PoV: The Development of a vision

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PoV: The Development of a Vision
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When I started my thesis project, I thought about the purpose it served for my degree. I thought back to what Howard Lester had said about the Computer Animation program at Rochester Institute of Technology. Howard was explaining the difference between a Master of Science degree and a Master of Fine Arts: a M.S. was a demonstration of technical knowledge, but a M.F.A. was a display of self-expression. As a matter of self-expression, I viewed the thesis animation as my last personal project before graduation and entering the workforce to work on other people's projects.

"A thesis should be a well polished one-quarter animation," was how the project was described to me. In order to accomplish that task, I had to incorporate the whole body of knowledge and skills that I acquired from this school and more. My technical comprehension of animation allowed me to create the raw material, and filmmaking techniques permitted me to fashion the final product.

I confess that I also had an ulterior motive for my thesis, and that was to compete against the work done by students of the Ringling School of Art and Design. For past couple of SIGGRAPH conferences and Ottawa animation festivals, I've been disappointed that there were so many Ringling entries that were shown at the festivals and so few RIT entries. Of course, RIT had not made as large a volume of animation pieces as Ringling, but I was determined to show that it was quality and not quantity that would get RIT the recognition it deserved.

What follows in this thesis report is a chronological report of this project from start to finish. First, the story development will be covered. Then the production process will be recounted with commentary on technical and aesthetic points. Finally, the post-production is explained.

**Wither the Digital Muse?**
The story was the most difficult part of this thesis. I spent almost three academic quarters and a summer searching for a story with which I could identify. What gave me particular trouble was the length of the story. I knew a lot of short stories, but I didn’t understand how to expand them to fit the 3-5 minutes length criteria. I also found a few stories that would take longer to retell, and again, I didn’t understand how to pare down the tales to something that would fit the time criteria.

For me, it was not a matter for finding the right answer, but a matter of asking the right question. Erik Timmerman told me that stories don’t just fall out of the sky. Stories are the results of taking inspirations and developing them. During one of my meetings with Erik, he asked me if I could remember the last dream I had. It turned out to be fortunate timing, because I had had a vivid dream earlier that week.

In this dream, I was standing on a platform with a magnificent view of waterfalls pouring out of an expansive Roman-looking structure that resembled the Coliseum in Rome. The locale was so exotic that I concluded that I was on a vacation trip. When I reached for my camera to record the breathtaking view, I discovered that I didn’t have one. I spent the
rest of the dream searching for that camera because I was so sure that I brought one. My feeling of dismay was so strong that I remembered it after waking up.

I wasn’t sure how to interpret the dream because I wasn’t well-versed in dream analysis. The one meaning that I got out of the dream was that I was so caught up in trying to capture the moment of being at the falls instead of relishing the moment of being there. I wondered if my subconscious mind was a better storyteller than my conscious mind and if it concocted the dream to tell me something.

The dream reminded me of one of the trips my family took. My parents, my brother and I traveled to China for a family reunion. At gatherings, I often sat off to the side because I was shy about not being able to communicate fluently with my relatives whom I had never met before. At one gathering, my father came over and chastised me for just sitting there instead of taking pictures, since I was the one holding the camera. I felt that he was too stressed out and needed to relax a little more. This thought and the camera was why I was reminded of the situation, and I started thinking about how to tie this together with my dream.

I was excited about having inspirational material for a story and worked on developing a plot that could be animated within 3-5 minutes. The premise that grew out of these two inspirations was about a tourist who loses his camera on a vacation trip. The prospect of losing one’s camera isn’t an upbeat situation, so I turned it around with a resolution of self-discovery. The challenge became how to display this self-discovery visually.

The third inspiration for the thesis was a Twilight Zone episode, “A Most Unusual Camera,” written by Rod Serling. The story was about a trio of thieves who discover that they had stolen a camera that could predict the future. The camera made its predictions in the form of photographs that recorded future moments in time of its subjects. My protagonist's camera recorded the past in a special way, but the Twilight Zone episode gave me the idea to use photographs as a dramatic device.

To make the photos special, I thought it would be appropriate if they were the only colored objects in a black and white world. This was nothing new, but I wondered if RIT was going to develop a reputation for making black and white animations (because of two previous well-known RIT thesis projects, Shadow Puppets and Division). In retrospect, perhaps I could have done the black and white scenes in sepia tones, but I think the impact would have been weaker.

The choice of working in black and white simplified the decisions in assigning shaders to objects. All I had to decide was, “Should this color be lighter or darker?” This is why I considered the color scenes difficult to color, because I had not decided upon a color palette. I thought about using a bright palette using every color of the rainbow as the antithesis of a black and white world, but my sense of taste won in the end. I decided to use a pastel color palette for the most part. Bold colors were reserved for certain objects such as Henry’s Hawaiian shirt, Pierre’s shirt, Sam’s tie, and the toy bus to help draw attention.
2-D or not 2-D? That is the Question...
There wasn’t anything in the story that required it be done as either 2-dimensional or 3-dimensional animation. I had worked in both media for three one-quarter animation projects, so I didn’t feel tied to either form. If I did my thesis in 2-D, it would have been impressionistic like *Beneath the Surface*, my 2-D animation about a woman who might be drowning in her sleep. If I did my thesis in 3-D, it would be fairly realistic like *Rolling Blunder* and *Cookies*, my two 3-D projects starring an orange cat. In the end, my decision boiled down to which medium was the one that I felt most comfortable with.

I felt more comfortable with 3-D animation because I had done more work with 3-D software and felt I understood its limitations. I felt that 2-D animation was more labor-intensive because I had to draw and color most of the frames for *Beneath the Surface*. For 3-D, all I had to do was build models of the characters and the sets and re-use them as needed. I was also intimidated by the thought of animating a waterfall in 2-D. I knew that I could use a particle system in 3-D because I had found an example file that demonstrated how to use one for a waterfall.

So I decided to do my thesis in 3-D, even though it meant driving to campus daily and being restricted to working on the lab’s schedule. This also meant that I would have to deal with other people, which had its benefits and downfalls. I would benefit from the comradery of a social environment and immediate sources of criticism and information, but the disadvantages were the competition for time on equipment and personality conflicts. I would also have to deal with login accounts and disk space, both of which could be problematic if the system administrator wasn’t very responsive.

Of Mice and Monikers
Erik asked me what the main character’s name was, and I replied, “Henry.” He explained that I would identify better with my characters if I gave them names. I was going to name him “George,” because I was thinking of the Warner Brothers cartoons where they parodied the characters from John Steinbeck’s *Of Mice and Men*. (Incidentally, I was actually thinking of Lenny, but Lenny kept saying, “Hey, George, can I keep him? Huh? Huh? Huh, George?” and that stuck in my mind.) However, I didn’t want to create confusion with my classmates named George. so I picked “Henry” out of my mental hat.

I wanted the audience to identify with Henry too, so I put some thought in his character design. I had read Scott McCloud’s *Understanding Comics*, and he discussed this masking theory about the way comic book characters are drawn. McCloud’s argument is that when we see a photorealistic character, we tend to think of the character as someone else; when we see a cartoony character, we see a reflection of ourselves because the simplicity of the character allows us each to fill in the details. This works to the comic books’ advantage by involving the reader, and I wanted to involve my audience, to make them share Henry’s experience.

Other reasons for making Henry a stylized character as opposed to a realistic character come from John Lasseter and George Maestri, two seasoned professionals in the
computer animation field. Both animators point out that the problem with realistic character designs is that the audience expects realistic characters to move realistically, and we are all experts in human motion from our everyday exposure to other people. Caricaturized characters have more leeway because the audience has no preconceptions about the way stylized characters are supposed to move.

I drew my inspiration in character design from Jim Henson’s muppets. I enjoyed Sesame Street and the Muppet Show immensely as a child, and the influences of Henson’s creations can be seen in the extremely simplified shape of Henry’s head and the rubber-bandy jointless quality of Henry’s limbs. Following animation tradition, Henry’s hands had only three fingers and a thumb each. This made animating the hands easier as there was one less finger on each hand to keep track of.

Since Henry was a tourist, I dressed him like one, and I think his costume was a large part of his appeal. To protect his head from the sun, I gave him a straw hat. For his garb, I gave him a Hawaiian shirt and shorts in homage to the nethack computer game. As a finishing touch, I gave him sandals because I have a Hawaiian friend who used to wear sandals just about everywhere he went.

“Thesis Proposal off the Starboard Bow!”
I had to assemble my thesis committee as part of the requirement for the thesis. I chose Marla Schwegge as my chairperson, because she was my faculty advisor for my 3-D animation projects and demonstrated understanding of the animation process. For the second committee member, I chose Erik Timmerman because he helped me a great deal with developing the story for the thesis, and I looked forward to having him help hone the plot as production went on. For the third committee member, I was encouraged to seek a person outside the Film/Video/Animation department, so I chose Nan Schaller because I took one of her computer graphics programming classes and knew that she came the computer animation screenings. I counted on Nan to give me a non-technical (animation-wise) outlook on my project.

The next step was storyboarding the thesis. With the storyboard, I was breaking the plot down into a series of drawings that determine the basic camera angles and rough edit points. Sometimes problems with the plot can be found at this step, and drawings are either thrown out or redrawn to fix the problem. The number of drawings, or shots, gave me an indication of how much animation to expect. After Marla and Erik picked at the storyboard, I ended up with 41 shots, which I guess is the average amount of shots for a 3-5 minute piece of animation because Beneath the Surface, which was 5 minutes long, had 50 shots.

At this point I was ready to make my thesis proposal. I wrote up my treatment, budget, and timeline. The proposal passed after a brief discussion about a couple of plot points and about the decision about doing the animation in 3-D as opposed to 2-D. At the time, I didn’t know what a tremendous commitment my project required, so I made an ambitious timeline schedule of only two quarters. After two years of working on this project, I sort of understand how James Cameron felt about Titanic.
Resource Management is a lot like juggling sharp knives

I had originally planned to animate my thesis project in ElectroGIG 3Dgo, which was the software I used for animating Rolling Blunder and Cookies. When the site license for ElectroGIG expired in the summer before I proposed my thesis, I felt left in a lurch. When I found out that the replacement software was going to be Alias|Wavefront Studio, I was both excited and scared. The excitement stemmed from the potential offered by Alias, and the fear arose from the fact that I would have to learn a whole new software package from scratch.

In ElectroGIG, most of us students built our characters out of primitive shapes because it was the best option offered by the software. ElectroGIG did have NURBs and metaballs, but precise animation was difficult to achieve with NURB objects because they were represented by a bounding box in wireframe mode, and metaballs tended to increase the rendering times to unacceptable lengths. We often had to be creative with the construction of our models, but we also felt limited by our options. Alias had a superior representation of NURB surfaces, but it also had a rich tool set that took longer to learn. The payoff of the steeper learning curve was more sophisticated models. Unfortunately, I think that some of us get so carried away by the sophistication of our tools that we forget our limitations.

We graduate students need to understand that we are making short subject films, not grand epic feature-length films. We simply don’t have the resources for the latter. It seems that we put a lot of faith in the availability and power of hardware and software.

The Silicon Graphics (SGI) workstations we used for creating our animations were fairly powerful machines to run complex software such as Alias, but just like any other machines, they broke down every so often. A hard drive would die or a power supply part would go bad, taking the machine out of commission. Sometimes the operating system would misbehave and not let people log into their accounts. Other factors that affected the availability of machines were classes and lab hours. The animators shared the lab with other students from Imaging Science, Industrial Design, Medical Illustration, and Information Technology because most of the other departments participated in funding the lab, but we animators felt very territorial about the equipment because we spent the most time in there. The school ran the lab just like any other computer labs on campus because they didn't foresee the lab usage being any different from the other labs. In a way the enforced lab hours were beneficial, forcing us to lead lives outside of the lab and get some much-needed sleep.

My project spanned three versions of Alias|Wavefront Studio, from version 7.5.2 to version 8.0 to version 8.5. Each upgrade was relatively painless, although it was slightly confusing when dealing with interface changes, especially menu rearrangements. The problem with upgrades was that some of us would hold off production to take advantage of the new features promised by the new versions. There were no guarantees that the new features would work as advertised, and sometimes an upgrade schedule had not been
accomplishment. In both cases, some time was lost in waiting for new software to solve problems when all that was really required was extra creativity.

Another consideration is the amount of disk space required for the project, and how it is managed. When I started the thesis project, all accounts were stored on a shared disk drive with only 4 gigabytes of space. We didn’t have disk quotas, so we were only limited to the free space remaining on the drive. That system only worked when everybody was conscientious about the space they were using compared to other people. When ISC took over the management of the lab, disk quotas were imposed. My disk quota was set to 150 megabytes, so I had the luxury of storing my characters and some props in separate files for organizational purposes. This allowed me to import objects as needed into a scene. Since the story was already broken up into 41 shots on the storyboard, I gave each shot an individual wire file. This scheme made keeping track of which scenes still needed to be animated easier in the production phase.

Even though we had accounts with ample disk quotas, disk space was a constant resource problem up to the last month of my thesis production. We stored our scene description language (SDL) files and the rendered frames they generate on a separate shared hard drive with two partitions. Rendered frames take far more room than Alias wire files, so this was why we had separate render partitions. The problem was the same one that we had when all accounts were stored on a shared hard drive: some people did not delete their files when they were done. At times, the tension in the lab escalated because other people didn’t want to give up the space they were using because they knew the repeat offenders would take that space. To alleviate the problem, the lab monitors were empowered to notify the disk hogs, but that only went so far because the removal of the offending files was voluntary. The solution used during the last month of my production phase was to wipe the render partitions clean of files on a daily basis. I was a disk hog a couple of times, but to avoid that status during production, I rendered only the test stills at full resolution of 648 x 486 pixels while rendering the animation at quarter resolution of 320 x 240. It wasn’t until I reached the post-production phase that I rendered my animation at full size.

