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Dragon Slayer Short Film Modeling and Rigging a Quadruped Dragon

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DRAGON SLAYER SHORT FILM
MODELING AND RIGGING A QUADRUPED DRAGON

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ABSTRACT

This thesis is a look at the design and implementation of a quadrupedal dragon, as specified by the needs of the short film *Dragonslayer*. It looks at the modeling of the three dimensional creature from artistic and technical points of view. The dragon is a worldwide fantasy and cultural icon, and this thesis focuses on the creation of one grounded in the western fantasy of the middle ages. The western dragons have four legs, a pair of wings, horns, and a relatively stout body in comparison to the eastern dragons, which more closely resemble serpents and possess antlers instead of horns. The distinction of the dragon as being quadrupedal is significant, since many rigs or models in industry use a wyvern, "bipedal dragon," model instead. A wyvern is a much simpler design and very closely resembles the actual anatomy of a bat. Because the quadrupedal dragon is a creature that does not exist or have comparable anatomy to any known animals on Earth, its anatomy was based on a combination of real animal physiology and some educated inferences to fill in any anatomical weaknesses. Since the dragon is such a recognized character from mythos, it is important that this dragon be an anatomically sound creature that does little to damage the suspended disbelief of a viewer. The dragon is also rigged to be versatile, machine efficient, and intuitively manipulated by an animator for use in film, video games, television, or even academic exercises.

DEDICATION

I would like to dedicate this thesis to my loving and supportive parents. Thank you both for being there for me when I was less than the person you knew I could be, and for helping me back onto a path of productivity and happiness.

ACKNOWLEDGMENTS

I would like to acknowledge the support of Dr. Jerry Tessendorf, Dr. Don House, Dr. Brian Malloy, Professor David Donar, Dr. Timothy Davis, Robert Helms, Hugh Kinsey III, Wynton Redmond, and Nina Breakiron.

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CHAPTER ONE

INTRODUCTION

Once upon a time, in a long forgotten valley, there waited a man drifting in long lost sleep. However, he wasn't your typical man, he hadn't just been waiting but keeping watch. He had been guarding the valley for so long that many ages had past and nothing but his bones remained; yet he labored on. This man was an ancient necromancer, and he was waiting for dragons for he was, the Dragon Slayer.
~ History of the Third Dragon War (a fictitious document related to the Dragonslayer *short film) ~*

Dragonslayer is a short film highlighting a moment of fatal conflict between a necromancer, who resides upon a mountaintop, and a large dragon lured in by a magical signal emitted from a pair of obelisks. The obelisks beckon the dragon and rouse the necromancer from his slumber as the beast approaches. A magical duel follows the appearance of the dragon. Ultimately, the Dragon is vanquished by the powerful magic of the necromancer, who then returns to his slumber to await another foe.

The short will be approximately twenty five seconds long, and seeks to explore the archetypal dragon and wizard duel. This film specifically features a magical duel. Since dragons are such overwhelmingly powerful creatures, without magical augmentation the necromancer could not engage a creature the dragon's size in physical combat. The conflict of magical or superhuman human versus dragon or beast is a staple of fantasy in most forms of media. Poems like the *Epic of Gilgamesh[EPIG72]*, novels like *The Hobbit[HOBB37]*, religious icons like St. George, films like *Dragonheart*, and games such as *Elder Scrolls V: Skyrim* all have a powerful human or wizard pitted against a monstrous dragon-like creature. There are many other examples throughout history and in many different cultures. For centuries the idea of dragons has fascinated people and having the strength to overcome strong beasts has inspired a thirst for power.

This thesis will specifically expand upon the methods used to create the Dragon for the short film. It will focus on the design of the Dragon as a character, the technical modeling and rigging challenges, and the future plan for the rest of the film. In the characterization section, a significant amount of emphasis will be on the heroic proportions and visuals of the Dragon's form and the blending of real animal anatomy in a fantastical way to preserve realism so that the Dragon is accepted as believable. The modeling and rigging sections will be approached from the production pipeline angle and future works towards the completion of the film will be presented.

CHAPTER TWO

BACKGROUND

2.1 Inception

The idea for the *Dragonslayer* short was generated when Robert Helms, a Clemson DPA alumnus and DreamWorks VFX artist, visited during his stay for the first Clemson DreamWorks summer collaboration project in 2012. He is the principal rigger for the *How to Train Your Dragon (HTTYD)* franchise. After talking with him about dragon structure and rigging, it was apparent that the complexity of dragon anatomy and movement deserved its own project and would make for a challenging modeling and rigging study. After the initial dragon model and design went through some critique and iterations, it took on the traits of a usable creature asset and began to develop some character of its own. As dragons are typically portrayed as combative, design choices were made that emphasize the ability of the creature to engage in conflict. The need for a supernatural foe to combat the dragon became clear and the necromancer character was conceptualized. Eventually, a short film detailing the conflict between giant flying beast and magical humanoid solidified.

2.2 Dragon Types

There are many kinds of large reptiles in fantasy commonly referred to as dragons. There are eastern dragons, which typically have four short legs that sometimes end in bird feet, have antlers instead of horns, and rely on magic (chi) instead of wings to keep them aloft. [DOEA93] African dragons even more closely resemble serpents, and have magical powers based on the number of legs they possess. [AFDG13]

Figure 2.1: Western, African, and Eastern Dragons [PHBD15] [AFDG13] [SHEN15]

Finally, western/European dragons have between 2-4 legs, horns, a stouter more muscular body, a pair of wings, and the ability to breathe fire, see Figure 2.1. The western dragon can be broken down into two major categories, true dragons and wyverns. The difference between a wyvern and true dragon is the number of limbs they possess. Wyverns have four limbs which includes two legs and two wings, while a true dragon has six limbs; two wings and four legs which are used for quadrupedal locomotion. [DRAC09] Wyverns will crawl along the ground like ancient dinosaurs or present day bats, using their wing joints as forelimbs; their fantasy anatomy is more grounded in the anatomy of real creatures, e.g. *Pteranodon* fossils found by archaeologists. [FOSF12]

Since wyverns have a more realistic and observable anatomy they are easier to implement in a 3D environment; as such, they are used more frequently in multimedia even if the character that is being designed is called a dragon. Some media examples include the creatures in the full length film *Reign of Fire* [REIN02], Smaug from the recent *Hobbit* films [HOBB14], the beasts on display in the *Harry Potter* franchise [HALL10][FIRE05], and the antagonist in *Dragon Hunter*, the film [HUNT09]. (See Figure: 2.2 below)

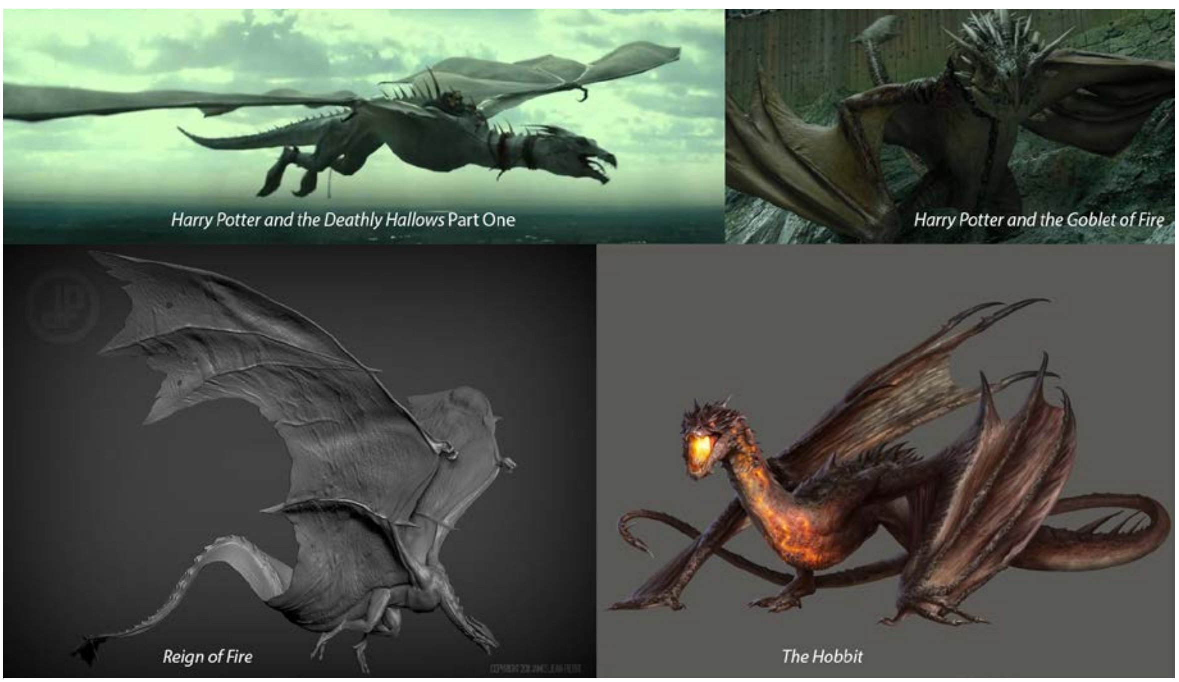


Figure 2.2: Representative wyverns from films [HALL10] [FIRE05] [REIN02] [HOBB14]

They are a popular staple in games such as *Elder Scrolls V: Skyrim [SKRI11],* movies like those above, television shows like *Game of Thrones* [GOTT11], and on the covers of books, for example *The Dragons of Pern Series*. [LODP15] Wyverns are almost always referred to as dragons, even though they do not share the fantastical anatomy of a true dragon. [DRAC09]

Drawing dragons in 2D does not entail the expenditure of artist resources that producing them for 3D animation does. Therefore, as media of all kinds transition into 3D work, many characters that would have been true dragons in 2D artistry are more frequently crafted as wyverns instead. This is a trend readily visible in the design choices concerning dragons that are repeated within a single franchise like *Sleeping Beauty* where Maleficent is a quadrupedal dragon, and its reboot, *Maleficent,* in which Diaval (her henchman) is a wyvern [MALE14]. *The Hobbit* is another franchise in which a true dragon, Smaug, has been converted into a wyvern. The original art drawn by Tolkien for the books and the animated 1977 film includes a quadrupedal dragon, but the live action 2012 film release of Smaug makes use of a wyvern body style, see Figure 2.4. The quadruped to wyvern trend has taken place as a whole in most media with the transition to 3D works because of the prohibitive cost of true dragon assets. Many of the most beloved and character rich dragons are only found in 2D animation and not 3D. The principal exceptions to this are Draco from *Dragonheart* and Saphira from *Eragon*. This trend took place during the stop motion and animatronic visual effects age as well. For example, in Figure 2.3, the puppet of Vermithrax (the dragon character of the film) was a monstrous 40 feet (12 meters) and it was already a massive undertaking.

Figure 2.3: Vermithrax puppet from the film *Dragonslayer 1981* [DRAS81]

To produce the effects they used 16 total puppets each for a specific shot or purpose [DRAS81]. Adding the construction and animation time expenditure of making Vermithrax a quadruped would have been cost prohibitive.

Figure 2.4: Dragon to wyvern transitions (from 2D to 3D) within franchises

[BEAU59] [MALE14] [HOBB37] [HOBB77] [HOBB14]

The average consumer of media is unaware of the difference between these fantasy creatures and does not notice the dissimilarities unless compared side-by-side. A major observation the viewer can immediately make, apart from the missing front legs, is the difference in ground locomotion. In scenes or shots where a wyvern is on the ground, they typically appear lumbering and clumsy; whereas, true dragons are portrayed as more agile; like large felines with wings used to augment their movements. The marked difference in movement is because where the wyvern's wings act as their only hands and they use the alar claw at the top as their thumb to move, a true dragon has separate forelimbs with hand-like appendages separate from their wing and alar claw, see Figure 2.5

Figure 2.5: Dragon and wyvern anatomy [DRAC09]

The alar claw, in real world anatomy, is the thumb of a flying reptile or mammal. In ancient times this thumb was visible within the *Pteranodon* genus, and this adaptation is still in use by bats today, see Figure 2.6. Bats use this appendage for much of their interaction with the world when not flying, for example climbing, opening up fruits, walking, clinging to parents etc.

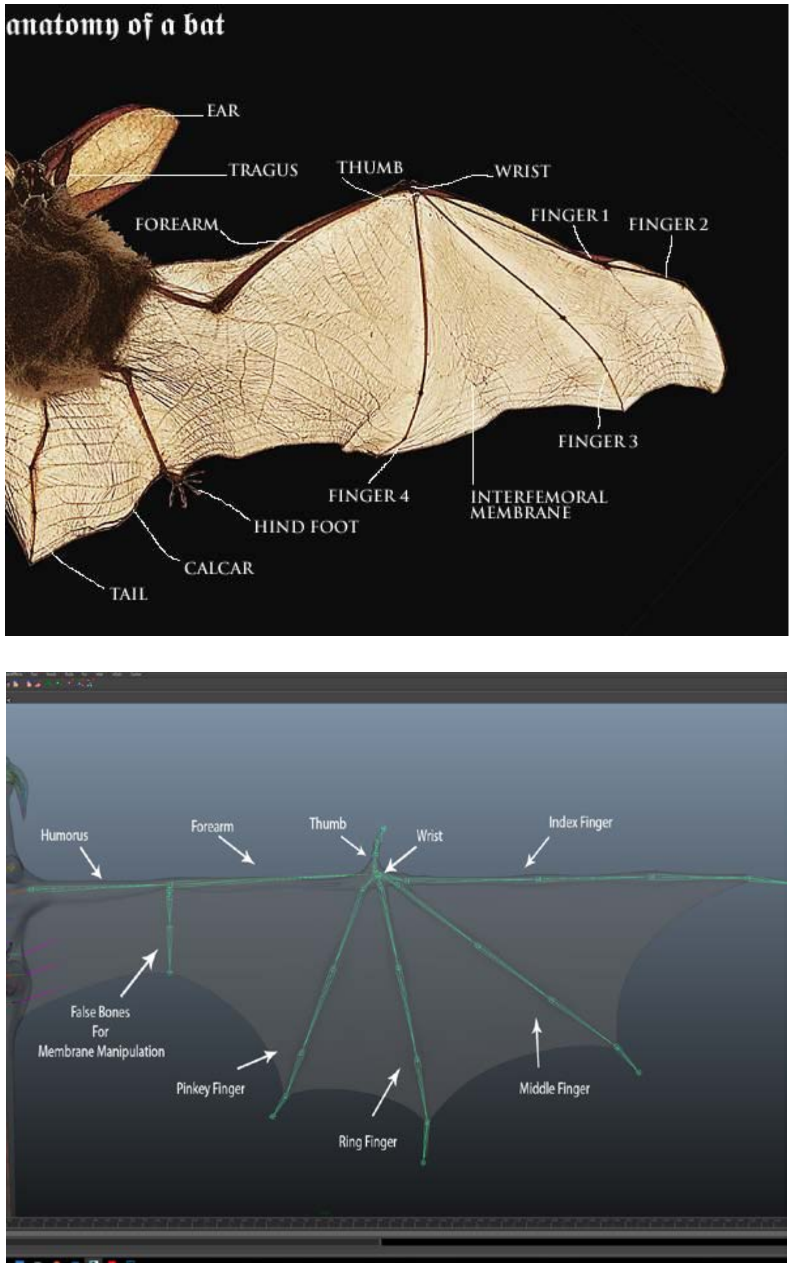


Figure 2.6: Bat anatomical photograph and orthographic view of Dragon wing [BATA15]

The wyvern suffers from being forced to rely on its alar claws for tasks better suited to hands. These appendages would be akin to possessing only a thumb on the end of your wrist instead of five fingers. True dragons in addition to possessing wings with a fully functioning alar claw, are also equipped with forelimbs or arms often ending in hands capable of fine manual dexterity exceeding that available to a wyvern using only its thumb claw. Because of their simplified anatomy, wyverns are incapable of interacting with the environment or characters the way true dragons can. For instance, in both *Eragon* and *How to Train Your Dragon,* Saphira and Toothless, true dragons, respectively use their forelimbs to catch a falling human and shield him from harm with their wings, see Figure 2.7.

Figure 2.7: True dragons saving the day [HTTD10] [ERAG06]

This heroic feat would be impossible for a wyvern like Smaug (not that he would be inclined to protect anything other than his horde of gold).

The choice between wyvern or dragon is a key design consideration for visual effects artists and directors. If the goal is an animalistic and powerful flyer who is out of place on the ground, a wyvern is the correct choice. Wyverns are simpler to rig, model and animate; therefore, saving time and resources that can be allocated to other parts of the project. True dragons, not only contain some of the raw animalistic power that wyverns possess in the air, but are also an incredible threat on the ground. However, they have additional limbs to model, rig, texture, and animate which will take up more time and computing power than a wyvern. The addition of the front limbs with very hand-like feet also add extra layers of complexity at all stages of the production pipeline.

Since dragons possess anatomy that gives them the illusion of hands, they are perceived as having more humanlike personalities and behaviors than wyverns, and often elicit a greater empathic response from the audience. [HAND55] This personifying aspect means that typically true dragons also come across as more intelligent and compassionate creatures. This humanizing approach holds true at all production levels, from children's shows with cartoon dragons in them such as *Dragon Tales*, *The Sword in the Stone*, and *Mulan*, to blockbusters in which dragons are meant to be key parts of emotional storytelling [TALE99][KING63][MUSH98]. Even *Puff the Magic Dragon*, a classic children's story, makes use of the hands as a humanizing element and includes them in cover art, see Figure 2.8. [PUFF78]

Figure 2.8: Dragons from kids shows with personality   [PUFF78] [TALE99] [MUSH98] [KING63]

2.3 True Dragon Because Wyverns Assets are Plentiful

One reason that this thesis focuses on the creation of a true dragon, instead of a wyvern, is that wyverns are commonplace in 3D work due to reduced production cost. As mentioned in section 2.3, believable true dragons are much more difficult to create than wyverns because of the increase in both design and technical considerations on a quadrupedal dragon. Quadrupedal dragons are less grounded in real world anatomy and require inventiveness and problem solving that wyverns, which can use the solutions of a bat, bird, or *Pteranodon*, do not. A quadrupedal dragon's forelimbs also provide more depth and functionality to the character that it is representing than a wyvern. The result is a balancing act of blending the fantasy world with the one we live in so as not to jar the viewer and destroy the suspension of disbelief.

CHAPTER THREE

DESIGN AND MODELING

3.1 Inspirations

Sources of inspiration for this project include the dragons from *Dragonheart*, *Reign of Fire*, *Harry Potter and the Goblet of Fire*, *Harry Potter and the Deathly Hallows,* the *Hobbit*, and real world animals that have applicable dragon-like features. The Dragon is an amalgamation of different pieces of disharmonious anatomy. The face and legs are heavily influenced by Alduin, a wyvern, from the video game *Elderscrolls: Skyrim,* see Figure 3.1.

Figure 3.1: Alduin of Elder Scrolls V: Skyrim [SKRI11]

Alduin is the penultimate opponent of the *Skyrim* game and his design reflects that. His bone structure looks like armor meant to deal damage to his foes as much as it is to protect him. Appropriating these features lends a menacing characteristic to the short films Dragon.

The false shoulder connection of the wing is based on the larger quadrupedal dragons in the *HTTYD* franchise. After speaking with Robert Helms (chief rigger for *HTTYD* 1 and 2) the shoulder muscle on the Dragon was completely redesigned, see Figure: 3.2.

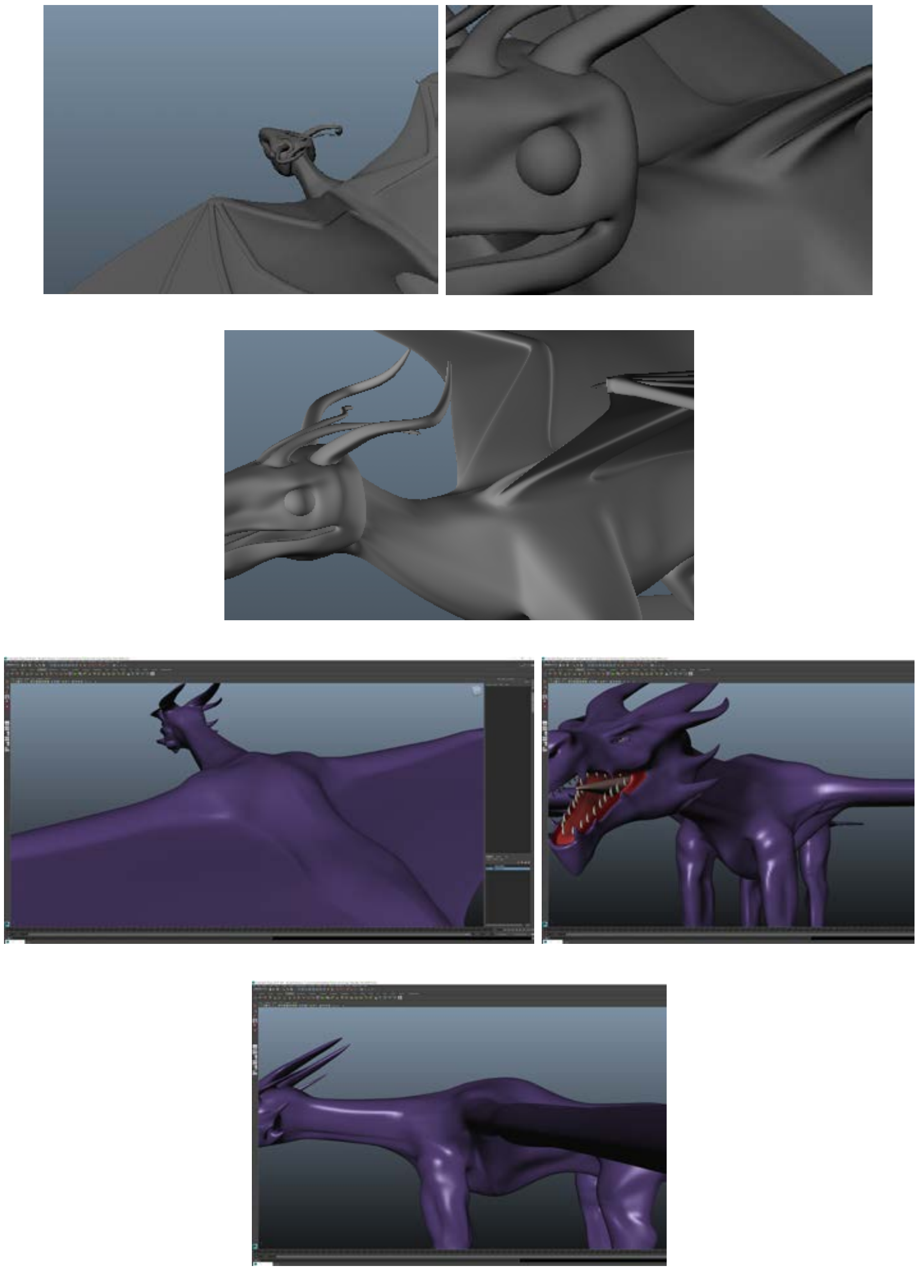


Figure 3.2: The shoulder in its first(top row) and final(bottom row) forms

Earlier dragons and most video game dragons have one small shoulder attachment for the wings, see Figures 3.3 - 3.5 below, generating an unrealistic expectation for flight and "hangbutt-syndrome." In hangbutt-syndrome a dragon flies along with its wings flapping and lower half dangling below. This happens because the membrane attaches high on the body near the shoulder and there is no lift holding its belly, rear legs, or tail aloft. In 3D films, for the last decade or so, artists have correctly adjusted for flight, by continuing the wing membrane further down the body in order to provide upward thrust of the aft portion of the dragon. While the dragons in these films are heavily stylized, the anatomical requirements for fluid movement are universal.

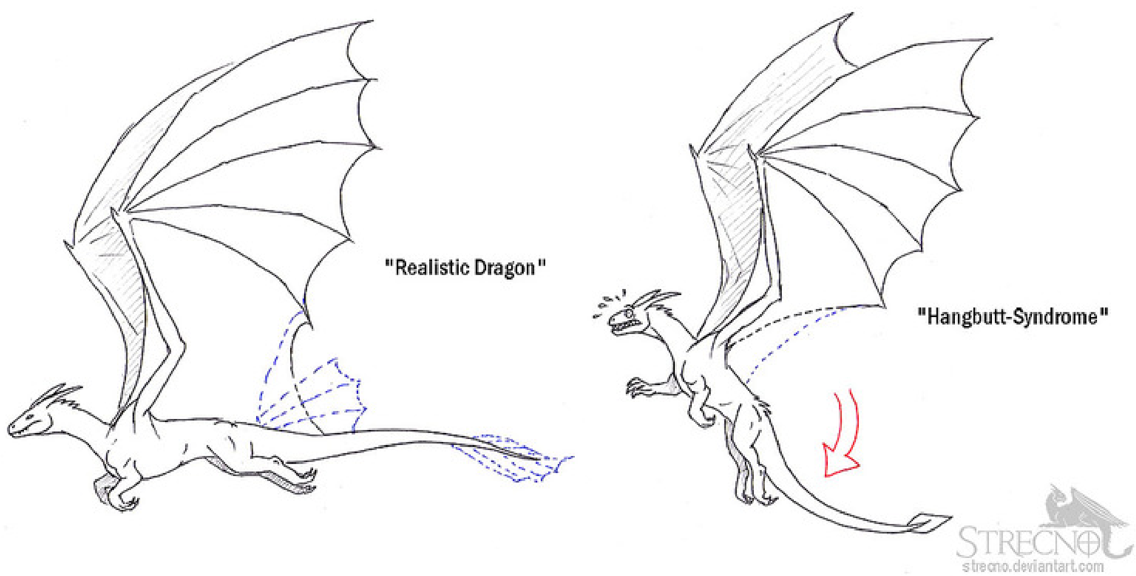


Figure 3.3: Hangbutt Syndrome, Strenco Deviant Art [HANG10]

Figure 3.4: *St George and the Dragon*, Carpaccio,1502 [STGR02]

Figure 3.5: *The Flight of Dragons* [FLGT82]

The wings of the Dragon are designed based on those of a large bat. Flying foxes are the largest winged creatures currently in existence that use a membrane instead of feathers for flight with wingspans of up to 1.5 m (5 ft). [FOXB15] Because feathered dragons are far less menacing and did not fit with the design motif of the Dragon in the project, the large bats were the closest modern and observable reference.

The thick muscular body and neck of the dragon are based on lions. Lions were used in lieu of other large cats, because they are not only incredibly powerful from a mechanical standpoint, but also immediately recognized as dominant predators.

