5-2002

# Winter tears: a study in computer animation

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# WINTER TEARS: A STUDY IN COMPUTER ANIMATION

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B.A. University of Maine, 1999

A MASTER PROJECT

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of *Arts*

(in Liberal Studies)

The Graduate School

The University of Maine

May, 2002

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***An*** Abstract of the Master Project Presented
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This project is a study into the art and science of Animation. Specifically, this project focuses on the development of story and character through the use of Computer Animation. From beginning to end, this animation comprises work done completely by the author. The main goal of the project was to understand the development process of an animated short through concentration on Story Development, Character Creation, and Character Animation.

In totality, the completed work comprises 10 months of individual labor that began in July 2001 and ended in April 2002. These 10 months of work have resulted in the creation of a 5 minute animated short entitled "Winter Tears." The spirt of the work was devoted towards expanding, testing, and solidifying the skill of the author. What has followed this long process is the best work that the author has produced to date.

The process of the project was a constant struggle of both work and discovery. In addition to the primary goals secondary goals were included. The first of these goals was the learning of an industry standard computer animation packaged called *AliasWaveFront Maya* and the second the creation of a animation piece to be used in a portfolio for job

applications. What the author hopes will be seen is a true love of animation and a profound respect for the amount of work and detail required for any animated piece in any discipline.

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# 1. ANIMATION OVERVIEW

In today's popular culture it is hard not to find animation. Everywhere one looks one can see animation on television, in movies, and on the Internet. The institutions such as ***Warner Brothers,*** *Hanna-Barbara,* and *Walt Disney* are easily recognizable names each with years of animation history and, for many, associated feelings of entertainment and joy. With so much animated media the time and labor in making an animation can be taken for granted. Animation is not like live-action film. It is a process **of** making motion rather than a process of recording pre-existing motion. What animation does is create motion from something that is motionless. This is a very general definition but, contains the fundamental truth for me that animation is a processes **of** desire and illusion.

Humans have always had a fascination for movement and the depiction of it from still images. One can look at cave images from 35,000 years ago and see buffalo and other animals depicted with multiple legs to give the illusion motion. However, what we think of as modern animation, what might be seen in a movie theater, real begins with discoveries **of** the renascence and the 1800's.[1]

The creation of animation relies upon a principle called 'The Persistence **of** Vision' This principle states that the eye retains what it sees for a fraction of a second. In practicality, it tells us that we humans do not see the world as a continuous and seamless procession **of** time, but as a series **of** fractionally retained 'still' images. Peter Mark Roget in 1824 recorded this discovery and with it came a series of optical inventions.

Humans need minimally 24 images each second to achieve the illusion of smooth motion. For this reason, the modem movie-goer sees on the silver screen an image projected 24 times a second, or rather 24 frames per second (fps). Television uses various formats with frame rates of both approximately **30** and 25 fps.

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[1] **Williams, Richard.** The Animator's Survival Kit**. 13.**

The development of film as a delivery format is greatly responsible for the way animation has developed. Before the creation of film, and the film projector, animations were limited to moving still images, such as those seen with the ***Magic Lantern,*** or to simple loop animations in apparatus such as the ***Thaumatrope,*** the ***Phenakistoscope,*** and the ***Zoetrope.*** During the days of early animation, the simple flipbook would be the closest thing to what film allows a person to create.

What film allows is a way to have anything photographed come 'alive' with motion. An example of such early animations include Stuart Blackton's ***Humorous Phases of Funny Faces*** where what he recorded is a series of ever changing human faces on a chalkboard in chalk.[2] Because animation is not limited to the recording of living-motion almost any medium can be used.

Stop-motion is the process of using physical models to produce animation. The most popular modern use of this technique uses Plasticine clay, but history has had many animations using anything from ready made children's toys to Ladislaw Starewich's use of embalmed beetles in ***Lucanus Cervus*** in 1910.[3] Even using humans in individual posses is possible. The most commonly seen example of this process would be in Peter Gabriel's video ***Sledgehammer*** directed by Steve Johnson in **1986.**

The current animation trend is to use the computer to replace film as the method of recording and processing of the animated images. With the power of the computer a hybrid animation style is coming of age, that of Computer Animation. Computer Animation is not a new form of animation but is instead a borrowing of traditions and techniques from both hand-drawn traditional animation and stop-motion. Computer Animation has progressed a long way from the very first simple geometric animations to the first modern feature length animations such as Pixar's *Toy Story* or PDI's ***Shrek.***

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[2] **Lord, Peter and Brian Sibley.** Creating 3-D Animation: The Aardman Book of Filmaking. 22.
[3] Ibid., ***25.***

What is becoming evident with computer animation is that anything able to be thought can be created. These creations can either be used alone in a world of pure computer imagery or combined with live-action features to add effects and depth.

What has made animation popular, in the mainstream culture, is called ***Character Animation.*** The processes of giving an object not just motion but also personality. This is a process that the Walt Disney Company has popularized and made standard in all feature animation. Without character, an animation is simply motion. Without a story, a character has nothing to act. Modern animation then is more than just drawing. Animation is a creative process that taxes the animator to think beyond 'mechanical' or 'linear' motion, but challenges them to interpret movement. This animation process places what we take for granted in our daily world, life and movement, in to each and every frame of work wether it be drawn, posed, or computer animated.

# 2. PROJECT DEVELOPMENT

To create an animation many different processes must be undertaken and with these processes comes a cycle of development. The steps needed to create any successful animation are: Story, Character, Animation, Lighting, Rendering, and Post Production. Depending upon the medium chosen the interior workings of these steps can vary, **but** without each step the quality and believability of an animation will deteriorate.

The following subsections describe and expand upon the work I did for ***Winter Tears.*** **A** project that was a labor of one person for approximately 10 months with hundreds of hours of work and hundreds of hours **of** separate computer time. Through creating this project I have discovered that animation is more a struggle of will than any type of talent or genius.

### Story

In early July 2001 I began thinking and creating stories. The story of ***Winter Tears*** was not the first idea for this project but was in fact the fifth. Other ideas included a robot's search for freedom, a penguin suite, a man and a restaurant, and an abstract music piece. What I wanted was a simple story that told a simple theme. What I finally created was a story about life, death, and the struggle of one character against impossible odds. The story is all told in a simple frame work about a water creature who tries to save the life of a flower when winter comes.

To find this story I did a few activities. The first was to watch animated shorts. In doing so, I wished to see how companies like *Disney* and *Pixar* told stories and how they simplified or expand upon a theme. The hardest part while viewing these animations was not to copy their stories. This strive for originality was a resonating conscience effort in every stage of this projects development. The second activity was to read short stories.

My reading was an effort to find a story kernel and a way to spark an idea within me. There was no single source for what I finally wrote, but a combination of many different ideas placed in a setting that I had not seen done.

The actual process of writing began in August 2001. Up to this time I had very little experience writing any form of screenplay. To help my understanding I found myself reading the book Making a Winning Short by Edmond Levy. Although this book is about live-action film and its methodology, Levy puts forth the frame work for a short and thus for writing ***Winter Tears.***

The process was in four stages. The first was to create a ***step outline.*** A step outline sets up in bullet/number format the plot of a screenplay. What you develop is a blue print illustrating what needs to happen, in active language, at every point of the film. The outline can also help flush out ideas into a simpler and more cohesive form. From there I developed a ***treatment.*** A treatment takes the step outline and writes the ideas in paragraph form giving more detail to the outline. The focus is on key action verbs and some camera directions. What one should be able to read is how the movie will look and what actions occur during the story. The third process was writing the actual screen play. This process takes the treatment and converts it into a standard screenplay format where one focuses on dialog, scene descriptions, and camera transitions.

The last process was essentially drafting. The final version of ***Winter Tears*** was the fifth draft. Many changes did occur during this drafting process that simplified the original idea in set, location, and characterization. Originally, the story used a humanoid water nymph as the lead character and was placed in an open field. Needless to say, as much as I liked the idea and the images that were in my mind, if I had not changed these ideas into simple forms I alone could not have completed the project. Every first script idea brought too much complication and too much development time for my skill level. The changes and the process were essential to laying a solid foundation during the future production phases.

**Character Modeling**

The process of modeling is to take the ideas of the story and then transform them into objects that can be used while animating. For example, if I wish to have a leaf in an animation then a computer description of what a leaf is and what it looks like must be entered into the computer. This process is one of taking geometric shapes, or creating geometric shapes, to make them look like the character desired.

The way a model is displayed and the quality of that model all depends on where and how that model will be used and shown. **A** planning process of pre-visualization to a progressive process of modeling then ensues. After modeling the character you can then apply a rig, a way of creation motion, using bones or a deformation systems, to allow the character to move and be animated within a scene.

My modeling process began in early September and ended in early December. It was painstakingly slow because I did not have experience with my chosen animation package *Maya*. The only experience I had with Maya was during the story development process where, in my free time, I read and did tutorials that came with the software. Therefore, ever modal that was created was a learning experience. The modeling became even more of a learning experience since most of the time I failed to create what I wanted. Many times the work I made was scrapped only to be done again.