The last item in resource management is the most precious: time. I had the most problems with this resource even though I took some steps to manage it. When the class schedules for the lab were posted, I took note of the days and time that the classes were held in the lab and which instructors were teaching. Some instructors would let students who were not in their class use the extra workstations, and others didn’t. So I planned my work schedule around the restricted classes, using my free time to research, eat, or get some extra sleep. I also charted completion dates for each shot, but I quickly abandoned that chart when my production schedule started slipping. Marla sensed that I was falling into procrastination mode, so she had me schedule weekly appointments with her because I worked better under deadlines. I think that was the best solution for me to have weekly (and even daily) objectives. Achieving the objectives gave me a sense of accomplishment and encouraged progress on the project.
**Breathing Life into the Story**

When I work on a shot, I had a workflow set up to handle the shot from beginning to end. First, the scene was prepared for animation. Next, the characters and objects were animated. And finally a test rendering was made of the animation. Corrections were made, and then work would progress to the next shot.

In preparing a scene for animation, I always consulted the storyboard drawing for the shot. For the most part, I was able to reproduce the camera angles and screen compositions of the drawings, but the drawings were meant to be used as guidelines. Sometimes adjustments had to be made because I was working with 3-D elements in my animation, not the 2-D elements of the storyboard drawings.

To assemble the scene, I gathered the set, lights, props, and characters together in a wire file. When an object wasn’t available, I modeled it and placed it in the scene. Then the camera angle and object positions were determined. There was usually some tweaking involved. The camera was too far away from the character, so I moved it closer. But now the character looks like he’s in the wrong spot, so I shifted him over to a side. Then the camera angle looks too low, so I have to raise the camera and angle it down. And so forth.

Before I proceeded with animating anything, I render a test still to make sure the shot looks correct. At this step, I usually worked on the lighting. If the lighting wasn’t right, like things were too light or too dark, or an additional light was needed, I would make the appropriate changes and render another test still. This was another tweaking cycle, and for some shots, I was stuck in this cycle for a long time.

To make the process of animation more efficient, I often broke the action down into smaller actions. I would draw tiny storyboards of the poses for the smaller actions and wrote down description of those actions, so I was clear on what I wanted to do. Using these mini-storyboards, the next thing I would work out was the timing chart for the actions. I would basically guess how long the main action would take and then assign the keyframe timing for the other actions based upon that guess. The keyframes often fell upon multiples of 5 frames. For example, a character would “hold still” from frames 1 to 10, then shift weight to the right hip from frames 10 to 25, “hold still” from frames 25 to 55, and finally shift weight to the left hip from frames 55 to 85. I used multiples of 5 frames because the animation playback was at 30 frames per second, and 30 is easily divisible by 5. I think this gave my animation a rhythmic quality, but I wasn’t conscious of that while I was animating.

Alias gave me the option of animating using forward and inverse kinematics. Forward kinematics (FK) was the way I learned to animate in 3-D with ElecritoGIG. FK is a top-down way of manipulating a character. To animate a character raising a foot to make a step with FK, I’d have to rotate the hip to raise the whole leg, and then I’d have to bend the knee to make the foot look more natural since the character isn’t goosestepping. With inverse kinematics (IK), I simply move the foot to where I want it, and the software
should figure out how to rotate the hip and knee joints to place the foot where I indicated. IK isn’t perfect, but it does make animation easier when it works correctly.

When animating my characters, I used a method that the members of the CG-CHAR mailing list call “layering.” I would start by animating the torso first, then add the animation for the head, arms, and legs, and finally finish up by animating the fingers if I had the time. This method worked fine with either FK or IK.

I used a few different tools to review the animation. At first I used Alias’s own playback, but it didn’t play the animation at the correct framerate of 30 fps, so I began using another Alias tool called playblast. Playblast was useful for checking the wireframe animation, but when I wanted to check animated shadows and particle systems, I preferred to render the shot at quarter resolution and use Alias’s flipbook utility to check the animation.

After I was done tweaking the animation, I would make a quarter resolution render of the shot and convert the frames to an SGI movie. Since SGI movies take up space, I did further conversion on the movie and compressed it into an MPEG movie with a public domain IRIX tool called mv2mpeg. To help inform my thesis committee of my progress, I placed the mpeg movies into my web directory at http://www.rit.edu/~jxy5395/thesis/

What follows is a discussion of the shots in the chronological order that they were completed. The advantage of having a storyboard was that I knew which shots I needed. With that knowledge, I was able to animate the shots out of order, allowing me to tackle the easier shots first and to delay working on difficult shots until a later time when I had more technical knowledge and skill.

**Shot 15 – Henry’s arms turn to bones**

I started animating with this shot because it was the simplest one to do with the only model that I had ready at the time: Henry. There was nothing needed for the backdrop because it was a dream sequence. It was going to be a test of IK animation and particle systems. If either one failed, I would have gone back to the drawing board to see what alternatives I had.

I wanted to position the camera at the level of Henry’s eyes, so that it would match the storyboard drawing. Unfortunately, in order to match the camera angles, the camera had to be located inside Henry’s head. When rendered, the image would be a dark blank one because the camera could only see the inside of Henry’s head, so I made the head and hat invisible.

I created a set of skeletal arms and hands for this shot and attached them to the body in the same fashion as the skin. I had some trouble with modeling the bones because I wanted to make them more realistic. When I realized that since my character is so stylized, why should I worry about the medical accuracy of his skeleton? For that matter, why does a character with rubbery arms have a skeleton? Once I accepted that the
skeleton was needed for artistic reasons, not functional, I went ahead and stretched and squashed spheres into bones.

The inverse kinematics worked fine for the arms, but forward kinematics was used on the fingers because I couldn’t get the fingers to bend correctly with IK. The fingers would contort in unnatural ways, so I had to pose each finger joint and set keyframes for their rotational values.

A particle system was used for the falling sand, and the setup was pretty basic. A solid behavior was applied to the particles so that they would be affected by gravity and bounce off objects (Henry’s hands in this case). The sand would also bounce off the ground plane, so I moved both the particle system and Henry way off the ground so that the sand won’t bounce on-camera. I would later find out that I could have turned off the floor collision instead.

**Shot 28 – Hands reaching for the last drop... and missing**
This was the next shot to be animated because it was similar to shot 15, with the same camera angle and the same action. I adjusted the timing for the animation of the arms so that they moved slower as they came up.

The tricky part of the shot was turning off the particle system at the right frame so the last grain would fall between the hands just as they overlapped. I went through many cycles of adjusting the keyframe for the last drop and running a simulation before finding the right timing.

**Shot 11 – Henry climbs up a dune**
My experience with ElectroGIG taught me that I didn’t have to animate the whole body if I didn’t show all of it. With that in mind, I planned this shot that the lower half of Henry’s body would be obscured by the sand dune. This way the walk cycle could be more like a puppet walk cycle than a Muybridge one.

The timing of the walk cycle was difficult. In order to convey the sense of walking on sand, I tried to exaggerate the downward steps as if Henry was exerting more effort in climbing the dune. The action is somewhat exaggerated from real life, but since it brings the point across clearly, it doesn’t seem out of place.

The path of Henry’s walk was at an angle to the camera, and I was having a hard time adjusting the timing of the animation when I realized something. It would be easier to tune the animation if I made Henry travel along one of the coordinate axes. I chose the X-axis, so I flattened the Y-translation animation curve, re-aligned the set and camera by rotating them, and started tweaking the timing from there. The process was simplified because I was now only dealing with movement in two directions (forward-backward and up-down from Henry’s perspective).

This shot was the first time I realized what a difference between raycast and raytracing meant. I used raytracing with shots 15 and 28 because I wanted shadows from the
particles to show up on the hands, thus establishing where the sand was falling in relation to the Henry. In shot 11, I thought I didn’t need a shadow because the ground where the shadow would appear was hidden from view. After comparing a raycasted render and a raytraced render, I realized to my chagrin that raytracing would be necessary because there was a visible gap between Henry’s head and the hat. Raycasting made the gap visible by illuminating the inside of the hat. Switching to raytracing forced a shadow in the hat interior, making the gap less noticeable. Admittedly, this sort of detail would escape the casual viewer’s notice, but since I was the animator and reviewed the sequence countless number of times, it stuck out like a sore thumb. Another solution would be another camera angle, but a higher camera angle would reveal more of Henry’s body and cancel out the advantage provided by the lower angle.

One thing I noticed with my flipbook renders of this shot was the jittering in the sand texture. Even though there was no animation for the sand dunes, the sand grains would twinkle noticeably. Luckily, the jittering was less apparent in the final render. If I were to re-render the shot again, I would try turning off the jitter option somewhere in render options.

**Shot 6 – Establishing shot of Henry on a bus**

Inspired by my success with vehicular motion in *Rolling Blunder* by keeping the camera stationary while the background moved past the race cars, I planned the same sort of set up for the bus shots. The interior of the bus would remain stationary while telephone poles would move past the windows to create the illusion of a moving bus. To add character to the bus motion, I made the bus interior roll from side to side. Henry’s body had the same rolling animation except in the opposite direction and offset by three frames. The desired effect was that riding on this bus was anything but a perfectly smooth ride.

Constructing the bus taught me a few lessons, all of which were important to the rest of the thesis process. I had planned out the camera angles for the bus shots such that I would only need to model half of the bus interior. I also constructed the bus around Henry, ensuring that the set would be the correct scale. This established the construction standards for the rest of the thesis: build only what was needed for the camera angle and build with a character in the scene for reference.

The seats on the bus were modeled after church pews because the bus sequence was Henry’s private moment with his picture scrapbook. I wanted to associate Henry’s experience to a religious one by evoking the sense of wonder similar to the one I had during my childhood attending Sunday church services. To reinforce the feeling of nostalgia, I modeled the rest of the bus interior after an old-fashioned one where the floors were made of wood paneling and wooden sashed windows. Very simple geometry was used, consisting mostly of planes and boxes. When combined with lighting and textures, the bus model was convincing.

Lighting and texturing the bus scenes was a religious experience for me, somewhat like Henry’s moment on the bus. My technical understanding of how to use lights and texture
was pretty basic from working with ElectroGIG. I knew how to use them but not how to use them well or how to use them artistically.

The bus textures demonstrated that I probably made a wise decision in making a mostly black and white animation. All I had to decide was “Is this surface lighter or darker than the neighboring surface?” Like the set modeling, the color decision-making started from objects next to Henry and ended with objects far away from Henry. I made the seat cushions a dark velvety color to hide possible intersection problems when Henry sat down, and the rest of the seat was made a 60% grey so that it was lighter than the cushion but darker than Henry’s skin. The bus floor had to look different from the bench, so I applied a wood grain texture to it. The remaining bus textures were determined in similar fashion.

The lighting design for the bus interior was based upon the idea I had for the bus station. I had seen many pictures of the Grand Central Station in NYC, depicting a vast interior space with beams of sunlight streaming through high-set windows. This was the sort of atmosphere that I wanted for the station in the beginning of PoV, and I also wanted to carry over that atmosphere onto the bus.

A lot of time was spent making the sunbeams visible without washing out the rest of the picture. During the two weeks I spent between changing lighting parameters and rendering images, I read an article on cinematography and a book on the making of Toy Story. These proved enlightening. I realized that I was trying too hard to reproduce reality when I should have been enhancing it. With that in mind, I was able to make better lighting decisions for the rest of thesis project.

The lighting problem that kept me occupied for almost two weeks was the row of spotlights used in casting the sunbeams into the bus. Despite the fact that directional lights cast perfectly parallel light rays, spotlights were used because they were capable of volumetric lighting effects. A row of narrowly focused spotlights was needed to fake the sunlight, but the lights near the camera kept obscuring the scene. I tried to correct this problem in a logical matter by turning down the fog intensity of the sunbeams, but whenever the scene wasn’t washed out, the sunbeam shining on Henry was barely noticeable. Once it dawned upon me that Henry’s reality didn’t have to reflect the real world in every little detail, I adjusted the spotlights individually so that the ones near the camera weren’t as intense as the ones further away.

Because the camera wasn’t close to the book, I used a spotlight to generate a yellow glow given off by the color photos on the open page.

I started animating Henry’s left hand, which was holding the book, but I had to move onto another shot because I had spent too many days fiddling with the lighting. Amazingly enough, the single keyframe on the wrist joint was all that was needed for the establishing shot. The IK setup of Henry’s body forced his hand to swing about his wrist as a fulcrum, so it looked like he was experiencing a bouncy ride.
Shot 8 – Close-up of Henry as he stares at his book
This shot demonstrated one of the advantages of working with 3-D computer animation: reusability. Since the setting was the same as shot 6, I just took shot 6’s wire file and saved it under the name of “shot8.” Then I changed the camera angle to match the storyboard and reviewed the animation playback. I thought the close-up looked boring because there wasn’t a view of the telephone poles passing by the windows and Henry wasn’t doing much. To add some interesting motion, I made it look like the bus hit a bump in the road by placing a spike in the bus interior’s animation curves. Secondary action of Henry bouncing up and down during and after the road bump was added, and then I rendered a flipbook. The flipbook showed that I didn’t have to change the lighting, but I still had to change the bus interior’s animation. Since this was a close-up shot, the bus motion appeared magnified (and therefore too jerky), so I toned down the animation until it resembled the one in shot 6.

Shot 9 – Henry yawns & Shot 10 – Henry falls asleep
These two shots got combined into one because I couldn’t find a reason for justifying a cut between Henry’s yawn and his preparation for sleep. The camera angles as shown in the storyboard were too similar to each other that I realized that it would look like a jump cut if I had animated the shots that way. Another solution would have been changing the camera angles of one of the shots, but I couldn’t think of a satisfactory camera angle change for either shot at the time, so I stuck with my decision to roll both shots into a single one.

There were a couple of intersection problems that weren’t obvious under the dim lighting conditions. Henry’s right arm went through the bench during his stretch, and his hat did the same thing when he tipped his head back. I caught them when I was doing the re-lighting in post-production and corrected them before making the final render for the shot.

Shot 16 – Henry starts from his nightmare and cries
The action of waking up with a start was fairly easy, but the rest of the animation for the shot was non-trivial. Since I planned for Henry to bury his face in his hands as he started crying, I added the extra action of him examining his hands to see if they’ve been skeletonized like in his nightmare. The crying part was rather difficult because I knew that I wanted Henry to break into quiet sobs, but I couldn’t get him to act that way. In retrospect, I think if I had been bolder and animated his shoulders, Henry would look more like he was sobbing. It’s probably fortunate that the shot ends in a fade-out to black to indicate a time and place transition to the next shot, because the fade-out hid the mistakes I made with Henry crying.

