Principles Of Animation As Applied To SAS/Nvision®
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ABSTRACT
This paper abstract describes the processes involved in creating an animation short. Topics covered include developing a concept, creating a story board, producing the final video. The ideas are drawn as thumbnail sketches. These drawings should include interesting positions of the characters and dramatic camera angles, then the sketches are assembled into a storyboard. Using SAS/NVISION each character and prop piece is then modeled and assigned attributes, for example, specularity, reflectivity, and polish. Key framing of the characters begins; the script file is saved and each scene is rendered and dumped to tape. Finally the tape is edited with sound and music.

INTRODUCTION
The Illusion of Life is making an inanimate object come to life. Animation, whether it involves moving a logo, moving bar charts, or simply animating an opening for your presentation, animation is giving life to something that is lifeless. Giving the simplest object or logo a reason to move (action reaction) can make any presentation more interesting to look at.

Most of the examples in this paper come from an animation I produced with SAS/NVISION software. The animation, called "Ruby's Dream", is about a residential pizza cutter that dreams of cutting pizza again, since most people nowadays order out for pizza. "Ruby's Dream" is a parody of "Red's Dream" created by John Lasseter of Pixar 1987

PRINCIPLES OF ANIMATION

Squash
Figure 1

Squash and Stretch.
example 1 - Ruby just before jumping fig 1.
example 2 - Ruby jumping up fig 2.

Squash and stretch is the mass distribution on the x y z axis. If you step on a beach ball, the size on the y axis decreases, and the size on the x and z increases. The mass bulges out. Likewise, if it is stretched, the x and z decrease, and the object on the y axis becomes longer.
Slow in & out

Anticipation.

example 1 - Ruby just about to cut another slice.

You can prepare your viewers for what is about to happen by leading them into the next scene with a recoil move and springing into the next action or direction.

Follow Through and Overlapping Action

Video example 1 - Ruby stops in the center of the pizza, but the handle continues to move back and forth.

Most of the time, animated sequences do not suddenly stop and then begin to move. This makes an animation very stiff and unnatural, which may be intended for a particular effect.

Timing

Video example 1 - Ruby bumping his head.

The number of frames between two key frames can change the feeling, mood, and meaning of the action.

Secondary motion

Video example 1 - Crawdaddy's antennas,

One movement of action supports the main action. For example arms swing just before a character jumps or lands. Similarly, eyes blink just before a character turns his head.
Staging

example 1 - “Ruby’s Dream”, Kitchen scene.

Staging is setting a mood or telling a story or situation with props, backgrounds, and lighting.

Exaggeration

Video example 1 - Crawdaddy's eyes bulging out.

Video example 2 - Skidding and stopping on the edge of the pizza.

You can Make an action or movement more pronounced and exaggerated to convey the emotion or action to the viewer.

TYPES OF MOVEMENT

1. Curve
2. Parabola
3. Linear
The number of points on the function are very close together in the beginning but begin to separate toward the end. The parabola is appropriate for a bounce effect.

**Figure 9 Linear function**

**Linear**

example - A globe spinning.

The points on the function remain equally spaced. This kind of movement is ideal for objects that need to rotate for an indefinite length of time, such as a spinning globe. Linear movement makes it easy to loop the animation.

**LIGHTING**

a. Spot light

Video example 1 - Used in Ruby’s Dream. Always a concentric circle with an inner and outer cone.

b. Bar light

Video example 1 - Used in logos, glass, metal, and so on. For example moon-like effect: a streak of light.

c. Global light

Video example 1 - Used as a radiant light. A fake ambient light.

d. Radiosity

Demo example 1 - Used as architectural walkthrough lighting. Soft shadows. Viewer independent.

**APPLICATIONS AND PRODUCTION WORK**

Your task as an animator is nearly always to present an idea in an entertaining, attractive, concise, timely, and affordable manner. After the fun part, the animator is left with concise, timely, and affordable. There are tools available to help you manage time and space. The need for these tools becomes obvious when you expand your presentation from slides to 30 frames per second. You have the option of rendering your entire animation in the 3-D system, but that means that every element (including the background) must be re-rendered for every frame. Sometimes this is necessary, but there is often a need to use the video environment as more than just a medium.

When creating for television, your images first need to make the trip from your computer to the world of video. The RGB image from your computer is translated into an NTSC or PAL video signal by an encoder. The handshake between the computer and the tape machine is handled by an animation controller. These devices are becoming internalized on more and more platforms. If you can afford one, a digital disk recorder offers a faster way to dump your images off the computer as well as a variety of playback modes (slow, fast, reverse, stop-action) when finally laying off to video tape.

When laying your animation to video tape, remember to give your editor a buffer; always lay down the first and last frames for a few seconds. Various editing problems will result if you don’t. (You don’t have to render your first and last frames over and over, there are commands to hold frames as they go to tape. I also recommend that frames be rendered to disk and then sent out to video tape. Rendering directly to a tape causes undue wear on the tape machine and the tape, and jeopardizes tape time and leaves you without any backup in the event of error. Extra disk space is relatively inexpensive and well worth the investment.

The quickest, simplest way to save time with video is to render one frame of a 3-D object and pass it over a background. This is the most basic form of composing which will be detailed later. Going one step further, you can render a short or long repeatable sequence that can be played, or moved as it is played, over a background and/or in concert with other moving or static elements. You must remember that although you save time rendering individual elements and then combining them in video, there is a degree of realism sacrificed when you don’t render in 3-D space. The look is different: the message may be wrong.