My character design process was not a matter of drawing what I wished to create. What I have in terms of drawn artistic skill is a highly refined style of doodles. My drawn art is very abstract and simple. Since most **of** the characters were real world objects I went out and found physical objects that would be the basis for what is seen in the final product. My work desk was inundated by many different leaves, a few small branches **of** trees, and photographs of flowers. They provided not only a reference for creating the 3d objects but, would also serve as a template when I began the texturing process.

I started modeling by working with the "simplest" object first. In my mind this was the leaf What I thought would take a few days to create in actuality took weeks. The original idea for the leaf was to create a maple leaf In various computer animations, leafs

are typically simple shapes like birch leaves. They are primarily **2D** tear shapes with a stem. After weeks of work and nothing that resembled a maple leaf I changed my design. The problem I had in creating a maple was a matter of my experience working in Maya. A maple has many edges and points. Trying to create these in a believable way, with smooth natural flowing curves, was beyond my expertise with the program.

Maya has many ways to create objects by using different modes of modeling: Polygon, Nurb, and Smooth Bodies. Knowing which modeling mode to use and how to effectively work in each mode takes both time and experience. By the time I was done with the leaf I had a much better understanding of each mode because I had tried them all in creating the leaf

Unfortunately, no matter what I tried or how long I worked I could not convince myself that what I saw on the screen was a maple leaf After weeks of work I abandoned the maple and went instead with the standard tear-shaped 'birch' leaf I can now understand why so many animations feature this type of leaf For a few days of work one can arrive at an object that resembles a leaf and reads correctly to the eye. In the end, the leaf I created was a Nurb object with an attached revolved curve surface **for** a stem. Later, I would find that the way I had modeled this Nurb surface took far too long to render. Eventually, I replaced the model with a Polygon leaf that made animation faster.

The rig for the leaf was another learning experience. The leaf needed to be able to curl when the main character blob interacted with it, but also need to be 'flexible' when it fell from the tree to the ground. Initially, I used bones[4] to enable the leaf to move. Essentially, **I** had a central spine that ran along the stem and middle of the leaf I added child bones to enable the sides of the leaf to flex. What I discovered was that the design was overkill. I had too much complexity in the rig and because of this the leaf could not be animated.

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**[4] Bones when defined can look like a skeleton inside any mammal or bird; however, the emphasis is on defining** joint **movement and not in creating a support structure.**

To simplify the rig I created and used a system of Bones and Deformation Targets. Although the system worked it was slow and still too cumbersome to be animated efficiently. The final rig of the leaf uses a simple deformation lattice. This lattice gave me a way to deform the main body of the with eight control points and the stem with six.

In contrast, the flower was a much smoother development process. It too, however, took a few weeks. As with all models it is not the basics of the form that takes the time but, it is in fact, the details that creates the work. The flower was also a special design consideration because it had to bend in interaction, die, and be rejuvenated. The rig then was completed with both bones and deformation targets[5] .

The blossom was created by lofting a Polygon surface out of five separate curves. In a sense, I created an elevation map that had a skin placed around it. From this basic rounded cone I deformed the curves to eventually produce the final blossom shape. In addition to this curve deformation I also utilized point deformation of the blossom Polygon. Because the blossom needed to die I created a 'dead' blossom from the original. That shape was a process vertex point rotation and point scaling to produce the final shriveled looking blossom. This severed as the deformation target.

The main stem was a 10 segment nurb cylinder which was deformed at the top through point manipulation. I created it as a nurb because nurbs provide smooth deformations when used with bones. If I had used a Polygon, I would have needed a high polygon count to achieve a smooth bend. Large numbers of polygons means a more complex model that would have resulted in longer render times.

The leaves that surround the stem are a deformed nurb plain. The points that define the plain were moved and scaled to produce a leaf shape. The nurb plain was then

**[5] A Deformation Target is the process of creating one model that has the same, but changed, construction of another. With the target set one can 'morph' between the two shapes.**

positioned and parented to the stem. These leaves are not actually connected to the stem they are only related to the steams movement through a hierarchical parenting relationship.

The rigging for the steam utilized a Bone system that was animated by a spline curve. The animation of the stem was then done through moving the spline's control points. I did have some problems with this rig until I got the bone weights correct. In early rigs, the blossom would deform as well as the stem when the curve was animated. The leaves were also animated by a deform target similar to the blossom's. The targets were a rotated copy of the initial leaves. In this way, I could control the many leaves with one keyable slider-control making animation easier when the flower wilted.

The final and main animated character is the blob. During the course of the project I came to refer to this character as 'Blobby' even though it is named Alesis in the script. Blobby presented many movements that had to be incorporated into one character. Blobby is first and foremost a blob. This means that when Blobby moves it must look like a drop of deformed water. Blobby is also required to interact with the leaf I decided to accomplish this interaction by having a character with a body, neck, and head. To a degree similar to a Hershey Kiss shape. I felt this body configuration would enable me to place recognizable personality into Blobby. Lastly, Blobby needed to 'run.' This would be a jumping motion that would be like a slinky crossed with the jumping fountains found at EPCOT in Walt Disney World. To accomplish these goals, Blobby was created as three separate models that work together as one through deform targets, bones, and quick frame based substitution.

The interactive Blobby model was constructed from a sphere. The sphere was changed into a sitting water droplet shape and a standing body/neck/head shape. Various other versions of the Blobby character were constructed using lathed curves; however, the appearance of these models were less than desired. The 'run' shape was again a

deformed sphere. In the end the modeling process for Blobby was the most relaxed but, much time was taken in the manipulating of individual UV points that defined the nurb sphere Blobby was constructed from.

The rig of Blobby proved to be the most interesting. The resting water droplet rig was a deformation lattice similar to what was used with the leaf To have Blobby both sit and stand the sitting shape was a blend target for the standing Blobby object. The standing shape had a bone system for animation with control objects placed at the neck and top of the head. The final shape of the system looked like an elbow held straight towards the ceiling while bending the hand at the wrist at **45** degrees. To finish up the bone skeleton it added 3 fanning legs at the base. Included in this basic layout were strategically placed bones to help hold the shape of Blobby so it did not collapse in on itself when it was animated.

The 'run' Blobby was a sphere placed in a 16 point deformation lattice with cluster controls. The run was created using keyfiame animation on the clusters. This animation cycle consisted of Blobby jumping and landing. After the cycle was finished it was converted into an animation clip that could be used with Maya's track editor for inclusion at any frame as a **24** frame clip. By placing all three model in the same position and performing a 1 frame substitutions (hiding one while showing the other) the models worked together giving the illusion of one character.

The stage, or Courtyard as it was eventually referred, combined polygons, nurbs, and smooth bodies. The walls are polygon rectangles with extruded polygon ridge caps. The wood posts that are in the walls are also polygon rectangles. The whole door assembly is multiple polygons that make up the door, frame, hinges, and handles. The door was placed into the wall through boolean modeling techniques.

The ground is a nurb plan that was subdivided into three areas by projecting three spline curves to both cutout the pond and divide the areas for grass and dirt. The pond is a nurb circle that is surrounded by a nurb torus. The liner stones that abound the set were first modeled as extruded polygons that were then converted to smooth body objects. A

bench, that appears in one corner, was constructed from three separate polygon rectangles. The bushes and shrubs that hug the courtyard walls were created using Maya's PaintEffects. These objects were not modeled but rather generated by the computer after many parameters were set to define how they 'grow.' PaintEffects also supplied the spring-time tree limb and growing flowers in the end sequences of the project. The grass was also created using Maya's Fur abilities and was defined by parameters rather than modeling.

The modeling process did not end until the animation was completed. I kept returning time and time again to correct small mistakes I had made during the initial modeling or in order to ease the process of animation. For as much planning as was done there always seemed to be something that became a problem. The leaf was the best example where inexperience made more work than would have experience. However, the mistakes made presented problems that extended my knowledge of the Maya environment.

**Texturing**

Texturing is the process of taking a finished model and adding color and visible surface features. In Maya the process is done by creating shaders. These shaders can be as simple as a bitmap image to something as complicated as a network of embedded and linked shaders. Texturing is a very subjective, skilled, and important discipline that adds unity of look and feel to the world that is being created. Any type of model, from a cartoon character to a realistic window, contains many decisions on surface material, color, light absorption properties, reflections, and much more. To have a texture look and 'feel' right is a process of patience, time, and for the inexperienced trial and error.

Creating shaders for an object is an interesting process that goes much smoother with experience. To achieve the look that one wants one must be familiar with the different types of surfaces Maya can create and the unique properties of each. My process

of texturing was done during the end **of** the modeling process from November to mid December. I used four types of surface materials in ***Winter Tears*** Blinn, Phong, PhongE, and Layered.

Each material has properties that work best depending upon what type of surface is desired. Blinn is a good general purpose material, but it will give a surface a plastic quality. Phong and PhongE give greater control over light reflection. However, these surfaces also produce a waxy look. The layered type has the ability to combine different surfaces into one. This type of shader was used to provide the smooth texture transitions between the living and wilted flower as well as the liquid and frozen Blobby. Surface material types are only the beginning in defining how a surface will ultimately appear.

