THEA 474: Digital Animation—A Peer Review of Teaching Project Benchmark Portfolio

Steve Kolbe
University of Nebraska-Lincoln, skolbe2@unl.edu

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Peer Review of Teaching Portfolio

THEA 474: Digital Animation

2013

Prof. Steve Kolbe
skolbe2@unl.edu
Johnny Carson School of Theatre & Film
Hixson-Lied College of Fine & Performing Arts
University of Nebraska - Lincoln
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Portfolio Objectives

This portfolio provides an overview of student learning in my Digital Animation course – THEA 474 (see Appendix A for Syllabus). This report serves as documentation of my attempts to define and refine the course goals, activities, assignments, and assessment. Through this portfolio, I hope to more effectively see ways to make this course more impactful for the students, but also to lay the groundwork for additional courses within the major in order to open up a more realized and robust animation focus at the Johnny Carson School of Theatre & Film. A facet of student learning that I plan to document and improve upon is how to effectively teach the technical and creative parts of the course. I chose this course because it is the only instruction currently available to those students with an interest in designing, creating, and animating within a 3D environment. As such, the course has tended to become a bit overwhelming for the students as I try to impart as much broad-based knowledge into a single semester. Further complicating things, since it is an elective, the students bring to the table a wide range of technical abilities as well – from very little computer knowledge to extensive understanding of computers and directory structures. The wide range of abilities of the students coming into the course has been problematic for me in crafting fair objectives that are achievable by all. Developing successive assignments that build upon each other is something I am keenly interested in as I help them to become more comfortable in 3D space – all the while understanding that not all of them intend to pursue animation any further than this singular course.

Size of Class: 11
Type of Student: Majors
Level of Course: Undergraduate
Type of Course: Elective within the Film / New Media major
Type of Portfolio: Benchmark
Evidence of Student Learning in the Portfolio: Examples of Student Work
Digital Animation – THEA 474 - is the only class offered by the Johnny Carson School of Theatre & Film (JCSTF) emphasizing design, creation, and animation within a fully realized 3D environment. The course delves into the creation of objects – modeling & texturing, the manipulation of objects – rigging & animation, and finishing the job – lighting & rendering. As this is an elective course, any student within the Film & New Media (FNM) major has access to it once they have completed Digital Motion Graphics (THEA 487) or gotten special permission to enroll. As such, most of the students tend to be either Juniors or Seniors in the program. Those interested in continuing studies in related areas do so in the form of pursuing an Independent Study course with me or by creating an animated Capstone project.

Enrollment

There is a prerequisite for this class – each student must have completed Digital Motion Graphics (THEA 487) or get special permission from me to enroll in the course. The enrolled students come from the FNM major within the JCTF, although in the past I have allowed a few other students on a case-by-case basis. The overarching goal of the course is to foster individual improvement over a foundation of broad, basic competencies in design, modeling, and animation. The students are mostly interested in animation in their rudimentary understanding of the medium. They do not yet know that ‘animation’ is another entire production pipeline for film and television. They are generally not even aware that, like film, each person has a specified role in animation production (not everyone is an animator) and that those individuals must develop highly specific skills to complete their tasks.

Course Goals

These include:
- Learn the production pipeline for animation
- Learn to navigate and create within the confines of the Autodesk Maya software package
- Learn the basics of modeling, texturing, animation and lighting of 3D assets
- Develop a sense for good structure in your geometry and animation
Teaching Methods

This course is project/assignment-driven, and students are required to complete seven assignments meant to develop specific creative and technical proficiencies. These assignments are separated into two primary groups that define the timeline of the course. The in-class exercises roughly follow portions of the text, “Introducing Autodesk Maya 2014”, and build the class towards each successive assignment. Each assignment then builds upon the skills learned in the previous assignment supported with increasingly advanced in-class activities.

In preparing for this class, I changed the lineup of the course assignments based upon feedback from previous offerings of the course. It seems most students want to get more into the creations and movement of 3D object (modeling and animation) and want to spend less time in the texture and lighting portions of the class. While texture and lighting are crucial components to creation and completion in a 3D environment, I agree that spending only a few weeks on each of the five main components (modeling, texture, rigging, animation, and lighting) meant that they were not getting enough depth into any of them. So, I lengthened the time we would spend on the two primary components (modeling and animation) and shortened—or combined everything else. This offering of the course then enjoys roughly 8 full weeks of modeling and 8 full weeks of animation—with a little bit of texture, rigging, and lighting thrown in where applicable.

In addition, this year I opted to use a textbook more throughout the class. Rather than merely assigning homework out of the text, we could begin exercises or explanations in class, and if we got sidetracked by questions and/or discussion, I could assign portions of the exercise to be done before our next class meeting. In this way, I was able to stay on-message, but still had the freedom to delve deeper and have more meaningful discussion as the students immersed themselves into the subject matter. This change was also effective in allowing students to work a little bit more at THEIR pace, rather than the typical fast-paced in-class exercises I usually pack into our class meetings.

The students learned the basics of asset management (I have a very strict naming convention and directory structure that I teach in my classes and it must be followed precisely) and how to move around in a 3D environment, then started in with modeling basic shapes and combining them to create more complex structures. In this way, they were opened up to thinking like a 3D artist. They were tasked with viewing the world around them and learning to visualize objects around them as a cluster of far more simple objects and shapes. Using this method quickly offers the students some confidence that they can create anything within the confines of their own imagination. The students incrementally learn various techniques in basic modeling and structure, and quickly move on to more advanced topics. Once we get to a level of advanced modeling structure (for a beginners course), we transition into a week of preparing a model (rigging) for movement or animation. During this transition, the in-class exercises become more basic once again, but this time focused on the basics of the structure of movement. Again, the students incrementally learn, building upon each exercise to ultimately be able to generate their OWN walk cycle onto a 3D character.

I primarily used my lectures to introduce new topics and techniques that would be put into use for current and upcoming assignments. I measure student learning of these methods
by looking for specific techniques in my assessments, guaranteeing their inclusion. This method allows me to see how creatively they use the techniques based upon their individual skill path as creators in this environment.

Rationale for Teaching Methods:

This is a small-to-medium sized course (11 students). As such, I am able to track individual student’s creative growth as they progress through the course. Since my main basic goals are that each student become better at modeling and animation, I tend to focus on tasks that simulate real-world modeling and animation production needs that also stimulate their minds into thinking about the world around them in a different context.

