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3D Animation: Creating an Experiential Environment.

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3D Animation: Creating An Experiential Environment

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by

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ABSTRACT

3D Animation: Creating An Experiential Environment

by

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This thesis is a supporting paper for three of my 3D animations created and presented for a Master of Fine Arts graduate exhibition. It discusses how the two realms of graphic design and 3D animation helped me to develop my heuristic techniques of creating animations. Using the three animations as examples, I make an attempt to explain how linear and figurative images influence each other in the creative process of creature/character development. I also discuss the various influences and cumulative explorations behind the imageries of animation. A brief discussion about Asian Indian aesthetic concepts and the general methodology of creating 3D animation using Alias|Wavefront Maya is also included.

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I would also like to thank my mother, father, and sister for their support and believing in my dreams.

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INTRODUCTION

The sculptural forms or “characters” that I create, when they walk, talk, fly, or swim, give me a sense of amazement, knowing that I have not carved, painted, filmed, or pulled any strings or rods. They don’t even have a tangible existence, but still I have learned to empathize with them to understand how they move and behave. This empathy and feeling experience is the core motivation for me to pursue aesthetic investigations in computer graphics. All the carving, molding, sketching, painting, pulling strings, lighting, filming, etcetera are done through technological mediation. Computer graphics, and computer animation in particular, is interdisciplinary in nature. A successful synthesis of scientific and artistic talents is needed for a successful synthesis of ideas and images to result in an animation. This art form is unique in the sense that I had an opportunity to become a sculptor, painter, puppeteer, cameraman, actor, and director, etcetera, in the course of creating a computer animation. I use technology as an assistant to create my own experiential environment.

In this era of globalization, artists are either moralizing about whether technology is impoverishing art or nostalgic for an earlier “primitive” form of art. Technology and media, by creating a homogeneous external reality and new ways of interaction, have broken down cultural belief structures. Along with it comes novel symbol making processes to make an attempt at understanding the various forms of reality; mental form, material form, and the unmanifested essence. I view my personal breakdown of cultural belief structures or ‘memes’ as a liberating experience to understand the primal reality, and hence a new belief structure. The essence of primal reality is seen in primordial art, and it coveys the simple dictum *sarvam sarvatmakam* (everything is related to the totality). In creating my animations, I attempt to create an experiential environment that reflects the unity in totality. In an attempt to interact with other sentient beings and to develop an understanding of our senses, I have embraced technology as a

tool to augment my creative experience. The algorithmic representation of personal vision by a series of computer commands does not diminish the pursuit of a personal artistic aesthetic like many critics of this medium have propagated. On the contrary, it rather offered me myriad techniques to celebrate self-expression. The animations and imagery I create with the aid of this medium are inquiry into the depths of the human spirit. This paper is a supporting document for three of my animations with a brief explanation of their methodologies and aesthetic principles.

An innovative use of technology has been employed throughout animation's history since the 1880s to create ones with higher quality and greater ease.[1] The use of computer technology as an art tool and medium is quite natural for contemporaries for the same above reasons and much more. Because of its ability to execute repetitive functions and duplicate information, the computer encourages divergent production. Thus, for me, this medium and its art tools became a perfect choice to develop divergent and convergent thinking. In eastern traditional beliefs, creating mandalas and patterns enhanced creative thinking. The mandala is both an art form and a type of therapy. At some levels creating mandalas and patterns are divergent productions of art. According to J.P. Guilford, in his Structure of Intellect theory which views intelligence as comprising operations, contents, and products, divergent production lays a foundation for creativity.[2] So, to create Mandalas and patterns (concepts of divergent production) in computer graphics (tools for divergent production) was a natural step for me, given my Indian cultural background.

In this passage, I'll briefly discuss the medium and tools used. Some philosophers and artists argue that the computer plays a bigger role in the art production and therefore should not be considered as either a medium or tool.[3] I believe computer art has similarities to traditional forms of art when one considers the aesthetic factors. The three general areas of aesthetic factors; media or material used, visual design, and content or subject matter, have been the same for all form of arts. I consider the computer as a medium and tool and a means to create and display my art works. The tools used in the process can be divided as hardware and software. The hardware

used are Windows based PC's, OS-9 based Mac G4, a Cannon digital camera, and HP scanners. The software used are Alias|Wavefront Maya for 3D modeling/animation, Adobe PhotoShop and Macromedia Fireworks for 2D manipulation of images, and Adobe After Effects and Adobe Premiere for compositing and special effects. I use 2D software programs to create or manipulate images either as bit-mapped images or vector objects. Bit-mapped images are an array of colored pixels and each pixel is determined by its location on a bit-plane as Cartesian co-ordinate points. Vector objects are shapes in 2D space defined by mathematical formulas. I use 3D software programs to create and manipulate objects in a hypothetical 3D space. The objects and the space they occupy are described as a collection of points represented by x, y, and z units which represent width, height, and depth respectively as Cartesian coordinates. 3D software program also allow creating surface features such as color and textures for the objects created. They can also be rendered or displayed from any point of view by creating a virtual camera and virtual light source.

I used the 2D and 3D application software in a series of studies to have a better understanding of space, form, and color. During my investigations of western theories and concepts of aesthetics, I developed a renewed interest in Asian Indian art. Proportions and patterns play a central role in the creation of Indian art.[4] The Indian art I was exposed to was mainly temple art at Madurai Meenakshi temple in Madurai. Madurai is called the 'Temple City' because of it famous temples and it is a city in the state of Tamil Nadu, India. The ornamental and symbolic paintings, mandalas, and sculptures fascinated me as a child and later on their structures and proportions while studying to be a civil engineer. I never had the opportunity to learn about the theory or practice of the artists and artisans but knew they were based on *silpasastras*, which is an ancient book about the "theory" or "science" of artistic representation. It is believed that ancient Indian artists chose to create an idealized image rather than a copy of nature. This ideal form was conditioned by *Dhyana* or *Yoga*. This method of creating forms by the practice of *Dhyana* (a common Sanskrit designation for both the meditative state and the

yogic techniques to achieve it) is prescribed in *sukranitisara*. Ananda Coomaraswamy and E.B. Havell are some of the early scholars who distinguished this approach of some Indian artists from a Western approach and are also responsible for the translations of *silpasastras* and *sukranitisara* in English. Havell, in his study about Indian sculpture and painting, quoted the *sukranitisara* to the effect that the artist must depend upon their own "spiritual vision" and not upon "the visible objects perceived by external senses."[5] The South Indian temple art reflects this vision, and its paintings and sculptures stand as elements of graphic communication. The graphic diagrams in the form of *yantra* and *pratima* were used to explain the concepts of nature and universe as understood by the ancients. Studying graphic design and animation led me to this avenue of exploring ancient graphic communication.

My interest in South Indian temple art and a desire to understand *pratima* (figurative sacred images) and *yantra* (linear sacred images) have greatly influenced my creative process. By developing my own creative process, which incorporates figurative images and linear images, my ultimate goal would be to make an attempt to understand the 'language of signs' of Indian art. This renewed interest came to me after a few years of probing the western color theories and image making prescriptions of graphic design and 3D modeling and animation. In Chapter 2, I'll discuss my motivations and inspirations. In Chapter 3, I'll briefly discuss the methodology. In Chapters 4, 5, and 6, I'll discuss the making of three different animation projects with three different aesthetic approaches.

CHAPTER 2

MOTIVATIONS AND INSPIRATIONS

> The computer [should be regarded as] more than a fancy picture maker; its powers are versatile enough to carry us into the virtual worlds it conjures up with its computational algorithms…[The] luminous screen under computer control can transport us – like Alice through the looking glass – into the virtual worlds it displays. We can, in a sense, live in these created environments and interact with them [6]

The sense of an illusory medium and the ability to interact at various levels of creation has, in some way, become addictive for me. The medium, with its limitless possibilities of experimentation, although often frustrating, in many ways satisfied my new desires. With art as a mode of mediation, my desire to understand the essence of 'Archetype' that permeates all manifestations, renewed my interest in primordial art in general and Asian Indian art (which from now on I shall refer to as Indian Art) in particular. Computer graphics and 3D animation in particular became a perfect medium for me to explore some of the aesthetic conceptions of primordial art. Computer as a medium and tool also allowed my intuition to connect with my life experiences to explore the conception of new artifacts.

Understanding Indian art and aesthetics required an understanding of various fundamental concepts. Three concepts that I wanted to make an attempt at understanding were: the concept of emptiness (*sunyata*), the concept of devotion (*bhakti*), and the concept of delight (*ananda*). *Sunyata*, at the microcosmic level, depicts potency, maturation, and production, and, in the total cosmological scheme, refers to receptivity, freedom, openness, limitless, and borderless nature. "In brief, it exhibits the dynamic moment as a continuous being."[7] *Bhakti*, from its original Vedic meaning of love between persons, has evolved into referring to religious devotion. Later, in the thirteenth to the seventeenth century, *bhakti* blossomed into a religious movement, the *bhakti* movement. Love as *bhakti* became the soul of aesthetic quests and measure of all that is highest in the creative life of letters, music, and art.[8] *Ananda*, plays an

important role in the Vedantic theory of aesthetics.[9] According to Samkara, an early 8th century Advaitin philosopher, what characterizes an aesthetic attitude, is the removal or suppression of *kama* (desire) and *karma* (activities) while their cause *avidya* (ignorance) continues. When an artist is able to suspend the processes of *avidya/kama/karma*, they receive *ananda* in sporadic contemplative periods.[10] Artists who engaged in unselfish pursuits realized ananda (delight).

Having a background in science and technology, empirical explanation and phenomenal world seemed like the answer to everything. But even with a superficial knowledge of quantum physics and reading books that explore parallels between Western science and Eastern philosophies [11], one can understand that mind and matter are mutually interdependent. The ancient Indian mystics with their prescriptions for the study of mind, which included but was not limited to meditation and creating art, came to the same conclusion as the scientists with their prescriptions for the study of matter. The conclusion being that at sub-atomic world subject and object become one. Now, as the dichotomous understanding of our universe is being challenged both philosophically and scientifically, the prescriptions for creating art and meditation of Eastern philosophies are gaining popularity. As I was learning the fundamentals of graphic design I too developed a renewed interest in Eastern philosophy and Indian art. Artists have tried to reflect the concept of non-duality since antiquity in various manifestations. My investigation of this concept was limited to the figures of Khajuraho in India and their state of *Yuganaddha* or "coincident manifestation of the opposites." This concept of non-duality and that the external and internal world are intimately related, which were communicated through the practice and manifestation of primordial art, was an influence in my creative process.

Furthermore, the contemporary field of mind/body medicine and the scientific understanding of the physiology of meditation has suggested the power of philosophical ideas on bodily processes.[12] Dr. Herbert Benson at the Harvard Medical School has done some extensive studies to establish a correlation between a philosophy of mind and the physiology of brain states. His investigations involved body temperature changes during meditation [13] and

metabolic and electroencephalographic changes during Buddhist meditative techniques.[14] Each of the monks used different techniques but they all involved meditation on complex visualizations. Being in the field of visualization, this motivated me to further investigate the Eastern philosophy and the creation of art for meditative and contemplative purposes.

In addition to South Indian temple art, my other influences have been *tantric* sculptures and paintings, string and rod puppetry of India, and shadow puppets of India and Indonesia. In all these art forms there is a sense of inseparability of connotation and denotation at some levels. Sculptures and paintings at Ajanta and Ellora caves, Khajuraho, Konarak, and Bhuvaneshvar are considered by many scholars to be some of the best examples of *tantric* sculptures. I was studying to be an engineer when I visited most of these places and naturally I was more interested in the architectural complexes and how the art work organically blended and became an integral part of the whole structure. Now, with a different perspective, and having developed my own creative processes, I am able to make a connection between the different manifestations and the conceptual background in the arts.

My interest in 3D character animation and character design led me to the visual aesthetics of Indian string puppets and shadow puppets. The *tantric* tradition in Indian puppetry plays an important role in the form of *yantra* images. These abstract line drawings used for meditation are often drawn on paper or leaves and placed inside the head or body of the puppet. Certain *yantra* passed down from ancestors are believed to have the power to affect people and are not shared outside the puppeteer's family. Traditional puppeteers believed that by following the *tantric* aesthetic conventions the village deity would enter the image. As Zimmer notes, in India the beauty of images is not intended for the aesthetic enjoyment of the secular beholder, it is a contribution to their magical force as "instruments" or "tools" (*yantra*).[15] Even though the magical properties of the puppets and the esoteric practices have disappeared, the visual aesthetics of the puppets and the performance are still followed according to the tantric

principles. These visual aesthetics and the concept of *yantra* have been an influence in my processes of digital puppet creation.

As I started taking art classes, my fluctuating emotions and feelings of being attuned to nature were granted an aesthetic thought. All the concepts, theories, and ideas crystallized in the creative process. The imagery I create and present in the form of animations are the result of various influences and cumulative explorations. The concepts I mentioned above are just a list of few among many that could have been my motivation and inspiration.

> Art is a quantity of doing and of what is done. Only outwardly, then, can it be designed by a noun substantive. Since it adheres to the manner and content of doing, it is adjectival in nature…The product of art – temple, painting, statue, poem – is not the work of art. The work takes place when a human being cooperates with the product so that the outcome is an experience that is enjoyed because of its liberating and ordered properties.[16]

This experience of bliss (*ananda*) and liberation by creating an experiential environment is the key to my creation of animations. 3D animation and computer graphics is a perfect medium for me to express my psyche's non-verbal response to events. By exploring Indian philosophy and aesthetics, I define a space through the interplay of forms in a manner that would be impossible for me without computer technology and digital medium. Through my creations, I hope to express certain aesthetic properties of the experiential environment in the experience of the perceiver

CHAPTER 3

METHODOLOGY

In this chapter I'll briefly discuss the general methodology involved in the creative process of using the two realms of graphic design and 3D modeling and animation that result in 3D animations and patterns. It is a process where shapes and patterns created in a 2D space become inspiration for characters developed in a 3D space and vice versa. For the purpose of this discussion, 2D space means a 'picture plane' that has only length and width (X and Y axis). This includes both a piece of paper and a computer monitor. Two-dimensional drawings on the monitor are done with the aid of 2D application software like Adobe Photoshop, Macromedia Freehand, and Macromedia Fireworks. 3D space means a 'pictorial space' that is presented to the artist on a computer monitor that gives a sense of depth (X,Y, and Z axis). Three-dimensional drawings on the monitor are done with the aid of 3D application software called Maya, developed by Alias/Wavefront.