Other features include color, light absorption (ambient light influences), bump maps, incandescent maps, transparency, and translucency. The leaf for example, used a Layered shader for its color (a combination of fractal and wave pattern procedural textures that was itself a layered shader), a bitmap bump map (defining the veins), a bitmap translucency map (to block light in the vein area), and a fractal procedural incandescent map. Whenever possible I preferred the use of procedural textures as these are defined by parameter to be generated by the computer. They provide a way to generate generic texture without the problematic seams that can be produced with badly tiled bitmap images.

The way the computer knows how to display a shader is based upon the mode **of** texturing. In ***Winter Tears,*** I primarily only used three modes UV texture mapping, Projection mapping, and Spherical mapping. UV texture mapping associates points on a bitmap, or shader, with corresponding UV coordinates on the model. UV mapping works best with polygon objects and gives a fairly straight forward one to one mapping between the shader and the texture. Objects such as the leaf, flower blossom, courtyard walls, ground, ridge caps, posts, and doors used UV texture mapping.

Projection mapping is a process of 'projecting' a texture onto a surface. The process would be similar to using a slide projector to shine an image onto a movie screen. If the projector is moved towards the screen less of the movie screen has an image. If the projector is moved back away from the screen then the screen holds a image, but it is only a small portion of the image. This type of texture mapping was used on the opening fall branch and the flower's stem/leaves. Projection mapping is primarily used with nurb surfaces.

Spherical mapping, and many other geometric shaped mappings, is the final type of mapping mode used. If you can imagine placing a sphere in wrapping paper then you get a basic interpretation of how an object receives its texture. Essentially, the shader surrounds the object to which it is being placed. This mode is great for any type of spherical surface and was used with the smooth body rocks that litter the courtyard set.

Texturing is a very time consuming process and without experience one cannot know what an object will look like until it is rendered. Therefore, for every parameter change in a shader a render must be used to see the results. Time then must be taken for the computer to generate an image. In total there were over 90 objects that required texturing in ***Winter Tears.*** Each requiring a shader with many of the individual shader parameters being defined by other shaders.

**Storyboarding**

Storyboarding is the process of taking the finished script and planning out the placement of characters in a scene. It is a visualization of the script and a pre-visualization of the finished animation. In a general sense, the storyboard is a 'comic book' version of the film. My storyboarding processes was out of order to what it should have been. I should have done the storyboard just after the script and before I began modeling. However, I decided to produce my storyboard with the actual models that I created and then render each image instead of hand drawing each image. This decision was based upon my artistic inability to draw well.

The storyboard process took a few weeks in the month of December. I used the process as a trial for the objects and characters I had created during modeling. What I discovered often were the short comings of my character rigs and the many fixes that **I** had to do to the models before animation. The largest difficulties, which I have mentioned, were the rigs of the leaf and the flower. I found it nearly impossible to move the leaf to setup individual shots for the storyboard. With the flower, **I** discovered the problem of the deforming blossom when I went to position the stem. Not only did **I** discover redos but I also found changes that needed to be made to the various shaders **of** those objects.

Besides pointing out the problems with the individual models the storyboard process helped me discover the shots I wanted for each individual scene. By taking the time to pre-visualize **I** had a blueprint when it came time to produce the final animation. By looking at the pictures that were rendered I had a clear sense of scale and character placement. **I** also had a working plan to how the cameras would move. The plan then emphasizing what I felt were the most important camera angles for the finished animation.

Besides being a great planning aid the storyboard was also the first sign of real progress. The project was finally taking a form that could demonstrate the objects made and the story I wished to tell. The process was also my first use cameras and lights in Maya. Up until this point in the production I had only used the modeling features of the application. **It** was a chance to see how the texturing reacted to a simple light setup, how the controls of the virtual cameras worked, and how the process of rending frames to files was done.

**Animation**

Animation is the process of moving and positing an object in time and space. It is a study of movement and an art of both exaggeration and careful subtile movements. Animation during its best moments should look natural and flow smoothly. What the

animator wants is for the viewer to forget that they are watching an animated piece. Animation is a practiced art that, like so much else in the production process, is greatly enhanced by long practice and experience. Above all, animation is a study in patience and discipline. I firmly believe that anyone can create great animation with the proper drive and time

Computer Animation combines the best attributes of both stop-motion and hand-drawn animation. The rigs that are used in computer animation, and the models that are developed, are a virtual stop-motion puppet. The rig is the armature and the computer is the means by which the animation is recorded to film. Stop-motion has the great advantage of not having to 'draw' the individual frames of animation by hand. It reuses one model throughout many frames that is designed to be bent and flexed. Stop-motion, however, does not allow non-linear animation. No matter how much a movement is planned, whenever one starts animating a model it is a linear process from a point A to a point B. If a step is missed, or a mistake made, then whole days of animation can be ruined.

Hand-drawn animation has the distinct advantage **of** being able to more accurately plan how the animation will occur. One can begin at the point A drawing and then skip to the point B drawing without the middle. Then the animator can work, from the middle out, drawing the mid-points between the various stages of action. If the animator works this way then all the images that make the animation are created, but they are created in a non-linear manner. Unlike stop-motion, if one frame or two frames were created incorrectly they can be easily substituted by new frames and not cause a whole days work to be thrown out.

Computer Animation gives the positioning and reuse of stop-motion, but allows the non-linear creation of an animated sequence. The computer also gives the great advantage of utilizing the computer to create inbetween frames for an animation. However, great attention must be giving to telling the computer, through the inputting of

data and the subtle adjustment of motion curves, how the inbetweens should be created. Like all animation, one does not press a magic button for a sequence to be animated for you.

I worked through the animation in ***Winter** Tears* fiom December **2001** until early February **2002** using a strict animation system. First, I placed the initial characters that would be filmed in a scene, along with a camera, to get the initial angle of a shot. Next, I would animated the camera to work out the timing **of** the whole scene. After the basic camera movement was created, I would rough-out the major motions of each individual object/character one at a time. It was a process of staging the action with virtual actors.

**A** rough animation was then created. The process creating the basic movements **of** position and large gestures and not small details. In movies, actors have to 'hit there marks' at certain times in order to say their lines. Rough animation places the objects where they should be when they should be. This was not an easy process. Whenever characters interacted, or the camera angles did not work right, modifications to the basic animation were always required. After the rough animation was finished a second process of refinement occurred.

The refinement of animation is an iterative process starting fiom the largest movements and working down the the smallest. It took days and in some cases weeks to work the animation of a scene. The problem was not moving the objects, the problem was moving the objects believably. In some situations the animation required reworks resulting in scrapped animation.

There are two examples of how the animation process required me to both rethink what I was doing and required me to constantly struggle to gain the correct movement. The opening sequence is perhaps the best example. What one sees in the finished animation is a leaf that falls fiom a branch, flutters in the wind, and lands on a rock. Later, a water creature (Blobby) creeps up onto the rock and investigates the leaf. What is seen in the final animation is the second version of this sequence and not the original animation.

The original first sequence of animation was too long, had unrealistic leaf movement, and inconsistent character animation with Blobby. What could be seen was a long sweeping shot of a paper airplane leaf and a hopping blob. This first version had the idea of the finished sequence, but the execution of the idea was very poor.

The second example also illustrated inconsistent character animation of Blobby. I unfortunately had an inconsistent vision of how Blobby would move as opposed to the way Blobby should move. Blobby is a blob and should therefore move like a blob. I, however, preferred him to preform a standing 'hop' when moving short distances instead of a 'blob crawl.' For every sequence in the animation where Blobby transforms into his blob shape and crawls across the ground was a redo. In total, 5 sequence were redone to correct my self created inconsistency problem.

Animation is more than a study of movement, time, and space it is also a study in consistency. At every frame the animator should understand what the character is thinking and what is driving that characters motion. If this concentration is lost, or misguided, then the animation ultimately suffers and work will need fixing or, in some instances, completely scrapped and started again.

I worked through the 13 scenes of the final animation in sequence. Meaning that I began animating scene 1 and ended by animating scene 15.[6] I worked in this linear way for a very simple reason, it help facilitate setting up the next shot. Modern large scale productions do not work in this linear format as individual segments do not need the previous to work, they are literally separate entities.

Typical production involves many people laboring in parallel on multiple segments of an animation. Since I was an animator of one I helped myself by working sequentially as the process helped me keep camera angles and transitions logical. By

[6] The fiial animation has only 13 scenes. Scenes numbers 2 and 3 were incorporated into scene 1's redo, as such, the animation of these scenes were scrapped in the final animation. The numbers remained the same to simplify production.

working this way, I saved myself some time setting up each of the 13 scenes. This saved time allowed me to fix mistakes and spend more time doing further refinements in the animation.

Not all animation needs to be done by an animator. Some animation can be done by the computer. What the animator is responsible for **is** telling the computer how to move an object rather moving the object. The best example of this is the snow in the final sequence of the animation.

The snow was accomplished by a particle system. Essentially, by setting various parameters, the computer generated a 'particle storm' of points that were defined, by texturing, to render like snow. The glows that were produced when the snow hit Blobby were generated by collision events which generated new glowing particles. **As** much as I would like to say that this was as easy as hitting a button, it actually took weeks to get this 'automatic' animation to work correctly. However, it was much faster than if I were to animation the hundreds of individual particles with keyframe animation.