During the first week, I lectured and showed examples of 3D models. Specifically, I showed them as a solid object and then as a wireframe mesh – showing the underlying structure the object is formed from. This was a way to initiate not only a conversation of what 3D models are, but also what properties make one model more correct than another. This allowed the students to start to view the class and software not as a technical hurdle, but as an artistic opening – a place to explore ideas and creating in a new medium or environment. Following this discussion, we took a walk around the building and through campus in order to start to ‘see’ objects around us. We would stop at certain objects and I would ask them to describe the simple components that might be used to make the object in the computer – using simple 3D shapes and terminology (cube, elongated cube, sphere, cone, torus, plane, etc.). This foundational instruction creates a solid base from which the course objectives evolve from and it speaks to the course objectives, “learn to navigate & create within the Maya software package”, and, “develop a sense of good structure in your geometry and animation.”

The course objective, “learn the production pipeline for animation,” comes from a number of over-arching conversations and lectures about the ins-and-outs of each department along the production pipeline – and why each is both unique in its’ skill set and critical to production.

While touched on earlier in the course, the course objective, “develop a good sense for structure in your geometry and animation”, is primarily addressed in the student presentations of each assignment. These are essentially critique sessions, in which students are asked to explain their procedure, their difficulties, show an element they are proud of, etc. I then offer my own assessment on the work and continue to pull comments from their peers. Of course, this is typically very uncomfortable for the students because they all fear failure in view of their peers, yet as the semester rolls along, they do start to find their confidence in the new tools and skills they are developing. As their skill sets grow, so does their confidence and their abilities. Their models should become more sophisticated and the structure more solid and apparent as the semester continues.
Assignment #1

Model a tractor using only primitive 3D objects:

This project is assigned after we have had our discussions about underlying structure and basic compositional shapes that can be used to represent more complex objects. Their first assignment in the class is to create a 3D rendition of a specific tractor in the software. I provide them with images of a specific tractor that they use for reference. The following are a few of the images they are given;
This project is to not only get them to start to understand the software from a basic how-to-use-and-manipulate-things point-of-view, but also to learn to breakdown a complex object into smaller, more relatable, primitive shapes. They are allowed ONLY to use basic 3D shapes to construct their model.

The students are assessed on 4 primary criteria for this project;

- Did they follow the directory structure I have shown them? This is crucial to creation in Maya. The software MUST know where the root directory is located – everything stems from the root directory. This first project has simple directory structure as a graded element to drive home how important this aspect is to their future projects.
- Did they follow the naming convention we learned in class? This has the same reasons for being included as the previous entry.
- Did they use ONLY basic, primitive 3D objects in the creation of their model? I do not want the students altering the primitive shapes just yet. They need to see that a complex object can be created by using simple primitive shapes.
- Does the model represent the reference object? This boils down to “how well did they translate what they see into the computer?”. They are graded on how well their model represents the reference, specifically on form and spatial relationships between the component parts.

A fifth, but ungraded portion of the assessment is the following;
- I also include an area for errors. This is a loose category in order to indicate when there are anomalies in their project that they need to learn to watch out for and
avoid. Mostly, I use this category as a flag for what I need to cover in the next class to make sure this doesn't happen again. This could be something as simple as duplicate geometry (causing render errors) or more complicated bad naming strategies (causing object hierarchy issues).

An example of high pass
In this example, the student has effectively created a 3D representation of the reference material. They have used only primitive 3D shapes, named them accordingly AND accurately, and followed the directory structure.
An example of mid pass

In this example, the student has created a 3D representation of the reference material, but the relationships are a bit off – too much distance between the front and rear axles, etc. They have used only primitive 3D shapes, but did not name all of them. However, this student did follow the directory structure. All this shows a bit of a lack of attention to detail in what they turn in.
**An example of low pass**

In this example, the student has created an average 3D representation of the reference material, and the relationships are not as off as the mid pass example. They have **NOT** used only primitive 3D shapes – the arrows indicate the main faults in the model:

#1 – the vertices here are pulled up away from the default cube shape, creating an upward-angled point. This is compounded by the addition of extra vertices with no cross-edge connecting them across the top face of the new, non-standard shape.

#2 – the vertices here have been scaled closer together to trim the profile of the front of the primitive cube.

#3 – the face on this primitive cube has been scaled down and moved up to form the non-primitive shape creating the rear fender.

In this case, none of the objects were named. However, this student did follow the directory structure.
Assignment #2

Model a wooden chair from the reference material

This project builds upon the first assignment in that accuracy is graded a little higher than it was before. At this point, we have begun to learn how to properly add geometry to our basic 3D primitives and can establish new levels of detail to our models. This second assignment is to create a 3D rendition of a specific chair. I provide them with three images of a specific chair that they use for reference. I also placed the exact same chair in the lab for them to look at and reference. The following are the reference images they are given;
These images are placed into the Maya software in a way so that they can see them while they are modeling. In fact, it works similar to a lightbox or onion skin – they model their object over or in front of the reference images.

The students are assessed on the same 4 criteria as the previous project. However, rather than looking for the basic primitives as before, I more closely assess how accurate their model is to the reference and this time I am starting to look at their topology – the structure of their wireframe mesh. This is the building block to the next phase, poly count.

- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- How accurately does their model represent the reference object?
- What is the quality of their topology?
An example of high pass

In this example, the student has effectively created a 3D representation of the reference material. They have named all of their objects accordingly AND accurately, and followed the directory structure. There is even a generally correct sense of structure in the lines of the mesh and a relatively shameless topology. The legs curve and taper where they should, the front, center of the seat bends slightly down appropriately, and the three primary back support pieces bend to curve around the user. There are the correct number of leg supports and even the smaller, supporting pieces that attach the seat to the back are angled out correctly.
An example of mid pass;
In this example, the student has created a moderate representation of the reference material. They have named all of their objects accordingly AND accurately, and followed the directory structure. The lines of the mesh get a little ‘wonky’ here and there as the flow of the mesh is incomplete. Here, the topology is a bit off as the legs and rungs have far too much geometry while the seat and two of the pieces of the back are more appropriate. The legs curve rather roughly and do not taper where they should (#3). The front, center of the seat (#2) does not bend slightly down as it should. The three primary back support pieces do bend to curve around the user, but they are not quite angled correctly and have interpenetration issues. There are the correct number of leg supports but the smaller, supporting pieces that attach the seat to the back (#1) are NOT angled out correctly.
An example of low pass;
In this example, the student has created a substandard representation of the reference material. The arrows indicate the main faults in the model:
#1 – While these support braces are angled appropriately, they do not have rounded ends and they have inappropriate topology.
#2 – The seat has too little geometry and does not appear complete. Here the topology is too low.
#3 – The rungs of the legs are too dense (too much geometry) and do not flare wider in the middle like in the reference. There are also two rungs in the back when there should only be one.
#4 – The three parts of the seat back are not curved appropriately and have too little geometry.
In this case, most of the objects were named and this student did follow the directory structure. In all, this feels like a model that was rushed in the last day before it was due and they ran out of time to finish it well.
Assignment #3

Design and model a retro-styled ray gun, laser gun, or pulse gun:

This project builds upon the previous two assignments in that structure, topological form, and poly count are looked at more exclusively than it was before. At this point, we have learned to manipulate the vertices, edges, and faces in our environment and should feel comfortable creating geometry when and where we need / want it. We can create considerably more detail to our models. This third assignment is to design and then model your own retro-styled ray gun, laser gun, pulse gun, etc. I provide them with some examples online and places to look as they research their designs.

The students are assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. This time I more closely assess how their lines flow through their mesh and how appropriate the topology and structure is.

- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- How well did they model their design and is their model fully realized (no parts left unfinished)?
- What is the quality of their topology and structure – how is the poly count distributed?

One thing I noticed here is that, given the opportunity to design / invent their own object, the students all groaned a lot and looked very concerned about the work involved, but their models were far better than the previous two assignments. In fact, there was very little difference between high and mid pass.
An example of high pass

In this example, the student has created a very nice model. They have named all of their objects accordingly AND accurately, and followed the directory structure. The only issues we have here are in the structure and the poly count. First, the grip – right behind the trigger - has some polygonal stretching that is a function of not enough geometry in the structure to accommodate the shape. Next, the little tubes running along the top of the gun are WAY too dense (too much geometry). That is why they appear to be a solid green line. Technically, the mesh around the twisty barrel of the gun is a little too dense as well, but that much curvature dictates a pretty heavy set of geometry in order to properly define the shape.
An example of mid pass
In this example, the student has effectively created a 3D representation of the reference material. They have named all of their objects accordingly AND accurately, and followed the directory structure. There is a pronounced structure in the lines of the mesh and a relatively shameless topology (the Barrel of the gun has some triangular faces that need to be resolved and the yellow body has too much geometry defining the indent that travel across the top of the mesh). In general, there is appropriate levels of both detail and geometry where expected, although the grip and the back of the weapon could use more definition.
An example of low pass;

In this example, the student has created the start of a design for a ray, laser, pulse, weapon, but has not fully realized the design and therefore has not been able to generate a fully realized 3D object. The model of the body is flat – very flat – as if it were cut from a single wooden 2 x 8. The structure and form of the mesh lines are haphazard and there are entire faces either missing or out-of-place. The one positive is the cylinder affixed to the bottom of the weapon. It has appropriate structure and topology.

Not surprisingly, ALL of the objects were named and they followed the directory structure showing that the entire class is grasping this fundamental at last. Again, this feels like a model that was rushed during the last day before it was due and they ran out of time to finish it well. It feels as though it were designed ‘on-the-fly’ within the software rather than researched and thought out.
Assignment #4

Model and rig a low-poly biped (the last of the modeling assignments):

This project does build upon the experience from the previous assignments, but it is a little different. In this assignment, they build a low-poly bipedal character based upon reference images that I provide them. It is a jointed, faceless character, because the students are not yet ready for the arduous task of creating a fully flexible, skinned character based upon this one course. We use a wooden Manikin® armature doll as our reference. This project, when completed, also serves as a segue into rigging a jointed character for movement and ultimately into the animation portion of the class. When this assignment is turned in, they must not only have the character modeled well, with all of the objects named appropriately – they must also have a rudimentary parent-child rigging relationship built into their model so that it can be animated.

The students are still partially assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. I am still looking closely at how their lines flow through their mesh and how appropriate the topology and structure is. However, this time I am now looking at the hierarchy of their parent-child rigging construct as well as the naming of the rigging joints. I must also score them on how accurately they have placed the pivot points for each joint in the rig.

- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- How correct is the parent-child hierarchy or the rigging structure?
- Are the pivot points placed accurately?
- What is the quality of their topology and structure – how is the poly count distributed?
An example of high pass;
Here, the student has created a very nice model. They have named all of their objects accordingly AND accurately, and of course followed the directory structure. The structure and poly count look appropriate. Model-wise, the only issues I have are with the hands and feet. The foot that is highlighted green is slightly out kilter from the joint it is parented to. The hands have a non-standard face (made of a misshapen n-gon (an n-gon is a polygon with more than 4 vertices defining it)) that is providing some errors. The naming convention is solid and the rigging hierarchy & pivot points are placed correctly.
An example of mid pass
This is a well-shaped model. They have named all of their objects and followed the directory structure. There is a little too much geometry defining the mesh – it appears a little sloppy structure-wise – especially when you look at how nice the chest looks compared to the rest of the denser mesh. The hands have an n-gon issue similar to what we saw on the high pass example. The feet are a little off shape-wise. The joints are not spheres, rather, they are slightly elongated for some reason which leads to pivot point and rigging deformities. The rigging hierarchy is complete and appropriate.
An example of low pass

In this model, the student has modeled the bipedal character well-enough, but there are obvious deformities in the head, chest, forearms, biceps, and feet. Here, the student has tried to solve the problem of the n-gon in the palm of the hands and has done fairly well. This model also has the same issue with the elongated spheres for the shoulder-joints. Overall, the mesh is more dense (higher poly) than it needs to be. There are a few objects with inappropriate names (the objects of both legs are named ‘left’), and the parent-child rigging setup suffers because of it.
Assignment #5

First attempted walk cycle (the first of the animation assignments):
As the first assignment of the animation portion of the class, I have found that they feel animation is pretty darn easy (having never really done it before). So, I created this project around letting them see for themselves how easy animation is NOT. I give the students access to a fully animated rig – complete with facial, foot roll, ball roll, spinal, and hip/ root controls. I give them a quick rundown on a new aspect of the directory structure they must now implement from here out (referencing a rigged character correctly into the Maya scene file) and I show them how to use the rigged character. I give them an explanation of Forward Kinematics and the new-to-them Inverse Kinematics principles and I show them why we need both principles in our rig to make them move properly. After that, I send them on their way. Their assignment is to make the character walk in place – like on a treadmill. In fact, I tell them to head to the University Rec Center in pairs or groups and observe each other on a treadmill – to take video reference and photos for their use. I do not give them a tutorial on HOW to create a walk cycle beforehand, they must forge forward to see if they can make it work.