[LION89] Feline anatomy was also used in combination with human and reptilian anatomy for the forelimb design. There are no known examples of this particular blend of anatomy in our world. The hands of the dragon possess three fingers and a thumb but also include a fleshy pad on the bottom for walking on the wrist and whole hand like a reptile, see Figure 3.6.

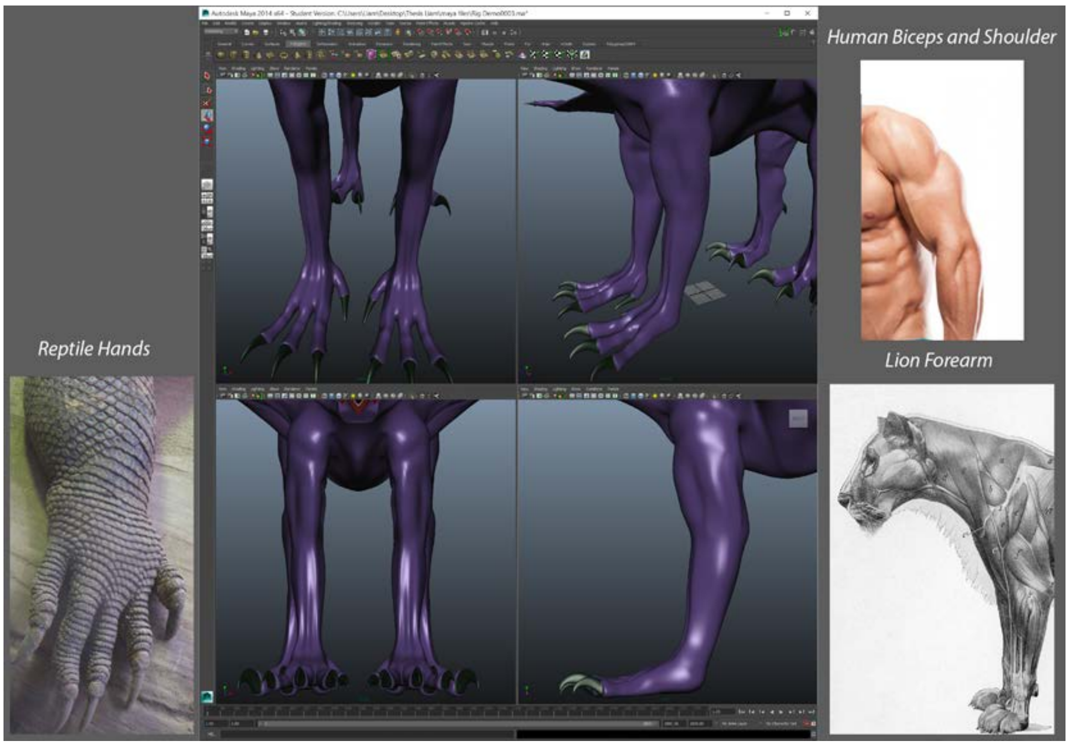


Figure 3.6: Composite anatomy of Dragon forelimb

The tail is a combination of the serpentine tail of Toothless from *How to Train Your Dragon* with the scythe-like weapon tail of Draco from *Dragonheart*. Combining these elements meant that the Dragon had the horizontal stabilization and elevator capabilities of Toothless, and the threatening qualities of Draco's bladed appendage, see Figure 3.7.

Figure 3.7: Inspiring tails in film [HTTD10] [DRAC96]

The Dragon is as anatomically functional as could be achieved in a fantasy creature while remaining a true dragon. These individual anatomical features were selected for specific purposes; however, they had to be sculpted into a single cohesive creature. Hand and limb anatomy, wing design, facial features, and reptilian and feline features all contribute to the menacing flair of the dragon.

3.2 The Anatomy of Dragon

Using real world anatomy and real world proportions is extremely important when modeling a fantastical creature because it is required for believability. If the surface area of the wings of the dragon is insufficient to hold the dragon up during flight, the creature transitions from a realistic representation of a fantasy beast into a stylized and sometimes downright cartoonish rendering of an otherwise menacing character. The gronckle, for instance, from *HTTYD* is a round, heavy dragon which could never be supported by its wings. Its anatomy is a deliberate choice in the interest of physical humor. The Dragon created for this thesis; however, is not meant to be humorous. It is intended to convey real weight, mass, and to look as though it could be supported by its anatomy. It is meant to be a functional creature with large chest muscles, feline legs for mobility, power, and flexible strides, and wings capable of bearing it aloft in a world with real physics, see Figure 3.8.

Looking at a design in silhouette is a standard practice in order to monitor how cohesively the physical elements were brought together. It provides a good way to gauge the impact of the asset as a whole.

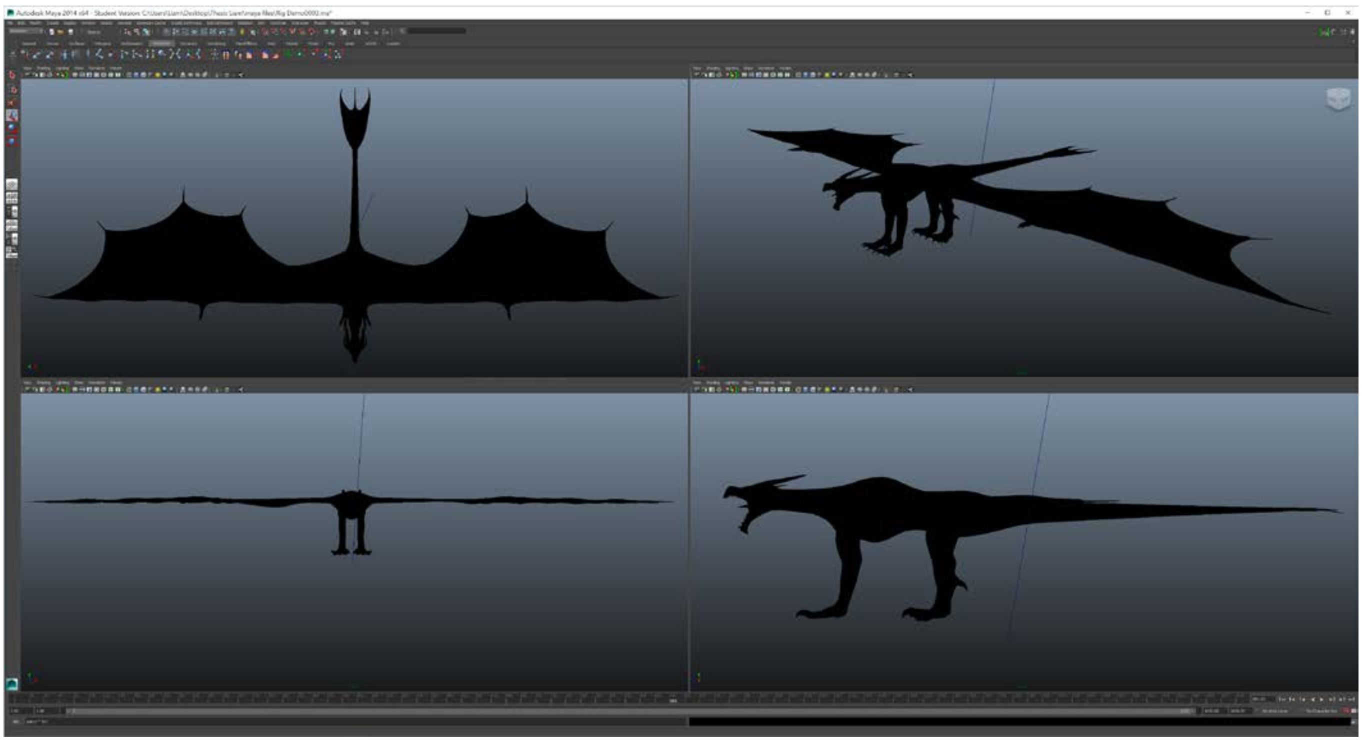


Figure 3.8: Silhouettes

Many incarnations and small adjustments were made before the finalized silhouette of the Dragon above was chosen.

3.3 Face and Neck

As mentioned in section 3.1, the face of the Dragon is modeled on Alduin from *Skyrim*. The boney features were smoothed and made more aerodynamic. Leathery skin, without bony plates, was chosen for the Dragon because Alduin would be too heavy and inflexible to fly. Seeing Alduin fly is like throwing tiny wings on a spiked armadillo.

Even though the unwieldy horns would make aerodynamic control very difficult, their proportions were kept because they are incredibly iconic and intimidating; not to mention a practical protection, like the neck frill of a triceratops.

Figure 3.9: The Dragon face shape combines the protective mantle of the triceratops with the beak of a raptor. [TRIC15] [BIRD12]

The model's default facial expression is aggressive, includes exposed teeth, and possess binocular vision. Binocular vision is a uniquely predatory trait because the animal's eyes are facing forward instead of on the side of the head so that there is a sharp increase in depth perception which allows for accuracy in hunting, and tracking prey.

The chin and upper lip structure mimics birds of prey which all have a singular mechanical purpose – the rending and removal of flesh, which is why the Dragon is fearsome. Exposed crocodilian teeth are another indicator that this is a predatory animal with prehistoric ferocity. The exaggerated brow bone gives him a permanently villainous expression. He has another set of horns on his cheeks, because after deciding to forego the plates visible on Alduin, the face became too docile for the desired menace of the character. The neck is heavily muscled and has the suggestion of a trachea but is not overburdened with distracting anatomical details, see Figure 3.9. The length and width of the neck are based on an adult female lion for its stockiness and elegance.

3.4 Hands for Wings

The Dragon's wings are an anatomical mimicry of those of a bat which would be the hands on a terrestrial mammal. The elongated fingers, webbing, and proportions are all derived from large flying animals. The alar claw helps to add menace and was retained so that if the Dragon were to climb, the wings could be used in concert with the forelimbs. The alar claws serve as anchor points similar to the way that an ice climber uses picks to scale a cliff.

The number of active fingers within the webbing of the wing allows for great control of the membrane and lowers the amount of stretch and compression per polygon face. The hand based rigging of the wing allows animators familiar with hands (which realistically should be all of them) to make use of familiar techniques. The fact that the wing anatomy is grounded firmly in reality will make animation easier as well. However, while the wing itself is based on actual anatomy, its connection to the shoulder is not, but the wing itself is familiar, realistic, and easy to digest as a viewer.

The false shoulders of the Dragon's wings make use of the trapezius muscles on top to create a ball shape. Visible in Figure 3.10 they are positioned behind the forelimb shoulders so that the latissimus dorsi can be used in conjunction with the pectoral muscles to create downward thrust. This does mean; however, that the front forelimbs would be weaker than those of a normal quadruped.

Figure 3.10: Edit of *Anatomica Draconis* by Katie Pfeilshiefter [DANA10]

The hand based rig of the wing allows for a familiar, well explored, and supported control scheme. In addition to being useful for flying, the hand based wing is available for many kinds of character animation that are beyond wings structured like those of a bird, plane, or insect. Wings can cling to surfaces, grab at enemy or ally combatants, or flex in mimicry of a fist to convey emotional tension. Animation reference is also readily available in the form of footage of bats in flight (see Figure 3.11). The largest flying creatures today are birds, but their wings do not look convincing on a dragon in most cases because they appear softhearted, kind, or fragile. Saphira, from the *Eragon* film, for instance is meant to be humanized, even angelic. Her wings contribute to this visual; whereas, Smaug, with his bat inspired wings, is meant to be death incarnate. Because of the design direction of this dragon project, bird wings were not suitable and bat wings were used to suggest demonic flair.

Since bat wings are elongated hands and they do not have feathers, their wings do not provide lift the same way bird or airplane wings do, by creating lower air pressure above the wing than below it, see Figure 3.11. Instead, bats are forced to use a scooping mechanic to throw air downward and away from their bodies with a very high rate of frequency. Birds and bats can both glide, but overall bats are mechanically inferior fliers; though, they do win the climbing challenge.

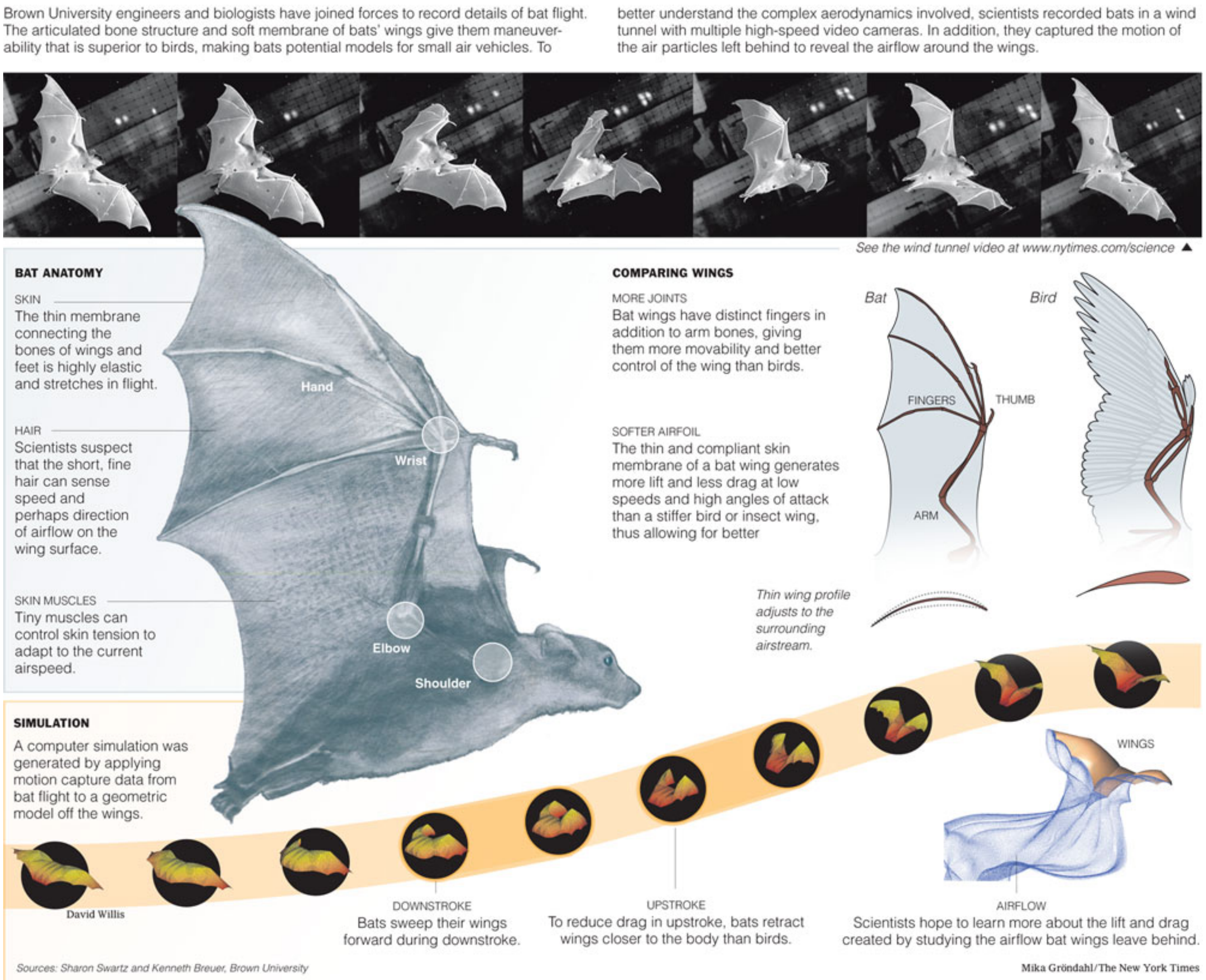


Figure 3.11: Bats in flight [BATF09]

Dragons would share this failing, but they are iconically leather winged and viewers expect them to look more like devils than bird winged angels. Because bats require larger surface area to body weight ratios than birds, their wing membranes attach all the way down at the ankle. This is why the dragon's wing membranes are so massive, and attach so far down the hip. It prevents the aforementioned hangbutt-syndrome (See section 3.1).

3.5 A Blend of Creatures

The limb bones of the dragon's front legs are based on the limb lengths of large felines (Figure 3.6). Heavier big cats such as lions, as opposed to slighter framed cheetahs, were used because they have the powerful build that could be used to launch a winged creature into the air, see Figure 3.12. The rear legs of the Dragon are more directly taken from fantasy, but support enough musculature for takeoff and are proportional to the body of the Dragon, despite not being found in nature.

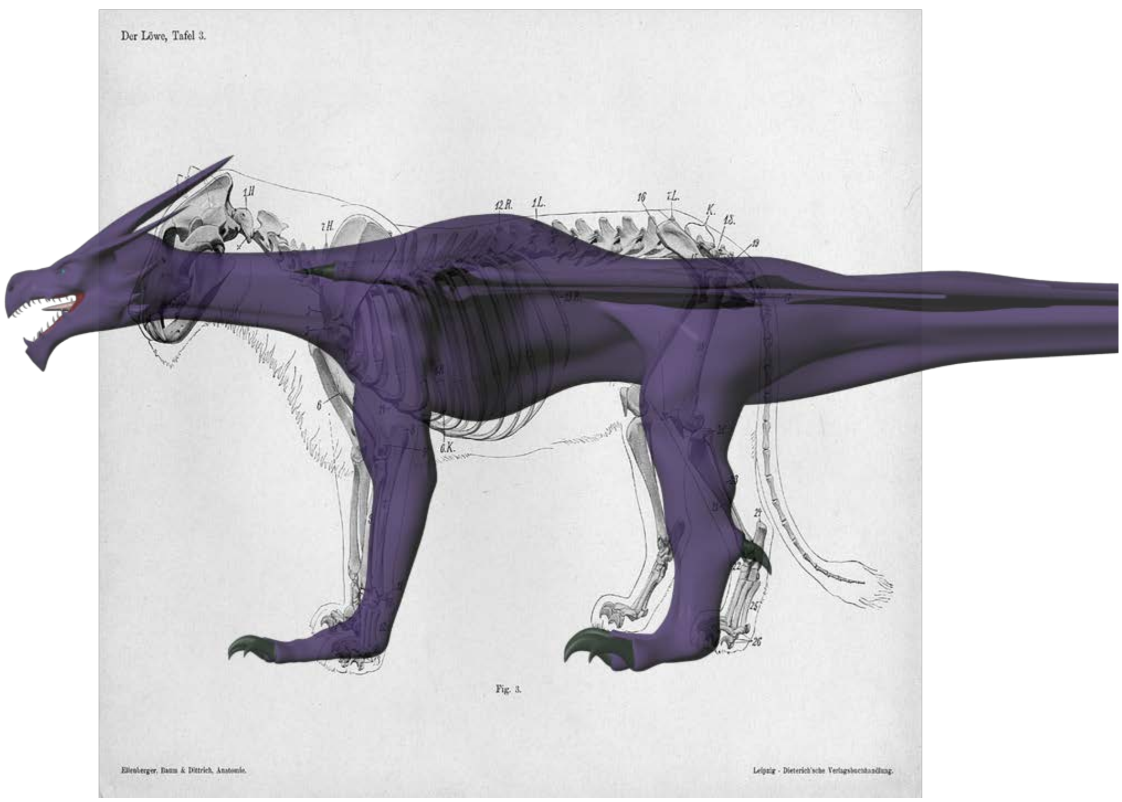


Figure 3.12: Lion and Dragon overlay [LION89]

3.6 Some Serious Size Problems Brought to You by the Square Cube Law

All of the anatomical features of the Dragon were designed to a specific size scale. The Dragon character in this film is 36 m (118 ft) from wingtip to wingtip, and 15 m (50 ft) from nose to tail. It has a body length of 3.2 m (10 ft) and stands 3.4 m (11 ft) at the shoulder, see Figure 3.13.

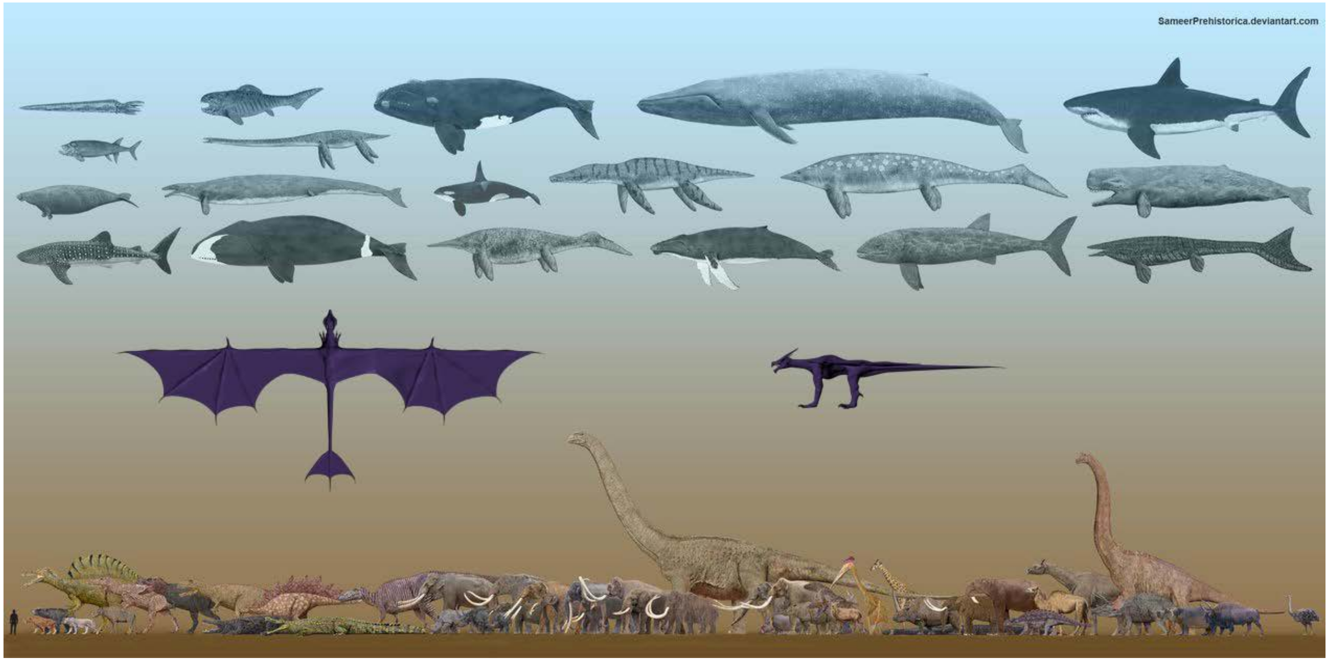


Figure 3.13: Size comparisons of megafauna and the Dragon Character [SIZE15]

The largest flying dinosaur fossil on record is that of the *Quetzalcoatlus*, part of the *Pteranodon* genus. [FOSF12] This creature measured an estimated 10 meters (33ft) from wingtip to wingtip, making the dragon around four times the size of the biggest airborne creature ever to have existed and placing it firmly in the realm of fantasy. The bird with the largest wingspan, an albatross, despite touching higher than a basketball rim, is a relatively pathetic 11.5 feet. The *Quetzalcoatlus* also had leathery wings which makes it a closer parallel to the anatomy of the Dragon. [PLGT12] The Dragon's wingspan is similar to that of a Boeing 737-100 series but it has far less mass and length. The surface area of the Dragon is not a perfect match to that of a *Quetzalcoatlus* but is as close as possible so that realistic uplift could be mimicked from an existing creature in nature. This enhances believability and allows the viewer to retain immersion within the story while watching impossible creatures flit about. Because of the square cube law, there is no way the beast could possibly fly in our world.

> The square-cube law can be stated as follows:
>
> When an object undergoes a proportional increase in size, its new surface area is proportional to the square of the multiplier and its new volume is proportional to the cube of the multiplier.
>
> If an animal were isometrically scaled up by a considerable amount, its relative muscular strength would be severely reduced, since the cross section of its muscles would increase by the *square* of the scaling factor while its mass would increase by the *cube* of the scaling factor. As a result of this, cardiovascular and respiratory functions would be severely burdened.
>
> In the case of flying animals, the wing loading would be increased if they were isometrically scaled up, and they would therefore have to fly faster to gain the same amount of lift. Air resistance per unit mass is also higher for smaller animals, which is why a small animal like an ant cannot be seriously injured from impact with the ground after being dropped from any height. [SQRE15]

Wings are only half the equation for successful flight because precise body control is the result of a correctly designed tail. The rough size of the tail membranes of the Dragon is derived from the tail of a modern plane. The tail of birds, because of their smaller size, are massive in relation to those of all other known flying objects and animals. However, using the tail of a bird would result in a rather strange looking dragon because pigeons with horns are not exactly menacing. Because dragons do not typically fly at hundreds of miles per hour, a biplane was used for reference instead of a military or civilian jet.

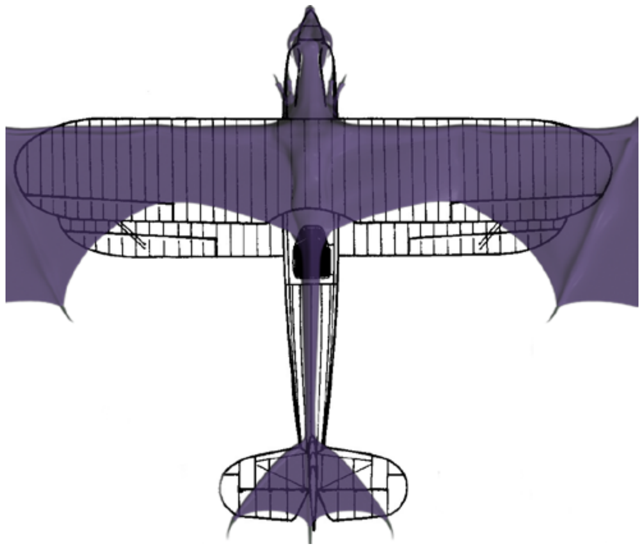


Figure 3.14: Biplane Dragon overlay [BIPL15]

The length of the tail was a purely subjective decision based on what looked appropriate, see Figure 3.14. It is; however, variable as the "tailCtrlSpecial" controller comes with a parameter that changes the length of the tail greatly, as discussed in Rigging. Webbing was used to keep the creatures anatomy uniform and to make use of the same skinning and rigging techniques learned working on the wings.

3.7 Topology – Quadrilaterals and Triangles in the Shape of the Dragon

The topology of the model is as even as possible, uses four sided polygons wherever possible, but does include triangles in areas with large deformation demands. Quadrilaterals (quads) are the preferred polygon size because they allow for even tessellation upon rendering, smooth loops without spiraling for muscles, skin, and deformation, easily convertible between file type, and compatible with most 3D packages. However, in some cases triangles are more useful and necessary. Triangles offer sharper detail than quad polygons of similar size and were a crucial tool for maintaining a manageable polygon count. Triangles were; therefore, the best option for sculpting the detail of some areas of the muscles, and to create the horns, spikes, and claws of the Dragon more efficiently. The polygons are visible from orthographic and detail views in Figure 3.15 below.