The other objects animated by the computer are the fall/spring branch and the closing growth of the new spring flowers. The fall branch in the first scene was animated by the computer basing its movements upon the movements of the leaf. Without this 'pinning' of the branch to the leaf the animation was very difficult and almost impossible.[7] By setting this relationship between movements it produced more believable results.

The spring branch actually used the PaintEffects system of Maya to be completely generated by the computer based upon parameter. The motion was created by placing virtual physical forces on the PaintEffect object. Likewise, the end sequence flower growth was created by the growing of a PaintEffect object which was created to look like the flower used in the earlier scenes.

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[7] **The first iteration of the opening scene did not use this relationship between the leaf and the branch to link the movements. It was rather a long process of frame-by-frame matching of the leafs movements to the branch.**

Depending upon how a character is rigged influences how an animator can animate that character. Blobby was a combination of three models. The animation was then done in three separate ways. When Blobby is a blob the animation was achieved by manipulating individual control points that were associated with a deformation lattice which surrounded Blobby. Each point was keyfiamed and the result was the blob crawl. In total, the lattice had 72 points that were manipulated to create the blob motion. When Blobby was standing two control points were manipulated. These points were used to move the bone structure that used a Inverse Kinetic system. By keyfiaming the two control points the wide range of Blobby's standing poses were created. The last water jumping version of Blobby was created by a lattice structure and keyframed points, but this animation was converted to a character clip that was used as a walk-cycle.

When creating animation it is best to make sure that the characters are designed and modeled for the situation they will be used in. If a rig is wrong, like my first rig on the original leaf object, animation can be hard to nearly impossible. Getting the rig, and the rig's controls, right is the best way to ensure a smooth work process. However, rigs and characters are not the only objects in a computer animation that can be animated. Lights and texture can also be animated in time and space. Each type of element requires the same process of refinement and attention that is required for any of the primary model.

**Lighting**

The production process of lighting is a special field all to itself that takes experience and practice to master. Without lighting what is modeled and animated can not be seen. Lighting also enhances and defines a scene by changing its mood and character. The virtual lights of the computer need just as much attention to detail as any other character in a production. Lights, like almost anything in the computer, can be animated in space and time and also in its characteristics such as color, type, and intensity.

The lighting process for the project began in late January 2002 and ended in late February 2002. Lighting was kept simple while still trying to produce what was required within a scene. This simplicity was done to keep time available for the rendering process. During the lighting process each object was looked at and lit individually. In some cases, the lighting for each object/group could use more than six individual lights. In larger productions this light number can be significantly increased.

There were a few considerations to keep in mind while lighting the various animation objects. First, the whole animation takes place outside and would therefore need to reflect how the sun is seen and how its associated outdoor ambient light works. Secondly, the animation needed to be kept consistent between scenes for coherence and uniformity. Lastly, the lighting setups needed to be as simple as possible to keep render time down and animations needs simple.

To give a quick overview of how the animation was lit I worked in groups. The leaf, the flower, the rocks, and the courtyard were all individual groups. If a group contained PaintEffect or Fur elements these were lit as separate files to facilitate their special lighting needs in Maya. I tried to keep the group lighting as a simple three light system. **A** key light, a fill light, and a rim. The key light simulated the direction of the sun while the fill kept the shadowed regions of an object still visible to the camera. The rim was used either to give the object some contrast to what was behind it or to work as a secondary fill light. The exceptions to this three lighting system were the leaf: which contained six lights arranged as a diamond, and the set which used spots to help highlight its various components.

Lighting was a very tedious process of selecting appropriate colors and intensities to complement the models but also to enhance what was happening in the story. The wilting flower is an example of animated light color from a green to a brown-yellow enhancing the change of texture during the flowers wilting. The change of the leaf from

brown to green was a similar process that incorporated blues and yellows to compliment the colors used in the leaf model. The light intensities had to change similarly during these phases.

Lighting was time consuming because I needed to see how each light effected the models in each fiame. Like texturing, the only way to truly know what an object looks like is to render that object or fiame. This time factor was multiplied because animated light sequences needed to be rendered completely see the effects on the sequence. As with animation, the work proceeded in increments. I first saw how one light would effect an object/scene then moved on to the next.

The best feature **of** working with virtual lighting is that a light can effect just one object or group leaving all others alone. In this way, the general outdoor lighting was setup to effect all models, while each group had lights keyed to only its objects. This greatly simplified light spillovers. Without this separation, the three lights that lit the flower would also have lit Blobby making it difficult to achieve the final needed coloration of each character. In addition to light separation virtual lights can also be negative. Meaning that lights can be used to subtract intensities from other lights. This negative lighting technique was used to add more distinct shadows in places like the courtyard and underneath the leaf on the rock in the first scene.

**Rendering**

After all the models have been made, the textures and lighting assigned, and the animation completed then the process of rendering can begin. Rendering is using the computer to generate the pictures associated with each frame of animation. For every pixel that is displayed on the computer screen many different and time consuming calculations are preformed by the computer to determine what a surface looks like. After all the pixels in one frame have been generated they are stored to disk in a image graphic format. These individual bitmap files are then placed together in sequence using

applications like Adobe AfterEffects or any other similar program to produce the final video file. Rendering the frames of scene can take seconds all the way to days and weeks depending upon the complexity of a scene.

The rendering process began in February and ended in mid April. It was both a simple process and a difficult one. When rendering the computer sits and works on calculations. In total there were over 6,500 fi-ames generated for ***Winter Tears.*** On average a fi-ame took 15-20 minutes to render (including the fi-ames not generated as whole images but as separate layers that were composited together). Rendering is a slow process that tested my patience on more that one occasion. When the computer was working correctly, or when I had not inputted wrong information, the process was simple. Simply starting the computer and walking away. However, the process was not always that smooth.

The first step in beginning rendering is to decided how the final render will be put together. Will all the objects be rendered together in each frame or will each individual object be rendered separately and then composited together? The first has the great advantage of being straight forward, as it places all the objects together in their proper depth placements. Meaning that objects that go from foreground to background accurately change positions. Unless you have more expensive compositing software this is the only way to render in some instances. The second method of individual object rendering and cornpositing offers the ability to change how the final film looks. Because each object is separate one can adjust color, saturation, brightness, contrast, and other image properties to correct small mistakes in the render. I tried to keep the objects as separate as possible grouping them from foreground to background. In some instances these separated objects did need corrections, such as the leaf in the opening sequence, which needed color correction.

To create these separate layers prep-work was needed on each **of** the individual sequences. One must go through each scene and tell the render application what objects should be included on separate render layers or export the various objects into their own

separate files to be rendered individually. The process is repetitive and monotonous not to mention difficult. Unless you have compositing software that utilized z-depth[8] great though is required in determining foreground and background render layers.

In Maya, and other software packages, one must also keep in mind any special render considerations for the various types of objects. For example, Fur and PaintEffects can only use global lighting to render. In ***Winter Tears*** these objects required more light than was available to them from the defined ambient lighting. To compensate for this lighting problem these objects had to be rendered in individual files so their special lighting did not spill over.

After the work of separating files and render layers is done the actual render process can begin. A few obstacles presented themselves during the render process. One was hardware and software related. On many occasions during the rendering the computers I worked with spontaneously rebooted. In fact, this happened many many times. Therefore, the idea of 'setting and forgetting' a computer during the render processes was not possible. The computers were 'baby sat' throughout the rendering time. They required checking every hour to make sure they were still processing. This reboot problem was particularly fi-ustrating if a computer was left to work overnight, but rebooted after **20** minutes of work. Thus wasting **8** hours of render time.

The second biggest headache during rendering was the snow particle system at the end of the animation. The snow particles were extremely memory intensive and often caused the computers to crash. Even with limiting the particle systems the process was long and fi-ustrating. To complete just one scene with particle snow it took anywhere from half a day to multiple days. It solely depended upon memory complications and how many shutdowns occurred during the process.