I purposefully grade this exercise very loosely, because I EXPECT them to do poorly. However, I have found that getting them to realize that they need instruction is the best way to overcome their youthful arrogance towards a topic they feel might be ‘easy’. If they do well, GREAT! We can do more complicated animation – but that has not ever happened. The more studious participants go out and watch online tutorials or look up an exercise or two in our – gasp – textbook! This should be easy, right? I mean, everyone knows how to walk! During this project, they were not required to move the upper body at all. I just wanted to see if they could get the character’s legs churning in an appropriate manner.

The students are still partially assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. I am no longer looking for modeling techniques as they did not model our rigged characters. They are scored on how well the walk cycle looks.
  - Did they follow the directory structure I have shown them?
  - Did they follow the naming convention we learned in class?
  - Does the character walk in place?
  - What is the quality of the walk motion (is it smooth or jerky)?
  - Are there are extra-added features of the walk cycle (did they add hip rotation, arm swings, a bit of ‘character’ to the walk)?
**An example of high pass**

For a first attempt, this animation is not bad. Keep in mind these students have never worked on character animation at all. The walk, while rudimentary has some little qualities that bring it to the high pass model. Yes, the student played with the facial controls a little and he posed the arms and spine, but ignore that for now since they are simply posed and not animated. Notice the knee joints do not 'pop' when the legs are extended – this indicates that the student lowered the hip to get the legs to bend and give them room to extend forward and back without hyper-extending. Next, notice the feet - they bend appropriately at the ball of the foot when the foot is about to lift off the ground. This is more than I would expect for a first attempt.
An example of mid pass
This animation is more what I expect from a first attempt at a walk cycle. The ball of the foot does not bend. The legs are inexplicably straightened throughout most of the cycle and the knees ‘pop’ right as the leg reaches full extension on the forward step.
An example of low pass

This animation is an example of a low pass group. Notice that the legs, while moving in a solid rhythm, do not bend – at all. The foot does not flex, nor does the ball of the foot animate. Here, the student played with the facial controls and moved the arms down, but did not spend enough time on getting better motion on the legs.
Assignment #6

**Picking up a heavy object (STEPPEDE):**
This assignment is a two-parter – meaning we work with this file for both assignments #6 and #7. Animation is a skill and a process and getting animation to look correct is a time-consuming endeavor. This assignment is all about helping them to get better animation in a short amount of time. Their goal: to make a bipedal character walk into frame, pick up a heavy object off the ground, and then carry it out of frame.

At this point, I take them through a tutorial on how to make a proper walk cycle, beginning with a discussion on the specific parts of a walk cycle. Those parts are; Contact, Down Pass, and Up. These four crucial poses are a function of EVERY walk cycle and getting them in place first is how we start to create proper movement. These four poses are depicted in the graphic below.

In class, we then take video of each of them performing the necessary action so that they would have reference footage to animate to. This allows them to try to create an animation of themselves performing the action. Each of them walks a little differently just as each of them pick up the heavy object differently and each of their walks changes differently while walking with a heavy object in their arms. This first part of the assignment requires them to do what is called, 'stepped' animation. It is a way for animators to use the software to 'block out' the key poses and important parts of an animated scene. It creates a rather 'choppy' looking motion as you will see, but this will get smoothed out in a cleanup pass after they have presented their stepped animations in class and gotten notes back.

The students are still partially assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. I am no longer looking for modeling techniques as they did not model our rigged characters. They are scored on how well the walk cycle looks.
- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- Do the feet slide?
- Is the blocking accurate to the reference?
An example of high pass
This is a solid example of a blocking pass. You can see the four poses of the walk as the character proceeds to - and even away from - the object. The bending down motion is pretty well thought out considering it is a more difficult pose to get the character into – but it is what the student did in their video reference. The feet are not sliding and the object is carried off frame.
An example of mid pass
This animation is a little different – as you would expect coming from different reference material. However, the picking up motion defies gravity and is not as well thought out. The walk does have the four poses included but the stride length is a little too long and not only feels uncomfortable, but does not quite feel like the video reference.
An example of low pass;
Unfortunately, this student was not working in stepped mode. You can tell because the character is trying to interpolate between the key poses the student placed on the character. There are moments of smooth – albeit ‘wonky’ – motion between a few poses and moments of stepped animation where a control point in the rig will ‘snap’ into the correct place. The bending down motion is incomplete and feels unnatural.
Assignment #7

Picking up a heavy object (SPLINED):

The second part of this assignment is to clean up the animation in 'splined' mode. This is where the animator changes all of the stepped keyframes into splined keyframes in order to start to smooth the transitions between key poses. This does cause some problems, however and that is why we do this as two different assignments. Once the students have their blocking notes addressed, I show them how to change their keyframes into splines and then how to start to clean up the motion. This involves revisiting the four key poses of the walk and making sure the foot does not move when it is in contact with the ground plane. This is a time-consuming phase of the animation and requires a high level of attention to detail. The students are tasked with turning in a finished, smooth (splined) animated file.

The students are still partially assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. They are also scored on how well the walk cycle looks, whether the feet are sliding, as well as its accuracy to the reference.

- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- Do the feet slide?
- Is the animation accurate to the reference?
An example of high pass

This animation includes the same lumbering gait the student had in his reference and the moment of picking up the object starts to appear to be difficult (it has weight). There are a few not-so-smooth moments in the walking motion – I feel the character moves a little too much up-and-down throughout, and the moment the character steps forward from picking up the object seems a little robotic or stiff. In general, the walk looks solid and is a very good representation of the reference footage.
An example of mid pass
This file was considered in the high pass for the previous assignment, but finds itself in the mid pass area here. Mostly because of the lack of improvements made from the comments received on the blocking stage. The character has a rough forward motion that still almost feels stepped or ‘jerky’ – especially towards the end of the file. The bending down motion is still very good although the object does not seem very heavy at this point.
An example of low pass
In this example, we see that the bending down motion is defying gravity a little as the object is picked up and the object does not appear to weigh much at all – there is no sense of struggle to pick up the object. Notice that the feet are sliding here and there throughout the walk as well.
Assignment #8

Facial poses:

This assignment is all about emotion. The face is where we primarily pick up on non-verbal communication and expressions are a major part of that. I give the students some sample expression sheets from various movies and/or projects. Expression sheets are drawings that show a specific character in many different emotional states to show the extremes of what that character will need to do during the course of the project. The images below are examples of expression sheets from the movies, Tangled, and, The Lego Movie.
The students are tasked with posing their 3D character to depict all 12 of the following expressions:

1) Sly
2) Happy
3) Sad
4) Angry
5) Joy
6) Fear
7) Confused
8) Disgust
9) Tired
10) Surprise
11) Worried
12) Excited
The students are still partially assessed on the same two over-arching criteria (directory structure and naming convention) as the previous projects. They are also scored on how well the emotion comes across in their pose and whether there is too much ambiguity in the emotion they are attempting to portray.

- Did they follow the directory structure I have shown them?
- Did they follow the naming convention we learned in class?
- Are all of the expressions present in the file?
- Does each pose effectively represent the designated emotion?

**An example of high pass**

Here, the student has made fantastic use of the facial controls. Notice they even used head angle and tilt to help get the emotion across to the viewer. The worried expression (#11) might be the only emotion that is weak in this example. The emotions really jump off the page at you.
**An example of mid pass**

In this example, the student did complete all twelve expressions, but they just don't quite portray them as strongly as in the high pass example. Many of these poses are very good, but every one of these expressions could use some additional work — even tilting the head here and there would help quite a bit. I feel the Tired (#9) and Fear (#6) expressions work pretty well here while Worried (#11), Disgust (#8), and Sly (#1) are the weakest.

![Mid Pass Examples](image)

**An example of low pass**

Here, the expressions are of a lesser quality than the rest of the groupings. It becomes very apparent when the face is not working correctly or the artist over-stretched a particular control rather than look for an additional control to get the face into the shape they envisioned. This is called ‘breaking the rig’, and we go over it in class. The corners of the mouth on Happy (#2) and Joy (#5) are examples of this. Sly (#1) and Confused (#7) work pretty well here, but overall, the rest of the expressions are lacking.

![Low Pass Examples](image)
Final Exam

This is the most difficult and time-consuming final I administer. All the students use the entire time allotted for the test. There are a few written pages (5) of the exam, but it is designed to only take a maximum of 15 to 30 minutes. I ask them a few questions about the interface, which tools are used when, and about the various heads up displays. The real meat of the test is the practical portion. This is designed to take the rest of the time - 90 minutes. There are sections that involve modeling, simple texturing, and even animation (poses). Through all of this, they must stay within the confines of the directory structure laid out throughout the course.

The texturing portion requires them to create, name, and assign simple textures (colors) to a pair of provided 3D models – a box of dynamite and a mailbox. These models are built for them already and loaded into a Maya scene file that they open during this section of the test. This tests their ability to stay within the assigned directory structure and to recall our naming convention rules – they must appropriately name each texture they create. I don’t care what color they choose for each of the objects – only that those textures are named appropriately and that no single polygon is left un-textured. As a result of everyone doing very well with this part, I am not going to show any results from this portion of the test. These are the objects from the test – without textures applied.
Although I do not give an actual animation assignment (keyframing) on the test (I feel animation takes too much time and trying to get them to perform an animated task in an hour and a half is cruel and unusual), they do have to take a couple of rigged characters and get them into two specific poses – I provide reference images for these poses, of course. These are the reference images for the poses;

The modeling section requires that they model a 3D character. I provide the reference images for the character they must create. Not surprisingly, this section takes the longest to complete and is the part of the test everyone saves for last. These are the reference images for the 3D character;
While it may appear as a pretty simple character, it poses a few problems for the students to solve. A cursory glance at the images might lead the student to assume starting with a sphere for the head and a cube for the body. However, upon close inspection of the orthographic reference images, you might notice that there are four feet! This usually trips a few students up for a bit – they must use their problem solving skills in modeling to overcome such an oddity. The feet are not significantly difficult to create, but require an understanding of the tools available. For example, while the body might still be stated as a cube, the feet might need to be created from the same object – or extruded from the bottom surface of the cube. Rounding them correctly is another problem to solve because if the rounding is not done well, we will see problems and errors in the resulting mesh at the end. The head is another issue. A sphere might be the obvious choice to begin the shape, but if not rotated first so as to line up the ‘hat’ on the character (both the point AND the apparent thicker base), the student will have immense difficulty creating the shape very well at all. All semester, we have been discussing these types of modeling issues – how to recognize and solve them.

An example of high pass

ANIMATION (POSES) PRACTICAL:
Here we see an excellent use of the rig to produce the desired poses. Notice the sense of balance in each pose as well. This is something we spoke of at length in our discussions in class. In the Turtle pose, the left shoulder is rotated forward towards the hands as in the reference, but the hands are a little too far apart. The head and feet are bent and angled correctly and the yoga pose has been created without breaking the spinal controls (you can still see both abdomen sections of the character between the pelvis and chest sections).
MODELING PRACTICAL:
In the High Pass modeling example, the head has been tilted back along the X axis in order to stretch the geometry up to the point of the hat. Unfortunately, even though the form and structure would support the seam at the base of the hat that is visible in the reference, the student did not create the extrusion of geometry that would have represented that seam. The four legs are represented well and the bottoms round off appropriately. The rounding on the rest of the body is sufficient as well. Note that in the side view, the arms do not arc backwards on their way up to the shoulders as they do in the reference. All of these objects were named and grouped appropriately. This is a fantastic example of work in such a short amount of time.
An example of mid pass

ANIMATION (POSES) PRACTICAL:
In this example, the poses are close but not as precise. In the turtle pose, although the hands are angled correctly and positioned well, the left shoulder is not rotated towards the hands making the character appear more upright and uncomfortable. In the yoga pose, the character also feels slightly off balance. The feet and head seem well placed, but notice that there seems to be a section of the spine missing. This is because the rig was not rotated correctly causing the spine control to misbehave. The lower abdomen geometry is buried inside the pelvis geometry, which is partially the cause of the unbalanced feel of the pose – the spine is now too short!