Because I don't follow any specific steps or remember what influences me to take the next step, I'll try to explain my process with a few examples from one of my projects called "Evoluck." As I was studying the shapes and patterns found in nature, one among many that fascinated me was the design and pattern of the wings of different insects. The wings became a subject of a few of my drawings and designs in 2D space. After trying different materials, I found a mix of charcoal, oil pastels, and pencil to be my choice to create drawings that exhibits surface textures. By layering colors and using a pencil and empty ball point pen, I was able to create shapes and patterns on top of the layered colors. By varying the pressure applied, either just the top layer of color was removed or all the layers were removed to reveal the paper surface. This process gave interesting surface texture to the drawings. So I tried scanning the drawings and used them to create surface textures for 3D models created in Maya. After a few experimental trial and error processes, I had a method where I would model different shapes in

Maya and use the scanned images of my drawings as texture images to create surface features for the 3D models. Figure 1 shows an insect's body with wings as I found and also a scanned image of a drawing on paper and its close up. I modeled different insect wings in 3D using Maya and used the drawings of wings to create surface texture. As I was trying different ways of modeling and texturing, I had a collection of 3D wings. So I decided to create a simple character that could use these wings. I wanted the characters for this project to be an 'impression' of unity of several entities rather than a 'representation.' The different images of the resulting character are shown in Figure 2.

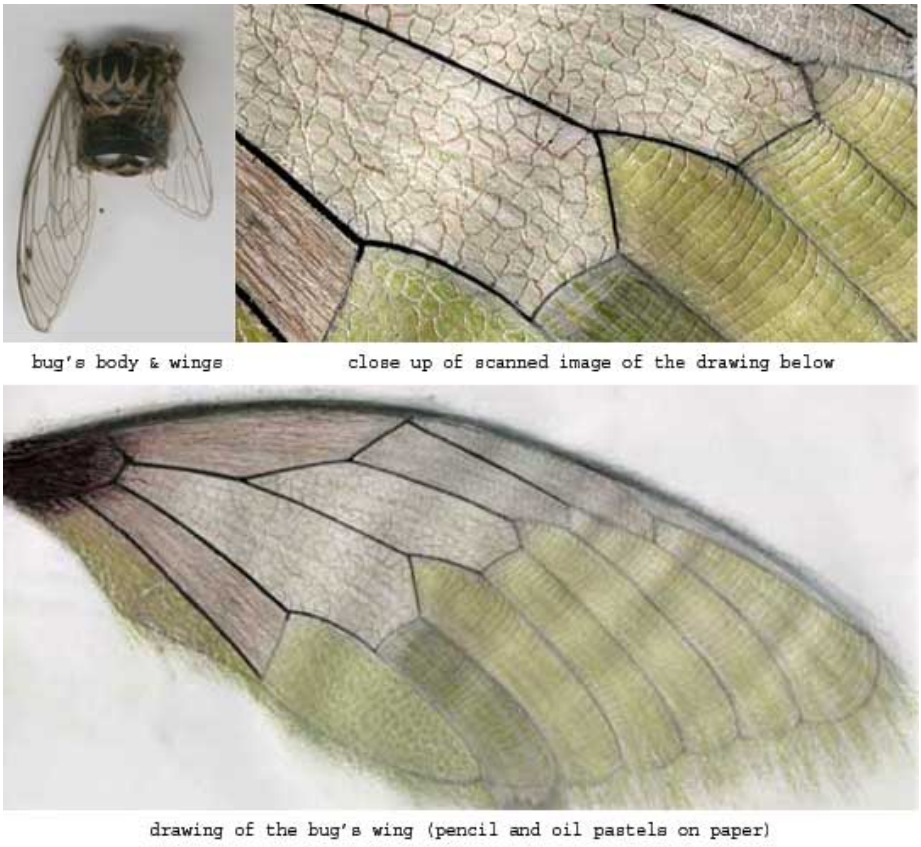

Figure 1 – Photo of a Found Bug (Cicada) and a Drawing of the Wing (Pencil and Oil Pastel)

After creating the character, simple patterns and textures were directly painted on the 3D surface of the body by using the 3D Paint program within Maya. Figure 2 shows the different

views of the rendered image of the character. The surface feature of the wing as seen on a rendered image is a result of a combination of mapping of the drawing (Figure 1) on the 3D wing surface and Maya's Layered Texture capabilities. After the character is textured and attached to a skeleton, I created animations of the character walking, flying, and swimming. Each one required a different technique. I liked the swimming sequence in particular and did further research into Maya's animation capabilities to create an animation sequence that would create an impression of shoaling of fish. The swimming sequence seen in the animation was done using the Dynamics module of Maya. The Dynamics module of Maya helps to simulate various motions that follow the laws of physics.

Figure 2 – Rendered Image of Different Views of the Character

The physics and mathematics involved in these processes have become more transparent in recent versions of Maya. There are infinite ways of doing animations using Dynamics. I experimented with particle animation within Dynamics. It is beyond the scope of this paper to

explain the process. In short, with a basic understanding of fluid dynamics and creative use of particle systems, I was able to create the animation sequence that appears to be multitudes of shoaling creatures.

Figure 3 shows the wire frame model at top left, the rendered image of the model at top right, and the screen shot of the Maya interface where all the mechanics and dynamics of the character is simulated. The Dynamics simulation was run several times by varying the attributes like force, speed, gravity, collision, drag, etcetera until the desired effect was achieved. Then, an environment was created to give a surreal look to the animation sequence.

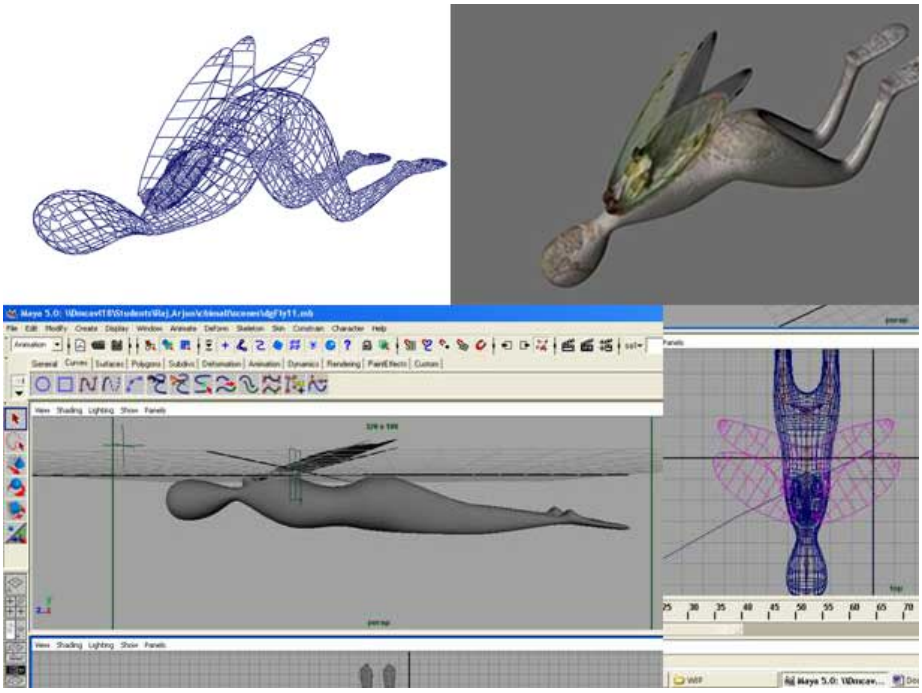

Figure 3 – Image of Wire Frame Model and Screen Shot of Maya Interface

By having cameras at different angles and at different places along the path of the animation, different camera cuts were rendered. Figure 4 shows the rendered image of the static character at top left and three stills of the character and the environment from the animation sequence.

Figure 4 – Rendered Images Showing How One Character Becomes a Multitude of Shoaling

After the stills are rendered in Maya and composited in After Effects, the process of pattern making and character development continued. The character developed for one animation sequence becomes an inspiration for creating 2D designs and other patterns and mandalas. These imageries gave me ideas to develop other characters in 3D. The 3D characters viewed from different angles create different picture planes and the different outlines of the same shapes are reduced to different forms. These forms, when further reduced as abstractions, become inspirations to develop more patterns and thus the process becomes cyclic. For example, in the case of the above animation sequence, the different poses created for the swim sequence when viewed from the top-view camera in Maya were the inspiration for a series of designs based on it. Figure 5 shows an example from the series.

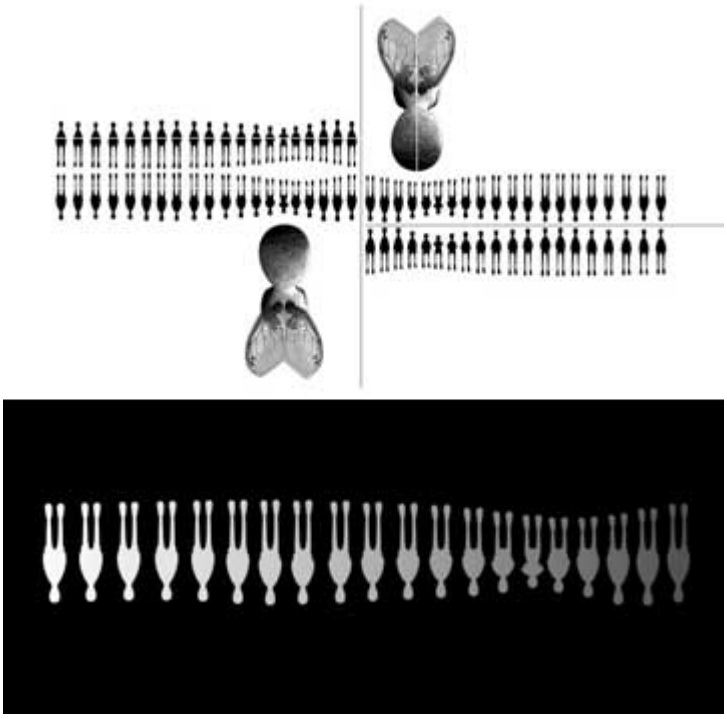

Figure 5 – An Example From a Series of Designs Based on Different Poses of an Animation

Similarly, views from other camera angles provide a different set of design elements. Thus, different perspectives of the same ‘object’ become a ‘subject’ for another series. For example, a rendered image of the character from the front-view camera was the inspiration for another series of designs and mandalas. Figure 6 shows an example where the rendered image of the front view of the character becomes a design element. The top left image is the rendered image of the front view of the character with its wings spread. Here, the character is reduced to a shape that is used as a design element. It also shows examples from a series of mandalas and patterns created from the repetitious use of this design element.

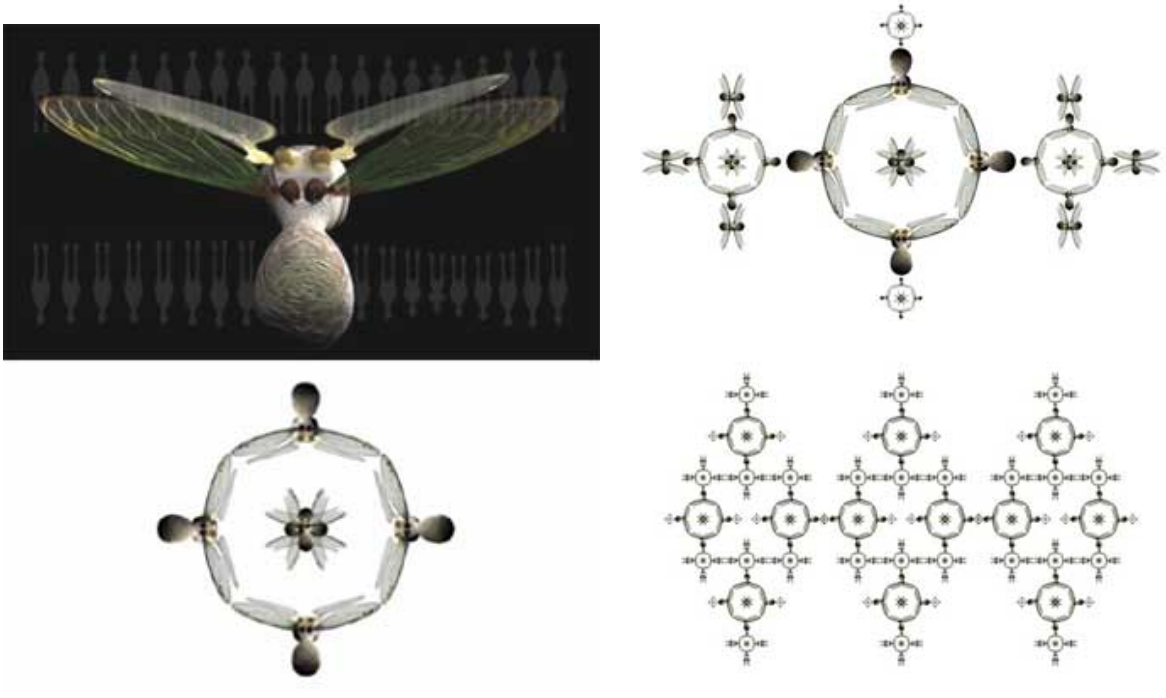

Figure 6 – Rendered Image of Front View and Examples of Patterns

Furthermore, if I like any particular element of a character that I created, I use it to create more designs and patterns. A shape with details and individual identity is abstracted as a design element or motif. Figure 7 shows an example where a part of the character's wings' structure is abstracted and used as a design element. These images of designs and patterns give me ideas to develop other characters. The motifs sometimes become virtual "building blocks", which when I combine in simple and complex spatial relationships, become inspirations for character design. These imagery and all the other designs and patterns created by methods briefed earlier are sometimes also used as textures that give surface features to 3D characters. Thus, my projects become interconnected in a way.