Blobby was also a time consuming render. The blob object utilized a process called Ray Tracing. Ray Tracing is a simple conceptual process that sends a 'ray of light' out from every pixel on the screen to see if it hits an object. After hitting a object the

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**[8] A file, like an alpha mask, that defines by a grayscale bitmap where an object fits into depth space.**

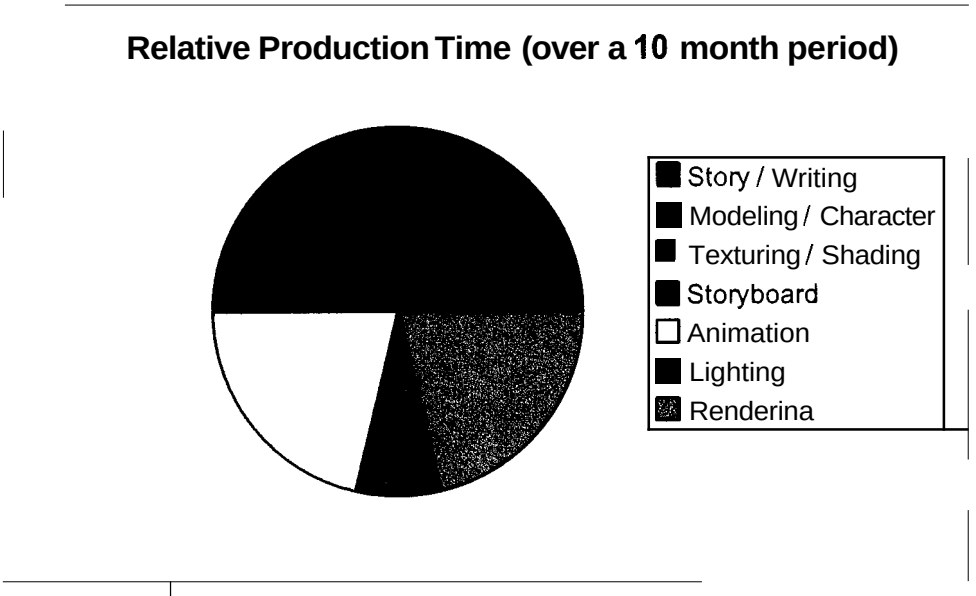
color is calculated. The complexity of ray tracing comes from reflection and rarefraction. Blobby utilized both render options. The reflections require additional rays to be cast and rarefraction required more math to be done while generation the individual pixels. The render times for just the Blobby character took minutes for distant shots up to 10-15 for close ups.

The render process is not hard, as the computer is doing the work, it is simply frustrating because of the time required to generate the individual images and the time required to setup the render. However, it is an exciting process because you finally get to see the fruit of the labor done. It is important to remember that no matter how careful you are in setting up a render sooner or latter a problem occurs.

When the render is wrong the only thing to do is start again and take the time to get the render right. This happened a few times with the most damaging for me while rendering the grass. Each scene with grass took at minimum a full **24+** day to render while the larger scenes took **3-4** days. When I began rendering the grass I took for granted what the render would look like based upon a few rendered tests. When I played back these first day long renders I discovered I had not taken enough time setting up the render and making sure that everything would work. The few early mistakes with the grass cost me **4** days of render time that needed to be redone.

The greatest feature of rendering is the ability to use multiple computers. What one can do is take the individual files and render two at a time on separate machines. Although the actual computing time is not cut down, the amount of physical time is halved. During the render process two computer were used to render the complete animation. While one worked on one scene, or one layer in a scene, another computer was working on another section. At the end of the render process this two computer approach allowed the project to be finished on time. For example, the grass took two full weeks of **24** hour rending to complete. If the rendering had been done with only one computer it would have taken **4** full weeks to complete.

# 3. PRODUCTION TIME




| | |
|---|---|
| **Story / writing** | **July** 2001 - **August** 2001 |
| **Modeling / Character** | **September** 2001 - **November** 2001 |
| **Texturing / Shading** | **November** 2001 - **December** 2001 |
| **Storyboard** | **December** 2001 |
| **Animation** | **December** 2001 - **February** 2002 |
| **Lighting** | **February** 2002 |
| **Rendering** | **February** 2002 - **April** 2002 |

**Figure 1.** Overview of Production Time

**A** typical work week was 5 days and **30** hours. During the work process overlap in phases did occur. These overlaps were periods of transition. During these transitions the next sections work was started while fmishing work left in another phase. The time was also used to correct problems found while utilize the last phase's work. Each phase **of** production never completely ended since when a problem was discovered it was immediately corrected. In total over 1000 hours of work was required to complete the 5 minute animation.

# 4. CONCLUSION

I look at the finished product of ***Winter Tears*** and wonder how it ever get done. I see a finished 5 minute animation that is fairly complicated and well done. **I** find it hard to believe that it took only 10 months to complete and that the whole animation was done, start to finish, by one person. The best part is that what was planned in the beginning was actually accomplished. Nothing was cutout to save time or make deadlines. All that was finalized and planned is in the final animation.

Of course, after 10 months of seeing one project I am glad it is over. I am very proud of what has been made, but **I** see more now **of** what could been done better rather than what was done well. I find that this is always the case with any of the projects I have worked on.

**I** remember how during each phase of the production I would actually have to stop myself from working to move on to the next process. **If I** had not done this I'm sure **I** would still be working on the animation to get it perfect. Like anything, it could always be better but it has to be called done at some point. I am happy to call this project finished and hold no regrets in doing so.

**I** look at what **I** have learned and again I am in awe. **I** started work on an animation process that I had very little experience with, in a program **I** had never used before, and successfully created an animation. I can not say that **I** know every facet **of** *Maya,* but I know that **I** have touched at least 70% of what it can offer. I feel I am prepared now to create what my mind, or anyone else's mind, can image..

With this project done **I** would like to start working on smaller projects that focus on various skill of animation. I would like to do motion studies with simple objects working on animation timing and spacing. **I** would also like to improve my modeling and texturing ability. Both of these skills will require years to even come close to mastering.

I also do not even know if anyone can really ever call themselves a master of animation. I believe one can become very good, but it seems there is always something new to learn or create.

Today, I look at animation as less of an 'art form', but more as a dedicated work process. I know what awes people on the screen can be done by almost anyone. What is needed is simply the time and patiences to create it. I am certain that if you work the system of refinement any result that is wished for can be achieved. Animation then is not a matter of skill or genius, but a matter of determination and will. Animation is not a fun process as it is work. However, the results of this work are worth every moment.

What I have learned is if you can not sit down and watch what you have created and get a thrill seeing it move, then you should not be an animator. The only thing that makes the amount of time and effort placed into every frame worth the labor is that magic.

If anyone plans on creating a project like mine in the future a few things should be kept in mind. The first, always keep yourself organized and to a time table; however, keep your organization and time table reasonable. Animation is a long involved process which will contain both quick and lengthy work. Secondly, Always keep extra time to correct mistakes. For myself, most of April was concerned with fixing and adding small details to enhance the world I made. Thirdly, keep you goals simple and defined. The story should be simple, the setting simple, and the animation simple. Simple does not mean poorly done, but simple means just within reach of your abilities. Also keep in mind what your project is for. If the project is just for academics then it can be anything you want. If the project is instead to supply portfolio material then you will need to keep in mind what the industry wants. This is something under 4 minutes that emphasizes the skills in the animation job you wish to have. I made the mistake of having my animation too long.

Finally, it might be interesting to work in a group. That way you will be able to divide the work among you and focus more on quality. I feel my animation is great, but it could be better. What if I only worked on the flower character for the whole process? The flower then would have had **10** months of my attention in stead of a fraction of my attention. The story could also be more complicated with a group and the world more detailed. However, if you work in a group make sure all love animation and want high-quality. In animation there is no room for the lazy.

During my animation process I found the work lonely and intense. I worked alone in an environment where no others were actively working with me. This is in contrast to large or small studios where many people labor on every aspect of a production. I could not walk down the hall to discuss the problems I was having or share the triumphs **of** what I had figured out. I was in a room with a computer working to accomplish my project. It was a great experience, but sometimes it would have been nicer to have had a work group.

Animation is work. Modeling is work. Lighting is work. Texturing is work. Rendering is work. Everything associated with the process is work. There is not a moment during the production where the end goal can leave your mind or, if it does, the end product will fail. Animation is a disciple that requires both creativity and hard pressed organization. I found the work intense and often painstaking; however, the end product is certainly worth the effort.

## REFERENCE & RESOURCES

### Software:

| | |
|---|---|
| Maya 4.0 | AliasWavefront |
| AfterEffects | Adobe Software |
| Windows XP | Microsoft |
| Windows 2000 | Microsoft |
| gobeProductive Suite | Gobe Software, Inc. |

### Hardware:

| | |
|---|---|
| AMD Athlon 1.4 Thunderbird | 100 GB Harddrive<br>512 MB Ram<br>nVidia GeForce2 Ultra 64 MB |
| AMD Athlon 1.2 Palomino | 40 GB Harddrive<br>256 MB Ram<br>3Dfx Voodoo3 16 MB |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# APPENDIX A

## Winter Tears
## Step-Outline, Treatment, Script

The writing process for the script consisted of many stages of drafting. The Step-Outline and Treatment were the first ideas associated with Winter Tears. There is a marked difference between the original concept and finished product. The Script, as presented, is the fifth draft. **A** few minor changes have occurred during production that changed the ending slightly, although the same idea remains.