MODELING PRACTICAL:
Here, as in the High Pass, we see that the head has been tilted and shaped correctly. This student even made an effort to create the seam at the base of the hat in the geometry. The form and structure appear to be good although the poly count might be a little on the high side – nothing too awful however. The arms are modeled well and have appropriate arcs in their shape. The body and all four legs, however, are not rounded enough and start to appear a bit squared off.
An example of low pass

ANIMATION (POSES) PRACTICAL:
Here we see some poses that just do not look finished. The balance of both poses is off. On the turtle pose, the shoulder is again not rotated towards the hands – although the hands look good. The character is not crouched down far enough and the legs are splayed apart awkwardly. It is also far too upright from the pelvis up. The yoga pose suffers from the same broken spinal control caused by not rotating the correct part of the rig. The spine is not curved enough which in turn forces the legs too far out over the head giving us the unbalanced feel as well.

MODELING PRACTICAL:
On this model, we unfortunately see that the student did not think through and solve any of the problems the reference presented them. They forged ahead and tried to create multiple objects and then fuse them together during their process. This CAN work, but it is by far a slower method for these types of problems. You can see the sphere of the head, but it is squashed and not titled to allow for stretching the geometry up to the point of the hat. The hat is a separate piece of geometry that is still unresolved and will be difficult at best to merge into the geometry of the head. The body mesh is a result of a pair of cubes being modeled separately (one for the body and one for the legs) then welded together. This was done without solving for the continuity of the structure and the flow of the mesh. This created some bad geometry – noticeable specifically in the front view. The body and legs are not rounded enough and have far too high of a poly count to be able to correct the underlying structure easily. From the side view, the arms also do not have the arcs that are present in the reference.
Reflection and Assessment

First off, I am thankful for the changes I made based upon the feedback I received from the course evaluations last time AND the changes I made to the objectives and assignments of the course based upon going through this Peer review of Teaching Project. I feel this offering of the course was the most useful to date and I have learned quite a bit about how to break this course into subsequent full modeling and animation courses should I ever get the opportunity to do so.

Setting up the assignments sequentially as I did this semester proved to be a boon not only for the students and their learning curves, but also for me as I found I enjoyed teaching this subject more than ever with the more focused time in the fundamentals of structure and form – both in the modeling and animation phases of the class. The students seemed to grasp the subject matter quicker and with greater interest than merely going through in-class tutorials and exercises as I have done in the past.

Looking back across the semester, I can see that learning has occurred – although not in the way I had assumed it might. I had imagined that the class might uniformly increase their skill sets, keeping the high, mid, and low passes obviously separate. However, the datum indicates that the mid and high pass students became more closely related, skill-wise, while the low pass students tended to languish towards the bottom of the creative spectrum of the class. Even though the low pass did increase their skill set, they did not gain as much ground as the mid pass group. This, as one might expect, became even more apparent on the final exam.

Starting with the first assignment (the tractor made from primitive 3D shapes), there was a broad range of skills and / or innate ability. As they progressed through the modeling phase of the course, the abilities increased across the board, but it became increasingly difficult to separate the high and mid pass level students. This same pattern is apparent throughout the animation phases of the course as well.

Another aspect of the class I enjoyed – but did not assess – was the presentation of their assignments / projects. It was a great way to get them to start using the terminology correctly in front of each other. I found they learned more from their peers correcting each other than they ever would just from my own corrections. It really was invigorating to listen to the class discussions open up as each question and answer spawned more interest and thought into their presentations and ultimately their subsequent assignments.

Student performance was satisfactory in that roughly 20% of the students (2 out of 11) failed to effectively meet the objectives set forth in the course outline on the syllabus. Of those two students, both of them exhibited difficulty paying attention in class and one of them was consistently 10 to 20 minutes late to class. In a course that only meets twice a week and for only 1 hour and 20 minutes each session, a third of his class time was missed throughout the semester. Both of these students found it difficult to present their work to myself and their peers and had trouble using the terms in their lexicon. The rest of the students showed a consistent upward trend in their skills and apparent understanding of the subject matter.
I must also remember that this is an ELECTIVE course and that part of the role of a beginners’ course such as this is to help the students to find out if this is something they have the talent to pursue further.

Based on the data in this class, a few items I would like to incorporate into the next offering of this basics class are;

- Self-assessment
  - It might be even more enlightening to allow the students to assess themselves – perhaps via a self-graded rubric

- Group assessment
  - Another possible aspect for enhanced learning is to allow for some sort of grade based upon what their peers think of their creative work.

- A pre-test at the beginning of the semester
  - This aspect is something I have been thinking about for the modeling phase of the class. I already do something similar in the first animation assignment – have them create a walk cycle with very little instruction. In animation, I find this to be helpful in that the students find they have difficulty performing the task well and it opens up their minds to the instruction that then follows. I was hoping something like this might work on the modeling side. Since at that point in the semester they are still so uneasy in the 3D environment, I am considering making it merely an in-class exercise rather than a graded assignment.