Figure 7 – Image of a Part of the Wing Structure and Patterns Based on It

In summary, unrelated forms are composed in 3D space and linked together to create characters. The visual image of the character created acts as a symbol because an idea is incorporated into the design process. Fundamental graphic design principles applied in 2D composition, like: static and dynamic, balance and imbalance, repetition and rhythm, motif and

pattern, etcetera are explored in 3D compositions of character development and animation. Different perspective views of the symbolic characters are used as motifs to create patterns and mandalas. Motifs, patterns, and mandalas are used to create surface features and textures of unrelated new forms. Unrelated forms are again composed together to create new characters. Thus, there is a sense of unseen unity among the different characters and in this cyclic process a new aesthetic is presented.

CHAPTER 4

MAKING OF ‘EVOLUCK’

It all started as a modeling and texturing exercise that I did to learn Maya 4.0, especially the added new features like subdivision modeling, 3D paint, and Non Linear animation. I started by modeling individual forms that are based on forms found in nature, which I had collected over a period of 2 years. The collection consisted of leaves, nuts, seeds, fly seeds, buds, bugs, and flowers. I started collecting them to basically study their forms, color, and texture. As my collection of different forms grew, both in the physical world and in the virtual world, one day I decided to make 3D mandalas with them. The mandalas gave me ideas to develop characters out of them. I randomly picked forms and textures from my collection and started putting them together in 3d space and just followed my intuition and tried different combinations. I would look for forms that I liked in all the four default views of Maya (top, front, side, and perspective). I saved the ones I liked and then added details to the model if necessary.

All the characters that I included in the “evoluck” project were created by a process that I will briefly discuss in the following steps. It is beyond the scope of this paper to go into detail about the different processes involved in Maya, so I have broken down the process into broad steps that would give the reader an overall understanding of the creative process involved in the production.

1. The basic form of the objects collected is modeled with no intention of accurate 3D replication. The screen shot of Maya interface as seen in figure 8 shows the four default views (top, front, side, and perspective). Infinite numbers of other views can be displayed as well by creating other cameras and selecting the desired camera as the panel view.

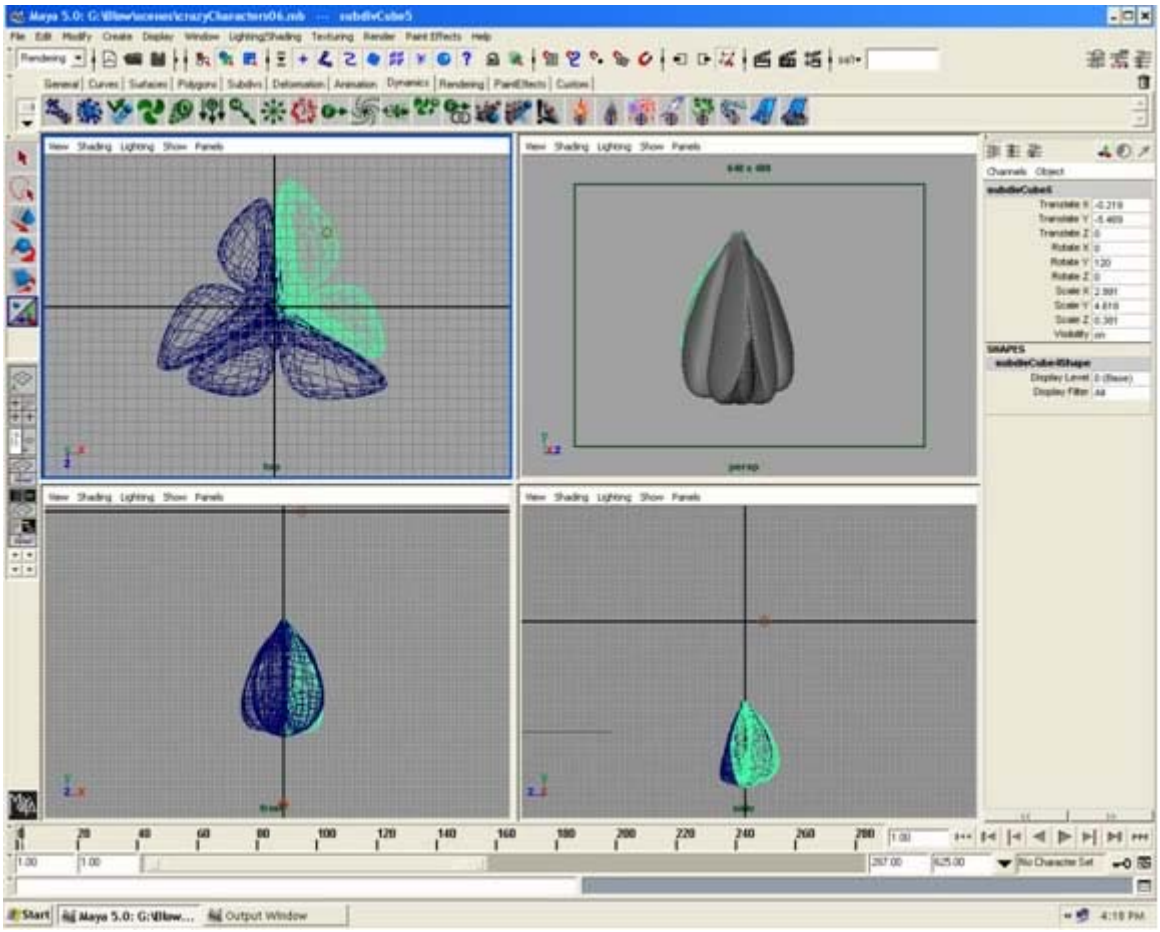

Figure 8 – Screen Shot of Maya Interface Showing the Four Default Views of the Camera

2. The wire frame model is given a surface material and various textures are applied to the surface material. There are limitless ways of creating surface features such as color and texture within the Maya interface. In this example, a ramp (a gradient of colors created by picking suitable colors) is attached to the color node of the surface material. A 2D paint program called Macromedia Fireworks was used in creating a gray scale image that would give the surface a bumpy texture. White areas of the image have no effect, while black areas have the most. Once this image is attached to the bump node, increasing or decreasing the bump value of the node can control surface bumpiness. Surface features are seen only when the object is rendered using the software render commands. Figure 9

shows the rendered image in the render window to the left and the ramp color node to the right. The different node connections are made in the Hypershade and the Hypergraph windows that are shown at the bottom. Figure 10 shows how changing the ramp colors changes the surface features of the rendered image from greenish to brownish hue.

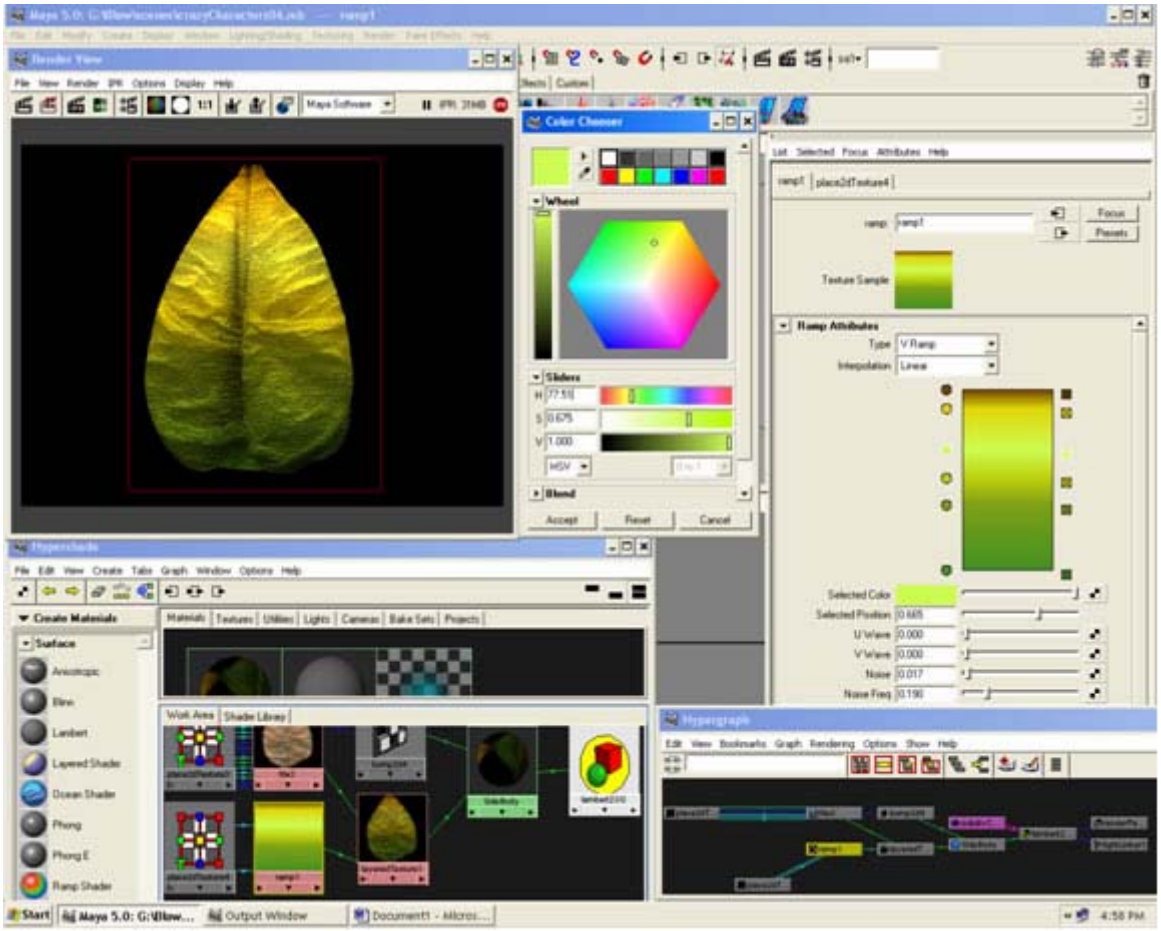

Figure 9 – Screen Shot of Maya Interface Showing the Different Material Attributes and the Render Window

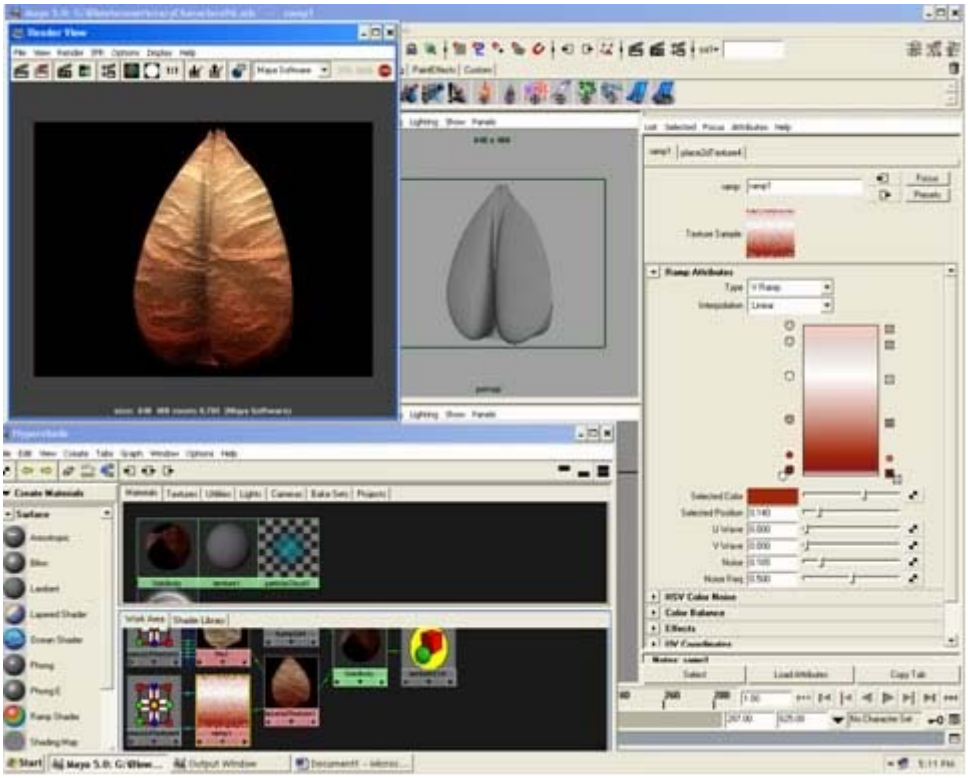

Figure 10 – Screen Shot of Maya Interface Showing the Ramp Color Attribute

3. After finishing the surface features, the different objects were imported into a same scene and assembled in 3D space to create forms based on personal aesthetic and symbolic value. As I finalize my design, I start seeing the form as a character (figure 11). As I start seeing them as characters, I add other forms that connect the original forms that I started with and assemble them in the likeness of a sculptor. The only difference here is the material difference. Instead of clay, metal, or wood, 3D objects are removed, connected, meshed, or welded together in different ways to form a cohesive whole out of different parts.