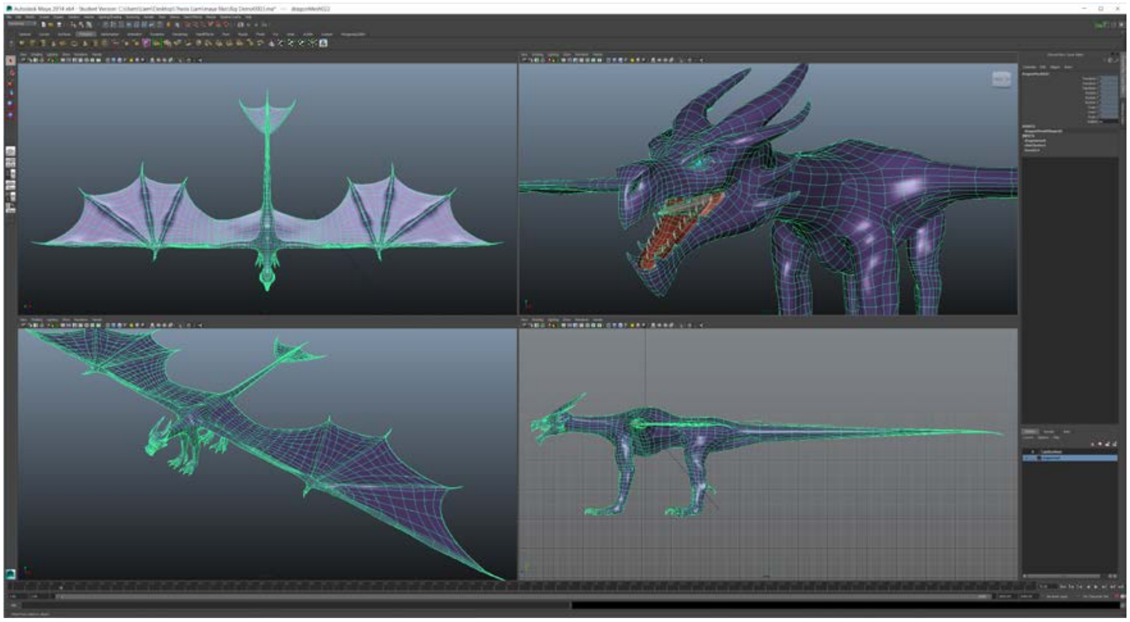


Figure 3.15: Topology orthographic

The model and rig needed to be usable on a home machine with a solid frame rate. This meant that adding in an extra twenty edge loops in order to get muscles in the dragon just to avoid triangles was needless. Because the model is tessellated in order to facilitate rendering, the presence of a small number of triangles, in the name of efficiency, is acceptable. The result of this mix of quadrilaterals and triangles, the need for different levels of detail, and density of polygons for deformation means that the mesh topology is unevenly distributed. There are more polygons in the face (which is standard), and areas of high deformation (elbows, knees, shoulders, spike insertions on the wings, the tail, and the hands and feet). The areas that do not deform as much have far fewer polygons that those with greater deformation because it allows the model to take up fewer resources. It is important to account for this when creating UVs, and when texturing.

CHAPTER FOUR

RIGGING AND ANIMATION

4.1 Requirements

The requirements for animation are all based upon the storyboards, see Apendix A Figures A.1 - A.l2. When rigging the Dragon, the required capabilities for each limb are determined with the poses demonstrated during the storyboards. These include flight, a leap from the side of the mountain during a terrestrial 180 degree turn, and diving attack with both the head and tail.

4.2 Set-up and Basic Structure

The rig is composed of bones and joints arranged to mimic real anatomical pivot and support points coupled with Spline Inverse Kinematics (SIK) solver handles, Inverse Kinematics Rotate Plane (IKRP) solver handles, custom Forward Kinematics (FK), and set driven key relationships to drive the mesh deformations. The controllers include extra attributes and hidden attributes in order to simplify the rig and animator interaction while providing the control necessary for animation. Specifically, the tongue, neck, spine, and tail are SIK solvers with seven control points. The base of these are parented to controls where they meet in order to facilitate intuitive interaction between otherwise unlinked rig assets. The arms, legs, and wings all make use of IKRP solvers with additional external control options to allow for greater manipulative control of the IK handle, see Figure 4.1.

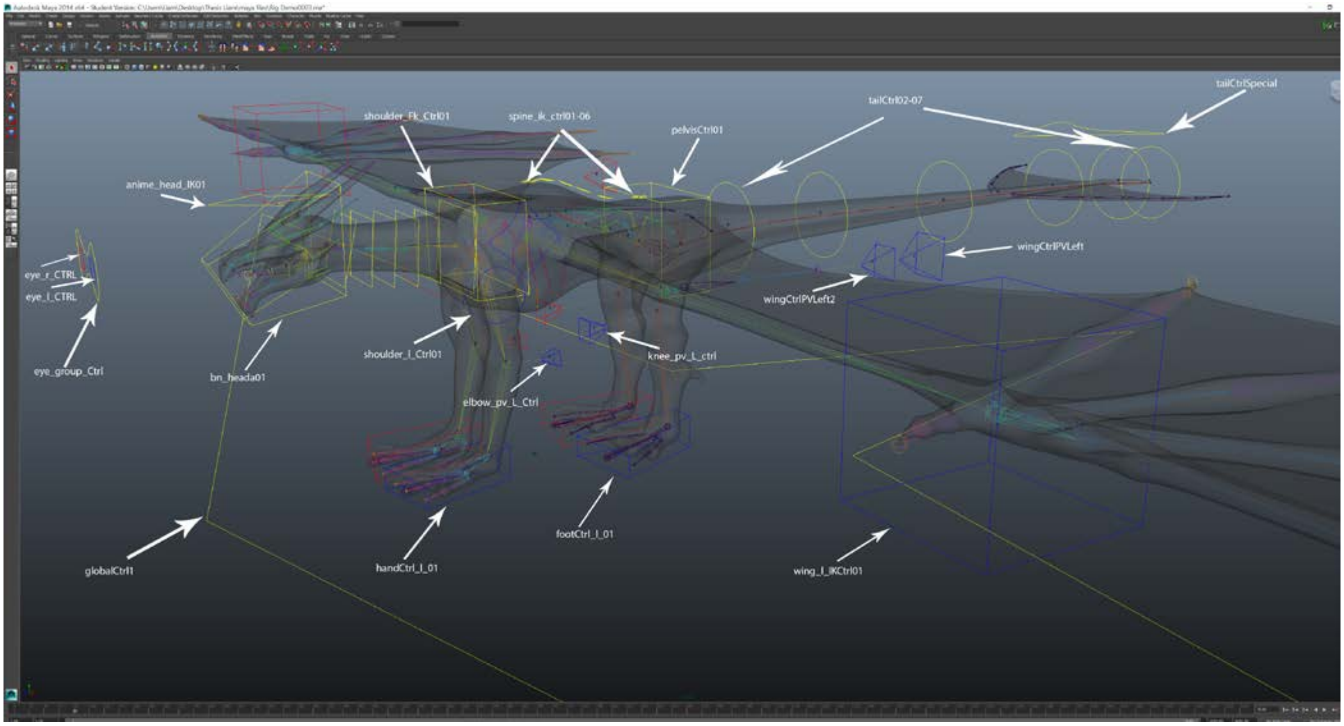


Figure 4.1: Most commonly used labelled controllers

Controllers in the figure above are labeled using the names they have in the actual Maya file in order to be useful to those who may wish to use the Dragon asset in the future.

4.3 Rotate Plane Solver Saves the Day (Many Days of Animation That Is)

The reason for using IKRP solvers instead of a normal IK solver is the massive increase in control. The way a solver typically works, is by either guessing or being informed of a preferred angle and then bending the joint based on that preset attribute. IKRP solvers allow for the animator to use a controller to key frame the tangent to the IK solver's angles of joint manipulation. [MAMY15] The capacity to manipulate the tangent, can be used to correct unacceptable automatic solutions and as an animation tool for rotating an entire limb quickly and easily. In order to function, an additional controller is required in the form of increased rig robustness, at the cost of complexity. Specific to this Dragon, the IKRP solver was used in the elbow and knee joints of the four lower limbs and the wings. The pitch of the entire wing can be adjusted with one controller in a very intuitive fashion. The knee and elbow joints gain a new level of articulation above and beyond a normal IK handle from this mechanism. The rotate plane solver in the elbow is demonstrated in Figure 4.2 below.

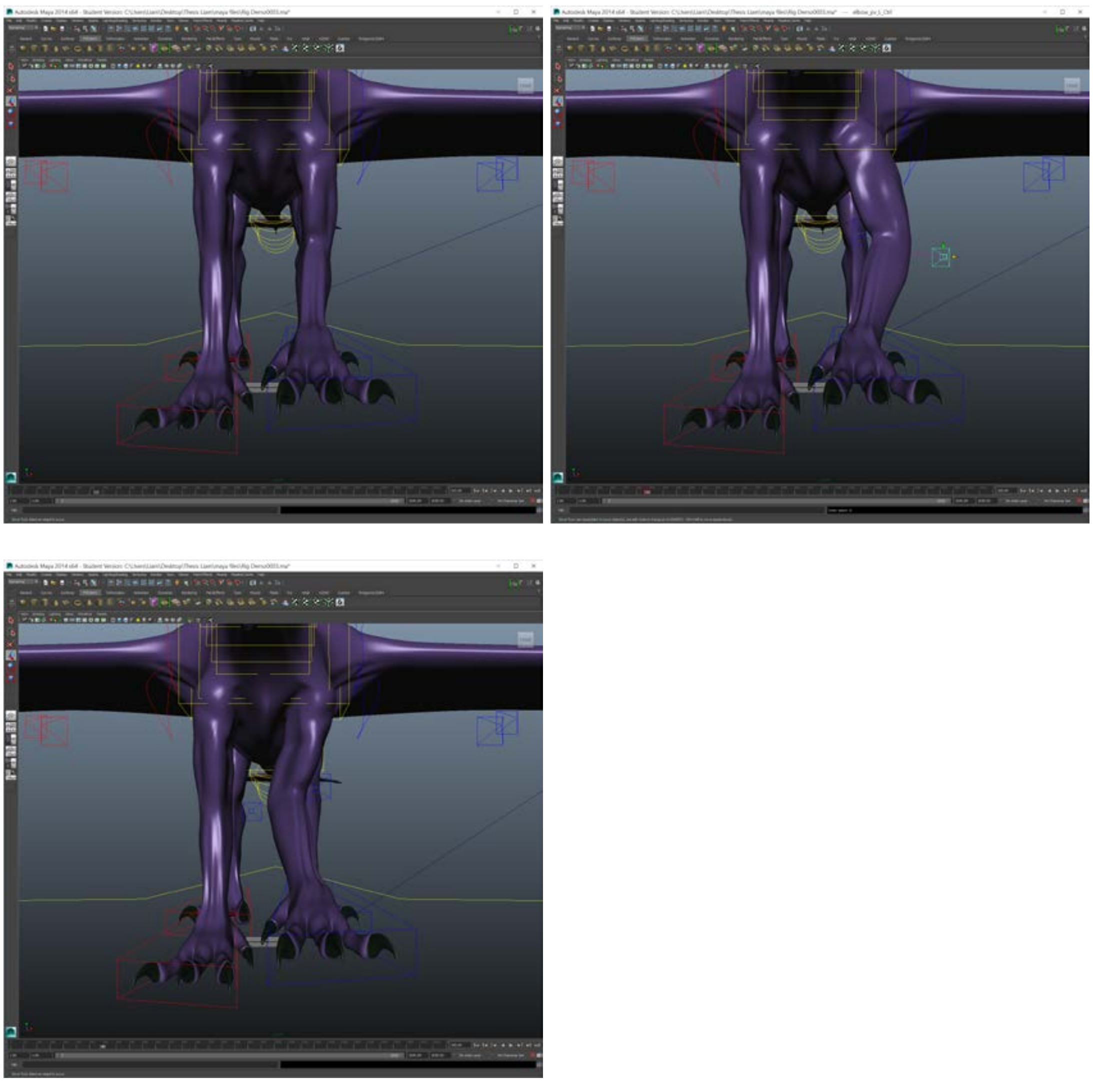


Figure 4.2: Rotate plane solver of front left forelimb

One of the large advantages of the IKRP solver and the control system in place is the avoidance of menus. The animator can make adjustments with a controller that is visually tied to the limb in question in a way that is intuitive and requires fewer interactions with the Maya interface, accelerating the workflow. Because the wings also use an IKRP solver, they mimic human arms and are familiar to experienced animators, lower the learning curve of the rig, and increase workflow speed.

4.4 Joint Placement (Where Your Bones At?)

Joint placement is the process that determines the points of articulation for the mesh. Poorly placed joints will hinder animators and riggers alike, and ultimately reduce the quality of the asset. The goal was to use the fewest number of joints possible to achieve the articulation that was desired. Using superfluous joints in a rig slows machine performance and wastes time. Efficient and well placed joints reduce the time spent painting weights and allow the mesh to be manipulated at the correct edge loops to maintain anatomical accuracy.

The bones of the Dragon rig are meant to be a rough mimicry of what the joints in a real life dragon would be. The rig is, by necessity, much less dense and with far fewer bones than required in a living creature. The hands and feet, for instance, make use of an additional bone in the forearm or shin in order to allow rotation that would be handled by the many bones of the wrist or ankle, respectively. The root joint of the creature is in the pelvis, but this is not always the case with true dragons in visual effects. The bone structure of the dragons in the *HTTYD* video game files that were released have a center of gravity in the shoulders. The Dragon uses a center of gravity at the pelvis in order to maintain weight and allow for bipedal motion without a second rig. In order for a dragon to rear up onto its hind legs, commonly required for games and movies, a dragon with a center of gravity outside of the pelvis is suboptimal. Animators are also more familiar with a pelvis based root joint and as such will be able to apply their existing animation experience to the rig without as steep a learning curve. It is very unlikely that a dragon would be required to do a handstand though, for which a shoulder based center of gravity would be superior. The Dragon has ribs as well as limb bones in order to prevent caving of the chest cavity, to allow for the mesh to be manipulated more specifically, and to reduce time spent on painting weights. The alternative was painting the chest and abdominal vertices to be controlled by the spine.

The Dragon has a large number of joints in the face. These allow for the opening and closing of the Dragon's jaws. He can also manipulate his lips, horns, and nostrils. The horns are not prehensile, but can be manipulated in order to convey emotion similar to a dog's ears.

Joints were named using a specific naming convention, on all parts of the rig, with multiple purposes. Prefixes were used to enable script based selection. When possible, joints were named in the common vernacular of existing animals after the joint they corresponded with. The joints were also designated root if they were the parent of many other joints and located in the centerline or left and right if they were not. As a result joints were named "prefix" _ "l" (left) or "r" right "_" "joint" "letter a,b,c…" number, e.g. bn_l_elbow01. This is the name of the left elbow joint number 1 bone and is used for binding. Joints that are not used for binding to the mesh are given the prefix "be". These joints were used for areas, like spikes, where the joints needed to extend to the end of the mesh, but the mesh did not require influence from the end bone, e.g. be_l_wingMiddle01.

4.5 Controllers

Controllers are how animators interact with rigs. If an animator is touching any other component of the rig, it is because the rigger has failed to provide adequate tools to the animator to manipulate that rig. The controllers should all have zero values for their attributes when the rig is in “bind pose” so that the animator can return to that starting position whenever they need to. The bind pose also provides a frame of reference for the average joint flexion of a given part of the character. The controllers in this Dragon rig are all Non-uniform rational B-spline (nurbs) curves. They look like polygons but are indeed nurbs curves.   The controllers are nurbs curves so that animators can make use of the display options in Maya to examine their handiwork without the use of layers, special shaders, or extra tools. The polygonal shapes of the curves are created using the linear curve tool and are meant to be unique to the part of the rig that they influence.

Each controller corresponds to a different SIK/IKRP control point or limb. This way, if they intersect or are moved about the scene, their function is clear. For instance, the controller for the main group of the Dragon is a low resolution outline of the creature as seen from above, see Figure 4.3.

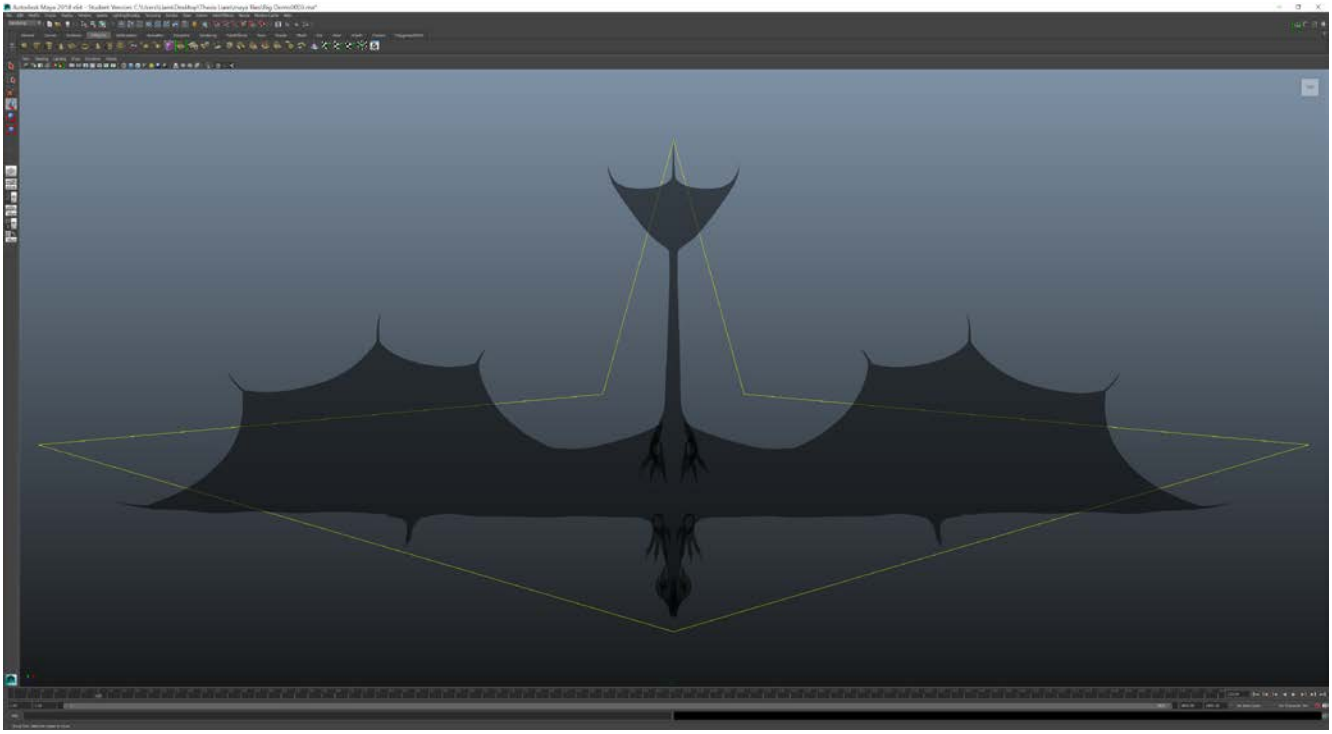
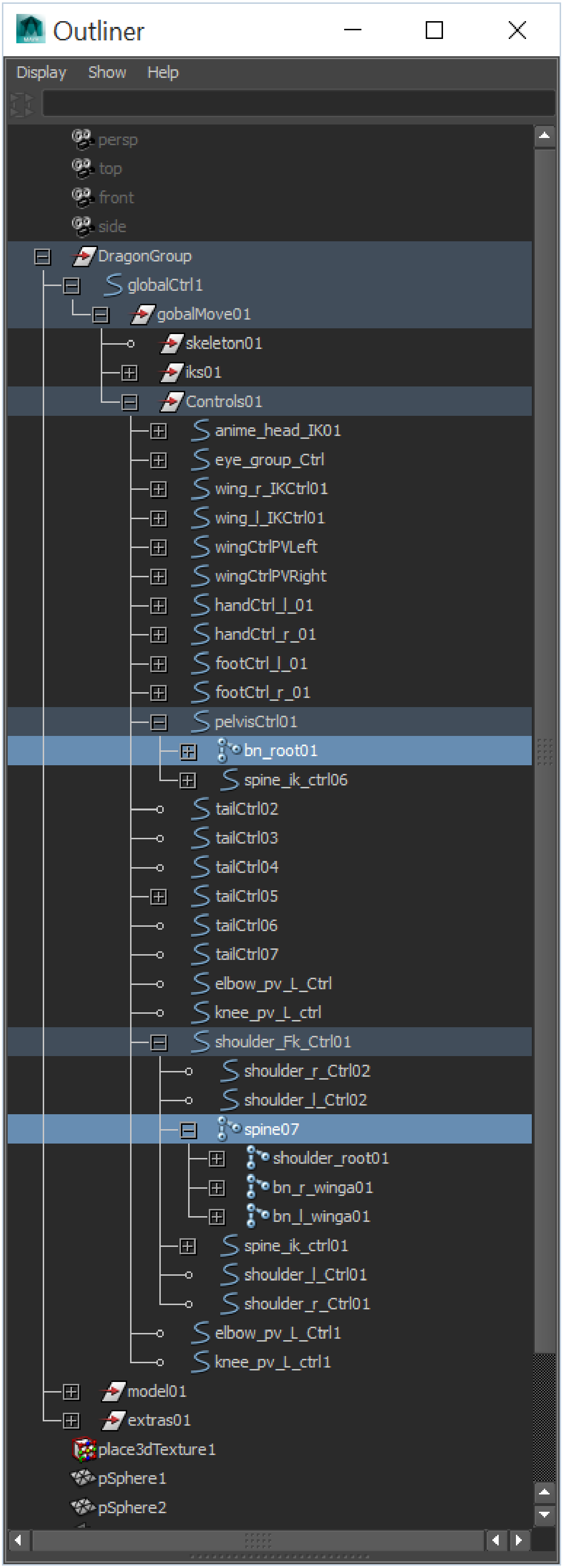


Figure 4.3: Dragon as seen from above with global controller

The controllers all use the standard color coding of red (right), yellow (center), and blue (left), so that a given controller is instantly recognizable as belonging to a given hemisphere of the rig. That way, if a control is pushed across the midline of the body, it is readily identifiable by the animator. All controllers are also named using a camel case convention with an “_r_” or “_l_” flag in order to facilitate scripting or accessing of the controllers in the Outliner by name.



The Outliner shows the hierarchy of the controllers and their groups. These must be in precise order to allow the rig to have a pyramid of influence. The global controller (globalCtrl1) moves everything by moving the individual controllers connected to the mesh. These specific controllers include the shoulders, hips, tail, and IK handle controls for the limbs and wings. These hubs of control are also all parents of controllers beneath them. The rig makes use of two skeletons with independent roots at the shoulders (spine07) and pelvis (bn_root01), selected in Figure 4.4.

Figure 4.4: The heirarchy of the rig

4.5.1 Extra Parameters for Animation

In order to aid the animation process, there are a number of added parameters on the controllers. The fingers and toes can all be curled with sliders of the IK handle controller closest to them. The mouth opens and closes to its limits with the global controller linked to the bones of the jaw. The tail has a twist operation for macro animation, and a large subset of flap controls manipulated with attributes linked to set driven keys. The result is a more efficient animation set up, with fewer key frames required. The set driven key and limits on the extra attributes help to prevent the rig from breaking. One solver controls a large number of bones, saving the animator from hand positioning them individually. The extra parameters have common sense names based on their function; for instance, Curl up/Down raises or lowers the spikes and membranes in the Y axis of the tail.

4.5.2 Controllers for Dragon

The global controller allows for translation, rotation, and scaling of the dragon mesh as a whole; it also influences all other controllers the same way. It also has extra attributes in order to allow animation of the jaw, spine, wing fingers, tail membranes, ribs for breathing, and the IK/ FK switch for the neck controls. See wing and tail examples in Figures 4.5 and 4.6 below.

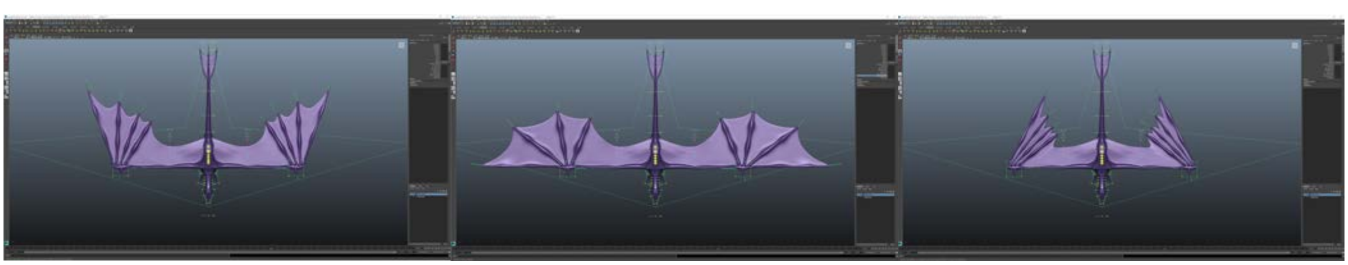


Figure 4.5: Using set driven keys from the global controller to control wing digits and expand and collapse the wing membranes

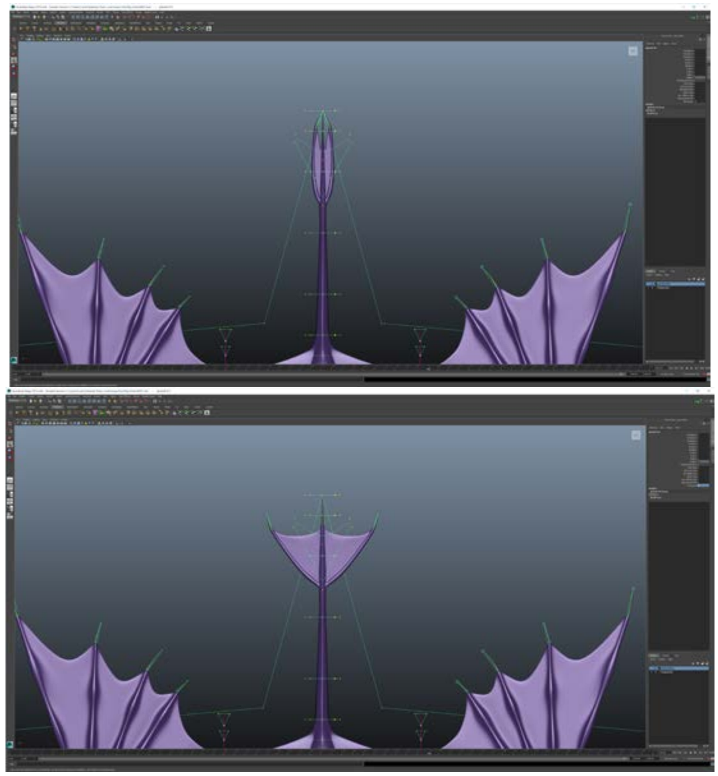


Figure 4.6: Using set driven keys from the global controller to control tail spikes in order to expand and collapse the membranes

4.5.3 Jaw Open and Close

The jaw has a set of limits determined by the set driven keys of the joints used to drive the mesh and the global controller. The jaw can only be closed to -8 degrees of the top jaw and 10 degrees of the bottom jaw. The top and bottom of the jaw open and close, and the head spines are part of the set driven key animation. The maximum the jaw can be opened is 20 degrees of the top jaw and -20 of the bottom jaw. The result is shown in Figure 4.7 below. The neutral jaw position or bind pose, is the far left image.