Shot 12 – Henry looks up at the sky
I changed the camera angle from the one depicted in the storyboard because it would have looked like a jump cut. I went for a high camera angle so that the sand filled the screen and made it obvious that the angle was changed. A lower camera angle would make the black sky fill the background and leave the audience with no frame of reference for where Henry was looking at the end of the shot.
I started this shot from scratch. First I took Henry’s model and positioned the camera to look down on him. Then, I placed a flat plane under his feet and stretched it out to fill the view. Using shot 11 as a reference, I made sure the lighting was consistent. Finally, I animated Henry looking around before noticing something high off-screen.

**Shot 14 – Henry runs forth to catch the sand**
I recycled the setup from shot 12 for this scene. I used the same camera angle, lighting and props.

Henry was supposed to look like he did a double-take and then rushed forward to catch the sand. It ended up looking like Henry’s arms went out of control and then he started running forward. It was not clear what Henry was feeling, and therefore, was unclear why he was acting that way. Even though I was dissatisfied with the animation, I started working on another shot in an effort to maintain the production momentum.

**Shot 13 – Establishing shot of the hourglass in the sky**
The hourglass that Henry saw in this shot has a significant importance to the film. From its obvious association with time, the hourglass was the embodiment of his obsession with capturing moments with his camera. Its immense size was supposed to reflect how consuming that obsession was. The hourglass’s broken state represented Henry’s fear that he was failing at his task. Henry reacted in shock at the sight, stiffened and staggered backward.

The low camera angle helped to make the hourglass look huge and menacing. Henry’s starting position in this shot established the distance between him and the hourglass. He stepped back so that more of the hourglass could be revealed to the audience.

**Shot 18 – Henry walks up to the railing**
I planned the camera angle for this shot to match that of shot 11 where Henry climbs up a dune so that I could take advantage of recycling Henry’s animation. While this looked like a great idea on paper, it failed to take into account the nuances of the motivation behind the motion. In shot 11, Henry was climbing a dune, so he was laboring every step of the way. In shot 18, he was perhaps rushing to the railing to get a better view, so he should be almost running. The difference in timing between the two walk cycles was more than I’d thought, so the motion looked wrong when I showed the shot to Marla. She commented that Henry was still laboring his steps because he brought his arms up higher than in a normal walk and because he paused between each step. I made the appropriate corrections, but it still looked odd. I decided to move on to the next shot and fix the walk for shot 18 later if I had the time.

**Shot 21 – Henry leans over the railing**
This shot probably had the most cliched camera angle of the film, but the angle served its purpose well. It presented the audience with the dramatic irony of the danger in which Henry was putting himself. Here he stepped closer to the edge of the cliff and stands up on his toes to get a better view through his camera, something most people would not do.
The biggest problem with the shot that I was not able to fix was the feet sinking through the ground. Even though I had the bones for the feet constrained to the ground, it did not prevent the feet from trying to follow the ankle joint at the same time. The combination of actions that the feet bones performed made the toes curl up and the sandals tip into the ground. I tried to set corrective keyframes during the frames when the sandals tilt too far, but this measure didn’t work. An alternative was turning off Henry’s toes and locking the feet in a single position. I thought this alternative would look very strange when Henry tried to stand on his toes, so I left the problem unfixed in the shot and hoped the scene’s brief screen time would cover up the visual error before the average viewer noticed it.

**Shot 4 – A photo comes out of the camera**

The animation for this shot was a rather simple matter for posing Henry with a camera in his hand and making the photo slide out of the bottom. I know from my research that this is not the way brownie cameras work, but Rod Serling had the photos pop out of the camera like bread from a toaster in the *Twilight Zone* episode, so I went ahead with action anyway. In preparation for this shot, I studied not only Polaroid cameras but also ATMs, photocopy machines, and toasters. I was interested in making the photo move like a piece of paper, and I think I succeeded by making the photo spit out at an angle before straightening and by adding a flutter to the bottom edge as it comes to a sudden stop. The secondary actions all happen very quickly, but the end results look convincing, and that is all that matters in filmmaking.

At the time I animated this scene, I had not settled upon a set design for the station where Henry takes this photo, so I left the background blank with the intention of filling it in at a later time when I’ve figured out the set design.

**Shot 39 – Henry looks up**

In the storyboard, Henry simply looks up into the sky for the bird casting a shadow that he noticed. When I started working on this shot, I thought the action was devoid of emotion, so I expanded the action into having Henry jump back in surprise and then looking up. It’s a repetitive movement because it’s similar to Henry’s reaction in shot 13 when he saw the hourglass in the dream sequence. It’s also consistent characterization, because the audience understands what Henry is feeling.

The camera angle for this shot is a low one because I didn’t feel like animating Henry’s legs. To maintain continuity with the previous shots, the camera was positioned to include the top of the columns behind Henry.

**Shot 20 – Henry brings up the camera**

Even though I drew a conventional camera in the storyboard, I decided to make Henry’s camera based upon the Kodak Brownie camera. Henry had an attachment to his camera, and what better way to show that by making the camera an old-fashioned one? The camera in the *Twilight Zone* episode was also a brownie camera that also took Polaroid-style photos. The worn edges on Henry’s camera reflect its age and usage, but they were
also the result of my inexperience with Alias’s shaders. I used a default leather texture as the displacement map on the camera body, but the consequence of using displacement maps on boxes is that the faces of the box will be offset from their wireframe positions when rendered, looking as if box was frozen as it started exploding outwards. An obvious solution to this problem is to use a bump map, but a bump map is a faked texture map that can be detected when the surface it’s applied to is seen from an angle. I preferred using a displacement map because it actually deforms the surface at render time and looks general better in close-ups, and I knew I had a close-up of the camera in shot 4.

**Shot 24 – Henry looks down where his camera fell**

This was another shot that I expanded from the storyboard because I felt that Henry could display more emotion. The drawing had Henry simply standing at the railing looking down at the bottom of the cliff. It didn’t seem like the kind of response I’d expect from a person who lost his precious camera, so I expanded Henry’s actions to reaching out his hand for the camera and then drooping as the realization of his loss sinks in. Henry could start climbing over the railing after his camera, but it would defy common sense or self-preservation if he were to do such a thing.

For this shot, I also experimented with the cinematography. The camera position was to be a reverse angle compared to the previous shot. The audience is now on the fallen camera’s side looking back to Henry for his reaction. Normally, such a low camera angle would make Henry look intimidating because he’s towering over the viewer, but this is not the desired effect. I tried to make Henry smaller (and therefore less menacing) by pulling the camera away from him so that he filled up only a quarter of the screen composition.

During my animation work on this shot, I began to realize the limitations of using inverse kinematics. When Henry’s hand moved from near his head to an outreach position, the elbow did a flip snap that was highly uncharacteristic of human movement. There are a few motions that cartoony arms can do and still remain credible, but this flip snap wasn’t one of them. After several hours of trying to correct the problem with setting keyframes on the rotation of the IK handle, I gave up in frustration and went back to the forward kinematics method of animating by setting keyframes on the joint rotations. I was able to complete the animation on the right arm without stressing out over misbehaving limbs.

I would later find out that the IK behaved the way it did because I probably didn’t set the pole of the IK handle properly. The *Alias Animation Manual* advises, “In some cases, the combination of translation and plane rotation might cause the IK solution to flip uncontrollably.” So let that be a lesson: “When in doubt, read the manual,” or “RTFM,” as a common computer jargon goes. Another tip that I received after the fact was, “Align the pole of the IK handle so that it’s pointing backward.” When the IK handle is changed from the default translation control type to plane rotation or plane/pole rotation control type, Alias will display a disc around the root of the IK handle with a pointer indicating the plane’s direction. It’s this plane in which Alias will try its best to bend the joints affected by the IK handle.
When I finished animating, the beginning of the shot no longer made sense in context of the plot. The camera angle made it look like Henry was throwing something with his right arm instead of thrusting his right hand out for the falling camera. Another problem was the screen composition. Most of the screen was dead space, and Henry looked so small in the quarter resolution renders that it was not easy to see what he was doing. For the sake of clarity, I moved the beginning of the shot to the moment just after his right arm is completely outreached, and I also moved the camera close enough to Henry so that his fingers can be seen as they drop limp from realization.

**Shot 25 – Henry looks up at the falls in despair**
This shot presented me with the question, “How does one show despair?” I decided that it was all in the timing and body language. When Henry looks up as if to appeal to some supreme being, he leads with his shoulders instead of with his head. His arms take as long to flex in anticipation as they take to push his shoulders up from a slouch.

The shot picked up from the end of shot 24, except that the camera angle was changed. I was reluctant to use an angle that was a full shot of Henry and showed the incomplete state of the background. All of Henry’s body would be visible in a full shot, which meant I also had to animate his legs because he wasn’t paralyzed from the waist down. Even though I did plan on filling in the background at a later point in the production, I couldn’t overcome the incompleteness of the landscape. Ignoring the background issue for the moment as best as I could, I relented to using the full shot and animated Henry’s right foot dropping down to the ground.

**Shot 27 – Henry does a double take**
I was puzzled about why I used this blurb for this shot because I didn’t think that Henry would react with a double take after seeing the water changed to sand. The more I thought about it, the more I felt that Henry would rub his eyes first to make sure of his sight. Then to maintain continuity with the next shot, he would start lunging forward to catch the sand. The lunge would be a careful one because he’s now aware of the railing and the cliff’s edge.

The camera angle and the lighting are the same as shot 27, so only the animation is different.

**Shot 17 – Henry gets off the bus**
I initially planned on animating Henry disembarking from the bus, but following Marla’s suggestion regarding shot 1, I didn’t have to show that action. Since I knew the shot would begin with a fade-in from black (just like shot 1) to indicate a change in time and locale, I decided to dispense with part about Henry getting off the bus and have him already standing outside of the bus. That may have cut down on the amount of animating I had to do, but it also presented a new challenge in keeping the action of standing around from being boring. To give Henry something to do, I had him look around until something off-screen catches his attention from screen right. Since he just left the dim interior of a bus, I had him shield his eyes with his scrapbook. Henry held his scrapbook
by the end instead of by the middle because his arm weren’t long enough to hold the book by the middle of the spine and provide shade for his eyes at the same time.

I knew what I wanted for the bus’s design, but for several reasons, I didn’t model it at this point. I had a European bus in mind, and originally I was going to turn the bus interior inside out to create the exterior, but after spending half a day trying to do this, I gave up in frustration. I decided that I would table the task until after I’ve found some photographs of European buses to give me direction and confidence. In the meantime, I took a cube, stuck the words, “BUS STAND-IN,” on the side and animated it as if it were the bus departing. The stand-in looked silly, but it did the job of conveying a departing bus.

At this point in the production, I decided to take a break from animating and work on modeling the characters that appear in the remaining scenes to be animated. I was reluctant to settle on character designs because I was unsure of how unique to make Henry. If I modeled the other characters realistically, it would make Henry an outcast because he would look like a freak by comparison. If I went the Muppets route and modeled the other characters similar to Henry, he would fit in better. I wanted to use the latter approach, but I was unsure of what different shapes to use to differentiate people. I still had not made a decision when I chose to start modeling the remaining characters.

The resolution to start modeling forced my hand, and I quickly decided that I would use Henry as the base model for the other characters because that’s the way I drew the father of the kid in the storyboard. This meant that I would have to use their costumes to tell them all apart, but it also meant that I didn’t agonize over modeling different bodies.

I started with the father of the kid because I had a better idea of how to dress him than the other characters. I took Henry’s model and lengthened the shorts into pants. The Hawaiian shirt was altered into a striped T-shirt to make the most of recycling the pieces without making too many alterations. I deleted Henry’s hat and started modeling a mushroom shaped hat based on my storyboard drawings. The character looked so French, so I named him Pierre and modified the mushroom into a beret. I took this opportunity to fix the flaws in the fingers. I would later discover that the fingers were still flawed but less noticeably so. I deleted the feet and made shoes. For a finishing touch, I gave Pierre a mustache.

I named the kid Jean, to be consistent with his father Pierre. Some research was done on child proportions, but in the end, I threw out my notes and winged it. I took Pierre’s model and scaled it down to about half-size. The proportion of children’s heads to their bodies is larger than it is for adults, so I scaled up Jean’s head. I deleted the beret and gave Jean a propeller cap. I added a visor to the cap because Jean no longer had eyes like the ones drawn in the storyboard. I narrowed Jean’s shirt stripes because I didn’t want him wearing the exact same shirt, but I also wanted the clothing to look similar because Jean and Pierre are related. I shrank the pants back into shorts and changed the colors of the pants and shoes. I thought Jean’s legs looked bare, so socks were added (or rather, the parts of the socks that stick out of the shoes were added). Unfortunately, the socks
didn't follow the legs when Jean bent his knees, so there was a lot of potential for intersection problems. The structure of the socks didn’t match the legs’ structure, so Alias assigned the legs and the socks differently to the skeleton. After spending a day with unsuccessful attempts to fix the socks, I tried to avoid this problem by not having Jean bend his knees if possible.

When it came to the couple in the first photograph, I had always imagined the male partner wearing a fedora, which I’ve associated to the 1940’s and 1950’s. I didn’t have an exact hat design in mind for the female partner, I knew that it was a hat with a floppy brim. The research on various hats from the era was so interesting that I started working on the female partner first. I took Pierre’s model, deleted the mustache and replaced the beret with a revolved shape. After pushing and pulling the control vertices, I arrived at the look that I wanted. A flower brooch was added to the hat for decoration. Then I changed Millie’s (as I decided to call her) body proportions. I made her slightly shorter, her shoulders narrower, her hips wider, and her chest more feminine. I exchanged Millie’s pants for a skirt and tapered the toes of her shoes. Since I figure that Millie would dress up to go to the train station, I made her clothes white. To make the materials of her clothes different, I altered most of the shaders. The shoes were given a Blinn shader to make them look like leather shoes. I used a ramp as a displacement map on the skirt to make it look pleated. I used a fractal texture map to give Millie’s hat a velvety feel. The frills on her sleeves were made with creative use of ramps as the transparency and displacement maps.