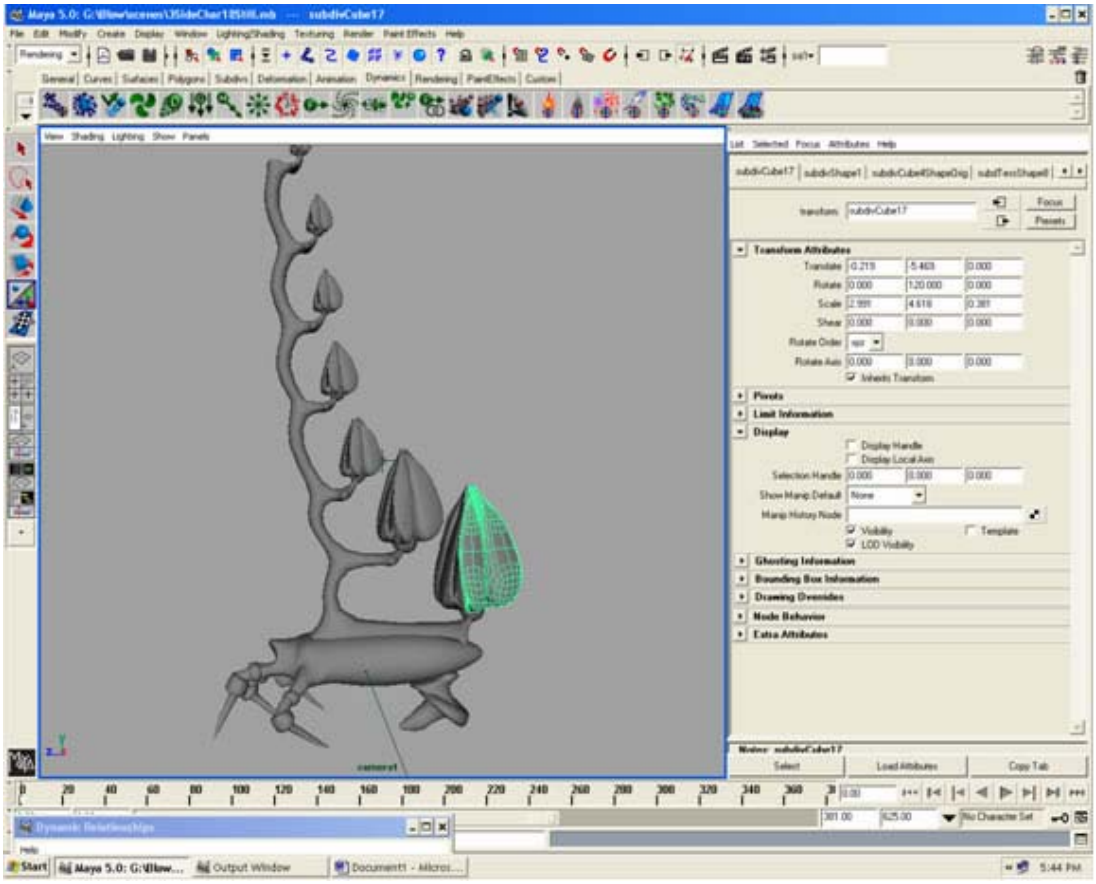

Figure 11 – Screen Shot of Maya Interface Showing Different Forms Being Connected to Form a Character

4. After the parts are connected together to represent a single body, a skeleton is created within the body (Figure 12). The skeleton is created in such a way that joints are placed where the parts needs to bend. Then a set of handles, constraints, deformers, locators, etcetera are created to act as control points. These are analogous to strings and other mechanics of a puppet.
5. Then the body is attached to the skeleton, which is referred to as skinning in Maya (Figure 13). Mostly, during the first attempt to move the skeleton, the body will not quite follow the skeleton. The skinning is then edited through various methods until the skin of the body deforms correspondingly to the transformations of the joints in the skeleton.

That is, if the handle of the leg is moved, the geometry that was used to create the shape of the leg should move and bend accordingly.

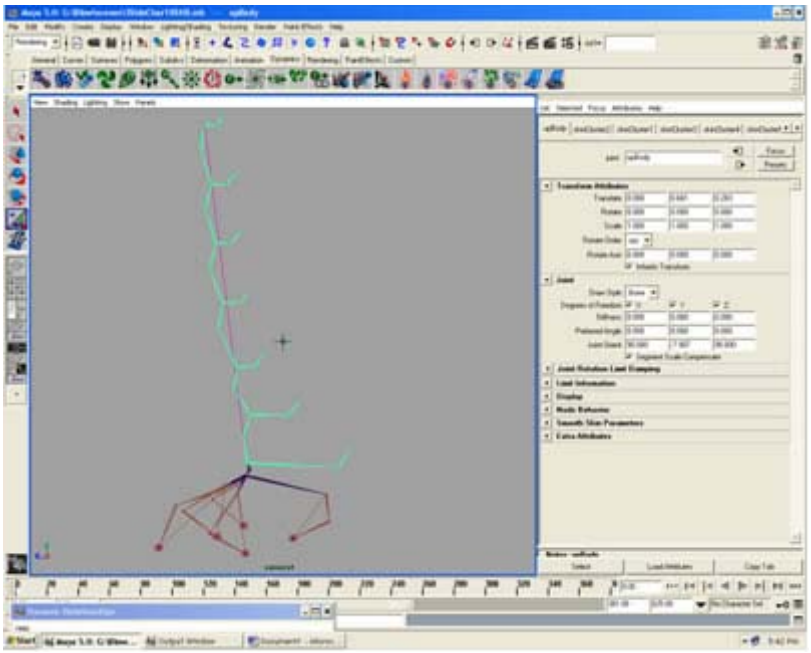

Figure 12 – Screen Shot of Maya Interface Showing the Skeleton

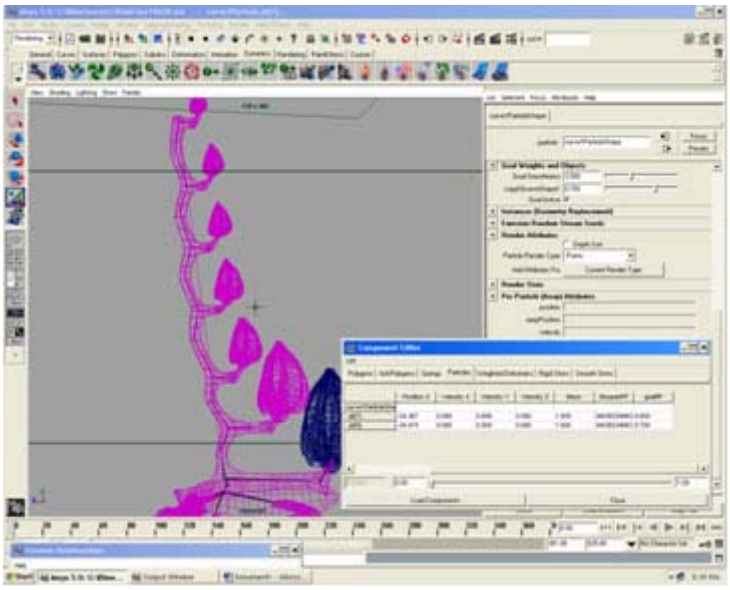

Figure 13 – Screen Shot of Maya Interface Showing the Skin and its Attributes

6. An environment is created and the character is placed within this environment. Lights and cameras are created as appropriate for the animation. Three-point lighting (Key light, Fill light, and Back light) does not always produce the desired look. Lighting is the most crucial element in the whole production. Some scenes may require lights that only illuminate certain objects in the scene. This is achieved by linking the light to object(s). The linked light has no effect on other objects.

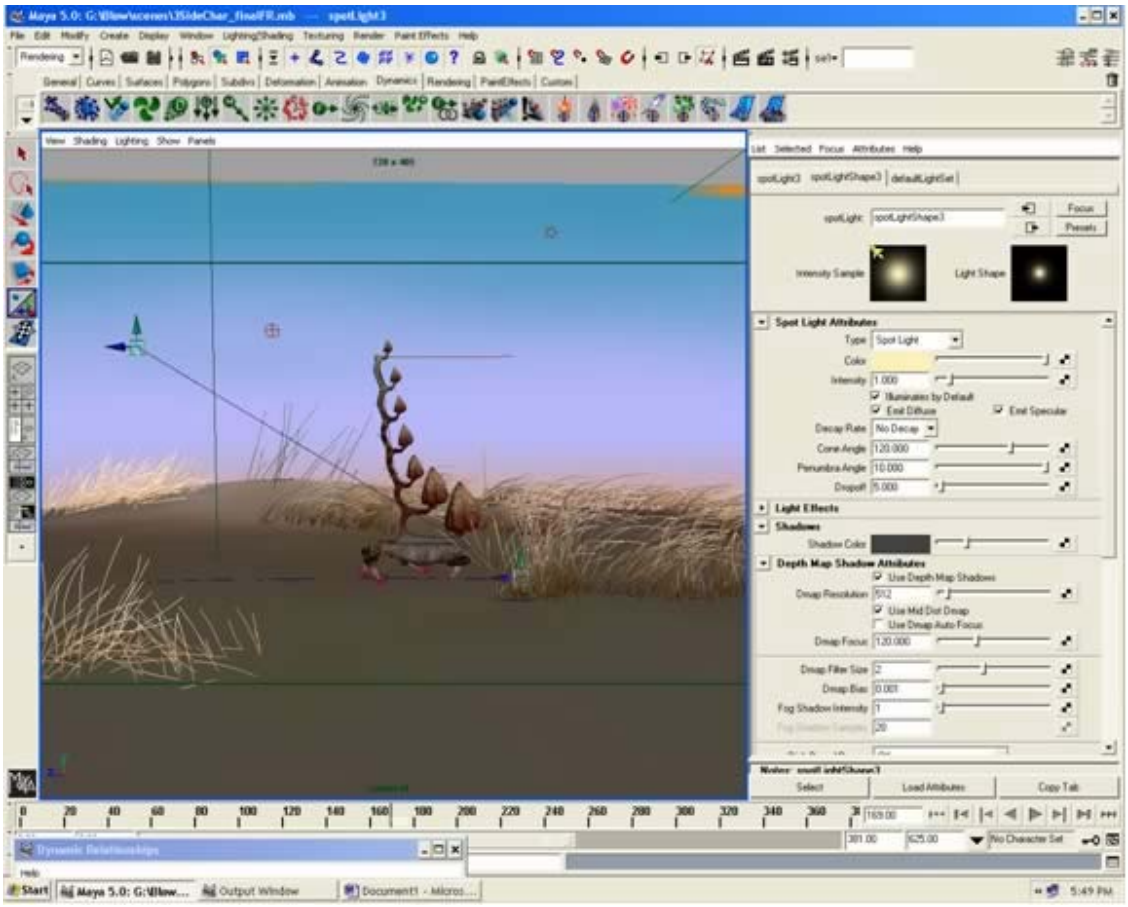

Figure 14 – Screen Shot of Maya Interface Showing the Environment and Lights

7. The character is then animated by setting keys on a time line. At frame 1, the different handles are moved to achieve a desired pose and all the transformations of the handles

are recorded by the process called ‘setting keys.’ Then at frame 10 or 15 or any other frame, depending on the animation style, the handles are moved again to achieve another pose and another key is set. This process is continued until a cycle is complete. The animation keys are saved as a clip and can be reused any number of times. This new function (non-linear animation) in the newer versions of Maya saves a lot of time especially for walk cycles. Figure 15 shows a Trax Editor window at top with a clip named ‘walky’ being applied to the character. The final animation sequence seen on the project was achieved by adding various other animation techniques like Dynamics, available within Maya. With the Dynamics option, gravity, collision, soft body/rigid body dynamics, etcetera are used to achieve a more natural movement.

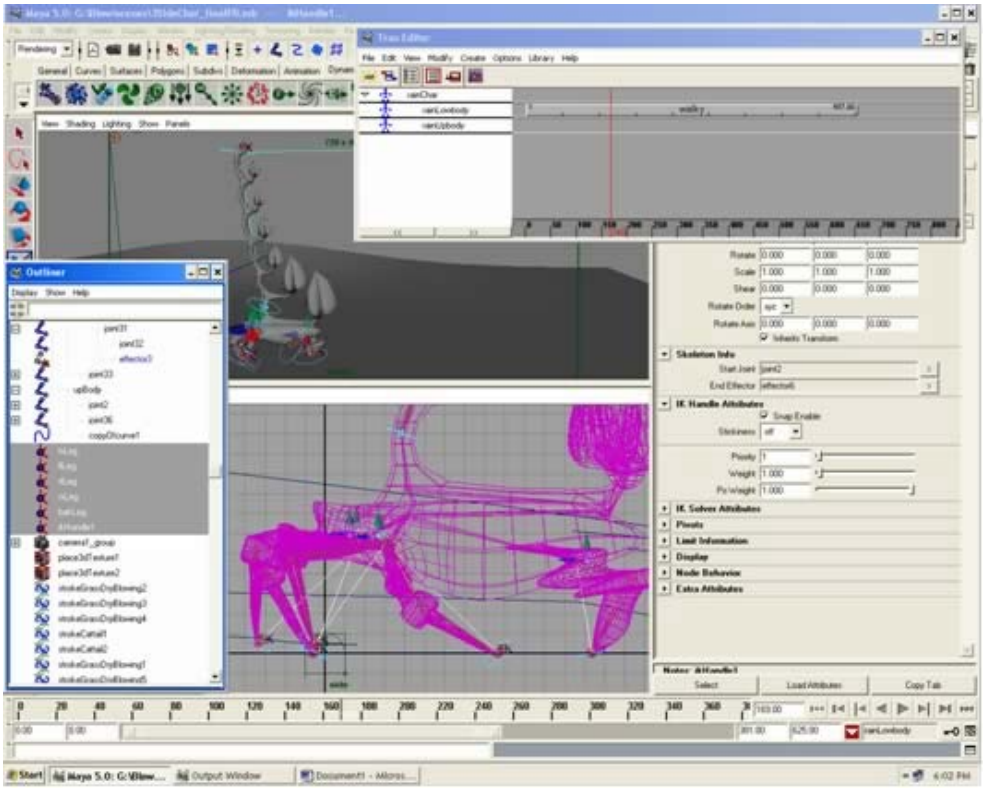

Figure 15 – Screen Shot of Maya Interface Showing the Leg Handles Used to Create the Walk Cycle and the Trax Editor Window at the Top

8. Finally, the animation is run as an un-rendered movie to test the motion. Then, single frames at different points in time are rendered to make sure the lighting and surface features behave the same throughout the entire time line. Figure 16 shows un-rendered view at the top and the rendered view at the bottom. The scene is then rendered as layers and the output images are imported into a compositing software application. In this example, sky, ground, character, and grass were rendered as separate layers. This not only saves render time but also gives options to make changes in post production. For example, the color of the sky or ground can be changed without having to re-render the whole sequence. I used Adobe After effects and Adobe Premiere for compositing and to render the final animation sequence as a Quick Time movie.