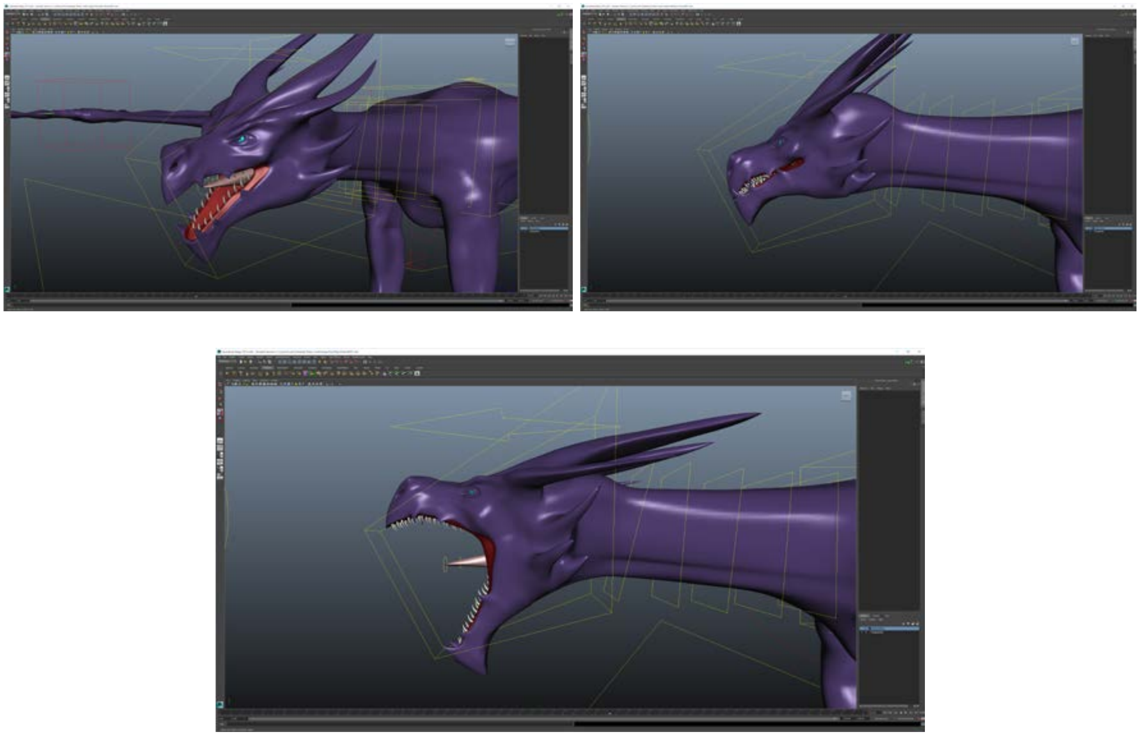


Figure 4.7: Using set driven keys from the global controller to control the jaw open and close

4.5.4 Head and Neck Rig and Controllers

The neck controls function in Inverse Kinematic or Forward Kinematic modes. The mode is switched with the global controller and automatically turns on/off the visibility of the IK controller. The neck is controlled by the arrow shaped controller at the top of the dragons head, “anime_head_IK01”, when in IK mode and by the array of squares ringing his neck when in FK mode. A series of joints is shared by these control systems with the exception of “jDrv_spIK_neck01”which is used only in IK mode as a driver joint for the position of the spline curve used by the solver to position the neck joints, see Figures 4.8-10.

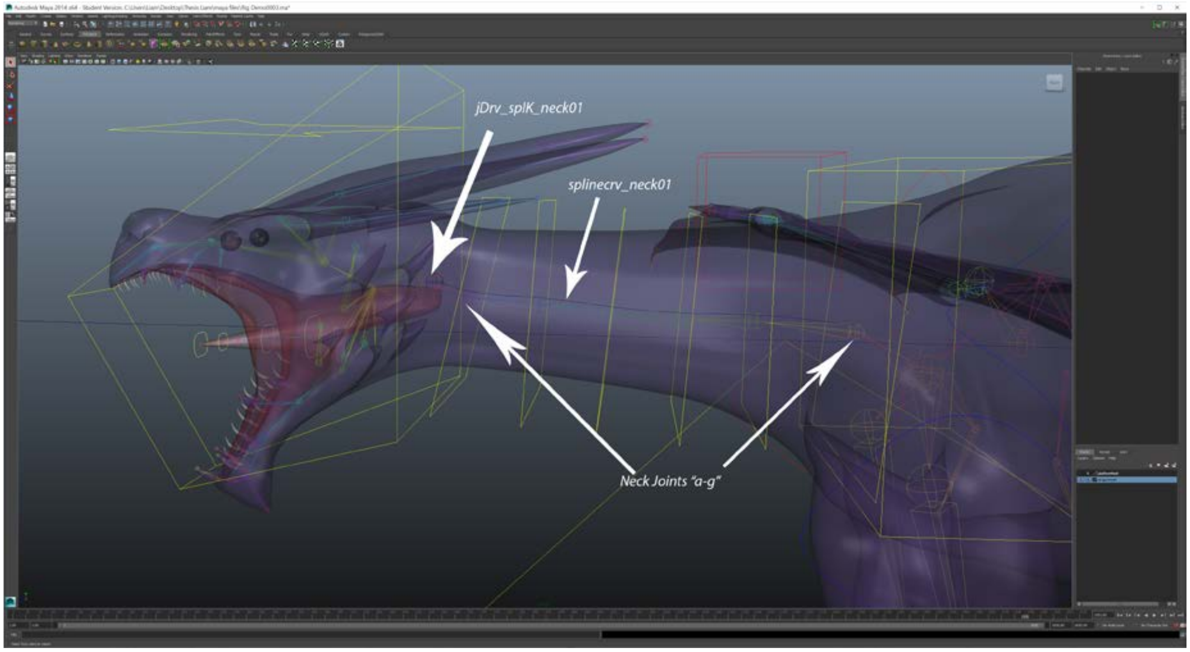


Figure 4.8: The neck rig

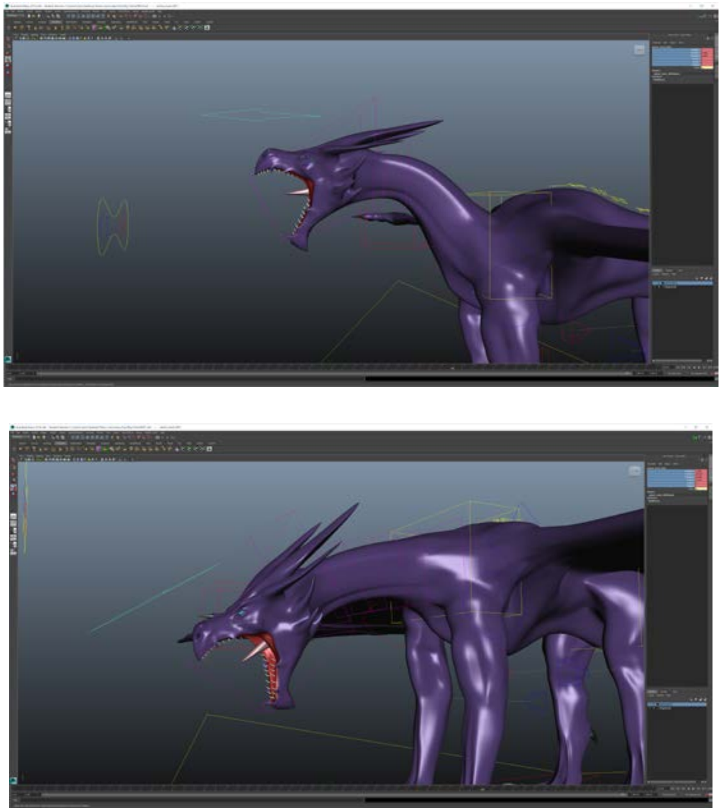
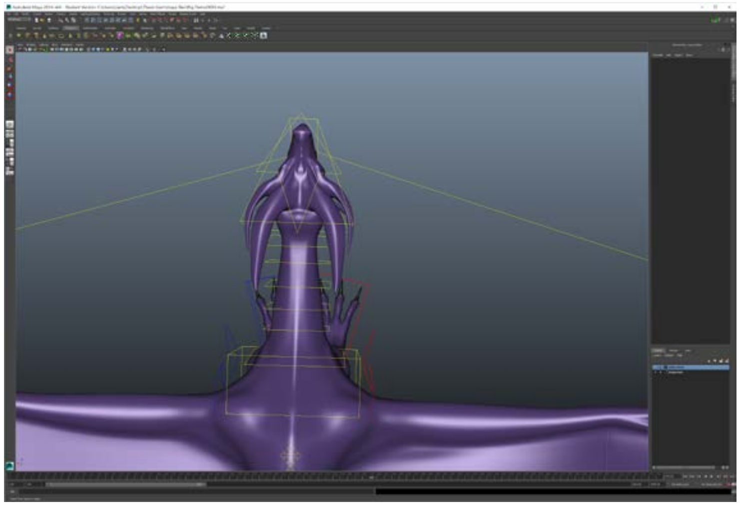


Figure 4.9: Demonstration of the flexibility of the neck in IK mode from ¾ view



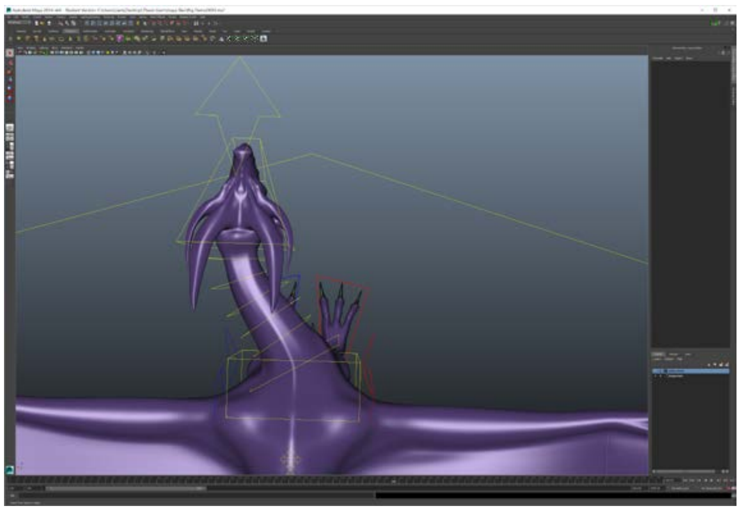


Figure 4.10: Demonstration of the flexibility of the neck in IK mode from top view

4.5.5 Eye Controllers

The eye controls, shown in Figure 4.11, are a set of three nurbs curves that the mesh of the eyes are connected to with aim constraints. The aim constraints of the eyeball meshes to the controllers do not include the default settings of the "World Up Type" in order to allow the eyes to rotate correctly beneath the global controller hierarchy. With the "World Up Type" set to any value other than "none" the use of the global controller to rotate the Dragon caused the eyes to spin and maintain orientation with the world space, instead of the object space, of the Dragon asset.

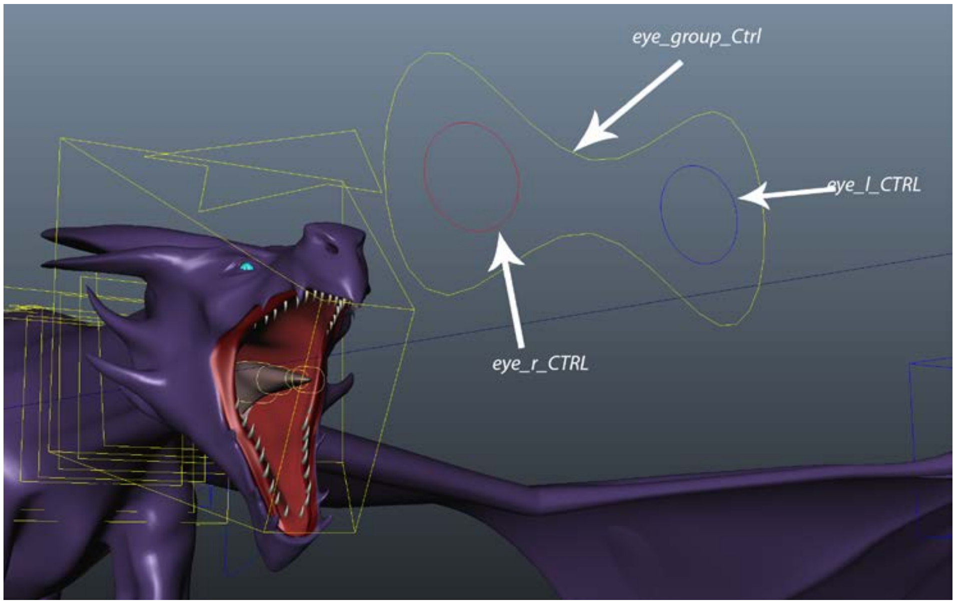


Figure 4.11: Eyeball controllers

4.5.6 Tongue Rig and Controllers

The tongue is rigged with a SIK solver and a series of nurbs curves controllers. The end controller allows for stretching from the base of the tongue along the curve of the spline solver, which mimics a real tongue moving backwards and forwards. The curve is controlled by the control vertexes, which are parented to cluster handles, which are in turn parented to the tongue controllers that are used to manipulate the bones of the tongue and allow for animation, see Figures 4.12-13.

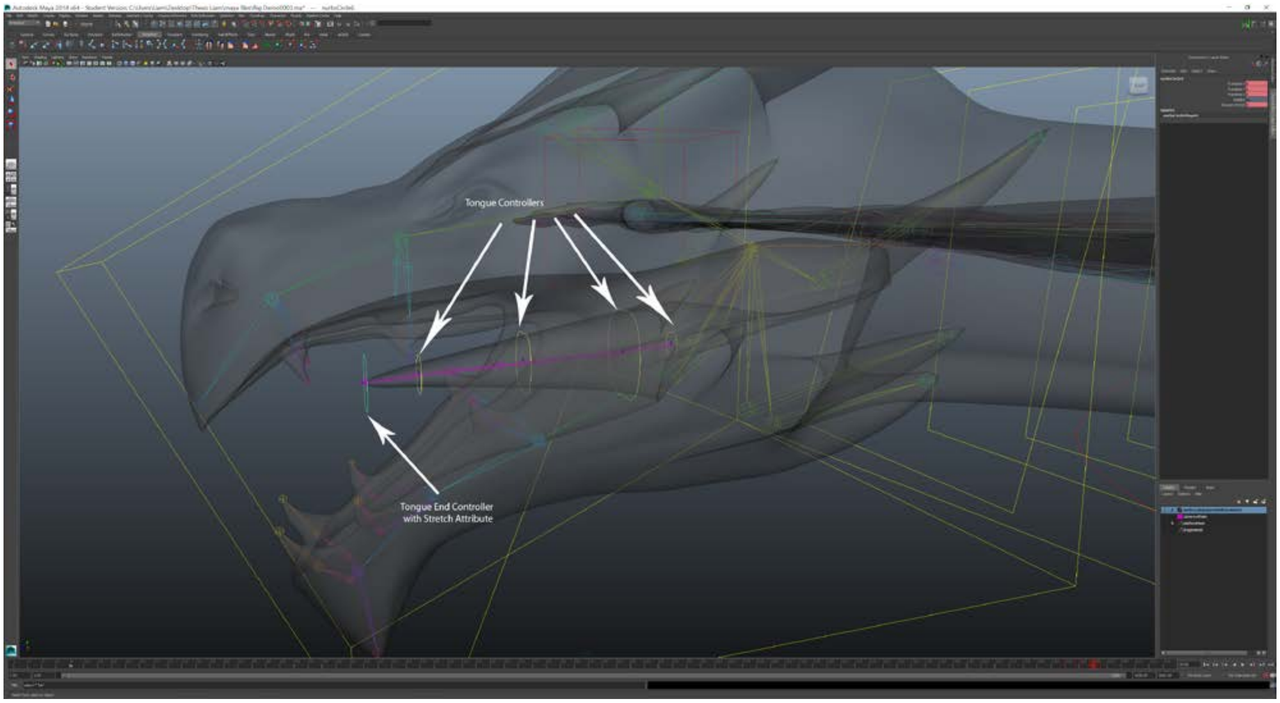


Figure 4.12: Tongue controllers

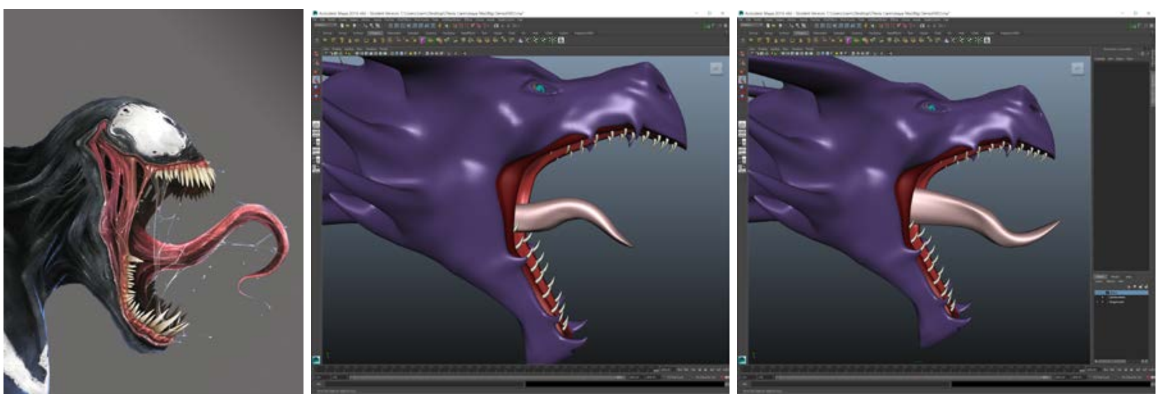


Figure 4.13 Inspiration and tongue articulation

4.5.7 Hands, Feet, and Leg Rigs and Controllers

The hand and forelimb IKRP handles of the Dragon use the same controller on each side of the Dragon. It is named “handCtrl_l_01”/ “handCtrl_r_01” and has extra attributes for animation of the finger digits. These extra controls allow for curling, rotating, spreading, and collapsing together of the fingers or toes. The “Finger Spread SDK/Toe Spread SDK” attribute makes use of set driven keys and, as such, has built in limits based on where the mesh begins to over stretch or to interpenetrate. In the event the animator wants to control one finger/toe at a time they can use the individual spread controls, which do not have limits, giving animators freedom the rigger may not have foreseen as necessary.

Figure 4.14: Finger digit extra attribute “Spread”

Figure 4.15: Rear digit extra attribute “Spread”

The fingers/toes can be curled individually, both upwards and downwards, into hyperextension or the shape of a fist. This hyperextension of the fingers/toes allows the animator to create more impact with the digits, see Figures 4.14 – 4.17.

Figure 4.16: Finger digit extra attribuite “Curl”

Figure 4.17: Toes digit extra attribute “Curl”

There are a set of false bones used to facilitate a foot roll that can be used to cut down animation times substantially during creation of walk/run cycles. These animations are accomplished with the use of the connection editor and extra attributes in some cases, and set driven keys in those requiring them. The foot roll is in neutral position at a value of 0, on its heel at 1, on the ball of the foot at 0.5, and on the toe tip at -1. This arrangement of set driven keys allows for smooth foot roll motion with almost no work by the animator, see Figure 4.18.

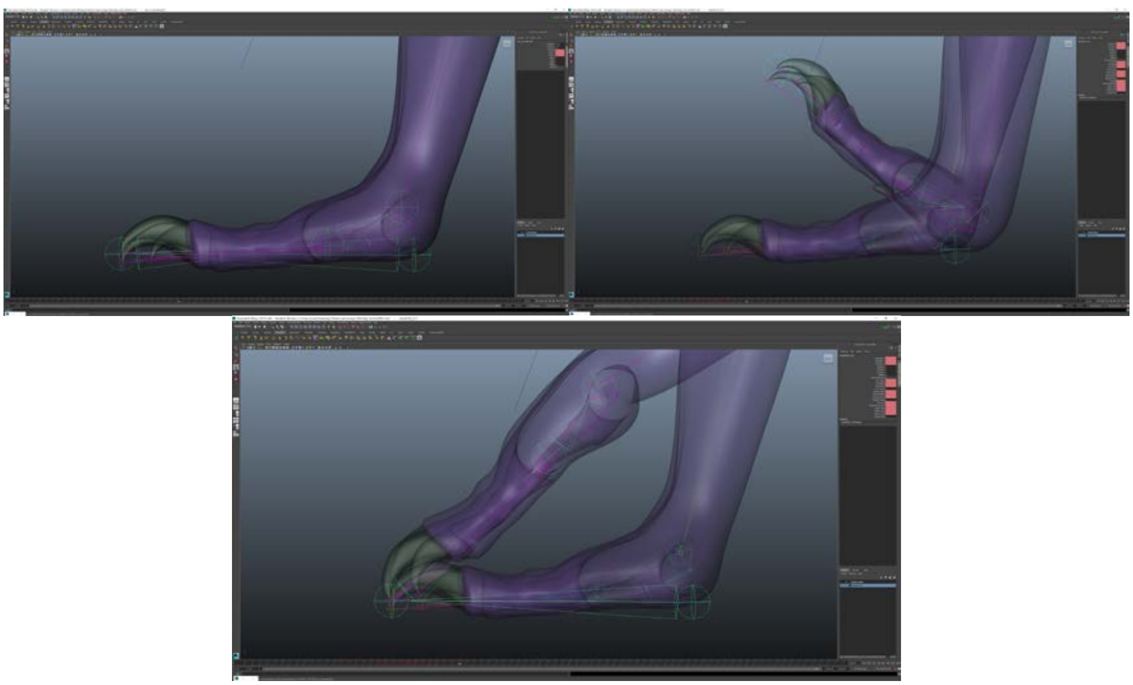


Figure 4.18: Foot roll false bones in action

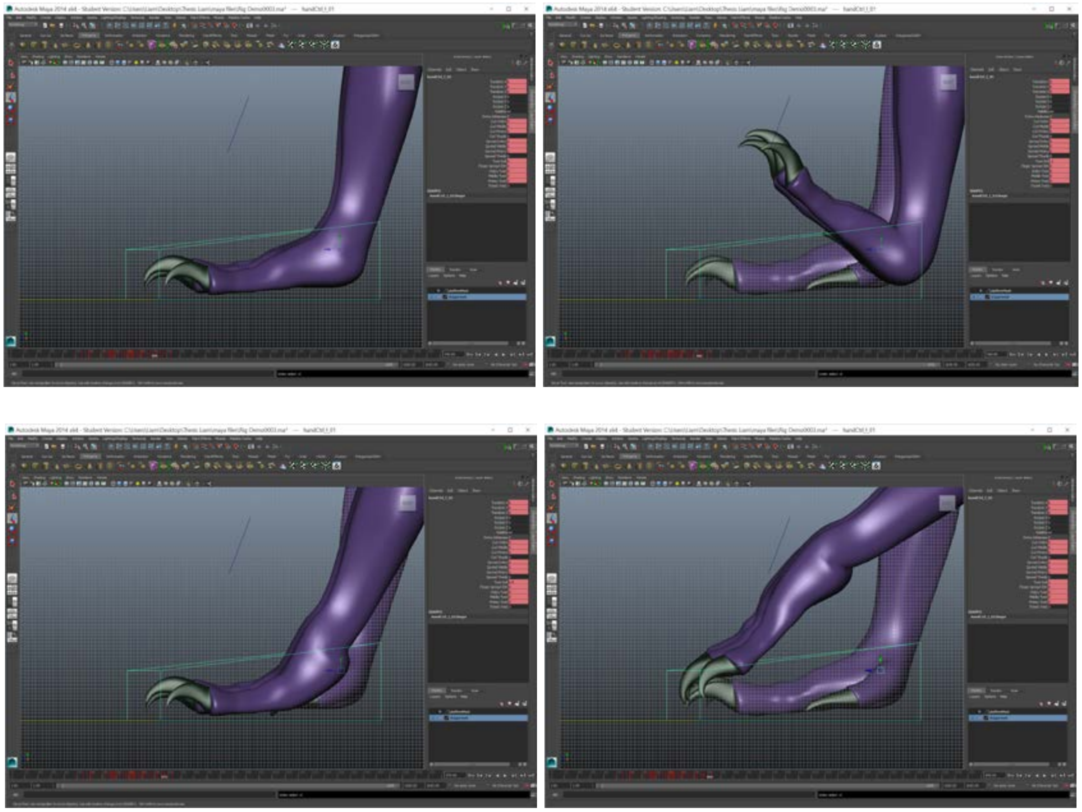


Figure 4.19: Foot roll with full opacity and visible controller channel box

The hand and foot controlers allow for IK handle manipulation typical in humanoid legs as well. The range of motion is not limited, and the “Sticky” funciton works properly with this rig. The rotate plane solver and pole vector controllers prevent flipping unless done by the animator intentionally, see Figure 4.19-21.