Finally, I started working on Millie’s companion, whom I named Sam. First, I took Pierre’s model, and as with the other characters, I began with the hat. The fedora also started out as a simple revolved shape that was modified by pushing and pulling control vertices. A hat band was added as a finishing touch. Pierre’s T-shirt was changed into a dress shirt for Sam, complete with a tie. The short sleeves were altered into long sleeves of a jacket. The shirt was duplicated and scaled up slightly to make the jacket body. I moved around the control vertices of the jacket body to make a V-shaped opening around the tie. The jacket lapels were made from a separate piece of geometry. I deleted the arms from the shoulder to halfway up the forearms, because I didn’t want to duplicate the Jean’s socks problem. After a test render, I added ends of the dress shirt sleeves poking out the ends of the jacket sleeves so that Sam looked more formal. After experimenting with herringbone and pinstripe patterns, I ended up giving a plain dark grey color to Sam’s suit jacket and pants. As a decorative touch, I gave his lapels and hat band a silky sheen. I made the dress shirt the traditional white and the tie a dark grey that was lighter than the suit grey. The hat was given a grey value that was lighter than the tie but darker than the skin. The shoes were made a traditional shiny black. Pierre’s mustache looked quite sharp on Sam, so I kept it.

**Shot 30 – Henry checks himself**
After seeing the red splotch on the ground, Henry was frightened that he might be bleeding, so he snapped upright, checking himself visually. Seeing nothing obvious, he wiped his right hand along his shirt just to make sure. Seeing nothing on his hand, he looked around on the ground for other red splotches.
Henry’s frightened nature was characterized here by quick, darting movement. His head would look at one point, pause for about 5 frames, snap to look at another point, and hold for another five frames. The hands moved just as quickly, except for the wiping action, which had to look as if the hand was in contact with the shirt. The impression of the hand rubbing along the shirt started with the hand leading the action and ended with the wrist leading the action. It’s a subtle touch that could be appreciated if it weren’t for an intersection problem where the right thumb disappears into the shirt for a couple of frames. I tried to fix the problem but I ran out of time.

**Shot 19 – A view of the waterfalls**

I’ve always been fascinated by the fantasy artwork of waterfalls that have no apparent sources. The waterfalls in my dream were more natural since there was a river source, but the water was running through a picturesque Roman structure. I tried to combine both the imagery of Roman ruins and the imagery of floating islands with waterfalls for this thesis. Even though natural waterfalls like Niagara Falls are spectacular enough, I thought it would be okay if I exaggerated the spectacle of the waterfalls in my thesis. It would explain Henry’s awe and his blindness to the danger of leaning forward until it was too late.

Unfortunately, I may have destroyed the credibility of Henry’s world with the introduction of such surreal elements. All of the shots up to this one are strongly rooted in a reality similar to ours -- with the exception of the dream sequence, which is understandably surreal. There is no indication aside from the characters that it is any different. No indication, that is, until the falls are seen. The surrealism may be shocking enough to jolt the viewer’s suspension of disbelief, but considering the photographs that come to life, I didn’t think the floating islands were too fantastic. Even if they were, then the audience would be sharing the same experience that Henry was having in this shot.

The props used in this were mostly recycled from shot 18. First, the camera angle was set to match the storyboard. A floating island was made from a cone primitive that was modified by pushing and pulling control vertices. I threw a displacement map on the island to make it look like a suspended clump of dirt. Then I duplicated the clump several times, scaled some of them to different sizes, rotated some of them around the vertical axis, and finally distributed them in the space in front of the cliff. I tried to place the islands so as to make the screen composition interesting with the use of irregular spacing and overlap. I cloned the columns and placed them on top of the large islands. In retrospect, I regret that I placed the pillars in regular geometric formations. I should have knocked a few columns over on their sides and broke some of them into pieces, but I ran out of time. The initial test renders looked like the viewer was looking out into a void with several floating islands nearby, so I added a sky texture and created some cliffs in the distance by copying and stretching the cliff that Henry was standing on. The faraway cliffs served to cut off the view into infinity and create a horizon line to anchor the scene.
I worked with the lighting to bring the islands forward and separate them from the distant background. The sunlight is a directional light recycled from shot 18, and in this shot, it worked as an edge light. However, the edge lighting it provided was more like slivers, so I rotated the sunlight slightly to get a broader band of light along the upper left edges of objects in the scene. I added another directional light to serve as a fill light that did most of the work of defining shapes in this shot. Positioned about 180 degrees around the vertical axis to the sunlight, the fill light was made dimmer than the sunlight but light enough to bring out the surface details of the floating islands. The combination of both lights created the right amount of visual drama, especially on the columns.

As mentioned before, I wanted to use Alias because I thought I could benefit from using particle systems for the waterfalls. Unfortunately, I couldn’t achieve the look that I was looking for with particles. The results looked like disappointing variations on curtains of silly string, hardly like the majestic streams of falling water in the fall example file.

Luckily I had a backup plan to use animated textures. First, I constructed an arched surface as the “skeleton” for the waterfalls. Then I created a shiny white shader with a ramp texture applied to the transparency channel to make transparent vertical streaks. To add ripples to the surface, I used the same ramp texture as the displacement map. Admittedly, this was not an exciting texture for a waterfall, so an animated element must be added. In the color multiply channels of both ramps, I mapped a noise texture. This had the effect of creating visible imperfections, but when the vertical offset of the noise texture was animated, it looked as if the surface was flowing downward.

The animated textures looked closer to what I had in mind, so I copied the waterfall surface and positioned the copies where the particle systems were. I kept the particle systems, but I changed their parameters so that they emitted mist instead of water. The mist looked a bit static, so I used torus-shaped volume wind force to churn the mist.

Despite all the animation in the background with the waterfalls and mists, I could not deem the shot finished until Henry was animated. He didn’t have to move much, but he shouldn’t stand still or else there would be little direction for the viewer. I had Henry move his head to look at four points on the screen to guide the audience’s attention. Other little touches were slight movement to the rest of Henry’s body and the addition of Henry’s camera and scrapbook to his hands for continuity.

**Shot 31 – Henry notices a kid standing nearby**

This shot had a straightforward setup. I started by taking the wire file for shot 30, fast-forwarding to the end of the animation, deleting the animation curves, and changing the camera angle to match the storyboard. I imported Jean into the scene, positioned him, and readjusted the camera angle so that he fit on-screen.

Animating Henry was also a simple matter. He started out looking down, straightening up, and then turning to notice Jean. The kid’s animation was supposed to be simple. He was to stand and stare at Henry, shifting his stance every now and then. The problem was the one I noticed back when I finished modeling Jean: the bottoms of the legs were...
popping through the socks. I couldn’t avoid this problem without making Jean look stiff. Since he was standing at a distance, I thought it would be okay because it was barely noticeable unless you were looking for it.

The important part of this shot was animating a ketchup drop falling from the hotdog in Jean’s hand and the splotch on the ground that it creates. The drop was a basic sphere that became visible right before it dropped and became invisible after it contacted the ground. As the drop disappeared, the splotch was made visible and scaled larger over time so that it appeared as if it was flattening out on the ground.

The ketchup shader was also animated. The color was changed from a dark grey to red as the drop fell from the hot dog. To continue the motif from shot 29, the ketchup resumed its dark grey state after becoming a splotch on the ground. At this point, Henry has not gotten over the loss of his camera, so he is still holding onto his prejudice of a black & white environment. The glimpse of red was a display of how color was slowly creeping into his world.

**Shot 32 – Henry is poked with a camera**

I made Pierre’s camera a conventional one because I wanted to differentiate it from Henry’s camera. Skip Battaglia mentioned at my thesis proposal that he couldn’t figure out if there was one camera or two just from reading the treatment. I realized that his confusion had some merit. It was possible that Pierre could have recovered Henry’s camera and was giving it back to him. To clarify that this is Pierre’s camera, I had to make it look different. The conventional camera may have been an inappropriate choice, considering that this project was produced at a school for photography, because it didn’t behave like a conventional camera in the shot 35. Rather, the camera was never shown doing anything unconventional, but the photo produced by the camera behaved like a Polaroid photo. Again, I knew that this is not the way conventional cameras work, but I used the model as an iconic representation that said, “This is a camera.” At the screenings, nobody raised any objections about the camera type, so it was acceptable within dramatic context.

Even though Pierre’s right arm is only part of him that’s shown, it introduces us to Pierre and hints at his personality. I envisioned Pierre as a brash person who is not afraid of getting what he wants. In this shot, he pokes Henry with a couple of insistent jabs instead of a couple of timid taps. It’s all in the timing and pose extremes. Both a jab and a tap take about the same amount of time to perform, but the anticipatory hold before the action is longer for a jab than it is for a tap because bigger actions need more windup. Obviously, a jab needs to travel a farther distance than a tap, so the extreme poses for a jab have a larger gap between them.

Henry jumps in surprise as the result of being jabbed. He’s deep in thought, trying to figure out the meaning of the red ketchup drip when Pierre interrupts. Because Pierre is so forceful in his approach, Henry reacts with a spastic jump. To make his reaction more clear, his response is exaggerated.
Shot 33 – The kid’s father asks Henry to take their photo
The original plans for this animation had Pierre communicate his request to Henry by holding out his camera. Pierre would then look off-screen, gesture for Jean to come over, pause, wind up, and lunge in that direction. After dragging a shy Jean on-screen, Pierre would point at himself and Jean and repeat his request.

After three days of working on this shot, I was only able to animate up to the point where Pierre lunges toward Jean. I had to shelf the shot to work on the next shot, but I planned to do more work on it when I found the time. However, that didn’t happen for a while. When I showed this shot to Marla, she didn’t understand the motive for Pierre’s lunge, so I felt that a lot more work had to be done.

It really wasn’t until nine weeks later when I was wrapping up production on shot 41 that I returned to work on this shot. A week was spent on re-working things into their current state, but the results were more satisfying. I think the nine-week break allowed me to approach the shot with a refreshed frame of mind.

The current version is the same as the original up to the point where Pierre waits after gesturing for Jean to join him. Instead of Pierre’s awkward lunge, Jean runs behind his father and peeks out to the side. The father shoves his son out front, points to Jean and himself, and repeats his request.

Jean’s run looks stiff and floaty however, because I used FK to animate his legs. I didn’t bend his knees because I was trying to avoid the sock intersection problem. I was also more concerned with keeping Jean’s feet from going through the ground than with showing Jean’s weight affecting his motion. I tried to minimize the problem by making the run brief.

Despite its flaw, I like the resulting shot because it feels natural. Jean and Pierre act in character without looking like some off-screen force compelled them. My favorite part is Pierre’s use of gestures to communicate between the other characters.

Shot 34 – Henry takes the picture
Ideally, this shot could have been about 5 seconds long, but it got stretched to 13 seconds instead. Why? I wanted to explore Henry’s state of mind and his response to his situation. He had just lost his camera, and now somebody wants him to take their picture with a camera. What does he think? What does he do?

Henry steps back with Pierre’s camera and studies it. It’s a reminder of his loss, and yet it could be the instrument of his redemption. With a sigh he lifts the camera, wipes his eyes, rubs his sniffling nose, aims the camera, and snaps the picture.

The challenge in animating this shot was getting Henry to hold the camera in both hands. It was easy enough to attach the camera to his left hand so that it would move with the hand. Because of the way Alias organizes objects internally, I couldn’t attach the camera to the right hand at the same time. I toyed with the idea of attaching a copy of the camera
there and trying to animate by lining up both cameras in wireframe mode. Then when it came to render time, I'd just turn the second camera invisible. I dismissed that thought as a silly idea, because it looked like a lot of work for what should be a simple action. I could easily copy the left arm keyframes to the right keyframes (while accounting for left-right differences, of course) and not worry about having two cameras matched every frame. Not having both hands attached to the camera gave me the freedom of having the hands do different actions, which is more natural looking than having both do the same thing.

**Shot 35 – The photo comes to life and then fades to black and white**

The whole point of this scene was to show how Henry’s world has changed. Henry expects the photo of Pierre and Jean to be his redemption, and it initially appears that way when the image springs to life in color just like the photo in shot 5. But instead it is a reminder of his loss as it turns into a black and white still.

This shot was executed in three steps in order to achieve the effect of a color photograph coming to life and then turning into black and white. First, the hand holding the photo was set up and animated, then the photograph itself was set up, animated and rendered twice. Finally, using the magic of Alias’s texture file shaders, the whole shot was put together.

The framing image of the hand holding the photograph is very minimalistic because the center of attention is the photograph itself, and I wanted to distract as little attention from that focus as possible. I placed a column in the upper left corner of the screen as a reminder of location, but the ground surrounding it is nondescript. I later decided that I wanted to have the hand animated, so I made it lift the photo from off-camera into the middle of the screen. I also added very subtle wavering of the hand for the rest of the shot because it’s inhuman for people to stand stock still for long periods of time.

Probably the fun part of this shot was distinguishing the difference between the personalities of father and son. The photograph shows little Jean trying to slip out of his dad’s grip as Pierre waves to the camera. Even as a still, the action is readable because of the poses.

Jean and Pierre’s animation was done as a 60-frame cycle so that I could loop the animation. The plan was to loop the animation three times over 420 frames of the shot. The first time would be the animation revving up to speed, the second cycle would be the animation at full speed, and the last would be the animation slowing down to a stop. Three cycles seemed to be a good balance for letting the viewer realize that the action was repeating without boring the viewer.

The choice of the cliffside as the background of the photo may be questionable because the view of the waterfalls would have been more spectacular. The decision was made because of staging continuity, time resource and rendering concerns. In shots 30 through 34, I had already set up where the characters are standing in relation to each other, especially in shot 34 where Henry is standing with his back to a railing (with the falls to
added in later). It was possible to re-do the backgrounds for all the previous shots just to have the waterfalls in this one, but another consideration is the amount of time that could be allocated for such a task. I felt that it would take too much time to plan and execute unnoticeable background changes, so I left the backgrounds as they were. Another argument against using the falls in the photo was that the particle systems for the mist would have been difficult to coordinate for looping. It’s possible to cycle particle system animation, but it’s also very time consuming to adjust the cycle to fit the rest of the animation.