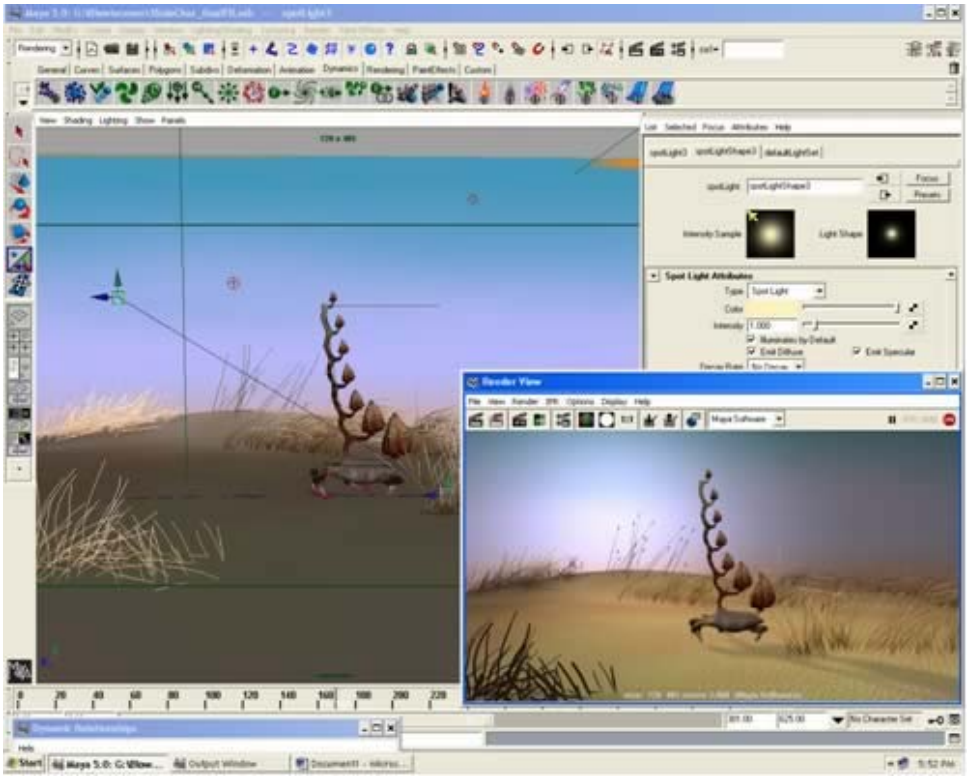

Figure 16 – Screen Shot of Maya Interface Showing the Render View Window at the Bottom

CHAPTER 5

MAKING OF “MEMETIC DANCE”

In this chapter I’ll briefly discuss about the inspiration and the different steps involved in the creative process of visualizing traditional beliefs with the aid of a new media.

My inspiration for this project was a study of colors I did using leaves and petals. As I come from a place where the leaves are pretty much green all the time, I was amazed by the color change. Before this study, I have never paid much attention to the foliage color change during the fall season. I started collecting different leaves from different trees at different time periods through out the fall season. I scanned them and made a digital catalogue. Looking at those images of leaves and their change over time made me try an animation in Maya. I did an animation where a falling leaf goes through color change in a reverse order, from brown and dead to green and full of life (sample animation). While working on this project, I made mandalas of leaves and petals of different colors and shapes. One of them had seven layers and this made me think about the seven chakras and the imagery eventually led me to subsequent projects that are based on ancient traditions and belief systems.

I come from a culture that believes that all living things have a positive and negative energy that flows in a crisscross pattern and that the movement of energy is visualized as ascending and descending forces. These forces are believed to activate energy centers at specific levels. Artists since antiquity have represented this tradition that embraces the charka system of Tantric Hinduism, in various ways. The most common form of representation is shown in figure 17.

Figure 17 – Image Showing one of the Many Representations of the Charka System

Every artist tries to represent both the body and embodiment in various ways that are culturally influenced. As I was learning the Maya interface and its object-oriented architecture, it was explained in the *Learning Maya* book, that, "Maya's architecture can be explained using a single line-*nodes with attributes that are connected*." All Maya objects, including geometry, shading, and lighting are referred as nodes. A node is nothing but an object that consists of attributes and behaviors. Changing these attributes over time creates an animation. Further more, connections and dependencies can be created between the attributes of these nodes. For example, for a sphere object, a dependency could be established between the x-axis scale attribute and the color attribute of the material assigned to the sphere. So, when the sphere is scaled in x-axis, the color of it automatically changes based on how the dependency is created. This ability of Maya to create animations by creating connections was the influence for creating the animation project "Memetic Dance." I wanted to try my representation of the body and embodiment and create a visualization process that would provide an avenue for meditation and contemplation.

I'll briefly discuss the process and the influences involved in the making of "Memetic Dance" in the next few paragraphs. I wanted to represent the body by using simple geometric shapes like, spheres, cylinders, and cones. I have seen a lot of representations of the charka system and having those images in my mind, I modeled a simple character as shown in figure 3.

The positive energy is represented by a form through which the vibrant colors of rainbow flows through up and down. The negative energy is represented by a mirror-form through which wavy black and white pattern flows through. The seven energy centers called chakras are represented by simple forms that are symbolic of lotus flowers and are placed along a central axis where the opposing forms crisscross (Figure.18). While I was doing a different study about colors and forms, I had collected some petals and leaves and made different interactive mandalas just for the fun of it. Figure 19 shows some of the stills. I modeled them in Maya and rendered them from different view points and used Macromedia Flash application to make them interactive.

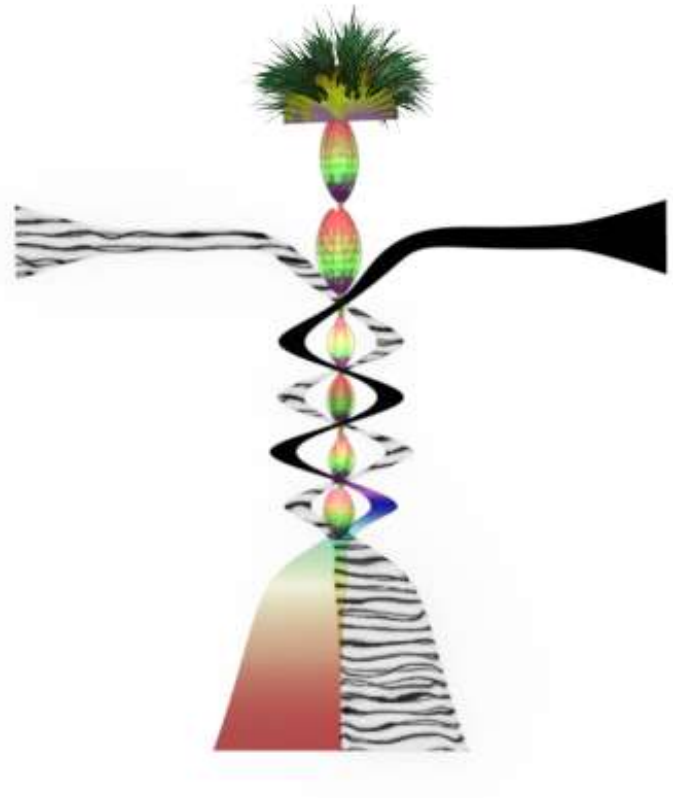

Figure 18 – Rendered Image of the Character

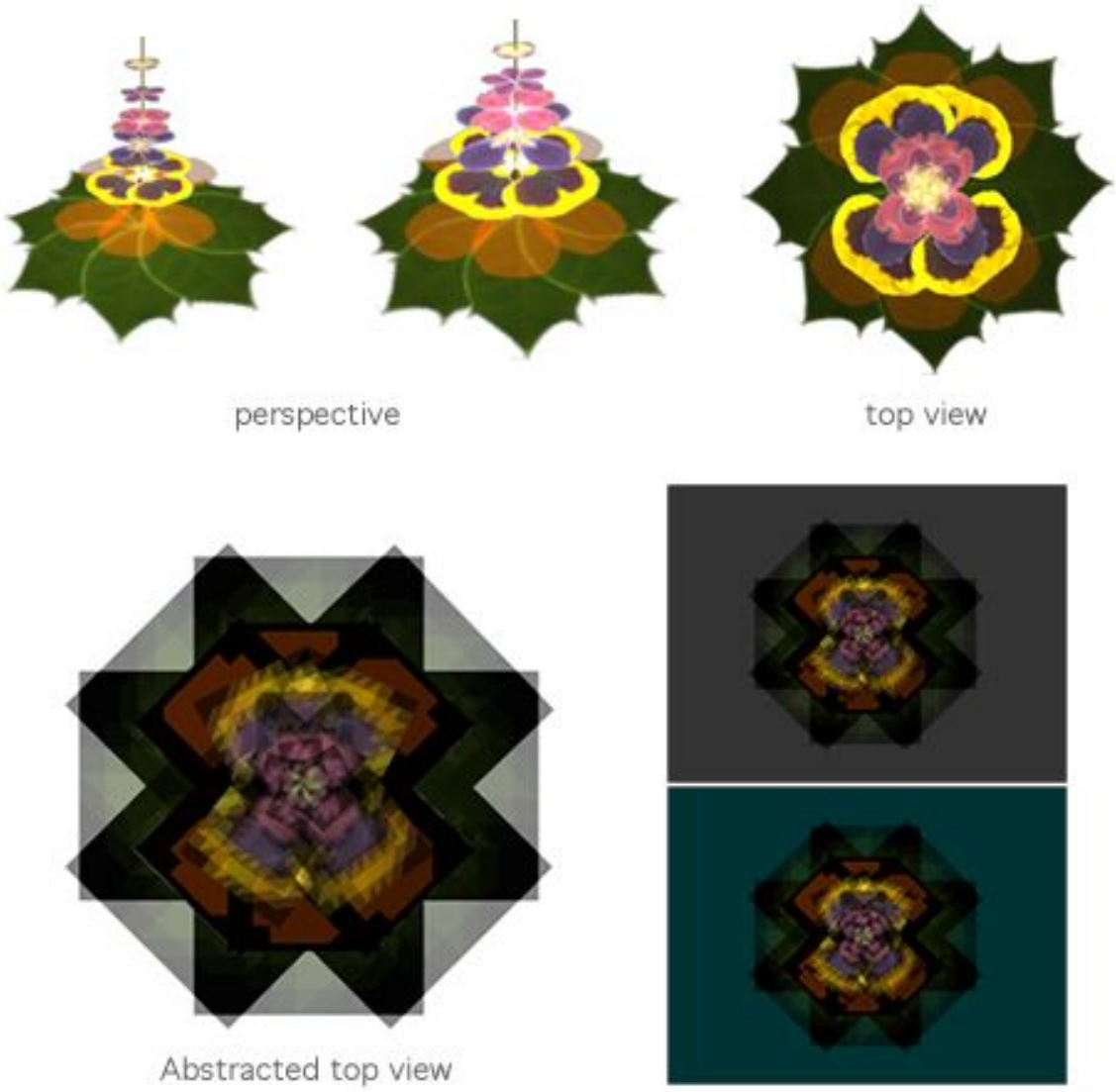

Figure 19 – Perspective and Top View Along with Abstracted Top View at the Bottom

Figure 20 – Sanskrit Letter Representing the First Center Called ‘Mooladhara’

The charkas are usually represented with certain number of leaves, petals, or spokes. So to add some extra characteristics and symbolic meaning to my original character shown in Figure 3, I added the seven petal structures just below each of the seven lotus forms. The abstracted renders of the top view (Figure 19) along with the seven Sanskrit symbols (Figure 20 shows one of the seven Sanskrit symbols) that represent the charkas were used as textures to create surface features of the seven spheres that I used in the animation to represent the macrocosm. A rendered image of the microcosm/microcosm is shown in figure 21.

Figure 21 – Rendered Image of Microcosm/Macrocosm

Because these forms are created in a virtual 3D space, I view them from different angles and then render them as images and use those images to create further 3D forms or just as design elements in a 2D space. Figure 22 shows a top-view of the character and the petal structures. These images were used to create surface textures by way of a method called Layered Textures within Maya.

