The Language of Cinema and Traditional Animation in the 3D Computer Animation Classroom

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Sophisticated technology, particularly in the area of three-dimensional computer graphics, has become more affordable, enabling university art departments to add 3D computer graphics imaging and animation to their curriculum. Offering a productive learning environment where content and meaning is not overshadowed by the necessary volume of technical information can be a challenge. To use the equipment creatively, students must learn certain steps and processes. A structure is needed to simplify the complex balance between the technology, animation techniques, and content. How do students learn to use these advanced tools and at the same time develop their own visual language? The desired structure can come from identifying where traditional media, specifically film and animation, overlap 3D computer graphic animation and where 3D has "rules" of its own. From these intersections, an effective strategy for teaching 3D animation can be created.

In the curriculum where I have developed this approach, students only have two semesters of 3D coursework. The first semester, they learn to model, light, and apply materials and textures; in the second semester, they animate. More than a few are mesmerized with the technology at first, then frustrated as they try to get it to build the cool objects they had envisioned. By emphasizing their combined role of director, camera operator, lighting technician, and animator students see more of the "big picture" of moving images in 3D. The technology, the "HOW" of using the computer to create this communication, is then learned in the process of exploring film and animation techniques.

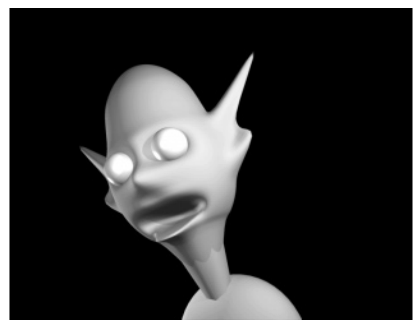
Cinema

Cinema is the art of the moving image. There is a camera that defines the viewing frame, a set for the action to occur in, objects, characters, and lighting. By looking to cinema, we can identify the basic tasks, as James Monaco does: "Three questions confront the filmmaker: what to shoot, how to shoot it, how to present the shot."[1] The "what" is tackled through conceptualizing and scripting. The "how to shoot it" addresses the use of the camera to carry the meaning and intent of the script. "How to present the shot" moves us to syntax, or how the pieces will be organized to form the complete whole. The storyboard is the template that evolves from the answers to these three basic questions. As in spoken and written language, a structure is formed that the viewer follows and feels - a beginning, a middle, and an end. This engages viewers, carrying them through conflict and resolution, in humorous or dramatic situations.

The cinematographer's tools include sets, lighting, camera angles, and camera movement. These are also the tools of the 3D animation student. Like the filmmaker, they use a script, storyboard, and concept drawings to model their scenes and characters efficiently. Scripts and storyboards are not the students' favorite thing to do! The real necessity for scripting and storyboarding is emphasized through thinking from the perspective of creating shots. To do this, the student has to consider many questions. Where is the camera (the viewer) going to be? What is the viewer's role? Will the camera move and how? What is in the scene?

From the filmmaker, we learn to plan lighting, camera angles, and movement as these shape meaning and create the desired emotion and interpretation. Color, contrast, angle, and field of view all work to give viewers information about what they're seeing and how to see and interpret it.

Translation of fill, rim, and key lights into the software's lighting tools is explored. Most 3D software has a selection of types of lights, from point lights to the sun, which the user can define. "Wattage" can be determined, as well as placement and direction, depending on the type of light. Lights can be designated to include or exclude certain objects, a task that is much harder in real life!



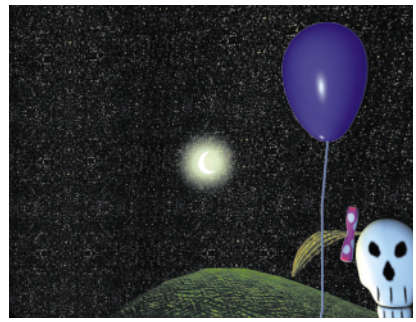
Figures 1a and 1b. Two examples of how lighting impacts the interpretation of a character. Images by David Beeler.

Figures 2a and 2b. This demonstrates the same set shot two different ways. In both shots, the camera starts in the same location; one shot uses tracking, in which the camera follows the object, the other uses a pan, where the camera turns on its axis to follow the object. Images by Pamela Turner.