The photograph animation was rendered twice: first in color and then in black and white. I had done some research and found that I couldn’t desaturate colors from an image within Alias because Alias worked in RGB colorspace even though it had HSV sliders for choosing colors. I initially used Adobe After Effects to dissolve between the color and black and white versions but found that I could duplicate the effect in Alias. The color version was mapped to the color offset channel of the black and white version, and the color multiply channel of both versions was animated between black (no image) and white (image).

**Shot 23 – The camera falls into the water below the falls**

To set up this shot, I took the wire file from shot 18, deleted Henry, and added a flat plane with a water shader applied to it. Then I changed the camera angle to match the storyboard. After looking at a test render of this angle, I was faced with a conflict because of the need for a degree of continuity. I felt that I needed to establish a frame of reference, since all I saw in the rendered test was a cliffside, some water, and not much else. This was probably not necessary because of the shots before and after this one, but I also wanted to keep the scale of the shots consistent. As I mentioned before, this story is a personal one, not an epic, so the camera angles should reflect that. To make the camera angle more plausible, I adjusted it so that a handheld camera could have filmed it. This meant bringing the railing into view, so that the viewer understands that the view is from the top of the cliff. It’s a simple touch, but it made me satisfied that the scene would hold up under closer inspection. I stretched the height of the cliff to exaggerate the distance to the water below. Then finally, I imported the model of Henry’s camera back into the wire file.

I thought about the continuity of outdoor shots and realized that if Henry had the scrapbook with him, then wouldn’t it be more tragic if he lost both the camera and the book? It made sense to me that he would lose the book if he got all caught up in trying to save his camera. So I imported the scrapbook into the shot and animated it falling down beside the camera. Both objects fall in a shallow arc because they were dropped, not thrown, over the edge. Because of their trajectories, they both went right through the bottom fringe of the cliff, so I added a bounce to both paths. I had to tweak the collision locations because I was using a displacement map on the cliff, so the cliff surface I was seeing in the wireframe mode didn’t quite match up with the rendered image.

There is a certain temptation to let Alias run a dynamics simulation on the scrapbook and camera models and use that for the animation, but for all the control parameters you can
set for the simulation, none of them will give you a fall that looks good by itself. The simulation won’t spin objects as they fall, so I had to set animation keyframes in the rotation channels for both the scrapbook and camera. The simulation could do object collisions, but again, it wouldn’t account for spinning objects. I made the book and the camera reverse their rotations after they look like they touched the wall to make the bounces more convincing.

Once the main animation was done, I added a few finishing touches. This is only shot in the film that uses the forced perspective trick. Henry’s camera and the scrapbook were scaled down slightly as they fell further away. I animated the water texture by changing the wave time and ripple time parameters over the course of the shot. At first, the waves moved too fast and looked like they were two different wave textures alternating every other frame. When I figured out that I should making fractional changes to the wave time and ripple time parameters, my waves started moving more gracefully. A particle system was set up at the base of the cliff to generate a mist. The final finishing touches added were the three photographs slipping out of the scrapbook. To make the photos have a different weight than the camera and the scrapbook, I made the photographs fall at a different rate and spin on different axes. I also made them flutter around in an erratic fashion as if they were being blown around by an updraft.

There wasn’t an easy way to reproduce the raytraced shadows of the directional light I was using for the sunlight in this shot with shadow casting spotlights in raycast rendering. This was one of the shots that had to be raytraced because it was important for the scrapbook and Henry’s camera to cast shadows on the cliffside as they fell. The shadows helped anchor the falling objects’ presence in the scene, and they also helped indicate where the objects impact the side of the cliff. The shape and texture of the cliff also benefited from raytraced shadows, which gave a richer definition to the nooks and crannies on the surface.

**Shot 2 – Henry sees something at the station**

I had a lot of difficulty in settling on a design for the station because I wanted to capture the sense of scale that train stations like Grand Central had. I looked at photos of train stations, atriums and cathedrals in search for ways to make the station look monumental. The results I got out of my research were which proportions to use, some cinematography tips and the use of reference objects.

Because I had already built columns for the outdoors shots, I decided to reuse them in the station architecture to give the film a subconscious visual continuity. First, I scaled up a column about 9 times its constructed size. The column didn’t look bigger – it looked more like I moved the camera closer to the column. While keeping the height the same, I made the column wider, and then I began to feel the impression that the column was more massive. Then I made copies of the column and lined them up in a row.

Pixar Technical Director Mike Krummhoefener paid a visit to RIT and offered this observation: Nothing is pure black, even in the darkest shadows. I agree with this view, but I caution against the opposite extreme of making everything bright. When you’re
trying to light the interior of a massive room, it should never be completely well lit. To take an extreme real-life example, an underground cave, you’ll find that it’s impossible to light every single corner, and even if you could, it would flatten out the space and make it less interesting because you’ve removed the tension between light and shadow. I didn’t want the station to be an open air one, so I placed a marble wall behind the row of columns. This helped to create shadows that defined the shape of the columns and bring out the details of the decoration at the top of the columns.

When setting up the composition of a shot in a big room, one thing you can do to emphasize the height of walls and ceiling is to use a camera angle that’s relatively low, but not as low as a worm’s eye view. The trick here is to make the location dwarf the viewer but not the setting. This technique has to be used in conjunction with reference objects in order to work effectively.

To help the viewer understand the sense of scale, you have to include familiar objects for references. Whether we are conscious of it or not, we measure the size of things by comparing them to other things, the most immediate one being the body. I placed Sam in the background for that purpose. Marla suggested that Sam should be animated because it looked like a still photo backdrop with Sam standing still, so I gave Sam a simple cyclic animation of looking around and shifting his feet.

Additional touches I made to the set design were extending the height of the wall and adding an interior corner. I could see the top of the wall and the sky beyond it (though not much of it) in my test renders, and the sky fragments made it unclear if we were indoors or outdoors. So I extended the height of the wall by adding blocks on top of the columns, leaving gaps between the columns in the upper walls where the sunlight can enter. I wanted to create more interior space, and I succeeded by changing the straight hallway of columns into a hallway intersection with an addition of an interior corner. I could have used the forced perspective trick where the objects in the distance are actually smaller than the objects in the foreground, but I didn’t feel the need to resort to such effect.

To save myself some time, I recycled the animation of Henry aiming his camera from shot 20. I used the same poses, but I nudged the keyframes around to prevent the actions from looking exactly the same. The results were better than when I recycled Henry’s walk cycle animation from shot 11 in shot 18.

**Shot 3 – The couple as seen through the camera’s viewfinder**

As the storyboard shows, I formerly planned on showing the view through the camera’s viewfinder, but since I decided to use a brownie camera, I had to make some changes. The reasons why I was interested in the view through the lens were the possibilities of using depth of field and camera graphics overlays (those circles that let you know if the lens is correctly focused). I figured that I could do without depth of field and the overlays, which could have been gimmicky because they’d only be seen in this one shot during the thesis. I simply cut to the chase and showed what Henry was seeing in shots 1 and 2.
The original shot was a medium shot of the couple because we would have been looking through the viewfinder, which can abolish the distance between the photographer and the camera’s subject. Since I changed the point of view of the shot from the camera to Henry’s eyesight, I felt that I couldn’t violate this separation because it would be an intrusion upon the intimacy between the couple. This is why I made this scene an extreme wide shot, to give Sam and Millie a buffer of privacy that is present at stations and terminals.

The wider shot presented a new problem in expanding on the background scenery. Since Sam and Millie no longer took up most of the screen space, I had to revise the composition. I placed the couple in the middle of the screen to literally be the center of attention. Then I remembered about the low camera angle from the previous shot, so I moved the couple down about two-thirds from the top of the screen. I imported the corner from shot 2, mirrored the corner, and positioned them as walls of a wide hallway, such that the lines of convergence (for the bottom of the walls, at least) led the viewer’s eye to Sam and Millie.

I started with the bare necessities when I filled in the rest of the background details. I put in a floor with the same aged marble texture as the columns. The displacement map on the aged marble shader didn’t fit in with the desired imagery, so I changed the floor into a smooth marble one that would be reflective if so many people didn’t walk all over it. The wall at the end of the corridor is a simple flat plane with a black and white grid to make it look like a windowed wall. The window grid is a lightsource shader instead of a lambert shader for the purpose of simulating overexposure of the outdoor environment when viewed directly through the window. I also didn’t have to concern myself with setting up lights to make sure the whole windowed wall was visible. Taking advantage of the camera angle, I placed a set of marble steps at the point where the walls ended. The steps hid the bottom of the windowed wall, leaving the presence of doors up to the viewer’s imagination.

As I placed a row of spotlights along the right-hand wall, I wondered if I would able to fulfil my vision of a station reminiscent of the Grand Central. The initial lighting attempt fell short of my expectations, because I needed some fill lights to bring the columns on the right side out of the shadows and some back lights to further define the shapes in the shadows, especially Millie’s face. Another light was added to provide indirect lighting caused by the sunlight reflecting off the marble floor, and this did much to enhance the ambiance of the scene.

This shot used more lights than any other shot in the thesis: 10, but the results were worth it. Additional lights were of some concern because the rendering times become longer as more lights are added. With rendering time in mind, I made sure that the only lighting with shadows turned on was the key lighting provided by the “sunlight” row of spotlights. It was important to me that the characters in the scene cast shadows to anchor their presence in the environment instead of looking like they were composited into the picture.
I re-evaluated the set design, and decided that the station looked more like a museum than a train station because it was nothing more than walls and a floor. To make it look less cold and impersonal, I added the benches from the bus interior in front of each column. The area at the top of the steps also looked barren so I placed a couple of columns up there for decorative purposes. Another Sam was placed back there for scale reference. I placed another Millie by one of the benches and changed her dress and hat color to make her different from the first Millie. The scene now looked like an operating train station. I considered populating more people, but I had spent three days setting up this shot and felt that it was time to start animating the focus of this shot, the couple.

In the treatment, the couple was just kissing, but when I finally got around to animating the shot, the characters’ personalities were so well established in my mind that I couldn’t make them kiss in a generic fashion. I envisioned Sam as being a solemn business type of person and Millie as being a romantic. I used those impressions to guide my animation of this shot. Sam is more concerned about catching his train, so he looks off in the direction of the trains and then checks his watch. Millie is more concerned about giving Sam a proper farewell, so when she thinks of one, she glances around to make sure no one is looking (but she doesn’t notice Henry, of course) and then plants a kiss on Sam’s lips when he looks back at her.

**Shot 5 – The picture develops and comes to life**

This shot was one of the most visually spectacular sequences of the film, and it was also one of the most technically challenging ones. It is my favorite shot because it works on a couple of aesthetic levels and closely matches my original vision of the shot.

At the visual level, this shot shows what is so special about Henry and his camera. The shot also hints at a history through the use of visual details. As the photo develops in Henry’s hand, we understand why Henry is the main character and what his talent seems to be. The other photos in his scrapbook, seen in the background at the end of the shot, suggest that Henry has been doing this sort of photography for a while.

At the plot level, this shot serves a few purposes: it provides a transition from the previous shot to the next; and it provides some sort of closure to the previous scene. As a transition, this scene gave me a creative way of changing the time and place without disrupting the viewer’s immersion. Through the use of a dissolve, the background changes from a train station floor to a bus seat while the foreground stays almost the same. Since it’s not an instantaneous change, the audience should understand that the end of the shot occurs some time after the beginning of the shot.

The shot was broken down into three parts: the photo animation, the hand holding the photo in the train station, and the hand holding the photo on the bus. The actual order of execution was in reverse. I took the wire file from shot 6 where Henry is already sitting on the bus, and I changed the camera angle to the view from Henry’s eyes. Again, I had to cheat a little and made Henry’s head invisible so that it wouldn’t be in the way of the view. The lighting looked fine, so no changes were made. I removed the keyframe from
the left wrist to keep the book from bouncing around too much and distract from the focus of the shot. I toned down the bus interior's wiggle because I remembered the lesson from shot 8 that most animation should be subtle in close-ups or else the actions seem too jerky in perception. The telephone poles were slowed down because their shadows moved too fast, like a flash or a flicker. Once this part of the shot was set, I duplicated the wire file and deleted the bus set and the scrapbook. I also changed Henry's pose to a standing position so I knew where to place a marble floor. After adding the floor, I thought the first part of the shot looked nondescript, so I added a marble column and a bench for background detail. For the dissolve to work, the lighting had to be the same or at least similar, because if the shadow changes position during the dissolve, it would jar the audience out of the immersion in the story. Since the lights came from the same base wire file, I left the key light alone and deleted the ones that had no effect on the shot. Reviewing the test renders, I decided to move the column and the bench around to make the screen composition more interesting. I rotated the bench so that its horizontal edges didn't run parallel with the top and bottom edge of the screen, and I moved the column off-screen so it cast a shadow across the floor and the bench. I duplicated the animation from shot 35 where Henry's hand brings the photo on-screen, and I also added slight waivering to the hand in both parts of this shot.

I did plan from the beginning to use couple kissing as the looping animation in the main photo, but the original version was Sam and Millie embraced in a 1950's style dipped kiss. The original intention was to have Henry's photographs be more vibrant and flamboyant than the original actions. By the time I started working on this shot, my experience taught me that my planned kiss would be far too complicated to animate correctly within a week, but I didn't want to re-use the same animation from shot 3 because I didn't want to bore my audience. Then, I realized that Sam would be initiating the kiss in the original version, so I thought it would be appropriate to animate Sam's response to Millie's kiss in shot 3. The resulting animation is understated compared to my original plans but no less poignant.

