, shock, or surprise from your audience by mixing a particular body style with a completely different personality. A good example of this technique is the Baby Herman character in *Who Framed Roger Rabbit*. Baby Herman has a "cutesy" body style but definitely the personality of a heavy. It goes against type, but it works for shock and comedic purposes.

How do you get the idea for a character from your mind into your computer? Well, you can start the old-fashioned way, with pencil and paper. For a "bad guy" character as described above, a "heavy," sketch out a rough outline for the body, starting with oval shapes, which are easy because the hand moves in a circular motion quite naturally. For those who say, "I can't even draw a straight line," well, don't! There's no need for straight lines here, but, if there is, use a ruler.

Start with a large oval for the upper torso chest area. Draw the oval lightly, and let your hand go round and round building the shape a lap at a time. Don't worry about being neat; this is a "rough sketch." Move down about half way through the first oval, and sketch a slightly smaller oval that represents the lower torso stomach area.

Move back to the top of the upper torso and draw in the shoulders using more circles. Don't worry about overlapping the lines, but, for the moment, just lay the lines down lightly and let them cross where they may. Use stretched ovals for both upper arms and forearms, and make the forearms just a bit smaller in diameter than the upper arms. Move on to the legs, and remember, for a "heavy," they should be short and squat, and the hips should be a little smaller than the shoulders. Add two more ovals for the feet, flattening the bottom.

When laying out these ovals, try a semi-neutral pose with all body parts visible from the front.

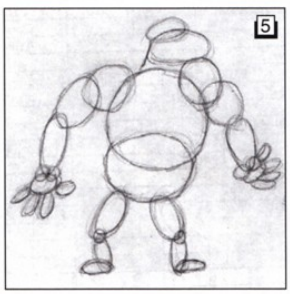
The hands use the classic cartoon-style hands with a thumb and three fingers (four fingers make the hand look too crowded and busy). Start with two small ovals for the heels of the palm and then add a larger oval for the rest of the palm. Add the thumb to one of the heel ovals, making it opposed to the direction of the hand. Now add three more ovals for fingers, bending them slightly at the middle. Keep in mind that these are the typical "heavy" guidelines of large hands with short, thick fingers.

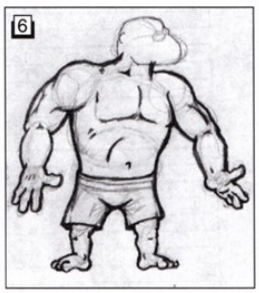
With the rough done (Figure 5), we go to the clean-up stage, where we draw in the outlines of the limbs and torso with heavier, darker lines. This is the time to determine which body parts pass in front of others to get the position of overlapping lines. As you darken the outlines (Figure 6), details such as muscle tone can be pulled out from the rough. Shading for the muscles should be determined by an imaginary light source (I generally imagine a light in front of, and to the right of the character).

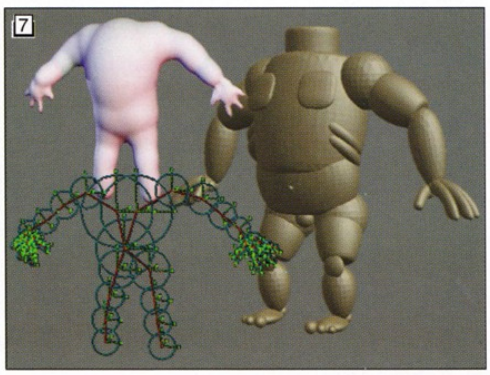
You can scan the completed sketch and use it as a background image in an application such as Imagine or Organica, where you can place primitives into the outline to form the character's basic shape. I used the blobs feature in Imagine to build an example of this character, then I made another example with Organica. In both cases (Figure 7), it was fairly easy work since I already had the reference background image.

This process for creating cartoon-like characters also can be adapted for creating just about any kind of character you can imagine, such as the alien shown at page top as a rough and the cleanup, and as an Organica model as primitives and rendered.

This process is just a framework. There really are no set rules, so use your imagination and stay flexible. □

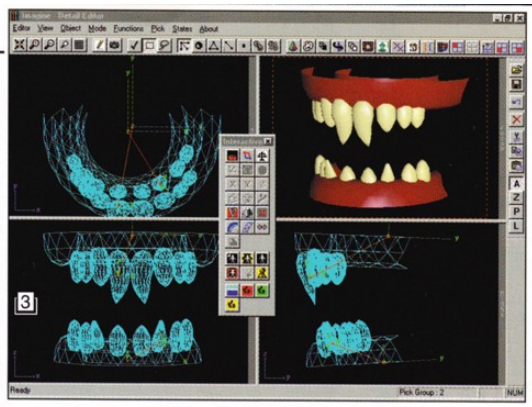






mapping and coloring later, and needs to be done before joining the two objects into a single mesh.