Once modeling, texture mapping, and lighting are learned, the student moves to animation. Camera movement is the first animation lesson. Here we address the "how" of shooting the scene. Basic camera moves (dolly, tracking, pan, tilt, and zoom) and how these moves and combinations of them can be emulated within the 3D computer environment are demonstrated. There are more active camera movements, thanks to helicopters, cranes, and remote control devices, allowing the viewer to see things, to be places, they would rarely see or experience in real life. 3D software makes this even more possible. However, the new student usually has no problem making the camera fly around like an angry bee, creating a viewing experience conducive to motion sickness. Moving the camera is easy. You just draw a path and adhere the camera to the path, and off it goes. It is control and communication that is difficult to achieve. While trying not to deny students any of the shots that a free-moving camera can offer, the angry bee approach is discouraged. The emphasis is placed on why the camera is moving, not just how do we move it within the software. Is it to follow a character, to place the viewer in the middle of the action, or to reveal objects?

Students are shown snippets of film to clarify camera movement and to help them better understand how the camera is being used in the communication process. One of the examples used is from Kurosawa's "Dreams,"[2] specifically the dream of The Village of Watermills. Here the camera is an active observer, following the character as he walks into the village. The camera tracks with the character as if on a parallel path. Then the camera combines the tracking movement with a pan as the viewer's path shifts direction and converges with the character's. The viewer is then facing the character, watching as he crosses the old bridge over the stream. The camera allows us to share in the experience of the character. We, like him, are wandering, curious and enchanted by the old village.

Another example is a scene in Jim Jarmusch's "Down By Law."[3] In contrast to Kurosawa's camera, here there is minimal movement. Jack and Zack are in jail. Jack is talking about what he's going to do when he gets out. He paces front to back, left to right, defining the space. The camera only moves slightly to keep him in frame as he comes front and right. The focus is on him as Zack sits in the background. The stillness of the camera, the tightness of the frame, emphasize the relationship and isolation of the characters,



Figures 3a and 3b. Camera movement to pull the viewer into the scene as it pulls back to reveal the subject. Stills from animation by Russ Honican.

as well as the intensity of Jack's reverie. The camera is unobtrusive. The viewer is present, quiet and intently observing.

Through watching these segments, the students become more sensitive to the role of the camera, and how important camera placement and movement is in conveying meaning and intent. The camera is the viewer, and its placement and action determine the viewer's involvement in the scene. Now the software can be approached with a better understanding of the medium. How to get the camera to pan, track, and dolly. How to combine movements like pan and zoom. How to fine tune those movements, to allow the camera to hesitate, slow down, or speed up. These are learned through technical demonstrations and then by applying them through individual animation. Camera movement is keyframed, or cameras are placed on a defined path. Function curves are edited to refine the motion.

Perhaps the most difficult topic to teach is syntax. This is the structuring part of the process, where images are sequenced to communicate time and space, creating a style and structure for the work. The students have decided what to shoot and how to shoot it; now they must present these shots. Here the need for previsualization, scripting, and storyboarding becomes most apparent. They must organize their scenes and think of transitions, fades, and cuts, and plan their animation accordingly. To do this, they have to think of the animation as a finished piece and break it down into shots. Scenes must be managed so that camera movement, models, and lighting match from cut to cut. These considerations determine what sets and models actually need to be built.

This is not only a technical concern. Choices in image structure and sequence are tools, just as lighting and camera movement are tools, for communication. Fast-paced cuts indicate excitement, a building of suspense. Longer shots allow thoughtfulness and rest. A cut from a shot tracking a character to a shot from the character's point of view gives us a "second camera," access to another perspective in experiencing the scene. Addressing syntax gives the student a better grasp of structure, timing, and storytelling - elements that are usually weak in early attempts at animation, video, and film.

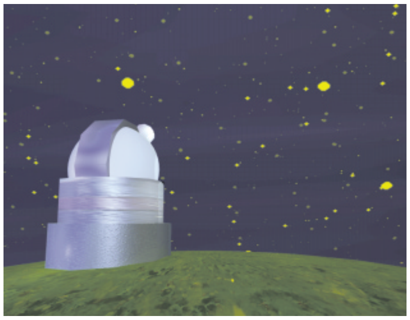
Students must visualize how to shoot and present the shot as they develop their storyboards, before they start modeling. They are encouraged to use the software as a tool to do preliminary tests in making these decisions. Once the storyboard is developed, it is used as a guide in the process of creating the scenes. Environments are modeled and lit much like film sets, keeping the camera in mind. Objects that appear in the background have simpler geometry and lack close-up details, as they're never viewed closely. Close-up shots are modeled separately. Walls or areas that are never seen are never modeled. Here the need for previsualization, scripting, and storyboarding becomes obvious. Otherwise, the student tends to work more sculpturally, modeling whole rooms and objects without respect to the ever-present camera frame.