The dissolve between the station and the bus interior sets could have been done inside of Alias, but the logistics of keeping track of the transparencies of each shader would have been a nightmare. Still, I had to know when the dissolve happens and how long it should last, so that I could render just the necessary frames for each part of the shot. There's no magical formula for this sort of thing, so I played it by ear (or by eye in this case). I figured that the dissolve should happen after the photo animation has cycled once, so I took the length of one cycle for the photo animation, which was 4.5 seconds long, and added one second to it for the fade-in. Doing some simple math, 30 frames per second x 5.5 seconds = 165, so that's how I chose frame 165 as the starting frame for the dissolve. The length of the dissolve was more arbitrary. I knew that a half-second would be too fast, and I was afraid of dragging out the dissolve, so I picked a 1 second length for the transition. I also arbitrarily ended the shot at 10 seconds because I was also concerned about dragging out the shot. In retrospect, I realize that I could have gotten away with a longer dissolve and perhaps another cycle of the photo animation, but I guess it's safer to err on the side of frustrating the viewer than boring them.
Shot 29 – A red splotch on the ground

This was one of the simpler shots to animate since it was just changing the color of the splotch on the ground. The splotch started out red and then faded to a dark grey. The initial red color was chosen because of the shock value of seeing color outside of a photograph in this film. I wanted Henry to be uncertain of his senses – and himself, so I made the splotch change its color.

I made some flowers because I knew that they were required for shot 38. I wanted to include the flowers in this shot because I felt that it was important to have them present to give the film additional value upon subsequent viewing, so that you might realize, “Hey, those flowers that changed color were always there!” I chose to model the flowers after *Myosotis Scorpioides*, commonly known as “forget-me-not,” because I wanted to recognize Erik’s contribution to my thesis, which I shall not forget.

To include the flowers in this shot, I had to pull the camera back for a wider view of the splotch instead of the close-up as indicated in the storyboard. The image composition didn’t feel right, so elements were added to give some perspective to the location of the splotch. The ground, which was originally a flat plane, was replaced with the clifftop from shot 18 because in my sense of continuity, Henry is looking down at the ground after the last grain of sand slips through his fingers. To maintain that continuity, I needed to show the edge of the cliff in this shot. The picture still looked ambiguous, so I added one of the railing posts and Henry’s foot to help anchor the splotch’s position.

At this point of the production, I had a meeting with Marla, and she made a suggestion that changed the production process for the rest of the thesis. She wanted to see all of the shots put together as a rough edit with stills, wireframe animations or even rough animations for the unfinished shots. Then I realized why the feedback I was getting from my thesis committee was sparse up to this point. I had been showing them individual shots that may stand on their own but also don’t convey how well they fit into the film as a whole until they’re edited together into a sequence.

Shot 38 – A colored flower & a bird’s shadow

When I started working on this shot, I considered the feasibility of modeling a bird within a reasonable amount of time. After deciding that it would be impossible for me to model and animate a bird to my satisfaction, I immediately thought of an alternative: a bug. The two bugs that came to mind were dragonflies and butterflies because they were large enough to cast a big shadow needed for this shot. I went with the butterfly because it was the more colorful of the two, considering the importance of color in my thesis.

The butterfly model was very basic, and I based it upon the Monarch Butterfly because I’m familiar with this local species. A single sphere was reshaped into the head and body, with the antennae attached as separate geometry. The wings were also created from reshaped spheres instead of trimmed planes because of texture mapping issues. If a trimmed plane was used, the applied texture map didn’t mirror correctly on the other side of the plane or didn’t match up with the trim edge. I had more control and fewer headaches using flatten spheres and layers of procedural ramp textures to get the desired
results. Since the butterfly is seen for only a few seconds and from a distance, I didn’t bother with giving it legs.

Animating the flower colors was a trivial matter, but the butterfly’s animation was trickier. The main concern with the flower color change was to make sure that all the parts did not change at the same speed and time. In retrospect, I think I could have stretched out the transition because it happens rather quickly. I also could have staggered the changes in the leaves and petals because it sort of appears too regular. At this point, all we see of the butterfly is its shadow, and it took some trial and error to position the insect so that its shadow was cast on the right spot. The butterfly’s path was deliberate, as I was trying to lead the viewer’s attention from the ketchup to the flower.

Shot 26 – The waterfall turning into a stream of falling sand
What I was hoping to accomplish with the transformation of the waterfall into falling sand in this shot was to make a visual metaphor of Henry’s fear haunting him. Henry’s camera (and the focus of his sanity) just went over the edge, so to me, it made sense that his panic drove him to hallucinate.

The storyboard drawing for this shot lacked a background, and I felt that needed to be changed because I was concerned about the staging. I didn’t want to confuse the viewer by leaving out details that would establish the waterfall’s location. Looking at a still of shot 19, I was struck by the resemblance between the floating islands and the hourglass. The imagery was so compelling to me that I decided to dissolve between a floating island and the hourglass to reinforce the connection between the current situation of the lost camera and Henry’s fear.

The texture animation for this shot was very complicated because there were so many of them. I made notes about the timing for the animation, but even having such notes didn’t prevent me from making mistakes. Since texture mistakes can’t be spotted until after they are rendered, it was a time consuming process to correct them. Fortunately, the mistakes were neglecting to set keyframes on certain shader parameters, so it wasn’t as tedious as other kinds of texture problems such as correcting the position of textures.

Shot 40 – A bird flies overhead in a blue sky
This was possibly the easiest shot to animate in the thesis; it only took one day to complete from start to finish. First, I chose a low camera angle to reflect Henry’s vantage point. Then butterfly was animated in stages. First its body was animated to travel along a path. The next pass was animating the wings, which flapped faster as the butterfly climbed high and flapped slower as it descended.

The remaining steps were to set up the background, the lighting, and finalize the camera angle. The sky environment texture from the previous outdoor shots was used, except this time, a blue tint was added to it. The lighting was positioned to be consistent with shot 39, with the sun located in the upper left-hand corner of the screen. A directional light was used for the fill light, to simulate outdoor lighting, which has high ambient colors. I adjusted the camera so that the butterfly entered and exited the shot cleanly. As
a decorative touch, I added a lens flare caused by a spotlight shining in the same direction as the sunlight.

I used motion blur when I rendered this shot because the wings flapped very quickly at one cycle every 1-3 frames. The blur made the butterfly move more naturally, and I could actually tell the difference between the motion blurred and non-motion blurred versions. Motion blur is best used on fast moving objects, and depending on how complex the scene is, it can increase renderings times dramatically.

**Shot 37 – Henry notices something on the ground**

Here, Henry turned around and moped as Jean and Pierre walked off into the distance. This shot is basically a set-up for the next shot, so I tried to find a natural way of making Henry look down at the ground. I figured that making Henry turn away from a happy Pierre and acting depressed was one possible way. At first, Henry sighed and shook his head at the same time after turning around, but that combined action didn’t look clear to me. So I separated the two actions, with the sigh first and then the shake of the head, and Henry’s depression started becoming apparent through his movements. To make his sigh more visible, I took a chance and exaggerated the motion of his shoulders, and the result was rather satisfying.

I was also satisfied with most of the little touches in Jean and Pierre’s animation in the background. I particularly liked Pierre patting Jean to move along while Jean stared at Henry. I wasn’t happy with the walking animation because I used FK on it, which created all sorts of problems. The walk cycles looked rather slow and buoyant because the leg movements lacked a certain snap at the extreme positions and because it didn’t look too much like the two background characters had any weight. There were also toe-ground intersection problems, but they’re not that noticeable to the average viewer.

**Shot 36 – A depressed Henry hands over the camera**

The treatment and storyboard had Henry hand the camera back to Pierre, but I changed my mind when I started working on this shot. To me, it made more sense that Pierre, being the impetuous one, would grab his camera and photo back from Henry. To continue along that thread, Pierre would inspect the photo, thank Henry with an enthusiastic handshake, and then walk off without thinking twice.

It looked as if Henry’s role in this shot changed from an active to a passive one, but that’s not the case at the end of this shot. When Pierre started walking away, Henry started chasing him but faltered in his steps as he changed his mind. This was the turning point of the film when Henry decided to accept his loss.

**Shot 22 – Henry drops the camera**

For this shot, I wanted the camera to roll out of Henry’s hands. Then Henry would make a couple of attempts at catching the camera before it falls to its fate. In order for the camera to bounce up, I had to move it away from Henry so that it wouldn’t fly into his face or through his hat. The end results didn’t match my expectations. It looked as if Henry threw his camera up and played volleyball with it before it slipped through his
grasp. I suppose that if I made his arms move in a darting fashion and had the camera bounce at a lower level on the screen, it would look more credible. Unfortunately I ran out of time to make such corrections.

I changed the camera angle from the storyboard to a profile angle of Henry so that his actions were readable. The angle did obscure the scrapbook at first, but it was also an advantage. It allowed me to animate the book without worrying excessively about whether the book intersected with Henry’s shirt or arm. I’m happier with the book’s animation because it shifted around convincingly under Henry’s left arm before sharing the camera’s fate.

**Shot 1 – Henry arrives at the station**

I didn’t think I had the time to model the train for this shot as I had planned when I drew the storyboard, so I had to think about making changes to this scene. I could have recycled the animation from shot 17 where Henry gets off the bus, but without the train, this shot would not have the same visual resonance that the shots with the photographs have. I reminded myself about the purpose of this shot: establish the setting and introduce Henry. This reminder helped me decide that I would have Henry walk into the shot set inside the station.

I took the wire file for shot 3 because I intended to use the reverse camera angle of shot 3 for this shot. I decided that the other end of the hallway intersection would look the same as the hallway end seen in shot 3. To ensure that things didn’t look exactly the same, I fixed the lighting set-up to be consistent with shots 2 and 3, and I changed the camera angle to be off-center so that the hallway perspective wasn’t the same as the next two shots.

For Henry’s walk on-screen, I use forward kinematics again with the same buoyancy and intersection problems as in shot 37 with Jean and Pierre. The floor intersection problem was compounded with the toe-flexing problem from shot 21. I spend a few days trying to correct the problem because I felt the sandals were an essential part of Henry’s character. The final version of the walk was still a bit buoyant, but Henry’s secondary actions when he stopped help convey some mass. The ground intersections were still present, but they happened so quickly for about 2 frames that it was acceptable.

I had the same reservations about an empty train station as I did with shot 3, so I got ambitious and populated the station with five other characters. I imported the Sam from shot 2 and kept his cyclic animation of looking around and shifting his feet. I imported another Sam and had him walk in front of the camera in the foreground. I deliberately placed him very close to the camera so that I didn’t have to animate his legs. I placed a family in the far background consisting of a Millie and two Jeans. After making cosmetic changes, I had one Jean sitting on top of a bench in the background. Then I had his mother scolding him as his brother taunted him from behind her. I actually wanted to add more characters, but I ran out of time and disk space.
Shot 41 – The world springs into color
This was the only shot in the whole film that has a camera movement, which is important. The camera pulls back to indicate that Henry’s world was now expanding and no longer confined within the borders of a photograph. I was tempted to use camera movement in shots like shot 22 to heighten Henry’s panic, but I realized that it would detract from the pullback in shot 40.

The replacement of the bird with the butterfly allowed me to alter the beginning of the shot. I made the bug fly near Henry so that he could be curious enough to raise his hand to inspect the butterfly. Then I was able to direct attention to his arms, as they became colorful.

The order of color appearance was initially semi-random. I had always intended to have Henry’s arms change color first, but beyond that, I didn’t have a plan, so I just turned colors on in what I thought was a visually interesting manner. Then I remembered that Henry should be the center of change, so I rearranged the color order so that the changes emanated outwards from Henry.

Post-production chaos
Once production was done, the post-production phase of the project could kick into high gear. This phase was where the individual shots were tied together into cohesive story. Even though the original planned shots were done, additional work may need required in post-production for the shots to fit together. Some shots that looked fine in the storyboard may not work after they have been animated. Some shots may have animation, modeling or rendering mistakes that were not caught in the production phase. Other shots may need finishing touches before they can be considered complete. When the shots were assembled into a rough edit, there may be additional shots needed to provide better transitions between the cuts. Then the editing decisions can be finalized, and the final full-sized renders started. Then the rendered frames had to be dumped to video, edited together with opening and ending credits, and the soundtrack added. Only then can the thesis animation be considered done!

At quarter resolution, it was hard for Nan and Marla to see the ketchup drop in shot 31, so by extrapolation, it would be difficult at full resolution for the average viewer to notice the drop turning red. The general consensus was that a close-up of Jean dripping the ketchup on the ground was needed to accentuate the fact that the red splotch on the ground is indeed ketchup and not blood. To solve this problem, I had shot 31 split up into three parts. The first part started out as usual with Henry straightening up and noticing Jean behind him. The second part is a close-up of Jean as he stared back at Henry. When the ketchup dropped from the hotdog, there was a cut to the third part, which is a medium shot of Jean’s feet next to the red splotch that forms as the ketchup drop lands. I broke an editing guideline in the third part by cropping Jean’s head off the top of the screen, but I was trying to maintain a visual continuity over the cut. I wanted to make sure that Jean’s body lined up horizontally in both parts of the shot while keeping the ketchup splotch within the NTSC-safe region of the screen.
Now that my thesis committee had a chance to see the whole animation in a rough sequence, the symbolism of color became a clouded issue. Questions were raised about the significance of color appearances throughout the film and the consistency of those appearances. Because there weren’t photographs in the open scrapbook, it wasn’t clear why the book glowed in the bus interior sequence. It also wasn’t evident why the ketchup and the photograph of Jean and Pierre faded to black & white. I had to re-examine my interpretation of the color symbolism and compare that interpretation to the impressions that the audience perceived.

The book glow was fixed simply enough by adding photographs to the open page, but the fading color was a more complex matter. As stated before, I intended the fading color of the ketchup as a matter of uncertainty for Henry. It foreshadowed the last scene of the film, but it faded because Henry had not accepted the loss of his camera yet. Marla and Nan thought the color fade was unnecessarily confusing because Henry already acts uncertain, and they recommended that the ketchup remain red once the color appeared. This changed the color symbolism a shade. It still foreshadowed the last scene, but it lost its meaning of Henry’s resistance to change. Since I had Henry displaying that choice of accepting his loss in shot 36, I decided that I could afford to make this change to ketchup color. Marla expressed some puzzlement over the fading of the photograph in shot 35. She didn’t understand why this photo faded to black & white when photos in the scrapbook remained in color. It turned out that she didn’t realize that Henry had false hopes in Jean and Pierre’s photo, so once that was explained, she focused on other potential problems with my thesis.