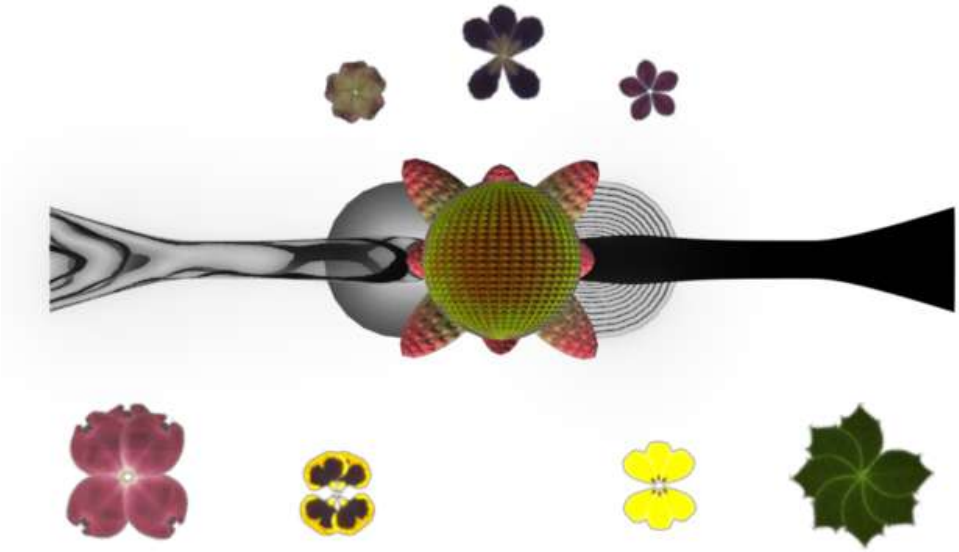

Figure 22 – Rendered Image of Top View of Character and Petal Structures

After the character is textured, a skeleton is created and bound to it. Then using Maya's capabilities to create connections and dependencies, a methodology is adopted to create expressions (mathematical formulas) to create a series of inter dependent animations. For example, as the camera moves up the character, the object that is symbolic of the charkas, open and close. The opening and closing animation in turn causes the buds within them to glow and dim. As the camera inverts, the colors of the objects changes to their respective opposite colors

in a color spectrum. Towards the end of the animation, as the rainbow of colors flow upwards on one side of the body, the different charkas opens and glows. At the end of the animation, the buds at the top blossom to flowers signifying the thousand petals of the seventh charka called the 'Sahasrara.' All these animations occur in a predetermined sequence where the occurrence of one affects the subsequent animation.

In this paragraph, I'll briefly discuss the making of the animation in Maya. The character was developed in an attempt to create an archetype that represents the charka system. Primitive shapes like, cylinders, spheres, and cones were re-shaped using various options available in Maya to create the character. Figure 23 shows the basic stages in the development of the character. I start in the wire frame mode where the primitive shapes are manipulated and arranged in a 3D space to create a form. Then I apply material properties to the shapes. Materials are chosen to give surface characteristics like skin, metal, plastic etc. Finally, color, texture, glow, transparency, etc. are added to the surface material

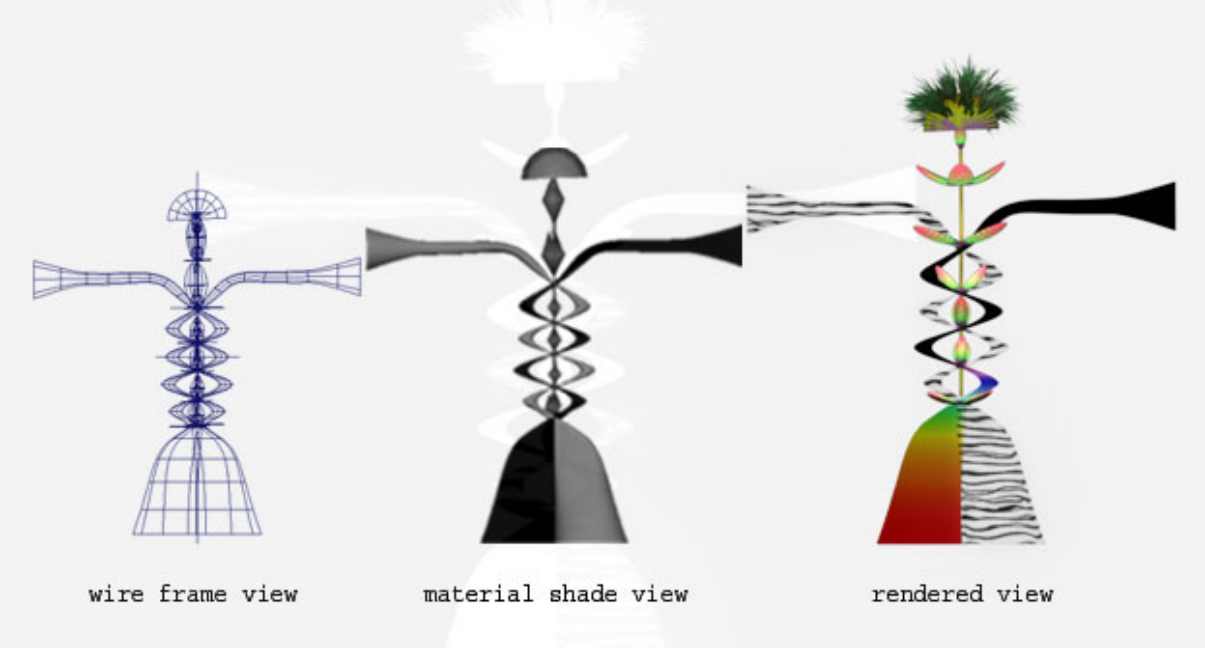

Figure 23 – Three Basic Stages of Character Development

A series of connections and dependencies were made between various attribute of the geometry (e.g. scale, rotation, translation), surface material (e.g. color, glow, texture), camera (rotation, translation), and light (translation, intensity, color). This was achieved by mathematical expressions, set-driven keys, and simple MEL scripts. For further details on these methods please refer to any book on Maya that covers these topics. Figure 24 shows the different views of the model as seen through the Maya interface.

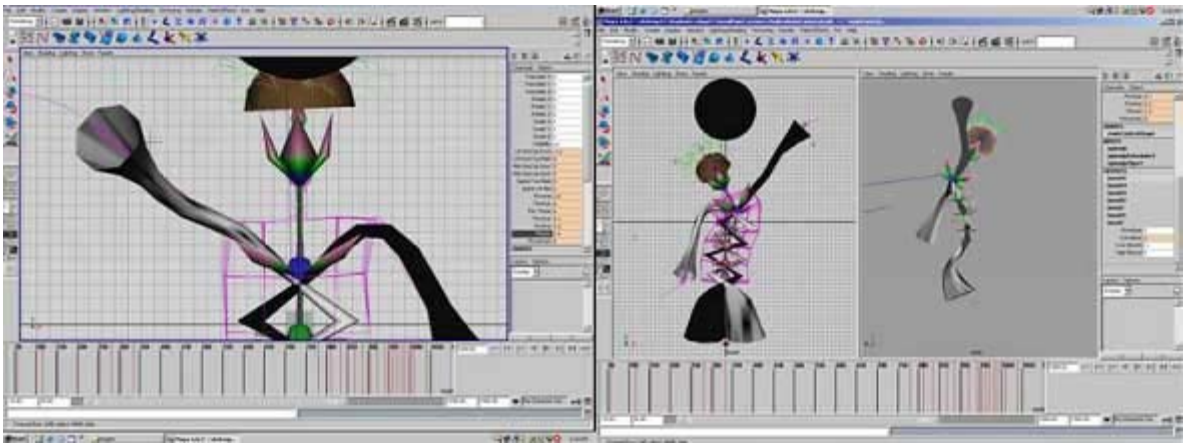

Figure 24 – Screen Shots of Maya Interface Showing the Character

Figure 25 shows the Maya interface through which the objects are given surface features like color and texture. This screen shot shows the rainbow ramp texture that was applied to the cylinder that represents the positive energy. Texture attributes are animated to create various effects. For example, the position of the colors in the ramp is animated to create the flowing energy effect. Figure 26 shows the camera attributes that were animated to create an effect of passing through the seven spheres. In this animation project of inter connected nodes, the camera is at the top of the hierarchy. Change in value of its position and rotation creates a sort of chain reaction in an inter-connected system.

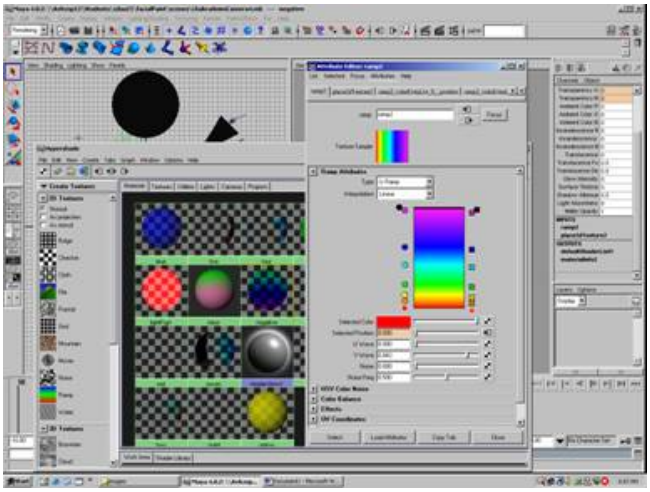

Figure 25 – Screen Shot of Maya Interface Showing Surface Material Attributes

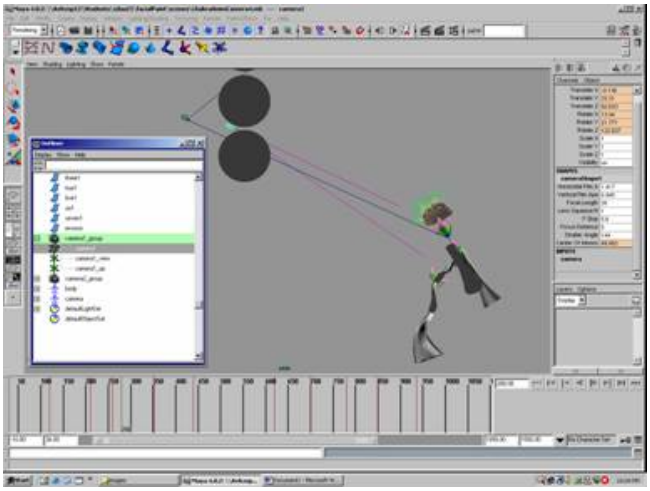

Figure 26 – Screen Shot of Maya Interface Showing the Cameras Center-Of-Interest and Rotation Attributes

In “Memetic Dance,” the camera moves almost every second, creating a unique composition in every frame of the animation. It follows a pre-determined path created by me to enhance the positive and negative space and how they interact with the edges of the frame. This path in effect controls the whole visual communication and invites the viewer to discover things that are not so obvious.

CHAPTER 6

MAKING OF “CHOPCHOPPY”

I was fascinated by Wallace and Gromit’s series that was shown in one of my animation classes. These short films are creations of Nick Park and his team at Aardman Animations. These films are done by a process known as stop-motion animation. The motion of a character or an object is broken down into increments and filmed one frame of film per increment. I wanted to try stop-motion animation using plasticine clay and armatures. Armature is basically a structure that supports the clay figure while the motion increments are made. Due to the time consuming nature of the process, and the expenses involved, I had to abandon the project. Two semesters later as I was learning the new version of Maya (Maya 4.0) and its non-linear animation techniques, I decided to do an animation project with simple characters that resemble plasticine clay models and the animation style would resemble stop-motion style of animation. As the project evolved, I started trying different things and the project totally deviated from my original story boards and I kept doing whatever I felt like at the moment. The result was the animation ‘Chopchoppy.’ I’ll briefly discuss a few things that I experimented in this project in the next few paragraphs.

I used the non-linear animation capabilities of Maya to create different poses of the characters and then mixed and matched those poses of upper body and lower body to create desired animations. The next few steps will briefly explain the non-linear animation capabilities of Maya without going into much detail.

1. After the character has been modeled, a skeleton is created and the model is bound to it. The skeleton is analogous to an armature. Moving the handles of the skeleton moves the character. The handles of the skeleton are moved to create a desired pose. For example, to make a character walk five poses are created as shown in figure 27.

Figure 27 - Five Poses of a Walk Cycle Starting from Right

2. Each pose is saved and Maya stores them separately under Character Poses as shown in Figure 28. Before creating poses, a whole lot of other steps need to be done to break down the entire skeleton into characters and sub-characters. In the case of a bipedal character (two legged), it can be broken down as upperbody and lowerbody. Upperbody can have sub-characters like spine, neck, head, etcetera.

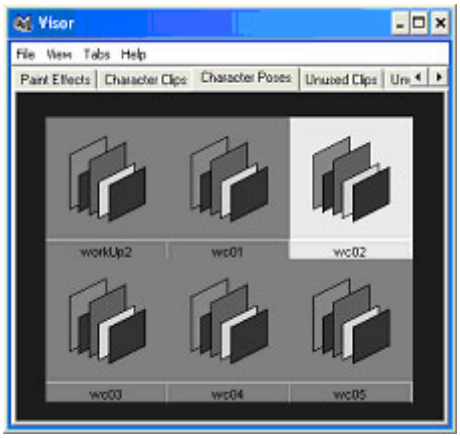

Figure 28 – Visor Window Showing Different Poses

3. Non-linear animation features are analogues to non-linear video editing systems. The poses created are stored as snippets. The pose snippets are placed on a time-line as shown in figure 29.

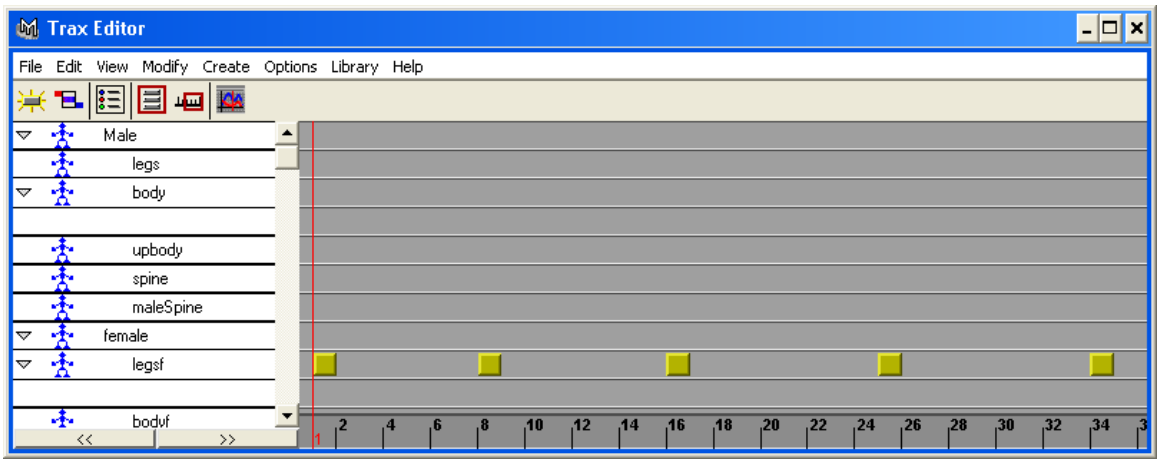

Figure 29 – Trax Editor Window Showing the Five Poses (Snippets) Placed Along the Time Line

4. The poses are then blended to create in-between frames using the various blend options available in Maya. The yellow line in Figure 30 shows that the poses have been blend together. This is where an artist has the option to make the animation either “smooth” or “choppy.”