**Winter Tears: Step-Outline**

1) An oak SHAKES in the breeze. The last leaf BRAKES off and FLYS into the air
2) The leaf FALLS into a RUNNING stream and RIDES the currents
3) The leaf gets STUCK in-between two rocks.
4) A water nymph, Alesis, RISES from the river
5) A. PICKS-UP the leaf and EXAMINES it between her fingers
6) A. LOOKS-UP at the *oak* where the leaf fell
7) Wind BLOWS through A's hair and she turns to LOOK left. She RUNS
8) EXAMINING the leave again she SMILES and LETS-GO of the leave
9) The leaf FLYS. A looks at it GO and CHASES after
10) A RUNS up hill until she ABUPTLY STOPS at the top
11) LOOKING down A. SEES a flower. A. KNEELS
12) The leaf HUVERS, but soon DEPARTS
13) The flower is DYING, dried out and LIMP.
14) A. TOUCHES a petal. She ENPARTS a bead of water
15) A. SMILES and RUBS her hands together above the flower
16) A. CREATES RAIN that FALLS from her hands to the flower
17) LOOKING at the flower A. GETS-UP, but TIRED and DRAINED
18) She SLOWLY TRAVELS back to the RIVER
19) Halfway there it SUDDENLY DARKENS. A. STOPS and LOOKS-UP to the sky
20) HOLDING her handout snow FALLS onto it. It FREEZES where it FALLS
21) A. PANICS and with new DETERMINATION RUNS to the stream
22) A. comes to a STOP. TURNING she LOOKS to the flower. ALONE in the snow
23) A. LOOKS back to the river, more ice GROWING on her. She TURNS back to the FLOWER
24) RUNNING A. COLAPSES in front of the flower
25) FRANTICLY she tries to keep snow from the flower
26) A. MOTIONS SLOW until she is FROZEN
27) Snow BARRIES both Alesis and the flower
28) Now spring, The tree now has GROWN buds and birds SING
29) A. MELTS in the GLOW of the sun. Water RUNS from her icy body
30) Where the flower once was a new seedling EMERGES

## Winter Tears: Treatment

CAMERA IS AT EYE LEVEL OF AN OAK BRANCH WITH ONE LAST LEAF. The wind is blowing the leaf and limb making them sway in the breeze. The leaf breaks fiom the limb and falls into the air. It lands in a running stream and starts riding the current. The leaf gets stuck in-between two rocks. ALESIS, a water nymph, emerges fiom behind the rocks. She is a transparent water figure that solidifies into a female form.

Alesis bends down and picks up the leaf in her right hand. She holds the leaf in front of her eyes and examines it. While turning the leaf over wind blows through her hair. Smiling, Alesis extends her arm and watches the leaf catch the wind. She releases the leaf and watches it as the leaf flies away towards a hill. Alesis takes chase. She "flies" up the hill in the path of the leaf. She does an energeticjoyful twist as she bounds. Alesis lands at the top of the hill and stops. She looks down and her face changes from joy to concern. The leaf waits circling in the wind. Alesis bends down kneeling on the ground. The leaf departs.

Alesis looks at a flower that is before her. It is limp, dried-out, and dying. She holds the flower by the base in her left hand and touches a petal with her right. She removes her right hand and a bead of water is left. Where the water is the flower petal becomes a healthier shade. Alesis smiles with a thought. She lets go of the flower and places her two hands above it and rubs them together. Alesis' hands transform in to a semi-transparent watery/solid form. From her hands water starts to rain. She stops. Alesis collapses a little and she places her left hand to her head in apparent fatigue. Looking at the now healthy flower Alesis slowly gets up joyfully tired. She "flies" slowly down the hill.

Halfway down the hill a shadow crawls along her face as the landscape around her grows dark. Alesis stops and looks slowly to the sky. Wind picks up and blows through her hair. She holds out her hand and white snow falls upon it. Where the snow lands her skin shimmers and crystallize into ice. Panic plays upon Alesis' face and she starts to "run" towards the river.

In slow motion she stops in the ever increasing snow. She looks back to the flower that stands alone with snow gathering on it. She looks again to the river with its flowing water. More snow collides with her cause more crystallization. Alesis with a look of

longing/determination **"runs"** towards the flower and collapses in front of it. She brushes off the snow that has formed on the petals. The snow continues to get worse and Alesis franticly tries to keep the snow off of the flower and the ground surrounding. Her motions slow as she continues to be pounded with snow and crystallizations. She stops moving as she is now a solid statue of ice. Snow falls covering the flower and burying Alesis. (FADE TO BLACK)

CAMERA **IS** AT EYE LEVEL OF AN OAK BRANCH. Many buds are formed on the limb. We see Alesis the ice statue kneeling in the remaining snow. She is melting. **CLOSE *UP*** on her face of the melting water that is like tears. The ground in front of her has a dead flower. Water from her flows and drips onto the ground. Near the dead flower the ground starts to break and a new seedling springs in the sunlight.

**WINTER TEARS**

**by**

**Daniel W. Bissell**

**Revision *5***

EXT. COURTYARD FALL TREE LIMB DAY

CLOSE ON LEAF AND BRANCH

A TREE LIMB sways slowly in the wind. The last LEAF of the tree fight against the wind to stay on the limb. The leaf falls.

FOLLOW ON LEAF

The leaf continues falling and lands on a stone that surrounds a garden pond.

PAN *UP*

The leaf sits on the stone and BLOBBY comes into view. Blobby is a playful water creature who looks carefully at the leaf He tries pushing the leaf with curiosity. The leaf stays dead and unresponsive. Blobby pushes the leaf over, but nothing. In a state of sympathy Blobby hops onto the same rock.

CLOSE ON LEAF

We see the brown dead leaf Soon it is engulfed by a ever intensifying glow.

PAN *UP*

The leaf raises of the rock because of some "Blobby Magic." The leaf floats and rotates showing a transformation from a dead brown leaf to a healthy green leaf

PAN OVER

The glow fades and the leaf gently falls back down. Blobby nudges it with his snout and sends it flying back into the air.

FOLLOWING LEAF

Blobby chases after it as a child would in play.

DIFFERENT ANGLE

The leaf comes to the courtyard wall and flies up and over. Blobby is left alone watching it leave. He is sad for the leafs leaving.

ROTATING

Turning around to head "home" Blobby notices a flower that slowly comes into frame.

DIFFERENT ANGLE

Blobby bounces over to the DEAD FLOWER. Much like the leaf Blobby wants to play except the flower is dead. He nudges the flower up to make it stand, but the flower soon falls back down "hunched" over itself

DIFFERENT ANGLE

Again Blobby works his magic and soon the flower changes from dead to ALIVE. Blobby investigates the flower finding it alright he turns to face back to the pond.

FOLLOWING

Blobby jumps onto another set of border stones and looks at the pond.

WAIST SHOT

Slowly SNOW FLAKES begin to fall. A few hit Blobby causing a GLOWING effect. These snow flakes cause B **lobby** pain. During a hit he looks back toward the flower.

DIFFERENT ANGLE

Blobby sees the flower slowly fall back over and DIE. Despite the SNOW Blobby returns to the flower.

ROTATING SHOT

Blobby again works his MAGIC and brings the flower some life, although half of what it was before. The flower quickly WILTS again. Blobby again shoves the flower with his snout. The snow continues to pick up. Blobby again works **his** Magic in obvious pain.

CLOSE ON FLOWER

The MAGIC GLOW slowly fades and the flower falls to the ground and out of frame.

ANOTHER ANGLE

Blobby is seen as an ICE BLOCK no longer water.

FADE OUT.

FADE IN.

EXT. COURTYARD SPRING TREE LIMB DAY

Leaves now are on the limb and small snow mounds still linger in the COURTYARD.

WIDE SHOT

Blobby sits a MELTING block of ice.

CLOSE UP

Water droplets melt down Blobby.

CLOSE UP ON GROUND

The water falls to the ground and **a** seedling emerges.

FADE OUT.

# APPENDIX B

## Winter Tears:
## Storyboard

The storyboard presents the vision for the final piece of animation. Arranged much like a comic strip the storyboard is used to visualize character placement and key story camera shots. Although it was done after modeling the storyboard helped set a firm foundation for the subsequent animation.