The real point of contention in the whole film was the hourglass in shot 26. I placed the hourglass in the shot because I wanted a visual connection to Henry’s nightmare earlier in the film. Marla favored substance over style by stating that the hourglass with the sand was too heavy-handed as metaphor. To her, the hourglass didn’t fit in because it was a surreal object in a realistic world. In the end, I figured that it was safer to be vague than to be heavy-handed, so I edited the hourglass out of shot 26.

I had to find a replacement for Erik because he was diagnosed with cancer in the middle of my production. He felt that he could not fulfill his obligations as a voting thesis committee member while undergoing tests and treatment, so he retired from the committee. His replacement had to come from the Film/Video/Animation department as part of the thesis requirement. I approached Cat Ashworth because I remembered her interest at my thesis proposal, but unfortunately she already had too many advisees. Marla recommended Charlie Boyd because of his editing background. I contacted Charlie, and he agreed to join my thesis committee.

Although Charlie came on board just as most of the production was done, this turned out to be a fortunate turn of events. He was able to provide with keen insights on my work that I wasn’t aware of before. After viewing the rough edit, Charlie was very supportive of the work and said that it looked very close to being complete. He particularly liked Zak’s draft soundtrack, stating that it tied the film together with an otherworldly quality. Charlie also mentioned that my editing had a deliberate pacing to it, and I realize that I
wasn’t editing my piece to fit within a certain time constraint, so my editing cuts seemed to happen at a leisurely pace which fit the type of story I was telling. My work wasn’t flawless though, since Charlie pointed out a couple of instances where I could tighten my edits.

Although he wasn’t perplexed by the awkward shot 27-29 sequence where Henry tried to catch the sand and missed the last grain, Charlie offered a simple yet elegant solution for the transition to the ketchup splotch on the ground. He suggested that I inserted a reverse angle shot of Henry looking down with his hands held out. I was already working on a different solution, but my solution involved adding two more shots where Charlie’s solution only needed one. Another reason why his suggestion appealed to me was that my two-shot solution were very brief and would not fit in the pacing that I had already established with my editing. So Charlie’s shot was one of shots animated in post-production.

From my experience with ElectroGIG, I knew that render time was a precious resource. I was very conscious of the amount of time it took to render a single frame in Alias throughout the whole production process. For ElectroGIG, a typical full size render took about 10 minutes, which became the yardstick for judging Alias’s rendering performance. I had to adjust the factors that affect the rendering speed to favor rendering the whole shot sequence. I meant whole shot sequences because when particle systems are involved, the first frame of the shot can take longer to render than the remaining shots because the rendering engine has to set up the particle simulation in memory.

One of the major factors that affect rendering times is the lighting. The Alias Render Manual mentioned that a typical photo-realistic scene has 75-100 lights to simulate real-world lighting situations, but the same manual cautioned that adding an additional light to the scene also increases the rendering time. I kept the number of lights below five with a few exceptions throughout the production. The outdoor scenes needed lighting consistency because one shot looked like it had bright sunlight and the next shot looked like it had overcast lighting. While I made the lighting uniform across the sequence, I also started changing the lighting set-up for raycasting, because I knew that raytracing, in general, took longer to render than raycasting. I was able to convert most of the outdoors shots, but the shots that showed the ground required raytracing for consistent shadows.

I went back to the dream sequence and added more lights around the hourglass, because I agreed with Nan and Marla that the hourglass was hard to see in shot 13. I could have just turned up the original light shining on the hourglass, but I learned that I could and should use lighting to define and enhance the shape of objects. The original light only lit one side of the hourglass, so the other side was lost in the shadow. I placed a spotlight on the right side to provide fill lighting for bringing the hourglass out of the black background. I placed another spotlight on the left side to provide an edge lighting that defined the right edge of the hourglass. A smaller spotlight was added to the right side and aimed at the sand remaining in the hourglass to accentuate the sand. Another spotlight was placed below the hourglass to make the sand particles stand out. I cringed
at the addition of each light, but the rendering didn’t take much longer because this was a simple scene.

Back in the ElectroGIG days, the rendering situation was rather simple because it was 8 people rendering on 18 machines. When I started my final full-sized renders, it was a far more competitive situation. I had to envy the production houses with render wranglers who would take care of the render queue, but the render sign-up system that we had in place worked even though it was far from perfect. I made a chart for keeping track of the shots’ render status. The chart reminded me of the shots that needed to be rendered and the rendered scenes that didn’t need to be re-rendered. Later I would extend the chart to cover the video transfer status.

Since I found that I actually had some time while waiting for my renders to finish, I went back to the shots that were not rendered at full size yet and added detail to them. To the outdoor shots, I finally was able to add the backgrounds whose absence bothered me. I took the cliff surface, made many inverted copies of it, and made a canyon setting with the copies. For the outdoor shots where the ground was seen, I added some ground debris in the form of scattered pebbles. For all the shots before shot 23 with Henry in them, I went back and made sure that he was carrying his camera and scrapbook. For shot 4, I added the station background and adjusted the lighting to match. Finally, for shot 17, I was able to create the real bus model to replace the bus stand-in. The bus was based upon the Leyland Guy Special bus, for which I was able to find reference pictures on the web, so perhaps all that time I spent by browsing the web was sort of useful after all. Because I couldn’t tell whether the bus wheel was rotating, I added a white bandage to the tire.

Wan Chiu had the clever idea of incorporating models from other students’ animation in the background of his thesis animation. When we discussed trading models from each other’s thesis, he offered to animate one of the photographs in Henry’s scrapbook. I accepted his offer because I was pressed for time. I requested that he animate one of his characters waving to the camera so that the animation could be looped. He gave me the wire file of the main character from his thesis sitting with another character from his other films, the baby cow, on her lap. I took the file and added the bench prop and the train station wall in the background. I also re-did the lighting to make it consistent with the rest of my colored animation.

I made animations for two other photographs in the scrapbook. One was Jean playing with a toy bus by a bench and the other was Millie doting upon a baby. I created the baby model in a rush by grabbing Jean’s head and sticking on a re-molded sphere. Both photographs are based upon personal experiences. Jean playing with a toy bus is based upon one of my baby pictures. The mother doting upon her child is based upon the numerous mothers and children that I know. The addition of the photos to the scrapbook made the book look complete and justified the existence of the yellow glow seen in the bus interior sequence.
Zak Margolis also offered to help me with the soundtrack. I accepted his offer because I knew that I wasn’t as musically inclined as Zak was, and I knew that he would do an excellent job. He and I had a couple of meetings to discuss my ideas for the music and sounds. Aside from the obvious sound effects for the camera, the bus and the waterfalls, I left the rest of the sounds to Zak’s discretion. The only part of the animation that I had a soundtrack idea for was the dream sequence. During the dream, I imagined a music box playing in distance, and as the dream progressed, the music box would wind down to a stop. When the hourglass appeared, there would be a cranking sound as if somebody was trying to wind up the music box, but the music box would only play a couple of notes before stopping again. The cranking and music would alternate, building up tension until Henry woke up from his nightmare. I let Zak run with the ball and gave him a rough edit of the animation for timing purposes. When Zak showed me the rough soundtrack, I knew that I had a talented partner. The music box idea wasn’t used, but it wasn’t missed. I think the lone guitar aptly captured the personal isolation of Henry’s world and the toy piano invoked the nostalgia of the photographs.

I had planned to use the optical disc recorder to transfer my animation to video, but the recorder was down for repairs by the time I was ready to do my transfers. Seeking alternatives, I decided to follow other students’ footsteps and use the Avid machines available to the Film/Video/Animation department. First, I tried to look up information on whether the Avid Composer software could import Alias pix files directly. The other students were converting their renders into PICT files or QuickTime movies before bringing their footage into Avid, and I thought that the conversion was an extraneous step that could be avoided. I found that I was correct when I consulted Avid’s web site, and I proceeded to import my footage into one of the Avid stations. Unfortunately, I was doing this near the end of the quarter when the Avid machines are heavily used. I was able to put together a final edit sans the ending credits and dump it to a master tape.

Since the Avid stations were booked solid, I needed a way of dumping the ending credits (once I had them done) to video. When I finally made my ending credits into a QuickTime movie, I reviewed the playback on one of the PowerMacs in the Animation Studio. The QuickTime played fine until it got to the scrolling titles, which scrolled unevenly up the screen. This made me hesitant about using the PowerMac to dump the ending credits to tape, but Nancy Gertner stepped in and offered access to the PowerMac with the Media 100 video card. I re-compressed my QuickTime using the Media 100 Vincent codec and found that the playback was smoother through the video card. I dumped the credits to tape and spliced the credits to the end of the film with the S-VHS linear editing stations in the Animation Studio.

The opening credits originally just presented the title of the piece. Using black letters on a black background, I revealed the title with blurry grey rectangles that were supposed to be reminiscent of the sunlight reflecting off the windows of a bus or train. Then the title was revealed again in white letters with a grey drop shadow before the screen fades to white. I showed the opening credits to Zak, who pointed out that I showed the title more than once. I flippantly asked him if it would be better if I plastered “John Yung presents” all over the opening titles. “Sure,” he said, so I replaced the first title appearance with
“John Yung presents” as a joke on Zak. The joke was probably on me instead, because I forgot to change the font size when I did the replacement...

The proposed thesis title was *The Occidental Tourist*, but that title had some negative connotations according to someone at my thesis proposal. I don’t know what those implications were or who brought that point to attention, but I chose *The Occidental Tourist* as a play on a film title *The Accidental Tourist*. The occidental part was a reference to eastern transcendentalism versus western materialism. It was a poor comparison, so I thought another title would be more appropriate.

Using PoV for the title appealed to me because of its double meanings, both of which apply to the situation in the story. PoV could mean either “Point of View” or “Persistence of Vision.” Henry’s camera provided him with a special point of view on the world. From Pierre’s point of view, the photo was just fine. From Henry’s point of view, the loss of his camera at first meant the end of the world, but he would later find out that it was only the beginning of a growing awareness. The persistence of vision applied to the photographs as a record of past moments, and it also applied to the work as a whole because animation relies on persistence of vision to make the audience perceive a series of still images as moving ones. A more personal interpretation for persistence of vision was my perseverance to complete this project after two years. An alternative title under consideration was *Moving Pictures*, because Henry’s pictures were moving in both motion and emotion, but PoV had the better double meanings.

For the ending credits, I felt obligated to mention the names of people who contributed to the thesis in one way or another. The names were displayed in color, in keeping with the appearance of color in the last scene. The blurred image of the end of the last shot was used for the backdrop of the ending credits because I didn’t want to fade to black or white, which would negate the conclusion of the film. I actually didn’t want to place my name in the ending credits because it was already displayed in the opening titles. I preferred to emphasize the contributions by other people to my thesis project, so I was thankful for the opportunity to display Zak’s name and the names of the people on my thesis committee on-screen for a moment longer than my credit.

Wan complained (perhaps jokingly) that his fifteen minutes of fame only lasted a little over two seconds in my film. So to give the audience a better look at the photos in the scrapbook, I replayed them in the ending credits. This worked out well, because I was able to show specifically what Wan contributed to my thesis and because the mother doting on her child was showing as the dedication to my parents and brother appeared on-screen.

Special thanks went to other people who made significant contributions in form of criticism, generosity, and motivation. I wanted to list all of my friends, but I was limited by time and screen space. Most of the people listed were classmates who gave me constructive criticism, their rendering time, and encouragement to finish the thesis at times when I faltered. Tom Frazier and Bill Landers were listed because they kept the equipment in running condition as best they could.
Conclusion
Now that I’ve screened my thesis animation, do I consider it complete? Not really, as some animators are fond of quoting Jean Renoir, “Art is never finished, it is only abandoned.” There are some things that I wish that I had the time to incorporate into my work, things such as depth of field and more people in the background. There are some shots that I want to correct because they have animation errors that I had to leave in due to time constraints. There are even a couple of shots that I would like to add, to see if I could clarify the plot.

And there are some things that I wish that I did. The biggest regret is not making a leica reel (animatic) from the start of the project. A leica reel is just the storyboard drawings edited together like a slide show of the whole film. Then as shots are done, I would replace the corresponding drawing in the leica reel with the completed animation. I think this would have been a better presentation for my thesis committee who became more involved in post-production when they finally saw a rough edit.

But as it stands, I think PoV is my best animation project to date. As a display of self-expression, PoV shows that I’ve not yet mastered the art of filmmaking, but I’m on my way. As a demonstration of my technical knowledge, it may be a tour-de-force. Even though PoV fell short of perfection, some of the results exceeded my expectations. I’m hoping that future thesis projects completed at RIT continue to raise the standard of quality. (And I have to admit, I’m still jealous of Ringling who continues to have more festival entries than RIT…)

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Bibliography


This is a collection of the proceedings from The Second Annual Walter Lantz Conference on Animation. The book itself looks slim, but it contains a massive amount of discussion on the medium of animation and the variety of storytelling forms the medium offers. Of relevant interest is the transcript of the panel on "Computers, New Technology and Animation," (pp. 59-69) but the rest of the book is recommended reading, especially if you're still developing a plot for your thesis project.


Donkin’s paper may be eight years old, but it’s still a good introduction to computer animation. It is interesting what was considered the state of the art in computer animation back in 1990, but the underlying concepts of what makes good computer animation as discussed by Donkin are true to this day. His layered approach to animating a scene influenced the way that I work, and his list of computer animator’s tools is noteworthy. I’m curious to see how many people will start marking up the monitors with china markers after reading this article.


Some of the information (types of lights and camera angles) found in this book may be basic to people with filmmaking background, but this book is more than an introduction to cinematography. deLeeuw explains how to use to use the camera and lighting to convey mood and setting, or to achieve a particular genre of film look. I particularly like his reader exercises because it caused me to think about the applications and implications of the information that he presented.