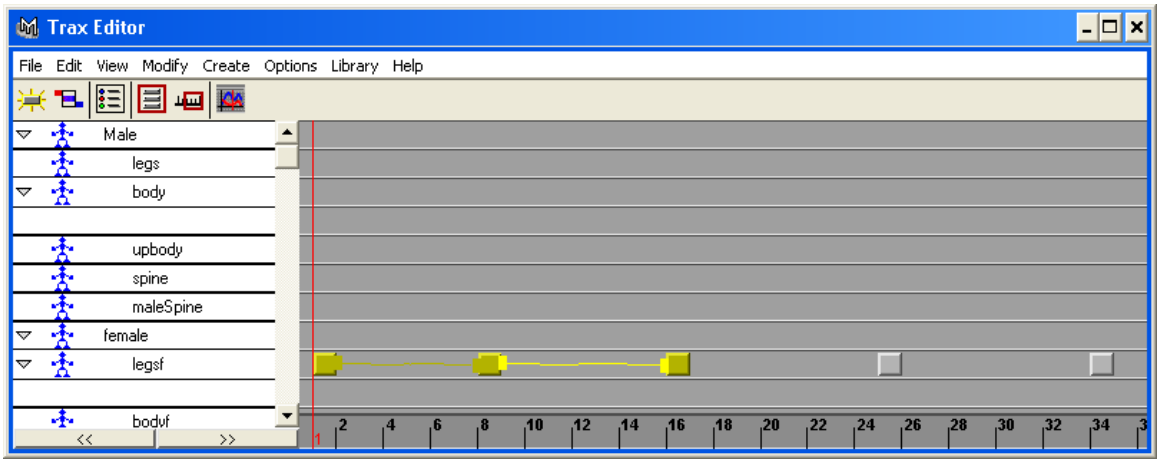

Figure 30 – Yellow Line Between Different Poses Represents Blend Operation

5. After all the poses are blended together, the whole walk cycle of five poses can be saved as a clip as shown in figure 31. This abstraction of motion into data enables the artist to

use and re-use the data in various ways. For example by scaling the clip, the character is made to walk slow or fast. By using the clip in cycles, the character is made to walk from one point to another in a straight path as long as the cycle lasts. This saves lot of time compared to traditional keyframe animation systems where keys have to be set for the entire path.

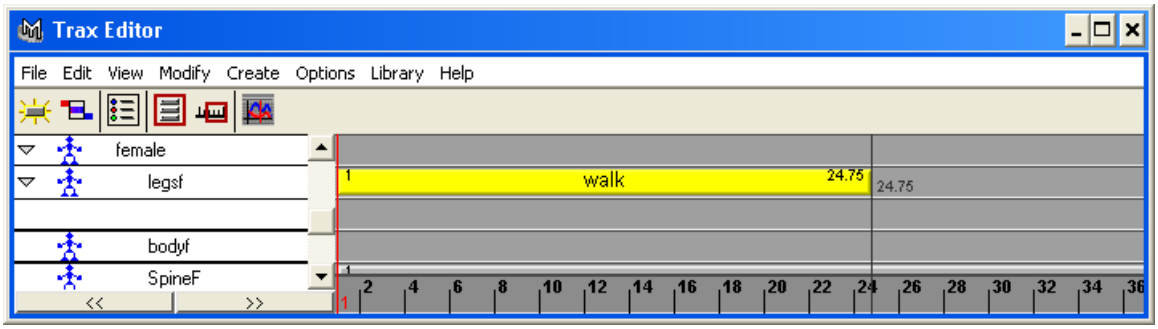

Figure 31 – Different Poses Saved as a Clip Named 'Walk'

Animation sometimes can be boring and repetitious. Prior to this project, I did a few character animation projects where the goal was to achieve realistic motion and learn the fundamentals of character animation. For this particular project, because I wanted the animation style to be more like a stop-motion animation, I decided to experiment with different ways of animating and texturing a character. The animation in Maya is stored as motion data that can be viewed in various ways within the Maya interface. One form of representation is as graphs as seen in the Graph Editor window shown in figure 32. The x-axis represents the time-line as number of frames and the y-axis represents the scale, rotation, translation, and other attributes that are normally changed in the animation process.

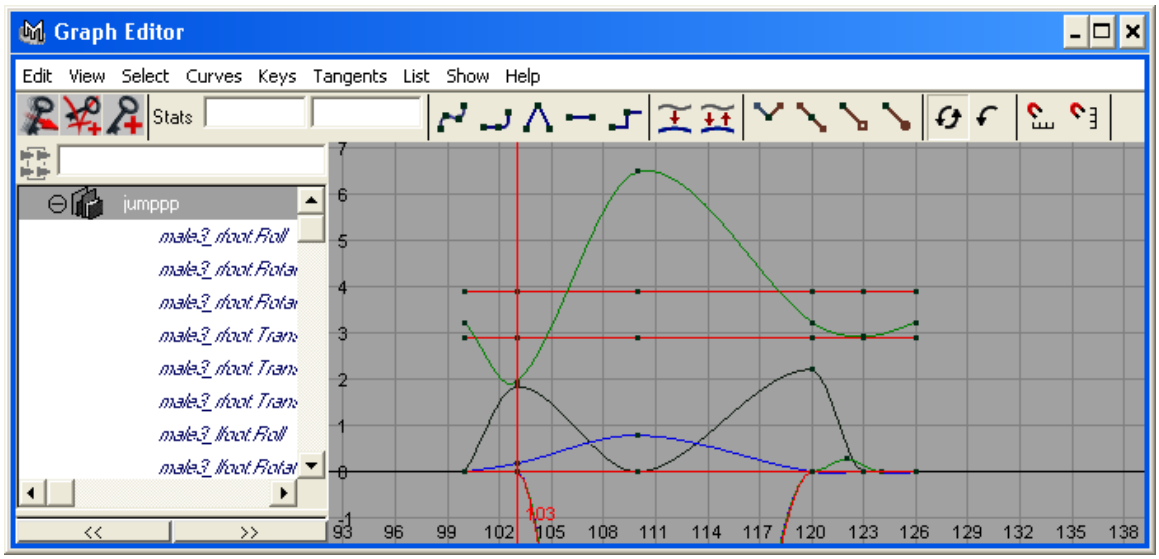

Figure 32 – Graph Editor Window Showing an Animation Cycle as Graphs

The project “chopchoppy” was done by various experimental animation processes. Some of the scenes in “chopchoppy” were animated by directly manipulating the graph by supplying values for the x axis and y axis. The numbers chosen were some times random and sometimes specific. Before I select numbers, I select a range first. For example, in one of the scenes in the animation, the character jumps to reach for the scissors. I figured that if I move the character 14 units up, it would seem as if the character is reaching for the scissors. So my range was 0 to 14. 0 represents the character being on the ground and 14 represents being up in the air 14 units above the ground level. There are various ways I choose numbers. It could be birthdays, scores of NBA or NCAA, Air Quality Index, pollen count, and the list goes on. I just pick a range and try different numbers to see if it fits the motion I am looking for. In this case of a character jumping up and down, one thing that popped up in my mind was stock market prices. After a few searches on the Internet, I found a set of values that fit my range of 0-14. It was the stock values of the top ten leading percentage losers of all US stocks on a particular day. Figure 33 shows the list and Figure 34 shows the corresponding graph, which was generated by the values under the ‘Last’ column. These values made the character jump up and down. I added other hand movements and head movements later on to complete the sequence.

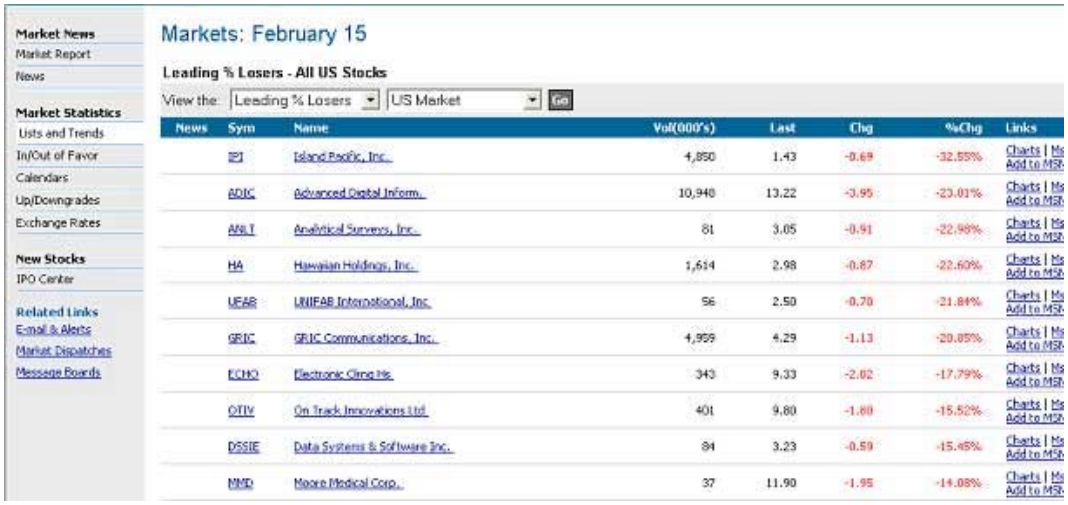

Figure 33 – Leading %Losers Chart Provided by ComStock, Inc (http://moneycentral.msn.com/investor/market/top10.asp?View=Losers)

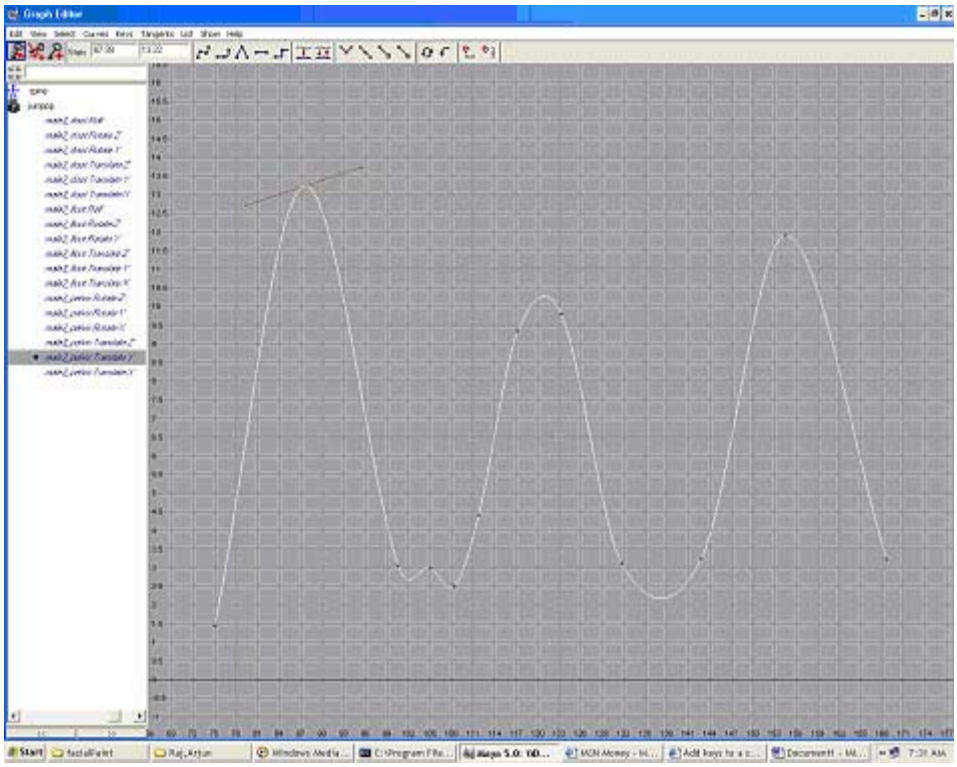

Figure 34 – Graph Editor Window Showing the Graph that Represents the Up and Down Movement of the Character (Y-axis translation). (*L-R the Values Change from 1.34, 13.22, 3.05, 2.98, …up to 3.23, which Corresponds to the 'Last' Column in Figure 33*).

Texturing of the “chopchoppy” project was also experimental in nature. Usually when texturing objects, image maps are created that represent the surface qualities of the object. For example, a skin texture map would be either created in a paint program like Adobe Photoshop or use scanned images or digital photos of actual human skin. For this project I wanted to create textures that not only gave surface features to objects and characters but also be symbolic in nature. For example, while texturing the male character, I used the image shown in figure 35 for his body and the image shown in figure 36 for his pants. Figure 35 is an image created in Photoshop by layering the home pages of different popular search engine sites like Google, Yahoo, Lycos, Ask Jevees, etcetera.

Figure 35 – Search Engine Texture

This image not only gives the body an earthy look from a distance but also signifies our quest for a perfect “search engine” that would give solutions to all our problems. Here I use “search engine”, both the word and the image as a metaphor. By reducing an idea into a simple image and then using it in place of another to suggest a similarity, the surface textures in this animation act as metaphors. Figure 36 shows a scanned image of a page from a telephone directory. This gives a pin stripped look to the pants material and also signifies “communication” at one level and various other meanings at different levels. Figure 37 shows a rendered still image of the project “chopchoppy” showing the surface feature of the body created by the search engine texture. Figure 38 shows a rendered still image of the lower body showing the pin stripped surface feature created by the telephone directory page texture.