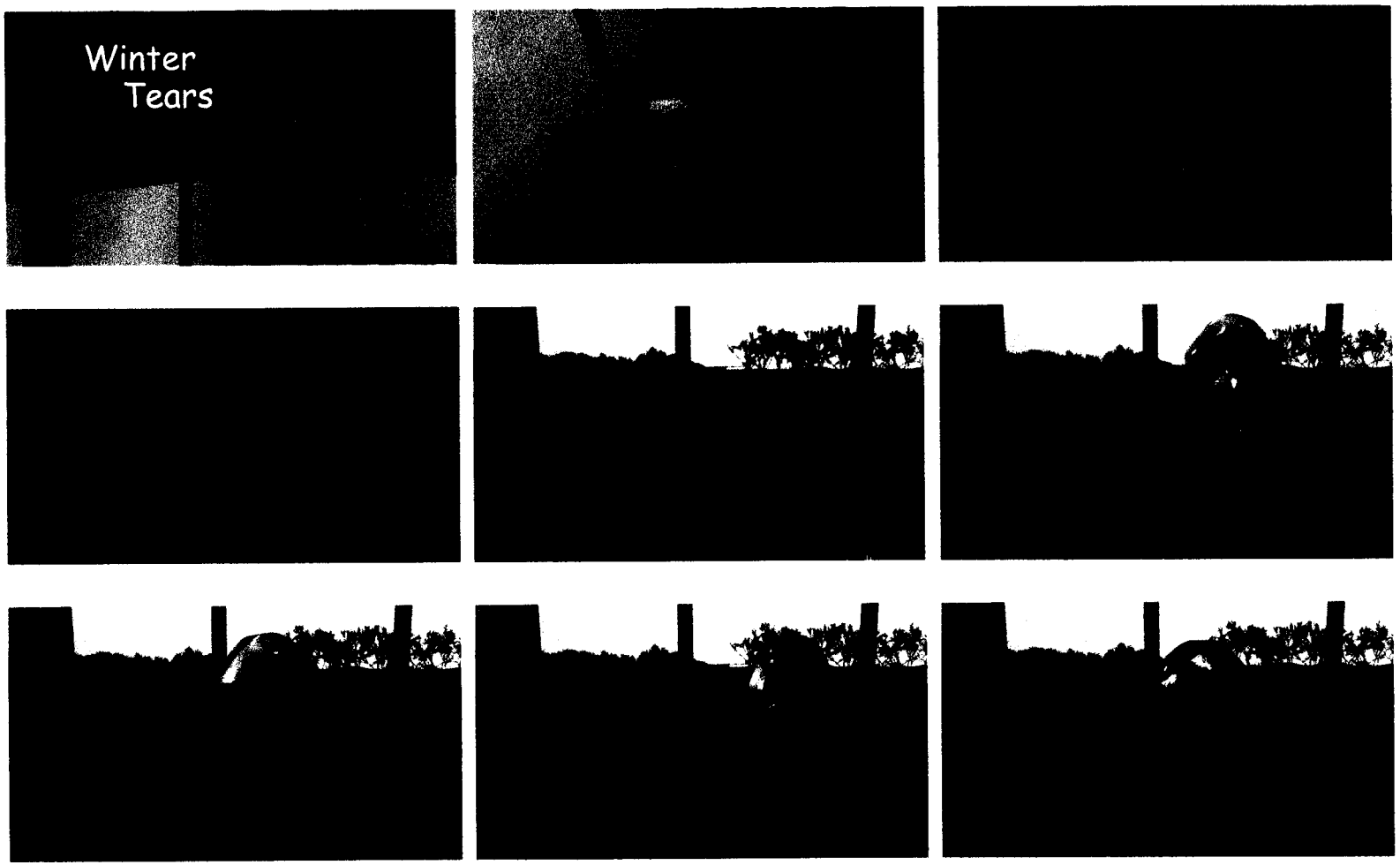


**Figure B.1.** Winter Tears Storyboard
The images above are in sequence left to right.

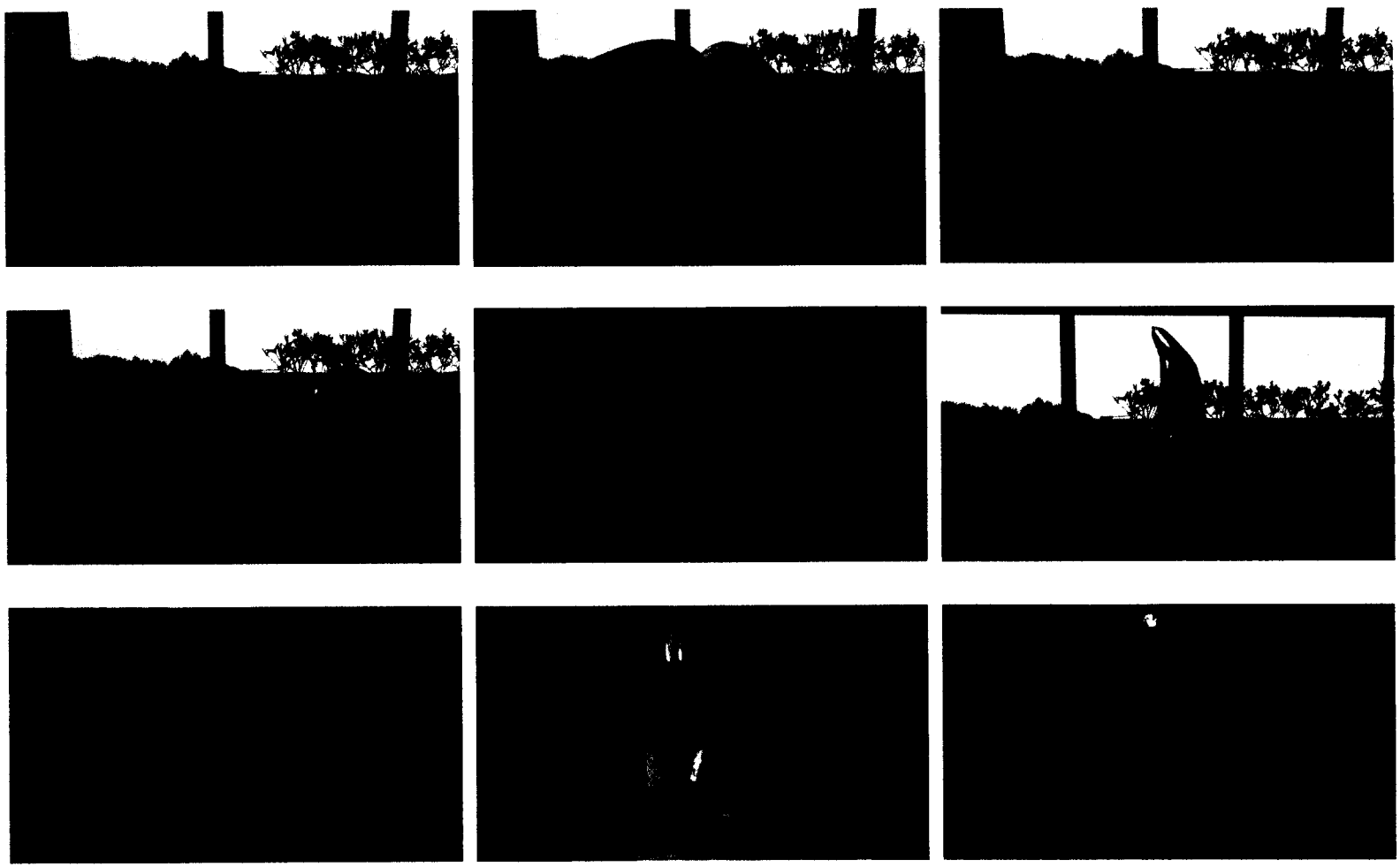

**Figure B.1** Continued

**Figure B.1** Continued

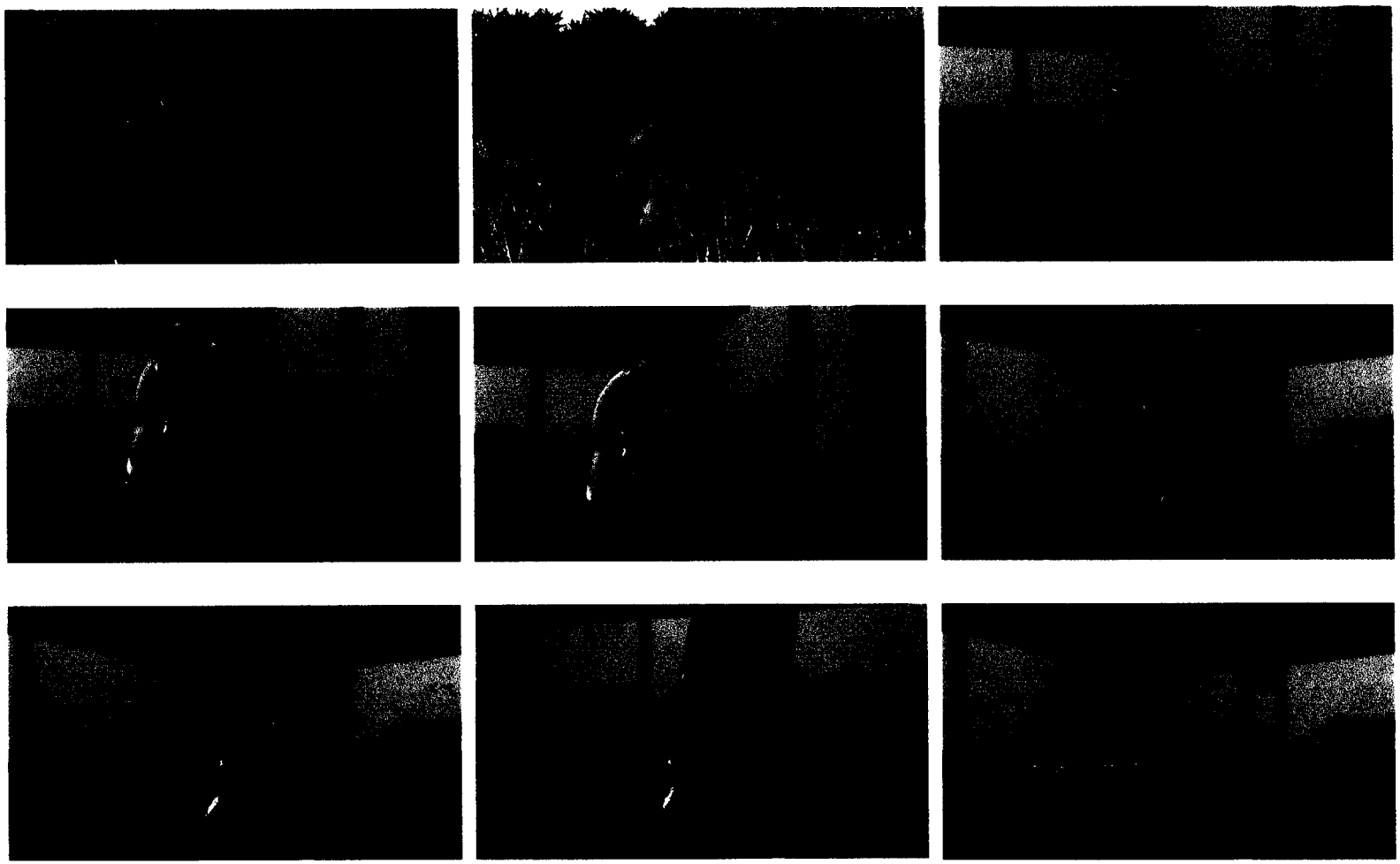

**Figure B.1** Continued

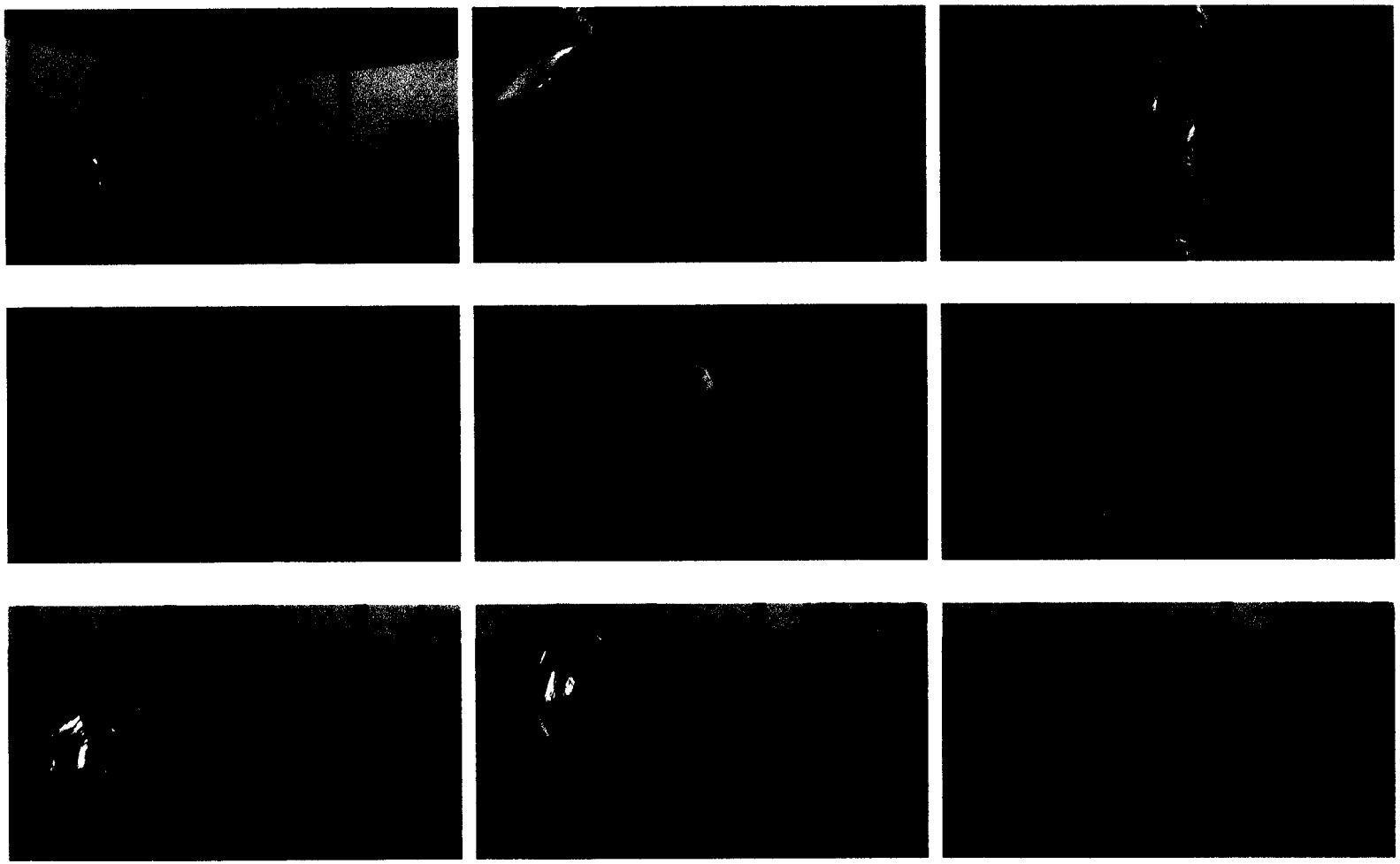

**Figure B.1** Continued

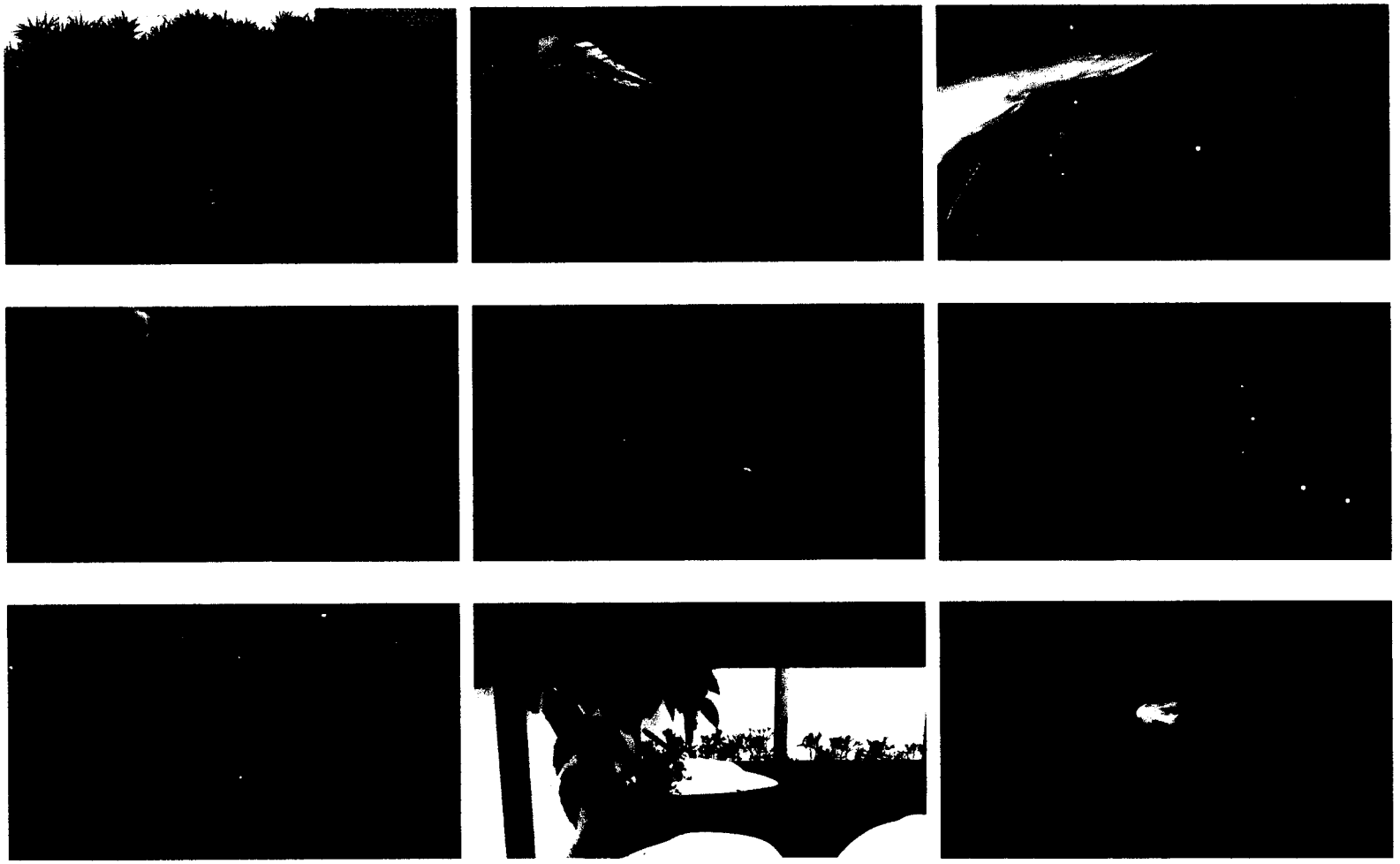

**Figure B.1** Continued

# BIOGRAPHY OF AUTHOR

Daniel Whinnery Bissell was born in Portland, Maine on April 20, 1977. He was raised in Saco, Maine and graduated from The Waynflete School in 1995. He attended the University of Maine at Orono and graduated in 1999 with two Bachelor's degrees; the first in Computer Science and the second in Mathematics. He returned to the University of Maine the following year to begin his graduate work in the MALS department.

After receiving his degree, Daniel will seek employment in the field of computer animation. Dan is a candidate for the Master of Arts degree in Liberal Studies from The University of Maine in May, 2002.