The practice of creating a repeatable sequence, called looping, saves tremendous amounts of rendering time even if the entire sequence is rendered within the 3-D system. When you first enter the animation menu, your model is assumed to be in the home position, that is: a move of 0 0 0; rotation of 0 on any axis; a scale of 1 1 1 or 100% of normal size. As long as you return the model to this state and the camera to match its frame one position, you will have a repeatable loop. Camera and light positions are absolute, not relative; therefore, if they are moved, you will need to retrieve coordinates for their original positions by either clicking in one of the isometric views with frame one selected or by checking the function menu. If your loop has specific time requirements, add one frame to your animation since your first and last frames will be identical. If you render a repeated loop to tape you will be dropping that last frame every time the loop begins anew, but this frame is needed in rendering so that your animation will step back evenly to the beginning frame. If the looping is to be done in editing, lay down the last frame (Don’t ask why—I don’t understand—it’s a video thing—just do it). WATCH YOUR FUNCTIONS! If you’re spinning the earth you’ll want a linear function so your planet doesn’t speed up and slow down during rotation.
Figure 10  Linear Function

Moving objects from off screen to off opposite screen is another linear probable. Be sure your curve or linear slope at the end of your animation would lead smoothly into the beginning of your animation. Looping takes a little a long way. We animated five crawdadies for 2 1/2 minutes for SUGI16 with 20-5-second or less animations (each animation containing only one crawdaddy).

Figure 11  Composited picture using alpha channel

Compositing

This is an example of Compositing. Both objects were modeled in SAS/NVISION.

More often than not, the images you create will be combined with other images. The old Vigen product gives you several options for layering images within the computer before or during the transfer to tape process. The new paint product allows compositing multi-level stills. There are many very good animation compositors that run on workstations and stand alone systems. The video editing suite offers a wide variety of tools for compositing including: switcher keying, digital tape read-before-write and digital video effects (DVEs).

However, you composite your images, the system of choice will need to know the shape of the object you are using. That is, when you render a frame it will always be the same rectangular shape no matter the shape of your model. SAS/NVISION renders alpha information with each frame which not only tells any digital system where the object is in the frame, but also tells how transparent each pixel is relevant to what is behind it. The alpha information can also be used with the image command matte parameter to show varying shades of white (more white — more opaque) where the image is.
**Mask cut out**

This is an example of a Mask cut-out. This mask is of a table lamp. A video switcher will use the combination of the actual image and its matte to cut away the unneeded portion of the frame around the object, thus revealing the background. The use of brightness information to cut a hole is called luminance keying. More advanced video switchers with linear keying can utilize all the luminance in the matte to generate accurate and gradual variations in transparency. For an animation, the matte for every frame is transferred to tape and this traveling matte is played simultaneously with the original animation to cut a hole for the entire sequence.

Another, more familiar, cut-out method is chroma keying. This is what allows your local weatherman to stand in front of a variety of images without ever leaving his spot. Any selected color may be dropped from a frame. You may want to render your object(s) with a solid, very saturated color background. If you have a switcher with good keying capabilities, this type of cut-out eliminates the additional tape transfer of the mask. Be careful; if your object contains that color in any part of it, that portion will disappear. (Watch your weatherman's ties-He'll hit the right color eventually.)

While the video switcher combines your images with other video, the DVE (Digital Video Effects) embellishes them. A low-end DVE can move your still- or already-moving image in the x, y or z direction. Higher-end systems add effects such as rotating in 3-D space, 3-D scaling, lighting, embossing, posterizing, mosaics, page turns, and modeling video into 3-D shapes. Filling a matte with a dark color instead of the actual object, making that image semi-transparent and laying it back in 3-D space with a DVE makes a great shadow—and with a traveling matte you have a perfectly timed moving shadow. These DVE's manipulate video in real time (not salesperson's realtime); an animation can be transformed in a hurry, saving much time and money in 3-D rendering. Compositing systems, mentioned earlier, have DVE's built into them. Workstation DVEs are less expensive than stand alone video DVEs but require video to be digitized before it can be manipulated, which either takes time or requires the added expense of a real time digital disk recorder. The workstation DVE/compositing system is an excellent alternative for a small or graphics-only production shop or a supplement to take the heat off the post-production suite of a busy production house.

**CONCLUSION**

Next time you you sit down to animate, think about what you are attempting to tell, and apply some of the techniques taught in this paper. You will find it easier to use the software(tools) because now you have a better understanding of how to do an animation. Let your imagination, not the software(tools), dictate the look and feel of your animation. Let the software be a means to the result.

a. Get an idea. Visualize it.
b. Sketch it out. Draw interesting key shots.
c. Story-board it roughly on paper.
d. Time the sequences,using a stopwatch, between frames. Get a rough idea how long it will be.
e. Finally, draw the Story board and color it. The better and more finetuned your story board is, the less time you will take guessing on your computer.
f. Begin Modeling. Do some test animations in wire frame. Apply some of the techniques taught in this paper.
g. Assign attributes to objects. Do some test animations in full render.
h. Render it.
i. Drop it on tape.

Whatever tools you use, always remember what you are trying to convey. Let the project drive the toys, unless the main idea is to show off your toys. And remember a few simple TV rules:

a. Safe Area · Different monitors (or TV sets) scan differently, so keep important information inside a 1/10th screen area border.
b. The 30% Rule - If something is to be seen, especially text, assign it at least a 30% higher luminance than what is behind it.
c. Highlights are beautiful - be careful where they show up. Highlights can interfere with readability or be mistaken for unintended information.
d. Fixed Shading - The simplest of all shading seems such a waste of time when working with photorealistic images, but is so valuable for the face of text when readability is a must.
e. Greyscale · You have 16.7 million colors to choose from in SANS/VISION, but if you happen to choose a thousand different hues with the same luminance, your picture will disappear on a black and white set.