Figure 36- Telephone Directory Page Texture

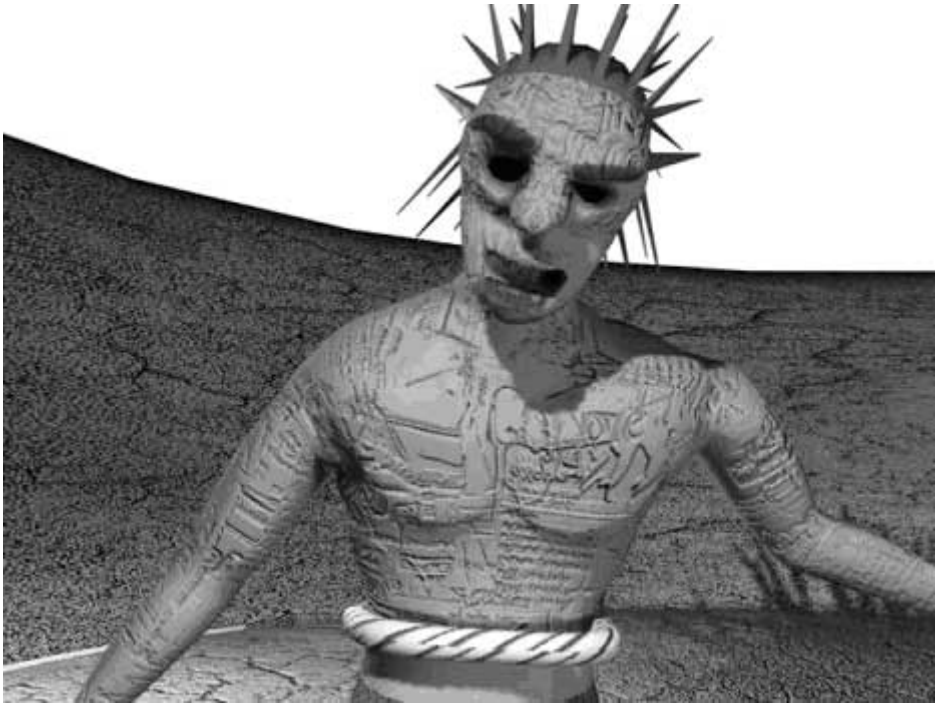

Figure 37- Rendered Image Showing the Surface Feature Created by the ‘Search Engine’ Texture

Figure 38- Rendered Image Showing the Surface Feature Created by the Scanned Image of the ‘Telephone Directory Page’ Texture

I wanted the texture for the head to signify that our heads are filled with thoughts of others and also have different meanings at different levels. Various images of human faces appropriated from Internet and personal photos were layered to create a texture image. The texture image was created using Adobe Photoshop. The image was then applied as texture map to the material used by the face. The resulting surface feature created by this texture is shown in figure 39. Towards the end of the animation this texture's attributes were animated to smooth out and disappear signifying "clearing head."

Figure 39- Rendered Image Showing the Close Up of the Surface Features of the Face

CHAPTER 7

CONCLUSION

My study at ETSU involved a wide range of course work form technology, art and design, and storytelling. These courses developed my heuristic techniques of animation. Graphic design courses emphasized the importance of composition over communication, technology courses emphasized developing more robust mathematical solutions, and drawing emphasized on developing an individual “mark.” Creating animations gave me a chance to juxtapose the diverse perspectives of Indian art and philosophy and Western art. My projects varied from photorealistic 3D modeling and rendering to projects with an aim to loose the physical specificity. In my later projects, I enjoyed the balance between the underlying complexity of creation and the simplicity of the resulting visual images. I made an attempt to create an explicit connection as well as a subliminal connection with the perceiver through the creation of archetypal images.

My interest in developing “archetype” characters was complemented by courses in Art History and Mythology. Primal mythological images of different cultures evoke a sense of experience and unite the human soul. Indian Art and South Indian Temple Art are mostly comprised of mythological images. Through adaptive exploration of those sculptural works and 2D works like motifs, patterns, and mandalas, I believe I have enhanced my creative thinking. As the figurative and linear images of Temple Art have different levels of meaning, so do my creations. The perception and response changes over time and with each individual. Through a self-indulging process and a cumulative knowledge, I was able to explore digital medium for my animations that are creative projections of ideas.

> Perhaps the most important quality of the archetype is that it operates autonomously in the psyche, organizes itself into images, and presses those numinous images upon the conscious ego. The complexes thus organized in some ways function as sub-personalities which have the potential of engaging in an active dialogue; that is, they can respond to questions posed by the conscious ego as if they had their own intentions and personalities. [17]

While writing this supporting paper, I read this passage in an article [17] and could not agree more about the quality of archetype. Creating art and exploring aesthetic thoughts have opened up a new world for me. I also learned to appreciate the wisdom of indigenous peoples and the connection between faith and reason. Visualizations are being increasingly used in relaxation techniques to augment traditional medical treatments. Numerous studies in the West support the benefits of meditation, which has been taken for granted in East.[18] My next step would be to build on this knowledge of art and technology and explore new avenues in the areas of virtual reality, augmented reality, immersive technology, etcetera. I would like to create visualizations that are therapeutic in nature and further my understanding of the representational power of this new medium.

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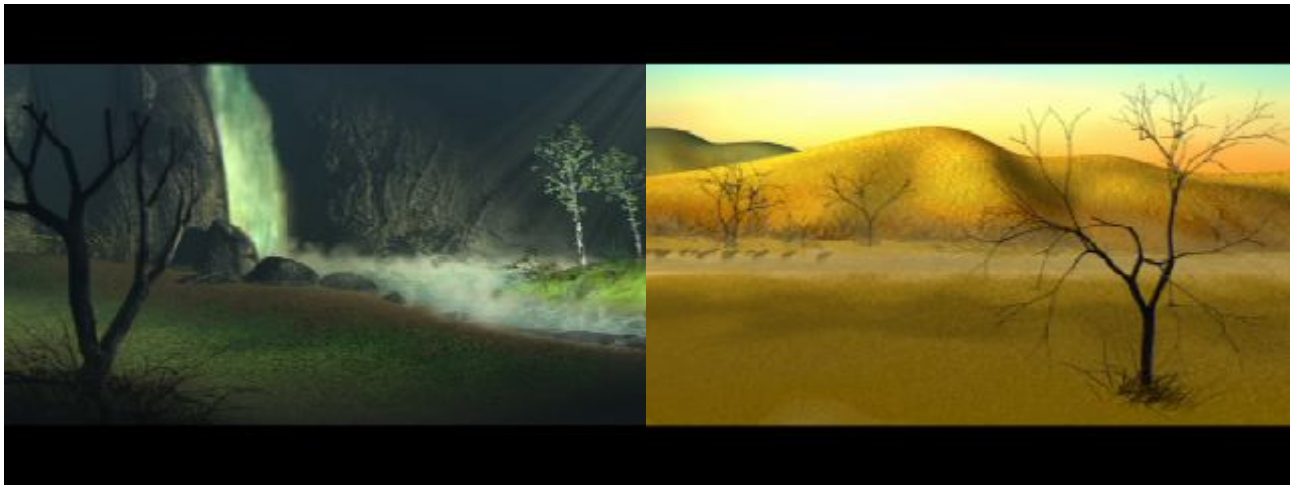
APPENDIX A

Still Images and Sample Animation from “Evoluck”



Sample Animation-Click on the Window Below to See a Compressed Version of “Evoluck”

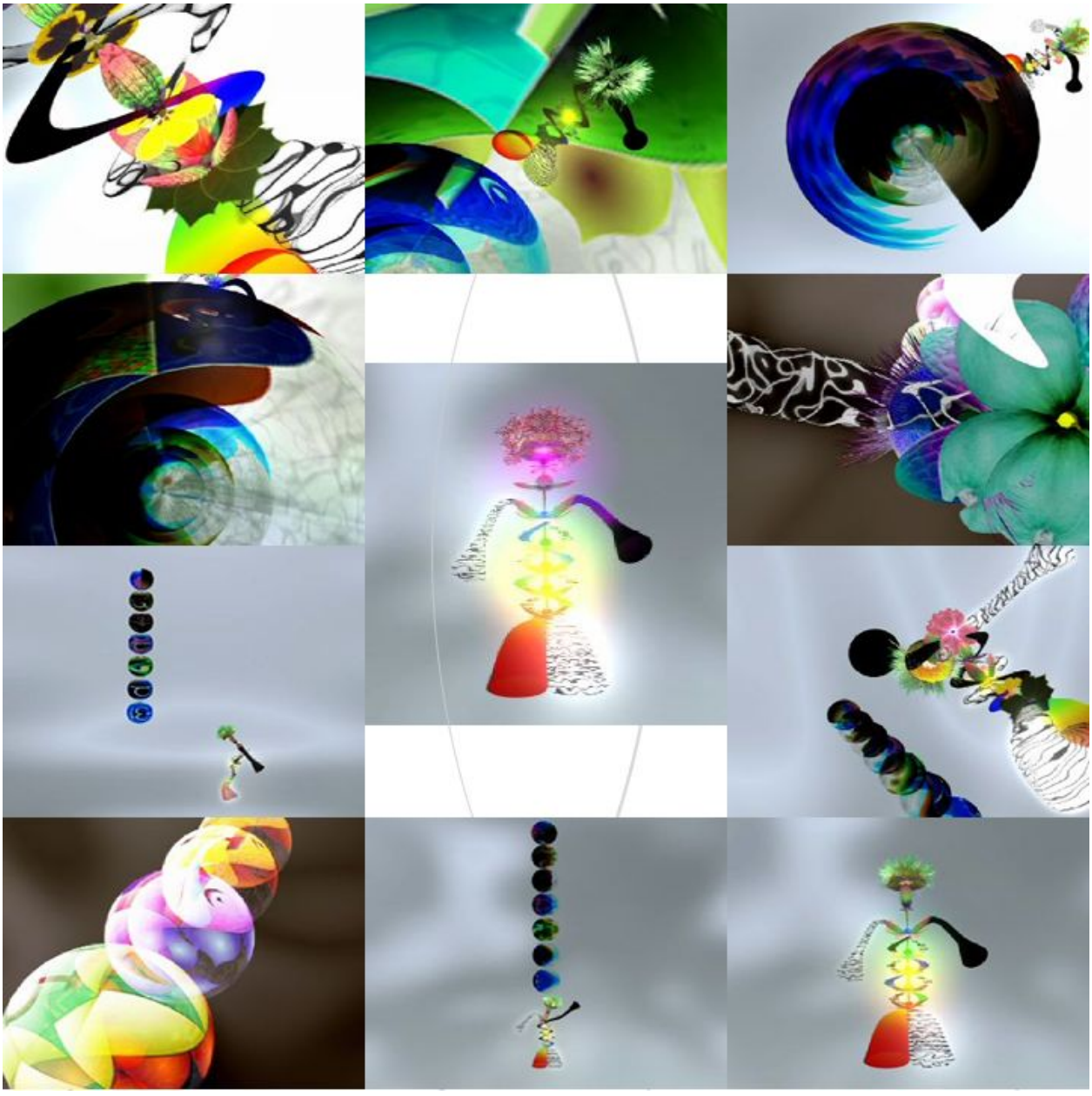
Adobe Reader 6.0 and Quick Time Player (4.0 and above) are required to play the animation. Download both for free from www.adobe.com and www.apple.com/quicktime

APPENDIX B

Stills from “ChopChoppy”

APPENDIX C

Stills from “Memetic Dance”



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Education:

East Tennessee State University, Digital Media Center/Advanced Visualization Lab, Johnson City, Tennessee.
Master of Fine Arts, Studio concentration in graphic design and animation (Summer 2004).
Master of Science in Technology, concentration in engineering design graphics and computer animation.

University of Kentucky, Lexington, Kentucky.
Master of Science in Engineering, concentration in environmental engineering.

Madurai Kamaraj University, Madurai, India.
Bachelor of Science in Engineering, concentration in structural engineering.

Work Experience:

2000 – Present: Graduate Assistant, ETSU, School of Graduate Studies. Lead the Technical side of Electronic Referral System (ERS) project, which replaced the traditional workflow of graduate school applications. Designed and maintained the ERS website including a database of all graduate applications. Maintained Electronic Theses/Dissertations (ETD) Website. Contributed to the creation of content and design of the ETD website. Solved computer networking and device problems. Created training manuals.

2000 Summer: 3D Artist /Internship, n-tara, Johnson City, TN. Worked with a five member team developing a children's interactive CD-ROM. Primary responsibilities included character modeling, character setup, character animation, lighting and texturing. Created CG content for web based projects.

1998 – 2000: Graduate Assistant, East Tennessee State University, Johnson City, TN. Worked on various projects for the school creating CG content utilizing various 3D, 2D, and web publishing software. Assisted in teaching and developing course content for 3D animation classes. Designed motion graphics and various digital content for Tri-Cities Summit (98-99). Collaborated with African and African American Studies Program and designed and published newsletters, created brochures, and designed web pages

Skills:

Character animation, character setup, facial animation and lip sync, modeling, lighting, texturing and compositing, story telling, storyboards, video production, desktop publishing, graphical visualization of ideas and concepts, web content and design.

3D Animation/Modeling
Maya 3.0 (Dynamics, Cloth, Fur, and Paint Effects)
3D Studio Max 3.1 and Plug-Ins
SoftImage|3D
Alias/Wavefront

2D/Compositing
Freehand
Photoshop
After Effects
Premiere
Perception
Final Cut Pro HD

Web
Dreamweaver
Fireworks
Flash

Hardware/Operating Systems
Silicon Graphics (O2, Octane) – Unix/Irix Systems
Macintosh (Mac G4, iMac) – OS 9, OS X
PC – Windows NT, 2000, and XP