The gums were made from a torus with the top and back set of points deleted. The remaining semicircle was shaped, then copied, pasted, and flipped on the Z-axis to give upper and lower gums. The teeth are made from a single tooth, created in the Forms Editor, then copied, pasted, and reshaped to fill the gums (Figure 3).



The next step was to add bones for moving the head on the neck, and for pivoting the jaw. The parent axis for the head object was moved to the base of the neck, and an axis was added at the base of the skull to allow the head to turn about at the top of the neck.

An axis was added to represent the skull itself. The upper teeth and gums were made a child of this axis. Another axis was added as a jawbone pivot, and a jawbone faces subgroup was set up to allow the lower lip and chin to be rotated easily up and down. In Figure 4 (below), an axis for the chin has been added to track its motion. The lower set of gums and teeth are a child subgroup of the chin axis, which is a child of the jaw axis. These bones are the only ones necessary, as the rest of the face will be manipulated with the magnet tool.

Magnetic modeling

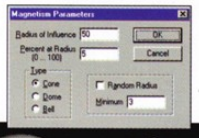
Magnetism lets you pull a point and have the surrounding points follow to a lesser degree in proportion to their distance, as controlled with Mode/Magnetism/Setup. To get the magnet tool, you must be in Drag Points mode, then toggle on Mode/Magnetism and use the Pick Point selection tool.

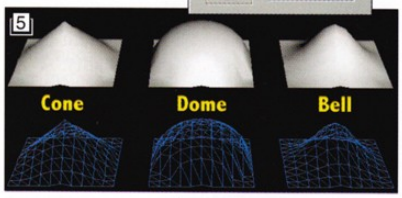
The Setup dialog's Percent at Radius setting determines how far the points will move at the magnet's radius of influence. A value of 50% moves these points half the distance the initial point is dragged, and 100% moves them an equal distance, but a value of 0% spreads the movement evenly from the dragged point to no movement at the radius. The curve of the resulting shape can be defined as cone, bell, or dome (Figure 5). Check Random Radius to get a less regular shape at the perimeter.

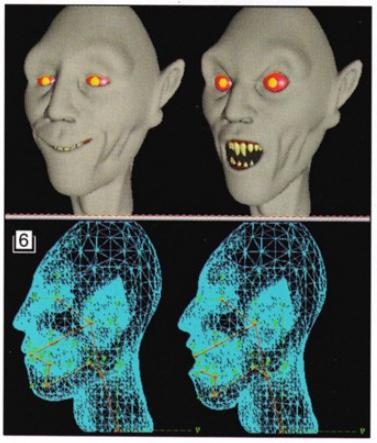
To form facial expressions using Magnetism, start by making sure you have created a default state that contains both shape and grouping information for your object. This should be the neutral, expressionless face. Using Pick Faces mode, select the faces that comprise just the front of the head, then Hide Unpicked to keep from accidentally dragging points on the back of the head. Zoom up close to the face and change from Pick Faces to Drag Points mode.

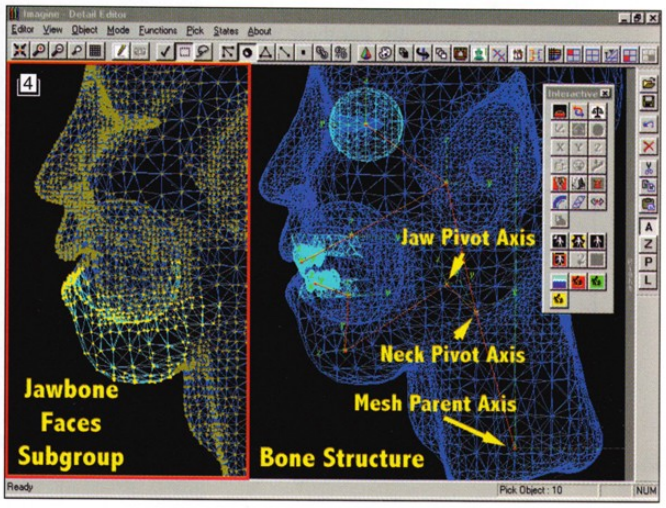
Determine the initial settings for the magnet tool by measuring the feature you want to change. To make a smile from the straight mouth position, start by turning on View/Coordinates, place the cursor at one corner of the mouth, and note the X value. Do the same at the opposite corner of the mouth and add the two absolute numbers (*e.g.*, X values of -30 and 70 mean the mouth is 100 Imagine units wide).