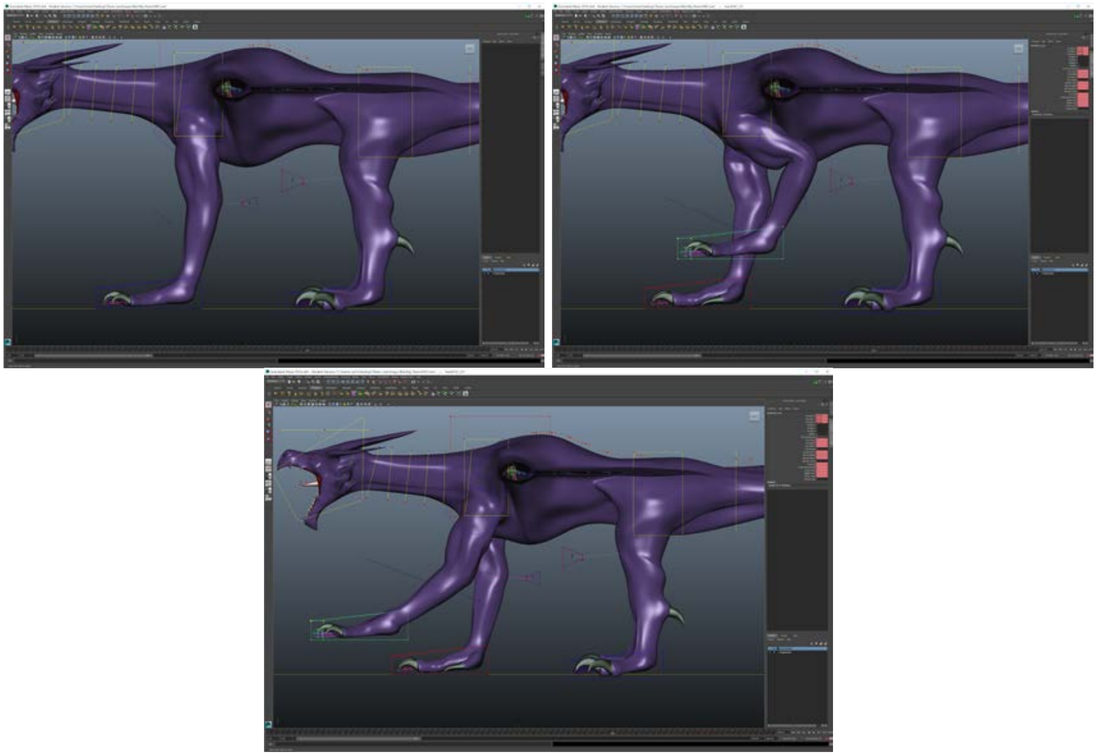


Figure 4.20: IK handle locomotion of the forelimb sideview

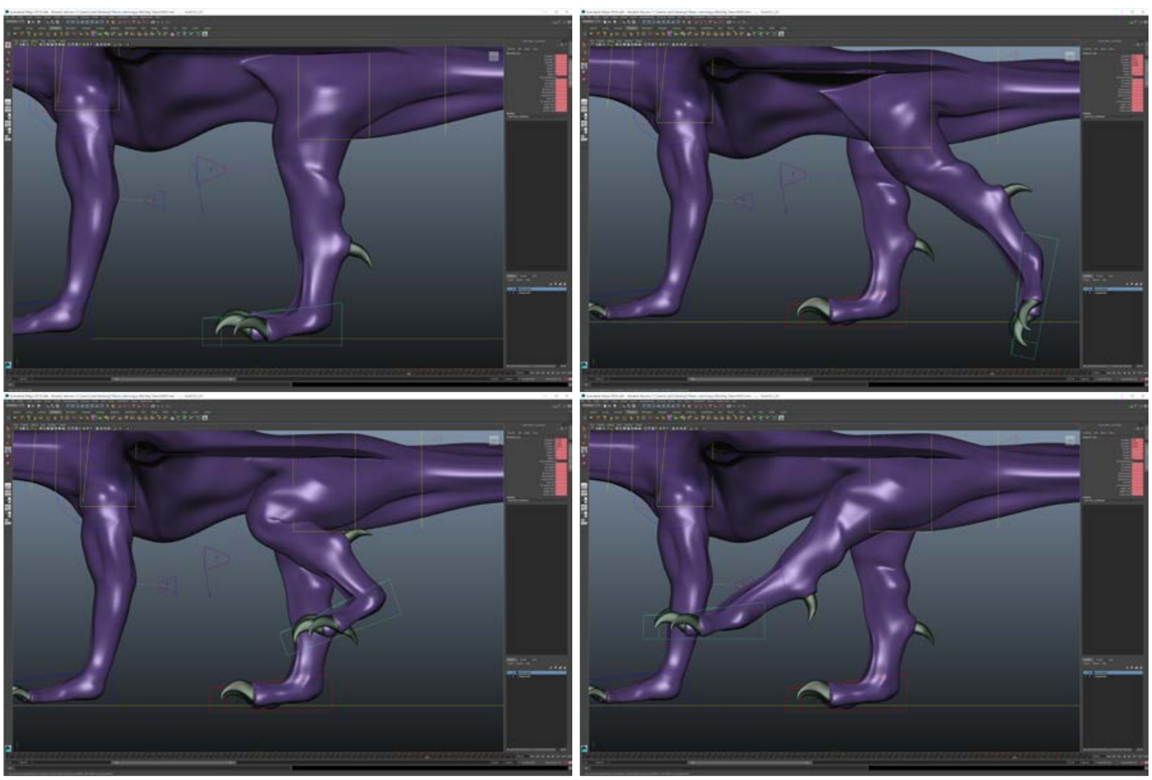


Figure 4.21: IK handle locomotion of the hind legs sideview

4.5.8 Shoulder Rig and Controllers

The shoulder girdle of the Dragon also moves the base of the neck, top of the forelimbs, and base of the wings. This is accomplished by parenting the secondary root joint of the upper spine “spine07” to the parent shoulder girdle controller, “shoulder_Fk_Ctrl01”. The controllers for the neck, spine, and both front legs are also parented under the shoulder girdle controller. These allow for the whole shoulder area to be manipulated, or for the child controllers moved independently. Rotation of the shoulder girdle controller can be, side-to-side, front to back, or up and down. Translation of the child controllers moves the base of the neck, the top of the spine, and the shoulder joints of both the wings and forelimbs, see Figure 4.22.

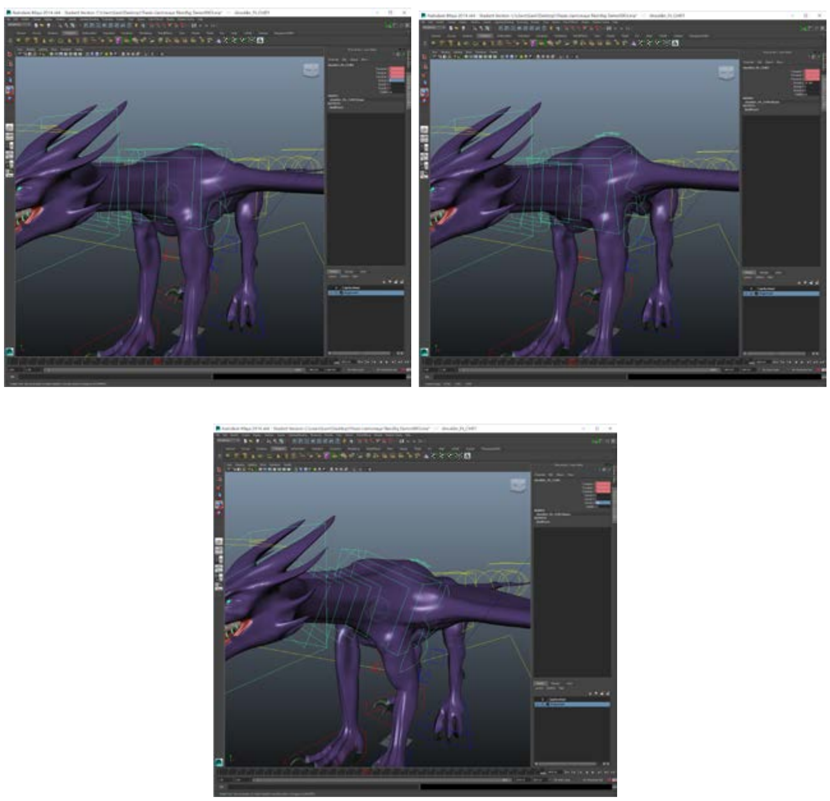
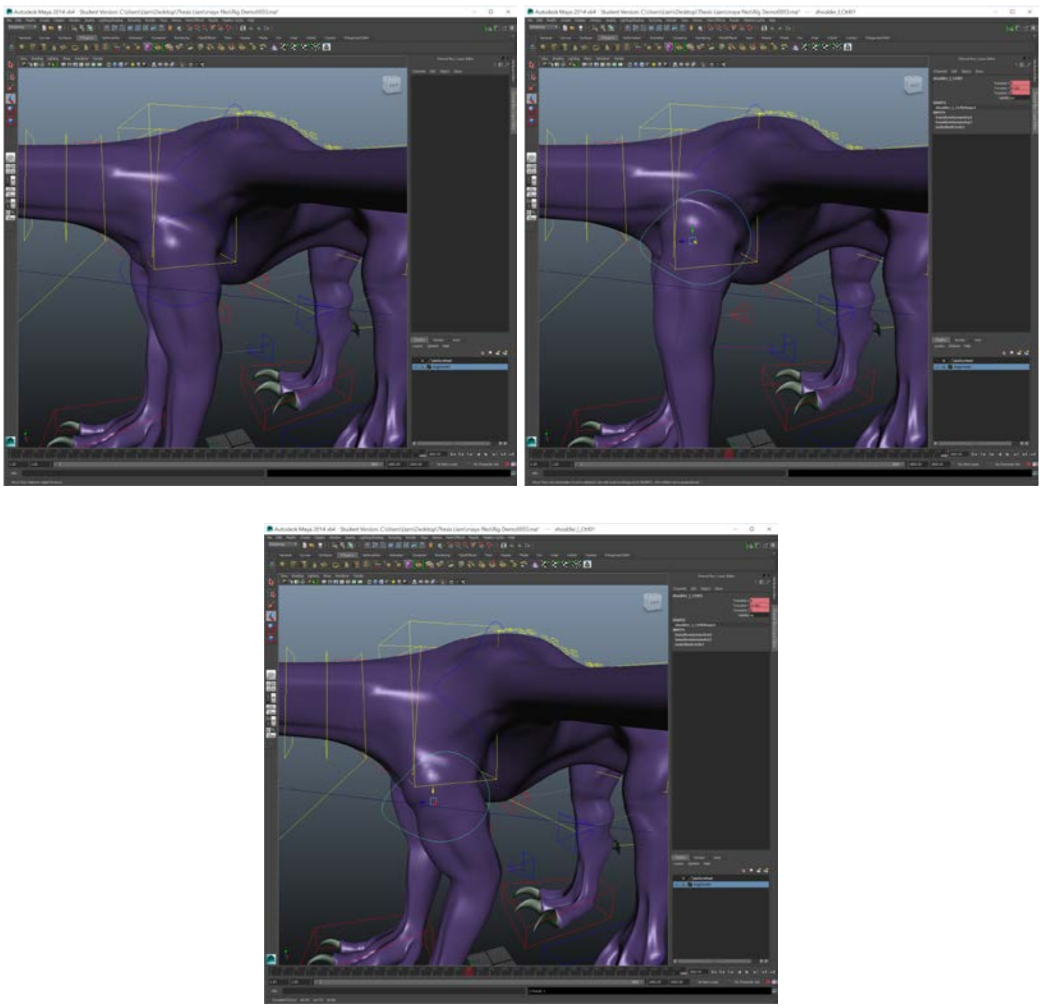


Figure 4.22: Shoulder girdle rotation in x and z axis

There are secondary controls for the each of the shoulders of the forelimbs and the false shoulders of the wings. These move with the shoulder girdle as a whole, normally, but can be independently controlled if the animator wants to manipulate the arms or wings, see Figure 4.23. Possible uses would be shrugging or hunching, a shoulder bump/shove, for a breathing animation, or as part of puffing out ones chest.



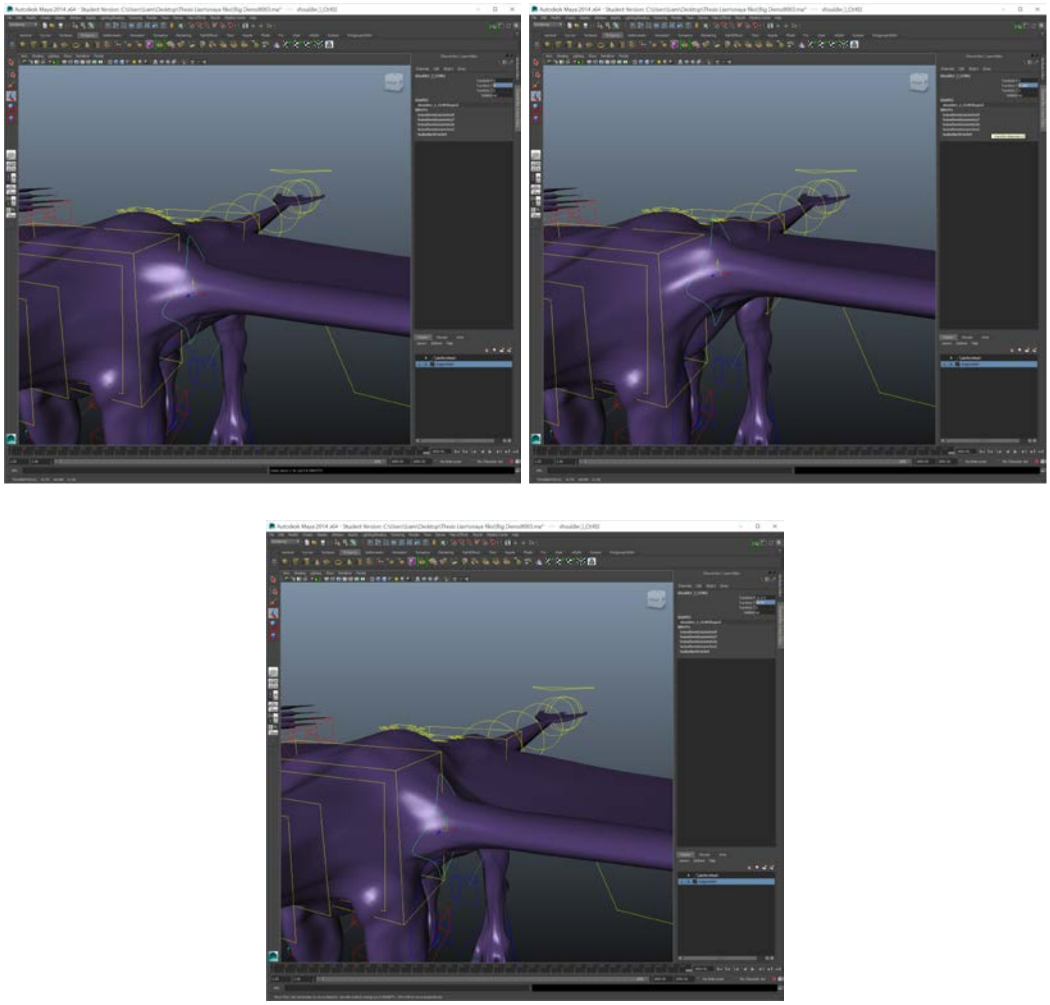


Figure 4.23: Independent motion of the shoulder and false shoulder controlers

The false shoulders of the wings can be placed in a way that greatly adds to the mass of the Dragon's upper body. The false shoulder controllers will still move correctly under the shoulder girdle parent, see Figure 4.24.

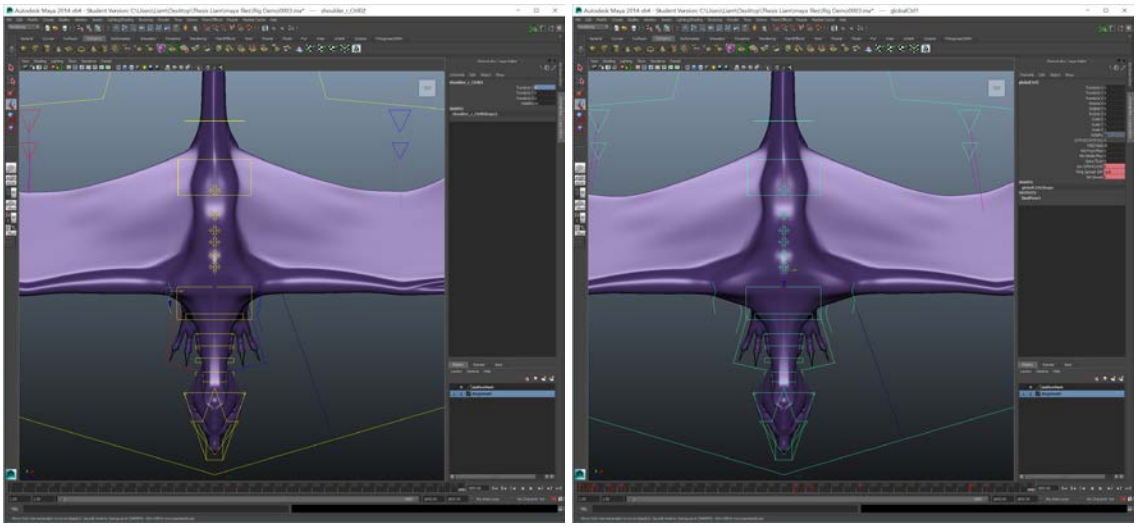


Figure 4.24: The false shoulder's independent controls can widen the upper back by lengthening the clavicles and scapulae of the Dragon

4.5.9 Tail Controller

The tail is controlled with seven controllers, six of which are used to position the SIK curve. The six spline controllers are circular in shape and are used to control the control vertex of the curve used by the SIK that drives the bones of the tail. They make use of cluster handles to do this because control vertexes cannot be directly parented to the controller. The seventh one, shaped like an elevator/stabilizer, is used to control the length of the tail and the webbing.

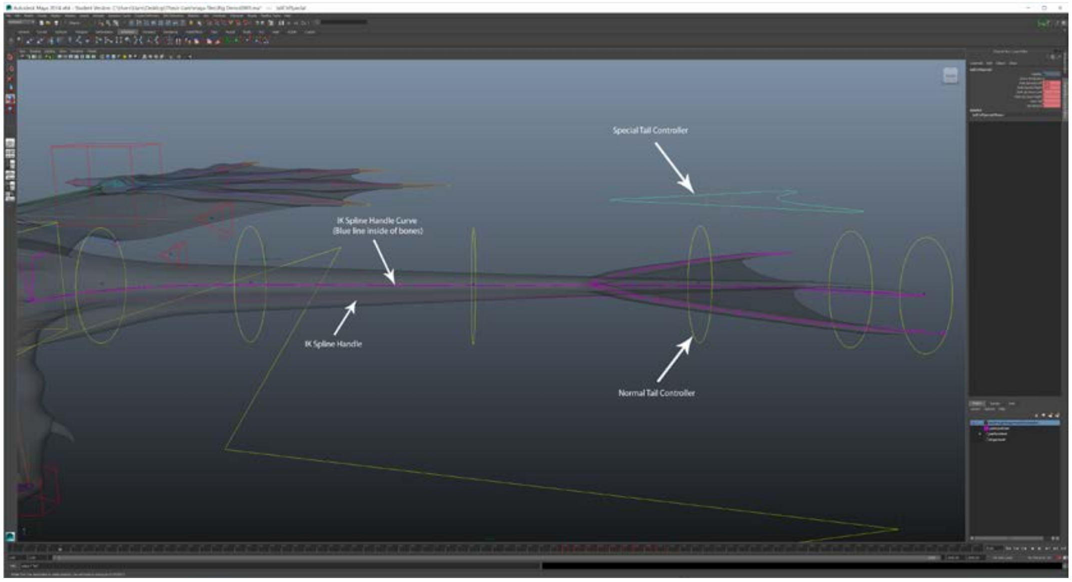


Figure 4.25: Controllers of the tail

A SIK handle was used to rig the tail because it allows for very rapid animation, and the solver creates a smooth curve down the length of the entire joint chain, see Figure 4.25. The SIK solver; thusly, does a large amount of the work for the animator. With as few as four controllers, an animator can manipulate fifty bones with precision and flexibility. The SIK solvers are one of the most computationally expensive parts of the rig, but are justified by the increased productivity. There are drawbacks; though, to the SIK solver. It resists being tied into a knot, which prevents accidental kinking of the tail mesh, but means the tail is less flexible than it would be with a forward kinematic rigging solution, see Figure 4.26.

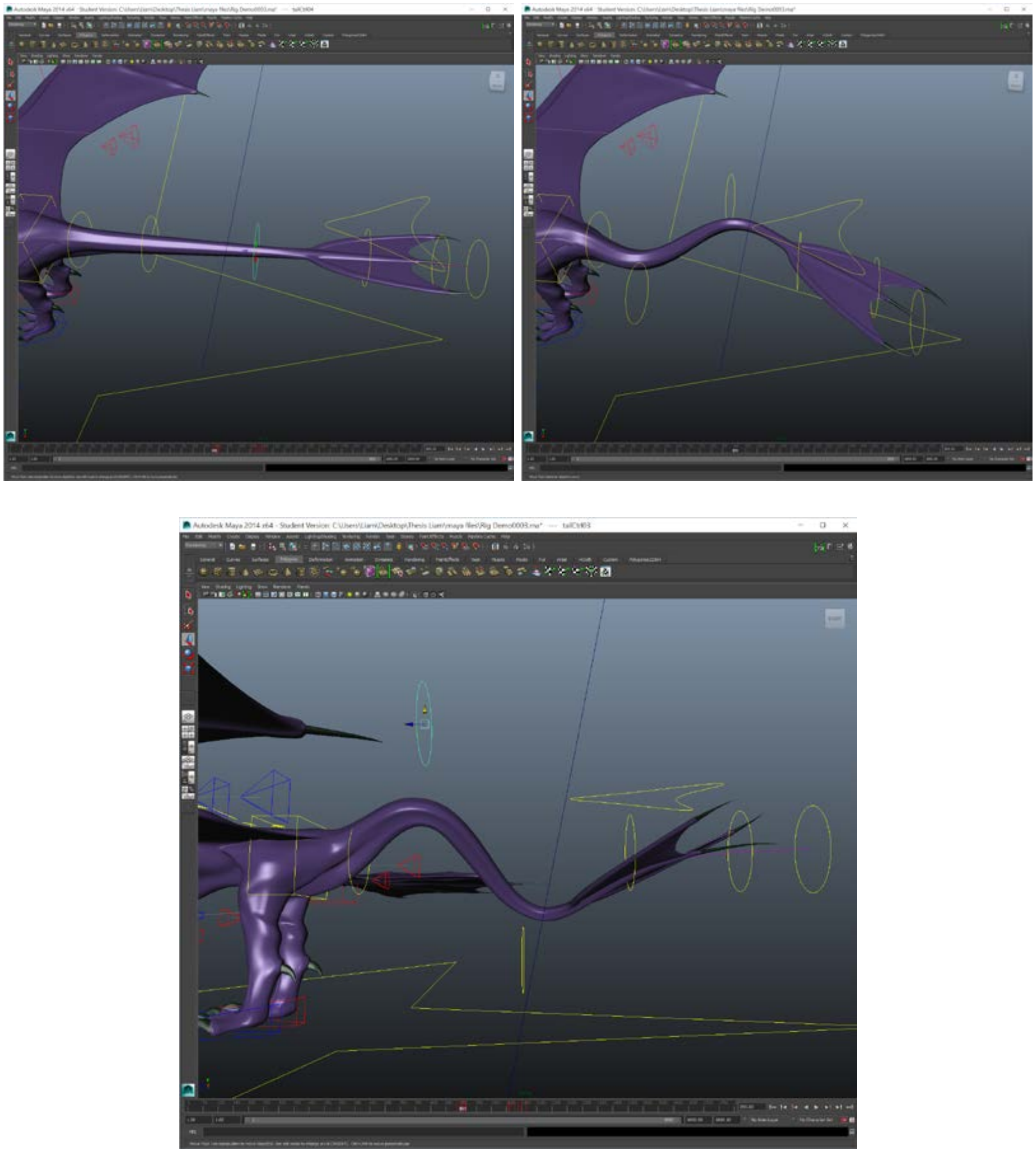


Figure 4.26: The tail controllers translate to manipulate the mesh

The “tailCtrlSpecial” controller is shaped like the webbing when in bind pose and has extra attributes for controlling the tail spikes. It can also control the length of the tail as well as the twist property of the SIK driving the tail portion of the mesh, see Figures 4.27-29.