This magazine article covers the discussions about cinematography held at the annual Lighting Workshop sponsored by the International Photographers Guild, Local 600. Eight master cinematographers give their views on how to make lighting work. The information was distilled, but was so provocative that it makes me wish that I had attended this workshop. The article is highly recommended reading because not only is it a quick and easy read, but because it recommends lighting exercises that are worth trying.

Here is the cornerstone that should part of any computer animator’s foundation of knowledge. Lasseter takes the fundamental principles of traditional animation developed by the Disney Animation Studios and discusses how the principles apply to 3D keyframe computer animation. This is mandatory reading for any aspiring computer animator, but it should not be read without seeing Lasseter’s two shorts mentioned in this paper: The Adventures of Andre and Wally B. and Luxo Jr.


Here are more tips from a 3-D computer animation pioneer. The principles mentioned in the first paper applied to any object. This time, Lasseter builds upon the Disney principles to present some pointers on making computer-generated characters seem alive. This is also mandatory reading for aspiring character animators. Lasseter includes a list of animation notes from Ollie Johnston in the following pages. I highly recommended it.


There’s that Lasseter guy again! If it isn’t obvious by now why he keeps popping up in this bibliography, then you really ought to watch his work! This coffee table sized book looks slim compared to other “The Art of…” books that Hyperion publishes, but it is still full of behind-the-scenes details of the development of the film from the original story ideas to concept art to storyboards to wireframes to test renders to production stills. It’s an excellent complement to the supplementary material in the Toy Story laserdisc box set, and it is the inspiration for this thesis report that you’re reading.


This is a highly entertaining book to read, but don’t let the author’s use of the medium to discuss the medium itself fool you. Scott McCloud definitely put some deep thought and research into his material. The pages noted above make up “Chapter Two: The Vocabulary of Comics,” which explores the power of icons. Other chapters that have some bearing on animation are “Chapter 3: Blood in the Gutter,” “Chapter Five: Living in Line,” “Chapter Six: Show and Tell,” “Chapter Seven: The Six Steps,” and “Chapter Eight: A Word about Color.” Although the book covers comic books, it is not difficult to take McCloud’s arguments and apply it to animation as I have with chapter two. The book’s now published by Harper Perennial (1994).

This book is an excellent introduction to computer character animation. Maestri covers many aspects of animating a character from designing and modeling one to walk cycles and facial animation. One thing I like about this book is Maestri shows that there is no single solution to modeling and animating a character. The follow-up to this book is currently being written, and I look forward to reading it after it has been published.


Mamet is a craftsman in the art of filmmaking, and if you’ve ever seen any of the films that he wrote or directed, you’ll know why. His characters are seemingly verbose, but if you examine their lines, you’ll see that Mamet cuts to the matter of advancing the plot. In his book, he reviews how filmmaking should advance the story. Of course, Mamet is opinionated, but he often has a point. This book was assigned reading for my first quarter of graduate seminar, yet I don’t know how I never got around to reading it until I was working on developing my thesis story. Mamet writes very concisely, so it would be foolish to skip reading this highly recommended book.


Susan and George Pyros review the process of organizing and planning an animation project. They cover the steps from beginning to end, and two case studies are compared to an average project. The nice thing about this article is that the Pyros give percentages of how much time each stage took during the total time to complete a project. They also give a list of questions to ask during each stage for making sure all things are considered.


Both John Donkin and John Lasseter cite this book as a reference. Thomas and Johnston are two of the “Nine Old Men” that made up Disney’s nucleus of animators when the studio started making feature films, and they recount their working experiences and techniques in this hefty book, which has become a bible for animators. I do not understand why they let this book go out of print in 1986, but I’m glad that it’s back in print thanks to Hyperion (New York, 1995).
Web Resources
I thought I’d include a list of web sites that were useful to my thesis project. I’m listing them separately from the bibliography because I felt that I had to include the following warning.

DISCLAIMER: Because the web is a dynamic environment, the URLs listed below may not exist by the time you read this. If the sites are still around, you can try finding their new URLs with a web search.

AliasWavefront’s site http://www.aw.sgi.com/

Alias maintains its own official company web site. Here you can find product info, press releases, and an event calendar. Features like the mpeg clips from Bingo the Clown and the announcement of the Student Competition winners are good reasons for visiting this site regularly. An even better reason for visiting the Alias site is the Assistant Online section which is a repository for “image files, tutorials, project files for exploring and learning Alias/Wavefront products.”

Duncan’s Corner

To some of the RIT computer animation grads, Duncan Brinsmead is the guy who demonstrates Alias’s particles on the tape shown in the particle systems class. To the Alias mailing list, he’s something of a patron saint who goes around answering the technically challenging questions of doing things in Alias PowerAnimator and Maya. On Alias’s web site, he has a list of Alias questions that he has answered with his intimate knowledge of the software package. Duncan covers a range of topics from modeling to expressions to shaders to rendering to, of course, particles.

Lumis.com http://www.lumis3d.com/

This site is a “high-end 3D/film resource” according to its maintainers David Rencher and William McCullough. Lumis.com does live up to its claim by providing plenty of content: textures, models, tutorials, plugins, links, books & videos, and Jake’s Alias Bible (which has a few entries from Duncan’s Corner). This is the place to get Alias PIX format plugins for Adobe Photoshop.

3dRender.com http://www.3drender.com/

Jeremy Birn, who maintains this site, is a talented 3-D artist who is very experienced with using Alias and Softimage. 3dRender.com contains some rendered stills, most are done by Birn himself while other stills come from other 3-D artists such as RIT’s Dylan Gottlieb, with notes on the production of the stills. Birn also has some informative articles, tutorials, and a list of recommended books on art and techniques on this site.
CG-Char http://www.cg-char.com/

The CG-Char mailing list is for character animators and other people who work with 3-D computer generated characters. It’s a focused mailing list that concentrates on discussion of general animation techniques and principles. Since there are some industry professionals on the list, it’s a very useful resource, but expect a lot of email if you subscribe to CG-Char, because the other subscribers are quite active.


I don’t know what this company actually does, but they do have a link to the Alias Frequently Asked Questions list. There is another version of the FAQ that has the same information in a more organized format, but I don’t have the URL (although I remember it was related to the Alias Users Group in Germany, if that helps).

Diego’s Alias links http://cutters.com/Diego/salias.html

Diego Velasco has a list of Alias resources on this page. Some of it duplicates the links on Lumis.com, but there are a few unique ones if you care to dig around.

3D-ARK.com http://www.3dark.com/

Billing itself as “one of the internet’s leading resources for 3D computer graphics & animation enthusiasts,” 3D-ARK.com has a lot to offer. There isn’t much in the Alias / Maya section, but there is a wealth of material for other software packages. Zero Batzell Dean, the maintainer of 3D-ARK.com, has done a good job of collecting informative articles on animation principles and careers in computer animation.

3DSite http://www.3dsite.com/

This is one of the first 3-D related sites that I visited on a regular basis. 3DSite is a portal (sort of like Yahoo and 3D-ARK.com) for links to 3-D computer graphics content. There are all sorts of links: educational, entertainment, community, hardware and software, services, and career.

3D Artists http://www.raph.com/3dartists/

This site is a gallery for 3-D artists around the world to display their work on the web. Noteworthy touches that distinguish this site from other galleries are interviews with artists and a rating system where you can enter your vote for the best artists in the gallery. Links to tutorials and a job center are also available.
APPENDIX A
Thesis Proposal
An Occidental Tourist
by
John Yung

Submitted in Partial Fulfillment of the
Requirements for the Degree
Master of Fine Arts

MFA Photography Program, School of Photographic Arts and Sciences
Rochester Institute of Technology
Rochester, New York
November 12, 1996

Marla Schwepp, Chairperson
Professor
School of Photographic Arts and Sciences

Erik Timmerman
Professor
School of Photographic Arts and Sciences

Nan Schaller
Professor
School of Information Technology and Computer Science
Treatment

This will be a short animation lasting about 3 to 5 minutes and done mostly in black and white with color added for certain emphasis.

The story is about Henry, a tourist who lives in a black and white world. He arrives at his destination by train and steps off. Looking around, he spots a kissing couple. Henry snaps a picture with his polaroid camera and then watches expectantly the developing photo. The couple in the picture are livelier than their real life counterparts; the photo is vibrantly colored, and the pictured couple's more flamboyant kiss is animated in a cycle.

Henry boards the tour bus from the train station. After sitting down, he takes out his photo album. He carefully adds the new photo of the kissing couple into a collection of animated pictures. Henry bathes his face in the colored glow of the photos before closing the album and drifting off into sleep.

Henry finds himself climbing up a sand dune. Looking up, he sees the upper portion of an hourglass, and the sand in that portion is nearly gone. Henry scrambles forward to catch the draining sand in his hands, but his hands turn skeletal, and the sand continue to fall through his bony fingers. He awakes at this moment, crying.

The tour bus arrives at its destination, and Henry disembarks. After walking around, he comes into view of waterfalls. After being mesmerized for a moment, he fetches his camera to take a picture. He leans too far over the railing and nearby loses his balance, but in regaining his footing, Henry drops the camera into the gorge. He looks down in horror as he realizes that his camera is irrecoverable.

Henry looks dejectedly up at the waterfalls and is surprised to see the water drops turn into grains of sand. The torrent of sand quickly die to a trickle, and Henry repeats his reaction in his dream by reaching out to catch the remaining sand. His cupped hands just miss the last grain of falling sand. Henry releases an anguished cry as a red splotch appears on the ground nearby.

Henry sees the splotch and quickly checks his body for a wound. He looks up and notices that he's been watched by a child holding a hot dog which is dripping ketchup on the ground. Henry is nudged by the child's father who asks Henry to photograph the parent and the child. Henry agrees to the task and snaps the picture. He watches the photo come to life in his hand, but the colors soon fade as the animation slow to a still. Henry hand the photo and camera to the father who is more thrilled by the picture.

Returning his glance to the ketchup splotch, Henry notices a pastel flower that he didn't notice before. A shadow passes over the flower, causing Henry to look up at a multicolored bird flying in a blue sky. As the camera dollies back from Henry, the scene turns from black and white into color.

I plan on animating this story in 3D with stylized (as opposed to realistic) characters and sets, using Alias | Wavefront Studio. This means that I'll be utilizing the Silicon Graphics Indigo² workstations on campus for animating and rendering. The rendered frames will be dumped to an optical disk and then transferred to SVHS tape for editing. The finished piece will be on SVHS.

The soundtrack will consist of sound effects and music. I plan on having an original score for the piece, and I'll be contacting the Eastman School and my musically inclined friends for a composer.
Budget

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Timeline

Winter Quarter (6 credits hours)

December
- weekly meetings with thesis committee
- work on modeling

January
- weekly meetings with thesis committee
- work on animation

February
- weekly meetings with thesis committee
- work on animation (should be 2/3 complete by end of month)
- make test renders
- review and revise

Spring Quarter (6 credit hours)

March
- weekly meetings with thesis committee
- work on animation (all initial work should be complete by end of month)
  start rendering approved animation sequences
- review and revise

April
- weekly meetings with thesis committee
- finish rendering approved animation sequences
- start post-production: editing and soundtrack work
- review and revise

May
- weekly meetings with thesis committee
- complete post-production
- screen the animation
- complete the thesis report
APPENDIX B
Original Storyboard
Shot 0: Fade in from black

Shot 1: Henry arrives at station

Shot 2: He sees something

Shot 3: The view through the camera lens

Shot 4: Photo comes out

Shot 5a: Hand holds up the photo…

Shot 5b: …which turns into a colorful one

Shot 6: Henry on the bus
Shot 7: Henry puts photo in book
Shot 8: He stares at his book
Shot 9: He yawns...
Shot 10: ...and falls asleep
Shot 11: Henry climbs a dune
Shot 12: He looks up...
Shot 13: ...and sees a broken hourglass
Shot 14: He tries to catch the sand
Shot 15: But his arms turn to bones

Shot 16a: Henry starts from his nightmare

Shot 16b: He buries his face in his hands

Shot 17: Henry gets off the bus

Shot 18: He walks to a railing

Shot 19: View of the waterfalls

Shot 20: He brings up his camera

Shot 21: He leans over the railing
Shot 22: Henry drops the camera

Shot 23: Camera falling into the water

Shot 24: He looks down

Shot 25: He looks up at the falls

Shot 26: Waterfall turns into falling sand

Shot 27: Henry rushes forward

Shot 28a: His hands reach for the last grain

Shot 28b: …and miss
Shot 29: Red splotch on the ground
Shot 30: Henry checks himself

Shot 31: He notices a kid nearby
Shot 32: He’s poked with a camera

Shot 33: Kid’s dad asking for photo
Shot 34: Henry takes the picture

Shot 35a: The picture develops…
Shot 35b: …into color and comes to life…
Shot 35c: ...but turns into black & white
Shot 36: Henry hands back the camera

Shot 37: He notices something
Shot 38: Colored flower & bird shadow

Shot 39: Henry looks up
Shot 40: Bird flying in a blue sky

Shot 41: The world expands into color the end
APPENDIX C
Production Stills
Shot 0: Fade in from white

Shot 1: Henry arrives at station

Shot 2: He sees something

Shot 3: What Henry is looking at

Shot 4: Photo comes out

Shot 5a: Hand holds up the photo...

Shot 5b: …which turns into a colorful one

Shot 6: Henry on the bus
Shot 7: [dropped from production]

Shot 8: He stares at his book

Shot 9: He yawns...

Shot 10: ...and falls asleep

Shot 11: Henry climbs a dune

Shot 12: He looks up...

Shot 13: ...and sees a broken hourglass

Shot 14: He tries to catch the sand
Shot 15: But his arms turn to bones

Shot 16a: Henry starts from his nightmare

Shot 16b: He buries his face in his hands

Shot 17: Henry gets off the bus

Shot 18: He walks to a railing

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Shot 34: Henry takes the picture

Shot 35a: The picture develops...

Shot 35b: ...into color and comes to life...
Shot 35c: …but turns into black & white

Shot 36: Henry hands back the camera

Shot 37: He notices something

Shot 38: Colored flower & bug shadow

Shot 39: Henry looks up

Shot 40: Butterfly in a blue sky

Shot 41: The world expands into color

the end

- C-6 -