In addition, part of this portfolio was to see if I could indicate sufficient growth in each of the two primary phases of the class that I could start to make a case for an expanded curriculum that would allow the students to delve deeper into creating within a 3D environment and allow for more substantial output. It is my belief, based on these findings, that this case can be made. Looking at assignments #3 (design & model a retro-styled ray gun) and #6 / #7 (animating a character walking in and picking up a heavy object), you can see how much their modeling and animation skills started to manifest at an increased rate when they were allowed more creative input into what they were working on. Obviously, an intro course such as this requires a certain amount of theory, tutorials, reading, discussion, practice, and even failure in order to build a solid foundation for learning the craft. Additional courses focused on individual aspects of modeling, animation, rigging, texture, or lighting could allow for their creative exploration in an even more creative environment that should enable their skills to improve at an even greater rate.
DIGITAL ANIMATION
3D Modeling, Animation and Lighting
THEA 474
Spring 2014

Professor: Steve Kolbe
Office: Ross 210
Office Hours: Wed. 10am-Noon & By Appointment
Phone: 472-4914
Email: skolbe2@unl.edu
Class Meets: T. & TH. 11:00am-12:15pm in Ross 213

Required Texts:
Published by Sybex
(Paperback - May 28, 2013)

Course Overview:
Digital Animation is a basics-of-3D-development course - an advancement of the Digital Motion Graphics course taught in the Film & New Media program. However, where that class dealt with the basics of animation/movement and motion graphics inside After Effects, this course is will live entirely within the Autodesk Maya software package. Students will learn to model, texture, rig, animate, light and render 3D objects they create using Maya 2014.

The depth of the software package is immense -deeper than any other software package you may have experienced - and can be overwhelming. Given the time constraints of our class periods and the semester, it will not be possible to explore every function available. In order to get the most out of this class, students are required to push themselves deeper into the software beyond the in-class exercises we will be doing. You will be graded on your creativity in the assignments and on your growth and confidence in the software during the semester. While the software IS extremely useful, it is still merely a tool with which to achieve the goals of the course.

Course Objectives:
By the end of this course you will:
• learn to navigate & create within the Maya software package.
• learn the production pipeline for animation.
• learn the basics of modeling, texturing, animation and lighting of 3D assets.
• develop a sense for good structure in your geometry and animation.
• have generated and completed 3D models and animation of your own.

Instructional Methods and Techniques:
Methods and techniques to be used throughout the course include:
• Lectures
• Software presentations
• In-class software exercises
• Critiques by instructor
• Peer critiques

Required Supplies:
• A personal USB flash drive or equivalent (8GB available storage and above preferred)

**Grading Breakdown:**
Assignments (seven)  70%  (10% each)
Final Examination  30%

**TOTAL 100%**

**Grading**:  
A+ = 97% to 100%
A  = 94% to 96.5%
A- = 90% to 93.5%
B+ = 87% to 89.5%
B  = 84% to 86.5%
B- = 80% to 83.5%
C+ = 77% to 79.5%
C  = 74% to 76.5%
C- = 70% to 73.5%
D+ = 67% to 69.5%
D  = 64% to 66.5%
D- = 60% to 63.5%
F  = 59% & Below

**Note on Grading:**  
Only exceptional work of professional quality will be considered an “A”. *Late assignments will be penalized* one full letter grade for each day they are late. *Any work that is one week or more late will not be accepted and given a zero point score for that assignment*, unless an exemption or permission has been granted due to extraordinary circumstances. *No incomplete grades will be given*. *All assignments are due in class*, unless otherwise assigned. I do not give extra credit work or assignments.

Students are required to complete every assignment.

**Evaluation.**  
Evaluation will be based on the following:
• Attendance (see Attendance Policy below)
• Positive attitude, and energetic participation in all class exercises, discussions and assignments.
• Willingness to participate in class discussions and peer critiques.
• Completion of all assignments.
• Final exam — may include written and practical software components.
• Other requirements as described during the course of the semester.

**Tests and Quizzes:**
There will be a final examination as listed at the end of the syllabus.

**Grade Disputes:**
Take one day to thoroughly & objectively consider my comments and those of the class. Then discuss your disagreement with me *within one week* of receiving your grade. Grading will not be discussed after the one-week period.
**Reading Assignments:**
Reading assignments are listed in the course outline. You are required to keep up with the hands-on and reading assignments. Additional reading materials may be handed out over the course of the semester.

**Assignments:**
Each assignment you turn in needs to be placed into the Drop Box for this class. Assignments are due on the day listed in the syllabus. They are due by the time class starts – after this time, you will start to lose points. Your files are date stamped on the server so I can tell when they are turned in. *Late assignments will be penalized* one full letter grade for each day they are late.

The way Maya works, each assignment will require you tuning in a project directory that holds any pertinent files. This directory must be named according to the following naming convention. **You will lose points for improper naming.**
- project##_descriptor_first name initial (lower case) Last name (Upper case first letter).file extension
  - Ex. Project01_benchModel_sKolbe

Inside this directory will be your Maya file(s), any images you needed – or generated, and any exports (playblasts / movies) you generated.

Maya allows you to save your model in two main formats - .ma and .mb. In the case of turning in a Maya file, it should always be a Maya ascii file (.ma) NOT a Maya binary file (.mb).

**Academic Honesty (copied from UNL Academic Student Handbook).**
“Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty. (See the Undergraduate or Graduate Studies Bulletin for complete text.) In accordance with the established procedures as described in the Code, students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision.

Any questions regarding the procedures for handling incidents of academic dishonesty may be directed to the Director of Student Judicial Affairs, 106 Canfield Administration Building (0418), 472-2021, who is primarily responsible for administering the Student Code of Conduct.

In addition to currently established procedures, the Academic Senate has passed a resolution which does, in proven cases of academic dishonesty, prevent a student from dropping the course during the semester. If the student has already dropped the course, the instructor has the right to add the name of the student back to the Final Grade Roster and give the student an appropriate grade. “
Class Participation & Attendance:
It is essential that you attend and actively participate both in class and in the course assignments. To participate, you must be present. You are expected to attend all class meetings and arrive on time. In order to accommodate students who may need extra time to commute from a class immediately prior to this class, attendance will be taken five (5) minutes after the scheduled start time of the class. Anyone who arrives after the attendance is taken will be considered late. Three instances of tardiness will be equivalent to one unexcused absence.

As stated in the Johnny Carson School of Theatre and Film bylaws:
“After a student misses an equivalent of one week’s worth of classes, each subsequent missed class will result in the reduction of the final grade by a full letter grade (i.e., A to B, B- to C-).
Students may be granted an excused absence, at the instructor’s discretion, to allow those students to participate in extra-curricular events representing the University. In such cases, the instructor must be notified in advance.”

This course meets twice a week. Hence, each student will be allowed a maximum of 2 unexcused absences. Any additional and subsequent unexcused absence beyond the 2 will result in the lowering of the final grade for the course as described in the bylaws above. Any requests for excused absences must be received in writing at least 1 week prior to the anticipated date of absence, unless for illness. In the case of illness, the instructor must be notified at the soonest possible time, with a note from a physician.