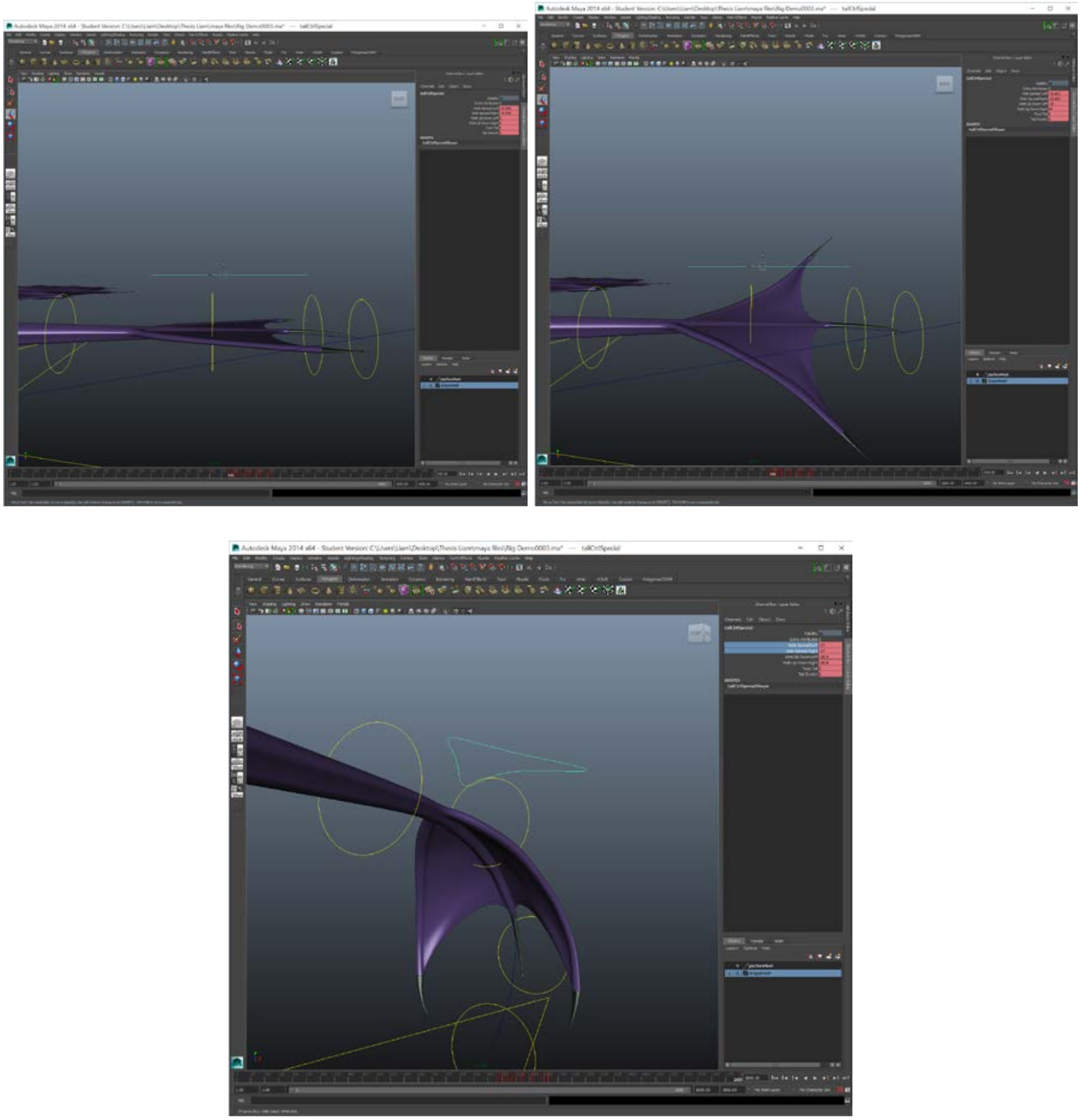


Figure 4.27: Spikes and membranes

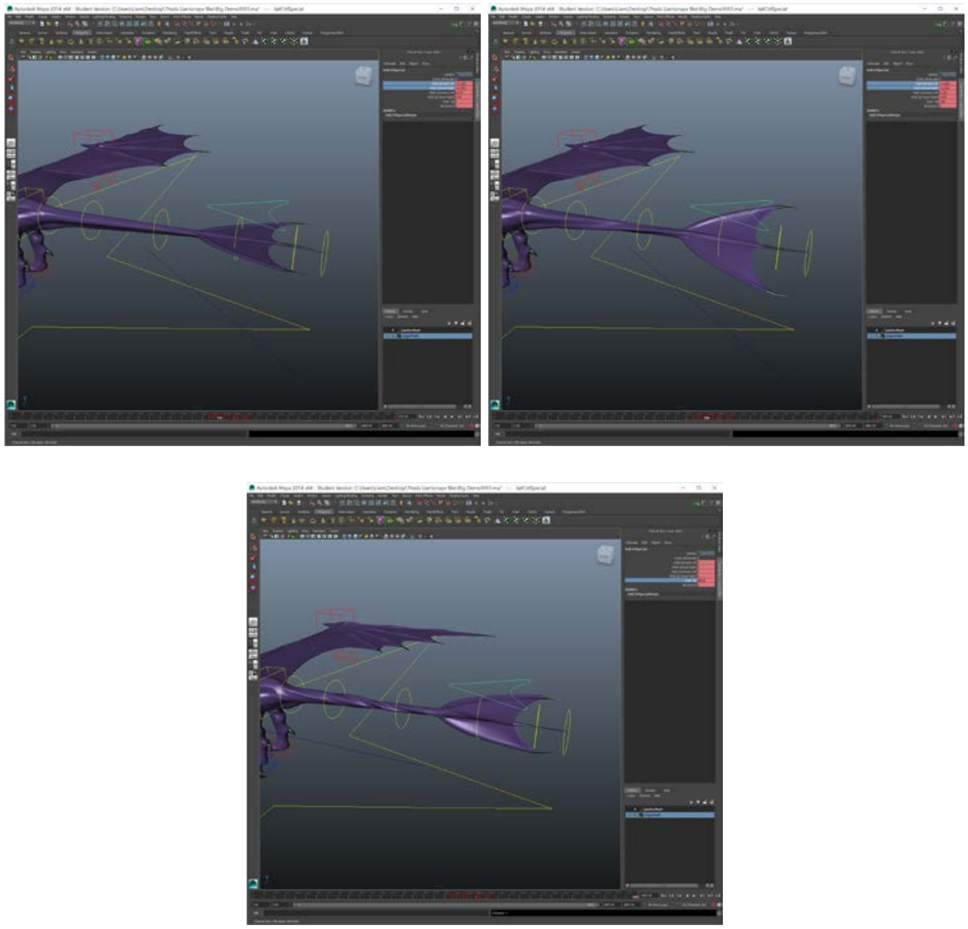


Figure 4.28: Twisting the tail

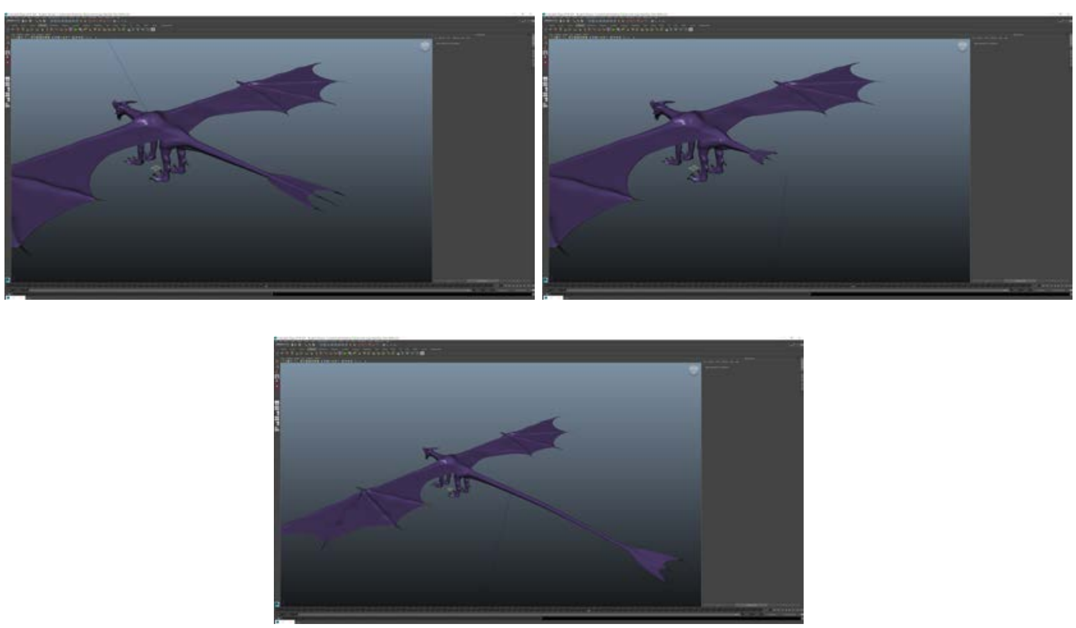


Figure 4.29: Changing the tail length

4.5.10 Winging It

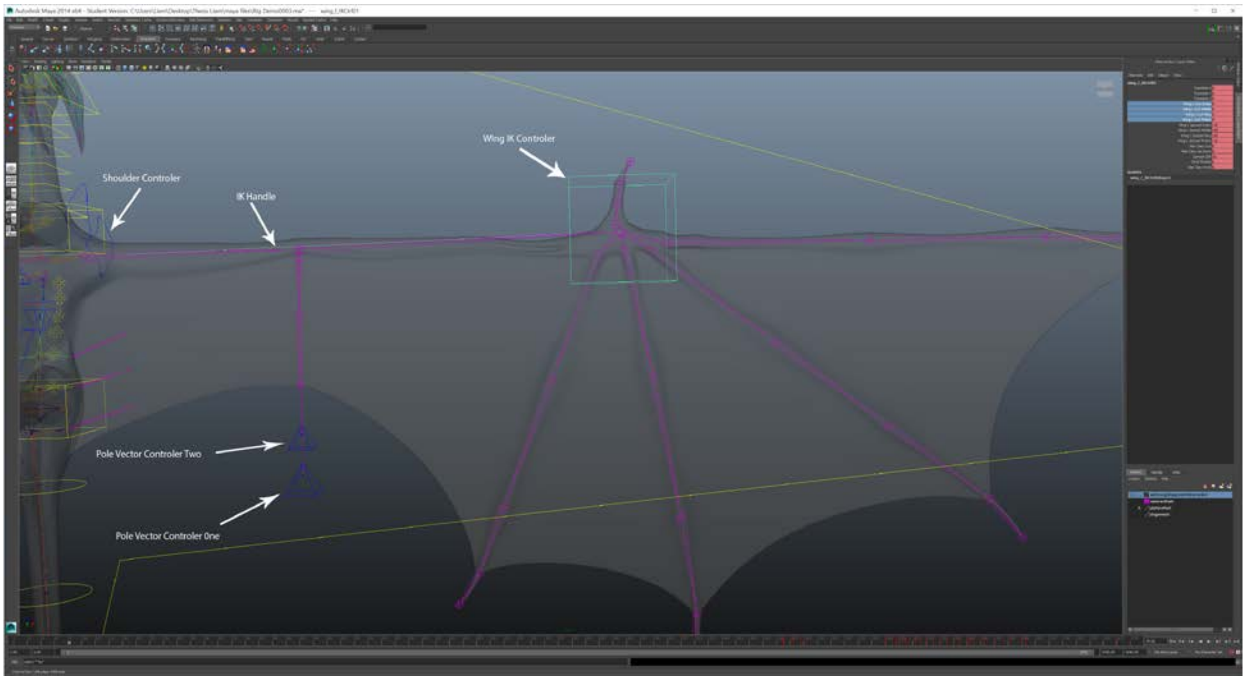


Figure 4.30: The Wing Controls and channle box of "wing_l_IKCtrl01"

The wing bones are all controlled primarily through the boxes on the wrists, see Figure 4.30. They drive the IKRP solver and have special attribute controls that allow for each finger to be curled and spread, see Figure 4.32. The angle of the wrist is controlled with an extra attribute on the "wing_l_IKCtrl01/ wing_r_IKCtrl01", see Figure 4.31.

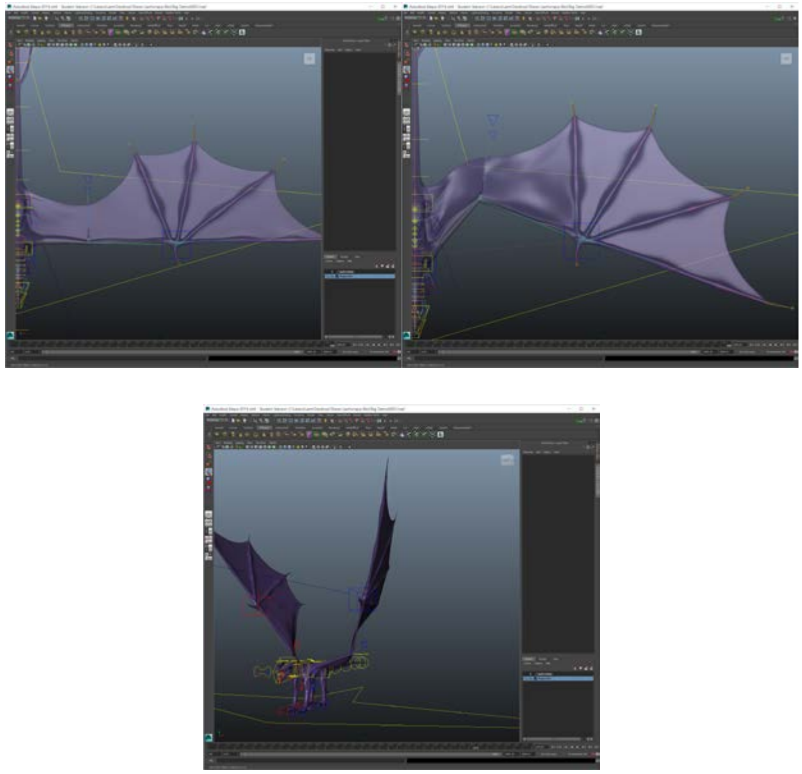


Figure 4.31: Manipulating the wing IKRP solver

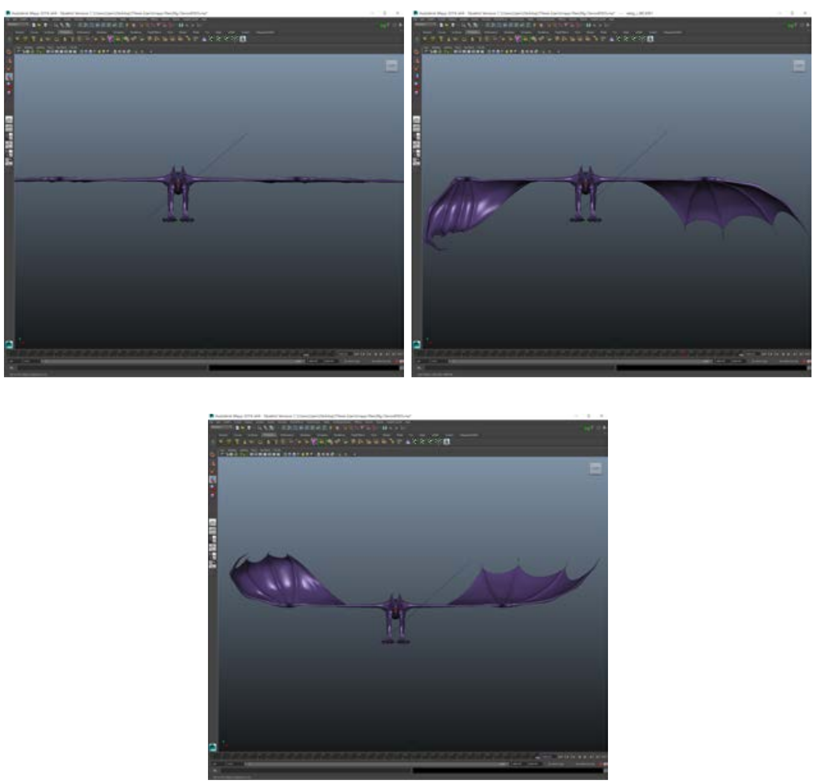


Figure 4.32: Wing digit curl in neutral, down, and up positions

The wings have a pair of controllers (“wingCtrlPVLeft and wingCtrlPVLeft2 / wingCtrlPVRight and wingCtrlPVRight2”) in addition to those of the wrist area IKRP solver. These pyramid shaped controllers manipulate the membrane of the wings between the body, elbow, and the pinky finger. They also allow for rotation of the wing membrane, control of its direction, and for pole vector control of the arm bones of each wing, see Figure 4.32-34.

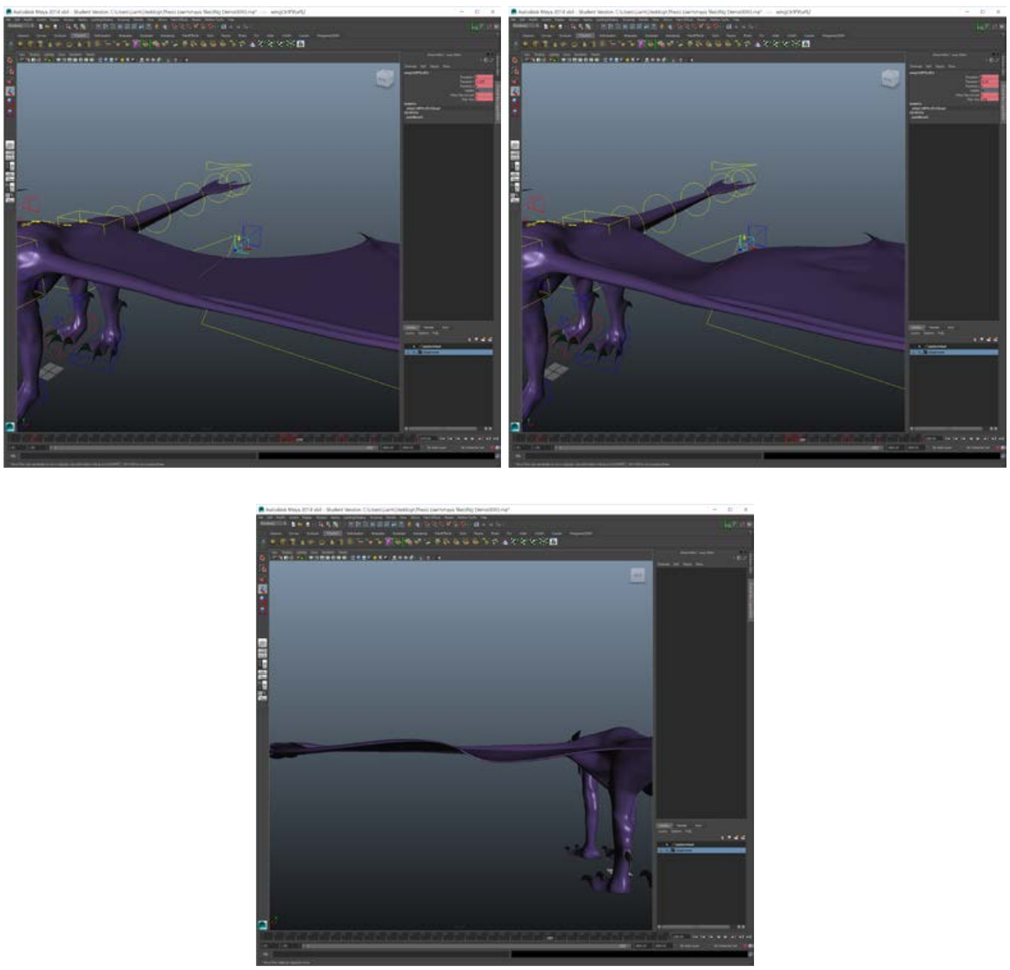


Figure 4.33: Twisting the bones of the wing membrane

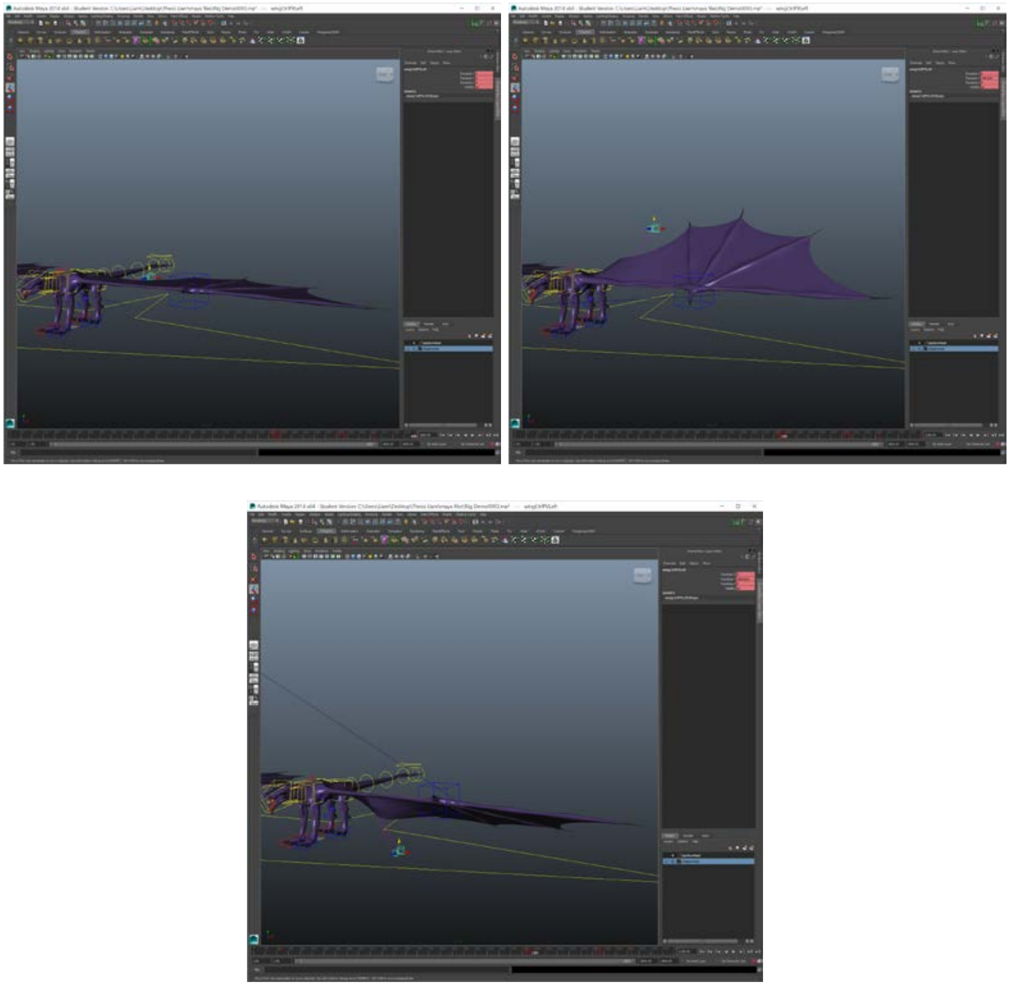


Figure 4.34: Controlling the Rotate Plane Solver

Controllers “wingCtrlPVLeft2” and “wingCtrlPVRight2” have an attribute that controls the total surface area of the membrane connected to the pinky, arm, and body, see Figure 4.35.

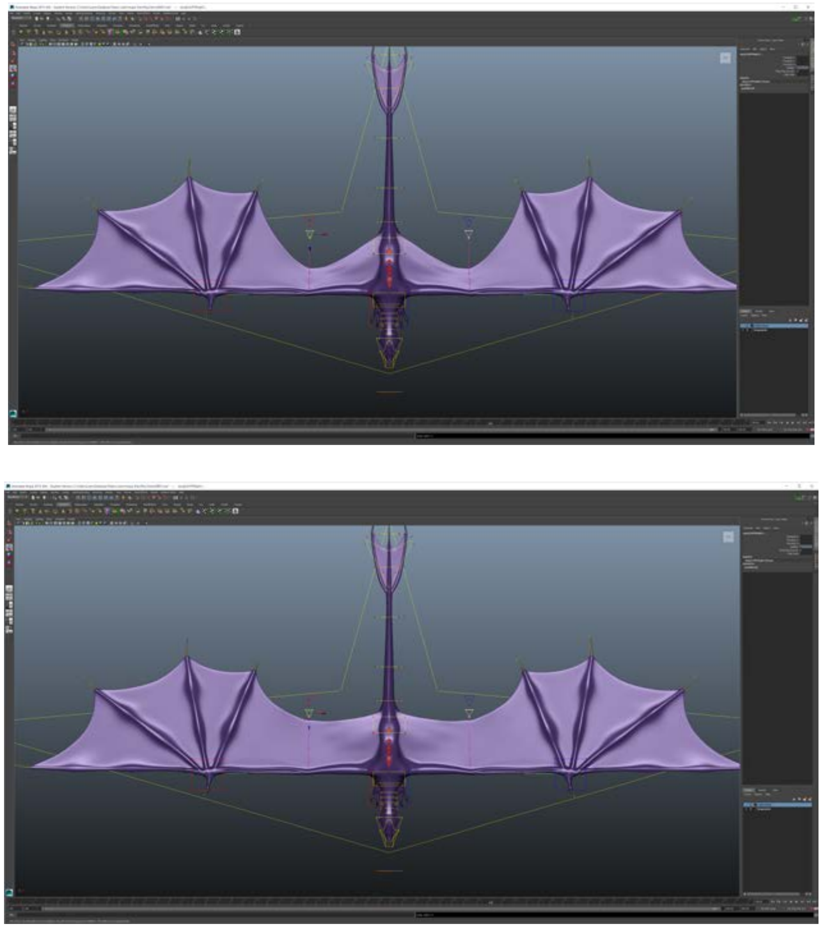


Figure 4.35: Wing membrane surface area change

4.6 Pelvis Control

The pelvis of this skeleton is the primary root bone and is parented to a controller "pelvisCtrl01" that also manages the hip bones at the top of the leg IK solver chains and the base of the tail SIK. The pelvis controller is a box shape and is used for translation and rotation, see Figure 4.36.

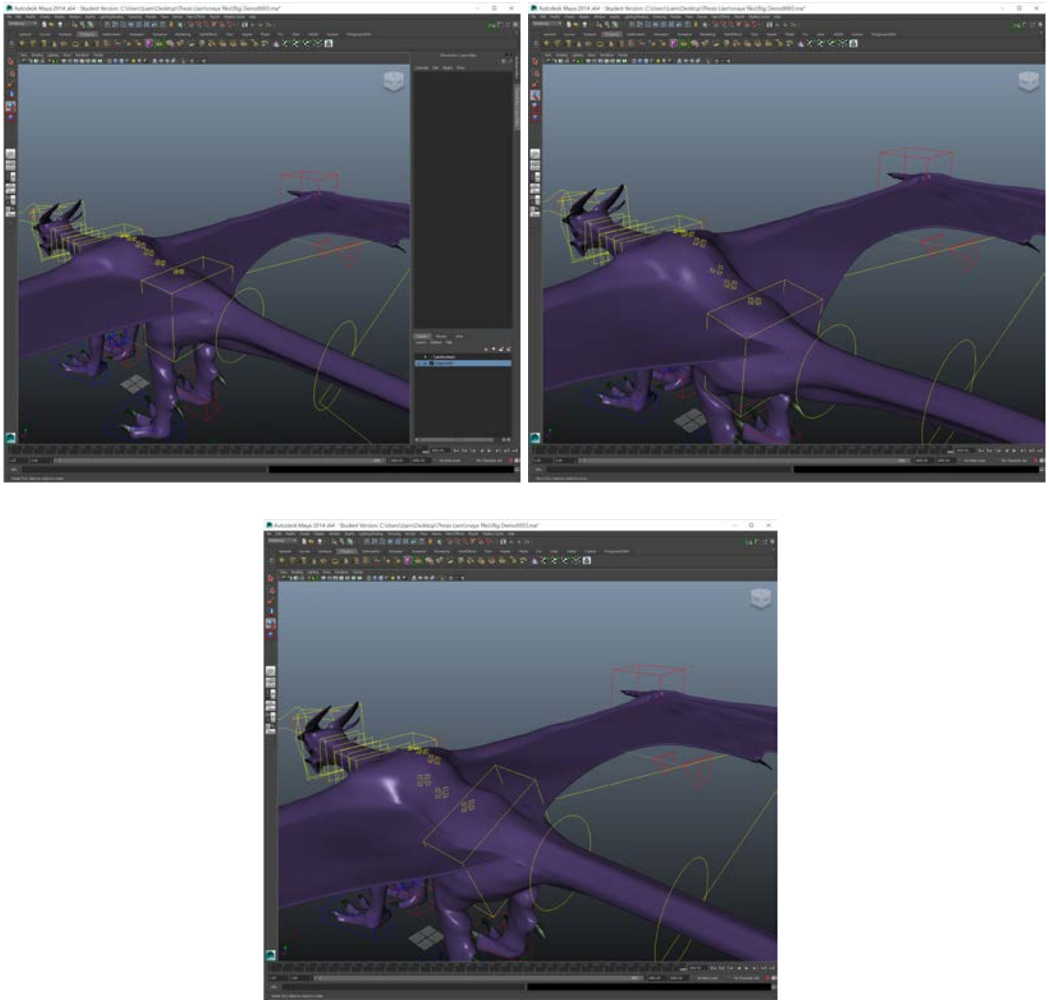


Figure 4.36: Pelvis controller, rotation, and translation

4.7 Binding Method and Weight Painting

In order to lessen the cost of the time intensive process of painting weight influences onto the mesh, it was ideal to be able to exclude specific joints from those selected for binding. In order to do this, prefixes of “be,” for bind excluded, and “bn,” for bind, were used in joint naming. This meant that by simply typing “bn*01” and shift selecting the mesh; binding the mesh to the skeleton could be done repeatedly with different parameters to find the best possible default influences. The result was a mesh and skeleton with a weight paint relationship close to the final, using only automatic tools.