Since we want to pull a smile by grabbing and pulling up one corner of the mouth and then the other, it will work best if the magnet's influence is limited to about half the mouth's length. Enter that in the Magnetism Parameters dialog for Radius of Influence. Start with 5 for Percent at Radius, which works best between 0 and 10%, and Use Bell type, which usually gives the most satisfying results for doing facial expressions. Put the cursor just outside one corner of the mouth and click and hold on a point. The radius of influence becomes evident as all the points and edges affected turn white. Drag the point around, up and out a bit, to form the first half of the smile, then release. Move the cursor to the other side of the









mouth and do the same again, getting a nice grin (Figure 6).

To add a little more realism to the smile, go back and drag the cheeks up and out as well. Once the smile looks right, go to Pick Groups mode and create a state called something like "grin." Be sure to check Shape Information when creating the state, as all you have modified is shape information.

To open the mouth, rotate the jaw pivot axis, which moves the teeth, gum, and chin down, then choose bones update. Next, use the magnet tool to pull the lips into a circular shape (Figure 6). You may want to hide the points of one lip while you drag points on the other, to keep from disturbing points you don't want moved at the edges of the magnet's influence.

Additional tips

- Study how facial muscles work. For instance, add subtle movement to the cheeks when the mouth moves.
- If bones are used, such as for the neck and jaw, be sure to pose the bones and update the mesh before using Magnetism. Updating the bones afterward updates the shape information, wiping out the changes you made with the magnet.
- To select and drag points in different views, grab the point you want in one of the tri-views and drag it a little. Hit Undo (the point remains selected) and move to another view where, while holding down the Ctrl key, you can proceed to drag the point. You don't have to be near the point to do this, as it will remain selected wherever you are in the view.

One downside of animating shape information is that you must create the states in the Detail Editor. Animating with Stage Editor states isn't possible because only grouping information is used in its states.

Because of the way the magnet tool moves points along a smooth curve, facial animation looks better than with using bones, and it is an easier and more natural way to model. This method also lends itself well to animating cloth and movement of large areas of flesh in a more realistic way. Experiment and you may surprise yourself with the results. □

AM99 Surface Constraints

AM99, also known as Hash Animation: Master 7, has many new features, and some old ones have been improved, so we have much

By Mike Caputo / Animation Bureau
Images by the Author

material to cover in the next few issues. Animation Master is very well regarded in the constraints arena, and AM99 now has "surface constraints." Put simply, this is a bones constraint setup that one would use to keep a snowboard glued to the wavy surface of a slope as it goes downhill, or to have the wheels of a lunar transporter stick to the convoluted surface of the Moon.

For the latter example, I've built two models: a simple planetary rover, and a rough, erratic surface on which it rides. This would be difficult to keyframe using traditional methods, since we would have to set many keyframes to prevent the wheels from going through the surface, and we would have to work in a shaded mode or constantly create preview renders. This could quickly become a nightmare if we needed the rover to travel a different course or in a different direction.

However, by using "surface constraints," we don't have to worry at all about the wheels sticking to the ground. Surface constraints automatically guide the surface (or a section) of one model to follow a contoured surface of a second model as it moves along that model.

With the control points of each wheel assigned to a bone, right-click (Cmd-click on Mac) on a wheel bone and choose "surface" from the list of constraints. In the Constraints Properties Panel, select the object (model) whose surface we want to adhere to. Also select a bone from that model that has all the surface control points assigned to it. This is how AM99 gets its surface information: this bone has been assigned the mesh control points that make up the surface we want to ride upon.

We also have to select one bone from that model, a critical step. The bone we select now controls animation of the wheel as it moves over the ground surface.

There are only two things to keyframe now: the body of the rover as it traverses the surface, and surface bones of the ground model that control the wheels. But we don't have to worry about the wheels falling through or rising about the ground, even if we change the ground surface or change the path of the rover.

To take this one step further, imagine if you had to animate a snake climbing a tree and wrapping around some branches. Without surface constraints, you would be spending a lot of time making sure the snake was on the surface of the tree, when you should be worrying about the animation of the snake itself.

*Mike Caputo's commercial work appears in two new collections of broadcast-quality royalty-free digital video clips from Synthetic Aperture (***www.synthetic-ap.com***). You can reach the author at <mcaputo@animationbureau.com> or visit* **www.animationbureau.com**.