Traditional animation techniques are addressed to help students create and control object/character movement. Cartoons and animation are so much a part of their visual vocabulary that they don't consciously notice things like anticipation and exaggeration. But the lack of these elements can make an animation difficult to "read." Viewers miss important signals. They need a cue that the character is going to run off screen or turn her head, a cue as to what to look at next. And even though students may have learned these techniques in traditional animation classes, they sometimes have to be reminded to apply them in 3D animation as well. These animation concepts can be difficult to simulate, depending on the student's 3D modeling ability. If the object wasn't built with movement in mind, it probably isn't going to move convincingly.

Animation videos are used to demonstrate the use of walk cycles, squash and stretch, anticipation, exaggeration. All types of animation are viewed, but I find clay animation to be particularly helpful as it, too, is 3D. A favorite example is Nick Park's "Creature Comforts,"[4] where zoo animals gesture, sigh, blink, and scratch as they are interviewed about their accommodations. Here we find wonderful examples of character motion creating personalities.

Animating in a virtual 3D environment that has no gravity is much like creating drawn or clay characters when it comes to communicating weight. The animator has to imply weight through the object's movement. Motion is studied, particularly head and eye movement, and walk cycles. The use of overlapping motion, which is critical in 3D characters, is emphasized.

Once these techniques have been identified, the appropriate software tools are introduced. There are numerous ways to create object movement, depending, of course, on the software used. Models can be translated, rotated, and scaled. They can be squished and stretched in numerous ways. Many software programs offer animation tools that create squash and stretch based on the object's keyframed movement. Natural forces such as wind and gravity can be applied so that the object reacts to the environment. Inverse kinematics[5] is taught as we investigate walk cycles. It is the students' storyboards that guide the technical demonstrations, their ideas providing the motivation to explore these digital tools, as they work to create the illusion of life.



Figures 4a and 4b. Camera tracks back to reveal that things are not what they initially seemed to be. Stills from animation by Kelly Perkins.

Conclusion

Borrowing from the already-developed principles of cinema and animation has proven to be an effective approach to teaching 3D animation and more. Students are exposed to new ideas through discussion and viewing contemporary work in animation and film. This approach helps make them aware of the context they live in and gives them the tools to create within that context. Through observation and application of cinema and animation techniques, they come to understand the connection between form and content, and how these techniques are used to effectively convey intended meaning. This encourages content development, without which the work is just a technical exercise. Understanding this, they are then able to articulate complete thoughts and not simply rehash what they observe in current 3D venues (games, special effects sequences, animations, and cartoons) but to express their own individual ideas and vision.

Students' response is positive, although I know it is challenging for them as the 3D software is unlike other software they've used. The interface is different and there are many new techniques to learn. Looking at the big picture gives them a different perspective, so they can step back and view the technology critically and avoid being overly enchanted by it. I believe they become more critical of their work as they gain understanding of why and when to use this tool and not just how. This is evidenced in the critiques. There is much more discussion about the intent and communication of their work than before. I hear comments like: "Is there a reason the camera is moving there?" "Perhaps some shoulder movement would help us read her character better." "I think the camera needs to hold a few seconds longer here so we can connect to that character." They're directing and animating, not just honing software skills. I have to remind them to ask technical questions relating to the use of the software.

Using cinema and animation as a guide in teaching doesn't necessarily add to the amount of information I have to cover in the class. Rather it provides a natural structure for the techniques that are taught. Students have only two semesters total of 3D imaging - one for modeling, the second for animation – so there is not the time, or resources, for doing full feature animation here! They are reminded to integrate skills learned in their other film, animation, and video classes. They learn to model concisely, and to say something economically. Television has taught them that 10 seconds is enough time to make a point. Being able to "say something" gives them more initiative to learn how to use the technology. By the end of the semester, the computer has become almost transparent. The emphasis is on the content, not on pushing buttons.

Ultimately, I feel the students receive a better visual communications education. They get to take a further, more interesting journey. And along the way they create some pretty interesting animation.

References

1 James Monaco. How to Read a Film. (New York: Oxford UP, 1981) 148.

2 "Village of the Watermills" from "Dreams." Dir. Akira Kurosawa. Warner Bros., 1990.

3 "Down By Law." Dir. Jim Jarmusch. Perf. Tom Waits, John Lurie and Roberto Benigni. Island Pictures,, 1986.

4 "Creature Comforts." Dir. Nick Park. 20th Century Fox, 1989.

5 Inverse kinematics is an animation technique based on the creation of "skeletons" or structures that move in relation to each other, much like our bones move. This allows a 3D-modeled thigh and calf to "behave naturally" and follow the foot when it is moved.