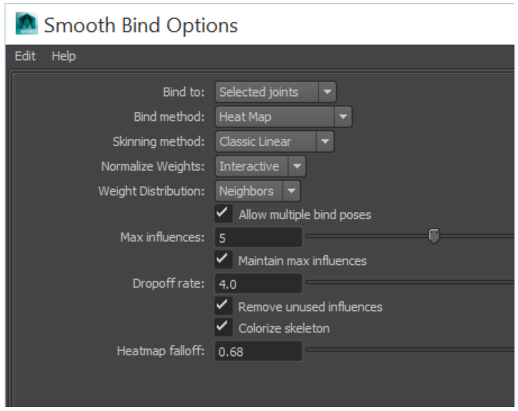


Figure 4.37: Custom Smooth Bind Options for the Dragon

With these settings, the mesh is bound only to the selected joints using the Heat Map bind method. The weight distribution is set to neighbors so the distance from bone to bone in 3D space is the determining factor in asigning the weight values in a given set of joints. The resulting distribution of influences in a joint chain upon the mesh are more even and take less time to edit by hand than those generated with another "Bind method". The Max influences, Dropoff rate, and Heatmap falloff are left to their default values, see Figure 4.37.

4.8 Zero Out Rig Script

The Maya option of going to the bind pose does not function in the Dragon rig because of the grouping, controller hierarchy, and the two skeleton setup. This script allows the animator to reset the rig to its starting position instantly and without it, doing so would be a time consuming and error prone process. It is a simple Maya Embedded Language (mel) command "setAttr" used many times for each specific controller, see Figure 4.38.

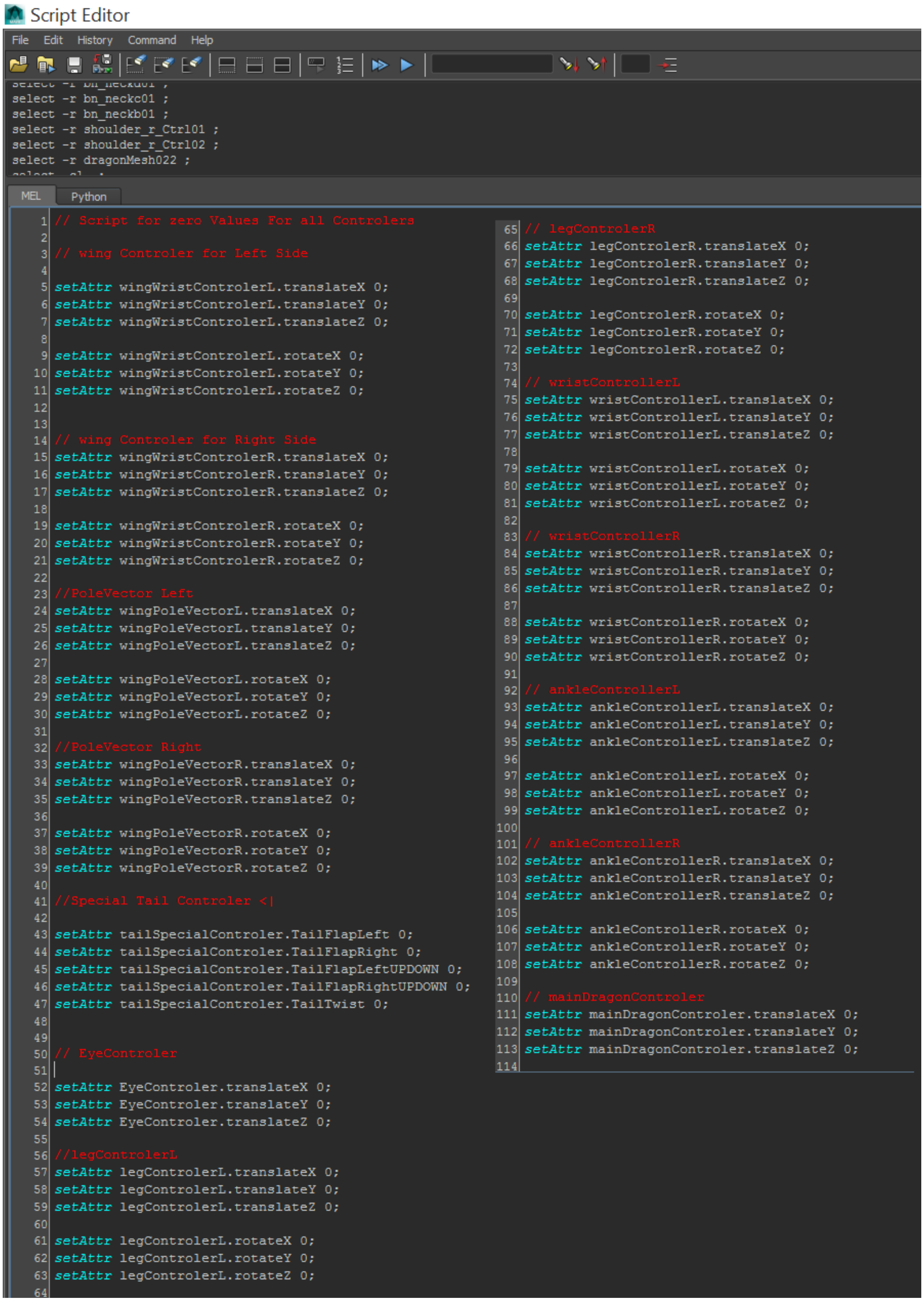


Figure 4.38: Zero Out Script

4.9 Limits on Controllers

All animators can break a rig, as such the limits placed on the controllers of the Dragon are not to prevent the rig from breaking. They are in place to make the breaks fewer and father between. If an animator is working and a joint flips or a limb behaves erratically, it should be the exception rather than the rule. Good controllers, limits, and joint placement can drastically reduce workload on animators and let them focus on creating solid animations with fewer iterations, time spent combatting the tools and assets, and more prompt delivery based on feedback from the director. The Dragon rig for instance has limits in the mouth. It is only allowed to open or close within a reasonable range, see section 4.7. This prevents disfiguring distortions that shatter any sense of realism and interpenetration of the mesh by over-rotating the jaw bones. The tail also needs limits to prevent kinking, but is still very flexible, and does not allow a rigger to create incorrect deformations unless they go out of their way to do so. The limits on the digits of the hands and feet, fingers of the wings, and the spikes controlling the webbing of the tail prevent the tearing of the polygon mesh. Similar limits were left off of the shoulders, head, neck, hips and tongue because some animators like to exaggerate the flexion and extension of those areas to increase the impact of posing. For instance the character "Twisted Fate" is moved in a way that would break his back during a *League of Legends Cinematic: A Twist of Fate* because the animators wanted him to be superhumanly powerful and flexible, see Figure 4.39.

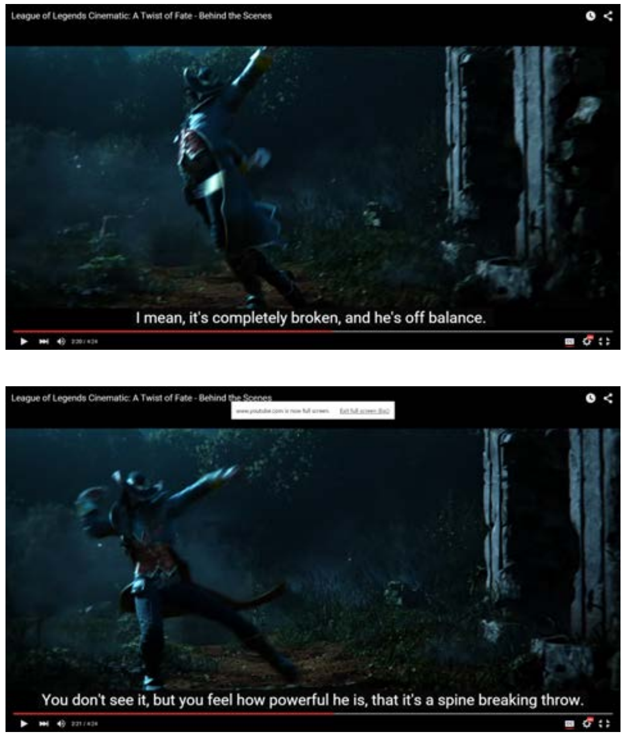


Figure 4.39: Comentary of *Leage of Legends Cinematic: A Twist of Fate – Behind the Scenes* [LOLF13]

CHAPTER FIVE

RESULTS

The Dragon character model has clean topology and solid design grounded in real world anatomy. It conveys the aggressive bestial nature of a western dragon using a unique shape that fits within the iconic dragon motif and supports the character goals of the beast in the film. The Dragon rig allows for articulation that goes above and beyond that required by the storyboards. The controls are animator friendly, and efficient. The controllers are well labeled, intuitive, color coded, and shaped so they are easy to select from many angles. The controllers have many unique attributes that allow for rapid animation and precise control. The use of set driven keys in conjunction with the extra attributes and connection editor allow for some built in animation that can save many hours of work.

CHAPTER SIX

CONCLUSION AND FUTURE WORKS

An epic battle was fought between the Dragon and necromancer, but the age old magic trap prevailed and another of the great dragons joined his frigid brethren in the flooded caldera of the mountain. Thus, the Dragon Slayer returns to his unending vigil, with only the ghosts of fallen foes for company.
~ History of the Third Dragon War (a fictitious document related to the Dragonslayer *short film) ~*

6.1 Conclusion

Completion of the Dragon character asset was an exercise in blending the art of sculpture with the technical demands of 3D animation and a desire for an easy to use character who was capable of doing more than just fulfilling its role in the film. Despite the fantastical nature of the Dragon, by using scientific principles, good design choices, and an appropriate mix of real creatures the end result, was a believable and exciting being.

In lieu of a single piece of unified concept art that was followed to create the dragon character, the sculpting process was iterative and even in his completed form remains malleable because of the rig. The topology concerns of edge flow, quadrilaterals vs triangles, evenly distributed polygon size, and detail only where needed, were met while keeping the mesh lightweight enough to run with a good frame rate on most machines.

The storyboards ultimately informed the requirements of the rig, and as such, the dragon is capable of the articulation mandated by them. With large wings and unwieldy membranes, many additional controls and the use of set driven keys to make manipulating the mesh feasible for animators were required.

6.2 Future Works

6.2.1 Necromancer

The Necromancer character has evolved a great deal over the course of this film's production. Originally, a burly warrior hermit living alone on top of a mountain, he ended up as a skeletal minion left behind to channel the magical power of ancient obelisks as a trap for passing dragons. The method for interacting with the dragon progressed from a large harpoon and chain into magical energies. The character design was greatly simplified to an anatomically correct human skeleton, except for the demon horned skull, and some clothing and props. He wears some jewelry and uses a wooden staff capped with the skull of a child dragon.

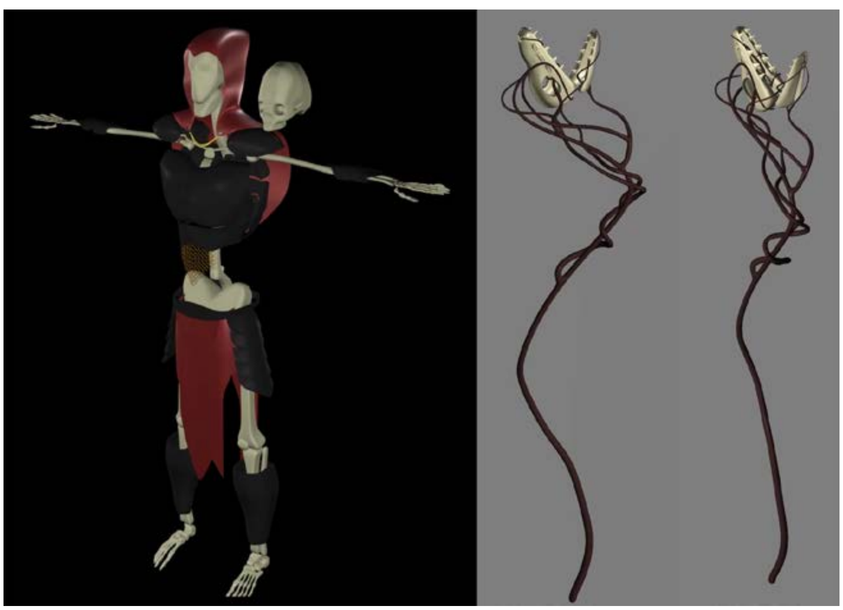


Figure 6.1: An early version of the necromancer with his staff prop. Bottom is a test of the idea of using dragon parts as armor. The current version of the character model is on the Right.

Figure 6.1 shows the changes in design and detail levels over time of the Necromancer character. He began as a heavily armored creature with a low polygon count and some proportion issues but morphed into a sinister looking skeleton with correct human anatomy and a demonic skull with a double set of jaws. Figure 6.2 shows some of the props for the Necromancer's workshop and a close up of his dagger and staff models.

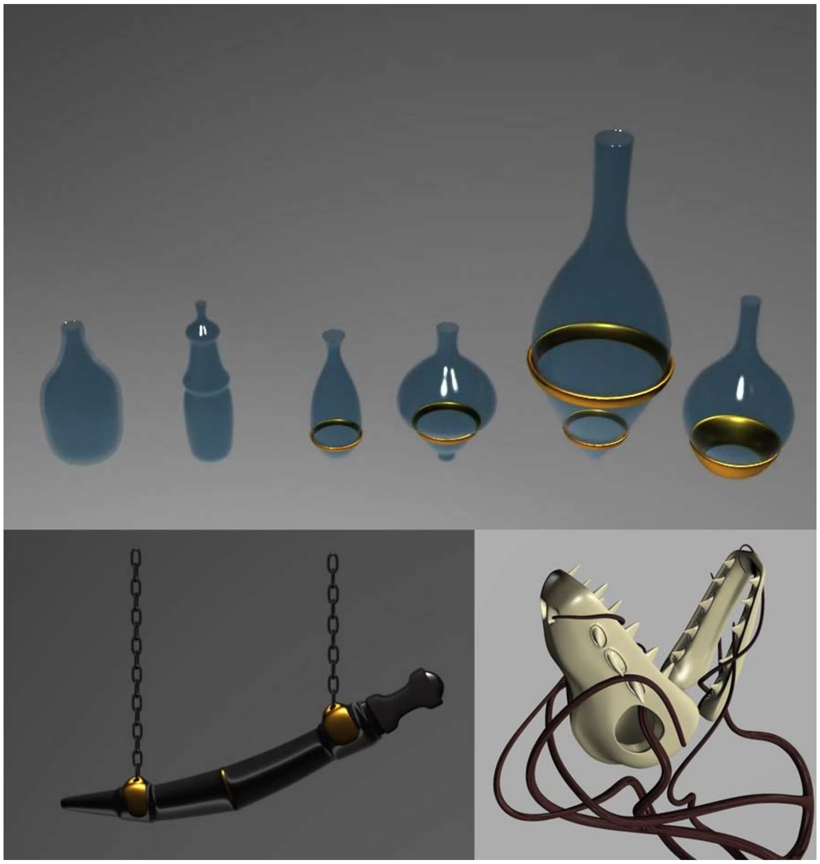


Figure 6.2: Props for the necromancer including glass vases for arcane work a dagger and a close up of the child dragon skull.

6.2.2 Setting

Inspired by Crater Lake, the setting of the film is a snowy mountaintop caldera. This caldera is nestled within an arrangement of nearby mountains of similar height. The mountains, snowy sky, and obelisks are almost all we see of the setting until the final shot, that reveals the dragon graveyard. The last shot gives the rather short story a secondary visual climax that echoes that of the martial conflict. The backdrop for the short will be a blend of 3D models of a small cluster of hero mountains, and 2.5D cards built up in 3D space to create a surrounding mountain range, see Figure 6.3.

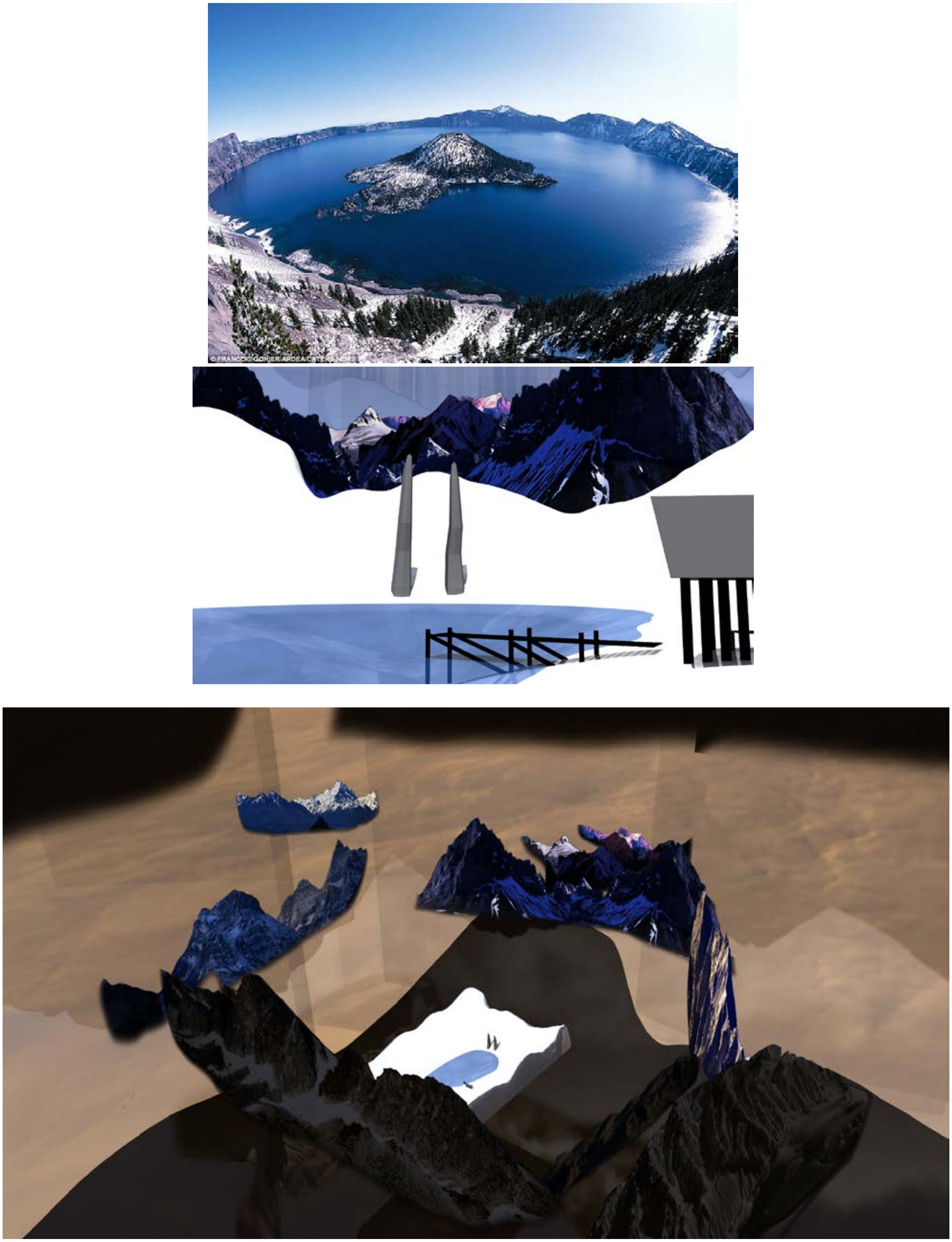


Figure 6.3: Crater Lake and the 2.5D cards arranged into the mountain setting

6.2.3 Water

The final shot of the film is a slow zoom out of the mountain top with a large number of dragon skeletons beneath the surface of a partially frozen lake. Initially the Dragon's death finale included falling into the lake and creating a large splash, but this was changed to sliding along the frozen surface towards the Necromancer. This alteration was done in order to reduce resources consumed and as an homage to the epic scene in *300* (film) in which a lone Spartan fells a mythically large rhino just before it would have broken the ranks of the small band of heroes. [RINO08]

6.2.4 Snow

Because the film takes place atop a snowy mountain, there is a need for multiple snow related effects: falling snow particles in the air around the characters, snow particle hero bursts to demonstrate magic influence and reinforce things like character movement, and the snow that coats the necromancer as he awakens falling off of him as he stands. Hugh Kinsey III has provided a solution for the snow particles in the air, see Figure 6.4, but the remainder of these effects need to be addressed with a combination of techniques in Houdini, Maya, and compositing.

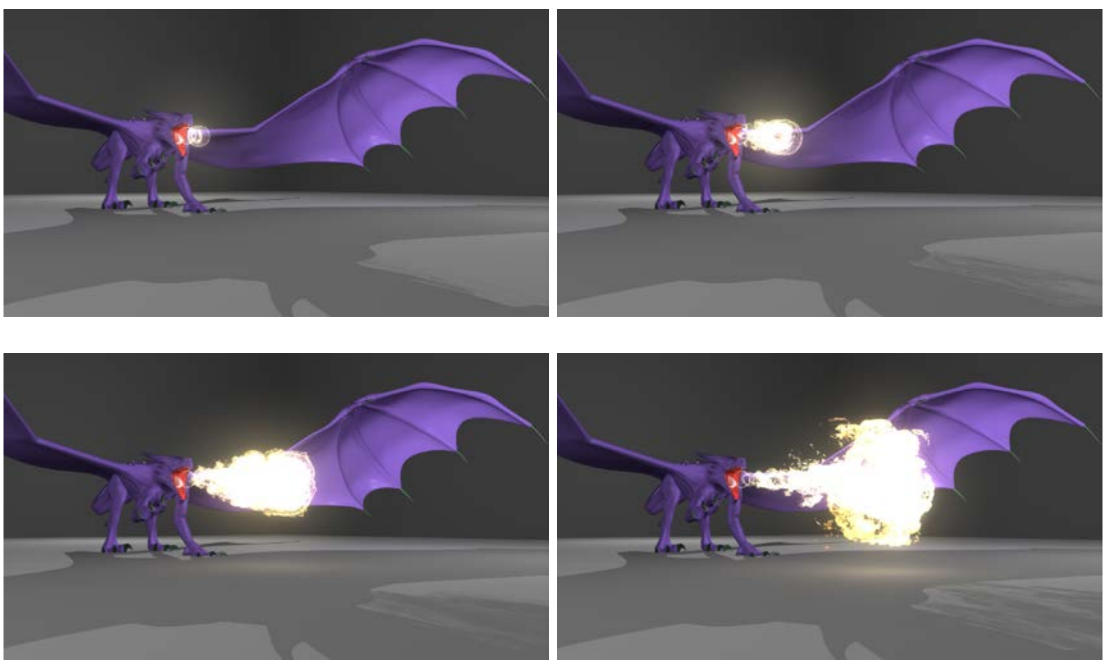
Figure 6.4: Snow effect test with an older model of the dragon.

6.2.5 Eyes

The eyes of the Necromancer are in large part responsible for creating his personality. Glowing eyes with easily recognizable shapes for mood are planned as simple orbs with a series of blend shapes. These are used as emitters for dense glowing particles and provide a supernatural series of 3D emoticons for use in the film. The eyes of the Dragon also make use of an effect to demonstrate the mind control of the Obelisks, and to provide speed lines during his final attack upon the Necromancer.

6.2.6 Fire

Dragons breathe fire in many of the ancient myths, so a test case for the dragon breathing flames was initiated, see Figure 6.5.



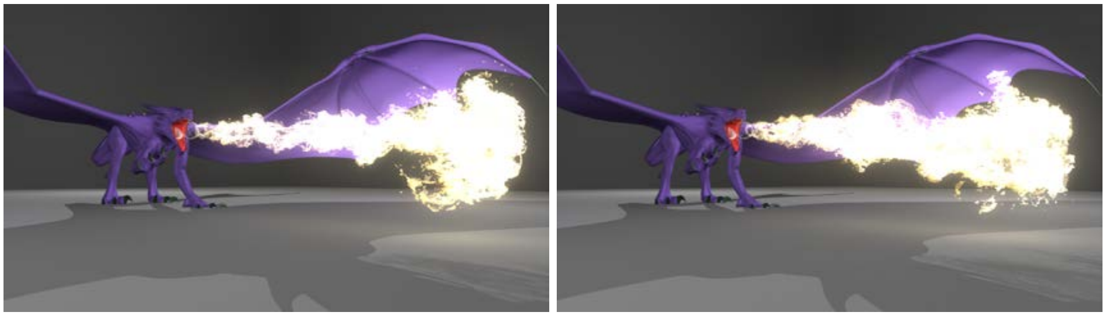


Figure 6.5: Dragon breathing fire

6.2.7 Lightning

Lightning is a staple of the fantasy genre, and the FX community is very good at creating both physically accurate and otherworldly effects. It is the method of attack for the Necromancer, see Figure 6.6, on the dragon and a personal favorite VFX tool. A key reference for the Necromancer's lightning attack were the wand duels in the *Harry Potter* franchise, see Figure 6.7.