You will be expected to spend at least 2 to 7 hours (per week) outside of class meeting times on readings, and working on your assignments. It is important for you to practice (after class) what has been covered during class so that you may raise any questions or problems at the next class session. It will not be in your best interest to procrastinate because of the large amount of material that will be covered during this course.

If you need any special accommodations or if circumstances arise that may affect your participation, please talk to me as soon as possible.

Academic Services for Students with Disabilities:
Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.
Peer Review of Teaching Project

This semester, I have elected to take part in the Peer Review Project, a University-wide, ongoing attempt to develop new and better methods for promoting student learning. This is a year-long process in which participants in the project (professors) put a great deal of thought into the design of a single course (in this case THEA 474) including syllabus, exams, class activities and written assignments. One of the project's ultimate goals is to improve student learning, and we cannot accomplish this goal without student input.

For the project, I will need to select several students whose work would be copied and included in my course portfolio as an archive of student performance for the course. These examples are a very important piece of the project for professors to show how much and how deeply students are learning. Once the course portfolio is completed, it will be put on a project website: www.courseportfolio.org so that it can be shared, used, and reviewed by other faculty.

Classroom and Computer Lab Rules and Procedures:
1. No food or drink in the computer labs - (I will allow beverages in the classroom DURING class ONLY if they have a sealable lid).
2. Only currently enrolled students may use the computer lab in Richards 17; No friends or family.
3. Always make a back-up your work on the server, your USB drive, the server, or other removable media (or the server).
4. The use of any form of headsets during class sessions will not be allowed. (This rule does not apply during the times when the instructor designates time for students to work on their own in class.)
5. The computers in this lab during class meetings are strictly for instructional purposes only. Checking of e-mail and similar abuse of use during class sessions will not be tolerated.
6. The classroom is not an open lab for all students. It has been reserved for students currently enrolled in DAI courses. As such, only students currently enrolled in a DAI course are allowed in the Richards 17 room. Currently enrolled students are granted access to the Richards 17 lab all hours of the day and night via their N-CARD. You are not allowed in the lab during other class times unless prior authorization from that instructor is granted.
7. All other UNL policies with regards to university-owned computers and web servers will apply during the entire duration of this course.
8. All cell phones should be placed on mute / vibrate during class times. If your phone goes off during class (this includes rings and alerts of any type), you will bring doughnuts for the class during the next class time.
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<tr>
<th><strong>WEEK 1</strong></th>
<th><strong>WEEK 2</strong></th>
<th><strong>WEEK 3</strong></th>
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<tr>
<td><strong>1/16 (TH)</strong> Chapter 2: Solar System – Part 1. Pivots and parenting.</td>
<td><strong>1/23 (TH)</strong> Flex day (could be more Solar System – we could move on to modeling tools)</td>
<td><strong>1/30 (TH)</strong> Chapter 3: Modeling a decorative box – Part 2.</td>
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<tr>
<td><strong>READINGS (Due on the day they are shown):</strong></td>
<td><strong>Chapters 1 and 3</strong></td>
<td><strong>Chapter 4 – pages 130 to 136</strong></td>
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<tr>
<td><strong>ASSIGNMENTS:</strong></td>
<td><strong>Assignment #1 – simple shapes to build a tractor. Due Thurs., Jan. 30 AT THE START OF CLASS.</strong></td>
<td><strong>Assignment #1 due AT THE START OF CLASS.</strong></td>
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WEEK 4

2/6 (TH)  Chapter 4: Modeling a catapult – Part 2.

Assignment #2 – simple shapes to build a wooden chair. Due Thurs., Feb. 13 AT THE START OF CLASS.

WEEK 5
2/11 (T)  Chapter 4: Modeling a catapult – Part 3.

2/13 (TH) Chapter 4: Modeling a catapult – Part 4.

Assignment #2 due AT THE START OF CLASS.

WEEK 6
2/18 (T)  Adding colors and textures – very basic texturing


Assignment #3 – design and model a retro ray gun. Due Thurs., Feb. 27 AT THE START OF CLASS.

WEEK 7
2/25 (T)  Chapter 7: Texture the wagon – Part 2.

2/27 (TH) Chapter 7: Texture the

Assignment #3 due
wagon – Part 3.

WEEK 8
3/6 (TH) Chapter 7: Texture the box – Part 2.

Assignment #4 –
Model a simple biped. Due Thurs., Mar. 13 AT THE START OF CLASS

WEEK 9
3/11 (T) Chapter 8: Bouncing a ball.

Assignment #4 Due AT THE START OF CLASS.

WEEK 10
3/18 (T) Chapter 8: Throwing an axe – Part 2.

Assignment #5 –
Animate a biped to a standing position. Due Thurs., Apr. 3 AT THE START OF CLASS.

WEEK 11
3/25 (T) NO CLASS
SPRING BREAK
3/27 (TH) NO CLASS

NO CLASS
SPRING BREAK

NO CLASS
NO CLASS

NO CLASS
NO CLASS

NO CLASS
NO CLASS

60
WEEK 12
4/1 (T) Chapter 8 & 9; Rigging a steam locomotive.

4/3 (TH) Chapter 9: FK walk cycle & rig.

Assignment #5 due AT THE START OF CLASS

WEEK 13
4/8 (T) Chapter 9: IK walk cycle & rig. Introduction to Norman.

4/10 (TH) Shooting reference footage for homework assignment #5. Working in class.

Assignment #6 – Animate a biped walk cycle. Due Thurs., Apr. 17 AT THE START OF CLASS.

WEEK 14


Assignment #6 due AT THE START OF CLASS
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<tr>
<td>4/24 (TH)</td>
<td>Chapter 10; Lighting the box.</td>
<td>Assignment #7 – Norman facial expressions. Due Thurs., May 1 AT START OF CLASS.</td>
<td></td>
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</tbody>
</table>

| WEEK 16 | 4/29 (T) | Chapter 11; Rendering the box. |
| 5/1 (TH) | Prep for final exam. | Assignment #7 due AT THE START OF CLASS |

| WEEK 17 | Tuesday, May 6 from 3:30 PM – 5:30 PM | Final Examination |