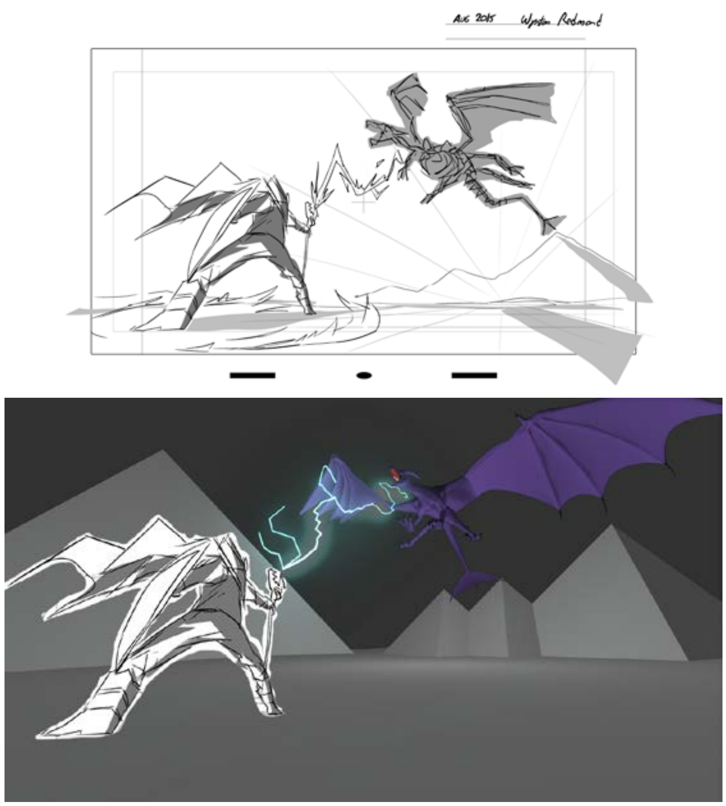


Figure 6.6: Dragon struck by lightning

Figure 6.7: Voldemort and Dumbledore duel in *Harry Potter and the Half-Blood Prince*

[HALF09]

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APPENDIX A

Storyboards for the *Dragonslayer* short film. Done by Wynton Redmond

Figure A.1: Shot One - Slumbering Necromancer with zoom out

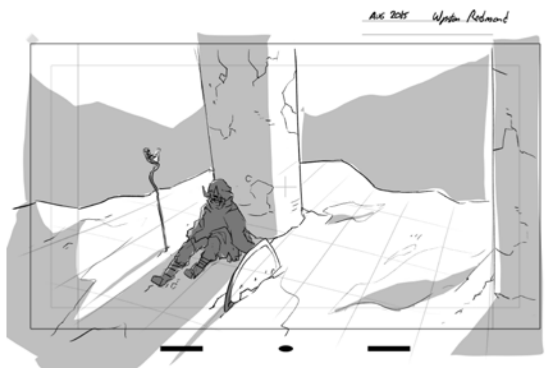
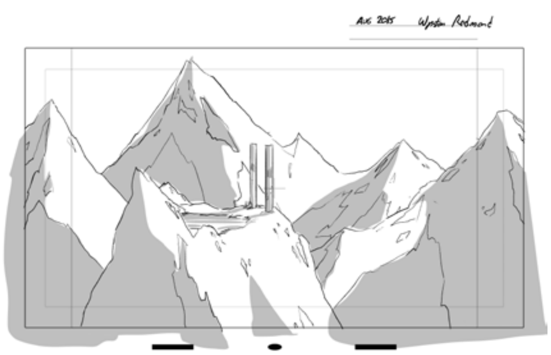
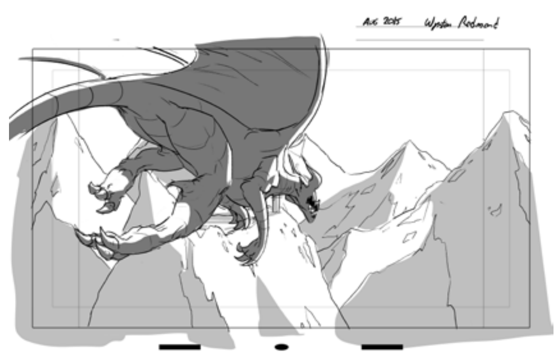


Figure A.2: Shot Two - Zoomed out shot of the Necromancer with his staff





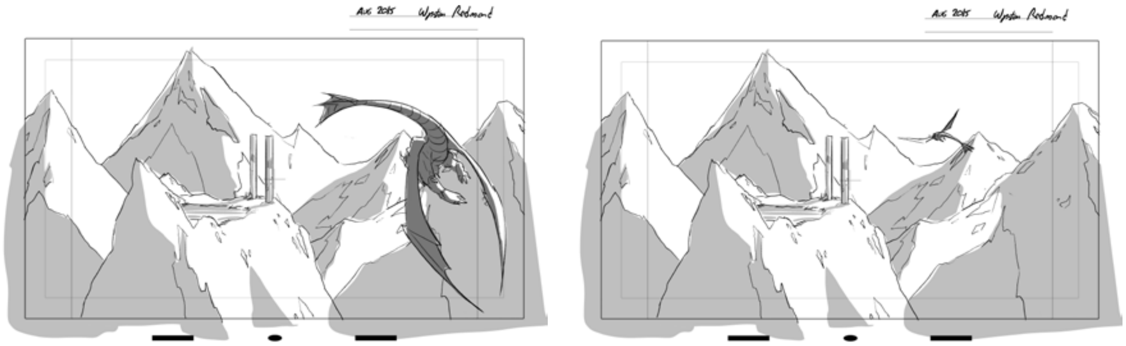


Figure A.3: Shot Three – The character, Dragon, flies into the mountain pass with the Obelisks

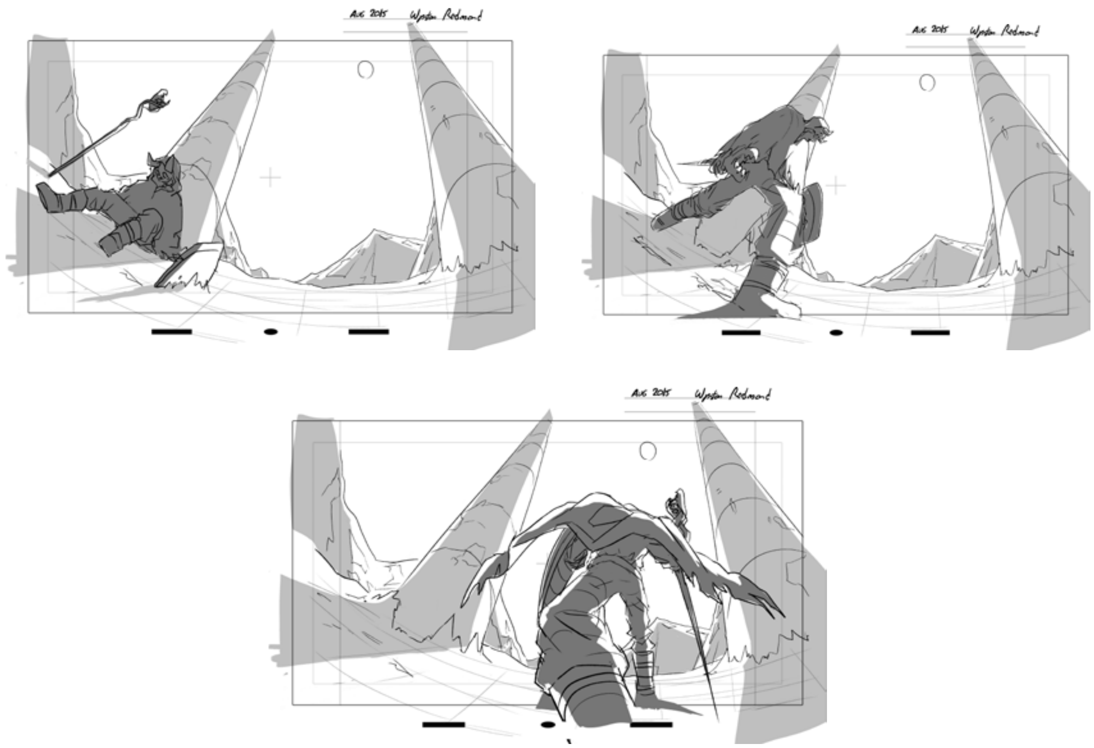


Figure A.4: Shot Four - Necromancer awakens as a pulse of magical energy booms out from the Obelisks

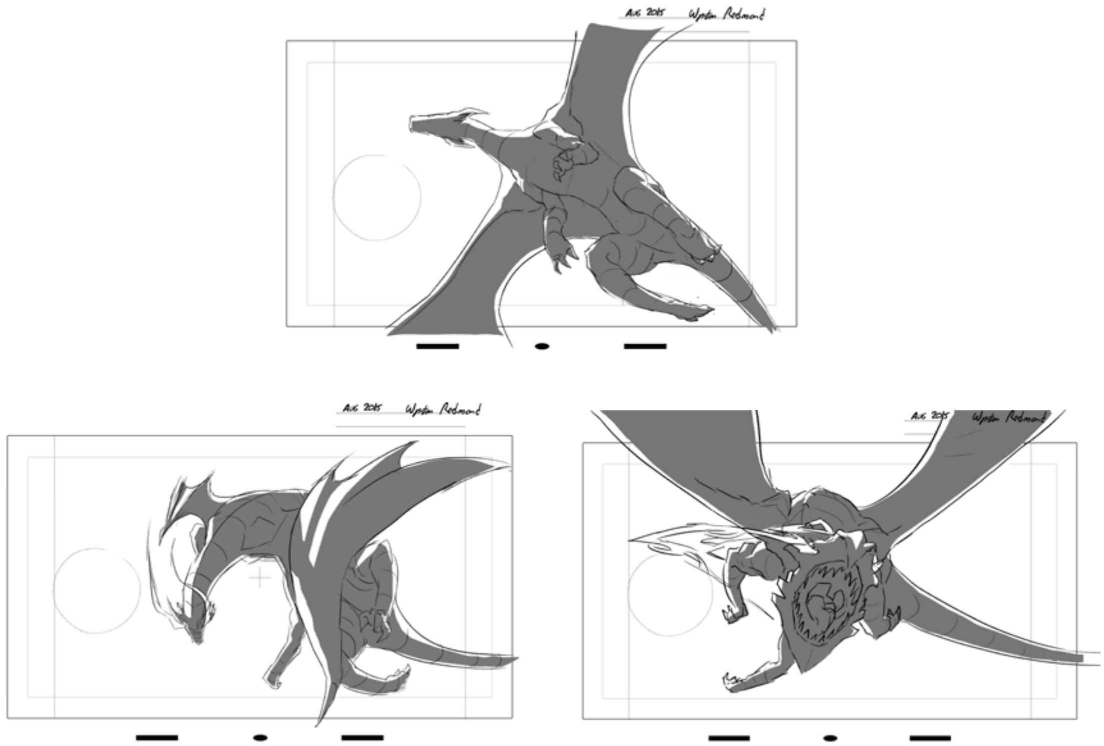


Figure A.5: Shot Five - Dragon turns to confront the Necromancer as the compulsion of the Obelisk engages his bestial nature.

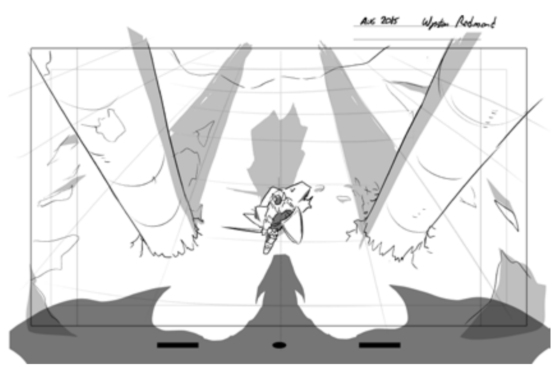


Figure A.6: Shot Six - Dragon dives at the Necromancer and the Dragon's shadowed silhouette mimics the Obelisks

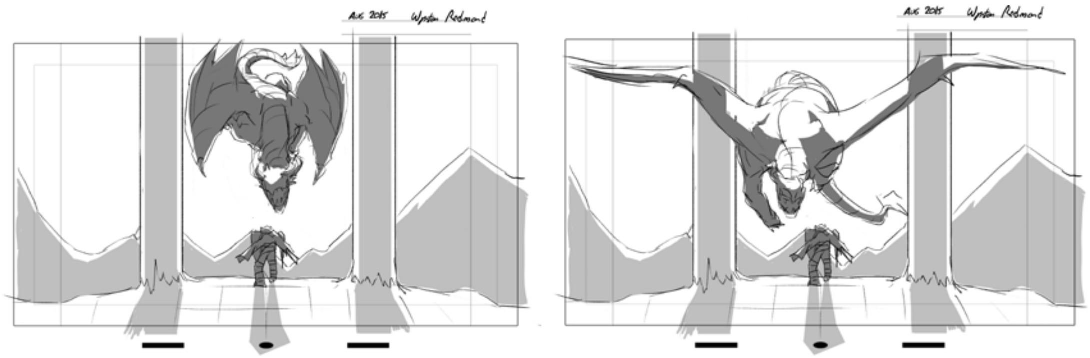
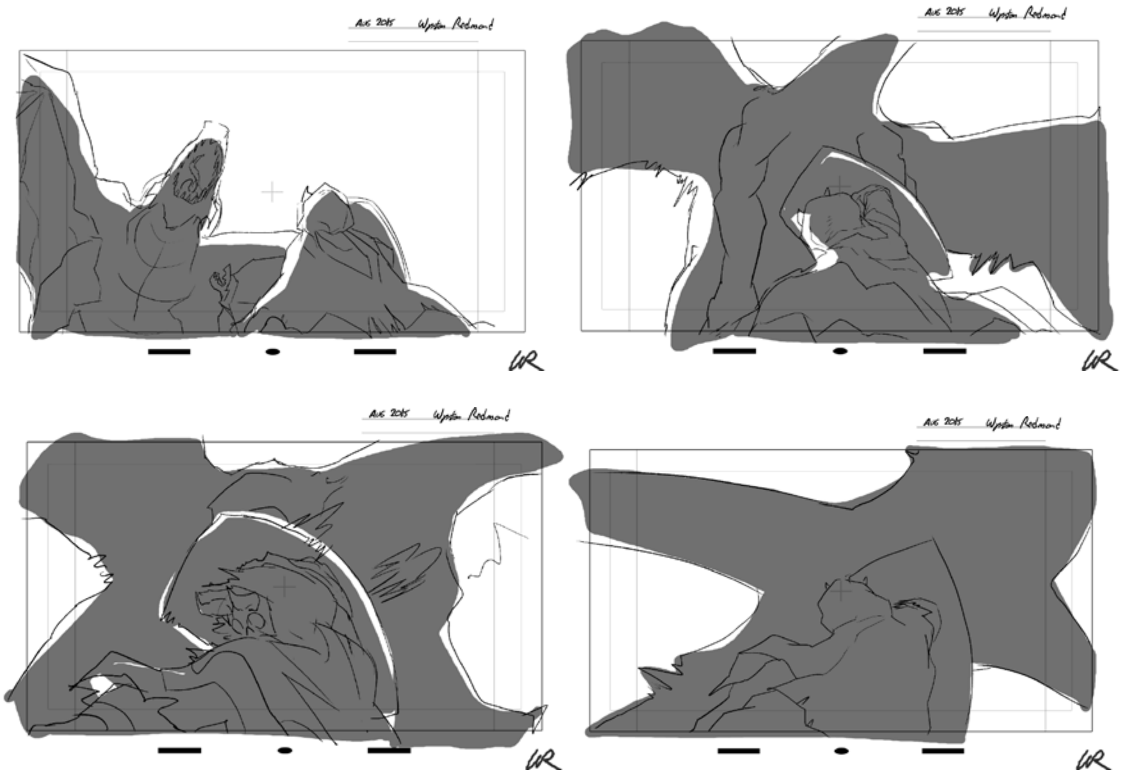


Figure A.7: Shot Seven - Dragon is lured through the Obelisks and aims his fury at the Necromancer



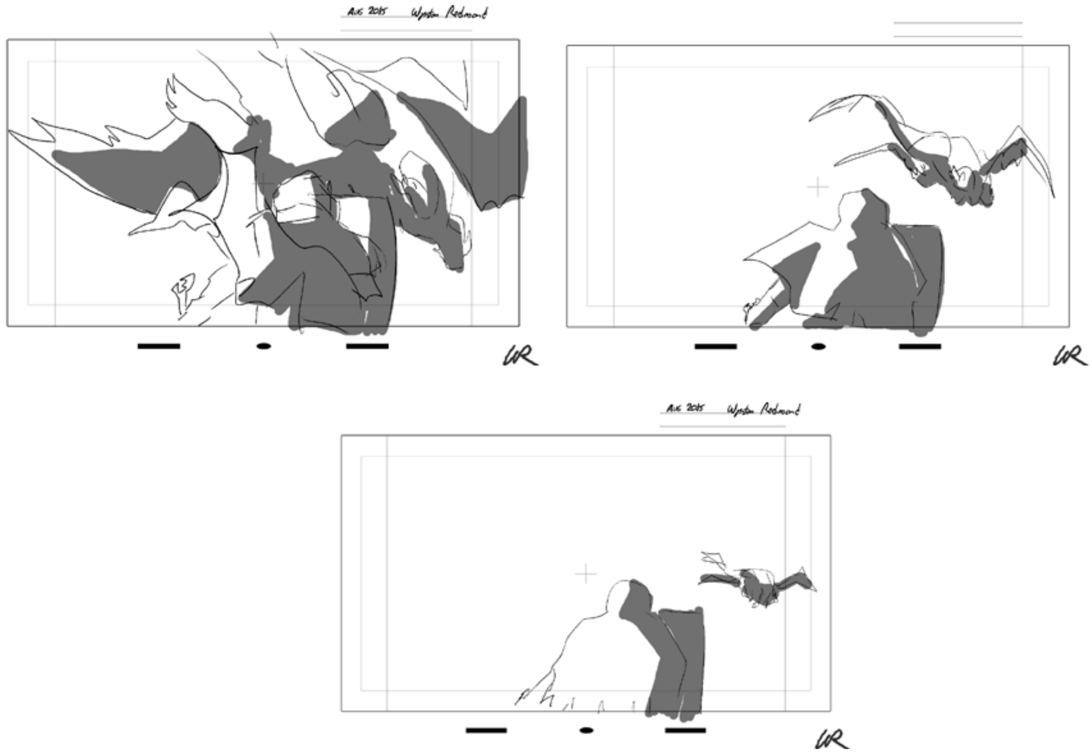
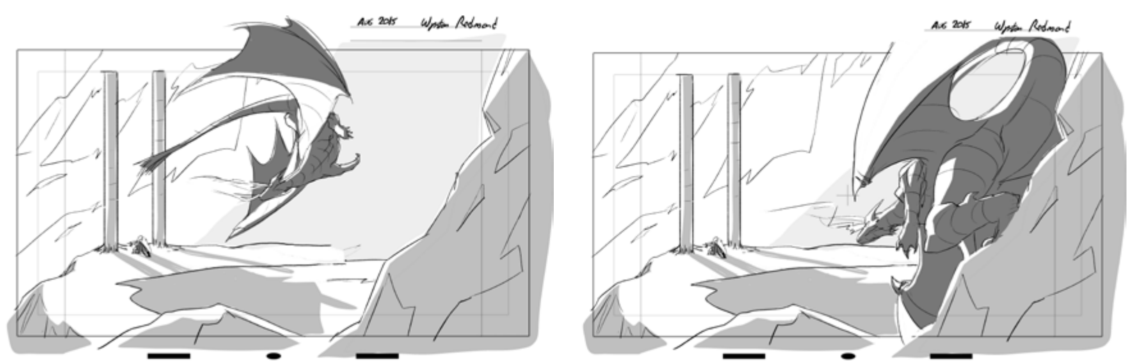


Figure A.8: Shot Eight - Dragon attempts to strike with his tail spikes, but the Necromancer blocks and the Dragon flies past.



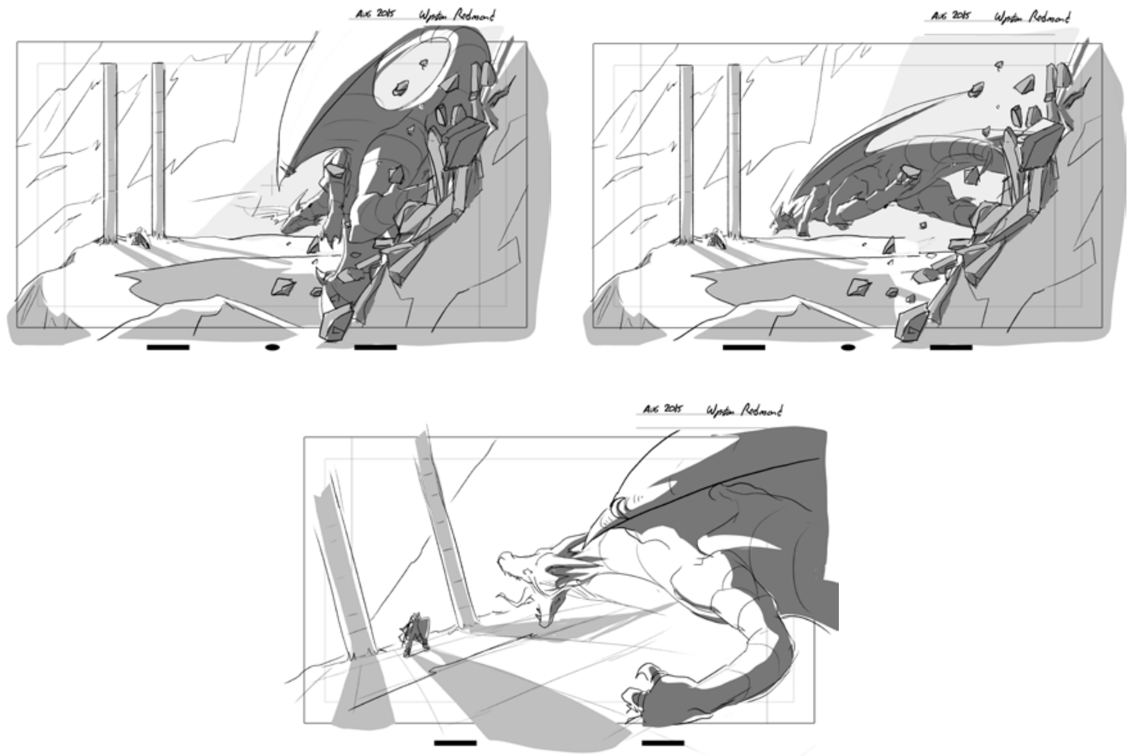


Figure A.9: Shot Nine - Dragon uses the nearby mountain terrain to make a sharp turn and redoubles his attack efforts on the Necromancer.

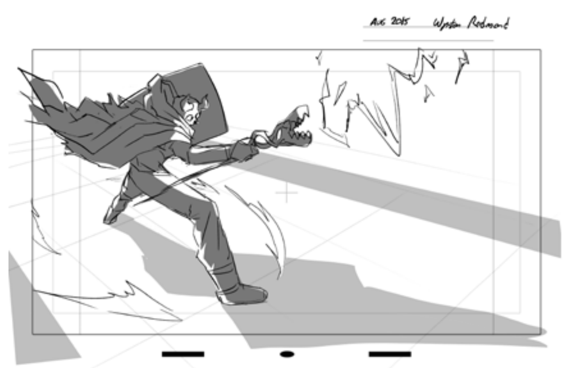


Figure A.10: Shot Ten - The Necromancer begins his magical assault upon the incoming dragon (from Dragon's over the shoulder perspective).

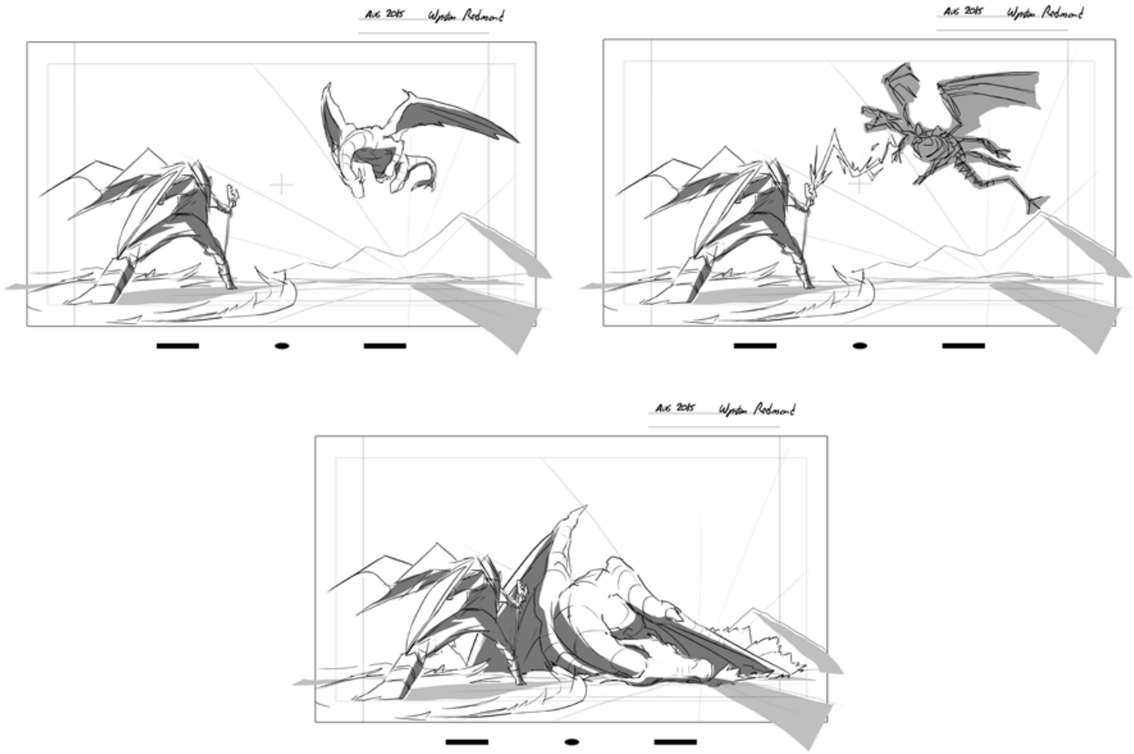


Figure A.11: Shot Eleven - A rewind to the Necromancer's perspective of his magical assault. Necromancer unleashes his final attack at the Dragon and the Dragon is killed by the torrent of magical lightning. Dragon slides to the feet of the Necromancer.

Figure A.12: Shot Twelve - The viewer is provided with a view of the lake and realizes that the mountaintop is littered with the skeletons of other defeated dragons.